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# AD2 Servo system user's manual

**Servo Drives**
**AD2RE-□SA-E**
**AD2RE-□PA-E**
**AD2RE-□SC-E**

**Servo Motor**
**ASK☐**


Thank you very much for purchasing our servo products
Please read this instruction manual carefully before installing, wiring, using, maintaining, and inspecting the product.
Please keep this manual in a safe place and deliver it to the end user.

# Change Log

| Revision | Description | Originator | Date |
|---|---|---|---|
| V1.0 | First Edition Release | sly | 2019-01 |
| V1.1 | Chapter 8 was amended:<br>Add ASK AC200V class motor list.<br>Add ASK AC400V class motor list.<br>Modify P50.02, P50.14, P50.16, P60.01, P60.02, P72.04, P72.05, P72.06, P72.0B, P72.0C, P72.0D, P73.02 parameters unit values. | sly | 2019-06 |
| V1.2 | Correction of errors:<br>4.5.3 Section DO output mapping address changed from 60FE.20~23 to 60FE.16~19.<br>5.3.2 Chapter LED panel user login chapter modification.<br>Added: 4.5.3 The use of new renewal diodes<br>New Parameters | sly | 2019-09 |
| V1.3 | 7.1.7 Chapter Servo enable invalid stop 605Ch: VAR changed to 0-3; Unit16 changed to 2; add set value meaning 2, 3 points 605Eh: VAR changed to 0-3; Unit16 changed to 2 | sly | 2021-01 |
| V1.4 | Section 2: 1. New parameters 2. Update the new definition of the cable.<br>Section 4: Adding new parameters.<br>Section 8: Adding new function codes. | sly | 2021-08 |
| V1.5 | Update the relevant parameters of the entire ASK series. | czm | 2023-03 |
| V1.6 | Delete the motor size part is the second point of the comment. | czm | 2023-04 |
| V1.7 | Update 100 flange motor, page 28.29 parameters. | czm | 2023-04 |
| V1.8 | Update the content in section 7.10.4. | czm | 2023-05 |

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# Section 1 Safety Precautions

## ■ Safety instructions

- Please read and follow these safety precautions when installing, operating, or maintaining the product.
- For personal and equipment safety, please follow all safety precautions described in the markings and manuals on the product when installing, operating, and maintaining the product.
- The "Caution", "Warning" and "Danger" items in the manual do not represent all safety precautions to be observed, but only in addition to all other safety precautions.
- This product should be used in an environment that meets design specifications, otherwise it may cause a malfunction due to failure to comply with the relevant safety precautions.
- The product quality warranty does not cover abnormal function or damage to parts caused by the regulations.
- We will not bear any legal responsibility for personal safety accidents and property damage caused by illegal operation of the product.

| **Security Level Definition** | |
|---|---|
| **Danger** | Indicates a potentially hazardous situation which, if not avoided, could result in death or serious injury. Additionally, there may be severe property damage. |
| **Caution** | If not used in accordance with the regulations, may cause fires, serious personal injury, or even death! |
| **Warning** | Failure to use in accordance with the regulations may result in moderate personal injury or minor injury, as well as the occurrence of equipment damage! |

| **When products arrive and are stored** | |
|---|---|
| **Warning** | • If the product and product accessories are damaged when opening the box, please do not install them and contact our company or your supplier immediately.<br>• Check carefully whether the arriving product and the ordered product model match, and whether the product and product accessories are included. |
| **Caution** | • Do not stack multiple of this product on top of each other as this may cause injury or malfunction.<br>• Do not store in places exposed to direct sunlight, places where the ambient temperature exceeds the temperature conditions for storage, places where the relative humidity exceeds the humidity condition for storage, places where there is a large temperature difference, places where there is high condensation, places near corrosive gases, places where there are flammable gases, places where there is a large amount of dust, dirt, salt or metal dust, places where water, oil or medicine drip, places where vibration or shock can affect the main body of product; otherwise it can lead to fire, Electric shock or machine damage.<br>• Do not hold the cable or motor shaft for weight holding, as this may result in injury or malfunction. |

| **When designing the system** |
|---|

| | |
|---|---|
| ⚠ **Danger** | • If the rated load of current is exceeded or the load is short-circuited for a long period of time resulting in over-current, the product may start smoking or catch fire.<br>• Safety devices such as fuses, or circuit breakers should be set externally. |
| ⚠ **Warning** | • Be sure to design safety circuits to ensure that the product system will still work safely if the external power supply is lost, or the product fails.<br>• For safe operation of the equipment, please design external protection circuits and safety mechanisms for output signals related to major accidents. |
| ⚠ **Caution** | • Be sure to install emergency brake circuits, protection circuits, interlock circuits for forward and reverse operation, and position upper and lower limit interlock switches to prevent damage to the machine in the external circuit of the product.<br>• The product may shut down all outputs after detecting abnormalities in its own system; when part of the controller circuit fails, it may cause its output to be uncontrolled. To ensure normal operation, a suitable external control circuit needs to be designed.<br>• If the output unit such as relay or transistor of the product is damaged, the output will not be controlled to the ON or OFF state.<br>• The product is designed to be used in indoor, overvoltage class II electrical environments, and its power system level should have lightning protection devices to ensure that lightning overvoltage is not applied to the product's power input or signal input, control output and other ports to avoid damage to equipment. |

| **When the product is installed** | |
|---|---|
| ⚠ **Danger** | • Only maintenance professionals with adequate electrical knowledge and training related to electrical equipment should install this product.<br>• For the product with open equipment, please install in the control cabinet with door lock (product cabinet shell protection > IP20), only operators with sufficient electrical knowledge and training related to electrical equipment can open the product cabinet. |
| ⚠ **Warning** | • When disassembling the product, the external power supply used for the system must be completely disconnected before performing the operation. Failure to disconnect all power supplies may result in electric shock or product failure and malfunction.<br>• While dissembling the product, the power and the power indicator must be turned off for at least 5 minutes, before disassembling the driver. Otherwise, the residual voltage may cause electric shock.<br>• Do not use the product in the following places: places with dust, oil fumes, conductive dust, corrosive gases, combustible gases; places exposed to high temperature, condensation, wind, and rain; places with vibration and shock. Electric shock, fire, and misuse can also cause damage and deterioration of the product! |
| ⚠ **Caution** | • Avoid metal shavings and wire tips falling into the ventilation holes of the product during installation, this may cause fire, malfunction, and misoperation.<br>• After installation, ensure that there is no foreign matter on the ventilation surfaces, otherwise it may lead to poor heat dissipation and cause fire, malfunction and misoperation.<br>• When installing, make a tight connection to the respective connector and lock the product connection hook firmly. If the products are not installed properly, it may lead to misoperation, malfunction and dislodgement. |

| **When wiring products** |
|---|

| | |
|---|---|
| ⚠ **Danger** | • Only maintenance professionals with adequate electrical knowledge and training related to electrical equipment should perform the wiring of this product. |
| ⚠ **Warning** | • During wiring operations, the external supply power used by the system must be completely disconnected before operation. Failure to disconnect all of them may result in electric shock or equipment malfunction or misoperation.<br>• When powering up and running after the wiring operation, the terminal cover that comes with the product must be installed. Failure to install the terminal cover may result in electric shock.<br>• Check the type of interface to be connected before connecting the cable correctly. If the wrong interface is connected or the wiring is incorrect, it may cause the product or external equipment to malfunction.<br>• The cable terminals should be well insulated to ensure that the insulation distance between the cables is not reduced after the cables are installed to the terminal block. Otherwise, it will lead to electric shock or equipment damage.<br>• Avoid metal shavings and wire tips falling into the ventilation holes of the controller when wiring, which may cause fire, malfunction, and misoperation!<br>• The bolts on the terminal blocks should be tightened within the specified torque range. Untightened terminal bolts may result in short circuit, fire, or malfunction. Over-tightening the bolts may damage the bolts and the product, resulting in dislodgement, short circuit, fire, or false operation. |
| ⚠ **Caution** | • The specification and installation method of the external wiring of the equipment should meet the requirements of local power distribution regulations.<br>• To ensure the safety of the equipment and the operator, the equipment needs to be reliably grounded using cables of sufficient wire size.<br>• For connections using connectors and external devices, press fit, crimp, or properly solder using the tool specified by the manufacturer. A poor connection may result in a short circuit, fire, or malfunction.<br>• If the product is labeled to prevent foreign objects from entering the product during wiring, such as the wiring head. Do not remove this label during wiring operations. Before starting system operation, be sure to remove the label to facilitate heat dissipation.<br>• Please do not bundle the control and communication cables with the main circuit or power supply cables, etc. The alignment should be more than 100mm apart, otherwise the noise may lead to misoperation.<br>• For applications with serious interference, please use shielded cables for input or output of high frequency signals to improve the system's anti-interference capability. |

| **Before powering on the product** | |
|---|---|
| ⚠ **Danger** | • Before powering on, please make sure the product is well installed, wired firmly and the motor unit is allowed to restart.<br>• Before powering on, please confirm that the power supply meets the product requirements to avoid causing damage to the product or starting a fire.<br>• It is strictly forbidden to open the product cabinet door or product protective cover, touch any terminals of the product, disassemble any device or parts of the product in the energized state, otherwise there is a risk of electric shock.<br>• Make sure that no one is around the product, the motor, or the machinery before powering it on, as this may result in injury or death! |

| | |
|---|---|
| ⚠ **Warning** | • After the wiring operation and parameter setting are completed, please conduct a test run of the machine to confirm that it can operate safely, otherwise it may lead to injury or equipment damage!<br>• Before powering on, please make sure that the rated voltage of the product is the same as the power supply voltage. If the power supply voltage is used incorrectly, there is a risk of fire! |

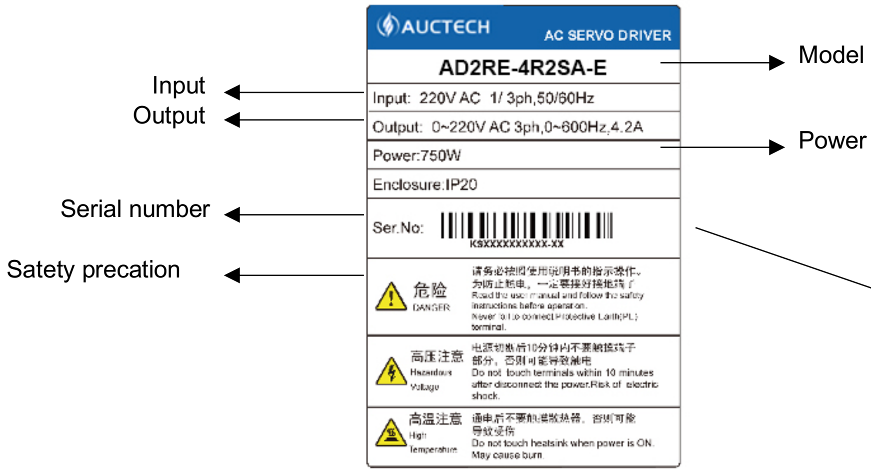
| **When operating and maintaining** | |
|---|---|
| ⚠ **Danger** | • Only maintenance professionals with adequate electrical knowledge and training on electrical equipment can perform the operation and maintenance of the products.<br>• Do not touch the terminals when the power is on, as this may cause electric shock or malfunction.<br>• When the motor or equipment is running, please never touch its rotating parts, otherwise it may lead to serious personal safety accidents. |
| ⚠ **Warning** | • When cleaning the product or retightening the bolts on the terminal block or the connector mounting bolts, the external supply power used by the system must be completely disconnected. Failure to do so may result in electric shock.<br>• When disassembling the product or connecting or removing the communication cable, the external supply power used by the system must be completely disconnected first. Failure to disconnect all of them may result in electric shock or false operation.<br>• While dissembling the product, the power and the power indicator must be turned off for at least 5 minutes, before disassembling the driver. Otherwise, the residual voltage may cause electric shock. |
| ⚠ **Caution** | • For online modification, forced output, RUN, STOP, etc., you must read the user's manual and confirm its safety before performing the relevant operations.<br>• Be sure to disconnect the power before loading and unloading expansion cards, modules, and other components! |

| **When the product is scrapped** | |
|---|---|
| ⚠ **Caution** | • Please dispose of them as industrial waste; when disposing of batteries, do so separately according to the ordinances established by each region to avoid property damage or human injury!<br>• End-of-life products should be treated and recycled in accordance with industrial waste treatment standards to avoid polluting the environment. |

# Section 2 Product Information

## 2.1 Introduction of Servo Drive

### 2.1.1 Nameplate and model description




**A D 2 R E - 4 R 2 S A - E - S**

**AD2 Series**

**Type of machine**
**R: Standard servo unit**
**Control interface**

**Control interface type**
**E: EtherCAT bus control**

**Rated output current**

| | | | | |
|---|---|---|---|---|
| **1R8: 1.8A** | **2R8: 2.8A** | **3R5: 3.5A** | **4R2: 4.2A** | **060: 6A** |
| **100 : 10A** | **120 : 12A** | **140 : 14A** | **250 : 25A** | **340 : 34A** |

**Capacity Class**
**S: Standard capacity**
**(P note 2): Capacity enhancement**

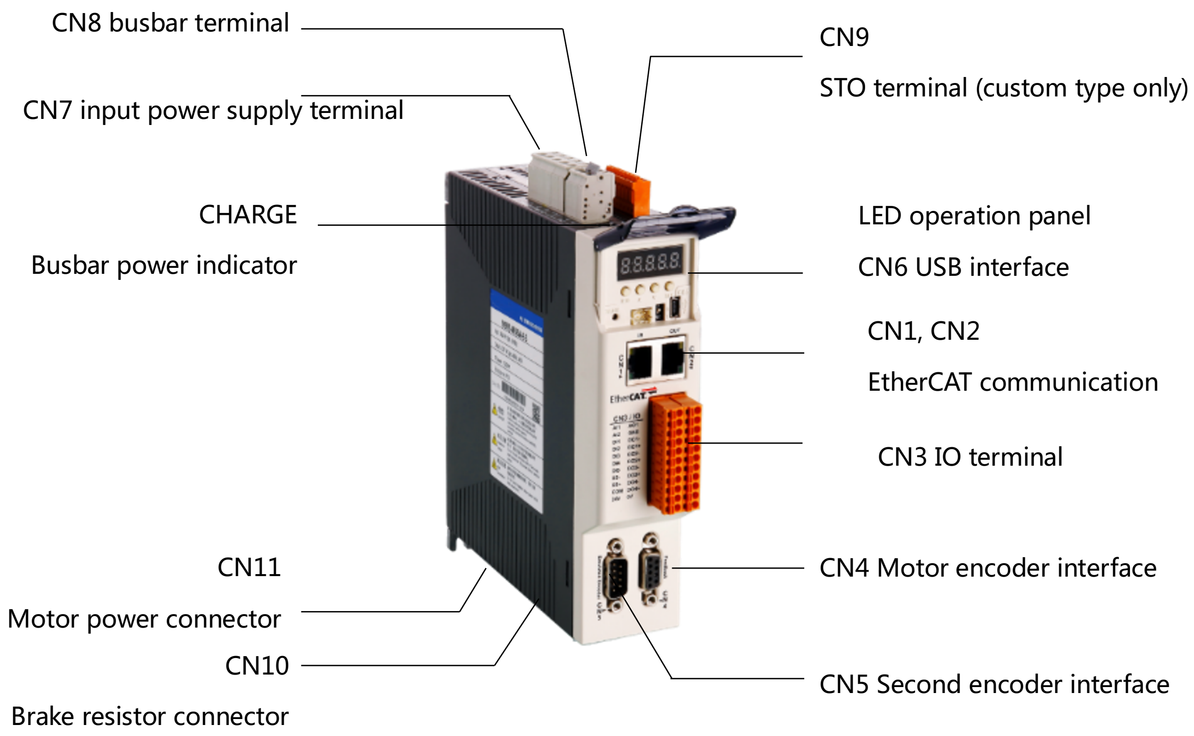
**Voltage Rating**
**A: AC220V**
**C: AC380V**

**Encoder type**
**E: Communication type encoder**

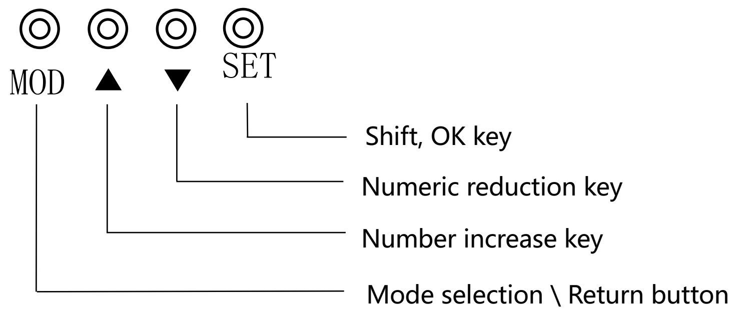
**Manufacturer Definition**
**None: Standard**
**S : STO type**
**SA: High precision analog input ST O + crossover output type**

Note: 1) Naming rules are only used for model number analysis, and cannot be used for ordering, please consult AUCTECHbefore ordering.
2) Under the same current output capacity, the capacitor capacity is increased to have stronger output power, which is suitable for high current shock.

## 2.1.2 Drive Composition




| Name | Description |
|---|---|
| CN1 communication bus input interface | Bus communication, input interface. |
| CN2 communication bus output interface | Bus communication, output interface. |
| CN3 IO terminal | Signal connection of DI, DO, AI, AO, emergency stop, contracting brake, etc. |
| CN4 Motor encoder interface | The encoder input interface of the servo motor. |
| CN5 Second encoder interface | External second encoder input interface. |
| CN6 USB debug/burn-in interface | Servo debug or firmware burn-in interface. |
| CN7 Power supply terminal | A1/A2 size servo driver CN7 has R, S, T, L1c, L2c pins, while A3/B1/B2 size servo driver has only R, S, T pins.<br>R, S and T are the main power input, and the input voltage level should be determined according to the relevant selection data.<br>L1c and L2c are control power inputs. Please determine the input voltage level according to the relevant selection data. |
| CN8 DC bus terminal | A1/A2 size Servo Drive CN8 has P1, P2, and⊖ pins, while the A3-size servo driver has P1, P2⊖ L1c, L2c pins.<br>P1, P2,⊖ are DC bus-related terminals, where P1 and P2 can be connected to DC reactors. |
| CN9 STO terminal | STO function terminal<br>Only STO custom models have this terminal, standard models do not have this feature. |
| CN10 Brake resistor connection terminal | P3, C, D brake resistor connection terminals<br>When P3 and D are shorted, the internal braking resistor is used.<br>P3, C Used when external braking resistor is connected. |
| CN11 Motor power connection terminal | Motor power connection terminals U, V, W are connected to the servo motor three-phase winding |
| LED digital tube | |

| Name | Description |
|---|---|
| | 8.8.8.8.8.<br>5-digit 8-segment digital tube for displaying, setting, and operating related information, parameters, and functions. |
| Operation Panel |  |
| CHARGE Busbar Indicator | The indicator light is on when the DC bus capacitor is charging. Do not touch the powered terminal part of the Servo Drive until the indicator light is completely off, and do not disassemble the Servo Drive. |
| PE ground terminal | For servo driver body grounding, and servo motor power line grounding. |

**⚠ Dangerous**

- ◆ CN7, CN8 interface has strong electricity, please do protective measures.
  - a) In the default case (no DC reactor is used), the P1/P2 terminals of the CN8 interface need to be shorted.
  - b) When using DC reactors, connect them between terminals P1 and P2.
  - c) When using the common DC bus, the positive bus is connected to the P1 terminal, and the negative bus is connected to the ⊙ .
- ◆ When the DO output is connected to a relay, please use a current-continuing diode, and pay attention to its polarity, otherwise it will not output properly or even damage the driver.
  - a) The maximum withstand voltage of DO output is DC30V.
  - b) The maximum continuous current of DO single output is DC 50mA.
- ◆ Please use current limiting resistors when connecting the DO circuit to the upper optocoupler signal.
- ◆ The COM terminal can only select one of PNP or NPN input methods and cannot be mixed.

## 2.1.3 Servo Drive Specifications

1) Electrical specifications

- Servo driver specification A1 (size W*H*D: 45*168*165)

| Model | 1R8SA | 2R8SA | 4R2SA |
|---|---|---|---|
| Mains power | AC200V~AC240V, 50/60Hz. | | |
| Control power | AC200V~AC240V, 50/60Hz. | | |
| Power | 200W | 400W | 750W |
| Single-phase input current | 2.5A | 4.1A | 6.1A |
| Three-phase input current | 1.2A | 1.9A | 2.8A |
| Output rated current | 1.8A | 2.8A | 4.2A |
| Maximum output current | 5.4A | 8.4A | 12.6A |
| Overload factor | 300% | 300% | 300% |
| Built-in braking resistor | × | × | 40W, 80Ω |
| Minimum resistance value of external braking resistor | 40Ω | 40Ω | 40Ω |

- Servo Drive Specification A2 (Dimension W*H*D: 60*168*165)

| Model | 060PA | 100SA | 120SA |
|---|---|---|---|
| Mains power | AC200V~AC240V, 50/60Hz. | | |
| Control power | AC200V~AC240V, 50/60Hz. | | |
| Power | 1KW | 1.5KW | 1.5KW |
| Single-phase input current | 8.2A | 10.5A | 11.8A |
| Three-phase input current | 4A | 6.7A | 7A |
| Output rated current | 6A | 10A | 12A |
| Maximum output current | 18A | 20A | 35A |
| Overload factor | 300% | 200% | 280% |
| Built-in braking resistor | 60W, 40Ω | 60W, 40Ω | 60W, 40Ω |
| Minimum resistance value of external braking resistor | 25Ω | 25Ω | 25Ω |

- Servo driver specification A3 (Dimension W*H*D: 70*192*181)

| Model | 120PA | 140SA |
|---|---|---|
| Mains power | AC200V~AC240V, 50/60Hz. | |
| Control power | AC200V~AC240V, 50/60Hz. | |
| Power | 2KW | 3KW |
| Single-phase input current | 14A | 20A |
| Three-phase input current | 8.2A | 9.3A |
| Output rated current | 12A | 14A |
| Maximum output current | 35A | 35A |
| Overload factor | 280% | 250% |
| Built-in braking resistor | 100W, 20Ω | 100W, 20Ω |
| Minimum resistance value of external braking resistor | 20Ω | 20Ω |

- Servo Drive Specification B1 (Dimension W*H*D: 70*265*217.5)

| Model | 6R8SC | 6R8SC | 8R3SC |
|---|---|---|---|
| Mains power | AC380V~AC440V ±10%, 50/60Hz. | | |
| Control power | DC24V ±10%. | | |
| Minimum driver current consumption (DC) | 1A | | |
| Power | 2KW | 3KW | 4KW |
| Three-phase input current | 7.3A | 9.2A | 10.7A |
| Output rated current | 5.4A | 6.8A | 8.3A |
| Maximum output current | 16.2A | 20.4A | 24A |
| Overload factor | 300% | 300% | 290% |
| Minimum resistance value of external braking resistor | 50Ω | 50Ω | 50Ω |

- Servo Drive Specification B2 (Dimension W*H*D: 80*265*217.5)

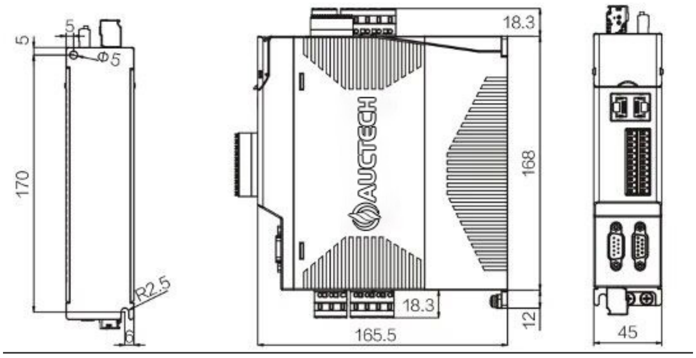
| Model | 100SC | 120SC | 140SC |
|---|---|---|---|
| Main power supply | AC380V~AC440V ±10%, 50/60Hz. | | |
| Control power | DC24V ±10%. | | |
| Minimum driver current consumption (DC) | 1A | | |
| Power | 5KW | 6KW | 7KW |
| Three-phase input current | 11.7A | 14A | 17A |
| Output rated current | 10A | 12A | 14A |
| Maximum output current | 30A | 35A | 35A |
| Overload factor | 300% | 290% | 250% |
| Minimum resistance value of external braking resistor | 50Ω | 50Ω | 50Ω |

- Servo driver specification B3 (Dimension W*H*D: 115*375*217.5)

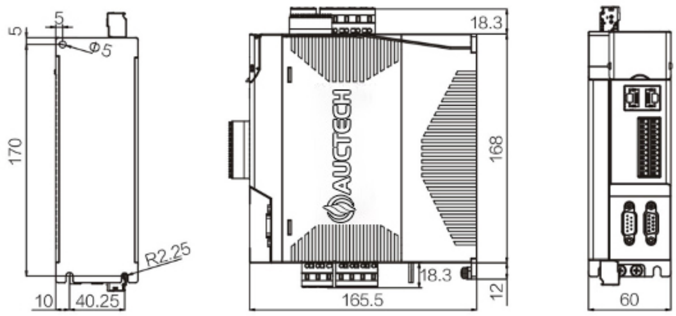
| Model | 210SC | 250SC | 340SC |
|---|---|---|---|
| Mains power | AC380V~AC440V ±10%, 50/60Hz. | | |
| Control power | DC24V ±10%. | | |
| Minimum driver current consumption (DC) | 1A | | |
| Power | 9KW | 10KW | 15KW |
| Three-phase input current | 24A | 28A | 38A |
| Output rated current | 21A | 25A | 34A |
| Maximum output current | 62.5A | 62.5A | 66A |
| Overload factor | 290% | 250% | 194% |
| Minimum resistance value of external braking resistor | 20Ω | 20Ω | 20Ω |

2) Specification size chart

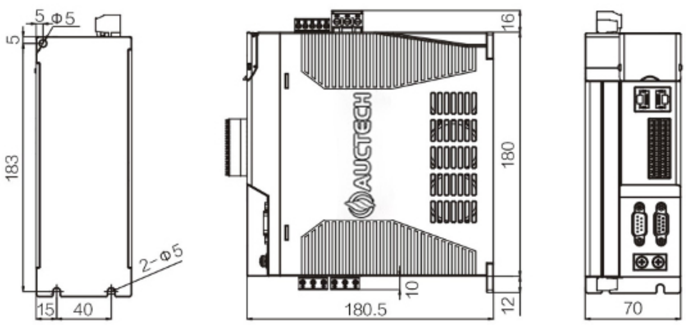
- AC220V class driver A1 specification (size W*H*D: 45*168*165)



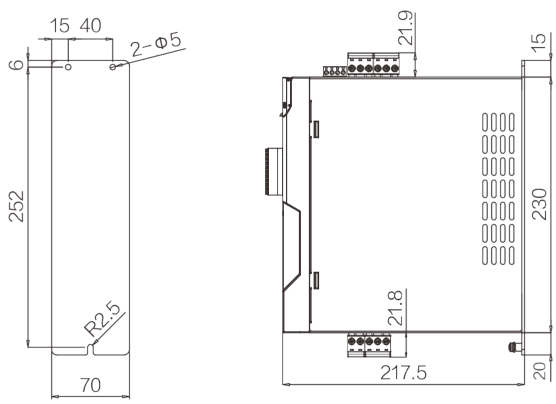

- AC220V class driver A2 specification (Size W*H*D: 60*168*165)



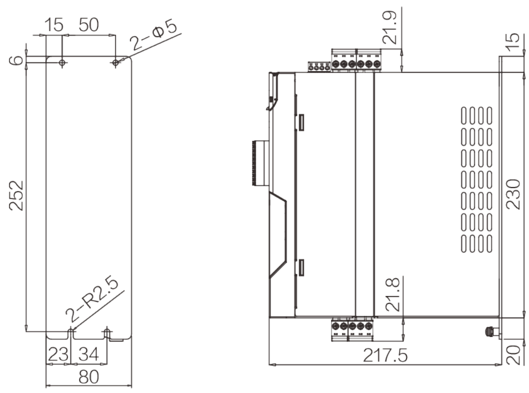

- AC220V class driver A3 specification (size W*H*D: 70*192*181)



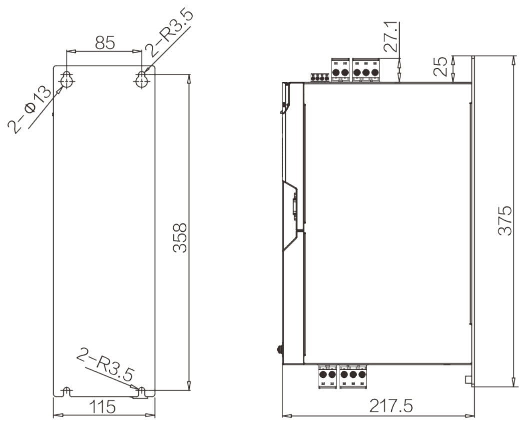

- AC380V Class Drive B1 Specification (Dimension W*H*D: 70*265*217.5)



- AC380V class drive B2 specification (size W*H*D: 80*265*217.5)




- AC380V class drive B3 specification (Dimension W*H*D: 115*375*217.5)



3) Basic specifications

| Projects | | | Description |
|---|---|---|---|
| **Basic Specification** | Control method | | IGBT PWM control, sine wave current drive mode |
| | | | AC220V, AC380V; three-phase full-wave rectification |
| | Encoder feedback | | ABZ encoder |
| | | | Communication encoder: Tamagawa, Nikon, Panasonic, Endat |
| | Control Mode | | Cyclic Synchronous Position Mode (CSP) |
| | | | Cyclic Synchronous Velocity (CSV) mode |
| | | | Cyclic Synchronous Torque Mode (CST) |
| | | | Wheel Position Mode (PP) |
| | | | Wheel speed mode (PV) |
| | | | Zero return mode (HM) |
| | | | CSP/CSV/CST mode switching |
| | | | Fully closed-loop control mode |
| | | | Probe latching function |
| | Conditions of use | Operating temperature | 0~45℃ |
| | | Storage temperature | -20~65℃ |
| | | Use/Storage Humidity | 90%RH or less, no dew condensation |
| | | Vibration resistance strength | 4.9m/s² |
| | | Impact strength | 19.6m/s² |
| | | Protection level | IP20 |
| | | Altitude | Below 1000m, above 1000m, 1.1% reduction for every 100m rise, maximum use altitude is 2000m |
| | EtherCAT Basic Slave Performance | Communication protocols | EtherCAT Protocol |
| | | Support Services | CoE (PDO, SDO) |
| | | Synchronization method | DC-Distributed Clock |
| | | Physical Layer | 100BASE-TX |
| | | Baud rate | 100Mbit/s |
| | | Duplex method | Full Duplex |
| | | Topology | Circumferential, linear |
| | | Transmission medium | Super Category 5 or higher network cable with shielding |
| | | Transmission distance | Maximum 100m between two nodes (good environment, high quality cables) |
| | | Number of slave stations | 65535 supported on the protocol, but no more than 240 units in actual use |
| | | EtherCAT Frame Length | 44~1498 bytes |
| | | Process Data | Single Ethernet frame up to 1486 bytes |
| | | Synchronous jitter of two slaves | <1μs |
| | | Refresh time | Approx. 100μs for 100 servo axes |
| | | Communication BER | 10-10 Ethernet Standard |
| | EtherCAT Configuration unit | FMMU unit | 8 |
| | | Storage Synchronization Management Unit | 8 |
| | | Process data RAM | 8KB |
| | | Distributed Clocks | 64-bit |

| Projects | | | Description |
|---|---|---|---|
| | | EEPROM | 32Kbit |
| **Analog signals** | Analog input channels | | 2-way, ±10V |
| | Analog output channels | | 1 way, ±10V |
| **Digital signals** | DI | HDI | 2-way, hardware response of 1μs, configurable as high-speed latch (i.e., probe function) or bus DI, or internal function. |
| | | DI | 3-way, hardware response 50μs, configurable bus DI or internal functions |
| | DO | | 4-channel, single-channel maximum withstands voltage DC30V, maximum continuous current DC50mA, configurable as bus DO or contracting brake output control, or internal function |
| **Built-in Function** | Overtravel (OT) prevention function | | Stop immediately when P-OT forward overtravel and N-OT reverse overtravel action |
| | Protection function | | Overcurrent, overvoltage, undervoltage, overload, main circuit detection abnormality, heat sink overheating, overload, overspeed, encoder abnormality, CPU abnormality, parameter abnormality, etc. |
| | Security Features | | Emergency stop function, safety torque shutdown function (not standard) |
| | LED display function | | 5-bit 8-segment LED display |
| | USB communication | | Debugging, diagnostics, monitoring and firmware burning operations |
| | Electronic nameplate function | | Internal integration of drive and motor IDs for automatic identification of drive and motor information |
| | Other | | Gain adjustment, filter, vibration suppression and other functions |

## 2.1.4 Braking energy absorption and braking resistor calculation

The Servo Drive uses an internal capacitor to absorb the regenerative energy that occurs when the motor decelerates, etc. If the internal capacitor cannot absorb all the regenerative energy, it can be absorbed by the internal braking resistor (note that individual models do not have an internal braking resistor). However, if the regenerative energy generated by the motor is too large, the regenerative action will be stopped, and the bus over-voltage alarm will occur to prevent the internal braking resistor from burning out. In this case, please change the operation mode to reduce the regenerative energy or install an external braking resistor to improve the regenerative energy handling capacity.

Note: 1. 400W and below model's servo drives do not have built-in braking resistors, please refer to the drive specification section for details.

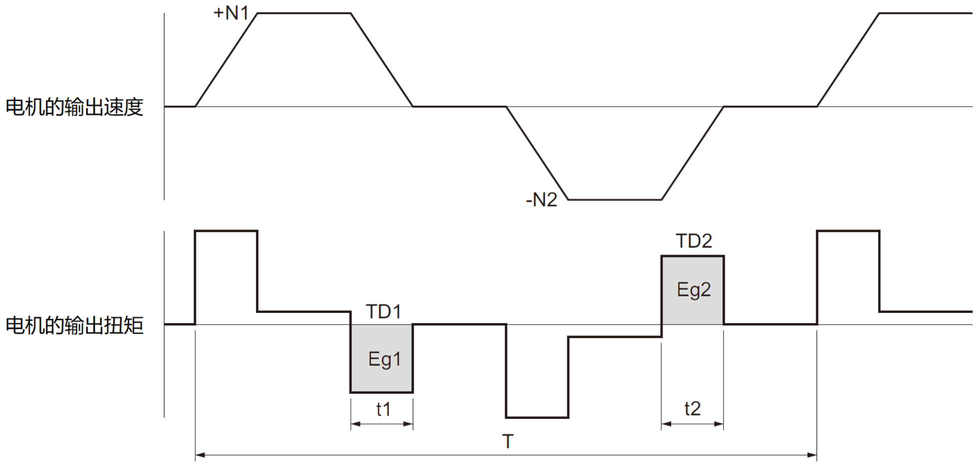
2、The regenerative absorption capacity of the servo driver varies with the random type.

Please refer to the following table for the presence or absence of braking resistors inside the servo driver and the capacitor regeneration absorption capacity.

| AD2 drive internal regeneration absorption | | | |
|---|---|---|---|
| Drive Model | Drive with built-in braking resistor | Minimum driver resistance (Ω) | absorbed by the driver capacitor Maximum braking energy Ec(J) |
| AD2RE-1R8SA | None | 40 | 20 |
| AD2RE-2R8SA | None | 40 | 20 |
| AD2RE-3R5SA | 40W; 80Ω | 40 | 20 |
| AD2RE-4R2SA | 40W; 80Ω | 40 | 20 |
| AD2RE-060SA | 40W; 80Ω | 40 | 20 |
| AD2RE-060PA | 60W; 40Ω | 25 | 34 |
| AD2RE-100SA | 60W; 40Ω | 25 | 34 |
| AD2RE-120SA | 60W; 40Ω | 25 | 34 |
| AD2RE-120PA | 100W; 20Ω | 20 | 60 |
| AD2RE-140SA | 100W; 20Ω | 20 | 60 |
| AD2RE-6R8SC | None | 60 | 130 |
| AD2RE-8R3SC | None | 50 | 130 |
| AD2RE-100SC | None | 50 | 156 |
| AD2RE-120SC | None | 50 | 156 |
| AD2RE-140SC | None | 50 | 156 |
| AD2RE-180SC | None | 50 | 156 |
| AD2RE-250SC | None | 20 | 203 |
| AD2RE-340SC | None | 20 | 270 |

1) Calculation of regenerative energy

- Horizontal axis regeneration energy calculation method




$$Eg1 = \frac{1}{2} \times \frac{2\pi}{60} \times \mathrm{N1} \times \mathrm{TD1} \times \mathrm{t1} \quad [\mathrm{J}]$$

$$Eg2 = \frac{1}{2} \times \frac{2\pi}{60} \times \mathrm{N2} \times \mathrm{TD2} \times \mathrm{t2} \quad [\mathrm{J}]$$

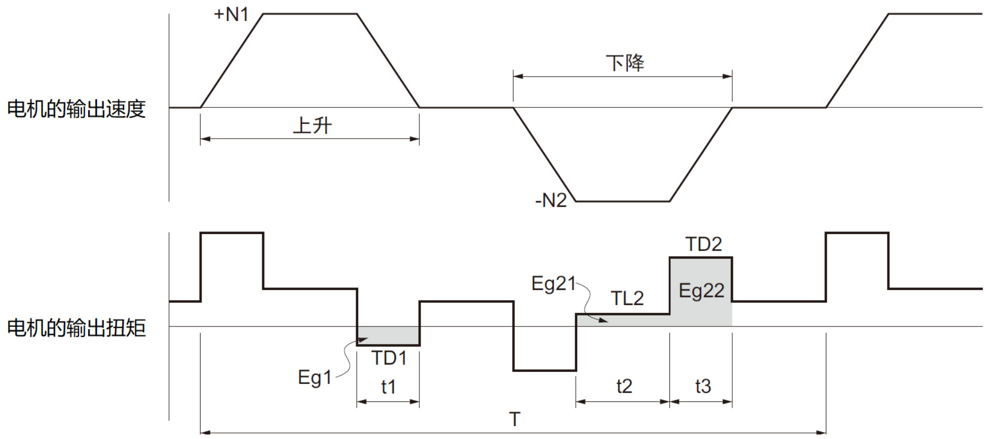
N1, N2: Speed at the start of deceleration (r/min)

TD1, TD2: Deceleration torque (Nm)

t1, t2: deceleration time (s)

Note: The actual regenerative energy is only about 90% of the value calculated in the above equation due to losses caused by motor coil resistance and drive.

- Vertical axis regeneration energy calculation method:




$$Eg1 = \frac{1}{2} \times \frac{2\pi}{60} \times N1 \times TD1 \times t1 \quad [J]$$

$$Eg21 = \frac{2\pi}{60} \times N2 \times TL2 \times t2 \quad [J]$$

$$Eg22 = \frac{1}{2} \times \frac{2\pi}{60} \times N2 \times TD2 \times t3 \quad [J]$$

$$Eg2 = Eg21 + Eg22 \quad [J]$$

N1, N2: Speed at the start of deceleration (r/min)

TD1, TD2: Deceleration torque (Nm)

TL2: Torque at descent (Nm)

t1, t3: Deceleration time (s)

t2: uniform running time during descent (s)

Note: The actual regenerative energy is only about 90% of the value calculated in the above equation due to losses caused by motor coil resistance and drive.

2) Braking resistor selection

If either Eg1 or Eg2 is lower than the regenerative energy Ec that can be absorbed by the servo driver's internal capacitor, the regenerative energy can be handled by the internal capacitor alone.

If either Eg1 or Eg2 exceeds the regenerative energy Ec that can be absorbed by the capacitor inside the servo drive, a regenerative resistor is required for energy release, and the average regenerative energy Pr(W) of the regenerative resistor can be found by the following formula.

$$Eg = (\mathrm{Eg1} - \mathrm{Ec}) + (\mathrm{Eg2} - \mathrm{Ec}) \ [\mathbf{J}]$$

$$Pr = Eg / T \ [\mathbf{W}]$$

Pr: regenerative power that must be absorbed in 1 cycle of action (in W)

Eg: regenerative energy that must be absorbed in 1 cycle of action (in J)

Ec: Regenerative energy that can be absorbed by the internal capacitor of the driver (in J)

T: Action cycle time (unit s)

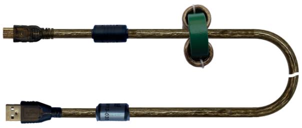
Notes: $\mathrm{Eg1} - \mathrm{Ec}$ When < 0, it is calculated as 0. $\mathrm{Eg2} - \mathrm{Ec}$ When < 0, calculated as 0.

## 2.1.5 Drive Options

1) Debugging Software

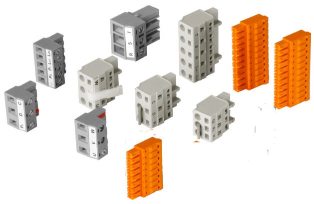
| Model | Description |
|---|---|
| AD-Setup | AD2 series servo system commissioning software |

2) Debugging cables



| Model | Description |
|---|---|
| AD-M13-030 | AD2 Series Mini USB Debug Cable 3m |

3) Terminal set

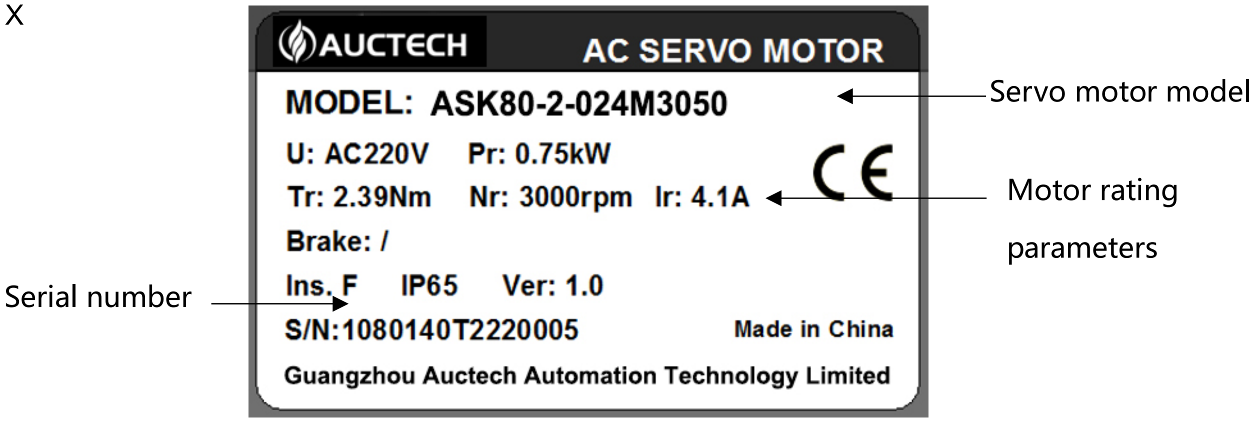


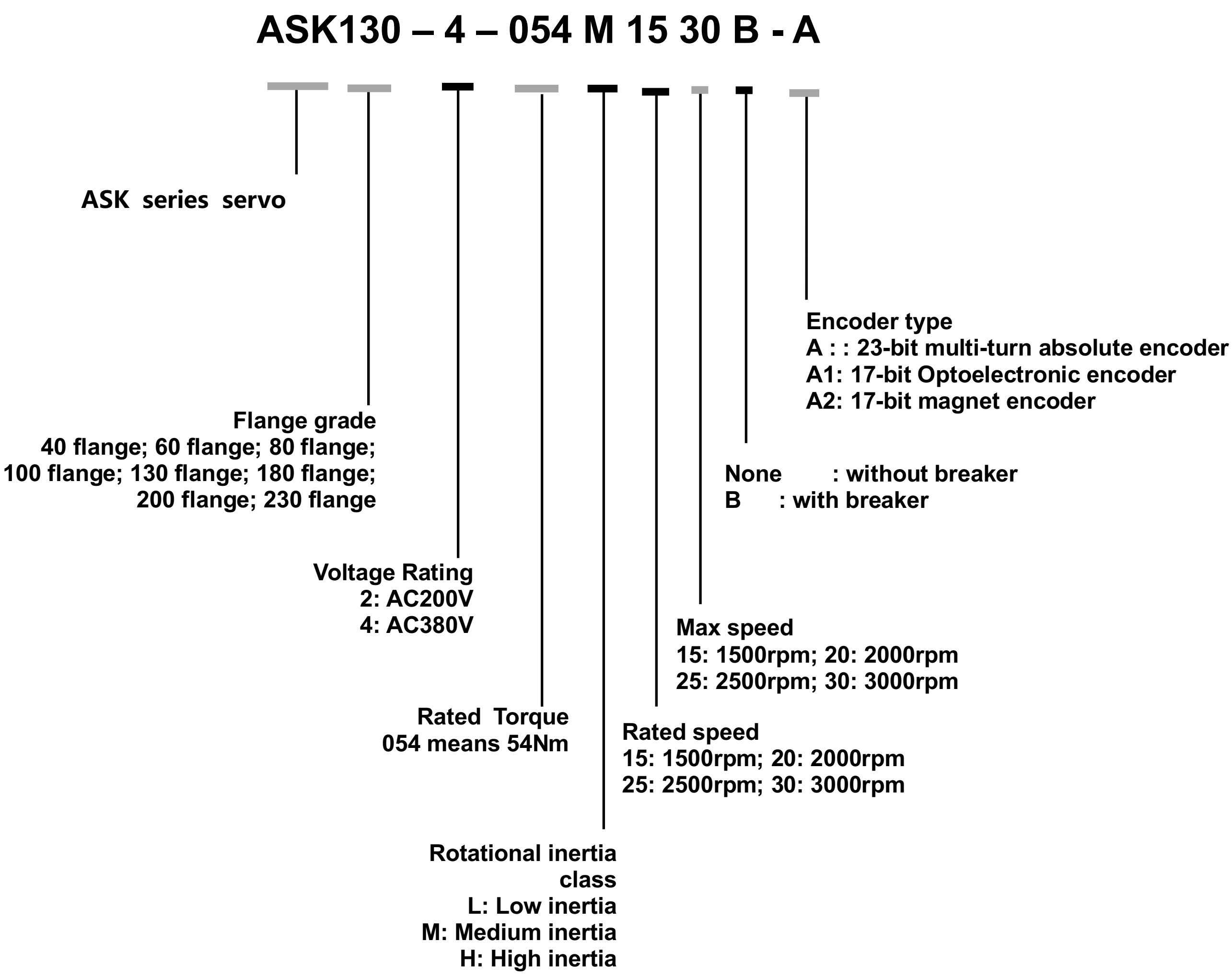
4) Communication network cable

## 2.2 Introduction of ASK servo motor

### 2.2.1 Nameplate and model description

X




Note: 1、The naming rules are only for model number analysis, and cannot be used for ordering, please consult AUCTECH before ordering.

2、With or without oil seal, with or without brake, will cause different motor characteristics, please note.

3、Motor data may be changed, please confirm with AUCTECH when using for design purpose.

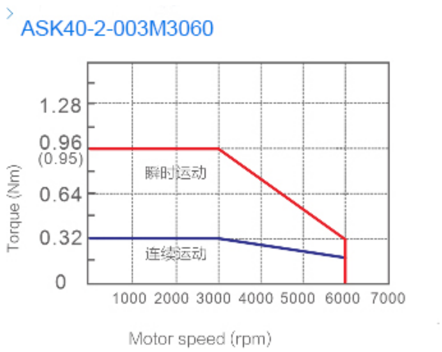
## 2.2.2 Motor specifications

- 40 flange motor data (0.1KW)

| Projects \ Motor Model | ASK40-2-003M3060 |
|---|---|
| **Voltage U (AC)** | AC220V |
| **Rated power Pr (kW)** | 0.1 |
| **Rated current Ir (A)** | 0.92 |
| **Rated torque Tr (Nm)** | 0.32 |
| **Rated speed Nr (rpm)** | 3000 |
| **Maximum current Imax (Arms)** | 2.85 |
| **Maximum torque Tmax (Nm)** | 0.95 |
| **Maximum speed Nmax (rpm)** | 6000 |
| **Torque coefficient Kt (Nm/A)** | 0.38 |
| **Rotational inertia Jm (10-4kgm2)** | 0.062 (0.072) |
| **Electrical time constant te (ms)** | 0.81 |
| **Mechanical time constant tm (ms)** | 1.128 |
| **Weight(kg)** | 0.43 (0.59) |
| **Heat sink size(mm)** | Aluminum 200×200×6 |
| **Holding voltage Ub (DC)** | 24V |
| **Holding current Ib (A)** | 0.29 |
| **Holding torque Tb (Nm)** | ≥0.4 |
| **Recommended power cable cross-sectional area (mm2)** | 0.5 |
| **Recommended Drive Models** | AD2RE-1R8SA-E |

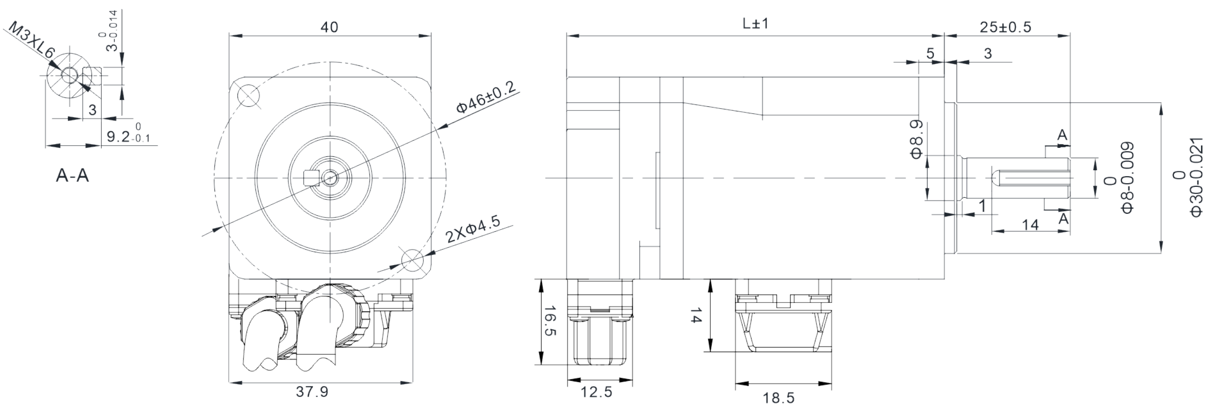
Note: The above is the standard model, () is with contracting brake motor parameters.

- 40 flange torque speed characteristics chart




Note: The characteristics of the transient operating area will vary depending on the supply voltage; if the load torque is within the rated torque, it can be used in the continuous operating area.

- 40 flange motor size drawing



| Motor Model | L without contracting brake size(mm) | L with contracting brake size(mm) |
|---|---|---|
| ASK40-2-003M3060□ | 67.7 | 95 |

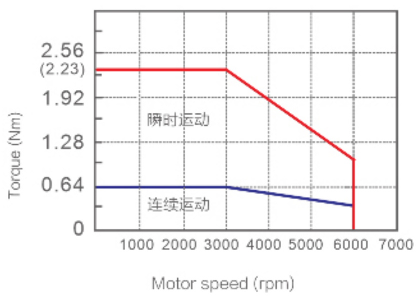
- 60 flange motor data (0.2KW~0.4KW)

| Projects \ Motor Model | ASK60-2-006M3060 | ASK60-2-013M3050 |
|---|---|---|
| **Voltage U (AC)** | 220V | |
| **Rated power Pr (kW)** | 0.2 | 0.4 |
| **Rated current Ir (A)** | 1.5 | 2.1 |
| **Rated torque Tr (Nm)** | 0.64 | 1.27 |
| **Rated speed Nr (rpm)** | 3000 | 3000 |
| **Maximum current Imax (Arms)** | 5.5 | 6.5 |
| **Maximum torque Tmax (Nm)** | 2.23 | 3.81 |
| **Maximum speed Nmax (rpm)** | 6000 | 5000 |
| **Torque coefficient Kt (Nm/A)** | 0.427 | 0.605 |
| **Rotational inertia Jm (10-4kgm2)** | 0.28 (0.30) | 0.56 (0.58) |
| **Electrical time constant te (ms)** | 2.46 | 2.11 |
| **Mechanical time constant tm (ms)** | 1.432 | 1.151 |
| **Weight (kg)** | 0.95(1.35) | 1.3 (1.55) |
| **Heat sink size (mm)** | Aluminum 250×250×6 | |
| **Holding voltage Ub (DC)** | 24V | |
| **Holding current Ib (A)** | 0.31 | |
| **Holding torque Tb (Nm)** | ≥1.5 | |
| **Recommended power cable cross-sectional area (mm2)** | 0.5 | |
| **Recommended Drive Models** | AD2RE-1R8SA-E | AD2RE-2R8SA-E |

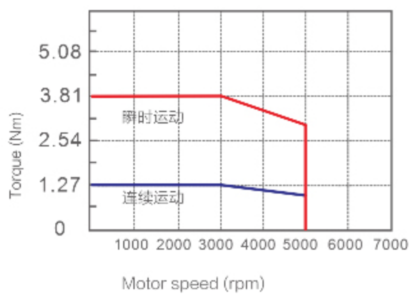
Note: The above is the standard model, () is with contracting brake motor parameters.

- 60 flange torque speed characteristics chart

ASK60-2-006M3060

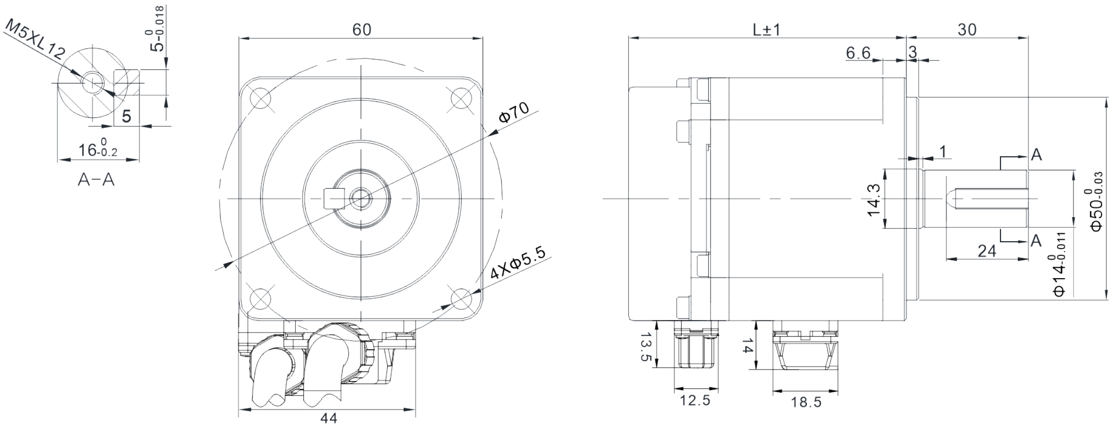



ASK60-2-013M3050




Note: The characteristics of the transient operating area will vary depending on the supply voltage; if the load torque is within the rated torque, it can be used in the continuous operating area.

- 60 flange motor size drawing




| Motor Model | L without contracting brake size(mm) | L with contracting brake size(mm) |
|---|---|---|
| ASK60-2-006M3060□ | 71.8 | 101.1 |
| ASK60-2-013M3050□ | 88.8 | 118.1 |

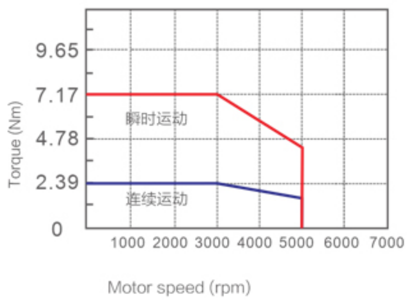
- 80 flange motor data (0.75KW~1KW)

| Motor model / Projects | ASK80-2-024M3050 | ASK80-2-032M3050 |
|---|---|---|
| Voltage U (AC) | 220V | |
| Rated power Pr (kW) | 0.75 | 1 |
| Rated current Ir (A) | 4.1 | 5.7 |
| Rated torque Tr (Nm) | 2.39 | 3.19 |
| Rated speed Nr (rpm) | 3000 | 3000 |
| Maximum current Imax (Arms) | 13.4 | 17.7 |
| Maximum torque Tmax (Nm) | 7.17 | 9.56 |
| Maximum speed Nmax (rpm) | 5000 | 5000 |
| Torque coefficient Kt (Nm/A) | 0.645 | 0.56 |
| Rotational inertia Jm (10-4kgm2) | 1.5 (1.65) | 2(2.15) |
| Electrical time constant te (ms) | 4.71 | 5.09 |
| Mechanical time constant tm (ms) | 0.919 | 0.822 |
| Weight (kg) | 2.12 (2.7) | 2.8(3.4) |
| Heat sink size (mm) | Aluminum 250×250×6 | |
| Holding voltage Ub (DC) | 24V | |
| Holding current Ib (A) | 0.48 | |
| Holding torque Tb (Nm) | ≥3.2 | |
| Recommended power cable cross-sectional area (mm2) | 0.5 | |
| Recommended Drive Models | AD2RE-4R2SA-E | AD2RE-060PA-E |

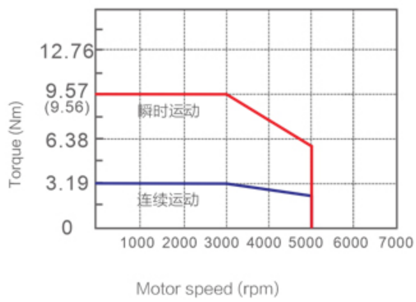
Note: The above is the standard model, () is with contracting brake motor parameters.

- 80 flange torque speed characteristics chart

ASK80-2-024M3050B

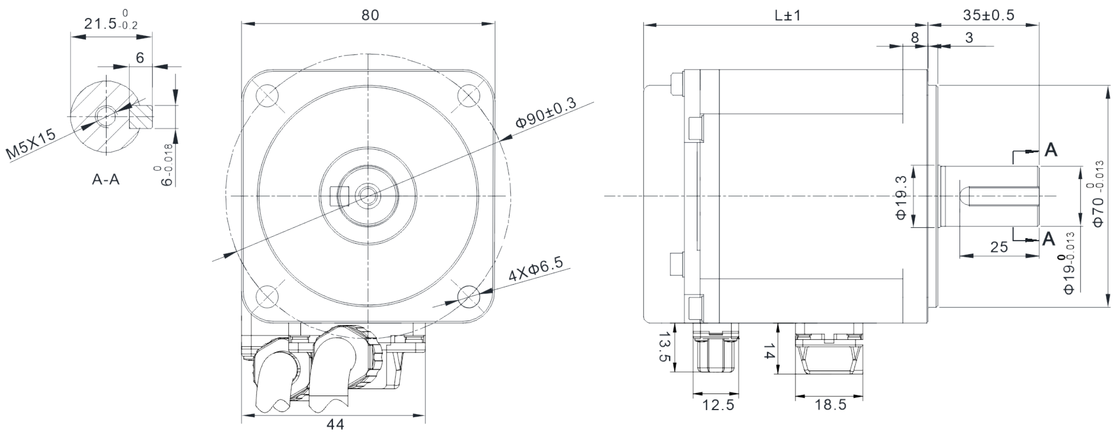



ASK80-2-032M3050




Note: The characteristics of the transient operating area will vary depending on the supply voltage; if the load torque is within the rated torque, it can be used in the continuous operating area.

- 80 flange motor size drawing




| Motor Model | L without contracting brake size(mm) | L with contracting brake size(mm) |
|---|---|---|
| ASK80-2-024M3050 | 90.9 | 121.9 |
| ASK80-2-32M3050 | 103.9 | 134.9 |

- 100 flange motor data (1KW~2KW)

| Projects \ Motor Model | ASK100-2-032M3060 | ASK100-2-048M3050 | ASK100-2-064M3050 |
|---|---|---|---|
| **Voltage U (AC)** | 220V | | |
| **Rated power Pr (kW)** | 1 | 1.5 | 2 |
| **Rated current Ir (A)** | 7.7 | 8.6 | 11.4 |
| **Rated torque Tr (Nm)** | 3.18 | 4.77 | 6.37 |
| **Rated speed Nr (rpm)** | 3000 | 3000 | 3000 |
| **Maximum current Imax (Arms)** | 23.1 | 25.8 | 32.4 |
| **Maximum torque Tmax (Nm)** | 9.55 | 14.32 | 19.1 |
| **Maximum speed Nmax (rpm)** | 6000 | 5000 | 5000 |
| **Torque coefficient Kt (Nm/A)** | 0.416 | 0.558 | 0.558 |
| **Rotational inertia Jm (10-4kgm2)** | 2.07 (2.33) | 2.69 (2.95) | 3.6 (3.86) |
| **Electrical time constant te (ms)** | 6.99 | 7.02 | 7.18 |
| **Mechanical time constant tm (ms)** | 0.7 | 0.58 | 0.55 |
| **Weight (kg)** | 4.5(5.4) | 5.0 (6.5) | 6(7.5) |
| **Heat sink size(mm)** | Aluminum 400×410×15 | | |
| **Holding voltage Ub (DC)** | 24V | | |
| **Holding current Ib (A)** | 0.6 | | |
| **Holding torque Tb (Nm)** | ≥9 | | |
| **Recommended power cable cross-sectional area (mm2)** | 1.5 | | |
| **Recommended Drive Models** | AD2RE-100SA-E | AD2RE-100SA-E | AD2RE-120PA-E |

Note: The above is the standard model, () is with contracting brake motor parameters.

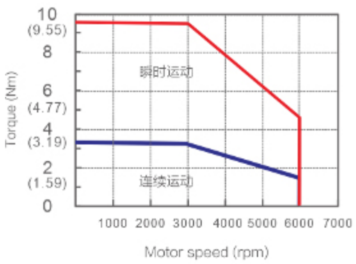
- 100 flange motor data (1KW~2.5KW)

| Motor Model / Projects | ASK100-4-032M3060 | ASK100-4-048M3050 | ASK100-4-064M3050 | ASK100-4-080M3050 |
|---|---|---|---|---|
| **Voltage U (AC)** | 380V | | | |
| **Rated power Pr (kW)** | 1 | 1.5 | 2 | 2.5 |
| **Rated current Ir (A)** | 4.5 | 4.8 | 6.8 | 8.4 |
| **Rated torque Tr (Nm)** | 3.18 | 4.77 | 6.37 | 8.0 |
| **Rated speed Nr (rpm)** | 3000 | 3000 | 3000 | 3000 |
| **Maximum current Imax (Arms)** | 13.5 | 14.4 | 20.4 | 24 |
| **Maximum torque Tmax (Nm)** | 9.55 | 14.32 | 19.1 | 22.7 |
| **Maximum speed Nmax (rpm)** | 6000 | 5000 | 5000 | 5000 |
| **Torque coefficient Kt (Nm/A)** | 0.707 | 0.99 | 0.936 | 0.947 |
| **Rotational inertia Jm (10-4kgm2)** | 2.07 (2.33) | 2.69 (2.95) | 3.6 (3.86) | 4.37 (4.55) |
| **Electrical time constant te (ms)** | 8.63 | 6.36 | 6.93 | 9.16 |
| **Mechanical time constant tm (ms)** | 0.73 | 0.68 | 0.56 | 0.45 |
| **Weight (kg)** | 4.5(5.4) | 5.0 (6.5) | 6.0 (7.5) | 7.0(8.5) |
| **Heat sink size (mm)** | Aluminum 200×200×12 | | | |
| **Holding voltage Ub (DC)** | 24V | | | |
| **Holding current Ib (A)** | 0.6 | | | |
| **Holding torque Tb (Nm)** | ≥9 | | | |
| **Recommended power cable cross-sectional area (mm2)** | 0.75 | | 1.5 | |
| **Recommended Drive Models** | AD2RE-5R4SC-E | | AD2RE-6R8SC-E | AD2RE-8R3SC-E |

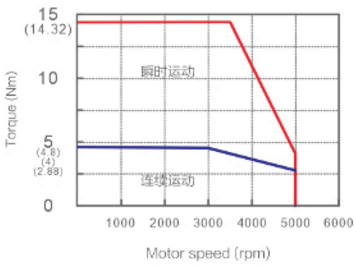
Note: The above is the standard model, () is with contracting brake motor parameters.

- 100 flange torque speed characteristics chart

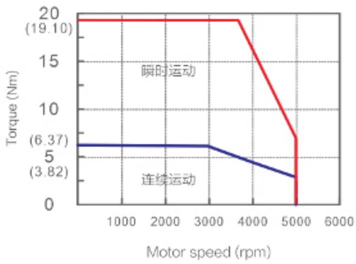
ASK100-2-032M3060



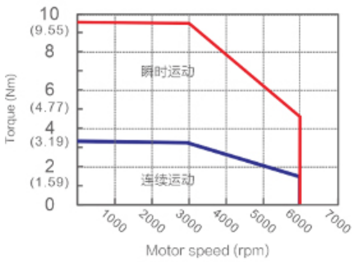

ASK100-2-048M3050



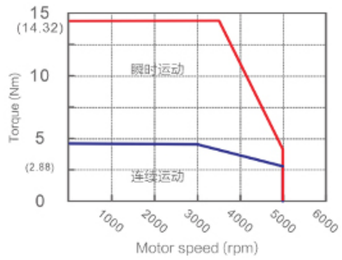

ASK100-2-064M3050



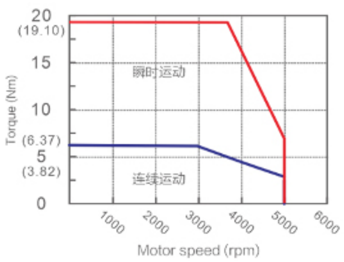

ASK100-4-032M3060



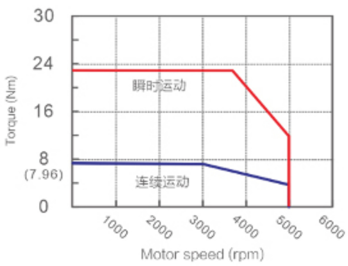

ASK100-4-048M3050




ASK100-4-064M3050

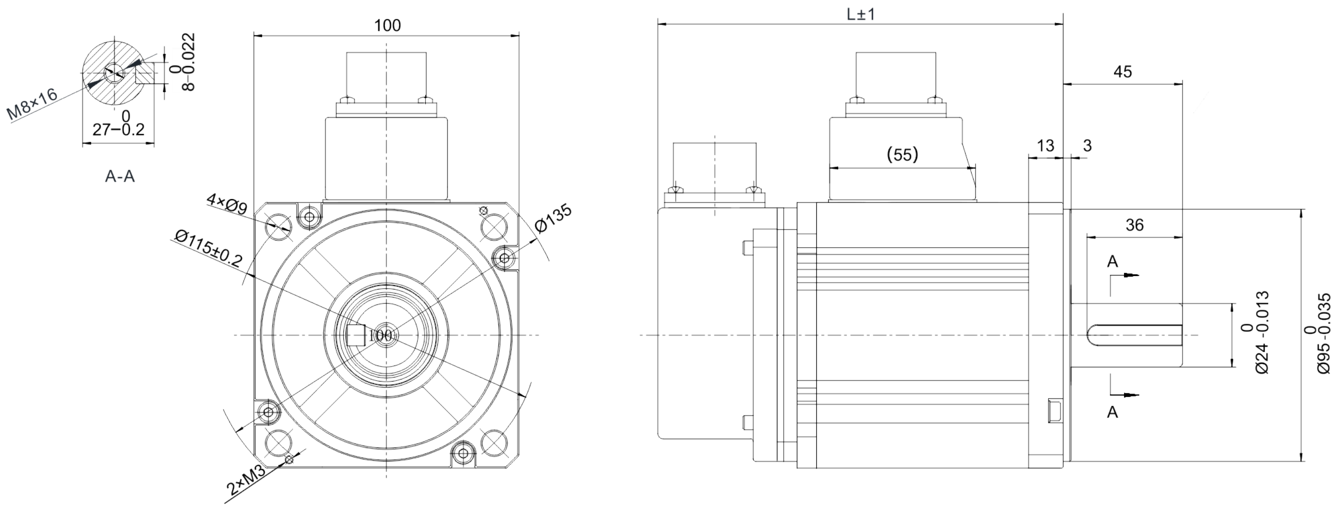



ASK100-4-080M3050




Note: The characteristics of the transient operating area will vary depending on the supply voltage; if the load torque is within the rated torque, it can be used in the continuous operating area.

- 100 flange motor size drawing




| Motor Model | L without contracting brake size(mm) | L with contracting brake size(mm) |
|---|---|---|
| ASK100-2-032M3060 | 146.9 | 183 |
| ASK100-2-048M3050 | 166.9 | 203 |
| ASK100-2-064M3050 | 186.9 | 223 |
| ASK100-2-064M3050 | 206.9 | 243 |

Note: The flange, torque, and speed of the same motor, 380V and 220V grade models have the same external dimensions.

- 130 flange motor data (0.85KW~1.8KW)

| Motor / Model / Projects | ASK130-2-083M1530 | ASK130-2-083M1530 | ASK130-2-096M1530 | ASK130-2-115M1530 |
|---|---|---|---|---|
| **Voltage U (AC)** | 220V | | | |
| **Rated power Pr (kW)** | 0.85 | 1.3 | 1.5 | 1.8 |
| **Rated current Ir(A)** | 6.12 | 9.25 | 11.5 | 12.9 |
| **Rated torque Tr (Nm)** | 5.41 | 8.27 | 9.55 | 11.46 |
| **Rated speed Nr (rpm)** | 1500 | 1500 | 1500 | 1500 |
| **Maximum current Imax (Arms)** | 18.4 | 27.75 | 34.5 | 34.9 |
| **Maximum torque Tmax (Nm)** | 16.2 | 24.81 | 28.7 | 31 |
| **Maximum speed Nmax (rpm)** | 3000 | 3000 | 3000 | 3000 |
| **Torque coefficient Kt (Nm/A)** | 0.88 | 0.89 | 0.83 | 0.89 |
| **Rotational inertia Jm (10-4kgm2)** | 9(10.5) | 13(14.5) | 17(18.5) | 21.7 (23.2) |
| **Electrical time constant te (ms)** | 8.47 | 8.89 | 7.4 | 12.33 |
| **Mechanical time constant tm (ms)** | 1.6 (1.86) | 1.42 (1.58) | 1.64 (1.78) | 1.11 (1.19) |
| **Weight (kg)** | 5.8 (7.4) | 7(8.8) | 8.4 (10.2) | 10(11.8) |
| **Heat sink size (mm)** | Aluminum 300×300×12 | | | |
| **Holding voltage Ub (DC)** | 24V | | | |
| **Holding current Ib (A)** | 0.69 | | | |
| **Holding torque Tb (Nm)** | > 12 | | | |
| **Recommended power cable cross-sectional area (mm2)** | 0.75 | 1.5 | 1.5 | 2.5 |
| **Recommended Drive Models** | AD2RE-060PA-E | AD2RE-100SA-E | AD2RE-120SA-E | AD2RE-120PA-E |

Note: The above is the standard model, () is with contracting brake motor parameters.

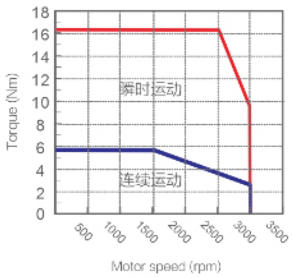
- 130 flange motor data (1KW~2.5KW)

| Projects \ Motor model | ASK130-2-048M2030 | ASK130-2-072M2030 | ASK130-2-096M2030 | ASK130-2-119M2030 |
|---|---|---|---|---|
| **Voltage U (AC)** | 220V | | | |
| **Rated power Pr (kW)** | 1 | 1.5 | 2 | 2.5 |
| **Rated current Ir (A)** | 5.4 | 8 | 11.5 | 13.4 |
| **Rated torque Tr (Nm)** | 4.77 | 7.16 | 9.55 | 11.9 |
| **Rated speed Nr (rpm)** | 2000 | 2000 | 2000 | 2000 |
| **Maximum current Imax (Arms)** | 16.2 | 24 | 34.5 | 34.9 |
| **Maximum torque Tmax (Nm)** | 14.3 | 21.5 | 28.6 | 31 |
| **Maximum speed Nmax (rpm)** | 3000 | 3000 | 3000 | 3000 |
| **Torque coefficient Kt (Nm/A)** | 0.88 | 0.9 | 0.83 | 0.89 |
| **Rotational inertia Jm (10-4kgm2)** | 9(10.5) | 13(14.5) | 17(18.5) | 21.7 (23.2) |
| **Electrical time constant te (ms)** | 8.47 | 8.89 | 7.40 | 12.33 |
| **Mechanical time constant tm (ms)** | 1.6 (1.86) | 1.42 (1.58) | 1.64 (1.78) | 1.11 (1.19) |
| **Weight (kg)** | 5.8 (7.4) | 7(8.8) | 8.4 (10.2) | 10(11.8) |
| **Heat sink size (mm)** | Aluminum 300×300×12 | | | |
| **Holding voltage Ub (DC)** | 24V | | | |
| **Holding current Ib (A)** | 0.69 | | | |
| **Holding torque Tb (Nm)** | > 12 | | | |
| **Recommended Power Cables Cross-sectional area (mm2)** | 0.75 | 1.5 | 1.5 | 2.5 |
| **Recommended Drive Models** | AD2RE-060PA-E | AD2RE-100SA-E | AD2RE-120PA-E | AD2RE-140SA-E |

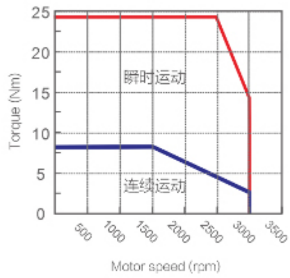
Note: The above is the standard model, () is with contracting brake motor parameters.

- 130 flange torque speed characteristics chart

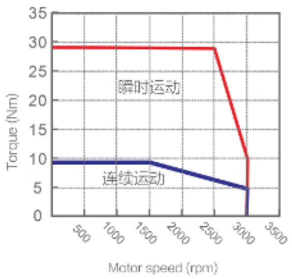
ASK130-2-054M1530



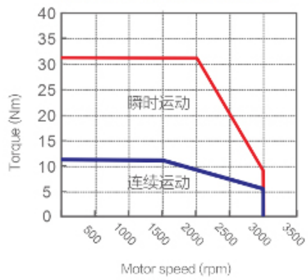

ASK130-2-083M1530



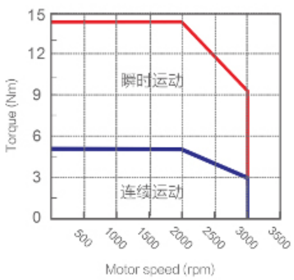

ASK130-2-096M1530



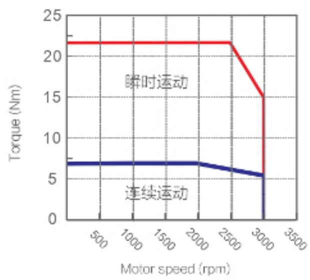

ASK130-2-115M1530



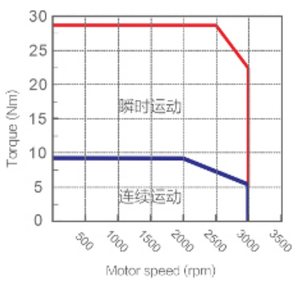

ASK130-2-048M2030



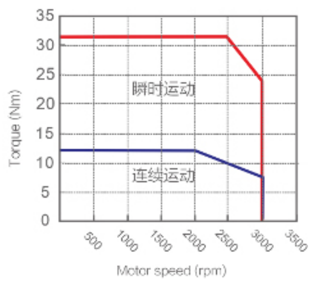

ASK130-2-072M2030




ASK130-2-096M2030




ASK130-2-119M2030




Note: The characteristics of the transient operating area will vary depending on the supply voltage; if the load torque is within the rated torque, it can be used in the continuous operating area.

- 130 flange motor data (1KW~2.5KW)

| Motor Model / Projects | ASK130-2-040M2530 | ASK130-2-050M2530 | ASK130-2-060M2530 | ASK130-2-096M2030 | ASK130-2-096M2530 |
|---|---|---|---|---|---|
| **Voltage U (AC)** | 220V | | | | |
| **Rated power Pr (kW)** | 1 | 1.3 | 1.5 | 2 | 2.5 |
| **Rated current Ir (A)** | 4.5 | 5.7 | 6.8 | 8.6 | 11.5 |
| **Rated torque Tr (Nm)** | 4 | 5 | 6 | 7.7 | 9.55 |
| **Rated speed Nr (rpm)** | 2500 | 2500 | 2500 | 2500 | 2500 |
| **Maximum current Imax (Arms)** | 13.6 | 17 | 20.4 | 25.8 | 34.5 |
| **Maximum torque Tmax (Nm)** | 12 | 15 | 18 | 23.1 | 28.7 |
| **Maximum speed Nmax (rpm)** | 3000 | 3000 | 3000 | 3000 | 3000 |
| **Torque coefficient Kt (Nm/A)** | 0.88 | 0.88 | 0.88 | 0.9 | 0.83 |
| **Rotational inertia Jm (10-4kgm2)** | 9(10.5) | 9(10.5) | 9(10.5) | 13(14.5) | 17(18.5) |
| **Electrical time constant te (ms)** | 8.47 | 8.47 | 8.47 | 8.89 | 7.4 |
| **Mechanical time constant tm (ms)** | 1.6 (1.86) | 1.6 (1.86) | 1.6 (1.86) | 1.42 (1.58) | 1.64 (1.78) |
| **Weight (kg)** | 5.8 (7.4) | 5.8 (7.4) | 5.8 (7.4) | 7(8.8) | 8.4 (10.2) |
| **Heat sink size (mm)** | Aluminum 300×300×12 | | | | |
| **Holding voltage Ub (DC)** | 24V | | | | |
| **Holding current Ib (A)** | 0.69 | | | | |
| **Holding torque Tb (Nm)** | > 12 | | | | |
| **Recommended power cable cross-sectional area (mm2)** | 0.75 | 0.75 | 1.5 | 1.5 | 1.5 |
| **Recommended Drive Models** | AD2RE-060PA-E | AD2RE-100SA-E | AD2RE-100SA-E | AD2RE-120PA-E | AD2RE-140SA-E |

Note: The above is the standard model, () is with contracting brake motor parameters.

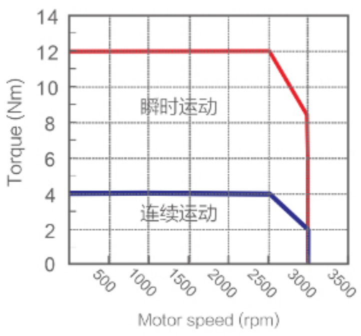
- 130 flange motor data (1.5KW~3KW)

| Motor Model / Projects | ASK130-2-048M3035 | ASK130-2-064M3035 | ASK130-2-064M3035 | ASK130-2-096M3035 |
|---|---|---|---|---|
| **Voltage U (AC)** | 220V | | | |
| **Rated power Pr (kW)** | 1.5 | 2 | 2.5 | 3 |
| **Rated current Ir (A)** | 5.4 | 7.2 | 8.88 | 11.5 |
| **Rated torque Tr (Nm)** | 4.77 | 6.36 | 7.95 | 9.55 |
| **Rated speed Nr (rpm)** | 3000 | 3000 | 3000 | 3000 |
| **Maximum current Imax (Arms)** | 16.2 | 21.6 | 26.6 | 34.5 |
| **Maximum torque Tmax (Nm)** | 14.3 | 19.8 | 23.9 | 28.6 |
| **Maximum speed Nmax (rpm)** | 3500 | 3500 | 3500 | 3500 |
| **Torque coefficient Kt (Nm/A)** | 0.88 | 0.88 | 0.9 | 0.83 |
| **Rotational inertia Jm (10-4kgm2)** | 9(10.5) | 9(10.5) | 13(14.5) | 17(18.5) |
| **Electrical time constant te (ms)** | 8.47 | 8.47 | 8.89 | 7.4 |
| **Mechanical time constant tm (ms)** | 1.6 (1.86) | 1.6 (1.86) | 1.42 (1.58) | 1.64 (1.78) |
| **Weight (kg)** | 5.8 (7.4) | 5.8 (7.4) | 7(8.8) | 8.4 (10.2) |
| **Heat sink size (mm)** | Aluminum 300×300×12 | | | |
| **Holding voltage Ub (DC)** | 24V | | | |
| **Holding current Ib (A)** | 0.69 | | | |
| **Holding torque Tb (Nm)** | > 12 | | | |
| **Recommended Power Cables Cross-sectional area (mm2)** | 0.75 | 1.5 | 1.5 | 2.5 |
| **Recommended Drive Models** | AD2RE-100SA-E | AD2RE-120PA-E | AD2RE-140SA-E | AD2RE-140SA-E |

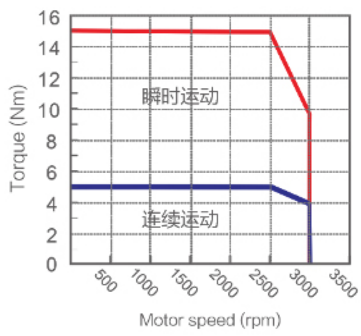
Note: The above is the standard model, () is with contracting brake motor parameters.

- 130 flange torque speed characteristics chart

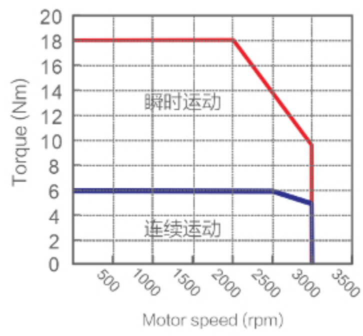
ASK130-2-040M2530



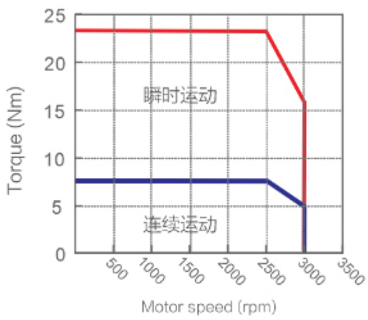

ASK130-2-040M2530



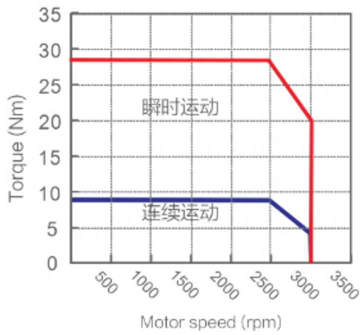

ASK130-2-060M2530



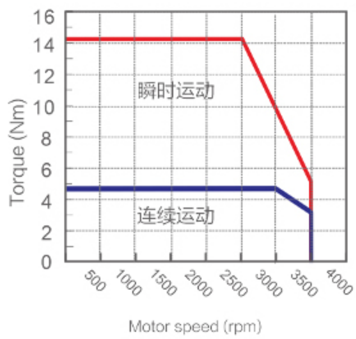

ASK130-2-077M2530



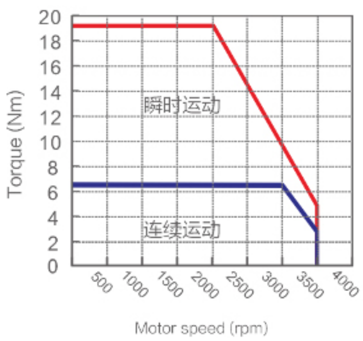

ASK130-2-096M2530



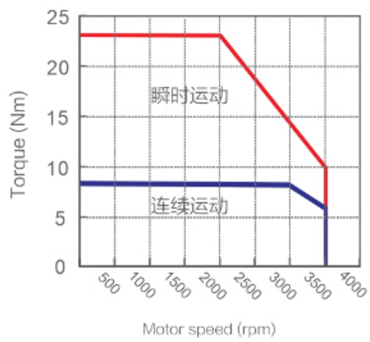

ASK130-2-048M3035



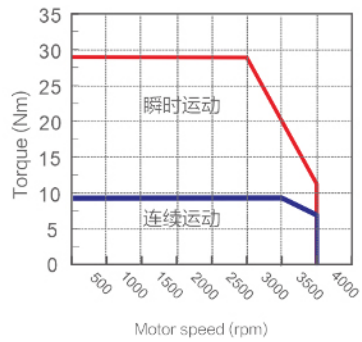

ASK130-2-064M3035




ASK130-2-080M3035




ASK130-2-096M3035




Note: The characteristics of the transient operating area will vary depending on the supply voltage; if the load torque is within the rated torque, it can be used in the continuous operating area.

- 130 flange motor data (0.85KW~2.3KW)

| Motor model / Projects | ASK130-4-083M1530 | ASK130-4-083M1530 | ASK130-4-096M1530 | ASK130-4-115M1530 | ASK130-4-150M1530 |
|---|---|---|---|---|---|
| Voltage U (AC) | 380V | | | | |
| Rated power Pr (kW) | 0.85 | 1.3 | 1.5 | 1.8 | 2.3 |
| Rated current Ir (A) | 4.42 | 6 | 5.8 | 7.8 | 10.2 |
| Rated torque Tr (Nm) | 5.41 | 8.27 | 9.55 | 11.46 | 15 |
| Rated speed Nr (rpm) | 1500 | 1500 | 1500 | 1500 | 1500 |
| Maximum current Imax (Arms) | 13.26 | 18 | 17.3 | 23.4 | 30.6 |
| Maximum torque Tmax (Nm) | 16.2 | 24.8 | 28.7 | 31 | 45 |
| Maximum speed Nmax (rpm) | 3000 | 3000 | 3000 | 3000 | 3000 |
| Torque coefficient Kt (Nm/A) | 1.22 | 1.38 | 1.66 | 1.47 | 1.47 |
| Rotational inertia Jm (10-4kgm2) | 9(10.5) | 13(14.5) | 17(18.5) | 21.7 (23.2) | 21.7 (23.2) |
| Electrical time constant te (ms) | 8.45 | 9.59 | 10.07 | 10.91 | 10.91 |
| Mechanical time constant tm (ms) | 1.6 (1.86) | 1.35 (1.51) | 1.2 (1.3) | 1.14 (1.22) | 1.14 (1.22) |
| Weight (kg) | 5.8 (7.4) | 7(8.8) | 8.4 (10.2) | 10(11.8) | 10(11.8) |
| Heat sink size (mm) | Aluminum 300×300×12 | | | | |
| Holding voltage Ub (DC) | 24V | | | | |
| Holding current Ib (A) | 0.69 | | | | |
| Holding torque Tb (Nm) | > 12 | | | | ≥15 |
| Recommended power cable cross-sectional area (mm2) | 0.75 | 0.75 | 0.75 | 1.5 | 1.5 |
| Recommended Drive Models | AD2RE-5R4SC-E | AD2RE-5R4SC-E | AD2RE-5R4SC-E | AD2RE-6R8SC-E | AD2RE-100SC-E |

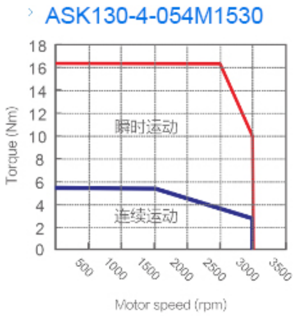
Note: The above is the standard model, () is with contracting brake motor parameters.

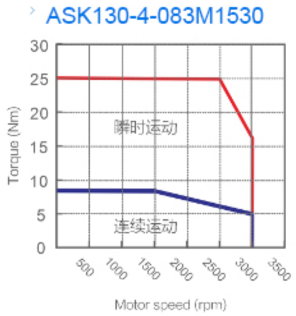
- 130 flange motor data (1KW~3KW)

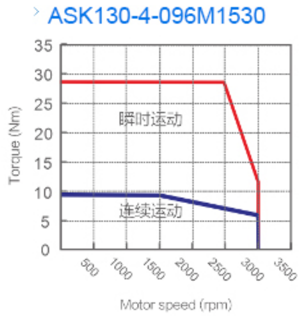
| Motor Model / Projects | ASK130-4-048M2030 | ASK130-2-072M2030 | ASK130-4-096M2030 | ASK130-4-119M2030 | ASK130-4-146M2030 |
|---|---|---|---|---|---|
| **Voltage U (AC)** | 380V | | | | |
| **Rated power Pr (kW)** | 1 | 1.5 | 2 | 2.5 | 3 |
| **Rated current Ir (A)** | 3.9 | 5.2 | 5.8 | 8.1 | 9.95 |
| **Rated torque Tr (Nm)** | 4.77 | 7.16 | 9.55 | 11.9 | 14.64 |
| **Rated revolution Nr (rpm)** | 2000 | 2000 | 2000 | 2000 | 2000 |
| **Maximum current Imax (Arms)** | 11.7 | 15.6 | 17.4 | 24.3 | 29.85 |
| **Maximum torque Tmax (Nm)** | 14.31 | 21.48 | 28.65 | 35.7 | 43.92 |
| **Maximum speed Nmax (rpm)** | 3000 | 3000 | 3000 | 3000 | 3000 |
| **Torque coefficient Kt (Nm/A)** | 1.22 | 1.38 | 1.65 | 1.47 | 1.47 |
| **Rotational inertia Jm (10-4kgm2)** | 9(10.5) | 13(14.5) | 17(18.5) | 21.7 (23.2) | 21.7 (23.2) |
| **Electrical time constant te (ms)** | 8.45 | 9.59 | 10.07 | 10.91 | 10.91 |
| **Mechanical time constant tm (ms)** | 1.6 (1.86) | 1.35 (1.51) | 1.2 (1.3) | 1.14 (1.22) | 1.14 (1.22) |
| **Weight (kg)** | 5.8 (7.4) | 7(8.8) | 8.4 (10.2) | 10(11.8) | 10(11.8) |
| **Heat sink size (mm)** | Aluminum 300×300×12 | | | | |
| **Holding power Ub (DC)** | 24V | | | | |
| **Holding current Ib (A)** | 0.69 | | | | |
| **Holding torque Tb (Nm)** | > 12 | | | | ≥15 |
| **Recommended Power Cables Cross-sectional area(mm2)** | 0.75 | 0.75 | 0.75 | 1.5 | 1.5 |
| **Recommended Drive Models** | AD2RE-5R4SC-E | AD2RE-5R4SC-E | AD2RE-6R8SC-E | AD2RE-8R3SC-E | AD2RE-100SC-E |

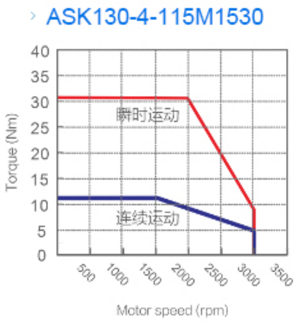
Note: The above is the standard model, () is with contracting brake motor parameters.

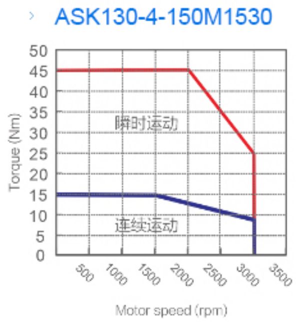
- 130 flange torque speed characteristics chart

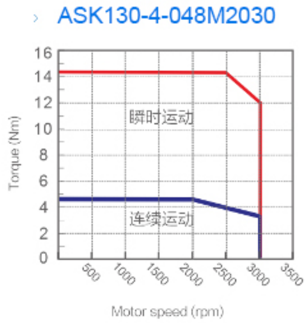


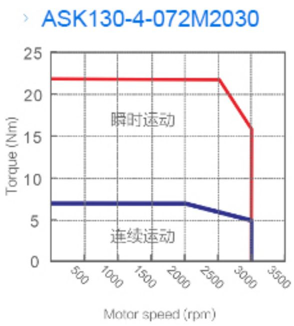



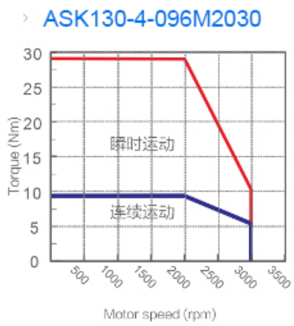



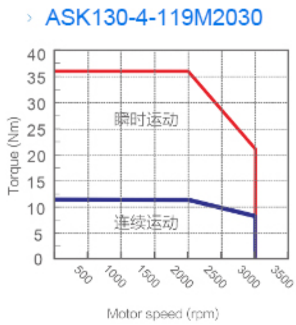



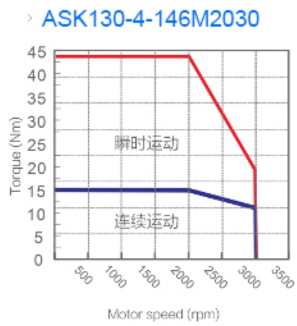




Note: The characteristics of the transient operating area will vary depending on the supply voltage; if the load torque is within the rated torque, it can be used in the continuous operating area.

- 130 flange motor data (1KW~3.8KW)

| Motor Model / Projects | ASK130-4-040M2530 | ASK130-4-050M2530 | ASK130-2-060M2530 | ASK130-2-077M2530 | ASK130-4-096M2530 | ASK130-4-150M2535 |
|---|---|---|---|---|---|---|
| **Voltage U (AC)** | 380V | | | | | |
| **Rated power Pr (kW)** | 1 | 1.3 | 1.5 | 2 | 2.5 | 3.8 |
| **Rated current Ir (A)** | 3.3 | 4.1 | 4.9 | 5.6 | 8.1 | 10.2 |
| **Rated torque Tr (Nm)** | 4 | 5 | 6 | 7.7 | 9.55 | 15 |
| **Rated rpm Nr (rpm)** | 2500 | 2500 | 2500 | 2500 | 2500 | 2500 |
| **Maximum current Imax (Arms)** | 9.8 | 12.3 | 14.7 | 16.8 | 27.9 | 30.6 |
| **Maximum torque Tmax (Nm)** | 12 | 15 | 18 | 23.1 | 28.7 | 45 |
| **Maximum speed Nmax (rpm)** | 3500 | 3500 | 3500 | 3500 | 3500 | 3500 |
| **Torque coefficient Kt (Nm/A)** | 1.22 | 1.22 | 1.22 | 1.38 | 1.18 | 1.47 |
| **Rotational inertia Jm (10-4kgm2)** | 9(10.5) | 9(10.5) | 9(10.5) | 13(14.5) | 17(18.5) | 21.7 (23.2) |
| **Electrical time constant te (ms)** | 8.45 | 8.45 | 8.45 | 9.59 | 11.19 | 10.91 |
| **Mechanical time constant tm (ms)** | 1.6 (1.86) | 1.6 (1.86) | 1.6 (1.86) | 1.35 (1.51) | 1.12 (1.20) | 1.14 (1.22) |
| **Weight (kg)** | 5.8 (7.4) | 5.8 (7.4) | 5.8 (7.4) | 7(8.8) | 8.4 (10.2) | 10(11.8) |
| **Heat sink size (mm)** | Aluminum 300×300×12 | | | | | |
| **Holding voltage Ub (DC)** | 24V | | | | | |
| **Holding current Ib (A)** | 0.69 | | | | | |
| **Holding torque Tb (Nm)** | > 12 | | | | | ≥15 |
| **Recommended Power Cables Cross-sectional area (mm2)** | 0.75 | 0.75 | 0.75 | 0.75 | 1.5 | 1.5 |
| **Recommended Drive Models** | AD2RE-5R4SC-E | AD2RE-5R4SC-E | AD2RE-5R4SC-E | AD2RE-6R8SC-E | AD2RE-8R3SC-E | AD2RE-100SC-E |

Note: The above is the standard model, () is with contracting brake motor parameters.

- 130 flange motor data (1.5KW~2.5KW)

| Projects \ Motor Model | ASK130-4-048M3035 | ASK130-4-064M3035 | ASK130-4-080M3035 |
|---|---|---|---|
| **Voltage U (AC)** | 380V | | |
| **Rated power Pr (kW)** | 1.5 | 2 | 2.5 |
| **Rated current Ir (A)** | 3.9 | 5.2 | 5.77 |
| **Rated torque Tr (Nm)** | 4.77 | 6.36 | 7.95 |
| **Rated speed Nr (rpm)** | 3000 | 3000 | 3000 |
| **Maximum current Imax (Arms)** | 11.7 | 15.6 | 17.3 |
| **Maximum torque Tmax (Nm)** | 14.31 | 19.08 | 23.89 |
| **Maximum speed Nmax (rpm)** | 3500 | 3500 | 3500 |
| **Torque coefficient Kt (Nm/A)** | 1.22 | 1.22 | 1.38 |
| **Rotational inertia Jm (10-4kgm2)** | 9(10.5) | 9(10.5) | 13(14.5) |
| **Electrical time constant te (ms)** | 8.45 | 8.45 | 9.59 |
| **Mechanical time constant tm (ms)** | 1.6 (1.86) | 1.6 (1.86) | 1.35 (1.51) |
| **Weight (kg)** | 5.8 (7.4) | 5.8 (7.4) | 7(8.8) |
| **Heat sink size (mm)** | Aluminum 300×300×12 | | |
| **Holding voltage Ub (DC)** | 24V | | |
| **Holding current Ib (A)** | 0.69 | | |
| **Holding torque Tb (Nm)** | > 12 | | |
| **Recommended power cable cross-sectional area (mm2)** | 0.75 | | |
| **Recommended Drive Models** | AD2RE-5R4SC-E | AD2RE-6R8SC-E | |

Note: The above is the standard model, () is with contracting brake motor parameters.

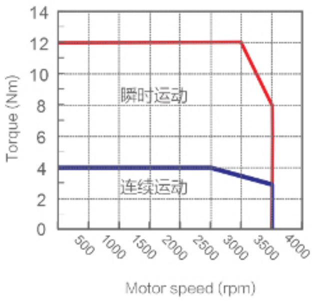
- 130 flange motor data (3KW~5KW)

| Projects \ Motor Model | ASK130-4-096M3035 | ASK130-4-127M3035 | ASK130-4-159M3045 |
|---|---|---|---|
| **Voltage U (AC)** | 380V | | |
| **Rated power Pr (kW)** | 3 | 4 | 5 |
| **Rated current Ir (A)** | 8.13 | 8.65 | 13.8 |
| **Rated torque Tr (Nm)** | 9.55 | 12.7 | 15.92 |
| **Rated speed Nr (rpm)** | 3000 | 3000 | 3000 |
| **Maximum current Imax (Arms)** | 24.4 | 25.9 | 35 |
| **Maximum torque Tmax (Nm)** | 28.7 | 38.1 | 40.3 |
| **Maximum speed Nmax (rpm)** | 3500 | 3500 | 4500 |
| **Torque coefficient Kt (Nm/A)** | 1.17 | 1.47 | 1.153 |
| **Rotational inertia Jm (10-4kgm2)** | 17(18.5) | 21.7 (23.2) | 12.97 (14.8) |
| **Electrical time constant te (ms)** | 11.19 | 10.91 | 15.47 |
| **Mechanical time constant tm (ms)** | 1.12 (1.2) | 1.14 (1.22) | 0.56 |
| **Weight (kg)** | 8.4 (10.2) | 10(11.8) | 14.4 (12.5) |
| **Heat sink size (mm)** | Aluminum 300×300×12 | | Aluminum 450×450×25 |
| **Holding voltage Ub (DC)** | 24V | | |
| **Holding current Ib (A)** | 0.69 | 0.69 | 0.13 |
| **Holding torque Tb (Nm)** | ≥12 | ≥15 | ≥17 |
| **Recommended power cable cross-sectional area (mm2)** | 1.5 | 1.5 | 2.5 |
| **Recommended Drive Models** | AD2RE-8R3SC-E | AD2RE-120SC-E | AD2RE-140SC-E |

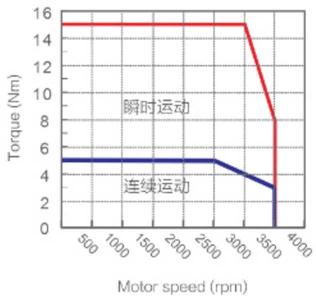
Note: The above is the standard model, () is with contracting brake motor parameters.

- 130 flange torque speed characteristics chart

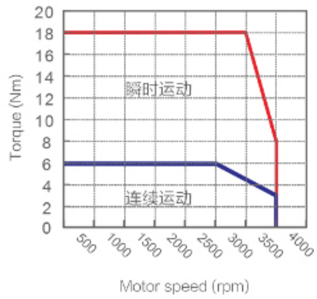
ASK130-4-040M2535



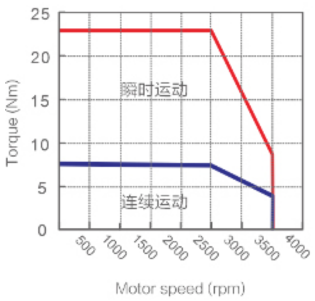

ASK130-4-050M2535



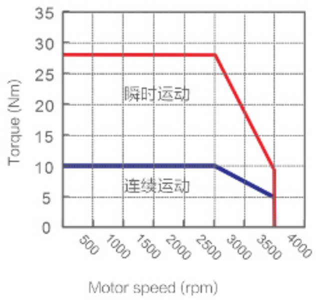

ASK130-4-060M2535



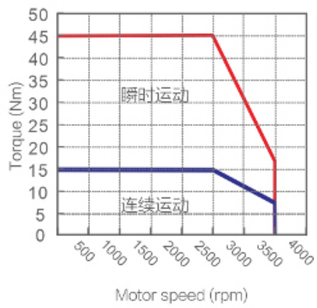

ASK130-4-077M2535



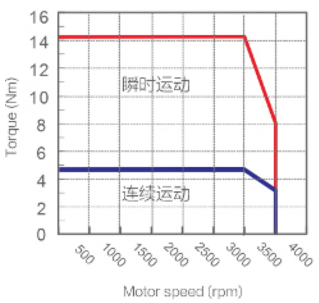

ASK130-4-096M2535



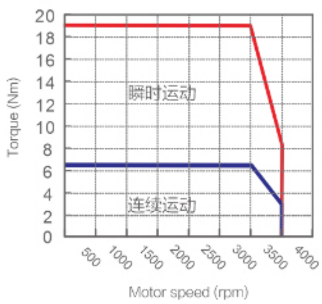

ASK130-4-150M2535



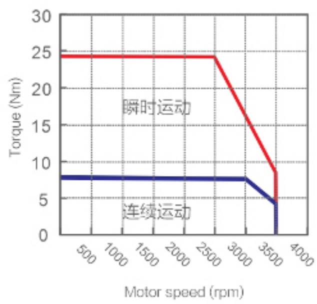

ASK130-4-048M3035



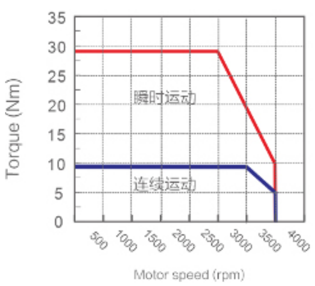

ASK130-4-064M3035



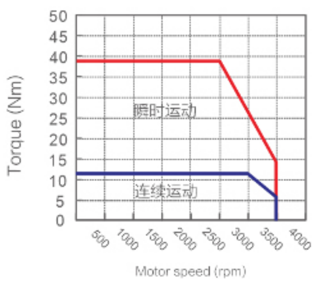

ASK130-4-080M3035



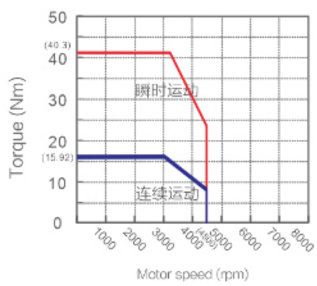

ASK130-4-096M3035




ASK130-4-127M3035

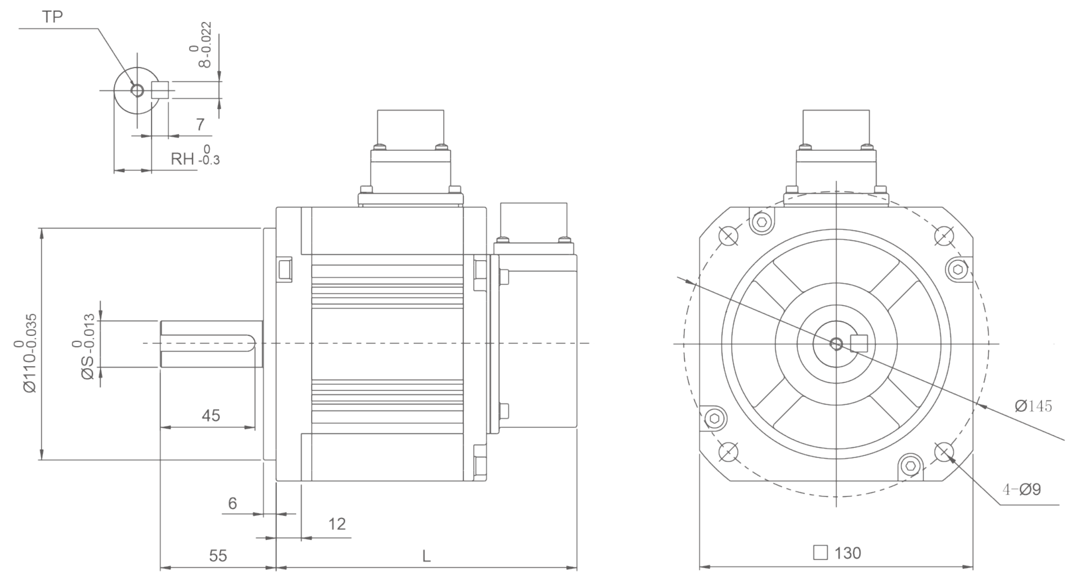



ASK130-4-159M3045




Note: The characteristics of the transient operating area will vary depending on the supply voltage; if the load torque is within the rated torque, it can be used in the continuous operating area.

- 130 flange motor size drawing



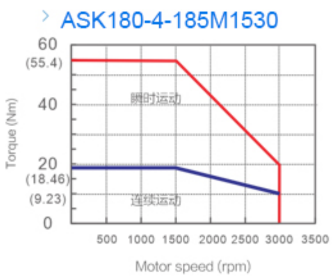

| Motor Model | S | RH | TP | L without contracting brake size(mm) | L with contracting brake Size(mm) |
|---|---|---|---|---|---|
| ASK130-2-054M1530 | 22 | 18 | M6×L20 | 143.5 | 169.5 |
| ASK130-2-048M2030 | | | | | |
| ASK130-2-048M3035 | | | | | |
| ASK130-2-040M2530 | | | | | |
| ASK130-2-050M2530 | | | | | |
| ASK130-2-060M2530 | | | | | |
| ASK130-2-064M3035 | | | | | |
| ASK130-2-083M1530 | 22 | 18 | M6×L20 | 160.5 | 186.5 |
| ASK130-2-072M2030 | | | | | |
| ASK130-2-077M2530 | | | | | |
| ASK130-2-080M3035 | | | | | |
| ASK130-2-096M2030 | 22 | 18 | M6×L20 | 177.5 | 203.5 |
| ASK130-2-096M3035 | | | | | |
| ASK130-2-096M2530 | | | | | |
| ASK130-2-096M1530 | | | | | |
| ASK130-2-115M1530 | 22 | 18 | M6×L20 | 207.5 | 233.5 |
| ASK130-2-119M2030 | | | | | |
| ASK130-4-146M2030 | | | | | |
| ASK130-4-127M3035 | | | | | |
| ASK130-4-150M1530 | | | | | |
| ASK130-4-150M2535 | | | | | |
| ASK130-4-159M3045 | 24 | 20 | M8×L20 | 258.4 | 272.6 |

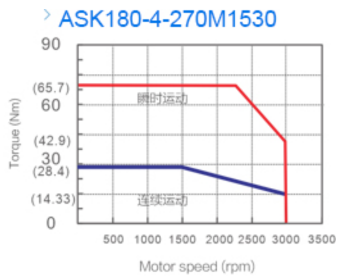
- 180 flange motor data (2.9KW~7.5KW)

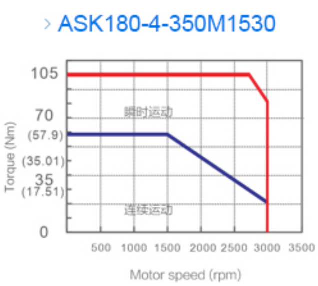
| Motor Model / Projects | ASK180-4-185M1518 | ASK180-4-270M1530 | ASK180-4-350M1530 | ASK180-4-478M1530 |
|---|---|---|---|---|
| **Voltage U (AC)** | 380V | | | |
| **Rated power Pr (kW)** | 2.9 | 4.4 | 5.5 | 7.5 |
| **Rated current Ir (A)** | 11 | 14.4 | 19.3 | 26.5 |
| **Rated torque Tr (Nm)** | 18.5 | 27 | 35.01 | 47.75 |
| **Rated speed Nr (rpm)** | 1500 | 1500 | 1500 | 1500 |
| **Maximum current Imax (Arms)** | 33 | 35.1 | 57.9 | 66 |
| **Maximum torque Tmax (Nm)** | 55.4 | 65.7 | 105 | 118.9 |
| **Maximum speed Nmax (rpm)** | 3000 | 3000 | 3000 | 3000 |
| **Torque coefficient Kt (Nm/A)** | 1.68 | 1.872 | 1.814 | 1.802 |
| **Rotational inertia Jm (10-4kgm2)** | 55(59.3) | 82.7(87) | 107(111.3) | 134(138.3) |
| **Electrical time constant te (ms)** | 21.64 | 17.5 | 16.67 | 18.4 |
| **Mechanical time constant tm (ms)** | 1.82 | 1.92 | 1.53 | 1.51 |
| **Weight (kg)** | 13(17) | 16(20) | 21(25) | 26(30) |
| **Heat sink size (mm)** | Aluminum 680×680×35 | | | |
| **Holding voltage Ub (DC)** | 24V | | | |
| **Holding current Ib (A)** | 1.3 | | | |
| **Holding torque Tb (Nm)** | ≥40 | | ＞40 | ≥50 |
| **Recommended power cable cross-sectional area (mm2)** | 1.5 | 2.5 | 2.5 | 4.0 |
| **Recommended Drive Models** | AD2RE-100SC-E | AD2RE-140SC-E | AD2RE-210SC-E | AD2RE-250SC-E |

Note: The above is the standard model, () is with contracting brake motor parameters.

- 180 flange torque speed characteristics chart

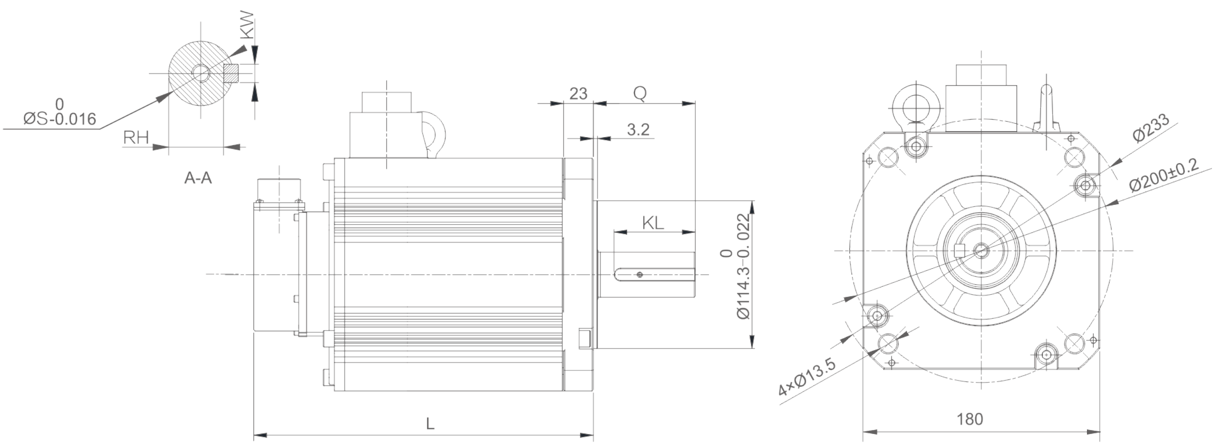



Note: The characteristics of the transient operating area will vary depending on the supply voltage; if the load torque is within the rated torque, it can be used in the continuous operating area.

- 180 flange motor size drawing




| Motor Model | S | Q | KW | KL | RH | L without contracting brake size(mm) | L with contracting brake Size(mm) |
|---|---|---|---|---|---|---|---|
| ASK180-4-185M1518 | 35 | 79 | 10 | 63 | 30 | 207.5 | 246.7 |
| ASK180-4-270M1530 | 35 | 79 | 10 | 63 | 30 | 230 | 269.2 |
| ASK180-4-350M1530 | 42 | 113 | 12 | 100 | 37 | 259 | 298.2 |
| ASK180-4-478M1530 | 42 | 113 | 12 | 100 | 37 | 278.5 | 317.7 |

- 180 flange motor data (2.5KW~2.9KW)

| Projects \ Motor Model | ASK180-2-170H1518 | ASK180-2-185H1518 |
|---|---|---|
| **Voltage U (AC)** | 220V | |
| **Rated power Pr (kW)** | 2.5 | 2.9 |
| **Rated current Ir (A)** | 10 | 11.7 |
| **Rated torque Tr (Nm)** | 17 | 18.5 |
| **Rated speed Nr (rpm)** | 1500 | 1500 |
| **Maximum current Imax (Arms)** | 24.7 | 29.7 |
| **Maximum torque Tmax (Nm)** | 42 | 47 |
| **Maximum speed Nmax (rpm)** | 1800 | 1800 |
| **Torque coefficient Kt (Nm/A)** | 1.7 | 1.58 |
| **Rotational inertia Jm (10-4kgm2)** | 65(66.1) | 70(71.1) |
| **Electrical time constant te (ms)** | 6.6 | 6.05 |
| **Mechanical time constant tm (ms)** | 2.2 | 2 |
| **Weight (kg)** | 19.5 (24.5) | 20.5 (25.5) |
| **Heat sink size (mm)** | Iron: 550×550×30 | |
| **Holding voltage Ub (DC)** | 24V | |
| **Holding current Ib (A)** | 1.7 | |
| **Holding torque Tb (Nm)** | 50 | |
| **Recommended power cable cross-sectional area (mm2)** | 1.5 | |
| **Recommended Drive Models** | AD2RE-140SA-E | |

Note: The above is the standard model, () is with contracting brake motor parameters.

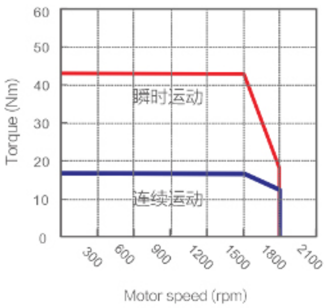
- 180 flange motor data (2.5KW~7.5KW)

| Motor Model / Projects | ASK180-4-170H1518 | ASK180-4-185H1518 | ASK180-4-280H1518 | ASK180-4-350H1518 | ASK180-4-480H 1518 |
|---|---|---|---|---|---|
| **Voltage U (AC)** | 380V | | | | |
| **Rated power Pr (kW)** | 2.5 | 2.9 | 4.4 | 5.5 | 7.5 |
| **Rated current Ir (A)** | 6.5 | 7.4 | 10.4 | 12 | 20 |
| **Rated torque Tr (Nm)** | 17 | 18.5 | 28 | 35 | 48 |
| **Rated speed Nr (rpm)** | 1500 | 1500 | 1500 | 1500 | 1500 |
| **Maximum current Imax (Arms)** | 16.1 | 19 | 25 | 24 | 40 |
| **Maximum torque Tmax (Nm)** | 42 | 47 | 67 | 70 | 96 |
| **Maximum speed Nmax (rpm)** | 1800 | 1800 | 1800 | 1800 | 1800 |
| **Torque coefficient Kt (Nm/A)** | 2.6 | 2.5 | 2.7 | 2.9 | 2.4 |
| **Rotational inertia Jm (10-4kgm2)** | 65(66.1) | 70(71.1) | 96.4 (97.5) | 122.5 (123.6) | 167.2 (168.3) |
| **Electrical time constant te (ms)** | 5.3 | 6.5 | 6.3 | 6.2 | 6.3 |
| **Mechanical time constant tm (ms)** | 2.5 | 2.05 | 1.89 | 1.69 | 1.65 |
| **Weight (kg)** | 19.5 (24.5) | 20.5 (25.5) | 25.5 (30.5) | 30.5 (35.5) | 40(45) |
| **Heat sink size (mm)** | Iron: 550×550×30 | | | | |
| **Holding voltage Ub (DC)** | 24V | | | | |
| **Holding current Ib (A)** | 1.7 | | | | |
| **Holding torque Tb (Nm)** | 50 | | | | |
| **Recommended power cable cross-sectional area (mm2)** | 1.5 | 1.5 | 1.5 | 1.5 | 2.5 |
| **Recommended Drive Models** | AD2RE -6R8SC-E | AD2RE -8R3SC-E | AD2RE -120SC-E | AD2RE -140SC-E | AD2RE -210SC-E |

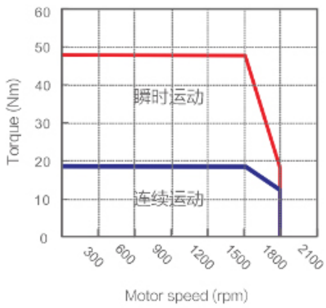
Note: The above is the standard model, () is with contracting brake motor parameters.

- 180 flange torque speed characteristics chart

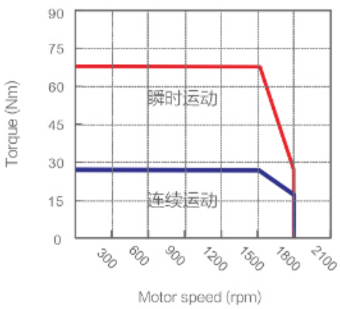
> ASK180-4-170H1518



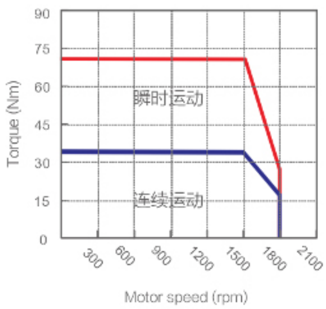

> ASK180-4-185H1518



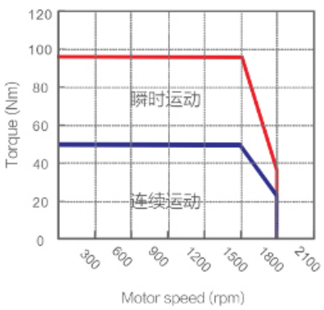

> ASK180-4-270M1530




> ASK180-4-350M1530

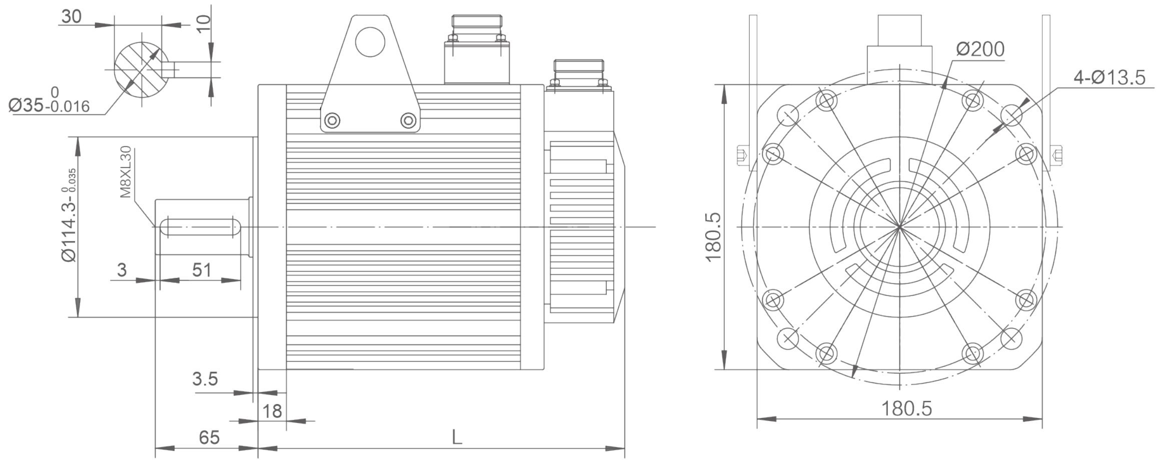



> ASK180-4-478M1530




Note: The characteristics of the transient operating area will vary depending on the supply voltage; if the load torque is within the rated torque, it can be used in the continuous operating area.

- 180 flange motor size drawing




| Motor Model | L without contracting brake size(mm) | L with contracting brake size(mm) |
|---|---|---|
| ASK180-2-170M1518 | 227 | 301 |
| ASK180-2-185M1518 | 233 | 307 |
| ASK180-4-270M1530 | 263 | 337 |
| ASK180-4-350M1530 | 293 | 367 |
| ASK180-4-478M1530 | 347 | 421 |

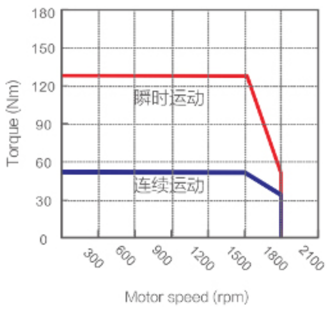
- 200 flange motor data (8.3KW~13.2KW)

| Motor Model / Projects | ASK200-4-530M1516 | ASK200-4-700M1520 | ASK200-4-840M1518 |
|---|---|---|---|
| **Voltage U (AC)** | 380V | | |
| **Rated power Pr (kW)** | 8.3 | 11 | 13.2 |
| **Rated current Ir (A)** | 18 | 28 | 23 |
| **Rated torque Tr (Nm)** | 53 | 70 | 84 |
| **Rated speed Nr (rpm)** | 1500 | 1500 | 1500 |
| **Maximum current Imax (Arms)** | 42.5 | 66 | 60 |
| **Maximum torque Tmax (Nm)** | 125 | 165 | 215 |
| **Maximum speed Nmax (rpm)** | 1600 | 2000 | 1800 |
| **Torque coefficient Kt (Nm/A)** | 2.9 | 2.5 | 3.6 |
| **Rotational inertia Jm (10-4kgm2)** | 72(73.8) | 97.7 (99.5) | 130.8 (132.6) |
| **Electrical time constant te (ms)** | 12.1 | 15.2 | 16.4 |
| **Mechanical time constant tm (ms)** | 1.49 | 0.93 | 0.77 |
| **Weight (kg)** | 46(61) | 52(66) | 59(71.5) |
| **Heat sink size (mm)** | Iron: 650×650×35 | | |
| **Holding voltage Ub (DC)** | 24V | | |
| **Holding current Ib (A)** | 4 | | |
| **Holding torque Tb (Nm)** | 120 | | |
| **Recommended power cable cross-sectional area (mm2)** | 2.5 | 4 | 4 |
| **Recommended Drive Models** | AD2RE-210SC-E | AD2RE-340SC-E | AD2RE-340SC-E |

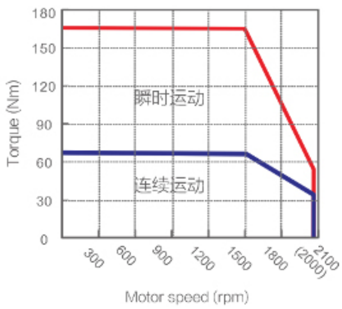
Note: The above is the standard model, () is with contracting brake motor parameters.

- 200 flange torque speed characteristics chart

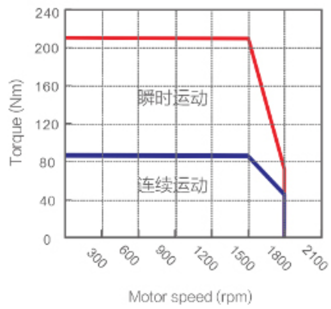
> ASK200-4-530M1516




> ASK200-4-700M1520

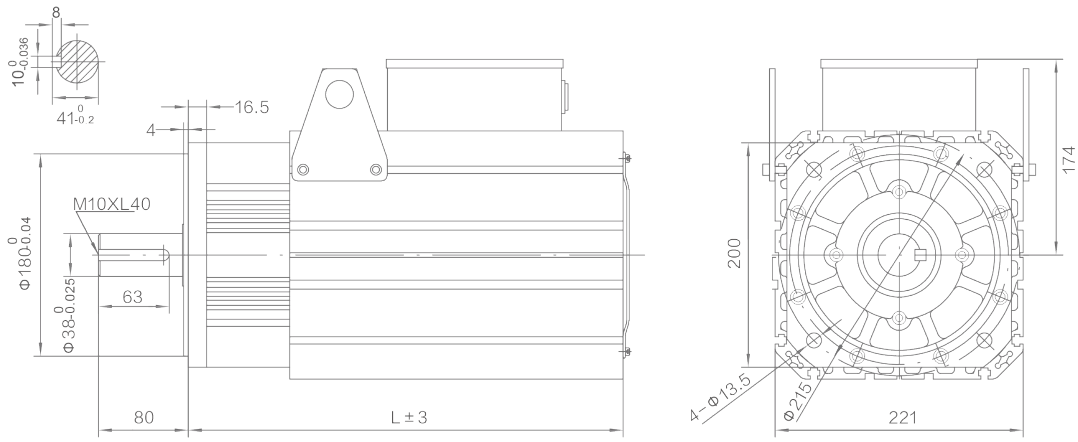



> ASK200-4-840M1518




Note: The characteristics of the transient operating area will vary depending on the supply voltage; if the load torque is within the rated torque, it can be used in the continuous operating area.

- 200 flange motor size drawing




| Motor Model | L without contracting brake size(mm) | L with contracting brake size(mm) |
|---|---|---|
| ASK200-4-530M1516 | 392 | 492 |
| ASK200-4-700M1520 | 435 | 535 |
| ASK200-4-840M1518 | 462 | 568 |

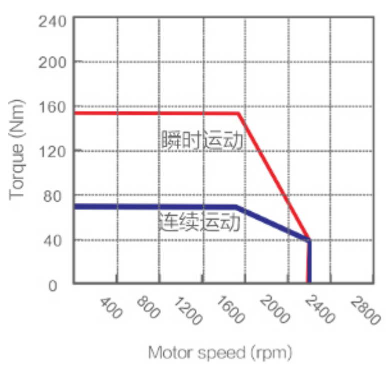
- 200 flange motor data (11KW~15KW)

| Projects \ Motor model | ASK200-4-700M1520 | ASK230-4-950H1518 |
|---|---|---|
| **Voltage U (AC)** | 380V | |
| **Rated power Pr (kW)** | 11 | 15 |
| **Rated current Ir (A)** | 30 | 36 |
| **Rated torque Tr (Nm)** | 70 | 95 |
| **Rated speed Nr (rpm)** | 1500 | 1500 |
| **Maximum current Imax (Arms)** | 66 | 66 |
| **Maximum torque Tmax (Nm)** | 154 | 174.2 |
| **Maximum speed Nmax (rpm)** | 2200 | 1800 |
| **Torque coefficient Kt (Nm/A)** | 2.3 | 2.85 |
| **Rotational inertia Jm (10-4kgm2)** | 260(262.2) | 380(382.2) |
| **Electrical time constant te (ms)** | 14.3 | 14 |
| **Mechanical time constant tm (ms)** | 8.2 | 12.8 |
| **Weight (kg)** | 64 | 77.5 |
| **Heat sink size (mm)** | Iron: 650×650×35 | |
| **Holding voltage Ub (DC)** | 24V | |
| **Holding current Ib (A)** | 4 | |
| **Holding torque Tb (Nm)** | 120 | |
| **Recommended power cable cross-sectional area (mm2)** | 4 | 6 |
| **Recommended Drive Models** | AD2RE-340SC-E | AD2RE-340SC-E |

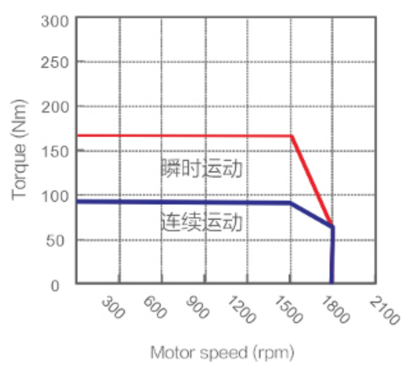
Note: The above is the standard model, () is with contracting brake motor parameters.

- 230 flange torque speed characteristics chart

> ASK230-4-700H1522

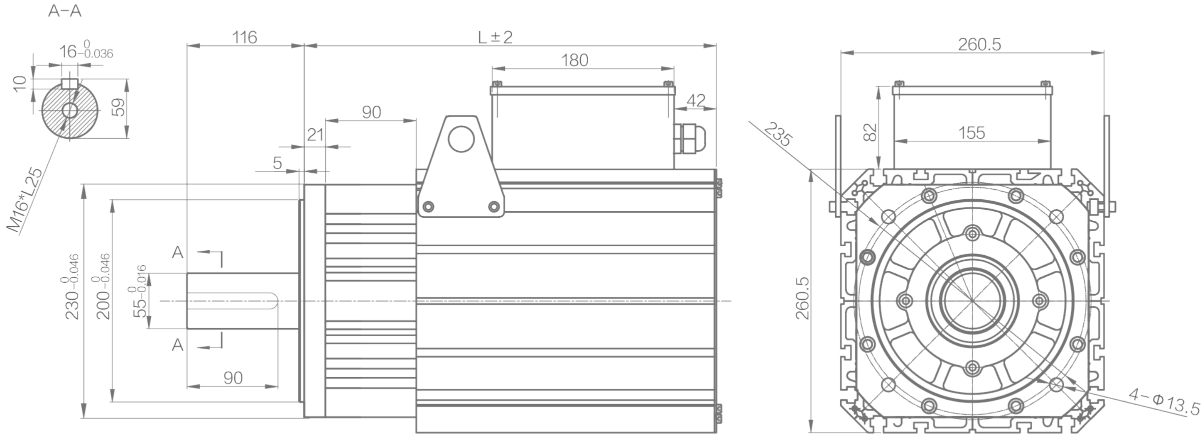



> ASK230-4-950H1518




Note: The characteristics of the transient operating area will vary depending on the supply voltage; if the load torque is within the rated torque, it can be used in the continuous operating area.

- 230 flange motor dimensional drawing




| Motor Model | L without contracting brake size(mm) | L with contracting brake size(mm) |
|---|---|---|
| ASK230-4-700H1522 | 408 | 508 |
| ASK230-4-950H1518 | 458 | 558 |

## 2.3 Cables and Options

### 2.3.1 Power Cables

**LM - 030 - B AF – 2. □**

**Motor power cables**

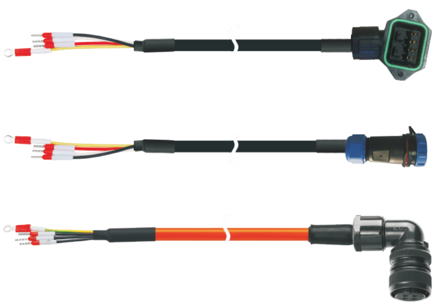
**Cable length**
**Example: 3m = 030**
**Maximum support 60m = 600**

**Wire diameter specification**
**S = 0.5 mm²; A = 0.75 mm²**
**B = 1.5 mm²; C = 2.5 mm²**
**D = 4.0mm²; E = 6mm²**

**Motor side connector type**
**AF = Front plastic housing inline connector for 40/60/80 flange motors without holding brake (AB for rear connector) ***
**BF = Front plastic housing inline connector for 40/60/80 flange motors with holding brake (BB for rear connector) ***
**A2 = Plastic housing aerial plug connector for 40/60/80 flange motors without holding brake**
**B2 = Plastic housing avionics connector for 40/60/80 flange motors with holding brake**
**A4 = Metal aerial plug connector for 100/130 flange motors without holding brake**
**B4 = Metal aerial plug connector for 100/130 flange with holding brake motor**
**A7 = Metal aerial plug connector for 180 flange motors**

**Special Requirements**
**0 = PVC plain fixed cable (black)**
**2 = PVC highly flexible cable (10 million bending cycles)**
**3 = PUR water, oil and corrosion resistant flexible cable**
**4 = PVC fixed cable with shield (black)**
**5 = PVC with shield high flexibility cable (10 million times bending)**

**Manufacturer Definition**
**None = drive-side dump type, no connector connected**
**S = Adapted AD2 drive**

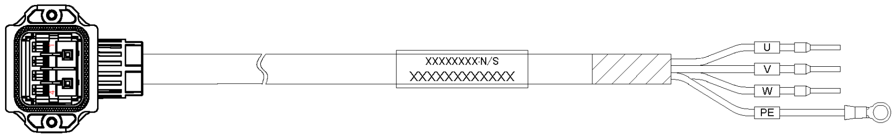
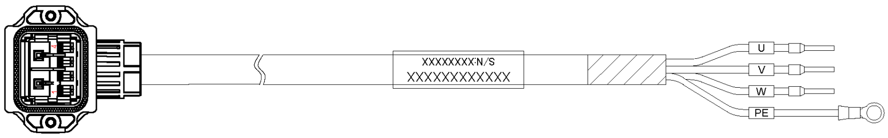
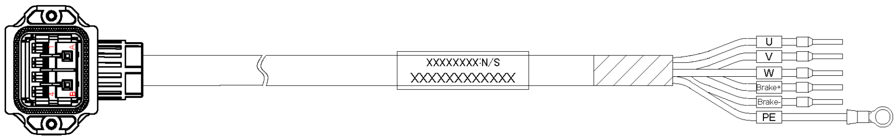
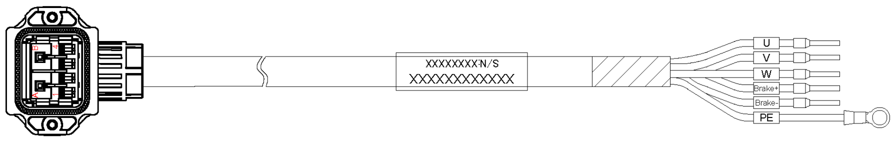


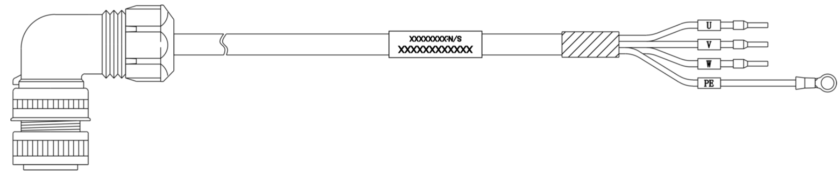
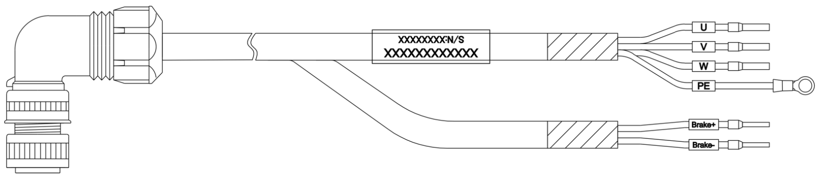
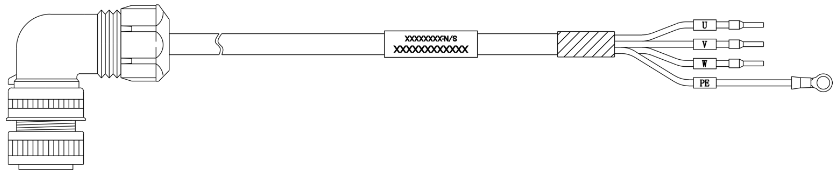
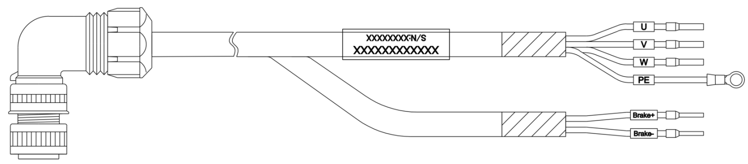
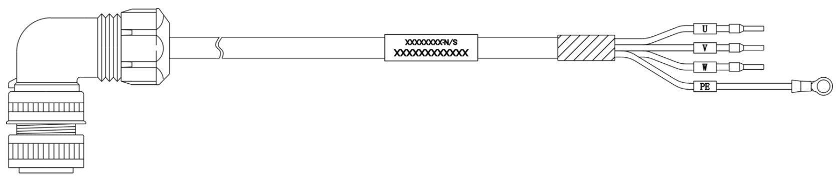
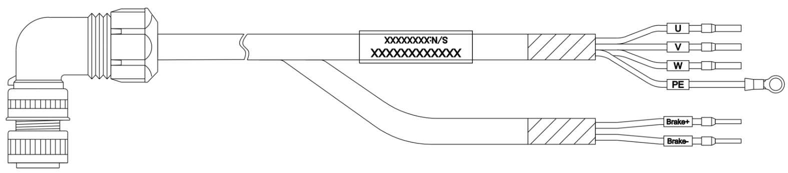
| Motor side connector type | Cable side connector type |
|---|---|
| AF/AB | SC-MC6S-AE20-01 |
| BF/BB | SC-MC6S-AE20-01 |
| A2 | CP-GM1311/S-4B |
| B2 | CP-GM1311/S-6B |
| A4 | CMS3108A20-4SI |
| B4 | CMS3108A20-18SI |
| A7 | YD32-4 |

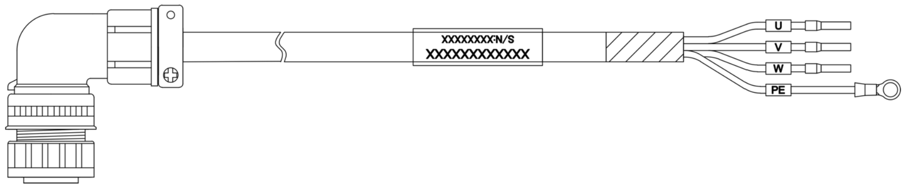
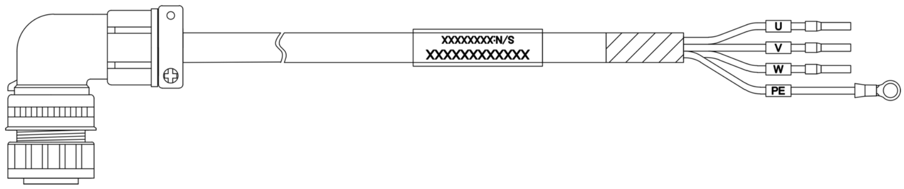
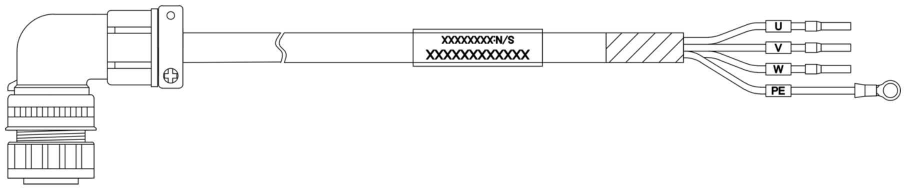
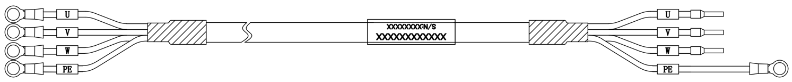
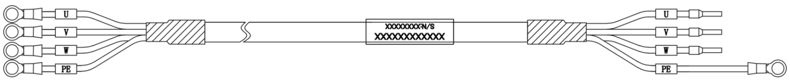
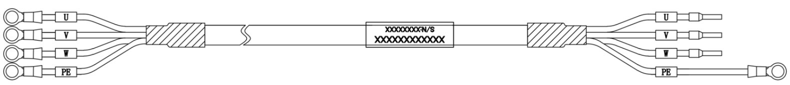
Note: 1、Standard cable lengths are 3m, 5m, 7m, 10m, 15m, 20m, and the other lengths need to be customized.

2、* Plastic case straight plug adaptable cable length supports up to 40m.

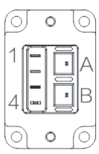
1) Power Cable Specifications

| Model | Content |
|---|---|
| LM-***-SAF-□. |  Connector Type: SC-MC6S-AE20-01 Terminals: E0508(3PCS) + RVS1.25-4(1PCS) |
| LM-***-SAB-□.S |  Connector Type: SC-MC6S-AE20-01 Terminals: E0508(3PCS) + RVS1.25-4(1PCS) |
| LM-***-SBF-□. |  Connector Type: SC-MC6S-AE20-01 Terminals: E0508(5PCS) + RVS1.25-4(1PCS) |
| LM-***-SBB-□.S |  Connector Type: SC-MC6S-AE20-01 Terminals: E0508(5PCS) + RVS1.25-4(1PCS) |

| Model | Content |
|---|---|
| LM-***-AA4-□.S |  Connector Type: CMS3108A20-4SI Terminals: E7508(3PCS) +RVS 2-4(1PCS) |
| LM-***-AB4-□.S |  Connector Type: CMS3108A20-18SI Terminals: E7508(3PCS)+E 0508(2PCS) +RVS 2-4(1PCS) |
| LM-***-BA4-□.S |  Connector Type: CMS3108A20-4SI Terminals: E1508(3PCS) +RVS 2-4(1PCS) |
| LM-***-BB4-□.S |  Connector type: CMS3108A20-18SI Terminals: E1508(3PCS)+E 0508(2PCS) +RVS 2-4(1PCS) |
| LM-***-CA4-□.S |  Connector Type: CMS3108A20-4SI Terminals: E2508(3PCS) +RV 3.5-4(1PCS) |
| LM-***-CB4-□.S |  Connector type: CMS3108A20-18SI Terminals: E2508(3PCS)+E 0508(2PCS) +R3.5-4(1PCS) |

| Model | Content |
|---|---|
| LM-***-BA7-□.S | <br>Connector type: YD32-4 Terminals: E1508(3PCS) +RVS 2-4(1PCS) |
| LM-***-CA7-□.S | <br>Connector type: YD32-4 Terminal E2508(3PCS)+RVS 2-4(1PCS) |
| LM-***-DA7-□.S | <br>Connector type: YD32-4 Terminals: E4009(3PCS) +RVS 5.5-4(1PCS) |
| KLM-***-CW4-□.S | <br>Terminals: RV 5.5-6 (4PCS)+E2508(3PCS)+RV 3.5-4(1PCS) |
| KLM-***-DW4-□.S | <br>Terminal: RV 5.5-6(4PCS)+E4009(3PCS)+RVS 5.5-4(1PCS) |
| KLM-***-EW4-□. | <br>Terminal: RV 5.5-6(4PCS)+E6010(3PCS)+RVS 5.5-4(1PCS) |

**2)** Power Cable Pin Definition

| **40/60/80 flange inline connector with plastic shell for motors** | |
|---|---|
| <br>SC-MC6S-AE20-01 | **Pins** \| **1** \| **2** \| **3** \| **4** \| **A** \| **B** |

| **Pins** | **1** | **2** | **3** | **4** | **A** | **B** |
|---|---|---|---|---|---|---|
| **Signal** | U | V | W | PE | Brake- | Brake+ |

**40/60/80 flange motor with plastic shell avionics connector**


CP-GM1311/S-4B CP-GM1311/S-

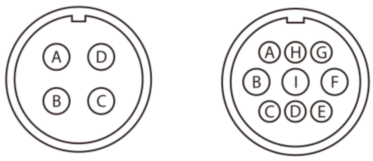
CP-GM1311/S-4B.

| Pins | 1 | 2 | 3 | 4 |
|---|---|---|---|---|
| Signal | V | U | W | PE |

CP-GM1311/S-6B.

| Pins | 1 | 2 | 3 | 4 | 5 | 6 |
|---|---|---|---|---|---|---|
| Signal | V | U | W | PE | Brake+ | Brake- |

**100/130 flange metal aerial plug connectors for motors**




CMS3108A20-4SI CMS3108A20-18SI

Without holding without holding

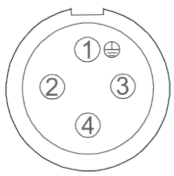
CMS3108A20-4SI.

| Pins | A | B | C | D |
|---|---|---|---|---|
| Signal | U | V | W | PE |

CMS3108A20-18SI.

| Pins | G | H | F | I | B | E |
|---|---|---|---|---|---|---|
| Signal | Brake+ | Brake- | U | V | W | PE |

**Metal aerial plug connectors for 180 flange motors**




YD32-4

YD32-4.

| Pins | 1 | 2 | 3 | 4 |
|---|---|---|---|---|
| Signal | PE | U | V | W |

## 2.3.2 Encoder cables

**L E - 0 3 0 - 1 P 2 - 1 . □**

**Motor encoder cables**

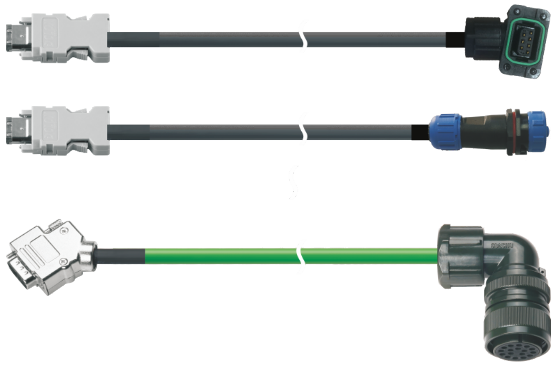
**Cable length**
**Example: 3m = 030**
**10m = 100**
**Support up to 60m**

**Encoder specifications**
**Fill in according to the selected motor encoder type**
**1: Single-turn absolute (4 cores)**
**(Used when the encoder is incremental)**
**4: multi-turn absolute type (6-cell, with battery dump 2, without battery)**
**(Used when the encoder is absolute)**

**Manufacturer Definition**
**No = Driver side dump type, without connector**
**S= Adapted AD2 drive**

**Special Requirements**
**0 = PVC with fixed cable (black)**
**2 = PVC with high flexibility cable**
**(10 million bending cycles)**
**3 = PUR with water, oil and**

**Motor side connector type**
**PF = Plastic case straight plug for 40/60/80 flange motors without holding brake**
**Connector front outlet (PB for rear outlet) ***
**P2: Plastic shell aerospace connectors for 40/60/80 flange motors**
**P4: Metal aerospace connectors for 100/130 flange motors**
**P6: Metal aerospace connectors for 180/200/230 flange motors**

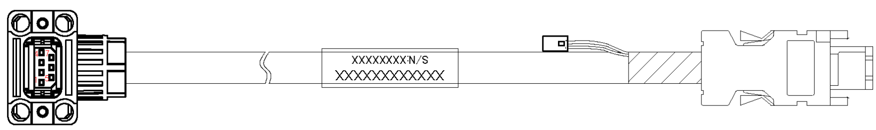


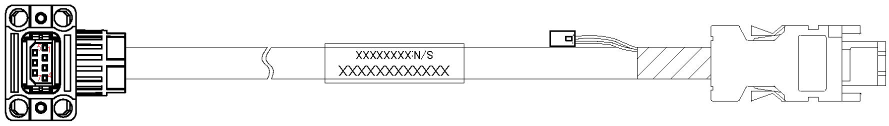
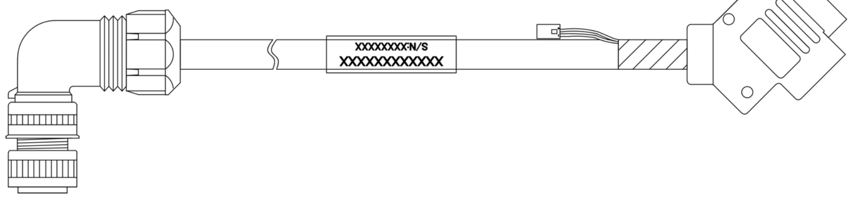
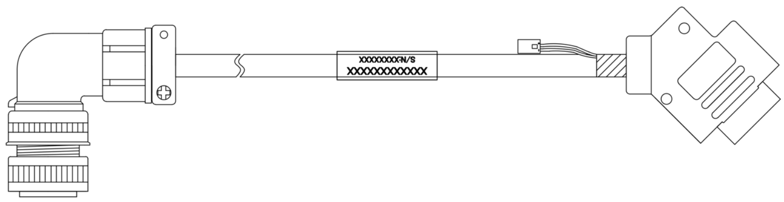
| Motor side connector type | Cable side connector type |
|---|---|
| PF/PB | SC-MC7S-A820-P1 |
| P2 | CP-GM1311/S-9 |
| P4 | CMS3108A20-29SI |
| P6 | YD28-7 |

Note: 1、Standard cable lengths are 3m, 5m, 7m, 10m, 15m, 20m, and the other lengths need to be customized.

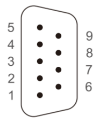
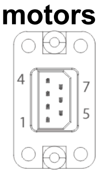
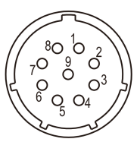
2、* Plastic case straight plug adaptable cable length supports up to 40m.

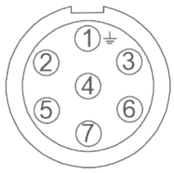
1) Encoder cable specifications

| Model | Content |
|---|---|
| LE-***-4PF-*.V |   Connector Type：SC-MC7S-A820-P1 Connector Type：KSA-1394a6P.01 Battery box leads |

| | |
|---|---|
| LE-***-4PB-*0.V | <br>Connector Type：SC-MC7S-A820-P1 Connector Type：KSA-1394a6P.01<br>Battery box leads |
| LE-***-4P4-*. | <br>Connector Type：CMS3108A20-29SI Connector Type：KSA-DB9p.02<br>Battery box leads |
| LE-***-4P6-*0. | <br>Connector Type：YD28-7 Connector Type：KSA-DB9p.02<br>Battery box leads |

2) Encoder Cable Pin Definition

<table>
<tr><td>AD2 driver side pin definition<br><br>KSA-DB9p.02</td>
<td>KSA-DB9p.02:
<table>
<tr><th>Pins</th><th>1</th><th>2</th><th>3</th><th>4</th><th>5</th><th>6</th><th>7</th><th>8</th><th>9</th></tr>
<tr><td>Signal</td><td>5V</td><td>SD+</td><td>SD-</td><td>GND</td><td>-<br>-</td><td>-<br>-</td><td>CLK+</td><td>CLK-</td><td>-<br>-</td></tr>
</table></td></tr>
<tr><td>40/60/80 flange inline connector with plastic shell for motors<br><br>SC-MC7S-A820-P1</td>
<td>SC-MC6S-AE20-01.
<table>
<tr><th>Pins</th><th>1</th><th>2</th><th>3</th><th>4</th><th>5</th><th>6</th><th>7</th></tr>
<tr><td>Signal</td><td>PE</td><td>5V</td><td>0V</td><td>SD+</td><td>SD-</td><td>BAT+</td><td>BAT-</td></tr>
</table></td></tr>
<tr><td>40/60/80 flange motor with plastic shell avionics connector<br><br>CP-GM1311/S-9</td>
<td>CP-GM1311/S-6B.
<table>
<tr><th>Pins</th><th>1</th><th>2</th><th>3</th><th>6</th><th>7</th><th>8</th><th>9</th></tr>
<tr><td>Signal</td><td>SD+</td><td>SD-</td><td>BAT+</td><td>5V</td><td>0V</td><td>BAT-</td><td>PE</td></tr>
</table></td></tr>
</table>

<table>
<tr>
<td>100/130 flange metal aerial plug connectors for motors<br><br>CMS3108A20-</td>
<td>CMS3108A20-29SI.<br>
<table>
<tr><th>Pins</th><th>G</th><th>H</th><th>J</th><th>K</th><th>L</th><th>S</th><th>T</th></tr>
<tr><th>Signal</th><td>0V</td><td>5V</td><td>PE</td><td>SD+</td><td>SD-</td><td>BAT-</td><td>BAT+</td></tr>
</table>
</td>
</tr>
<tr>
<td>Metal aerial plug connectors for 180 flange motors<br><br>YD28-7</td>
<td>YD28-7.<br>
<table>
<tr><th>Pins</th><th>1</th><th>2</th><th>3</th><th>4</th><th>5</th><th>6</th><th>7</th></tr>
<tr><th>Signal</th><td>PE</td><td>5V</td><td>0V</td><td>SD+</td><td>SD-</td><td>BAT+</td><td>BAT-</td></tr>
</table>
</td>
</tr>
</table>

## 2.3.3 Communication cables

**KSL - C A T - 0 0 3 . 1**

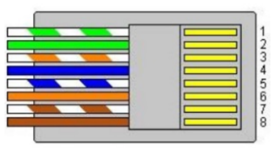
**AUCTECH Cable**

**EtherCAT communication cable**

**Cable length**
**Example: 3m = 030**
**10m = 100**
**Maximum support 90m = 900**

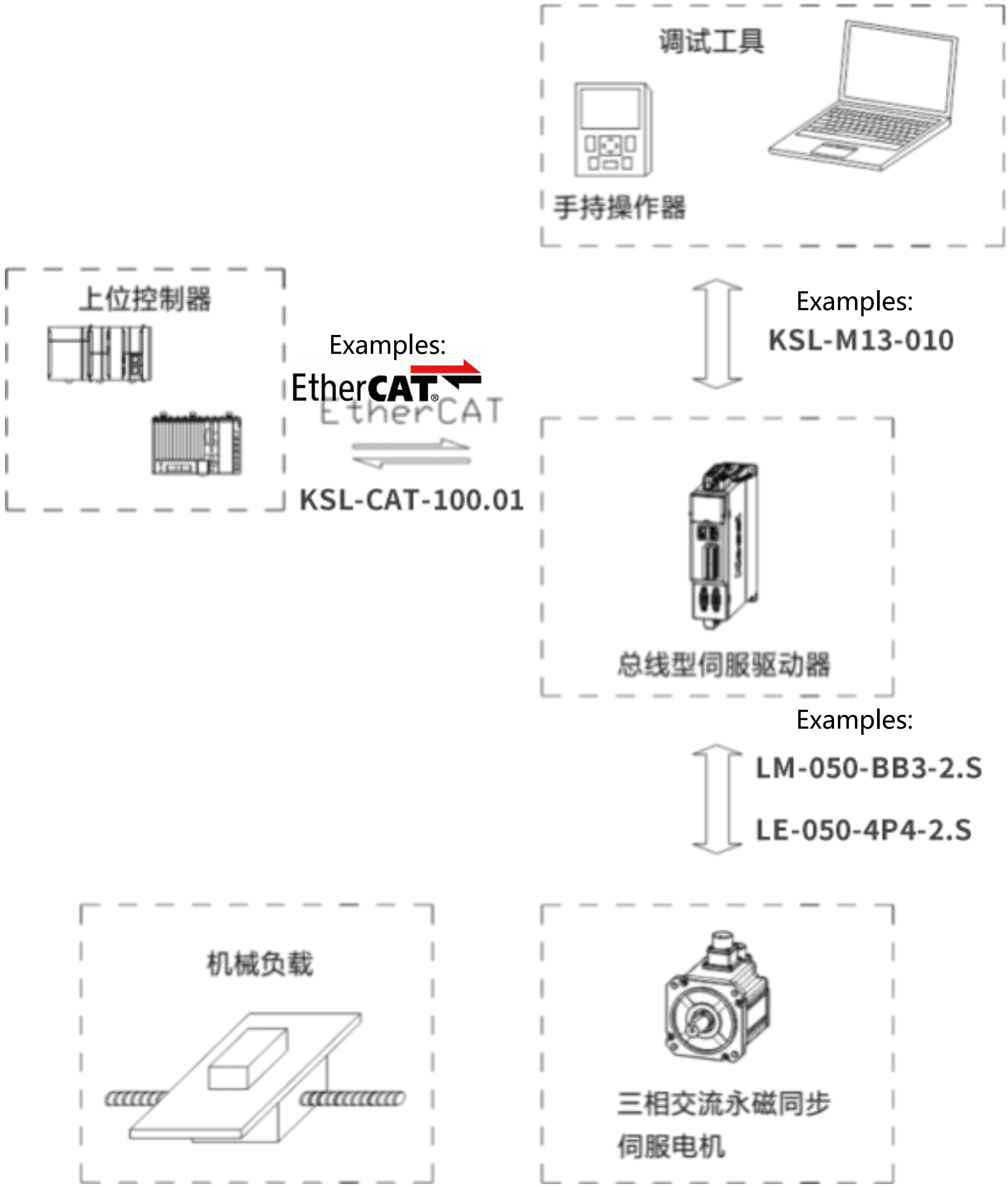
**Manufacturer Definition**
**Super Category 5 shielded network cable**

## 2.3.4 Bus communication cable pinouts



| Pins | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | Housing |
|---|---|---|---|---|---|---|---|---|---|
| Signal | TD+ | TD- | RD+ | / | / | RD- | / | / | Shielding |

## 2.4 Servo system composition



# 2.5 Recommended model comparison table

| Motor | | Cables | | Drivers |
|---|---|---|---|---|
| **Flange** | **Motor Model** | **Power & Hold cable type** | **Encoder cable type** | **Drive Model** |
| 40 | ASK40-2-003M3060 | LM- □□□□□- SAF/SAB- □ . | LE- □□□□□- 4PF/4PB-□. | AD2RE-1R8SA-E |
| | ASK40-2-003M3060B | LM- □□□□□- SBF/SBB- □ . | | |
| 60 | ASK60-2-006M3060 | LM- □□□□□- SAF/SAB- □ . | LE- □□□□□- 4PF/4PB-□. | AD2RE-1R8SA-E |
| | ASK60-2-006M3060B | LM- □□□□□- SBF/SBB- □ . | | |
| | ASK60-2-013M3050 | LM- □□□□□- SAF/SAB- □ . | LE- □□□□□- 4PF/4PB-□. | AD2RE-2R8SA-E |
| | ASK60-2-013M3050B | LM- □□□□□- SBF/SBB- □ . | | |
| 80 | ASK80-2-024M3050 | LM- □□□□□- SAF/SAB- □ . | LE- □□□□□- 4PF/4PB-□. | AD2RE-4R2SA-E |
| | ASK80-2-024M3050B | LM- □□□□□- SBF/SBB- □ . | | |
| | ASK80-2-032M3050 | LM- □□□□□- SAF/SAB- □ . | LE- □□□□□- 4PF/4PB-□. | AD2RE-060PA-E |
| | ASK80-2-032M3050B | LM- □□□□□- SBF/SBB- □ . | | |
| 100 | ASK100-2-032M3060 | LM- □□□□-BA4- □ . | LE- □□□□□- 4PF/4PB-□. | AD2RE-100SA-E |
| | ASK100-2-032M3060B | LM- □□□□- BB4- □ . | | |
| | ASK100-2-048M3050 | LM- □□□□-BA4- □ . | LE- □□□□□-4P4-□ . | AD2RE-100SA-E |
| | ASK100-2-048M3050B | LM- □□□□- BB4- □ . | | |
| | ASK100-2-064M3050 | LM- □□□□-BA4- □ . | LE- □□□□□-4P4-□ . | AD2RE-120PA-E |
| | ASK100-2-048M3050B | LM- □□□□- BB4- □ . | | |
| | ASK100-4-032M3060 | LM- □□□□- AA4- □ . | LE- □□□□□-4P4-□ . | AD2RE-5R4SCE |
| | ASK100-4-032M3060B | LM- □□□□-AB4- □ . | | |
| | ASK100-4-048M3050 | LM- □□□□- AA4- □ . | LE- □□□□□-4P4-□ . | AD2RE-5R4SCE |
| | ASK100-4-048M3050 | LM- □□□□-AB4- □ . | | |
| | ASK100-4-064M3050 | LM- □□□□- AA4- □ . | LE- □□□□□-4P4-□ . | AD2RE-6R8SC-E |
| | ASK100-4-064M3050B | LM- □□□□-AB4- □ . | | |
| | ASK100-4-080M3050 | LM- □□□□-BA4- □ . | LE- □□□□□-4P4-□.S | AD2RE-8R3SC-E |
| | ASK100-4-080M3050B | LM- □□□□- BB4- □ . | | |
| 130 | ASK130-2-054M1530 | LM- □□□□- AA4- □ . | LE- □□□□□-4P4-□.S | AD2RE-060PA-E |
| | ASK130-2-054M1530B | LM- □□□□-AB4- □ . | | |
| | ASK130-2-083M1530 | LM- □□□□-BA4- □ . | LE- □□□□□-4P4-□.S | AD2RE-100SA-E |
| | ASK130-2-083M1530B | LM- □□□□- BB4- □ . | | |
| | ASK130-2-096M1530 | LM- □□□□-BA4- □ . | LE- □□□□□-4P4-□.S | AD2RE-120SA-E |
| | ASK130-2-096M1530B | LM- □□□□- BB4- □ . | | |
| | ASK130-2-115M1530 | LM- □□□□-CA4- □ . | LE- □□□□□-4P4-□.S | AD2RE-120PA-E |
| | ASK130-2-115M1530B | LM- □□□□-CB4- □ . | | |
| | ASK130-2-048M2030 | LM- □□□□- AA4- □ . | LE- □□□□□-4P4-□.S | AD2RE-060PA-E |
| | ASK130-2-048M2030B | LM- □□□□-AB4- □ . | | |
| | ASK130-2-072M2030 | LM- □□□□-BA4- □ . | LE- □□□□□-4P4-□.S | AD2RE-100SA-E |
| | ASK130-2-072M2030B | LM- □□□□- BB4- □ . | | |
| | ASK130-2-096M2030 | LM- □□□□-BA4- □ . | LE- □□□□□-4P4-□.S | AD2RE-120PA-E |
| | ASK130-2-096M2030B | LM- □□□□- BB4- □ . | | |
| | ASK130-2-119M2030 | LM- □□□□-CA4- □ . | LE- □□□□□-4P4-□ . | AD2RE-140SA-E |
| | ASK130-2-119M2030B | LM- □□□□-CB4- □ . | | |
| | ASK130-2-040M2530 | LM- □□□□- AA4- □ . | LE- □□□□□-4P4-□ . | AD2RE-060PA-E |
| | ASK130-2-040M2530B | LM- □□□□-AB4- □ . | | |
| | ASK130-2-050M2530 | LM- □□□□- AA4- □ . | LE- □□□□□-4P4-□ . | AD2RE-100SA-E |
| | ASK130-2-050M2530B | LM- □□□□-AB4- □ . | | |
| | ASK130-2-060M2530 | LM- □□□□-BA4- □ . | LE- □□□□□-4P4-□ . | AD2RE-100SA-E |
| | ASK130-2-060M2530B | LM- □□□□- BB4- □ . | | |
| 130 | ASK130-2-077M2530 | LM- □□□□-BA4- □ . | LE- □□□□□-4P4-□.S | AD2RE-120PA-E |
| | ASK130-2-077M2530B | LM- □□□□- BB4- □ . | | |

| Motor | | Cables | | Drivers |
|---|---|---|---|---|
| **Flange** | **Motor Model** | **Power & Hold cable type** | **Encoder cable type** | **Drive Model** |
| | ASK130-2-096M2530 | LM- □□□□-BA4- □ . | LE- □□□□□-4P4-□ . | AD2RE-140SA-E |
| | ASK130-2-096M2530B | LM- □□□□- BB4- □ . | | |
| | ASK130-2-048M3035 | LM- □□□□-BA4- □ . | LE- □□□□□-4P4-□ . | AD2RE-100SA-E |
| | ASK130-2-048M3035B | LM- □□□□- BB4- □ . | | |
| | ASK130-2-064M3035 | LM- □□□□-BA4- □ . | LE- □□□□□-4P4-□ . | AD2RE-120PA-E |
| | ASK130-2-064M3035B | LM- □□□□- BB4- □ . | | |
| | ASK130-2-080M3035 | LM- □□□□-BA4- □ . | LE- □□□□□-4P4-□ . | AD2RE-140SA-E |
| | ASK130-2-080M3035B | LM- □□□□- BB4- □ . | | |
| | ASK130-2-096M3035 | LM- □□□□-BA4- □ . | LE- □□□□□-4P4-□.S | AD2RE-140SA-E |
| | ASK130-2-096M3035B | LM- □□□□- BB4- □ . | | |
| | ASK130-4-054M1530 | LM- □□□□- AA4- □ . | LE- □□□□□-4P4-□.S | AD2RE-5R4SA-E |
| | ASK130-4-054M1530B | LM- □□□□-AB4- □ . | | |
| | ASK130-4-083M1530 | LM- □□□□- AA4- □ . | LE- □□□□□-4P4-□.S | AD2RE-5R4SA-E |
| | ASK130-4-083M1530B | LM- □□□□-AB4- □ . | | |
| | ASK130-4-096M1530 | LM- □□□□- AA4- □ . | LE- □□□□□-4P4-□.S | AD2RE-5R4SA-E |
| | ASK130-4-096M1530B | LM- □□□□-AB4- □ . | | |
| | ASK130-4-115M1530 | LM- □□□□-BA4- □ . | LE- □□□□□-4P4-□.S | AD2RE-6R8SA-E |
| | ASK130-4-115M1530B | LM- □□□□- BB4- □ . | | |
| | ASK130-4-150M1530 | LM- □□□□-BA4- □ . | LE- □□□□□-4P4-□.S | AD2RE-100SC-E |
| | ASK130-4-150M1530B | LM- □□□□- BB4- □ . | | |
| | ASK130-4-048M2030 | LM- □□□□- AA4- □ . | LE- □□□□□-4P4-□.S | AD2RE-5R4SA-E |
| | ASK130-4-048M2030B | LM- □□□□-AB4- □ . | | |
| | ASK130-4-072M2030 | LM- □□□□- AA4- □ . | LE- □□□□□-4P4-□.S | AD2RE-5R4SA-E |
| | ASK130-4-072M2030B | LM- □□□□-AB4- □ . | | |
| | ASK130-4-096M2030 | LM- □□□□- AA4- □ . | LE- □□□□□-4P4-□ . | AD2RE-6R8SC-E |
| | ASK130-4-096M2030B | LM- □□□□-AB4- □ . | | |
| | ASK130-4-119M2030 | LM- □□□□-BA4- □ . | LE- □□□□□-4P4-□ . | AD2RE-8R3SC-E |
| | ASK130-4-119M2030B | LM- □□□□- BB4- □ . | | |
| | ASK130-4-146M2030 | LM- □□□□-BA4- □ . | LE- □□□□□-4P4-□ . | AD2RE-100SC-E |
| | ASK130-4-146M2030B | LM- □□□□- BB4- □ . | | |
| | ASK130-4-040M2530 | LM- □□□□- AA4- □ . | LE- □□□□□-4P4-□ . | AD2RE-5R4SC-E |
| | ASK130-4-040M2530B | LM- □□□□-AB4- □ . | | |
| | ASK130-4-050M2530 | LM- □□□□- AA4- □ . | LE- □□□□□-4P4-□.S | AD2RE-5R4SC-E |
| | ASK130-4-050M2530B | LM- □□□□-AB4- □ . | | |
| | ASK130-2-060M2530 | LM- □□□□- AA4- □ . | LE- □□□□□-4P4-□ . | AD2RE-5R4SC-E |
| | ASK130-2-060M2530B | LM- □□□□-AB4- □ . | | |
| | ASK130-2-077M2530 | LM- □□□□- AA4- □ . | LE- □□□□□-4P4-□ . | AD2RE-6R8SC-E |
| | ASK130-2-077M2530B | LM- □□□□-AB4- □ . | | |
| | ASK130-2-096M2530 | LM- □□□□-BA4- □ . | LE- □□□□□-4P4-□ . | AD2RE-8R3SC-E |
| | ASK130-2-096M2530B | LM- □□□□- BB4- □ . | | |
| | ASK130-4-150M2535 | LM- □□□□-BA4- □ . | LE- □□□□□-4P4-□ . | AD2RE-100SCE |
| | ASK130-4-150M2535B | LM- □□□□- BB4- □ . | | |
| | ASK130-4-048M3035 | LM- □□□□- AA4- □ . | LE- □□□□□-4P4-□.S | AD2RE-5R4SA-E |
| | ASK130-2-048M3035B | LM- □□□□-AB4- □ . | | |
| | ASK130-4-064M3035 | LM- □□□□- AA4- □ . | LE- □□□□□-4P4-□.S | AD2RE-6R8SA-E |
| | ASK130-2-064M3035B | LM- □□□□-AB4- □ . | | |
| | ASK130-2-080M3035 | LM- □□□□- AA4- □ . | LE- □□□□□-4P4-□.S | AD2RE-6R8SA-E |
| | ASK130-2-080M3035B | LM- □□□□-AB4- □ . | | |
| | ASK130-4-096M3035 | LM- □□□□-BA4- □ . | LE- □□□□□-4P4-□.S | AD2RE-8R3SA-E |
| 130 | ASK130-2-096M3035B | LM- □□□□- BB4- □ . | | |

| Motor | | Cables | | Drivers |
|---|---|---|---|---|
| **Flange** | **Motor Model** | **Power & Hold cable type** | **Encoder cable type** | **Drive Model** |
| | ASK130-4-127M3035 | LM- □□□□-BA4- □ . | LE- □□□□□-4P4-□.S | AD2RE-120SC-E |
| | ASK130-4-127M3035B | LM- □□□□- BB4- □ . | | |
| | ASK130-4-159M3045 | LM- □□□□-CA4- □ . | LE- □□□□□-4P4-□.S | AD2RE-140SC-E |
| | ASK130-4-159M3045B | LM- □□□□-CB4- □ . | | |
| 180 | ASK180-4-186H1530 | LM- □□□□-BA7- □ . | LE- □□□□□-4P6-□ . | AD2RE-100SC-E |
| | ASK180-4-186H1530B | LM- □□□□-BA7- □ . | | |
| | | LB- □□□□- B7- □ | | |
| | ASK180-4-284H1530 | LM- □□□□-CA7- □ . | LE- □□□□□-4P6-□ . | AD2RE-140SC-E |
| | ASK180-4-284H1530B | LM- □□□□-CA7- □ . | | |
| | | LB- □□□□- B7- □ | | |
| | ASK180-4-350H1530 | LM- □□□□-CA7- □ . | LE- □□□□□-4P6-□ . | AD2RE-210SC-E |
| | ASK180-4-350H1530B | LM- □□□□-CA7- □ . | | |
| | | LB- □□□□- B7- □ | | |
| | ASK180-4-480H1530 | LM- □□□□- DA7- □ . | LE- □□□□□-4P6-□ . | AD2RE-250SC-E |
| | ASK180-4-480H1530B | LM- □□□□- DA7- □ . | | |
| | | LB- □□□□- B7- □ | | |
| | ASK180-2-170H1518 | LM- □□□□-BA7- □ . | LE- □□□□□-4P6-□ . | AD2RE-140SA-E |
| | ASK180-2-170H1518B | LM- □□□□-BA7- □ . | | |
| | | LB- □□□□- B7- □ | | |
| | ASK180-2-180H1518 | LM- □□□□-BA7- □ . | LE- □□□□□-4P6-□ . | AD2RE-140SA-E |
| | ASK180-2-180H1518B | LM- □□□□-BA7- □ . | | |
| | | LB- □□□□- B7- □ | | |
| | ASK180-4-170H1518 | LM- □□□□-BA7- □ . | LE- □□□□□-4P6-□ . | AD2RE-6R8SC-E |
| | ASK180-4-170H1518B | LM- □□□□-BA7- □ . | | |
| | | LB- □□□□- B7- □ | | |
| | ASK180-4-186H1518 | LM- □□□□-BA7- □ . | LE- □□□□□-4P6-□ . | AD2RE-8R3SC-E |
| | ASK180-4-186H1518B | LM- □□□□-BA7- □ . | | |
| | | LB- □□□□- B7- □ | | |
| | ASK180-4-280H1518 | LM- □□□□-BA7- □ . | LE- □□□□□-4P6-□ . | AD2RE-120SC-E |
| | ASK180-4-280H1518B | LM- □□□□-BA7- □ . | | |
| | | LB- □□□□- B7- □ | | |
| | ASK180-4-350H1518 | LM- □□□□-BA7- □ . | LE- □□□□□-4P6-□ . | AD2RE-140SC-E |
| | ASK180-4-350H1518B | LM- □□□□-BA7- □ . | | |
| | | LB- □□□□- B7- □ | | |
| | ASK180-4-480H1518 | LM- □□□□-CA7- □ . | LE- □□□□□-4P6-□ . | AD2RE-210SC-E |
| | ASK180-4-480H1518B | LM- □□□□-CA7- □ . | | |
| | | LB- □□□□- B7- □ | | |

| Motor | | Cables | | Drivers |
|---|---|---|---|---|
| Flange | Motor Model | Power & Hold cable type | Encoder cable type | Drive Model |
| 200 | ASK200-4-530H1518 | LM- □□□□- AA4- □ . | LE- □□□□□-4P6-□ . | AD2RE-210SC-E |
| | ASK200-4-530H1518B | LM- □□□□-AB4- □ . | | |
| | | LB- □□□□- B7- □ | | |
| | ASK200-4-700H1518 | LM- □□□□-BA4- □ . | LE- □□□□□-4P6-□ . | AD2RE-340SC-E |
| | ASK200-4-700H1518B | LM- □□□□- BB4- □ . | | |
| | | LB- □□□□- B7- □ | | |
| | ASK200-4-840H1518 | LM- □□□□-BA4- □ . | LE- □□□□□-4P6-□ . | AD2RE-340SC-E |
| | ASK200-4-840H1518B | LM- □□□□- BB4- □ . | | |
| | | LB- □□□□- B7- □ | | |
| 230 | ASK230-4-700H1520 | LM- □□□□- AA4- □ . | LE- □□□□□-4P6-□ . | AD2RE-340SC-E |
| | ASK230-4-700H1520B | LM- □□□□-AB4- □ . | | |
| | | LB- □□□□- B7- □ | | |
| | ASK230-4-950H1520 | LM- □□□□- AA4- □ . | LE- □□□□□-4P6-□ . | AD2RE-340SC-E |
| | ASK230-4-950H1520B | LM- □□□□-AB4- □ . | | |
| | | LB- □□□□- B7- □ | | |

Note: 200/230 flange motor, in the cable selection, need to adapt the fan, temperature sensor cable, please refer to the motor accessories section selection.

# Section 3 Installation Instructions

## 3.1 Installation of Servo Drive

### 3.1.1 Installation site

- Please install in a mounting cabinet that is free from sun and rain;
- Do not use this product in the vicinity of corrosive and flammable gas environments such as hydrogen sulfide, chlorine, ammonia, sulfur, chlorinated gases, acids, alkalis, salts, and combustible materials.
- Do not install in high temperature, humid, dusty, or metal dusty environments.
- Vibration-free sites.
- Installation site pollution level: PD2.

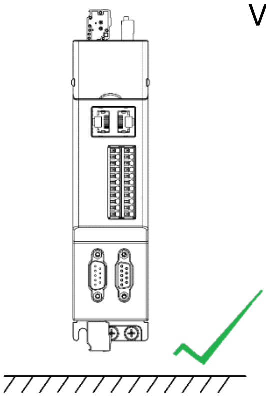
### 3.1.2 Installation Environment

| Projects | Description |
|---|---|
| Operating ambient temperature | 0 ~ +45°C (no freezing) |
| Use of environmental humidity | Below 90%RH (no condensation) |
| Storage temperature | -20~65℃ (no freezing) |
| Storage humidity | Below 90%RH (no condensation) |
| Vibration | Below 4.9m/s2 |
| Impact | Below 19.6m/s2 |
| Protection level | IP20 |
| Elevation | 1000m or less (above 1000m, 1.1% reduction for every 100m of elevation, maximum use poster 2000m) |

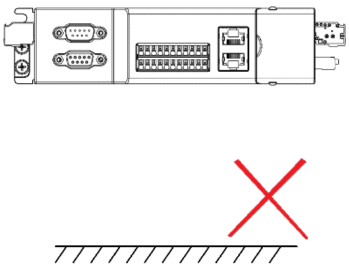
## 3.1.3 Installation Notes

- Make sure the mounting direction is perpendicular to the wall. Use natural convection or a fan to cool the Servo Drive. Securely fix the Servo Drive to the mounting surface through 2 to 4 (the number of mounting holes varies depending on the capacity) mounting holes.
- When mounting the Servo Drive, face the operator with the front of the Servo Drive facing the wall and make it perpendicular to the wall.

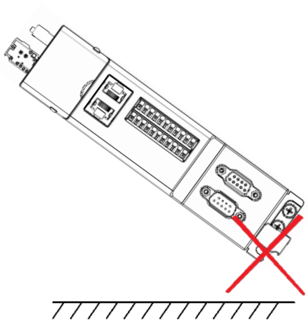
Vertical



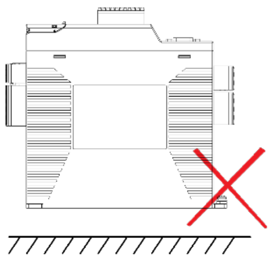
Horizon



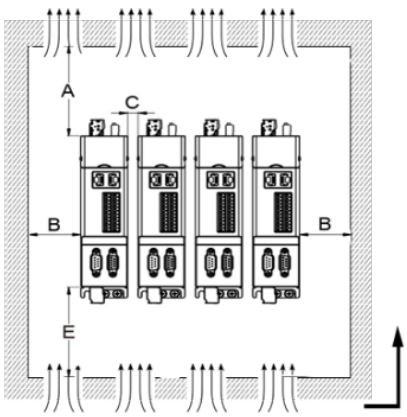
Tilt Mount



Straight

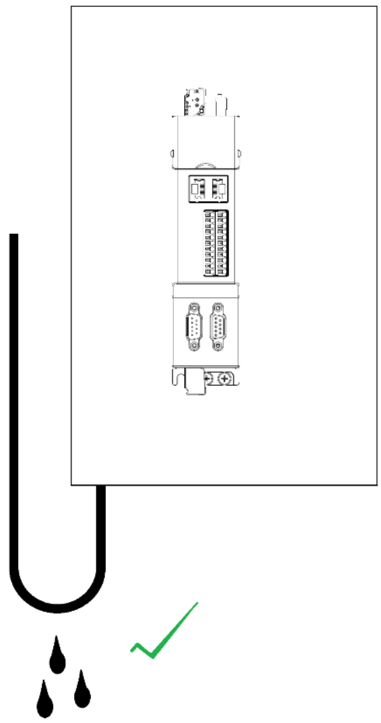


- Cooling To ensure cooling by fan and natural convection, please leave enough space around the servo driver as shown in the figure below. Install a fan for cooling on the upper part of the servo driver and keep the temperature inside the cabinet evenly so that the ambient temperature of the servo driver is not locally too high.




Note: Product specifications A size>120mm, B size>50mm, C size>10mm, E size>120mm

- Side-by-side installation
  When installed side-by-side, it is recommended to leave more than 10mm spacing on each side of the horizontal (if restricted by the installation space, you can choose the minimum 2mm spacing), and more than 50mm spacing on each side of the vertical.
- Grounding
  Be sure to ground the grounding terminal, otherwise there may be a risk of electric shock or interference that may cause false operation.
- Alignment requirements
  When wiring the drive, be careful to avoid having liquid adhere to the surface of the cable in the field, which could cause liquid to flow inside the drive along the cable.



# 3.2 Installation of servo motor

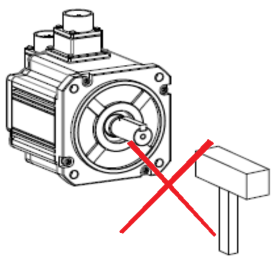
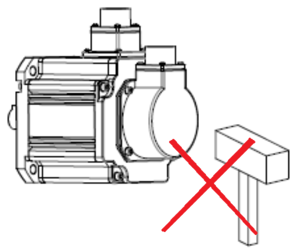
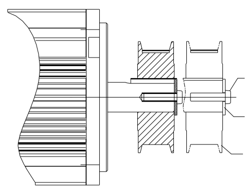
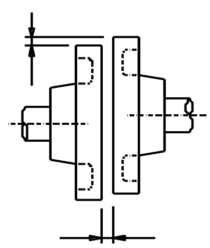
## 3.2.1 Installation site

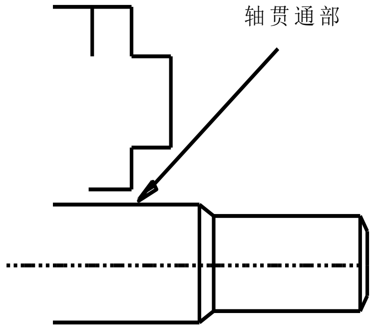
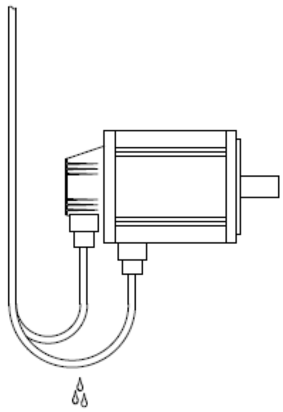
- Do not use this product in the vicinity of corrosive and flammable gas environments such as hydrogen sulfide, chlorine, ammonia, sulfur, chlorinated gases, acids, alkalis, salts, and combustible materials.
- Please choose the model with oil seal in the place where there are grinding fluid, oil mist, iron powder, cutting, etc.
- Places away from heat sources such as fireplaces.
- Do not use the motor in an enclosed environment. Enclosed environments can cause high motor temperatures, shortening the life of the motor.

## 3.2.2 Installation Environment

| Projects | Description |
|---|---|
| **Operating environmental temperature** | 0~40℃ (No freezing) |
| **Operating environmental humidity** | 20%~90%RH (no condensation) |
| **Storage temperature** | -20℃ ~60℃ (Maximum temperature guarantee: 80℃ 72 hours) |
| **Storage humidity** | 20%~90%RH (no condensation) |
| **Vibration** | Below 49m/s2 |
| **Impact** | Below 490m/s2 |
| **Protection level** | H1, H4: IP65 (except for the shaft penetration part and the motor connector connection terminal part)<br>Other: IP67 (except for the shaft penetration part and the motor connector connection terminal part) |
| **Elevation** | Below 1000m, above 1000m, please reduce the amount of use. |

## 3.2.3 Installation Notes

<table>
<tr><th>Projects</th><th>Description</th></tr>
<tr><td>Anti-rust treatment</td><td>● Before installation, wipe off the "rust inhibitor" on the shaft extension of the servo motor and then do the relevant rust prevention treatment.</td></tr>
<tr><td rowspan="2">Note on encoders</td><td>● It is forbidden to hit the shaft extension and the encoder shield during installation, otherwise it will cause the encoder glass optical code disc to break.<br> </td></tr>
<tr><td>● When mounting a pulley on a servo motor shaft with a keyway, use a screw hole in the shaft end.<br>● To install the pulley, first insert the double-headed nail into the screw hole of the shaft, use a washer on the surface of the coupling end, and gradually lock the pulley in place with a nut.<br><br>● For servo motor shafts with keyways, use screw holes in the shaft end; for shafts without keyways, use friction coupling or similar methods.<br>● When dismantling the pulley, a pulley remover is used to prevent the bearing from being strongly impacted by the load.<br>● When dismantling the pulley, a pulley remover is used to prevent the bearing from being strongly impacted by the load.<br>● To ensure safety, install a protective cover or similar device, such as a pulley mounted on the shaft, over the rotating area.<br>● When connecting to the machine, use a coupling and keep the axis of the servo motor in a straight line with the axis of the machine. Install the servo motor so that it meets the centering accuracy requirements shown in the figure on the left. If the centering is not sufficient, vibration will occur and may sometimes damage the bearings and encoder, etc.<br><br>Measured at four locations around the entire circumference of the circle, the difference between the maximum and minimum value is guaranteed to be less than 0.03mm.</td></tr>
</table>

<table>
<tr><th>Projects</th><th>Description</th></tr>
<tr><td>Installation direction</td><td>● The servo motor can be mounted in horizontal or vertical direction.</td></tr>
<tr><td>Oil and water countermeasures</td><td>● Do not use ordinary servo motors or cables immersed in oil or water.<br>● When used in places with water, oil or condensation, special treatment of the motor is required to meet the protection requirements; however, the motor needs to be shipped from the factory to meet the protection requirements for the shaft through section, and the motor type with oil seal should be specified. The shaft through section is the clearance of the shaft protruding from the end of the motor.<br><br><br>● In applications where liquids are present, install the motor wiring ports facing down (as shown below) to prevent liquids from flowing along the cable to the motor body.<br><br>◆ If you are using a servo motor with an oil seal in a place where oil drips onto the shaft penetration part, please specify the servo motor with an oil seal.<br><br>Conditions of use for Servomotors with oil seals:<br>Ensure that the oil level is below the edge of the oil seal.<br>When mounting the servo motor vertically upward, do not allow oil to accumulate on the edge of the oil seal.</td></tr>
<tr><td>Cable Tension</td><td>● Connecting the cable bending radius should not be too small, but also should not apply too much tension on the cable. In particular, the core wire diameter of the encoder signal cable is usually only 0.2, 0.3mm, the wiring should not be tensioned too tightly to prevent the cable core from tearing.</td></tr>
</table>

# Section 4 Wiring

## 4.1 General wiring diagram and port introduction

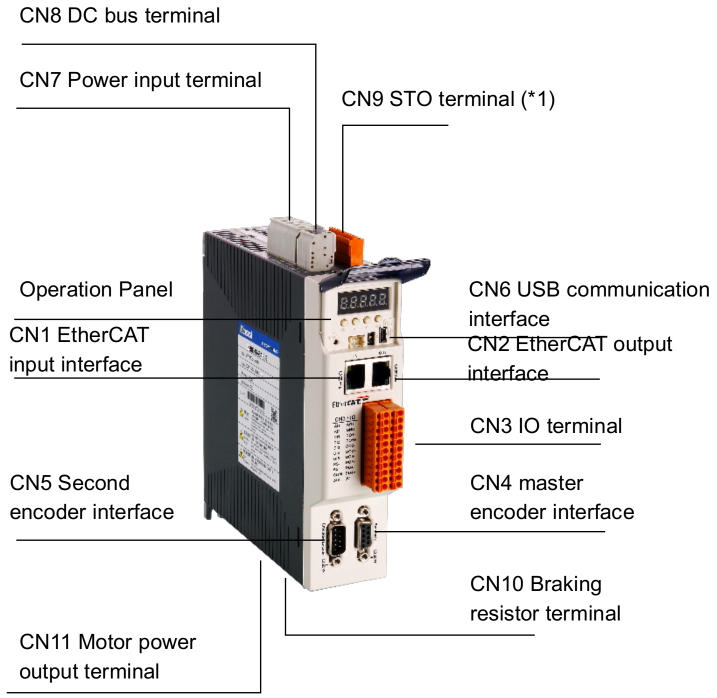



Figure 4-1-1 Drive terminal layout diagram

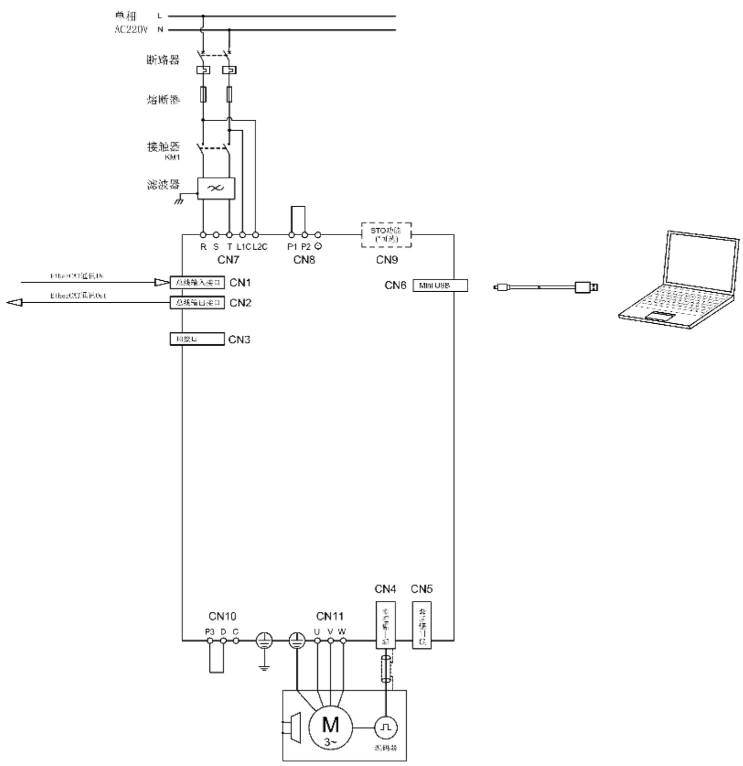



Figure 4-1-2 General wiring diagram

### 4.1.1 Definition and explanation of terminals

1) AC220V class A1, A2 specifications Driver terminal definition

Includes 1R8SA/2R8SA/4R2SA/060PA/100SA/120SA models.

| Terminal number | Marker | Name | Function |
|---|---|---|---|
| CN1 | IN | EtherCAT communication IN | EtherCAT communication In. |
| CN2 | OUT | EtherCAT communication OUT | EtherCAT communication Out. |
| CN3 | IO | IO signals | DI\DO\AI\AO\SS and other functions. |
| CN4 | Feedback | Master encoder feedback interface | Servo motor body encoder access. |
| CN5 | Emulated Encoder | Second encoder interface | External encoder access. |
| CN6 | - | USB communication interface | Computer debugging communication port. |
| CN7 | L1C, L2C, R, S, T | Power input terminal | L1C/L2C is the control power input, need to access AC220V power; R, S, T is the main power supply input, single-phase power supply to access AC 220V to any two of them. When the three-phase power supply is connected to the three-phase AC220V to R, S, T. |
| CN8 | P1, P2,⊖ | Common DC Bus Terminals | By default, P1 and P2 are shorted using shorting tabs; if you need to use DC reactors, you need to cancel the shorting tabs and connect the DC reactors between P1 and P2; and when using the common DC bus, the bus⊕ connect to P2 terminal, bus⊖ connect⊖ . |
| CN9 | STO1, STO2, etc. | Safe torque shutdown terminal | STO function (Only drive versions with security features have this port.) |
| CN10 | P3, D, C | Braking resistor terminal | By default, P3 and D are shorted using the shorting tabs, and the braking resistor inside the drive is used for braking energy absorption. If you need to use external braking resistor, you need to cancel the short connection between P3 and D, and connect the external braking resistor to P3 and C. |
| CN11 | U, V, W | Motor power output terminal | Motor power line interface |
| PE | ⏚ | Grounding | Motor ground, drive ground. |

Table 4-1-1 AC220V drive A1/A2 specification terminal definition

2) AC220V class A3 specification Driver terminal definition
120PA/140SA models are included.

| Terminal number | Marker | Name | Function |
|---|---|---|---|
| CN1 | IN | EtherCAT communication IN | EtherCAT communication In. |
| CN2 | OUT | EtherCAT communication OUT | EtherCAT communication Out. |
| CN3 | IO | IO signals | DI\DO\AI\AO\SS and other functions. |
| CN4 | Feedback | Master encoder feedback interface | Servo motor body encoder access. |
| CN5 | Emulated Encoder | Second encoder interface | External encoder access. |
| CN6 | - | USB communication interface | Computer debugging communication port. |
| CN7 | R, S, T | Power input terminal | R, S, T is the main power supply input, single-phase power supply access to AC 220V to any two of them. For three-phase power supply, it is necessary to access three-phase AC220V to R, S, T. |
| CN8 | P1, P2,⊖ , L1C, L2C | Control power and DC busbar | L1C/L2C is the control power input, need to access AC220V power; P1/P2/⊖ is the common DC bus terminal, by default P1, P2 use shorting piece shorting; if you need to use DC reactor, you need to cancel the shorting piece, connect the DC reactor between P1, P2; and when using common DC bus, bus⊕ connect to P2 terminal, bus⊖ connect⊖ . |
| CN9 | STO1, STO2, etc. | Safe torque shutdown terminal | STO function (Only drive versions with security features have this port.) |
| CN10 | P3, D, C | Braking resistor terminal | By default, P3 and D are shorted using the shorting tabs, and the braking resistor inside the drive is used for braking energy absorption. If you need to use external braking resistor, you need to cancel the short connection between P3 and D, and connect the external braking resistor to P3 and C. |
| CN11 | U, V, W | Motor power output terminal | Motor power line interface |
| PE | ⏚ | Grounding | Motor ground, drive ground. |

Table 4-1-2 AC220V drive A3 specification terminal definition

3) AC380V Class B1, B2 Specification Drive Terminal Definition
Includes 5R4SC/6R8SC/8R3SC/100SC/120SC/140SC/210SC /250SC models.

| Terminal number | Marker | Name | Function |
|---|---|---|---|
| CN1 | IN | EtherCAT communication IN | EtherCAT communication In. |
| CN2 | OUT | EtherCAT communication OUT | EtherCAT Communication Out. |
| CN3 | IO | IO signals | DI\DO\AI\AO\SS and other functions. |
| CN4 | Feedback | Master encoder feedback interface | Servo motor body encoder access. |
| CN5 | Emulated Encoder | Second encoder interface | External encoder access. |
| CN6 | - | USB communication interface | Computer debugging communication port. |
| CN7 | R, S, T | Power input terminal | R, S, T is the main power supply input, single-phase power supply to connect AC 220V to any two of them. For three-phase power supply, you need to connect three phases AC 380V to R, S, T. |
| CN8 | P1, P2, ○- | Common DC Bus Terminals | By default, P1 and P2 are shorted with shorting tabs; if a DC reactor is used, the shorting tabs are removed and the DC reactor is connected between P1 and P2; when a common DC bus is used, the bus bar⊕ is connected to the P2 terminal and the bus bar ○- is connected to ○-. |
| CN9 | STO1, STO2, etc. | Safe torque shutdown terminal | STO function (Only drive versions with security features have this port.) |
| CN10 | Brr1, Brr2 | Braking resistor terminal | Drive external braking resistor for braking energy absorption |
| CN11 | U, V, W | Motor power output terminal | Motor power line interface |
| CN12 | 0v, 24v1, 0v, 24v2 | 24V control power terminal | 24V control power interface |
| PE | ⏚ | Grounding | Motor ground, drive ground. |

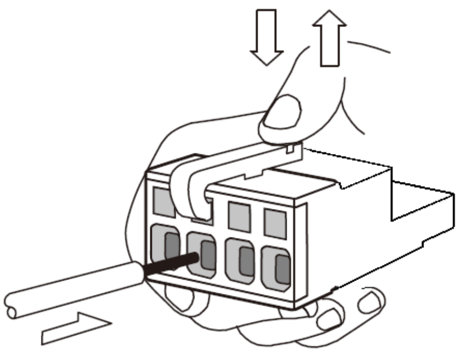
Table 4-1-3 AC380V Drive B1/B2 Specification Terminal Definition

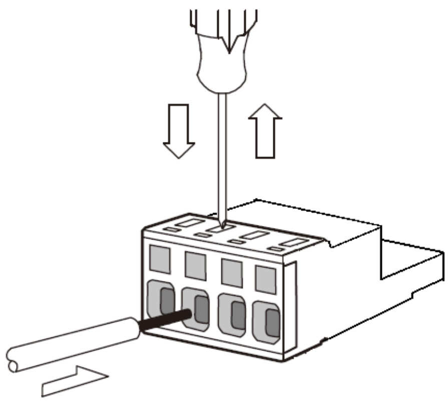
4) AC380V Class B3 Specification Drive terminal definition includes 250SC/340SC models.

| Terminal number | Marker | Name | Function |
|---|---|---|---|
| CN1 | IN | EtherCAT communication IN | EtherCAT communication In. |
| CN2 | OUT | EtherCAT communication OUT | EtherCAT Communication Out. |
| CN3 | IO | IO signals | DI\DO\AI\AO\SS and other functions. |
| CN4 | Feedback | Master encoder feedback interface | Servo motor body encoder access. |
| CN5 | Emulated Encoder | Second encoder interface | External encoder access. |
| CN6 | - | USB communication interface | Computer debugging communication port. |
| CN7 | R, S, T | Power input terminal | R, S, T is the main power supply input, single-phase power supply to connect AC 220V to any two of them. For three-phase power supply, you need to connect three phases AC 380V to R, S, T. |
| CN8 | P2, ○- | Common DC Bus Terminals | When using a common DC bus, the bus⊕ is connected to the P2 terminal.<br>Busbar ○- connects to ○-. |
| CN9 | STO1, STO2, etc. | Safe torque shutdown terminal | STO function (only drive versions with security features)<br>Only this port is available.) |
| CN10 | Brr1, Brr2 | Braking resistor terminal | An external braking resistor is driven for braking energy absorption. |
| CN11 | U, V, W | Motor power output terminal | Motor power line interface |
| CN12 | 0v, 24v1, 0v, 24v2 | 24V control power terminal | 24V control power interface |
| PE | ⏚ | Grounding | Motor ground, drive ground. |

Table 4-1-3 AC380V Drive B3 Specification Terminal Definition

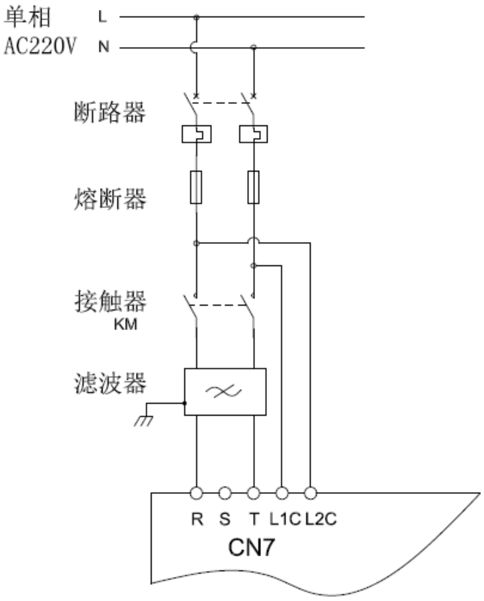
## 4.1.2 Wiring tool use

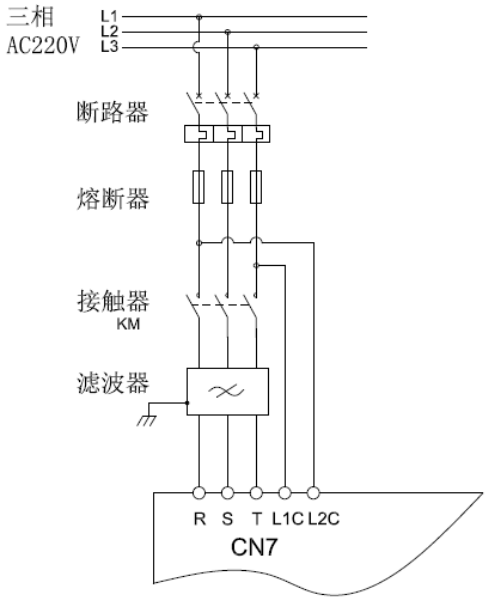




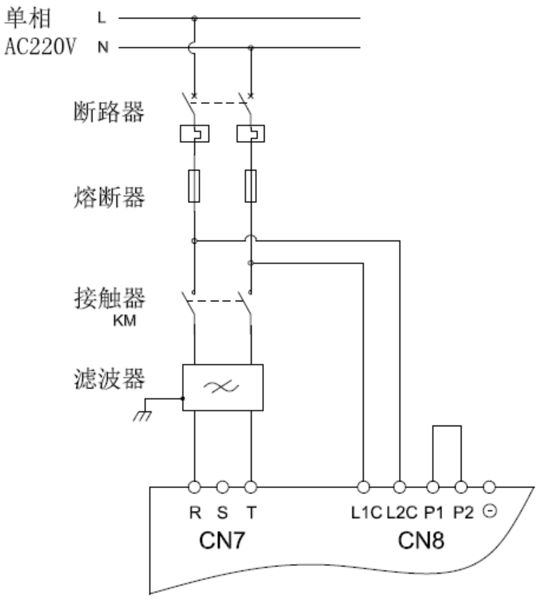
# 4.2 Servo drive main circuit and control circuit connection

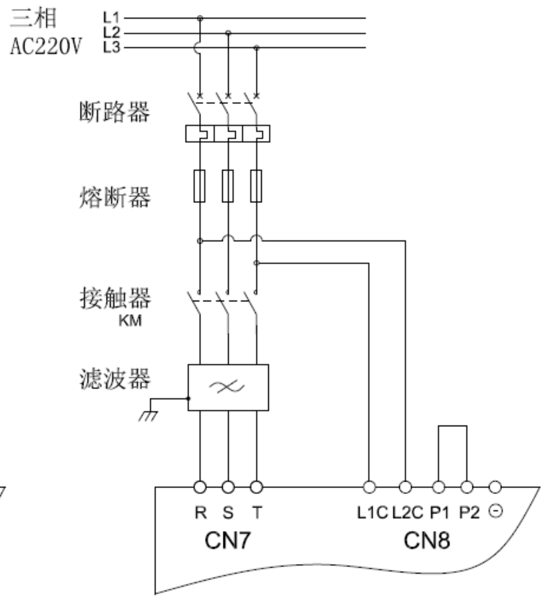
## 4.2.1 Main circuit connection AC220V class A1/A2 specifications



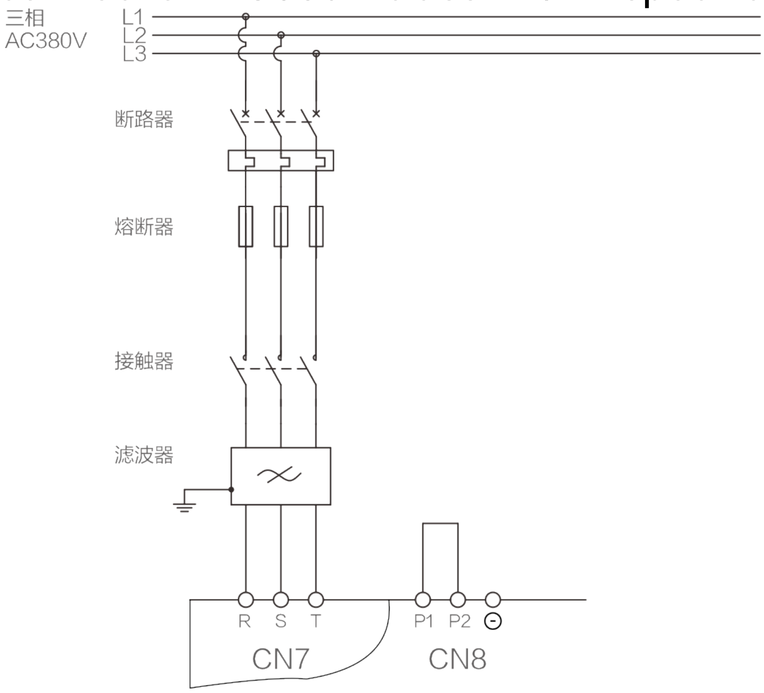




## 4.2.2 Main circuit connection AC220V class A3 specification

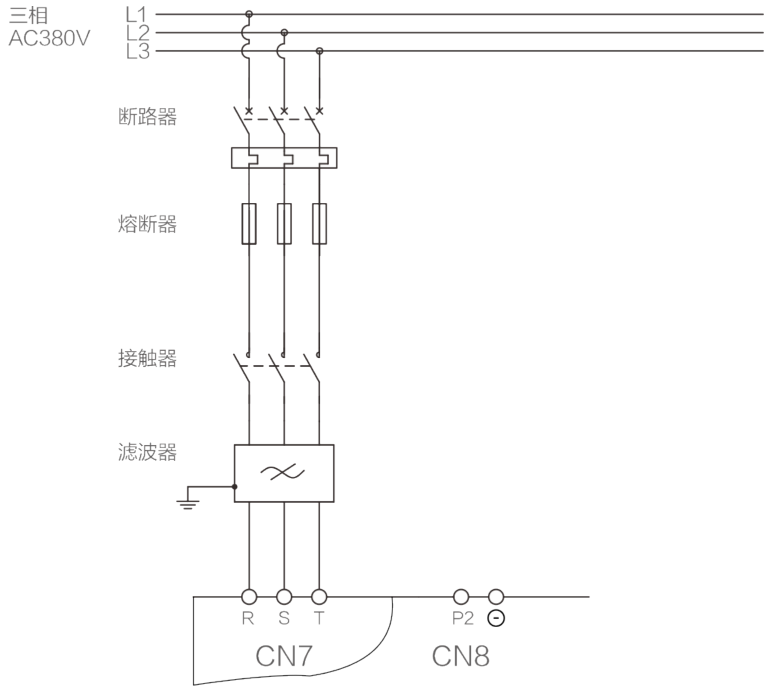


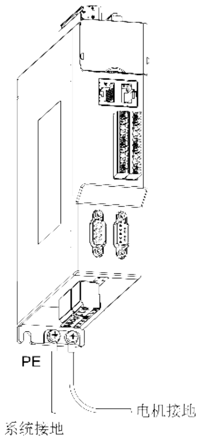
## 4.2.3 Main circuit connection AC380V class B1/B2 specification



## 4.2.4 Main circuit connection AC380V class B3 specification




## 4.2.5 System grounding




| ⚠ **Dangerous** |
|---|
| ● To prevent electric shock, be sure to ground the servo driver and servo motor.<br>● According to the relevant standards for electrical equipment, D-level grounding (grounding resistance below 100Ω) is used for 200V level, and C-level grounding (grounding resistance below 10Ω) is used for 400V level.<br>● Use a cable with a wire diameter above the applicable wire size, and keep it as short as possible.<br>● When using multiple drives, do not ground in series, as this will cause misoperation of the drive and surrounding control equipment. |

## 4.2.6 System Wiring

Table 1-3 AD2 drive input main circuit recommended wire size

| Size Specification | Model | Rated input current Single/Three phase | L1C, L2C Recommended Wiring Specifications | | RST Recommended Wiring Specifications | | PE Grounding | |
|---|---|---|---|---|---|---|---|---|
| | | | mm² | AWG | mm² | AWG | mm² | AWG |
| A1 | 1R8SA | 2.5/1.2A | 0.75 | 18 | 0.75 | 18 | 0.75 | 18 |
| A1 | 2R8SA | 4.1/1.9A | 0.75 | 18 | 0.75 | 18 | 0.75 | 18 |
| A1 | 3R5SA | 5.2/2.3A | 0.75 | 18 | 0.75 | 18 | 0.75 | 18 |
| A1 | 4R2SA | 6.1/2.8A | 0.75 | 18 | 1.5/0.75 | 16/18 | 0.75 | 18 |
| A1 | 060SA | 6.4/4.0A | 0.75 | 18 | 1.5/0.75 | 16/18 | 0.75 | 18 |
| A2 | 060PA | 8.2/4.0A | 0.75 | 18 | 1.5/0.75 | 16/18 | 1.5 | 16 |
| A2 | 100SA | 10.5/6.7A | 0.75 | 18 | 1.5 | 16 | 1.5 | 16 |
| A2 | 120SA | 11.8/7.0A | 0.75 | 18 | 1.5 | 16 | 1.5 | 16 |
| A3 | 120PA | 14.0/8.2A | 0.75 | 18 | 2.5/1.5 | 14/16 | 2.5 | 14 |
| A3 | 140SA | 20/9.3A | 0.75 | 18 | 4/2.5 | 12/14 | 4 | 12 |

Table 1-4 AD2 drive B1/B2/B3 specification input main circuit recommended wire diameter

| Size specification | Model | Rated input current Three phases | R S T Recommended Wiring Specifications | | P E Grounding | |
|---|---|---|---|---|---|---|
| | | | mm² | AWG | mm² | AWG |
| B1 | 6R8SC | 9.2A | 1.5 | 15 | 1.5 | 15 |
| B1 | 8R3SC | 10.7A | 1.5 | 15 | 1.5 | 15 |
| B2 | 100SC | 11.7A | 1.5 | 15 | 1.5 | 15 |
| B2 | 120SC | 14A | 2.5 | 13 | 2.5 | 13 |
| B2 | 140SC | 17A | 2.5 | 13 | 2.5 | 13 |
| B2 | 180SC | 20A | 2.5 | 13 | 2.5 | 13 |
| B3 | 250SC | 28A | 4 | 11 | 4 | 11 |
| B3 | 340SC | 38A | 6 | 9 | 6 | 9 |

# 4.3 Servo driver and ASK series servo motor power connection

## 4.3.1 Recommended model comparison table of drive and ASK motor

1) AD2 drive with AC220V ASK motor recommended model

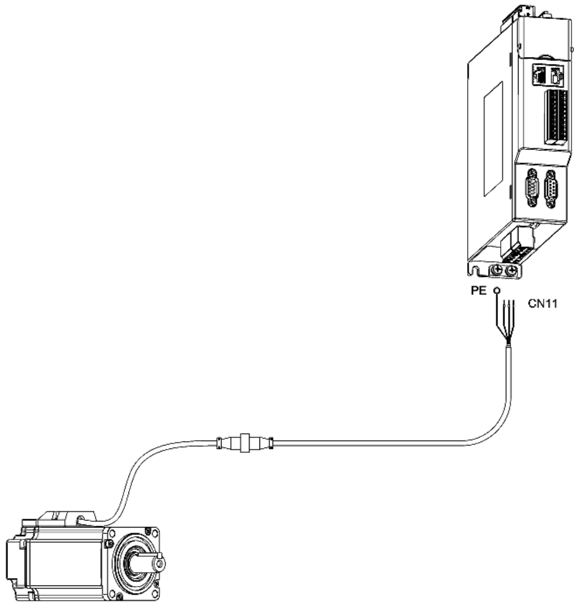
| ASK Motor Model | AD2 drive model | Recommended wiring specifications for motor UVW | | Recommended wiring for motor PE Specification | | Recommended wiring specifications for grips | |
|---|---|---|---|---|---|---|---|
| | | mm² | AWG | mm² | AWG | mm² | AWG |
| ASK40-2-003M3060 | AD2RE-1R8SA | 0.5 | 20 | 0.5 | 20 | 0.5 | 20 |
| ASK60-2-006M3060 | AD2RE-1R8SA | 0.5 | 20 | 0.5 | 20 | 0.5 | 20 |
| ASK60-2-013M3050 | AD2RE-2R8SA | 0.5 | 20 | 0.5 | 20 | 0.5 | 20 |
| ASK80-2-024M3050 | AD2RE-4R2SA | 0.5 | 20 | 0.5 | 20 | 0.5 | 20 |
| ASK80-2-032M3050 | AD2RE-060PA | 0.5 | 20 | 0.5 | 20 | 0.5 | 20 |
| ASK100-2-032M3060 | AD2RE-100SA | 1.5 | 16 | 1.5 | 16 | 0.75 | 18 |
| ASK100-2-048M3050 | AD2RE-100SA | 1.5 | 16 | 1.5 | 16 | 0.75 | 18 |
| ASK100-2-064M3050 | AD2RE-120PA | 1.5 | 16 | 1.5 | 16 | 0.75 | 18 |
| ASK130-2-054M1530 | AD2RE-060PA | 0.75 | 18 | 0.75 | 18 | 0.75 | 18 |
| ASK130-2-083M1530 | AD2RE-100SA | 1.5 | 16 | 1.5 | 16 | 0.75 | 18 |
| ASK130-2-096M1530 | AD2RE-120SA | 1.5 | 16 | 1.5 | 16 | 0.75 | 18 |
| ASK130-2-115M1530 | AD2RE-120SA | 2.5 | 14 | 2.5 | 14 | 0.75 | 18 |
| ASK130-2-048M2030 | AD2RE-060PA | 0.75 | 18 | 0.75 | 18 | 0.75 | 18 |
| ASK130-2-048M2030 | AD2RE-100SA | 1.5 | 16 | 1.5 | 16 | 0.75 | 18 |
| ASK130-2-050M2530 | AD2RE-120PA | 1.5 | 16 | 1.5 | 16 | 0.75 | 18 |
| ASK130-2-119M2030 | AD2RE-140SA | 2.5 | 14 | 2.5 | 14 | 0.75 | 18 |
| ASK130-2-048M2030 | AD2RE-060PA | 0.75 | 18 | 0.75 | 18 | 0.75 | 18 |
| ASK130-2-050M2530 | AD2RE-100SA | 0.75 | 18 | 0.75 | 18 | 0.75 | 18 |
| ASK130-2-060M2530 | AD2RE-100SA | 1.5 | 16 | 1.5 | 16 | 0.75 | 18 |
| ASK130-2-077M2530 | AD2RE-120PA | 1.5 | 16 | 1.5 | 16 | 0.75 | 18 |
| ASK130-2-096M2530 | AD2RE-140PA | 1.5 | 16 | 1.5 | 16 | 0.75 | 18 |
| ASK130-2-048M3035 | AD2RE-100SA | 0.75 | 18 | 0.75 | 18 | 0.75 | 18 |
| ASK130-2-064M3035 | AD2RE-120PA | 1.5 | 16 | 1.5 | 16 | 0.75 | 18 |
| ASK130-2-080M3035 | AD2RE-140SA | 1.5 | 16 | 1.5 | 16 | 0.75 | 18 |
| ASK130-2-096M3035 | AD2RE-140SA | 1.5 | 16 | 1.5 | 16 | 0.75 | 18 |
| ASK180-2-170H1518 | AD2RE-140SA | 1.5 | 16 | 1.5 | 16 | 0.75 | 18 |
| ASK180-2-185M1518 | AD2RE-140SA | 1.5 | 16 | 1.5 | 16 | 0.75 | 18 |

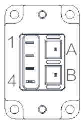
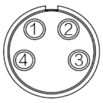
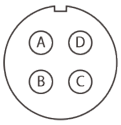
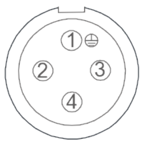
2) AD2 drive with AC380V ASK motor recommended model

| ASK Motor Model | AD2 drive model | Recommended wiring specifications for motor UVW | | Recommended wiring specifications for motor PE | | Recommended wiring specifications for grips | |
|---|---|---|---|---|---|---|---|
| | | mm² | AWG | mm² | AWG | mm² | AWG |
| ASK-4-032M3060 | AD2RE-5R4SC-E | 0.75 | 18 | 0.75 | 18 | 0.75 | 18 |
| ASK-4-048M3050 | AD2RE-5R4SC-E | 0.75 | 18 | 0.75 | 18 | 0.75 | 18 |
| ASK-4-064M3050 | AD2RE-6R8SC-E | 1.5 | 16 | 1.5 | 16 | 0.75 | 18 |
| ASK-4-080M3050 | AD2RE-8R3SC-E | 1.5 | 16 | 1.5 | 16 | 0.75 | 18 |
| ASK130-4-083M1530 | AD2RE-5R4SC-E | 0.75 | 18 | 0.75 | 18 | 0.75 | 18 |
| ASK130-2-083M1530 | AD2RE-5R4SC-E | 0.75 | 18 | 0.75 | 18 | 0.75 | 18 |
| ASK130-4-096M1530 | AD2RE-5R4SC-E | 0.75 | 18 | 0.75 | 18 | 0.75 | 18 |
| ASK130-4-115M1530 | AD2RE-6R8SC-E | 1.5 | 16 | 1.5 | 16 | 0.75 | 18 |
| ASK130-4-150M1530 | AD2RE-100SC-E | 1.5 | 16 | 1.5 | 16 | 0.75 | 18 |
| ASK130-4-048M2030 | AD2RE-5R4SC-E | 0.75 | 18 | 0.75 | 18 | 0.75 | 18 |
| ASK130-4-072M2030 | AD2RE-5R4SC-E | 0.75 | 18 | 0.75 | 18 | 0.75 | 18 |
| ASK130-4-096M2030 | AD2RE-6R8SC-E | 0.75 | 18 | 0.75 | 18 | 0.75 | 18 |
| ASK130-4-119M2030 | AD2RE-8R3SC-E | 1.5 | 16 | 1.5 | 16 | 0.75 | 18 |
| ASK130-4-146M2030 | AD2RE-100SC-E | 1.5 | 16 | 1.5 | 16 | 0.75 | 18 |
| ASK130-4-040M2530 | AD2RE-5R4SC-E | 0.75 | 18 | 0.75 | 18 | 0.75 | 18 |
| ASK130-4-050M2530 | AD2RE-5R4SC-E | 0.75 | 18 | 0.75 | 18 | 0.75 | 18 |
| ASK130-4-060M2530 | AD2RE-5R4SC-E | 0.75 | 18 | 0.75 | 18 | 0.75 | 18 |
| ASK130-4-077M2530 | AD2RE-6R8SC-E | 0.75 | 18 | 0.75 | 18 | 0.75 | 18 |
| ASK130-4-096M2530 | AD2RE-8R3SC-E | 1.5 | 16 | 1.5 | 16 | 0.75 | 18 |
| ASK130-4-150M2535 | AD2RE-100SC-E | 1.5 | 16 | 1.5 | 16 | 0.75 | 18 |
| ASK130-4-048M3035 | AD2RE-5R4SC-E | 0.75 | 18 | 0.75 | 18 | 0.75 | 18 |
| ASK130-4-064M3035 | AD2RE-6R8SC-E | 0.75 | 18 | 0.75 | 18 | 0.75 | 18 |
| ASK130-4-080M3035 | AD2RE-6R8SC-E | 0.75 | 18 | 0.75 | 18 | 0.75 | 18 |
| ASK130-4-096M3035 | AD2RE-8R3SC-E | 1.5 | 16 | 1.5 | 16 | 0.75 | 18 |
| ASK130-4-127M3035 | AD2RE-120SC-E | 1.5 | 16 | 1.5 | 16 | 0.75 | 18 |
| ASK130-4-159M3045 | AD2RE-140SC-E | 2.5 | 14 | 2.5 | 14 | 0.75 | 18 |
| ASK180-2-185M1518 | AD2RE-100SC-E | 1.5 | 16 | 1.5 | 16 | 0.75 | 18 |
| ASK180-4-270M1530 | AD2RE-140SC-E | 2.5 | 14 | 2.5 | 14 | 0.75 | 18 |
| ASK180-4-350M1530 | AD2RE-210SC-E | 2.5 | 14 | 2.5 | 14 | 0.75 | 18 |
| ASK180-4-478M1530 | AD2RE-250SC-E | 4 | 11 | 4 | 11 | 4 | 11 |
| ASK180-4-170H1518 | AD2RE-6R8SC-E | 1.5 | 16 | 1.5 | 16 | 0.75 | 18 |
| ASK180-4-185M1518 | AD2RE-8R3SC-E | 1.5 | 16 | 1.5 | 16 | 0.75 | 18 |
| ASK180-4-270M1530 | AD2RE-120SC-E | 1.5 | 16 | 1.5 | 16 | 0.75 | 18 |
| ASK180-4-350M1530 | AD2RE-140SC-E | 1.5 | 16 | 1.5 | 16 | 0.75 | 18 |
| ASK180-4-478H1530 | AD2RE-210SC-E | 2.5 | 14 | 2.5 | 14 | 0.75 | 18 |
| ASK200-4-530M1516 | AD2RE-210SC-E | 2.5 | 14 | 2.5 | 14 | 0.75 | 18 |
| ASK200-4-700M1520 | AD2RE-340SC-E | 4 | 11 | 4 | 11 | 4 | 11 |
| ASK200-4-840M1518 | AD2RE-340SC-E | 4 | 11 | 4 | 11 | 4 | 11 |
| ASK230-4-700H1522 | AD2RE-340SC-E | 4 | 11 | 4 | 11 | 4 | 11 |
| ASK200-4-840M1518 | AD2RE-340SC-E | 6 | 9 | 6 | 9 | 6 | 9 |

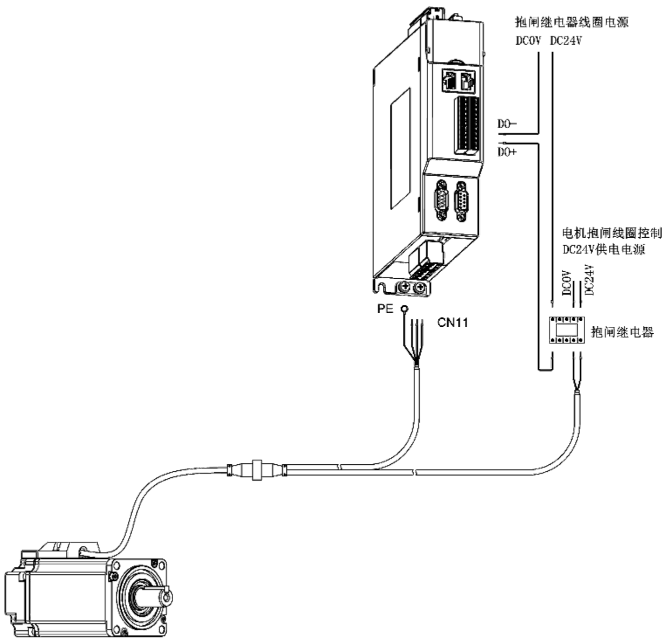
# 4.3.2 Power connection of servo motor without contracting brake

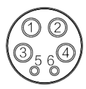
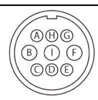
Note: The ground wire must be firmly connected!




| Connector Drawing | Adapted motor frame | Terminal Pin Definition |
|---|---|---|
| <br>SC-MC6S-AE20-01 | ASK Series<br>40 flange motor,<br>60 flange motor,<br>80 flange motor. | <br>端子符号 1 2 3 4 A B<br>信号 U V W PE Brake- Brake+ |
| <br>CP-GM1311/S-4B | ASK Series<br>40 flange motor,<br>60 flange motor,<br>80 flange motor. | <br>端子符号 1 2 3 4<br>信号 V U W PE |
| <br>CMS3108A20-4SI | ASK Series<br>100 flange motor,<br>130 flange motor. | <br>端子符号 A B C D<br>信号 U V W PE |
| <br>YD32-4 | ASK Series<br>180 flange motor. | <br>端子符号 1 2 3 4<br>信号 PE U V W |

## 4.3.3 Power connection of servo motor with contracting brake




| Connector Outline Drawing | Adapted motor frame | Terminal Pin Definition |
|---|---|---|
|  CE-GM2111/S-6B | ASK Series<br>40 flange motor,<br>60 flange motor,<br>80 flange motor. |  端子符号: 1, 2, 3, 4, 5, 6<br>信号: V, U, W, PE, Brake+, Brake- |
| CMS3108A20-18SI | ASK Series<br>100 flange motor,<br>130 flange motor. |  端子符号: G, H, F, I, B, E<br>信号: Brake+, Brake-, U, V, W, PE |

# 4.4 Servo driver and servo motor encoder connection

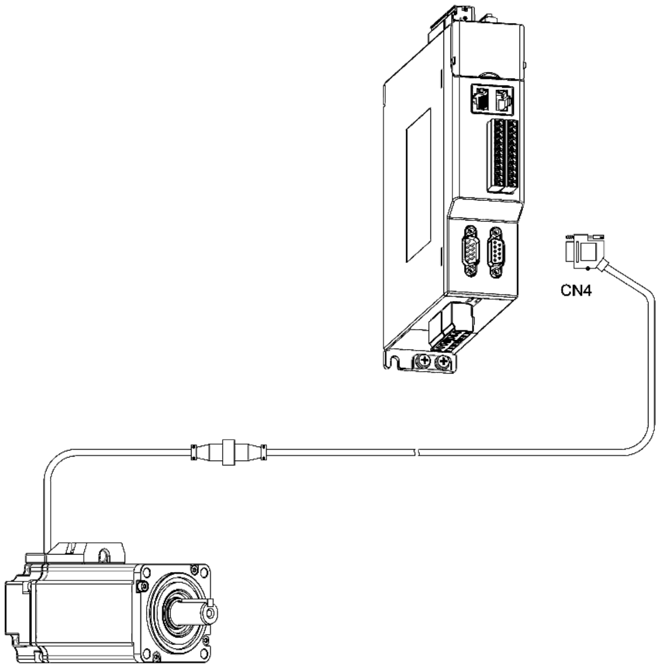
The encoder cable must be twisted shielded

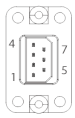
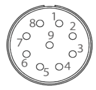
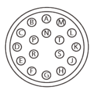
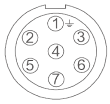
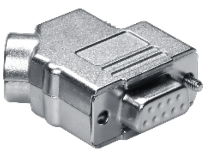
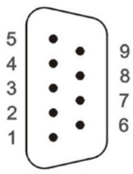

Table 4-4-1 Recommended Cable Information

| Wire size | Ω/km | Theoretical allowable cable length |
|---|---|---|
| 26 AWG (0.13mm²) | 143 | 10 |
| 25 AWG (0.15mm²) | 89.4 | 16 |
| 24 AWG (0.21mm²) | 79.6 | 18 |
| 23 AWG (0.26mm²) | 68.5 | 20 |
| 22 AWG (0.32mm²) | 54.3 | 25 |

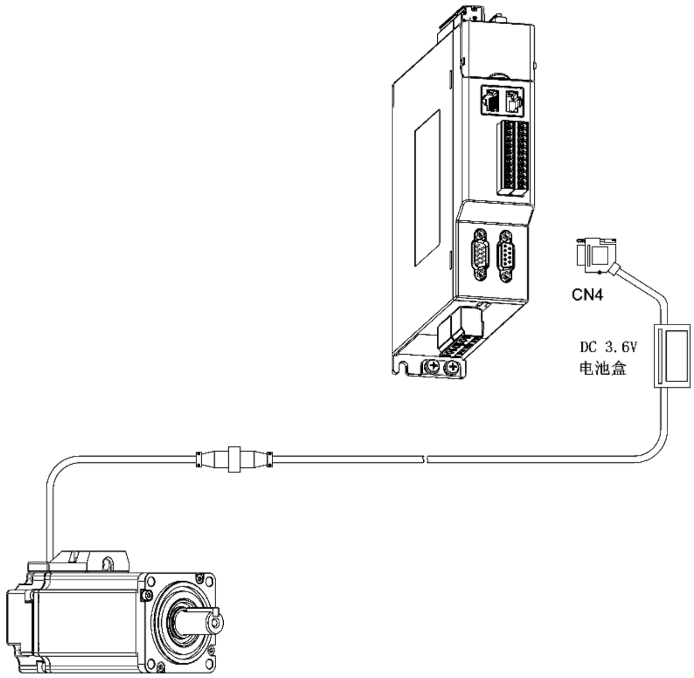
Note: The above table is the value at the ideal environment. In actual use, the quality of wire, wiring standards, interference, laying environment, connector quality, crimping (welding) quality and other factors should be considered. If the cable length on site exceeds 20m, please confirm with our technical staff.

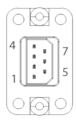
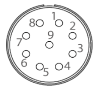
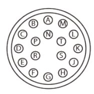
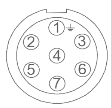
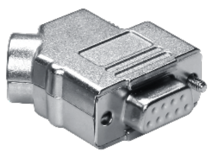
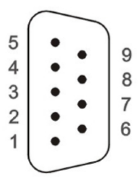
## 4.4.1 Connection of bus-type incremental encoders




| Connector Outline Drawing | Adapted motor frame | Terminal Pin Definition | |
|---|---|---|---|
| <br>SC-MC7S-A820-P1 | ASK Series<br>40 flange motor,<br>60 flange motor,<br>80 flange motor. |  | 端子符号 1 2 3 4 5 6 7<br>信号 PE 5V 0V SD+ SD− BAT+ BAT− |
| <br>CP-GM1311/S-P | ASK Series<br>40 flange motor,<br>60 flange motor,<br>80 flange motor. |  | 端子符号 1 2 3 6 7 8 9<br>信号 SD+ SD− BAT+ 5V 0V BAT− PE |
| <br>CMS3108A20-29SI | ASK Series<br>100 flange motor,<br>130 flange motor. |  | 端子符号 G H J K L S T<br>信号 0V 5V PE SD+ SD− BAT− BAT+ |
| <br>YD28-7 | ASK Series<br>180 flange motor,<br>200 flange motor,<br>230 flange motor. |  | 端子符号 1 2 3 4 5 6 7<br>信号 PE 5V 0V SD+ SD− BAT+ BAT− |
| <br>KSA-DB9s.02 | Adapted to AD2 drive first encoder interface |  | DB−9连接器引脚定义<br>1 5V 4 GND 7 CLK+<br>2 SD+ 5 RESERVE 8 CLK-<br>3 SD- 6 RESERVE 9 RESERVE<br>外壳屏蔽 |

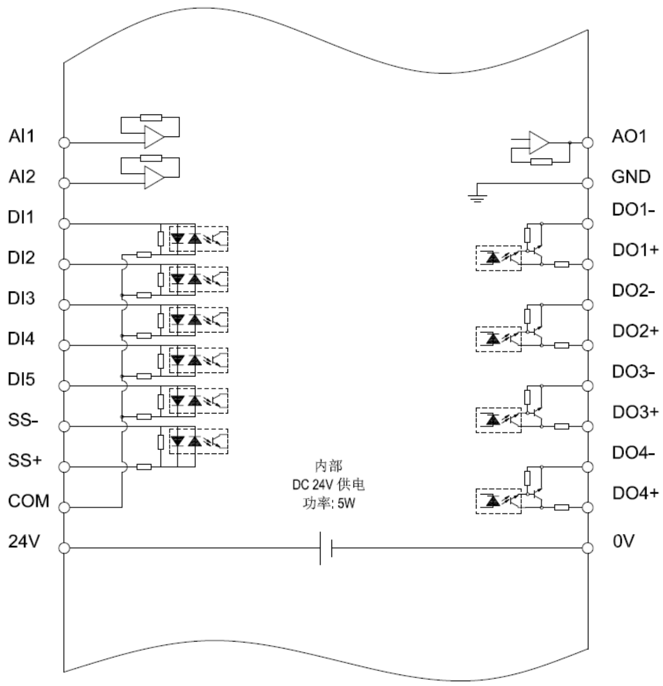
## 4.4.2 Connection of bus type absolute encoders




| Connector Outline Drawing | Adapted motor frame | Terminal Pin Definition |
|---|---|---|
| <br>SC-MC7S-A820-P1 | ASK Series<br>40 flange motor,<br>60 flange motor,<br>80 flange motor. | <br>端子符号 1 2 3 4 5 6 7<br>信号 PE 5V 0V SD+ SD- BAT+ BAT- |
| <br>CP-GM1311/S-P | ASK Series<br>40 flange motor,<br>60 flange motor,<br>80 flange motor. | <br>端子符号 1 2 3 6 7 8 9<br>信号 SD+ SD- BAT+ 5V 0V BAT- PE |
| <br>CMS3108A20-29SI | ASK Series<br>100 flange motor,<br>130 flange motor. | <br>端子符号 G H J K L S T<br>信号 0V 5V PE SD+ SD- BAT- BAT+ |
| <br>YD28-7 | ASK Series<br>180 flange motor,<br>200 flange motor,<br>230 flange motor. | <br>端子符号 1 2 3 4 5 6 7<br>信号 PE 5V 0V SD+ SD- BAT+ BAT- |
| <br>KSA-DB9s.02 | Adapted to AD2<br>drive first<br>encoder<br>interface | <br>DB-9连接器引脚定义<br>1 5V 4 GND 7 CLK+<br>2 SD+ 5 RESERVE 8 CLK-<br>3 SD- 6 RESERVE 9 RESERVE<br>外壳屏蔽 |

BAT+ Absolute battery positive; BAT- Absolute Battery Negative

## 4.5 Drive CN3 terminal IO connection

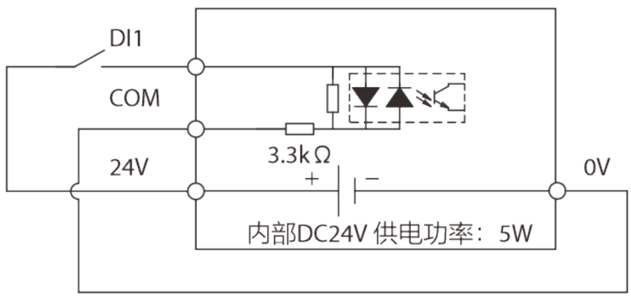



## 4.5.1 Digital input

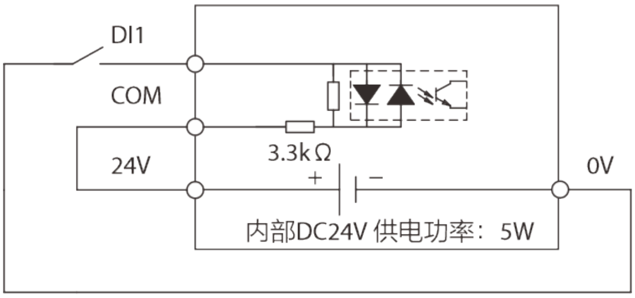
| Pins | | Default Function | Explanation | Remarks |
|---|---|---|---|---|
| CN3 | DI1(*) | Bus IO input NO | The DI channel status is fed back to the upper controller via the bus. | Bus mapping address 60FD.20 |
| | DI2(*) | Bus IO input NO | The DI channel status is fed back to the upper controller via the bus. | Bus mapping address 60FD.21 |
| | DI3 | Bus IO input NO | The DI channel status is fed back to the upper controller via the bus. | Bus mapping address 60FD.22 |
| | DI4 | Bus IO input NO | The DI channel status is fed back to the upper controller via the bus. | Bus mapping address 60FD.23 |
| | DI5 | Bus IO input NO | The DI channel status is fed back to the upper controller via the bus. | Bus mapping address 60FD.24 |
| | 24V | Internal DC24V output | DC24V power output inside the driver. | The internal DC24V power supply is 5W. |
| | 0V | Internal DC0V output | Driver internal DC0V power output. | The internal DC24V power supply is 5W. |

Note: * The two digital input ports DI1 and DI2 are high-speed hardware ports.

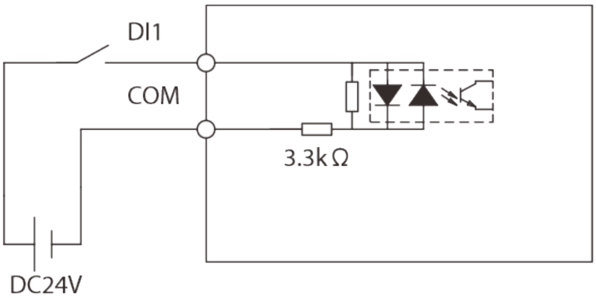
1) PNP signal input when using internal DC 24V power supply



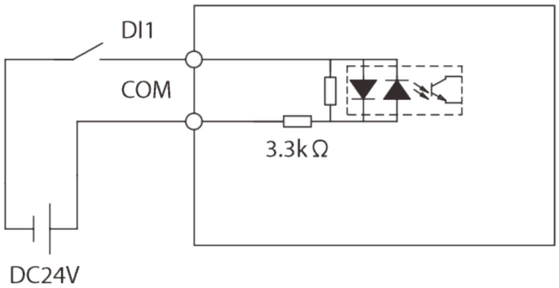

2) NPN signal input when using internal DC 24V power supply




3) PNP signal input when using external DC 24V power supply



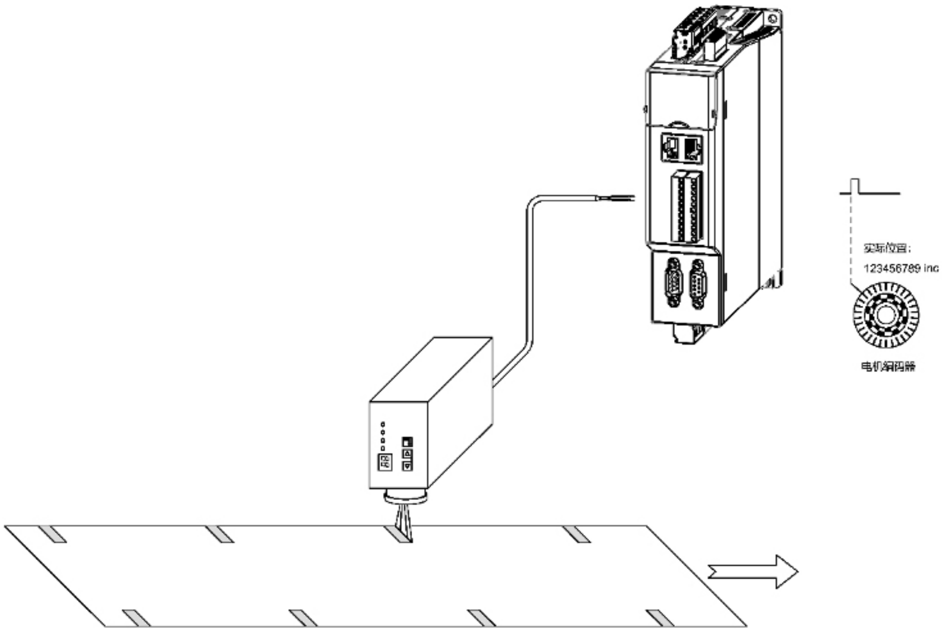

4) NPN signal input when using external DC 24V power supply




Note: PNP and NPN signals cannot be mixed at the same time!

## 4.5.2 Probe input

- The AD2 drive is equipped with two high-speed latching functions, Probe 1, and Probe 2, which can latch the motor position information when the external DI signal or motor Z signal changes.
- CN3's DI1 and DI2 digital channels are high-speed input ports, so the probe 1 and probe 2 functions must use DI1 and DI2 hardware ports.



## 4.5.3 Digital output

| Pins | | Default Function | Explanation | Remarks |
|---|---|---|---|---|
| CN3 | DO1 | Bus IO output NO | The upper controller controls the output status of this DO channel via the bus. | Bus mapping address 60FE_01.16 |
| | DO2 | Bus IO output NO | The upper controller controls the output status of this DO channel via the bus. | Bus mapping address 60FE_01.17 |
| | DO3 | Bus IO output NO | The upper controller controls the output status of this DO channel via the bus. | Bus mapping address 60FE_01.18 |
| | DO4 | Gate output NO | Gate control output signal. | * |

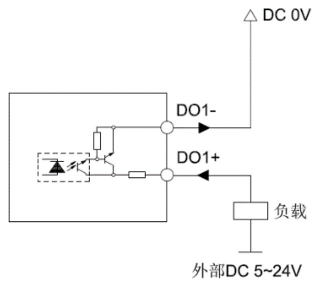
Note: 1. * If DO4 is configured as bus IO output, its corresponding bus address is 60FE_01.19

2、DO maximum withstand voltage of DC30V

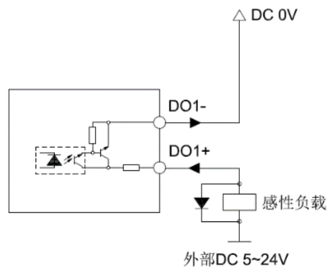
3、DO single output current up to DC50mA

- DO1 is used as an example to illustrate the wiring and usage of DO, DO2~DO4 wiring, and usage are the same as DO1.

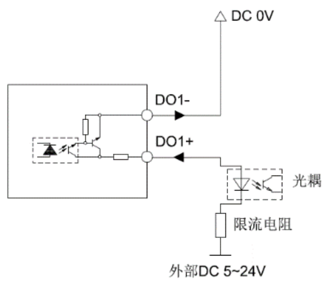
1) Use common load access DO




2) When using inductive loads to connect to DO, please use a current-continuing diode and pay attention to its polarity




3) When using an optocoupler to connect to the DO, a current limiting resistor should be put in series in the circuit




4) Use of Continuity Diodes

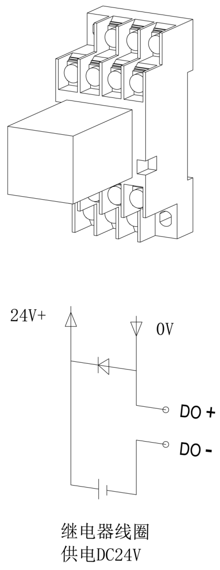
To protect the Servo Drive, be sure to connect a Schottky diode (hereinafter referred to as a continuity diode) in the external circuit when using the DO output of the Servo Drive.

Recommended Continuity Diode Model: SB2100

Manufacturer: Qiangmao

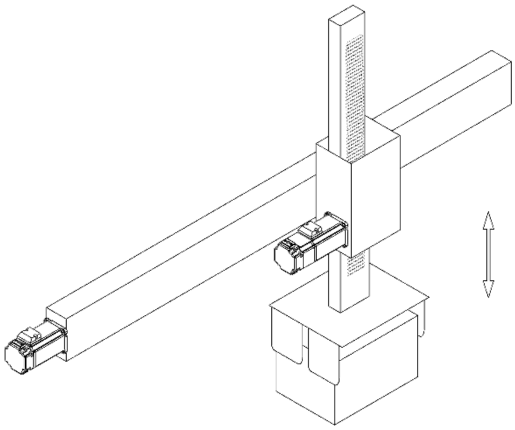
Technical parameters: 100V/2A

The wiring diagram is as follows:



## 4.5.4 Contracting brake control

Typical applications of contracting brake

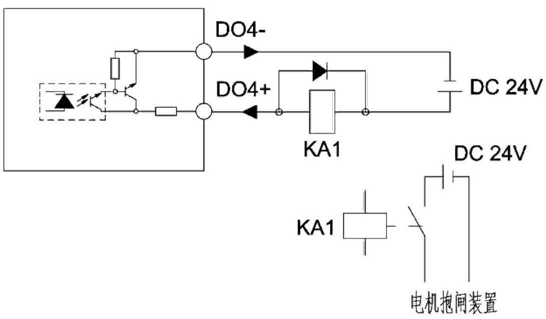


**Caution**

- The contracting brake mechanism built into the servo motor is a special mechanism for fixing the current position of the shaft in the event of a power failure, and is not used for braking purposes, but only when the motor is brought to a stop.
- When the contracting brake is not marked, there is no polarity distinction between its coils. If it is marked as permanent magnet brake, please pay attention to the polarity, and do not reverse it.
- Please set the correct timing and parameters of contracting brake with the actual working condition.
- When the servo motor of the built-in contracting brake is running, it may make a slight clicking sound, which does not affect the function.
- When the contracting brake coil is energized, magnetic flux leakage may occur at the shaft end, etc. Be sure to consider the effect when using magnetic sensors and other instruments near the motor.

Because of the high current of the contracting brake coil of the servo motor, the AD2 drive contracting brake control needs to be connect an external relay.

Note: When using, please pay attention to the current flow direction and use an external circuit with a current-continuing diode. Please also check whether the driver DO output parameter configuration is output control of contracting brake and whether it corresponds to the actual wiring port.

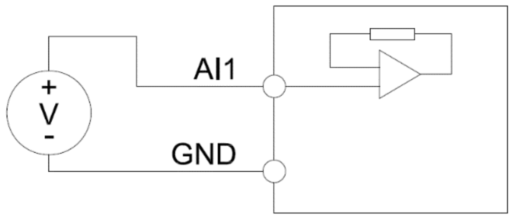


## 4.5.5 Analog input

| Pins | | Default Function | Explanation | Remarks |
|---|---|---|---|---|
| CN3 | AI1 | Bus analog input 1 | The analog value of this channel is fed back to the upper controller via the bus. | Bus mapping address 5000_01<br>-10V: = -10000<br>0V: = 0<br>+10V: = +10000 |
| | AI2 | Bus analog input 2 | The analog value of this channel is fed back to the upper controller via the bus. | Bus mapping address 5000_02<br>-10V: = -10000<br>0V: = 0<br>+10V: = +10000 |

Note: AI1 and AI2 inputs are ±10V signals.

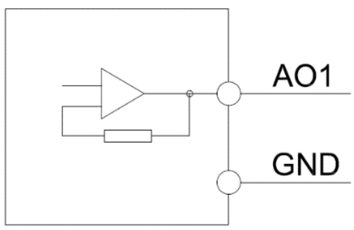
- AI1 is used as an example to illustrate the wiring and usage of AI, while AI2 is wired and used in the same way as AI1.




## 4.5.6 Analog output

| Pins | | Default Function | Explanation | Remarks |
|---|---|---|---|---|
| CN3 | AO1 | Bus analog output 1 | The upper controller controls the output value of this analog channel via the bus. | Bus mapping address 5003_01<br>-10000: = -10V<br>0: = 0V<br>+10000: = +10V |

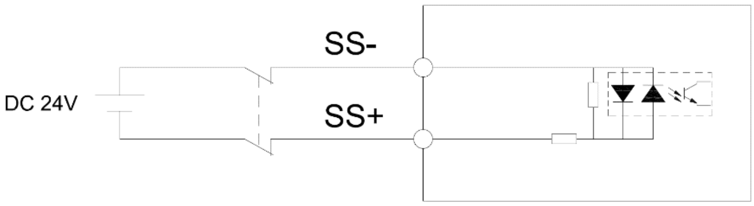
Note: The analog output type is ±10V.




## 4.5.7 Safety emergencies stop input

| Pins | | Default Function | Explanation | Remarks |
|---|---|---|---|---|
| CN3 | SS- | Emergency stop function Normally open logic | When this signal is triggered, the servo will perform an emergency stop action. | The default is normally open logic, but in practice it is recommended to use normally closed logic. |
| | SS+ | | | |

- Example of normally closed logic wiring:



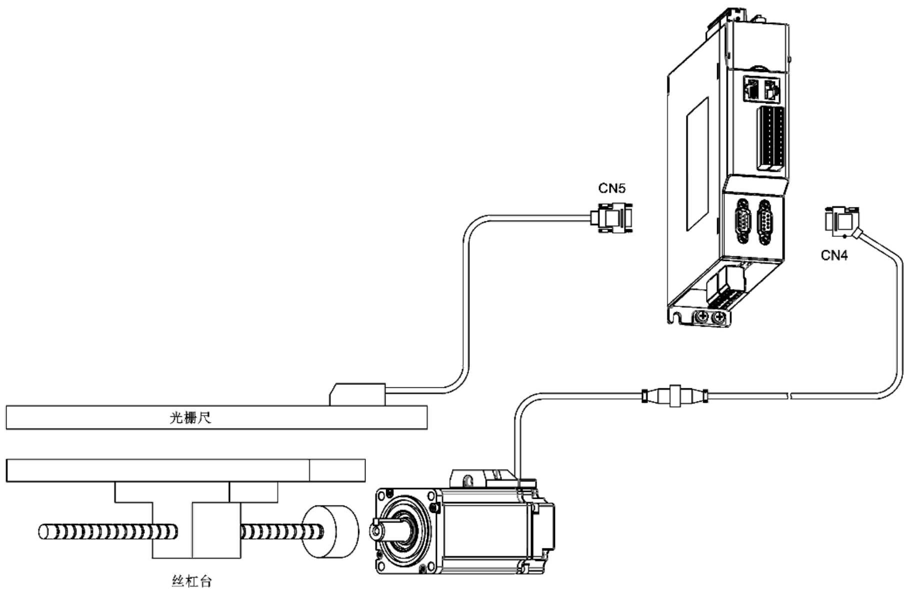

### 4.5.7 Encoder battery information and precautions

1) The battery has the risk of leakage after a long period of use, it is recommended to replace the battery every 2 years.
2) If the battery is used incorrectly, it may leak and corrode components or cause dangerous situations such as battery explosion, so please be sure to observe the following:
   - Connect the positive and negative terminals of the battery correctly and pay attention to + and - direction when putting it into the battery box.
   - If a battery used for a long time or a scrapped bettary put in the machine, the battery may leak or other situations, not only will corrode the surrounding parts, but also has the risk of short circuit due to its conductivity. So please replace it regularly (reference period: recommended to replace it every two years).
   - It is forbidden to disassemble the battery to prevent the electrolyte flywheel and affecting personal safety.
   - It is forbidden to put the battery into fire or use it in a high temperature environment. If the battery is subjected to continuous heating, the risk of explosion may arise.
   - Do not short-circuit the battery, the battery positive and negative short-circuit may cause fire, explosion, and other hazards.
   - This battery is a disposable lithium battery, please do not charge, otherwise it may cause leakage, explosion, and other risks.
   - Dispose of the replaced battery, please dispose of it according to the local regulations.

Table 4-4-3 Encoder battery information description

| **Battery specifications** | **Projects and Units** | **Rating** | | |
|---|---|---|---|---|
| | | **Minimum value** | **Typical values** | **Maximum value** |
| Output: DC3.6V 2700mAh Battery specification: ER14505H | Battery Voltage(V) | 3.2 | 3.6 | 5 |
| | Battery alarm voltage (V) | 2.6 | | |
| | Battery fault voltage (V) | 2.85 | 3 | 3.2 |
| | Battery use environment (℃) | 0 | / | 40 |

# 4.6 Second encoder connection



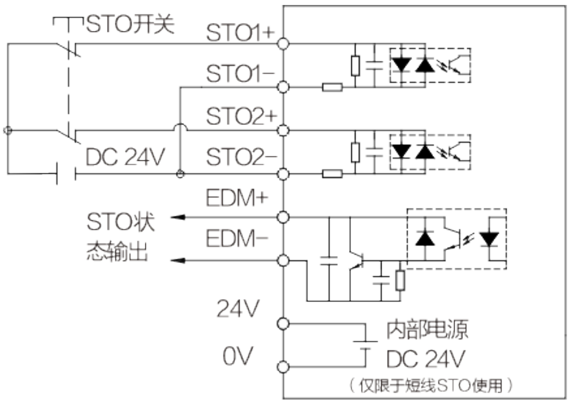

| Function | Supported encoder types | Description |
|---|---|---|
| Full closure of the location | ABZ | Fully closed loop |
| External encoder | | External encoder counting, zero return, etc. |

Note: For the second encoder and full closed loop function, please check with AUCTECH's technical staff to see if the drive firmware version is supported.

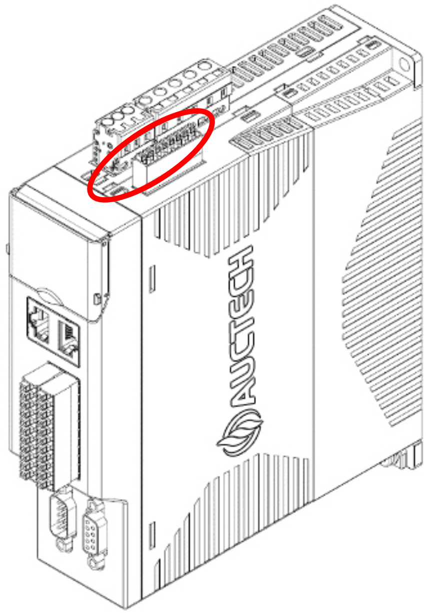
# 4.7 STO Wiring

- The STO function, Safe Torque Off, prevents the motor from generating torque or accidental starting while it is standby.

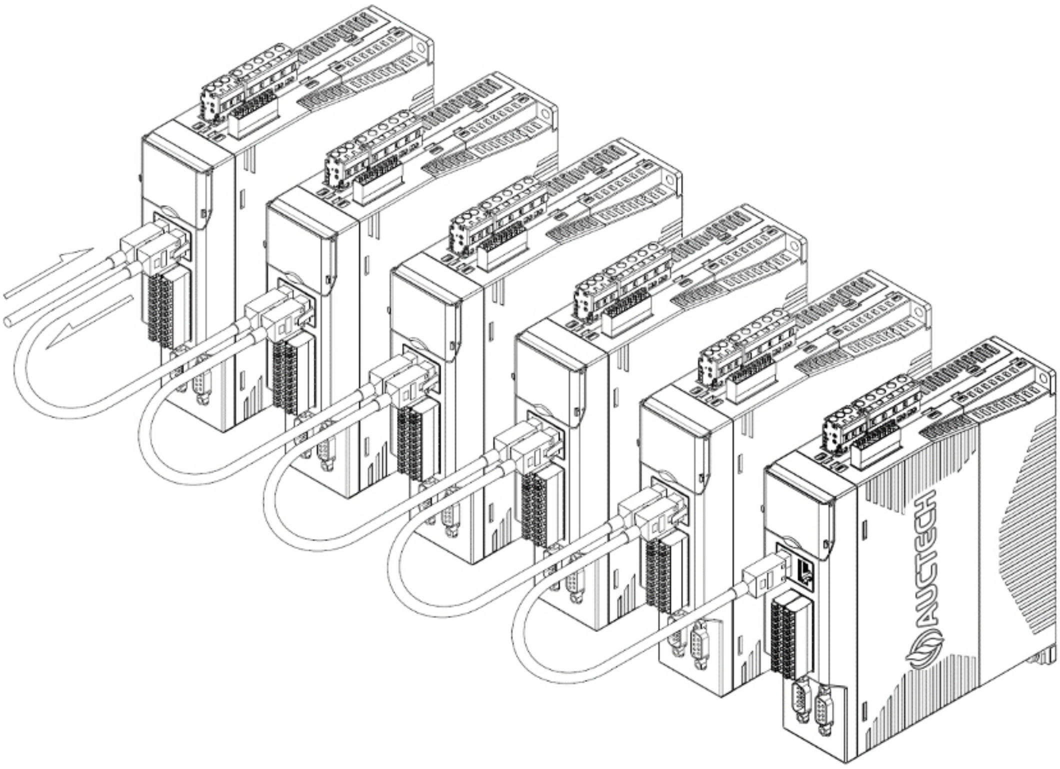
Note: If the STO function is activated while the motor is in motion, the motor will continue to rotate based on inertia until it stops, so please use the STO function correctly in relation to the load conditions.

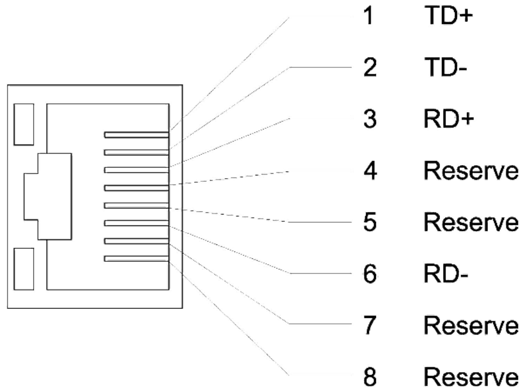



- STO function is optional, please verify whether the ordered model supports it.



# 4.8 EtherCAT communication connection



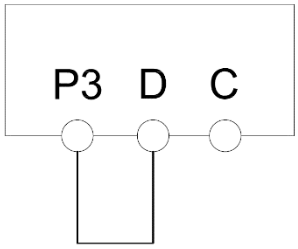

<table>
<tr><th>RJ45 Pinout</th><th>Definition</th><th>Description</th><th>Pin Distribution</th></tr>
<tr><td>1</td><td>TD+</td><td>Data sending+</td><td rowspan="9">
</td></tr>
<tr><td>2</td><td>TD-</td><td>Data sending-</td></tr>
<tr><td>3</td><td>RD+</td><td>Data reception+</td></tr>
<tr><td>4</td><td>Reserve</td><td>/</td></tr>
<tr><td>5</td><td>Reserve</td><td>/</td></tr>
<tr><td>6</td><td>RD-</td><td>Data reception-</td></tr>
<tr><td>7</td><td>Reserve</td><td>/</td></tr>
<tr><td>8</td><td>Reserve</td><td>/</td></tr>
<tr><td>Housing</td><td>Shielding</td><td>Shielding</td></tr>
</table>

# 4.9 Braking resistor connection

The use of braking resistors is divided into two forms: internal braking resistors and external braking resistors. By default, the drive uses internal braking resistors for braking energy absorption.

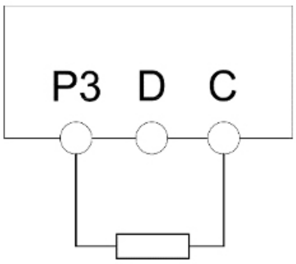
By default, when the motor is in the braking and generating state, the braking energy generated needs to be absorbed by the drive capacitor and internal braking resistor. If the braking energy is large, the drive internal capacitor and braking resistor can not be absorbed in time, it will lead to high DC bus voltage, causing the drive failure alarm. In this case, it is necessary to choose a suitable external braking resistor to absorb the braking energy to ensure the stable operation of the drive.

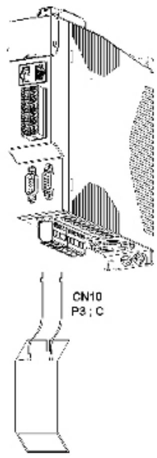
Figure 4-9-1 CN10 terminal wiring when internal brake resistor is used




Note: Some drive models do not have built-in braking resistors, please see the drive specification information section for details

Figure 4-9-2 CN10 terminal wiring when external braking resistor is used




**Cautions**

Please note the following tips when using external braking resistors

- Be sure to remove the shorting tab between P3, D before connecting the external brake resistor between terminals P3 and C. Otherwise, the driver will be damaged.
- Do not connect the braking resistor to the DC bus P1.⊖ Otherwise, it may lead to fry or cause fire.
- The brake resistor resistance value should not be less than the minimum resistance value allowed by the drive, otherwise it may cause a drive fault alarm or damage the drive.
- Please correctly configure the braking resistor parameters, such as incorrectly filling in the braking resistor resistance and power will cause the drive false alarm or braking resistor damage or cause a fire in serious cases.
- Please install the brake resistor on a non-combustible material such as metal.

## 4.10 Braking energy calculation and braking resistor selection

(For specific selection, please refer to section 2, Product Information, Brake Energy Absorption Instructions section)

Table - Braking energy absorption and minimum allowable resistance of the drive

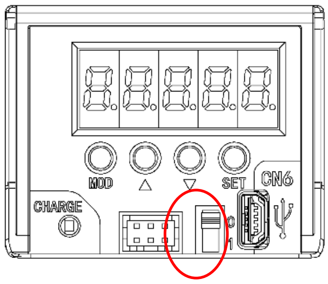
| AD2 Driver 220V level internal regeneration absorption | | | | | |
|---|---|---|---|---|---|
| **Drive Model** | **Built-in braking resistor** | **External braking resistor Resistance value** | **Power** | **Braking resistor model** | **Maximum braking energy that can be absorbed by the driver capacitor Ec (J)** |
| AD2RE- 1R8SA (200W) | None | 50Ω | 100W | RXLG-100W 50RJ | 20 |
| | | | 200W | RXLG-200W 50RJ | |
| AD2RE-2R8SA (400W) | None | 50Ω | 100W | RXLG-100W 50RJ | 20 |
| | | | 200W | RXLG-200W 50RJ | |
| | | | 400W | RXLG-400W 50RJ | |
| AD2RE-4R2SA (750W) | 40W; 80Ω | 50Ω | 200W | RXLG-200W 50RJ | 20 |
| | | | 400W | RXLG-400W 50RJ | |
| AD2RE-060PA (1kW) | 60W; 40Ω | 25Ω | 200W | RXLG-200W 25RJ | 34 |
| | | | 400W | RXLG-400W 25RJ | |
| | | | 800W | RXLG-800W 25RJ | |
| | | | 1000W | RXLG-1000W 25RJ | |
| AD2RE- 100SA (1.5kW) | 60W; 40Ω | 25Ω | 400W | RXLG-400W 25RJ | 34 |
| | | | 800W | RXLG-800W 25RJ | |
| | | | 1000W | RXLG-1000W 25RJ | |
| | | | 1500W | RXLG-1500W 25RJ | |
| AD2RE- 120SA (1.5kW) | 60W; 40Ω | 25Ω | 400W | RXLG-400W 25RJ | 34 |
| | | | 800W | RXLG-800W 25RJ | |
| | | | 1000W | RXLG-1000W 25RJ | |
| | | | 1500W | RXLG-1500W 25RJ | |
| AD2RE- 120PA (2kW) | 100W; 20Ω | 25Ω | 400W | RXLG-400W 25RJ | 60 |
| | | | 800W | RXLG-800W 25RJ | |
| | | | 1000W | RXLG-1000W 25RJ | |
| | | | 1500W | RXLG-1500W 25RJ | |
| | | | 2000W | RXLG-2000W 25RJ | |
| AD2RE- 140SA (3kW) | 100W; 20Ω | 25Ω | 800W | RXLG-800W 25RJ | 60 |
| | | | 1000W | RXLG-1000W 25RJ | |
| | | | 1500W | RXLG-1500W 25RJ | |
| | | | 2000W | RXLG-2000W 25RJ | |
| | | | 2500W | RXLG-2500W 25RJ | |
| | | | 3000W | RXLG-3000W 25RJ | |

| AD2 Drive 380V level internal regeneration absorption | | | | | |
|---|---|---|---|---|---|
| **Drive Model** | **Built-in braking resistor** | **External braking resistor resistance value** | **Power** | **Recommended models of braking resistors** | **Maximum braking energy that can be absorbed by the driver capacitor Ec(J)** |
| AD2RE-6R8SC (3kW) | None | 50Ω | 800W | RXLG-800W 50RJ | 130 |
| | | | 1000W | RXLG-1000W 50RJ | |
| | | | 1500W | RXLG-1500W 50RJ | |
| | | | 2000W | RXLG-2000W 50RJ | |
| | | | 2500W | RXLG-2500W 50RJ | |
| | | | 3000W | RXLG-3000W 50RJ | |
| AD2RE-8R3SC (4kW) | None | 50Ω | 800W | RXLG-800W 50RJ | 130 |
| | | | 1000W | RXLG-1000W 50RJ | |
| | | | 1500W | RXLG-1500W 50RJ | |
| | | | 2000W | RXLG-2000W 50RJ | |
| | | | 2500W | RXLG-2500W 50RJ | |
| | | | 3000W | RXLG-3000W 50RJ | |
| | | | 4000W | RXLG-4000W 50RJ | |
| AD2RE-100SC (5kW) | None | 50Ω | 1000W | RXLG-1000W 50RJ | 156 |
| | | | 1500W | RXLG-1500W 50RJ | |
| | | | 2000W | RXLG-2000W 50RJ | |
| | | | 2500W | RXLG-2500W 50RJ | |
| | | | 3000W | RXLG-3000W 50RJ | |
| | | | 4000W | RXLG-4000W 50RJ | |
| AD2RE- 120SC (6kW) | None | 50Ω | 1500W | RXLG-1500W 50RJ | 156 |
| | | | 2000W | RXLG-2000W 50RJ | |
| | | | 2500W | RXLG-2500W 50RJ | |
| | | | 3000W | RXLG-3000W 50RJ | |
| | | | 4000W | RXLG-4000W 50RJ | |
| | | | 5000W | RXLG-5000W 50RJ | |
| | | | 6000W | RXLG-6000W 50RJ | |
| AD2RE- 140SC (7kW) | None | 50Ω | 1500W | RXLG-1500W 50RJ | 156 |
| | | | 2000W | RXLG-2000W 50RJ | |
| | | | 2500W | RXLG-2500W 50RJ | |
| | | | 3000W | RXLG-3000W 50RJ | |
| | | | 4000W | RXLG-4000W 50RJ | |
| | | | 5000W | RXLG-5000W 50RJ | |
| | | | 6000W | RXLG-6000W 50RJ | |

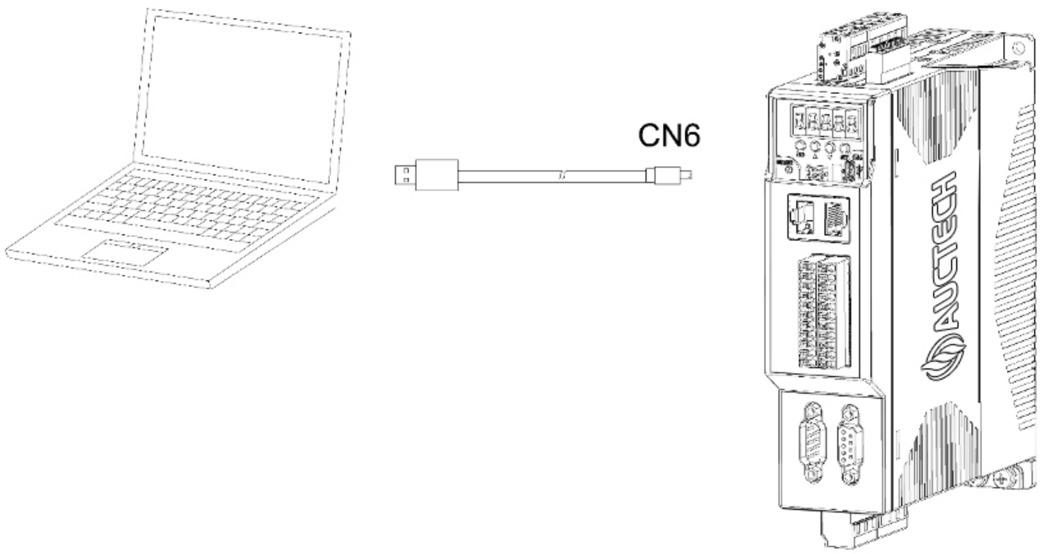
1) Mini USB software debugging and firmware upgrade connection

- By default, the operator panel dip switch is in the "0" position, and the drive is in normal operation mode in this position. For firmware upgrade, you need to toggle this switch to the "1" position.

  Note: When the switch is toggled to 1, the drive will not function properly. Please toggle this switch back to "0" after a successful firmware upgrade.




The AD2 driver uses the CN6 (Mini USB) interface to communicate with the computer on which the debug software or firmware burn-in environment is installed.




Note: 1. Industrial grade USB cable with magnetic ring and shielding layer is recommended for debugging cable.

2、Due to the limited space height of the CN6 interface, please use a MINI USB interface with a connector height ≤ 10mm.

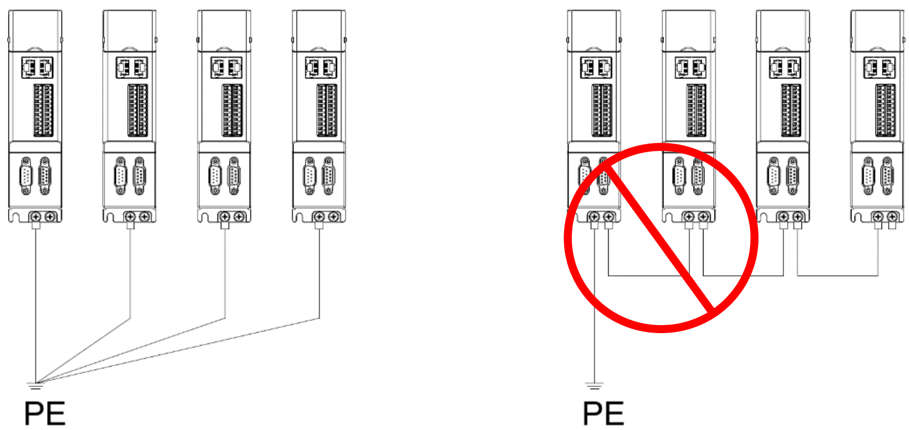
3、Do not use a MINI USB connector that is too high and too large to prevent damage to the drive's CN6 interface.

# 4.11 System grounding

**Cautions**

To prevent accidental electric shock, make sure grounding measures are implemented

- Be sure to ground the motor and drive firmly and reliably.
- According to the relevant standards for electrical equipment, the 200V class drive should be grounded with class D (grounding resistance below 100Ω) and the 400V class drive should be grounded with class C (grounding resistance below 10Ω).
- Use a grounding cable of the recommended wire diameter or greater and as short as possible.
- When grounding multiple drives, series grounding should not be used, but individual grounding or common grounding should be used.
- Forms need to be consistent with the cautions



## 4.12 Anti-interference strategies for electrical wiring

1) To suppress interference, take the following measures:

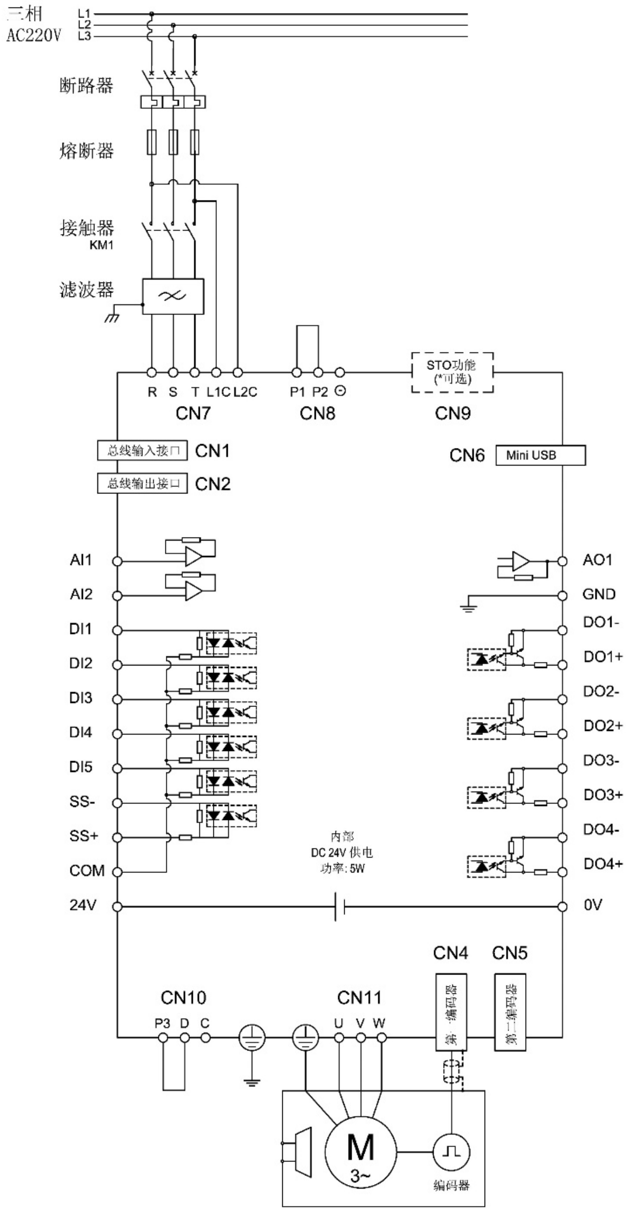
- Power cable and encoder cable should be less than 20m, the longest should not exceed 25m, and the encoder cable should be twisted shielded cable.
- Use thicker wire diameter cables ($2mm^2$ or more recommended) for grounding wiring whenever possible.
- It is recommended to all grounding cables use above category D (grounding resistance resistance value of 100Ω or less).
- Single point of grounding must be used
- Please use a noise filter to prevent RF interference. When using in a residential environment or in an environment with strong power interference noise, please install a noise filter on the input side of the power cord.

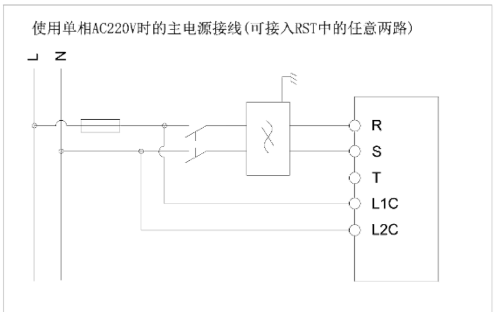
2) To prevent misoperation caused by electromagnetic interference, the following treatment can be used:

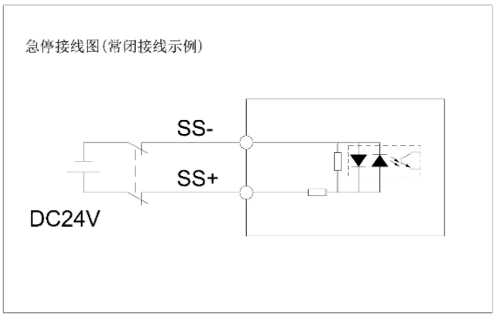
- Install the noise filter as close to the servo drive as possible.
- Install surge suppressors on the coils of relays and electromagnetic contactors.
- When wiring, please lay the strong electricity lines separately from the weaks and keep distance more than 30cm. Do not put them into the same pipe or bundle them together.
- Do not share the same power supply with welding machines, electrical discharge processing equipment, etc. When there is a high frequency generator nearby, install a noise filter on the input side of the power line.
- Adding magnetic rings to the control power, power cord and encoder cables.

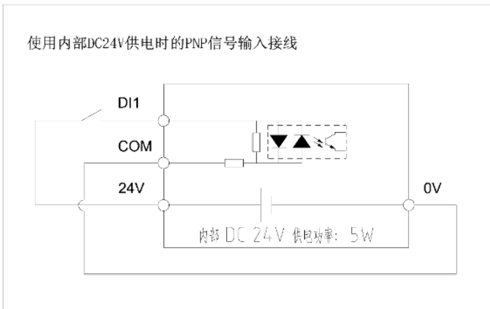
3) Recommended magnetic ring material: manganese zinc magnetic ring
4) Manufacturer: New Conda Magnetic Material
5) Model: NCD/HP1-H60/35/20
6) Control cable wound 3 turns on the magnetic ring and connected to the driver.
7) Power cable U\V\W three-phase on the magnetic ring wound 3 turns and then connected to the drive, note that the PE ground wire can not be wound into the ring.
8) The encoder cable is wound 3 turns on the magnetic ring and connected to the driver.

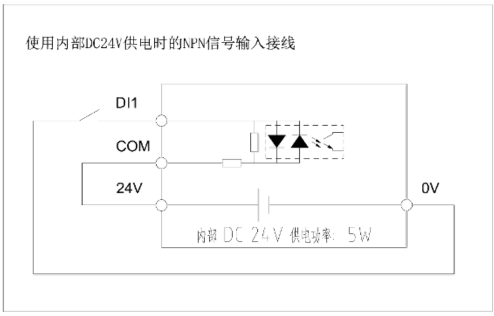
# 4.13 General wiring diagram

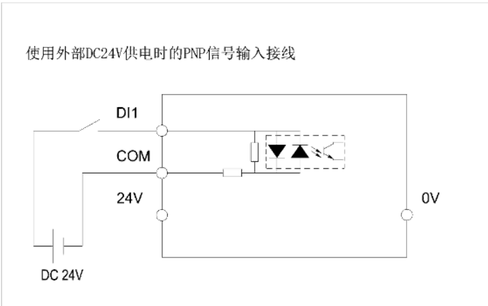


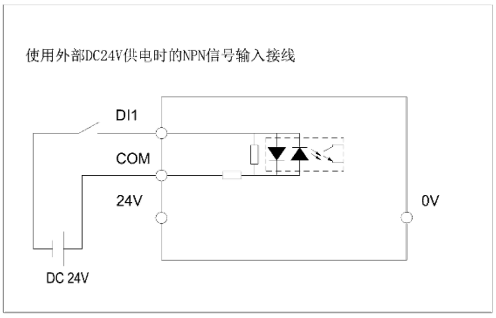

使用单相AC220V时的主电源接线(可接入RST中的任意两路)
L
N
R
S
T
L1C
L2C

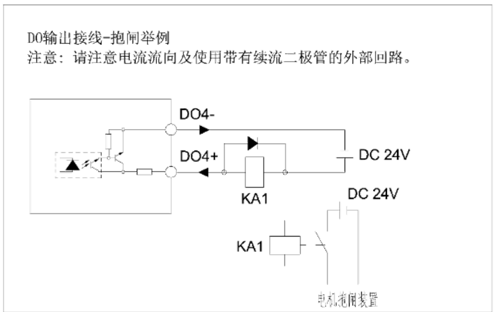

急停接线图(常闭接线示例)
SS-
SS+
DC24V

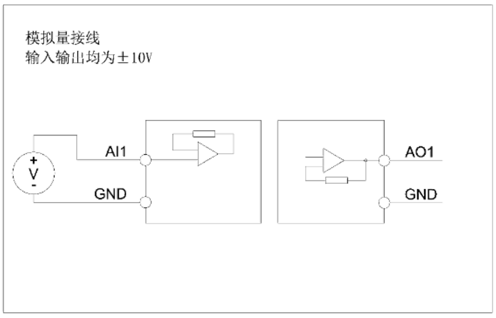

使用内部DC24V供电时的PNP信号输入接线
DI1
COM
24V
0V
内部 DC 24V 供电功率: 5W

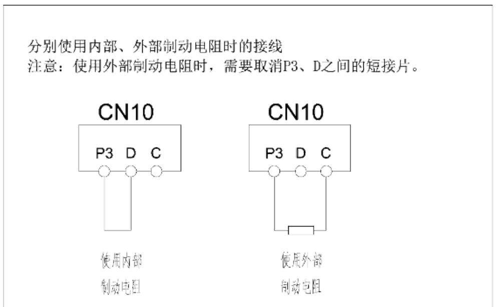

使用内部DC24V供电时的NPN信号输入接线
DI1
COM
24V
0V
内部 DC 24V 供电功率: 5W

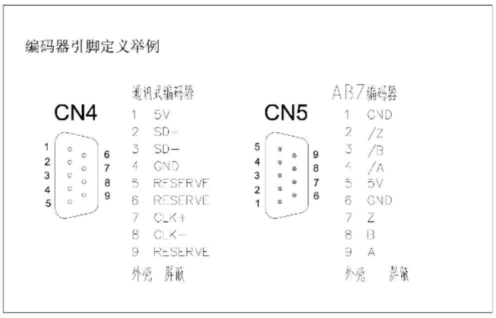

使用外部DC24V供电时的PNP信号输入接线
DI1
COM
24V
0V
DC 24V


使用外部DC24V供电时的NPN信号输入接线
DI1
COM
24V
0V
DC 24V


DO输出接线-抱闸举例
注意：请注意电流流向及使用带有续流二极管的外部回路。
DO4-
DO4+
DC 24V
KA1
DC 24V
KA1


模拟量接线
输入输出均为±10V
AI1
GND
V
AO1
GND


分别使用内部、外部制动电阻时的接线
注意：使用外部制动电阻时，需要取消P3、D之间的短接片。
CN10
P3 D C
CN10
P3 D C


编码器引脚定义举例
CN4
通讯式编码器
1 5V
2 SD+
3 SD-
4 GND
5 RESERVE
6 RESERVE
7 CLK+
8 CLK-
9 RESERVE
外壳 屏蔽
CN5
ABZ编码器
1 GND
2 /Z
3 /B
4 /A
5 5V
6 GND
7 Z
8 B
9 A
外壳 屏蔽

# Section 5 Panel Display and Operation

## 5.1 Panel Composition and Introduction

### 5.1.1 Panel Composition


| Name | Function |
|---|---|
| 5-bit 8-segment LED digital tube | Displays various types of drive information, parameter settings, general functions, etc. |
| Panel operation keys | For switching, changing, and setting operations. |
| Power indicator | Drive DC bus power indication. |
| Firmware write switch | Firmware burn-in switch, toggle to the "0" position above for normal use. |
| Mini USB communication port | Communicates with a computer that has debug software or a firmware burn-in environment installed. |

### 5.1.2 Digital tube display

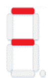
| Mode | Top Menu | Submenu example |
|---|---|---|
| Monitoring and displaying | Dp. 002 | r.10 |
| Parameter setting | P10. 01 | 68 |
| Fault alarm | En. 001 | E.52.10 |
| Control function | Fn. 001 | JOG |
| Normal state | Ξ n.1 | None |

1) Panel operation keys


| Button | Key Name | Function |
|---|---|---|
| MOD | Mode selection \ Return button | ● Return to the top-level directory; if it is already in the top-level directory, it is the function to switch between modes.<br>● Exits the editing state.<br>● Parameter browsing page, long press for 2 seconds and group will switch (parameters group to large and small).<br>● Mode+▲ : EtherCAT board reset. |
| ▲ | Number increase key | ● Increase numbers or index (the number sequence is -0123456789); when long numbers are displayed, move up one page of the screen to show the content.<br>● Special controls, such as forward rotation, adjustable speed, etc.<br>● Browse the status, if it is the alarm content, you can directly on the alarm. |
| ▼ | Numeric reduction key | ● Decrease the number or index (the number sequence is 9876543210-); when long numbers are displayed, move down one page of the screen to display the content.<br>● Special controls, such as reversing, adjusting speed, etc.<br>● Browse the status, if it is alarm content, you can directly next alarm. |
| SET | Shift, OK key | ● In the Browse state, access the submenu items from the parent menu.<br>● In editing status, edit bit is shifted left. In the parameter editing status, OK saves the setting (requires a long press for 2 seconds). |

# 5.2 The contents of panel displays

After the servo drive is powered on, the display can be used for servo power-on status display, parameter display, fault display and monitoring information display.

| | |
|---|---|
| **Power-on status display** | Used to display the status of the servo, such as servo ready, running, etc.<br>When the servo drive is fault-free and not in other display menus, the first digital tube on the far left of the panel is used to display the status of the servo, as follows:<br> Indicates that the servo internal self-test is normal and initialization is successful.<br> Indicates that the servo main power is on.<br> Indicates that the servo is ready.<br> Indicates that the servo is running. |
| **Parameter display** | Displays the function code and the function code setting value. |
| **Fault display** | Servo fault alarm code is displayed. |
| **Monitoring Information** | Displays information such as the current operating parameters of the servo. |

## 5.2.1 Power-up initialization process

- When the servo is normal

Initialization

Initialization successful

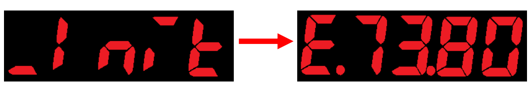
The main power is on and the servo is ready to run.

- When the servo fault alarm or initialization fails, the screen will display the fault code and flash

Example: When the encoder is disconnected, the E73.80 fault code appears on the display and flashes at a frequency of 0.5S.

Initialization

Fault Alarm



## 5.2.2 Panel display switching method

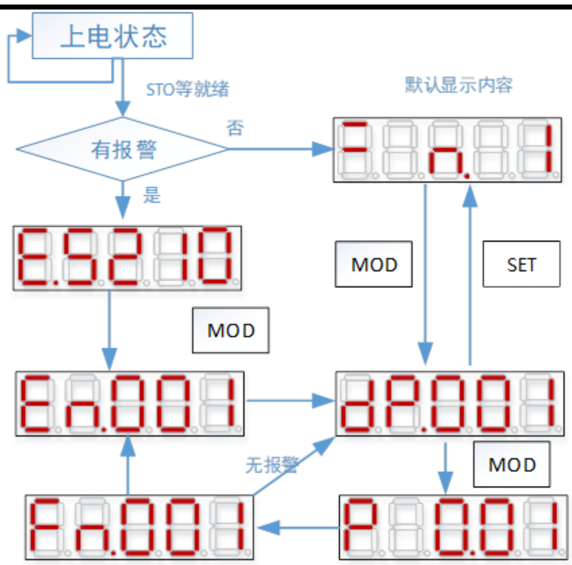



Figure 5-2-2 - Panel display switching method between menus

## 5.2.3 Parameter display

- The AD2 series drives have a total of 27 groups of parameters, and parameter locations can be quickly located by group. A list of parameters can be found in the Parameter Object section.

Parameter groups are displayed:

| Show | Name | Content |
|---|---|---|
| PXX.YY | Function code group | XX: Function code group number.<br>YY: The number within the function code group. |

Example: P10.01

| Show | Name | Content |
|---|---|---|
|  | Motor parameter group | 10: Motor parameter group.<br>01: Motor series. |

- Data of different lengths and negative numbers are displayed:

1) Signed data of 4 digits or less, or unsigned data of 5 digits or less, are displayed on a single page (5-digit digital tube on one page). For signed numbers, the highest bit of data "-" indicates a negative number.

Example: -9999 shows: 

Example: 65535: 

2) 4 digits and above signed, or 5 digits and above unsigned data are displayed in multiple pages (up to three pages) from high to low according to the number of digits, with every 4 digits being one page, press ▲ to page up, press ▼ to page down.

Example: -2147483647

The first digital tube on the left side displays the current page number (high four-digit page, middle four-digit page, low four-digit page).

High four Middle four Lower four

3) Display of decimal points

Example: 10.2: 

## 5.2.3 Parameter setting display

| Show | Name | Display Occasions |
|---|---|---|
|  | Done | Function completed successfully |
|  | P.INIT | Parameter initialization |
|  | OK | Successful parameter setting |
|  | NOT OK | Unsuccessful parameter setting |

## 5.2.4 Fault display

The panel can display current or historical fault information. For fault information analysis and troubleshooting, please refer to the chapter "Section 11 Troubleshooting".

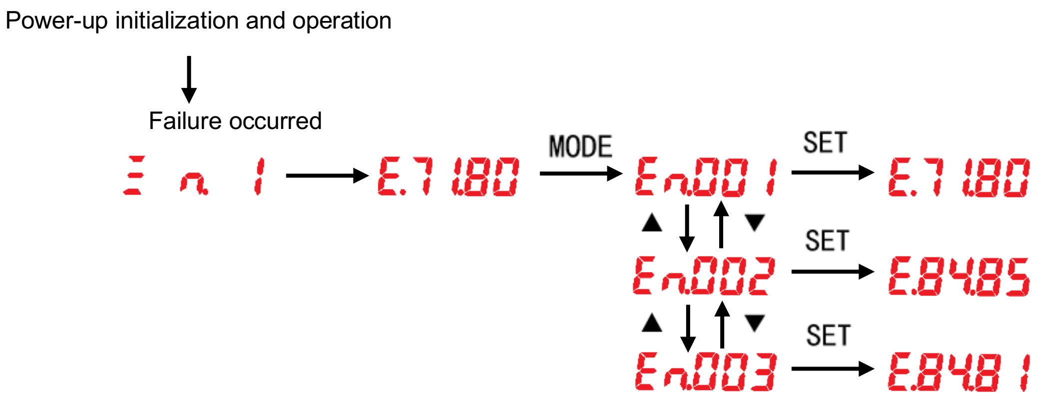
If a single fault occurs, the panel pops up the corresponding fault code and keeps flashing until the fault is confirmed and reset. If more than one fault occurs at the same time, the last fault code occurs is displayed. Multiple fault codes occurring at the same time can be viewed one by one by flipping through EN.001.

The parameter P91.18 allows you to select the 10 most recent fault codes that have occurred, and the fault codes are displayed in P91.19.

Example: Single fault code E73.80

| Show | Name | Content |
|---|---|---|
|  | Encoder connection error | E. Servo fault class code<br>73. Fault code group<br>80 Number in fault code group |

Example: Multiple faults occurred at the same time, in order of time, E8481; E8485; E7180.




## 5.2.5 Monitoring parameter display

The dp group in Panel Status can be used to display the operational status of the drive.

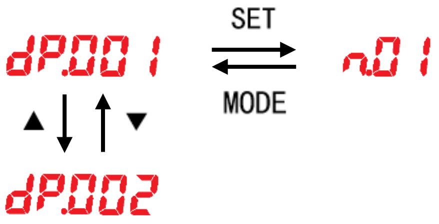



Figure 5-2-5 - Monitoring display switching

The following table shows the specific information of the dp monitoring group:

| Function Code | Name | Unit | Meaning | Examples |
|---|---|---|---|---|
| dp.001 | Node number | - | The local node number, which is shown here as the EtherCAT slave address when the EtherCAT bus writes the station number. | Local node number n.01 The slave address is "1". |
| dp.002 | Actual speed | rpm | Servo motor actual speed | |
| dp.003 | Given speed | rpm | Current given speed | |
| dp.004 | Current output | A | Output Current RMS | |
| dp.005 | Voltage output | V | Output Voltage RMS | |
| dp.006 | DC bus voltage | V | DC bus voltage | |
| dp.007 | Encoder | inc | Actual feedback value of the encoder, communication object 0X6064 | |
| dp.008 | Pulse Feeding | inc | Position ring gives incremental pulses | |
| dp.009 | Control words | / | Communication object 0x6040 | |
| dp.010 | Status word | / | Communication object 0x6041 | |
| dp.011 | EtherCAT Status Word | / | EtherCAT communication status word | |

# 5.3 Basic panel operation

## 5.3.1 Parameter Setting

- Parameter settings can be made using the Servo Drive's panel, see the Parameter Object section for details.

1) In the parameter setting group, long press "MOD" to quickly locate the parameters by group.

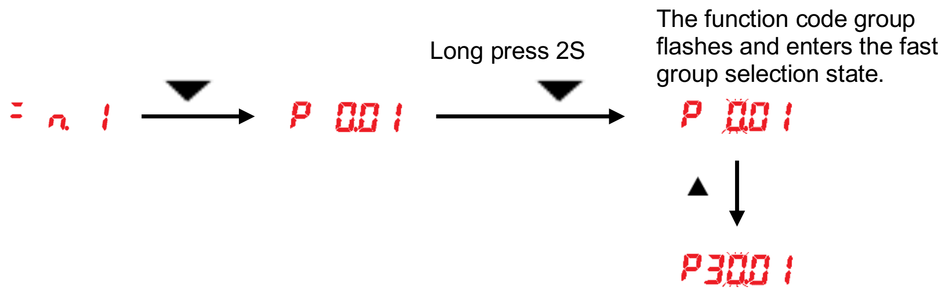



Figure 5-3-1 Quick selection of parameter groups

2) The following are examples of changing the motor rotation direction to "clockwise positive" and changing the "contracting brake opening delay" to 250ms after power on:

Note: You must log in with a password to edit the parameters before changing them, otherwise the parameters will fail to be saved.

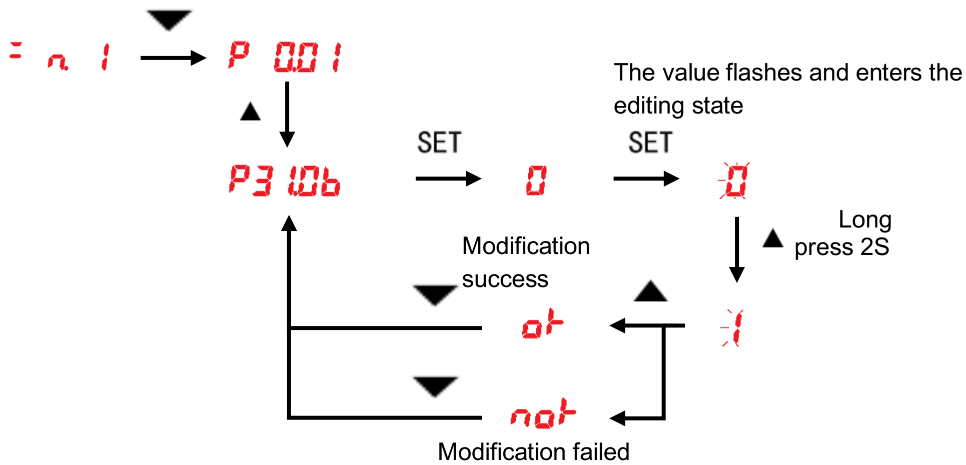



Figure 5-3-2 Changing the direction of motor rotation

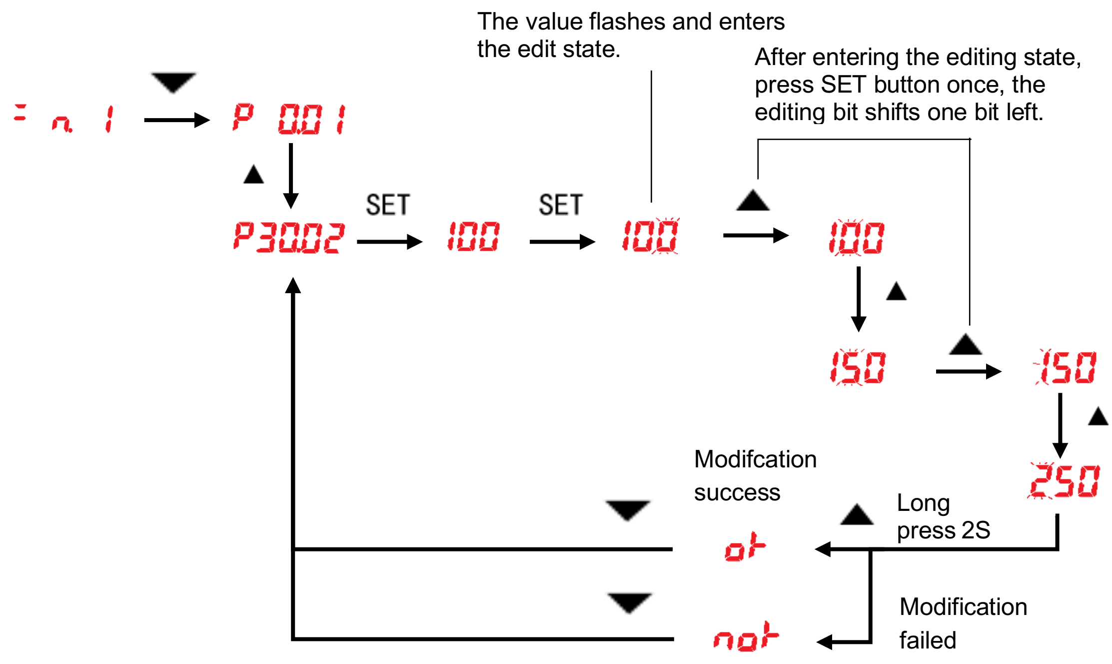



Figure 5-3-3 Changing the "contracting brake opening time"

## 5.3.2 User Login

By default, users can only view the parameters and cannot edit or modify them. To modify parameters, you need to log in with a password first.

After 6 minutes of login, the password will automatically expire. If you need to continue editing, you need to log in again.

- The default login password is "1111", the following is the password login procedure:

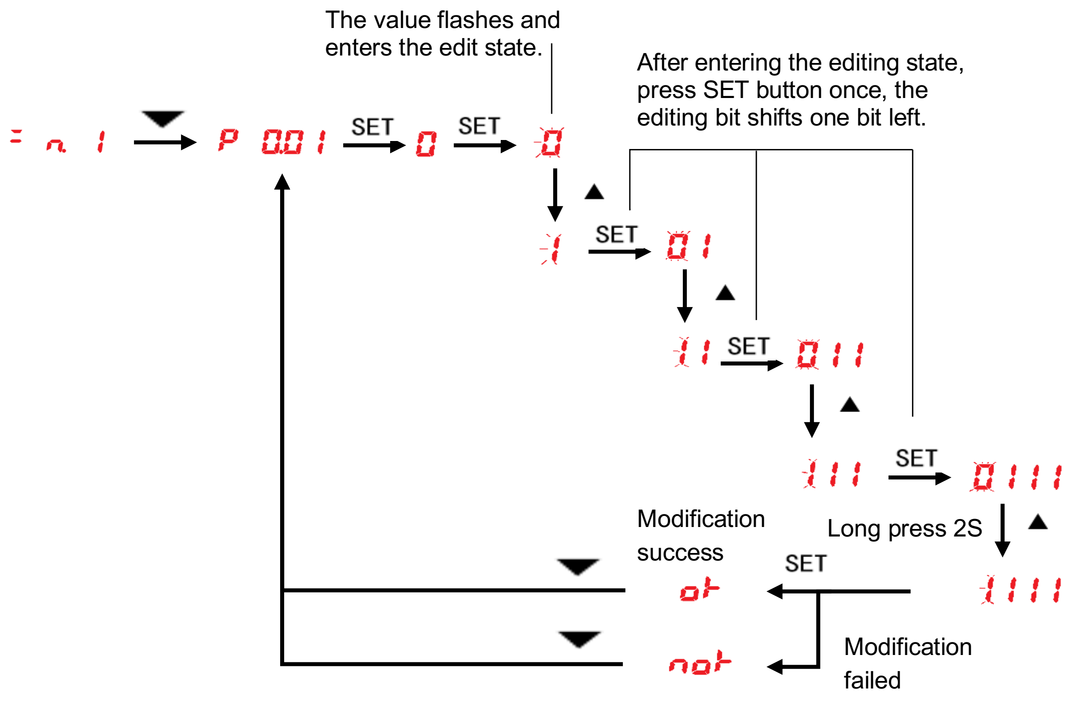



Figure 5-3-4 Panel user login

## 5.3.3 Fault Reset

When the drive control channel is selected as "AD Commissioning Software Control" or "Panel Control", the panel can provide a fault reset function to clear the current alarm status.

Note: When the control channel is selected as "Controller Control", this function is not effective.

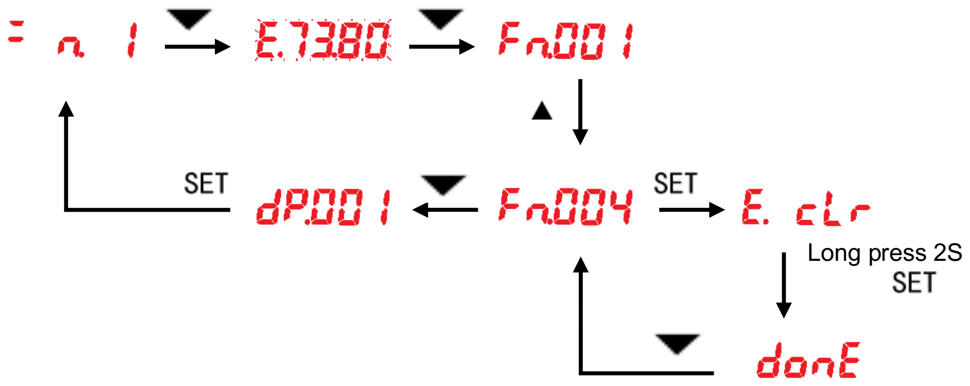



Figure 5-3-5 Panel fault reset operation

## 5.3.4 JOG function

When the drive control channel is selected as "panel control", the panel can provide JOG function to facilitate axis testing without debugging software and upper controller.

Note: 1、JOG function must be in the "panel control" state to take effect.

2、Before running, please pay attention to whether the operating environment is safe and whether the wiring and grounding measures are implemented correctly.

3、After the trial run is completed, please note to change back to the original control channel selection.

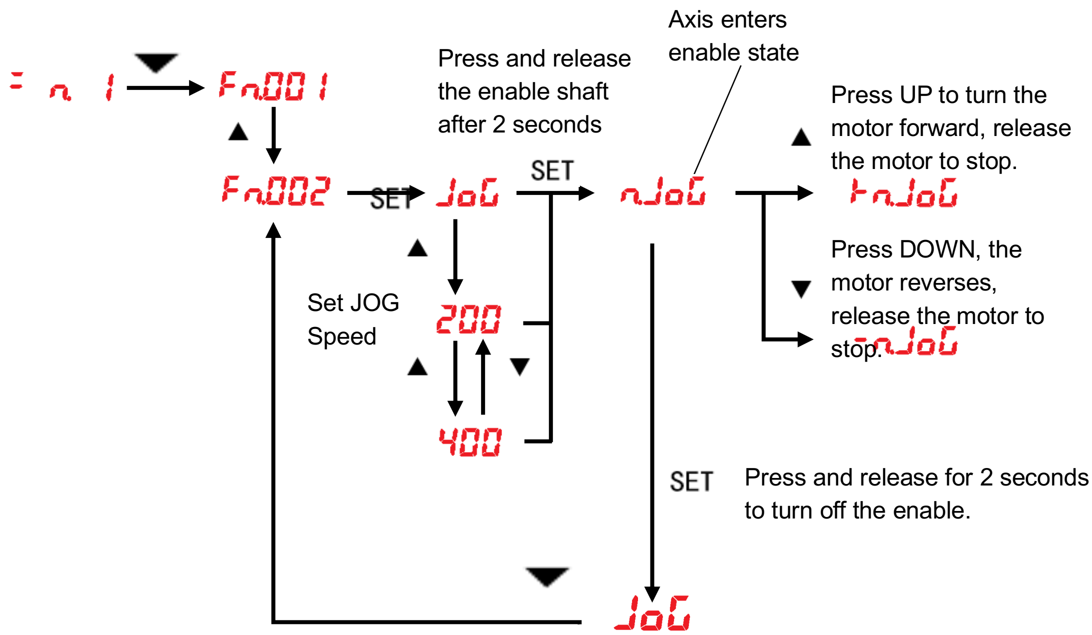



Figure 5-3-5 Panel JOG operation

About JOG speed: The unit of jogging speed is 0.1RPM. So, the panel shows 200, the actual is 20 RPM. The default jog speed is 200, and the incremental value of single increase or decrease is 200. To ensure safe operation, the maximum JOG value is one tenth of the maximum motor speed, for example, for a motor rated at 3600RPM, the maximum panel JOG speed is 36 rpm.

## 5.3.5 Parameter initialization

In special cases, the panel can be used to perform parameter initialization operation on the Servo Drive. After performing this operation, all parameter values of the servo will be restored to factory default values, so please use this function carefully.

| ⚠ **Cautions** |
|---|
| ● When initializing the parameters, be sure to stop the motor movement, turn off the motor enable, and disconnect the servo main power, leaving only the control power. Failed to do so may result in unpredictable mechanical or personal accidents.<br>● After parameter initialization, please execute power-off restart first.<br>● After parameter initialization and power-off restart, please fill in the motor parameters, encoder parameters and related control parameters correctly according to the actual connection based on uploaded parameters.<br>● Forms need to be consistent with the style of notes |

The following diagram shows the steps for resetting the drive parameters using the panel:

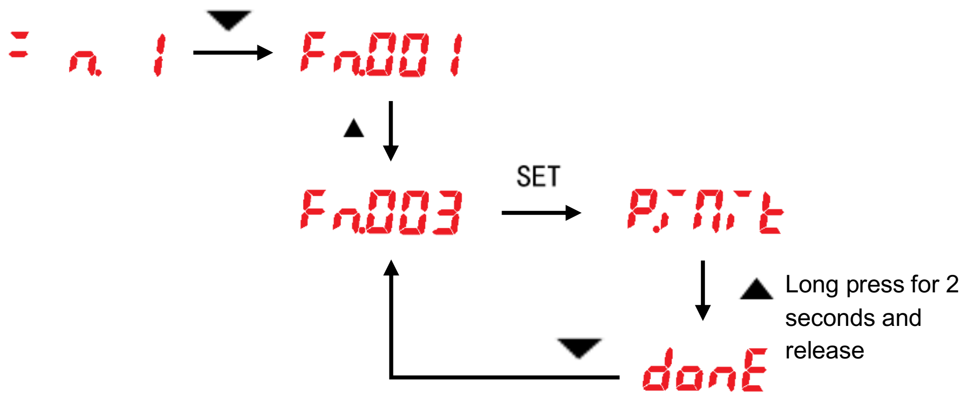



Figure 5-3-6 Panel parameter initialization steps

# Section 6 Introduction to EtherCAT Communication

This section introduces the basics of EtherCAT real-time industrial Ethernet communication, communication parameter settings, EtherCAT finite-state machine, PDO configuration, DC clock, etc.

## 6.1 EtherCAT bus communication basics

### 6.1.1 EtherCAT Protocol Overview

EtherCAT is a high-performance, low-cost, easy-to-use, topology-flexible and easy-to-implement industrial Ethernet technology for high-speed networks at the industrial field level, using a standard Ethernet physical layer and a twisted pair (100Base-TX) transmission medium.

The EtherCAT system consists of a master and a slave. The master requires only a common network card, the slave requires a special slave control chip.

6-1-1 EtherCAT Network Diagram

- EtherCAT main features:
  1) Full compliance with Ethernet standards, allowing coexistence with other Ethernet devices and protocols on the same bus.
  2) No slave subnets, complex nodes, or IO nodes with only 2 bits can be used as EtherCAT slaves.
  3) High transmission rate, 100-megabit Ethernet, full duplex mode.
  4) Good synchronization performance, clock synchronization accuracy of less than 1us for each slave node device.
  5) The refresh cycle is short and can achieve a data refresh cycle of less than 100us.
- To support a wider variety of devices and a wider range of application layers, EtherCAT has established the following application protocols:
  1) CoE (EtherCAT-based CAN application protocol).
  2) SoE (servo-driven equipment line regulation according to IEC 61800-7-204).
  3) EoE (Ethernet over EtherCAT).
  4) FoE (File access over EtherCAT).

  Slave devices do not need to support all communication protocols; instead, they simply choose the one that best suits their application.

## 6.1.2 System parameter setting

To enable the AD2 series Servo Drives to be correctly connected to the EtherCAT fieldbus network, the relevant parameters of the AD2 series Servo Drives need to be set.

| Servo parameter serial number | Name | Setting range | Default Value | Target set value |
|---|---|---|---|---|
| P00.02 | Control channel selection | 0: Control panel control<br>1: Controller control<br>2: AD commissioning software control<br>3：Analog 1 control<br>4：Analog 2 control<br>5：Reserve | 1 | 1 |
| P01.01 | Bus Type Selection | 0: No bus board<br>1：EtherCAT<br>2：CANOpen | 1 | 1 |

Note: When using EtherCAT bus control you need to select P00.02 command channel as controller control and P01.01 bus type as EtherCAT to download and save parameters and power off and restart.

## 6.1.3 EtherCAT communication specification and communication structure

1) EtherCAT Communication Specification

| Projects | | Specification |
|---|---|---|
| Communication protocols | | IEC 61158 Type 12.<br>IEC 61800-7CiA 402 Drive Profile |
| Application Layer | SDO | Fast Transfer Service<br>General transmission services<br>Segmented Transfer Service |
| | PDO | Variable PDO Mapping<br>Support 4 TPDO channels, each supporting up to 16 objects<br>Supports 4 RPDO channels, each supporting up to 16 objects |
| | CiA 402 | Wheel Position Mode (PP)<br>Wheel speed mode (PV)<br>Wheel Torque Mode (PT)<br>Home Recurrence Mode (HM)<br>Synchronous Periodic Position Mode (CSP)<br>Synchronous Cycle Velocity mode (CSV)<br>Synchronous Periodic Torque Mode (CST) |
| Physical Layer | Transfer Protocol | 100BASE-TX (IEEE802.3) |
| | Maximum distance | 100m |
| | Interface | RJ45*2(IN, OUT) |

2) EtherCAT Communication Architecture

Various application layer protocols are available for communication using EtherCAT. In the AD2 series Servo Drives, the IEC61800-7 (CiA402)-CANOpen motion control sub-protocol is used.
The following figure shows the EtherCAT communication structure based on the CANOpen application layer.

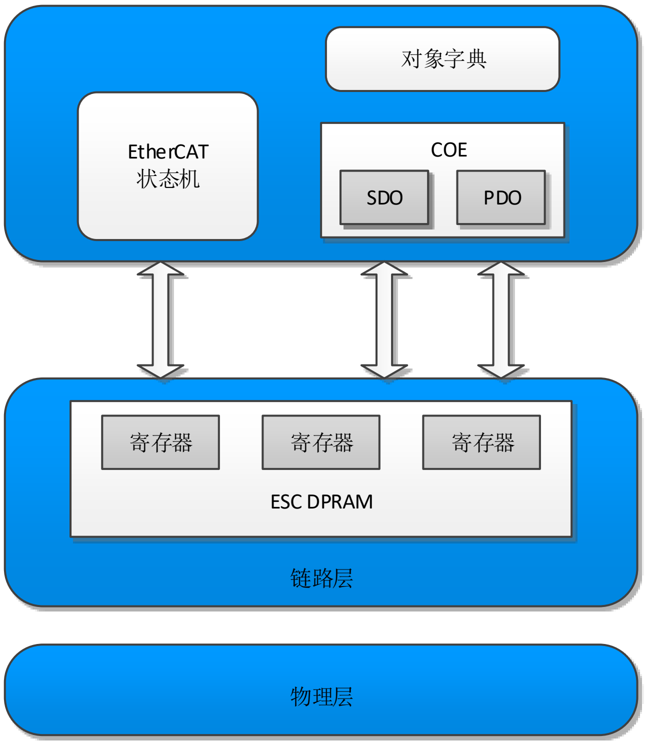


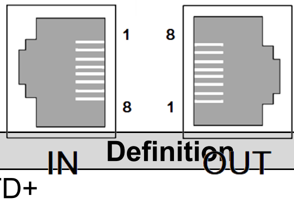

Figure 6-1-3 EtherCAT communication structure based on CANOpen application layer

In the structure diagram, the application layer object dictionary contains communication parameters, application data, and PDO mapping data, etc. The PDO process data object contains real-time data during the operation of the servo drive and is accessed periodically for reading and writing, while the SDO mailbox communication is accessed and modified acyclically for some communication parameter objects and PDO process data objects.

## 6.1.4 Basic Features

- Interface Information

The EtherCAT cable is connected to a network port terminal with metal shield and is divided into input (IN) and output (OUT) interfaces. The electrical characteristics are in accordance with IEEE802.3, ISO8877.

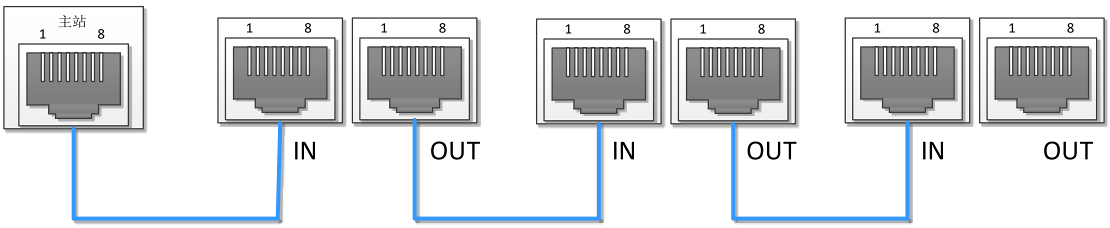



| Pinning | Definition | Description |
|---|---|---|
| 1 | TD+ | Data sending + |
| 2 | TD- | Data sending - |
| 3 | RD+ | Data reception + |
| 4 | / | Empty Foot |
| 5 | / | Empty Foot |
| 6 | RD- | Data reception- |
| 7 | / | Empty Foot |
| 8 | / | Empty Foot |
| Housing | Shielding | Shielding |

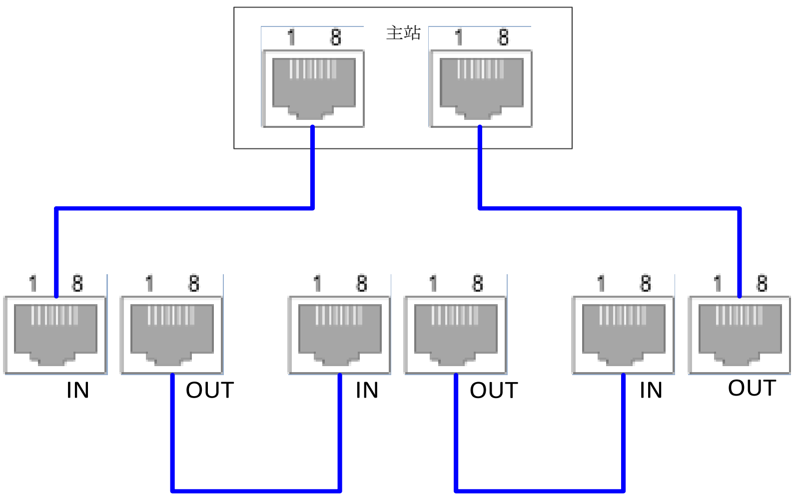
- Topology Connection

The therCAT communication topology is flexible in connection. This servo comes with IN and OUT interfaces, and the topology connection is as follows.

1) Linear connection.




2) Redundant ring connections:



# 6.2 EtherCAT Communication Basics

## 6.2.1 Finite-state Machine

1) The following block diagram shows the EtherCAT state transition:

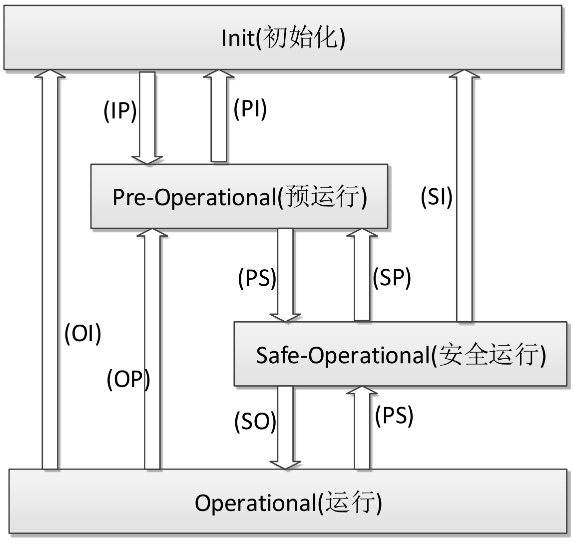



Figure 6-2-1 ETherCAT Finite-state Machine

The EtherCAT device must support 4 states and is responsible for coordinating the state relationship between the master and slave applications during initialization and runtime.

Init: Initialization, abbreviated as I.

Pre-Operational: Pre-operational, abbreviated as P.

Safe-Operational: safe operation, abbreviated as S.

Operational: Operational, abbreviated as O.

When transitioning from the initialization state to the operation state, the sequence of "initialization -> pre-operation -> safe operation -> operation" must be followed. No transgressions are allowed.

Transitioning is possible when returning from the running state. The state transformation operations and initialization process are listed below:

| State and state transformation | Operation |
|---|---|
| Initialization<br>Init (I) | No communication at the application layer, the master can only read and write ESC registers |
| Initialization to pre-run conversion<br>Init to Pre-Op (IP) | Master Configure Slave Site Address Register<br>Configure Mailbox Channel<br>Configure DC distribution clock<br>Request "pre-run" status |
| Pre-run<br>Pre-Op (P) | Application layer mailbox data communication (SDO) |
| Conversion of pre-operation to safe operation<br>Pre-Op to Safe-Op (PS) | Master initializes process data mapping using mailboxes<br>Master configures<br>SM channels for process data communication<br>Master configures FMMU to<br>request "security status" |
| Safe operation<br>Safe-Op (S) | Process data communication is available, but only read input data is allowed, no output signal is generated (TPDO) |
| Safe operation to operation conversion<br>Safe-Op to Op (SO) | The master sends a valid output data<br>requesting "operational status" |

| State and state transformation | Operation |
|---|---|
| Operation Status<br>Op(O) | All inputs and outputs are valid<br>Mailbox communication is possible (SDO, TPDO, RPDO) |

## 6.2.2 Process Data PDO

PDO real-time process data transmission follows the producer-consumer model. PDO can be divided into RPDO (Receive PDO), where the slave receives commands from the master through RPDO; and TPDO (Trasmit PDO), where the slave feeds its own status through TPDO.


Figure 6-2-2 PDO transmission model

1) PDO mapping parameters

PDO mapping is used to establish the mapping relationship between object dictionary and PDO. 1600h~17FFh is RPDO and 1A00h~1BFFh is TPDO. 4 RPDOs and 4 TPDOs are available in the AD2 series Servo Drive. The drive defaults to two fixed PDO mappings, one RPDO and one TPDO, using communication objects 0x1600 and 0x1A00.

| Object 0x1600: RPDO1 mapping | | | |
|---|---|---|---|
| Sub-index | Numerical value | Number of data bytes | Meaning |
| 0 | 7 | 1 | Number of mapped objects |
| 1 | 0x6040 | 2 | Control Word (control word) |
| 2 | 0x607A | 4 | Target Position |
| 3 | 0x60FF | 4 | Target Velocity |
| 4 | 0x6071 | 2 | Target Torque |
| 5 | 0x6081 | 4 | Profile Velocity (Torque Limiting Velocity) |
| 6 | 0x60B8 | 2 | Touch Probe Function (latching function) |
| 7 | 0x6060 | 1 | Modes Of Operation (operation mode) |

| Object 0x1A00: TPDO1 mapping | | | |
|---|---|---|---|
| Sub-index | Numerical value | Number of data bytes | Meaning |
| 0 | 8 | 1 | Number of mapped objects |
| 1 | 0x6041 | 2 | Status Word |
| 2 | 0x6064 | 4 | Position Actual Value (Actual Position) |
| 3 | 0x606C | 4 | Velocity Actual Value (Actual Velocity) |
| 4 | 0x6077 | 2 | Torque Actual Value (Actual Torque) |

| | | | |
|---|---|---|---|
| 5 | 0x60B9 | 2 | Touch Probe Status (latching status) |
| 6 | 0x60BA | 4 | Touch Probe Pos1 Pos Value (latch value 1 rising edge position) |
| 7 | 0x60FD | 4 | Digital Input (Digital Input) |
| 8 | 0x6061 | 1 | Modes Of Operation Display (actual operation mode) |

2) PDO Configuration

The PDO mapping parameter contains a pointer to the process data corresponding to the PDO that the PDO needs to send or receive, including the index, subindex, and the length of the mapped object. The subindex 0 records the number of objects mapped by the PDO, and the length of each PDO data can be up to 4*N bytes, which can map one or more objects at the same time. Sub-indexes 1 to N are the mapping contents. The mapping parameters are defined as follows.

| **Digits** | 31 | ...... | 16 | 15 | ...... | 8 | 7 | ...... | 0 |
|---|---|---|---|---|---|---|---|---|---|
| **Meaning** | Index | | | Sub-index | | | Object Length | | |

The index and subindex together determine the location of the object in the object dictionary, and the object length specifies the specific bit length of the object, expressed in hexadecimal, i.e:

| Object Length | Seat length |
|---|---|
| 08h | 8-bit |
| 10h | 16-bit |
| 20h | 32-bit |

For example, the mapping parameter that represents the 16-bit control word 6040h-00 is 60400010h.

## 6.2.3 Mailbox Data SDO

- EtherCAT mailbox data SDOs are used to transfer non-periodic data, such as configuration of communication parameters, configuration of servo drives operating parameters, etc. The EtherCAT CoE service types include:
  1) Information on emergency events.
  2) SDO requests.
  3) SDO response.
  4) TxPDO.
  5) RxPDO.
  6) Remote TxPDO sending requests.
  7) Remote RxPDO sending requests.
  8) SDO information.

## 6.2.4 Distributed Clocks

The Distributed Clock enables all EtherCAT devices to use the same system time and thus control the synchronized execution of tasks for each device. The slave devices can generate synchronization signals based on the synchronized system time. AD2 series drives only support the DC synchronization mode. The synchronization period is controlled by SYNC0. The cycle range varies according to the different motion modes. Note: DC (Distributed Clocks) is the synchronous clock, EtherCAT supports three synchronization modes, i.e. DC synchronization, SM2 (Sync manager) synchronization and FreeRun (free run), DC synchronization is based on the first axis clock with high accuracy, SM2 synchronization is based on the RxPDO information time, FreeRun has no synchronization. FreeRun has no synchronization.

## 6.2.5 CiA402 control introduction

- The Servo Drive must be guided in accordance with the process specified in the standard CiA402 protocol to use the AD2 Series Drive before the Servo Drive can operate in the specified state.

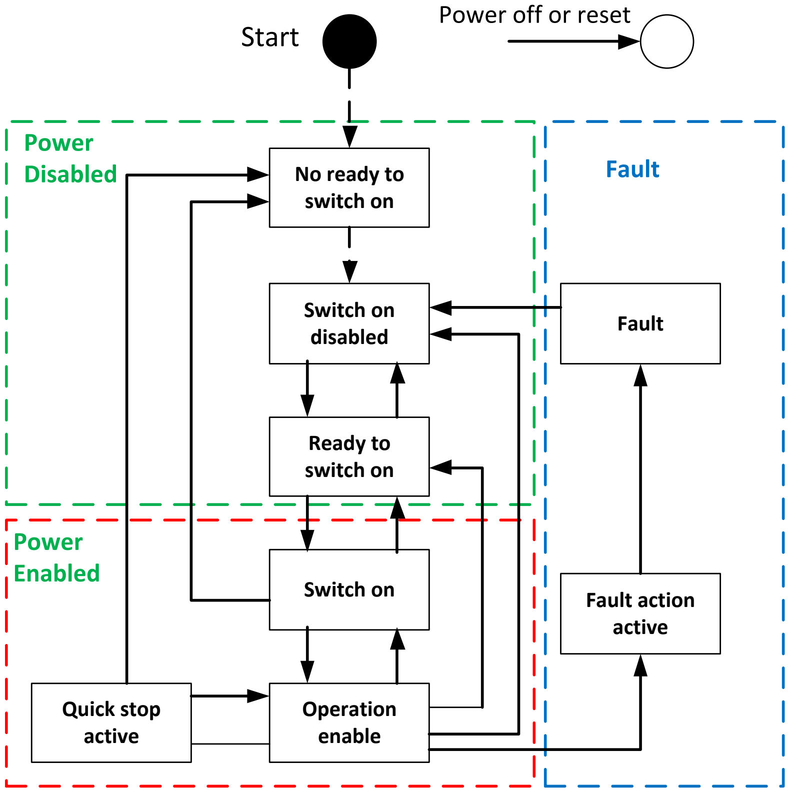



Figure 6-2-3 CiA402 state switching diagram

- The states are described in the following table:

| | |
|---|---|
| **Not ready to switch on** | The control is powered on, the driver initializes, internal self-tests, and remains in this state until initialization is complete. |
| **Switch on disable** | Servo initialization is complete, and the Servo Drive is fault-free, or errors have been eliminated.<br>Drive parameters can be set. |
| **Ready to switch on** | The servo drive is ready.<br>Drive parameters can be set. |
| **Switch on** | The servo drive waits for the servo enable to be turned on.<br>Drive parameters can be set. |
| **Operation Enable** | The drive is running normally, a servo operation mode is enabled, the motor is powered on, and the motor rotates when the command is not 0.<br>If the drive parameter property is "Run Change", it can be set, otherwise it cannot be set. |
| **Quick stop active** | The Quick Stop function is activated, and the drive is performing the Quick Stop function.<br>The drive parameter property "Run Change" can be set, otherwise it cannot be set. |
| **Fault action active** | The drive has failed and is in the process of performing a failover.<br>If the drive parameter property is "Run Change", it can be set, otherwise it cannot be set. |
| **Fault** | Fault shutdown is complete, and all drive functions are disabled while allowing drive parameters to be changed for troubleshooting. |

# Section 7 Basic control mode

This section lists the control modes supported by AD2 series Servo Drives and their usage. Please select and use the corresponding control mode properly according to the application.

The servo system consists of three main parts: servo driver, servo motor and encoder.

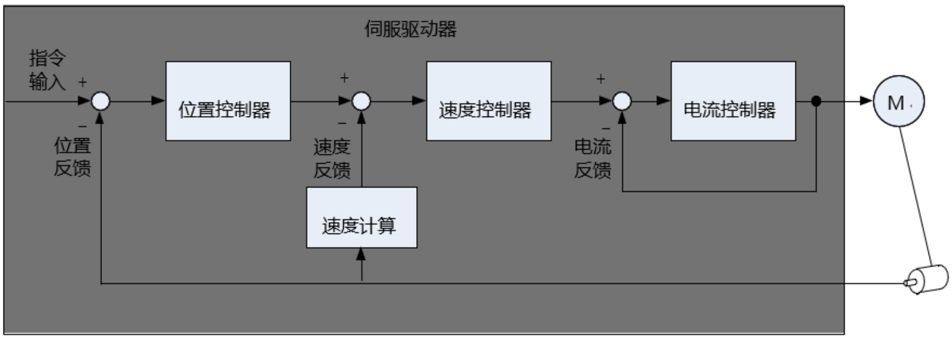



Figure 7-1-1 Servo system control sketch

The servo driver is the control core of the servo system. Through the processing of input signals and feedback signals, the servo driver can work in position control mode, speed control mode and torque control mode, and the above three modes can realize the precise control of motor position, speed, or torque respectively. Among them, position control is the most important and most used control mode of servo system.

- A brief description of each control mode is as follows:

1) Position Control

   Position control is to control the position of the motor by position command. The total number of position commands is used to determine the target position of the motor, and the rate of change of the target position determines the motor rotation speed. By reading the feedback value from the encoder, the servo drive can achieve fast and precise control of the motor rotor position and the motor speed. Therefore, the position control mode is mainly used in applications that require precise position control, such as robots, placement machines, engraving machines, CNC machine tools, etc.

2) Speed Control

   Speed control refers to the control of the motor speed by speed command. By parsing the speed command given externally, the servo drive can achieve fast and accurate control of the motor speed. Therefore, the speed control mode is mainly used in applications with high requirements for motor speed, such as the spindle of CNC milling machines.

3) Torque control

   The input current of a servo motor is linearly related to the output torque; therefore, the control of the current can realize the control of the output torque of the motor. Torque control means that the output torque of the motor is controlled by inputting a torque command to the servo controller. The torque command can be given by means of communication. The torque control mode is mainly used in devices with strict requirements on the force of the material, such as winding and unwinding devices and other tension control applications.

## 7.1 Basic Settings

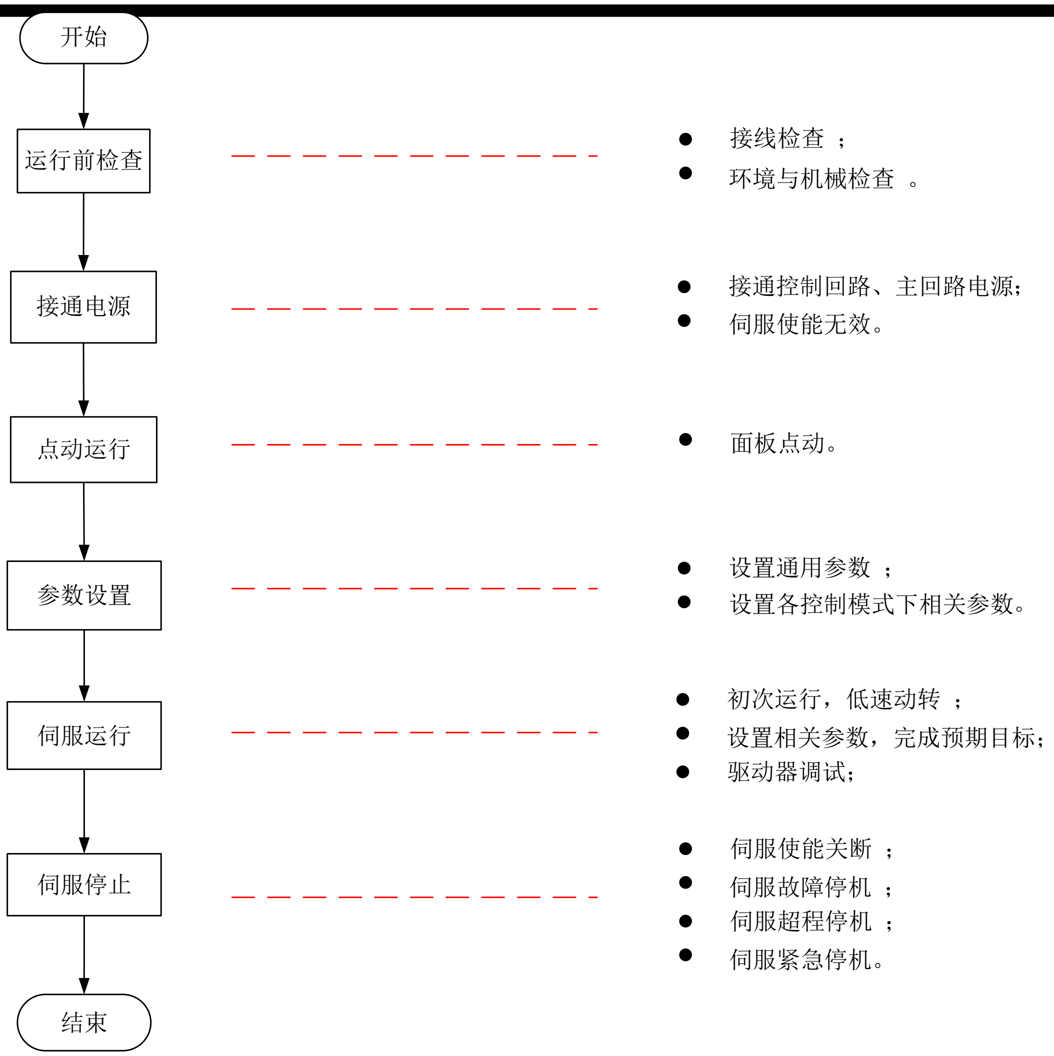



Figure 7-1-2 Servo setting flow

## 7.1.1 Pre-run inspection

- The following checks are required before running the servo driver and servo motor:

| Marks | number | Contents |
|---|---|---|
| | | **Wiring** |
| ☐ | 1 | The AC220V control power supply of the servo driver and the main circuit power input terminals (R, S, T) must be properly connected. |
| ☐ | 2 | The servo driver main circuit output terminals (U, V, W) and the servo motor main circuit cable (U, V, W) must be in phase and securely connected. |
| ☐ | 3 | The main circuit power input terminals (R, S, T) and the main circuit output terminals (U, V, W) of the servo driver cannot be shorted. |
| ☐ | 4 | Each control signal cable of the servo driver is wired correctly: external signal cables such as contracting brake and STO have been connected correctly. |
| ☐ | 5 | The servo driver and servo motor must be reliably grounded. |
| ☐ | 6 | When using an external braking resistor, the two poles of the external braking resistor must be connected between P3 and C on the CN10 terminal. |
| ☐ | 7 | All cables are within the specified force range. |
| ☐ | 8 | The wiring terminals have been insulated. |
| | | **Environment and Machinery** |
| ☐ | 1 | There are no foreign objects such as wire heads and metal shavings inside or outside the servo drive that will cause short circuits in the signal and power lines. |
| ☐ | 2 | The servo drive and external braking resistor are not placed on combustible objects. |
| ☐ | 3 | The mounting of the servo motor, the shaft and the mechanical connection must be reliable. |
| ☐ | 4 | The servo motor and the connected machinery must be in an operable condition. |

## 7.1.2 Turn on the power

1) Turn on the control power and main circuit power

Turn on the AC220V of the control circuit, and the main circuit power supply:

For single-phase 220V main circuit power terminals for R, S, T any two; for three-phase 220V or 380V main circuit power terminals for R, S, T.

When the control circuit power and the main circuit power are turned on, the panel display shows the set node number, and the top and middle two horizontal lights of the first LED from the left are on, indicating that the servo driver is in the operational state, waiting for the servo enable signal from the host computer.

If the drive panel display keeps showing "no.SS", it means the emergency stop signal is valid, please configure the emergency stop signal parameters correctly or connect the emergency stop signal correctly.

If the drive panel display shows a fault, please refer to "Chapter 11 Troubleshooting" to analyze and troubleshoot the cause.

2) Disable servo enable

Refer to "6.2.5 Introduction to CiA402 Control" for a description of the process.

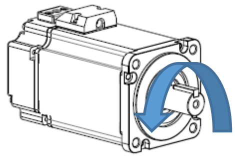
## 7.1.3 Rotation direction selection

By setting "Rotation direction selection (P31.0B)", the direction of rotation of the motor can be changed without changing the polarity of the input command.

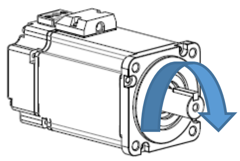
- Associated parameters:

| Serial number P31.0B | Name | Motor rotation positive direction | | | Setting effective | Break Enable | Data Range | 0~1 |
|---|---|---|---|---|---|---|---|---|
| | Access Properties | RW | Unit | - | Related Models | ALL | Factory setting | 0 |

0: Counterclockwise is positive, facing the motor shaft, specifying that its direction of rotation is positive when counterclockwise.



1: Clockwise is positive, facing the motor shaft, specifying its direction of rotation clockwise when it is positive.



## 7.1.4 Contracting brake setting

A contracting brake is a mechanism that prevents the servo motor axis from moving when the servo drive is in a non-operating state, and keeps the motor locked in position so that the moving part of the machinery does not move due to self-weight or external forces. If the servo motor does not come with a contracting brake, this subsection can be skipped.

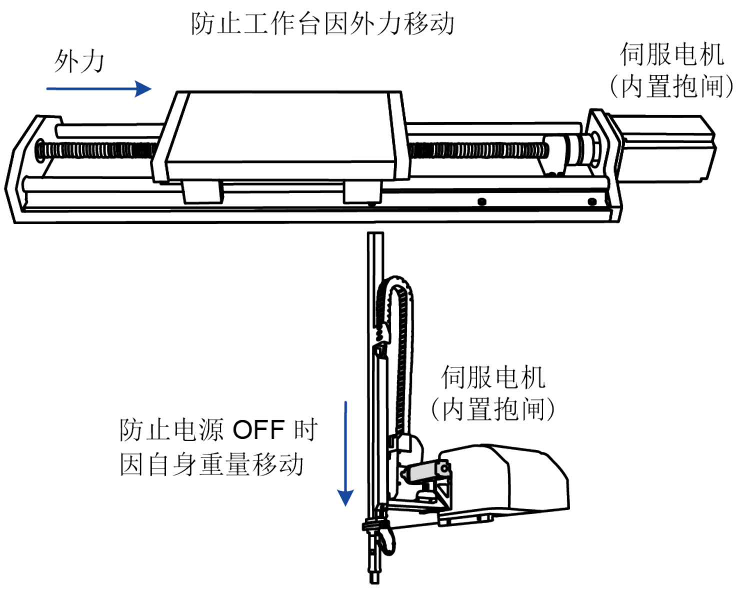



Figure 7.1.4-1 Schematic diagram of contracting brake application

Caution:

1. The contracting brake mechanism built into the servo motor is a non-energy-activated fixed special mechanism, which cannot be used for braking purposes and is only used when the servo motor is brought to a stop.
2. The contracting brake coil may have polarity need to carefully check the instructions of the servo motor.
3. When the motor of the built-in contracting brake is running, the contracting brake may make a clicking sound, which has no effect on the function.
4. When the contracting brake coil is energized (contracting brake open state), magnetic flux leakage may occur at the shaft end and other parts. Please be careful when using instruments such as magnetic sensors near the motor.

1) Contracting brake wiring

The AD2 series servo driver can be equipped with a contracting brake control DO output signal at the CN3 interface, which drives an external intermediate relay circuit to control the motor contracting brake coil.

Note: The maximum output current of DO circuit is DC 50mA, so the control of contracting brake coil should not be connected to DO directly.

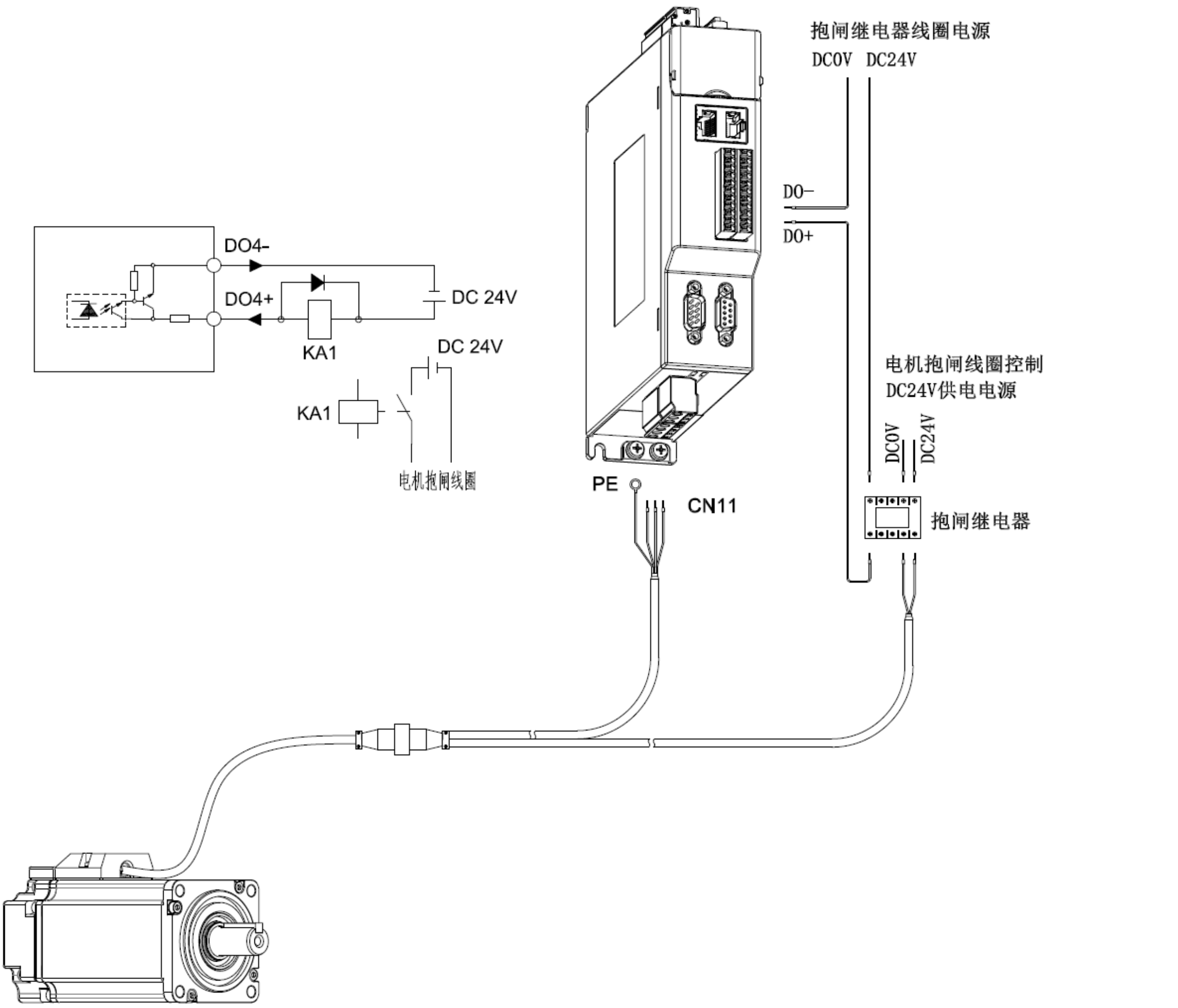



Fig. 7.1.4-2 Diagram of contracting brake wiring

- Note on the wiring of the contracting brake:

1. The cable length of the motor contracting brake needs to fully consider the voltage drop caused by the cable resistance, and the contracting brake needs to ensure that the input voltage is at least 24V.
2. Do not share the power supply with other electrical equipment to prevent the voltage or current from decreasing due to the work of other electrical equipment, which will eventually lead to the false operation of the contracting brake, and the impact of the contracting brake will affect other electrical equipment.
3. Recommend the use of copper cables conforming to the national standard GB/T12706.1-20020.5mm2 or above.
4. If the contracting brake coil with the servo motor has polarity direction, please pay attention to the positive and negative polarity of the wiring.
5. Use an external circuit with a current-continuing diode to prevent reverse voltage breakdown of internal components
6. Please check whether the driver DO parameter is configured as contracting brake output and whether it corresponds to the actual wiring port.

2) Software settings for grips

Before using the contracting brake function, please make sure the following parameters are set correctly.

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| Number P30.02 | Name | Contracting Brake opening time delay | | | Setting effective | Effective immediately | Data Range | 1~1000 |
| | Access Properties | RW | Unit | ms | Related Models | ALL | Factory settings | 100 |
| Since the contracting brake has a mechanical response time, this parameter is used to set the delay time for the opening of the brake. | | | | | | | | |

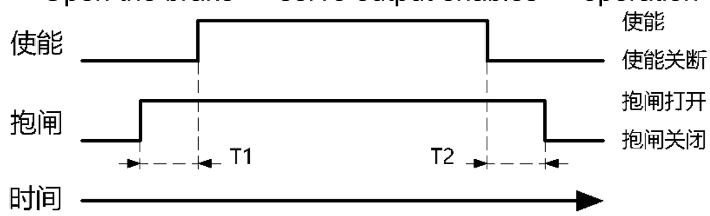
| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| Number P30.03 | Name | Locking delay time | | | Setting effective | Effective immediately | Data Range | 1~1000 |
| | Access Properties | RW | Unit | ms | Related Models | ALL | Factory settings | 100 |
| Since the contracting brake has mechanical response time, this parameter is used in the negative timing control of the contracting brake to set the delay time from the motor holding coil holding to the servo stop output torque. The longer the time, the more obvious the effect of preventing fall, but generally not more than 500ms. | | | | | | | | |

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| Number P30.04 | Name | Contracting Brake Timing | | | Setting effective | Effective immediately | Data Range | 0~1 |
| | Access Properties | RW | Unit | - | Related Models | ALL | Factory setting | 1 |

Change the parameter to set the sequence of servo output and contracting brake action.

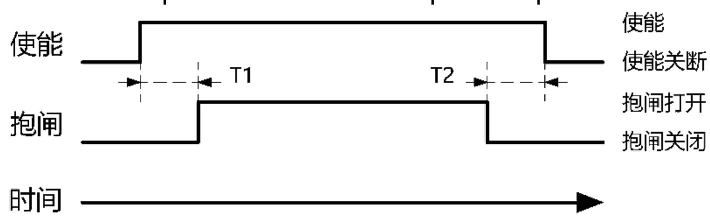
0: Positive timing sequence of contracting brake

Open the brake → servo output enables → operation → servo output shutdown → brake locking




1: Hold gate negative timing

Servo output enable → brake open → operation → brake lock → servo output shutdown




T1: P30.02 contracting brake opening delay time; T2: P30.03 contracting brake holding delay time.

According to the current state of the servo driver, the working timing of the contracting brake mechanism can be divided into the normal state contracting brake timing of the servo driver and the fault state contracting brake timing of the servo driver.

3) Servo driver normal state contracting brake timing (contracting brake negative timing)

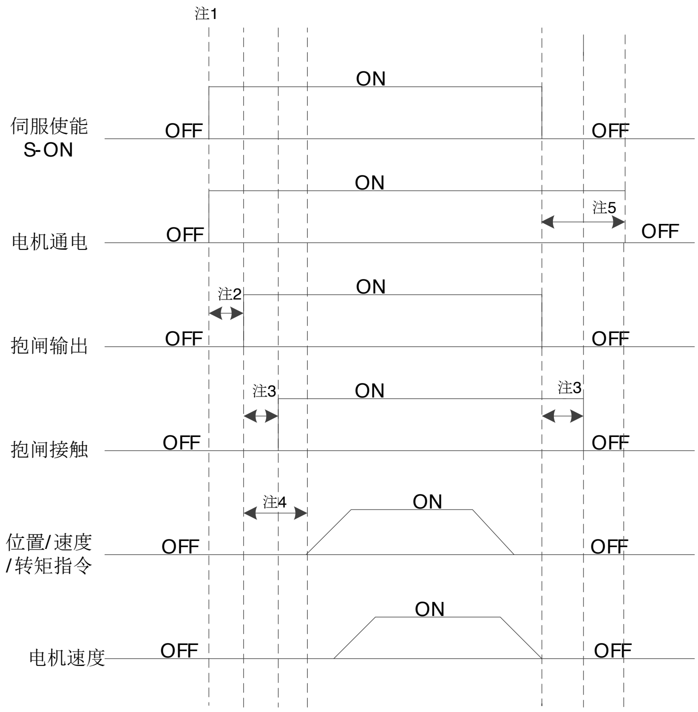



Fig. 7.1.4-3 Timing of contracting brake when the motor is stationary

**Cautions**

- When the servo is enabled ON, the contracting brake output is set to ON and the motor enters the energized state.
- Output of the contracting brake output signal after a delay of 10ms.
- Refer to the motor specifications for the delay time of the contact section of the contracting brake.
- From the time the contracting brake output is set to ON to the time when the command is entered, please interval P30.02 or more.
- When the servo is enabled OFF, the contracting brake output is set to OFF at the same time, and the delay time for the motor to enter the non-energized state after the contracting brake output is OFF can be set by P30.03.
- Do not input position/speed/torque commands during the P30.02 time after the brake output is turned ON from OFF, as this may result in lost commands or operation errors.
- When used in the vertical axis, the mechanical moving part may move slightly due to the self-weight or external force. When the servo motor is stationary, servo enable OFF occurs, and the contracting brake output immediately turns OFF, but the motor remains energized during P30.03 time to prevent the mechanical moving part from moving due to self-weight or external force.
- Forms need to be consistent with the notes

4) Servo drive fault state contracting brake sequence
Servo failure is divided into Type 0 controllable failure and Type 1 uncontrollable failure according to the different ways of stopping. The servo drive fault state contracting brake timing can be divided into the following 2 cases:

- Type 0 failure occurs:
The contracting brake DO output condition is the same as the " contracting brake timing in the normal state of the Servo Drive".
- Type 1 failure occurs:
When a type 1 fault occurs and the contracting brake is enabled, the contracting brake output immediately turns OFF and the motor is powered off.

## 7.1.5 Brake settings

When the motor torque and speed are in opposite directions, energy is transferred from the motor end back into the drive, causing the bus voltage value to rise, and when the voltage rises to a certain height, the energy can only be consumed through the braking resistor. At this time, excessive energy must be consumed according to the braking requirements, otherwise the servo drive will be damaged. Some models of AD2 series Servo Drives are not equipped with internal braking resistors. When the braking resistor is needed to implement the braking function, an additional braking resistor must be applied.

1) Torque measurement
If the motor does a back-and-forth action, the kinetic energy will be converted into electrical energy when braking and fed back to the bus capacitor. If the bus voltage exceeds the braking voltage, the braking resistor will consume the excess feed-back energy. Taking the motor no-load from 3000rpm to standstill as an example, the motor speed curve is as follows:

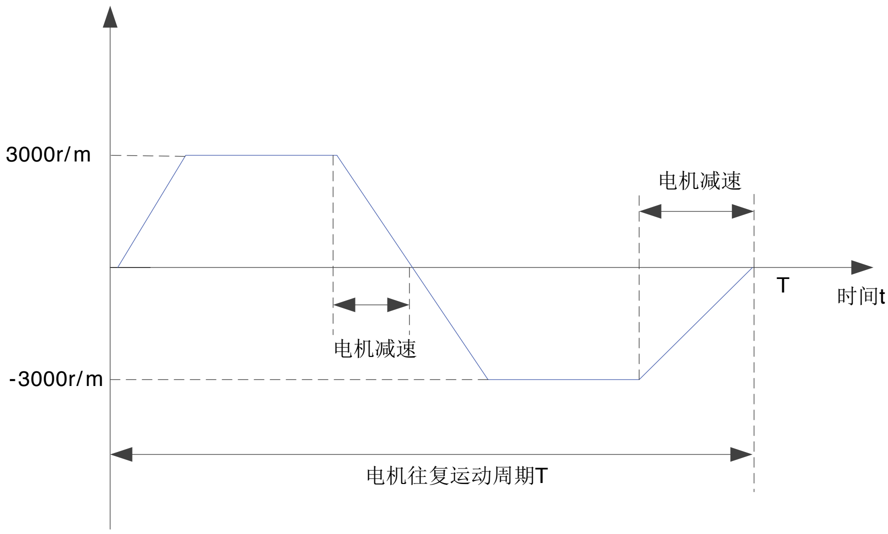



Figure 7.1.5-1 Example of motor speed curve in the absence of external load torque

2) Braking resistor selection

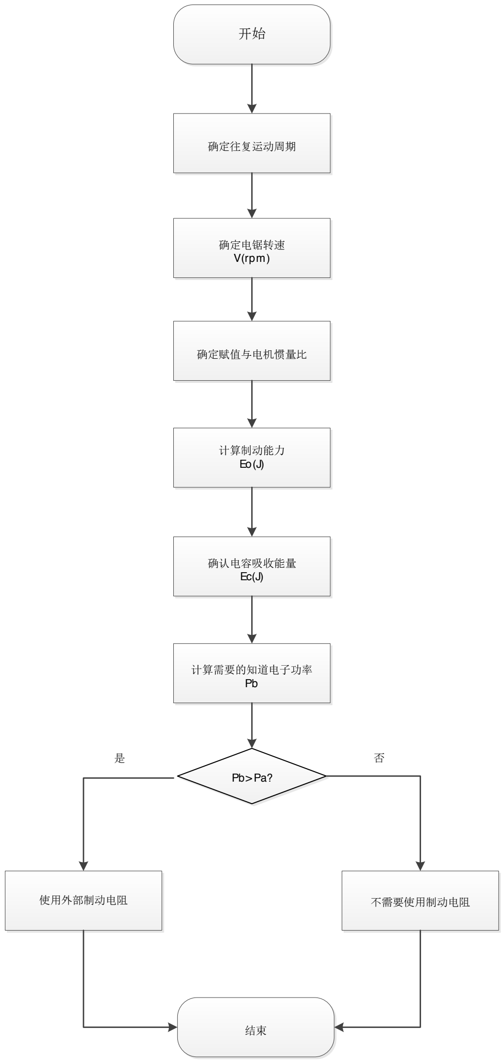



Figure 7.1.5-2 Braking resistor selection flow chart

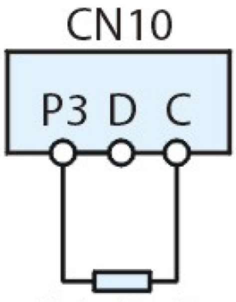
For specific selection of braking resistors, please refer to the braking resistor selection in the product specification section.

A simple calculation here is: Assuming the load inertia is N times the motor inertia, the total braking energy is $(n+1) \times Eo$ when decelerating from 3000 rpm to 0. The energy required to be consumed by the braking resistor is $(n+1) \times Eo - Ec$ joules, excluding the energy absorbed by the capacitor Ec. Assuming a reciprocating motion period of T, the required braking resistor power is $2 \times \frac{(n+1) \times Eo - Ec}{T}$. According to Figure 7.1.5-2, the current use of the braking resistor can be determined, and the power of the braking resistor can be selected.

3) Braking resistor connection and setting

- Using external braking resistors:

  When Pb×T>=EC, an external braking resistor needs to be connected. At this time, according to the different ways of braking resistor cooling. The external braking resistor should be used when the derating 70%, that is: Pr = Pb / (1-70%), and ensure that it is greater than the minimum resistance value allowed by the drive. The two ends of the external braking resistor are connected to P3 and C of the servo CN10 terminal.




- Pb x T < Pa without braking resistor:

  When Pb×T<EC, there is no need to connect the braking resistor, and the braking energy can be absorbed by the bus capacitor only.

| ⚠ **Cautions** |
|---|
| ● Please set the resistance value (P31.10) and power (P31.11) of the external braking resistor correctly, otherwise it will affect the use of this function.<br>● If an external braking resistor is used, make sure that the resistance value meets the minimum allowable resistance value limit. If the resistance value of the braking resistor is too small, the brake tube of the driver will be damaged.<br>● Under natural environment, when the braking resistor can handle power (average value) is used at rated capacity, the temperature of the resistor will rise to 120°C or more (under continuous braking). For safety reasons, use forced cooling to reduce the braking resistor temperature; or use a braking resistor with a thermal switch. For the load characteristics of the braking resistor, please consult the manufacturer. |

4) There is external load torque, and the motor is in power generation

The direction of rotation of the motor is the same as the direction of torque, and the motor outputs energy to the outside. However, in some special cases, the motor torque output is opposite to the direction of rotation, when the motor makes negative work, and the external energy is fed back to the drive through the motor. When the load is continuously generated, it is recommended to adopt the common DC bus scheme.

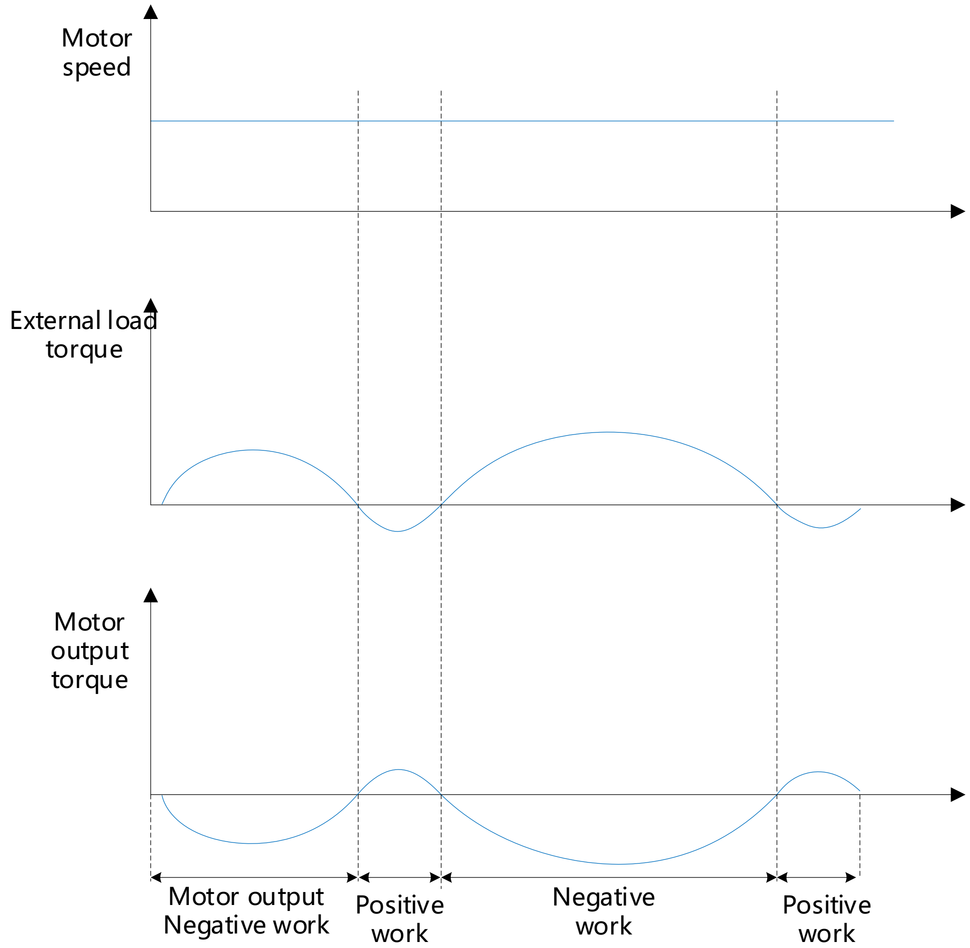



Figure 7.1.5-3 Example of the curve in the presence of external load torque

Take 750W servo motor (rated torque 2.39Nm) as an example, when the external load torque is 60% of the rated torque and the speed reaches 1500rpm, the power fed back to the drive is (60%×2.39)×(1500×2π/60)=225W, considering that the braking resistor needs to be derated by 70%, so the external braking resistor power is 225/(1-70%)= 750W, resistance value of 50Ω.

- Associated parameters:

<table>
<tr><td rowspan="2">Serial number P31.10</td><td>Name</td><td colspan="3">Braking resistor resistance value</td><td>Setting effective</td><td>Break Enable</td><td>Data Range</td><td>1~1000</td></tr>
<tr><td>Access Properties</td><td>RW</td><td>Unit</td><td>ohm</td><td>Related Models</td><td>ALL</td><td>Factory settings</td><td>Model decision</td></tr>
<tr><td colspan="9">This parameter is used to set the actual braking resistor resistance value, the default is the built-in braking resistor resistance value corresponding to each drive model (please refer to the product specification chapter for details). When the external braking resistor is connected, it should be filled in according to the actual value of the external braking resistor resistance.<br>This value, if set to 0, does not provide protection related to brake resistor overload, so it is not recommended to set this value to 0.</td></tr>
</table>

<table>
<tr><td rowspan="2">Serial number P31.11</td><td>Name</td><td colspan="3">Braking resistor power</td><td>Setting effective</td><td>Break Enable</td><td>Data Range</td><td>1~10000</td></tr>
<tr><td>Access Properties</td><td>RW</td><td>Unit</td><td>W</td><td>Related Models</td><td>ALL</td><td>Factory settings</td><td>Model decision</td></tr>
<tr><td colspan="9">This parameter is used to set the actual braking resistor power used, and the default is the built-in braking resistor resistance value corresponding to each drive model (please refer to the product</td></tr>
</table>

| |
|---|
| specification section for details). When the external braking resistor is connected, it should be filled in according to the actual value of the external braking resistor power.<br>This value, if set to 0, does not provide protection related to brake resistor overload, so it is not recommended to set this value to 0. |

5) Servo operation

- Select the appropriate control mode by parameter modification

| Serial number P00.02 | Name | Control channel selection | | | Setting effective | Restart power | Data Range | 0~4 |
|---|---|---|---|---|---|---|---|---|
| | Access Properties | RW | Unit | - | Related Models | ALL | Factory settings | 1 |
| This parameter is used to set the way the control command is given.<br>0: Control panel control<br>Use the LED panel for related operations with limited functionality.<br>1: Controller control<br>Through bus communication such as EtherCAT/CAN Open, the servo drive is enabled, run, stop, reset, etc., and the relevant control commands, such as position command, speed command, torque command, etc., are issued by the bus.<br>2: AD commissioning software control<br>The servo drive is operated by AD Servo Tool commissioning software.<br>3: Analog 1 control<br>Reserved<br>4: Analog 2 control<br>Reserved | | | | | | | | |

Note: The AD2 series servo has five control modes, so be sure to select the appropriate control mode according to the current working conditions

- After inputting the command, the servo motor rotates

| Servo operation instructions | | |
|---|---|---|
| **Records** | **Serial number** | **Content** |
| □ | 1 | For initial operation, a relatively low given command should be set to rotate the motor at low speed to confirm that the motor rotation is correct. |
| □ | 2 | Observe whether the motor rotation direction is correct. If you find that the motor turns opposite to the expected one, check the input command signal and command direction setting signal. |
| □ | 3 | If the motor rotates in the correct direction, the actual speed, time current and other data of the motor can be observed using the drive panel or AD commissioning software. |
| □ | 4 | After the above motor operating conditions are checked, the relevant parameters can be adjusted to make the motor work at the desired operating conditions. |
| □ | 5 | Refer to "Section 9 Adjustment" to commission the Servo Drive. |

- Power-on Timing Diagram

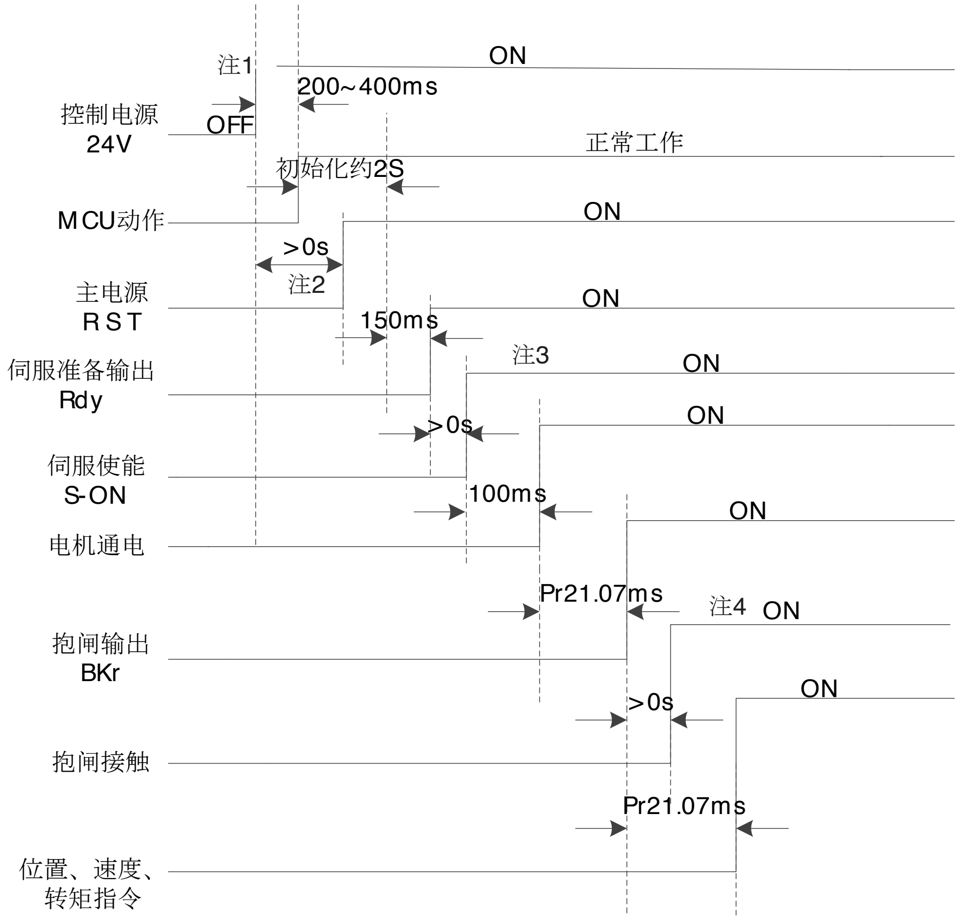



Figure 7.1.6-1 Power-on Timing

Caution:

1. MCU start-up time, determined by the servo power +5V power build-up time.
2. The main power on moment is recommended to be after the control power.
3. The servo enable power-up time depends on the command given.
4. The delay time of the brake contact section action depends on the mechanical action time of the motor's brake, and the P30.02 setting time needs to be greater than the delay time.

- Associated parameters:

| Serial number P30.02 | Name | Gate opening time delay | | | Setting effective | Effective immediately | Data Range | 1~1000 |
|---|---|---|---|---|---|---|---|---|
| | Access Properties | RW | Unit | ms | Related Models | ALL | Factory settings | 100 |
| Since the brake has a mechanical response time, this parameter is used to set the delay time for the opening of the brake. | | | | | | | | |

- Timing chart for shutdown in case of fault or overtravel

1、Fault: Zero speed stop

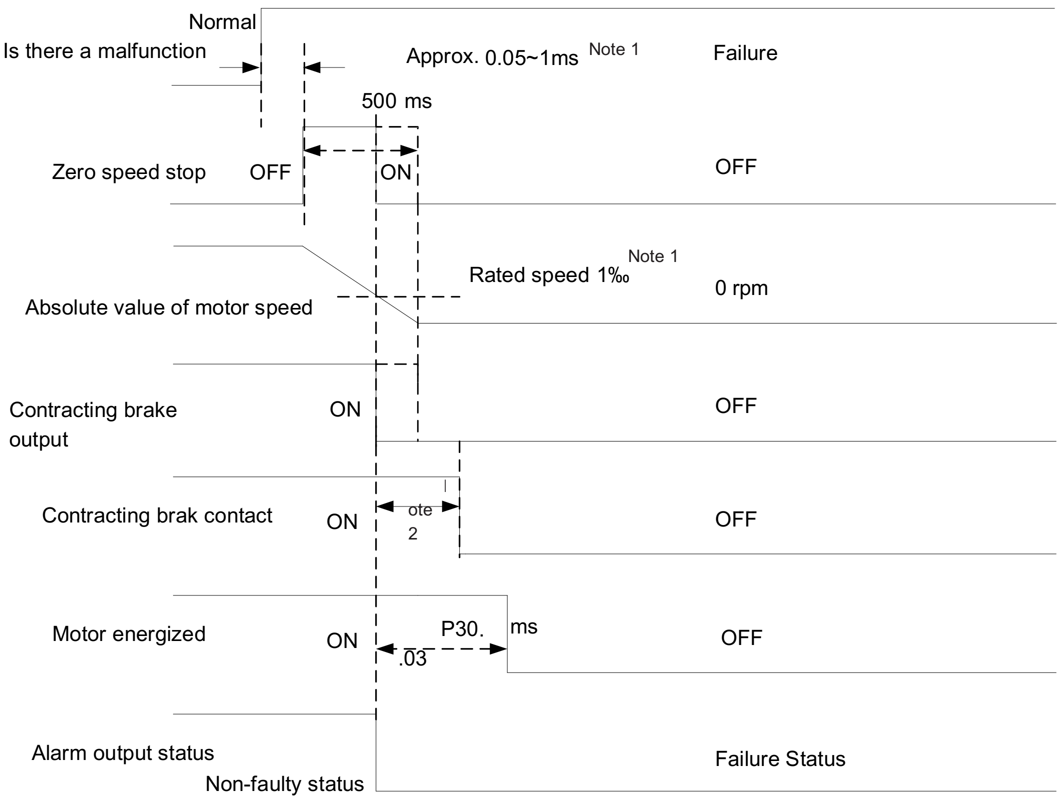



Figure 7.1.6-2 Timing diagram of zero-speed shutdown state at fault

Cautions:

1. If the motor speed reaches below 1‰ of rated speed before 500ms, the zero-speed stop signal becomes invalid.
2. The delay time of the contracting brake contact part action depends on the motor's contracting brake specification, and the P30.03 setting time needs to be greater than the delay time.

2、Failure: Contracting brake forced stop

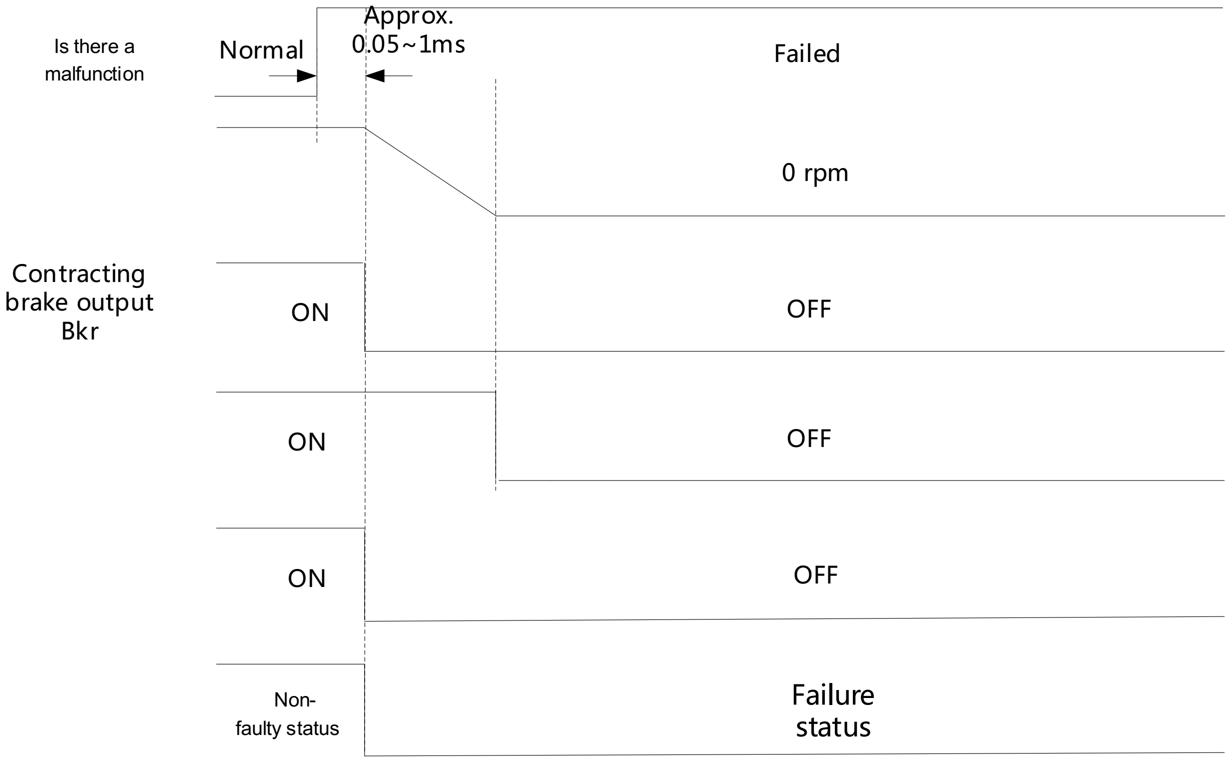



Figure 7.1.6-3 Timing diagram of forced contracting brake state at fault

If the contracting brake output is not connected, it will be coasting stop.

3、 Overrun: zero speed stop, keep the position latching state

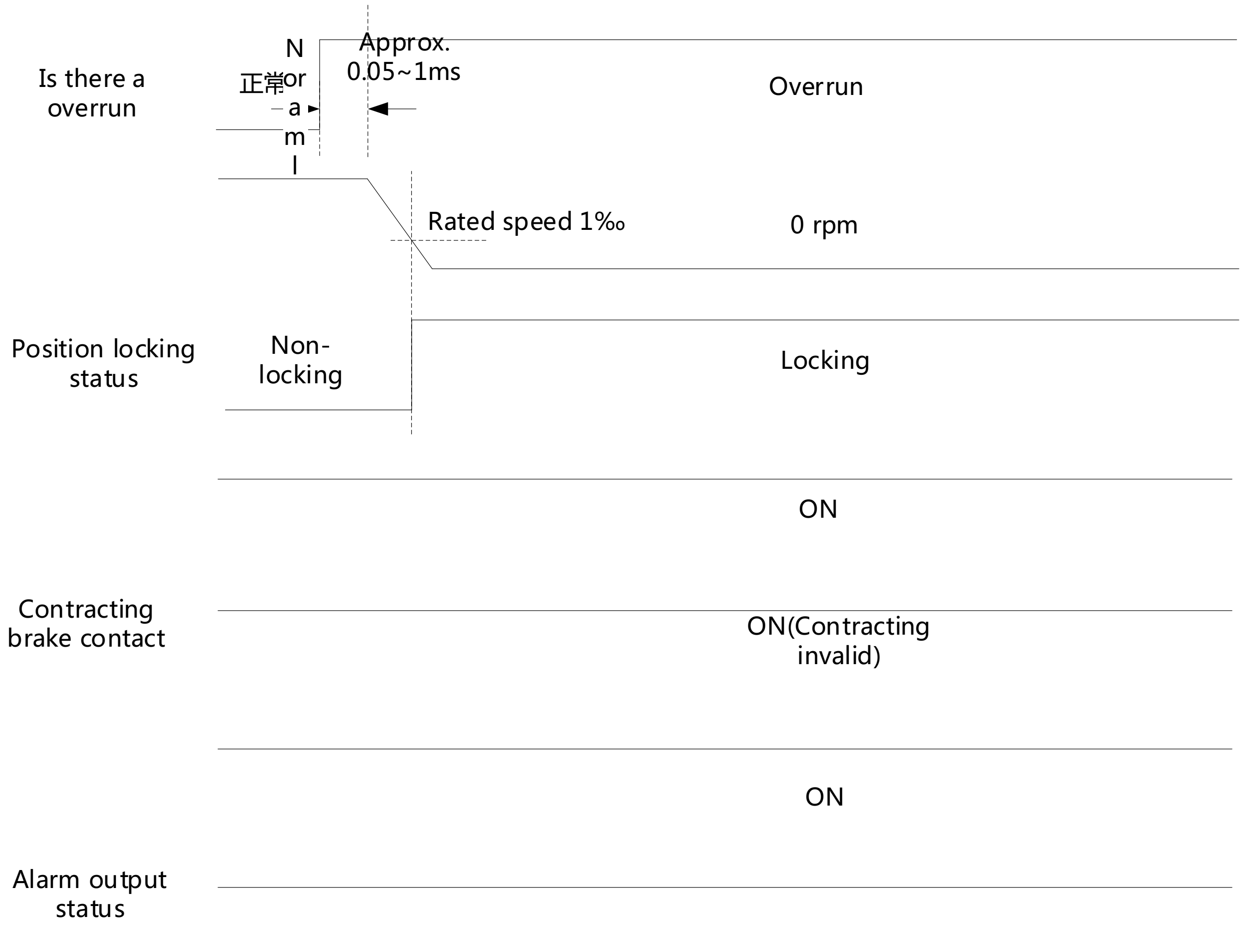



Figure 7.1.7-4 Timing diagram of zero-speed stop state during overrun

4、 Fault reset:

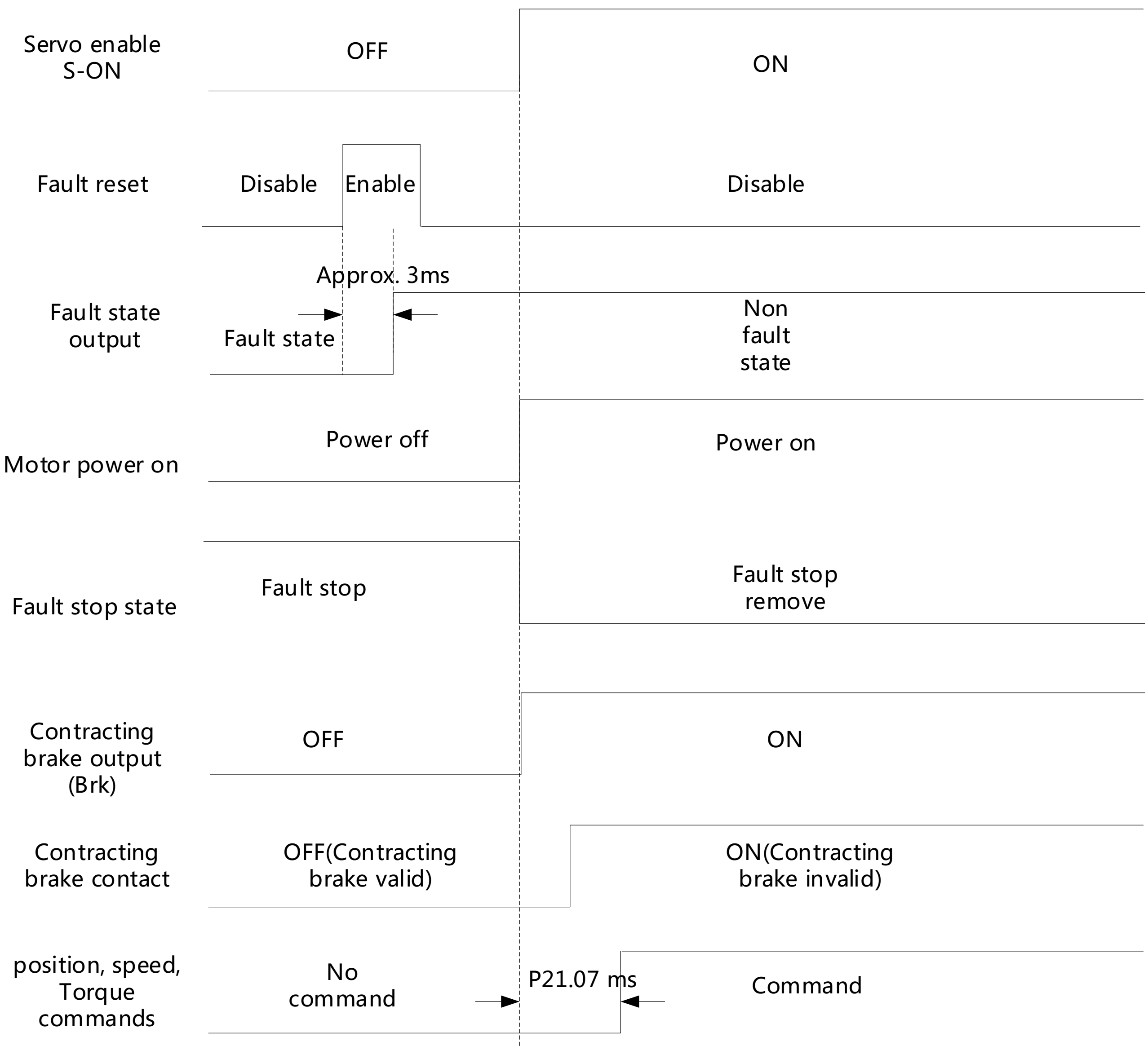



Figure 7.1.6-5 Fault Reset Timing Diagram

## 7.1.6 Servo stops

- According to the different stopping methods, it can be divided into contracting brake stop and zero speed stop; according to the stopping state, it can be divided into motor drive off state and position hold lock state. The details are as follows:

| Shutdown method | Hold brake stop | Zero speed stop |
|---|---|---|
| **Downtime Description** | Servo motor is not energized, forced to stop by contracting brake, deceleration time is decided by contracting brake specification; if there is no contracting brake, it will be coasting stop. | The servo driver outputs the reverse braking torque, and the motor rapidly decelerates to 0. |

| Drive off state | Position hold latching state |
|---|---|
| After the motor stops rotating, the motor is not energized, and if there is a contracting brake, the motor shaft is locked; if there is no contracting brake the motor shaft can rotate freely. | After the motor stops rotating, the motor shaft is locked and cannot rotate freely. |
| If there is a contracting brake, the mechanical impact is larger and the deceleration process is extremely fast; if there is no contracting brake, the deceleration is smooth and the mechanical impact is small, but the deceleration process is slow. | Fast deceleration, there is mechanical shock, but the deceleration process is fast. |

- Servo stop bus object dictionary setting

1) Servo enable invalid stop

Enable is invalid when communication control servo, and servo Disable operation mode is stopped.

Associated with:

| Index | Name | Disable operation option code | | | Settings Effective | Operation settings Downtime effective | Data Structure | VAR | Data Type | Uint16 |
|---|---|---|---|---|---|---|---|---|---|---|
| 605Ch | Access Properties | RW | Can Mapping | NO | Related Mode | ALL | Data Width | 0~3 | Factory Settings | 2 |
| The set values mean the following:<br>0: Turn off the output of the servo unit and coasting to stop the motor.<br>1: After the motor stops at the deceleration ramp, turned off the output of the servo.<br>Note: When the finite-state machine jumps from Operation Enable to Switch On state, use 605Ch to select the stop method. | | | | | | | | | | |

Note: Only in the bus control mode, you can set the servo to enable stop or contracting brake stop

2) Fault shutdown

The servo shutdown method is different depending on the type of fault. Please refer to "Section 11 Troubleshooting" for fault classification.

Associated with:

| Index | Name | Fault reaction option code | | | Settings Effective | Operation settings Downtime effective | Data Structure | VAR | Data Type | Uint16 |
|---|---|---|---|---|---|---|---|---|---|---|
| 605Eh | Access Properties | RW | Can Mapping | NO | Related Mode | ALL | Data Width | 0~2 | Factory Settings | 1 |
| The set values mean the following:<br>0: Turn off the output of the servo unit coasting to stop the motor. | | | | | | | | | | |

1: The motor stops at the deceleration ramp.
2: The motor stops at a fast stop ramp.
3: Motor stops at maximum current (speed control, speed given command is 0).
Note: After an alarm occurs, i.e., before the system jumps into the Fault finite-state machine, use 605Eh to select the shutdown method.

3) Overtravel stop

Terminology:

"Overtrun": is the mechanical movement beyond the designed safe range of movement.

"Over-range stop": It is a safety function that when the moving part of the machinery is beyond the safe moving range, the output level of the limit switch changes, and the servo driver makes the servo motor stop forcibly.

When the servo motor drives the vertical axis, the workpiece may fall off if it is in the overtravel state. To prevent the workpiece from falling, the servo program has fixed the overtravel stop method "zero speed stop, position lock state". If the workpiece is moving in a straight line, be sure to connect a limit switch to prevent damage to the machine. In the overtravel condition, the motor (workpiece) can be reversed by inputting a reverse command.

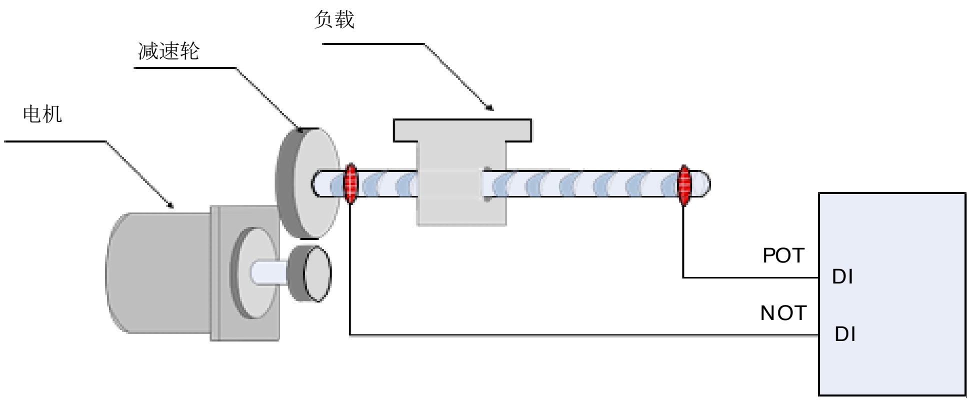



Figure 7.1.7-1 Installation schematic of limit switch

When using the overtrun stop function, any two of the five digital input ports from DI1 to DI5 of the CN3 port of the servo drive should be configured as function 2/102 (forward motion disable) and function 3/103 (reverse motion disable), respectively, with corresponding configuration parameter numbers P70.01 to P70.05, to receive limit switch input level signals. Set 2 and 3 for normally open logic, and 102 and 103 for normally closed logic. depending on whether the DI terminal level is valid, the drive will enable or disable the overrun stop state.

4) Quick stop

- The servo has 2 types of quick stops:

1. Use the SS interface of the CN3 port to input the emergency stop signal and configure the correct parameters according to the level logic of the external input

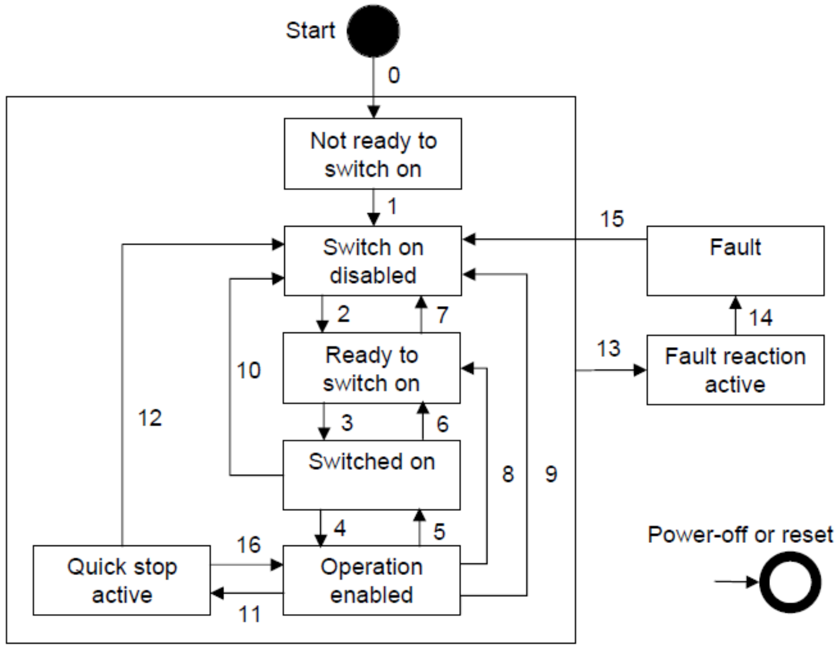
| Serial number P70.06 | Name | Emergency stop input logic | | | Setting effective | Effective immediately | Data Range | 6, 106 |
|---|---|---|---|---|---|---|---|---|
| | Access Properties | RW | Unit | - | Related Models | ALL | Factory settings | 6 |
| This parameter is used to select the logic setting for the emergency stop input<br>6: Normally open logic, representing the valid state when corresponding to the servo's emergency stop state.<br>106: Normally closed logic, representing the emergency stop state of the corresponding servo in case of invalid state. | | | | | | | | |

2. When bit2 (Quick stop) of control word 6040h is 0, the quick stop is executed, and the stop method is selected by object dictionary 605Ah.

<table>
<tr><td>Index</td><td>Name</td><td colspan="3">Quick stop option code</td><td>Settings Effective</td><td>Operation settings Downtime effective</td><td>Data Structure</td><td>VAR</td><td>Data Type</td><td>Uint16</td></tr>
<tr><td>605Ah</td><td>Access Properties</td><td>RW</td><td>Can Mapping</td><td>NO</td><td>Related Mode</td><td>ALL</td><td>Data Width</td><td>0~7</td><td>Factory Settings</td><td>2</td></tr>
<tr><td colspan="11">The set values mean the following:<br>0: Turn off the output of the servo unit and coasting to stop the motor.<br>1: After the motor stops at the deceleration ramp, it jumps to the Switch on disabled state.<br>2: After the motor stops at the fast stop ramp, it jumps to the Switch on disabled state.<br>3: After the motor stops at the maximum current, it jumps to Switch on disabled state (speed control, speed given command is 0).<br>4: Undefined<br>5: After the motor stops at the deceleration ramp, it still stops at QuickStop state.<br>6: After the motor stops at the Quick Stop ramp, it still stops at QuickStop.<br>7: After the motor stops at the maximum current, it still stops in QuickStop state (speed control, speed give command is 0).<br>Note: When the finite-state machine jumps from Operation Enable to Quick reaction active state, use 605Ah (Quick stop option code) to select the stopping method.</td></tr>
</table>

## 7.2 Servo status setting

The Servo Drive must be guided in accordance with the process specified in the standard 402 protocol to use the AD2 Series Drive before the Servo Drive can operate in the specified state.




- The states are described in the following table:

| | |
|---|---|
| **Start** | This state is entered automatically after power-up or reset. |
| **Initialize**<br>**Not ready to switch on** | The control is powered on, the driver initializes, internal self-tests, and remains in this state until initialization is complete. |
| **Servo no fault**<br>**Switch on disable** | Servo initialization is complete, and the Servo Drive is fault-free, or errors have been eliminated. Drive parameters can be set. |
| **Servo ready**<br>**Ready to switch on** | The servo drive is ready. Drive parameters can be set. |
| **Enable**<br>**Switch on** | The servo drive waits for the servo enable to be turned on. Drive parameters can be set. |
| **Servo operation**<br>**Operation Enable** | The drive is running normally, a servo operation mode is enabled, the motor is powered on, and the motor rotates when the command is not 0. |

| | |
|---|---|
| | If the drive parameter property is "Run Change", it can be set, otherwise it cannot be set. |
| **Quick stop**<br>**Quick stop active** | The Quick Stop function is activated, and the drive is performing the Quick Stop function. The drive parameter property "Run Change" can be set, otherwise it cannot be set. |
| **Fault stops**<br>**Fault action active** | The drive has failed and is in the process of performing a failover. If the drive parameter property is "Run Change", it can be set, otherwise it cannot be set. |
| **Fault**<br>**Fault** | Fault shutdown is complete, and all drive functions are disabled while allowing drive parameters to be changed for troubleshooting. |

- Control commands and status switching:

| **CiA402 state switching** | | **Control word 6040h** | **Status word 6041h bit0~bit9*1** |
|---|---|---|---|
| 0 | Power up-->Initialization | Natural transition without control commands | 0x0000 |
| 1 | Initialization --> servo without fault | Natural transition, no control command required if an error occurs during initialization, go directly to 13 | 0x0250 |
| 2 | No servo failure-->Servo ready | 0x0006 | 0x0231 |
| 3 | Servo ready --> waiting to turn on servo enable | 0x0007 | 0x0233 |
| 4 | Wait to turn on servo enable --> servo operation | 0x000F | 0x0237 |
| 5 | Servo run --> wait to turn on servo enable | 0x0007 | 0x0233 |
| 6 | Wait to turn on servo enable --> servo ready | 0x0006 | 0x0231 |
| 7 | Servo ready --> No servo failure | 0x0000 | 0x0250 |
| 8 | Servo run-->Servo ready | 0x0006 | 0x0231 |
| 9 | Servo operation-->No servo failure | 0x0000 | 0x0250 |
| 10 | Waiting to turn on servo enable --> no servo failure | 0x0000 | 0x0250 |
| 11 | Servo operation --> quick stop | 0x0002 | 0x0217 |
| 12 | Quick stop-->no servo failure | Quick stop mode 605A is selected as 0~3, after the stop is completed, natural transition without control command | 0x0250 |
| 13 | Fault shutdown | Once the servo drive fails in any state other than "fault", it will automatically switch to the fault stop state without control commands. | 0x021F |
| 14 | Failure to stop-->Failure | Natural transition after failure shutdown is complete, no control commands required | 0x0218 |
| 15 | Fault-->Servo no fault | 0x80; bit7 rising edge is valid; bit7 is held as 1, all other control instructions are invalid. | 0x0250 |
| 16 | Quick stop --> servo operation | Fast stop mode 605A is selected as 5~7, and after the stop is completed, send 0x0F | 0x0237 |

Note: *1. Because the status word 6041h bit10~bit15 (bit14 is meaningless) is related to the operation status of each servo mode, it is indicated by "0" in the above table.

# 7.2.1 Control word 6040h

| Index | Name | Control words control word | | | Settings Effective | Operation setting shutdown is effective | Data Structure | VAR | Data Type | Uint16 |
|---|---|---|---|---|---|---|---|---|---|---|
| 6040h | Accessible Questioning sex | RW | Can you map | RPDO | Related Mode | ALL | Data Scope | 0~65535 | Factory Settings | 00 |

Set control commands:

| Bit | Name | Description |
|---|---|---|
| 0 | Servo ready | 1 - valid, 0 - invalid |
| 1 | Turn on the main circuit electricity | 1 - valid, 0 - invalid |
| 2 | Quick Shutdown | 1 - invalid, 0 - valid |
| 3 | Servo operation | 1 - valid, 0 - invalid |
| 4~6 | | Related to servo operation mode |
| 7 | Fault Reset | For resettable faults and warnings, the fault reset function is executed;<br>bit7 rising edge is valid;<br>bit7 is held to 1 and all other control commands are invalid. |
| 8 | Suspension | Please refer to the object dictionary 605Dh for the pause method in each mode. |
| 9~10 | NA | Reserved. |
| 11~15 | Manufacturer customization | Reserved, undefined |

Notes:
1. it is meaningless to assign each bit of the control word alone and must be used together with other bits to form a control instruction.
2. bit0~bit3 and bit7 have the same meaning in each servo mode, and commands must be sent to direct the servo drive into the expected state in accordance with the CiA402 finite-state machine switching process, with each command corresponding to a determined state.
3. bit4~bit6 are related to each servo mode (please check the control commands in different modes).

### 7.2.2 Status word 6041h

| Index | Name | Status word | | | Settings Effective | - | Data Structure | VAR | Data Type | Uint16 |
|---|---|---|---|---|---|---|---|---|---|---|
| 6041h | Accessibility | RO | Can you map | TPDO | Related Mode | ALL | Data Scope | 0~FFFF | Factory Settings | 00 |

Reflects servo status:

| Set value (binary) | Description |
|---|---|
| xxxx xxxx x0xx 0000 | Not ready to switch on |
| xxxx xxxx x1xx 0000 | Switch on disabled |
| xxxx xxxx x01x 0001 | Ready to switch on |
| xxxx xxxx x01x 0011 | Switched on |
| xxxx xxxx x01x 0111 | Operation enabled |
| xxxx xxxx x00x 0111 | Quick stop active |
| xxxx xxxx x0xx 1111 | Fault reaction active |
| xxxx xxxx x0xx 1000 | Fault |

Notes:

1. Each bit of the status word is meaningless when read alone and must be composed together with other bits to feed back the current state of the servo.
2. bit0~bit9 have the same meaning in each servo mode, and the control word 6040h sends the command in sequence, and the servo feeds back a determined state.
3. bit12~bit13 are related to each servo mode (please check the control commands in different modes).
4. The bit10 bit11 bit15 has the same meaning in each servo mode and gives feedback on the state of the servo after executing a certain servo mode.

# 7.3 Servo mode setting

## 7.3.1 Introduction of servo mode

The servo pre-run mode can be set via object dictionary 6060h. The servo current operation mode can be viewed via object dictionary 6061h.

- Mode setting 6060h:

| Index | Name | Mode selection Modes of operation | | | Setting effective | - | Data Structure | VAR | Data Type | Int8 |
|---|---|---|---|---|---|---|---|---|---|---|
| 6060h | Accessibility | RW | Can map | RPDO | Related Models | ALL | Data Scope | 0~10 | Factory settings | 00 |

Set the polarity of position command, speed command, and torque command.

| Set value | Name | Description |
|---|---|---|
| 0 | No mode setting | Reserved |
| 1 | Wheel position mode (pp) | Reference wheel position mode (pp) |
| 2 | No mode setting | Reserved |
| 3 | Wheel speed mode (pv) | Reference wheel velocity mode (pv) |
| 4 | Wheel torque mode (pt) | Reference wheel torque mode (pt)*Note |
| 5 | No mode setting | Reserved |
| 6 | Back to zero mode (hm) | Reference home zero return mode (hm) |
| 7 | Interpolation mode (ip) | Reference position interpolation mode (ip)*Note |
| 8 | Periodic synchronous position mode (csp) | Reference period synchronous position mode (csp) |
| 9 | Periodic synchronous velocity mode (csv) | Reference period synchronous velocity mode (csv) |
| 10 | Periodic synchronous torque mode (cst) | Reference period synchronous torque mode (cst) |

*Note: This control mode is not supported by AD2 series.

- Mode display 6061h:

| Index | Name | Operation mode display<br>Modes of operation display | | Setting effective | - | Data Structure | VAR | Data Type | Uint16 |
|---|---|---|---|---|---|---|---|---|---|
| 6061h | Accessibility | RO | Can mapping | TPDO | Related Models | ALL | Data Range | 0~10 | Factory settings | 00 |

Set the polarity of position command, speed command, and torque command.

| Set value | Name | Description |
|---|---|---|
| 0 | No mode setting | Reserved |
| 1 | Wheel position mode (pp) | Reference wheel position mode (pp) |
| 2 | No mode setting | Reserved |
| 3 | Wheel speed mode (pv) | Reference wheel velocity mode (pv) |
| 4 | Wheel torque mode (pt) | Reference wheel torque mode (pt)*Note |
| 5 | No mode setting | Reserved |
| 6 | Return to zero mode (hm) | Reference home zero return mode (hm) |
| 7 | Interpolation mode (ip) | Reference position interpolation mode (ip)*Note |
| 8 | Cycle synchronous position mode (csp) | Reference period synchronous position mode (csp) |
| 9 | Cyclic synchronous velocity mode (csv) | Reference period synchronous velocity mode (csv) |
| 10 | Periodic synchronous torque mode (cst) | Reference period synchronous torque mode (cst) |

*Note: This control mode is not supported by AD2 series.

## 7.3.2 Mode Switching

- Notes on the use of mode switching:

1. When the servo drive is in any state, unexecuted position commands are discarded after cutting from the wheel position mode or the cycle synchronous position mode to other modes.
2. When the servo drive is in any state, after cutting to other modes from the wheel speed mode, wheel torque mode, cycle synchronous speed mode, cycle synchronous torque mode, it first performs a ramp stop, and after the stop is completed, it can cut to other modes.
3. When the servo is in zero return mode and is running, it cannot be cut to other modes; when zero return is completed or is interrupted (fault or invalid enable), it can be cut to other modes.
4. When switching from other modes to cycle synchronous mode in servo operation status, please send commands at least 1ms apart, otherwise command loss or error will occur.

### 7.3.3 Each mode supports communication cycles

| Cycle time | Wheel Position Mode (PP) | Zero return mode (HM) | Cycle Synchronization Position Mode (CSP) | Cycle Synchronization Speed Mode (CSV) | Wheel speed mode (PV) | Wheel Torque Mode (PT) | Cyclic Synchronous Torque Mode (CST) |
|---|---|---|---|---|---|---|---|
| 100us | X | X | X | X | X | X | X |
| 200us | Y | Y | Y | Y | Y | X | Y |
| 400us | Y | Y | Y | Y | Y | X | Y |
| 1ms | Y | Y | Y | Y | Y | X | Y |

The synchronization periods supported by each mode of 1ms and below are shown in the table above and may lead to operational errors when used outside the specifications.

1ms or more, the value of the position loop control cycle (AD2 series servo position loop control cycle is 200us) integer times of the synchronization cycle can also be supported, but the maximum should not exceed 8ms, otherwise the servo control effect can not be guaranteed.

# 7.4 Cycle synchronous position mode (csp)

In the cyclic synchronous position mode, the upper controller completes the position command planning, and then sends the planned target position (607Ah) to the servo drive in a cyclic synchronous manner, and the position, speed and torque control is done internally by the servo drive.

## 7.4.1 Control Block Diagram

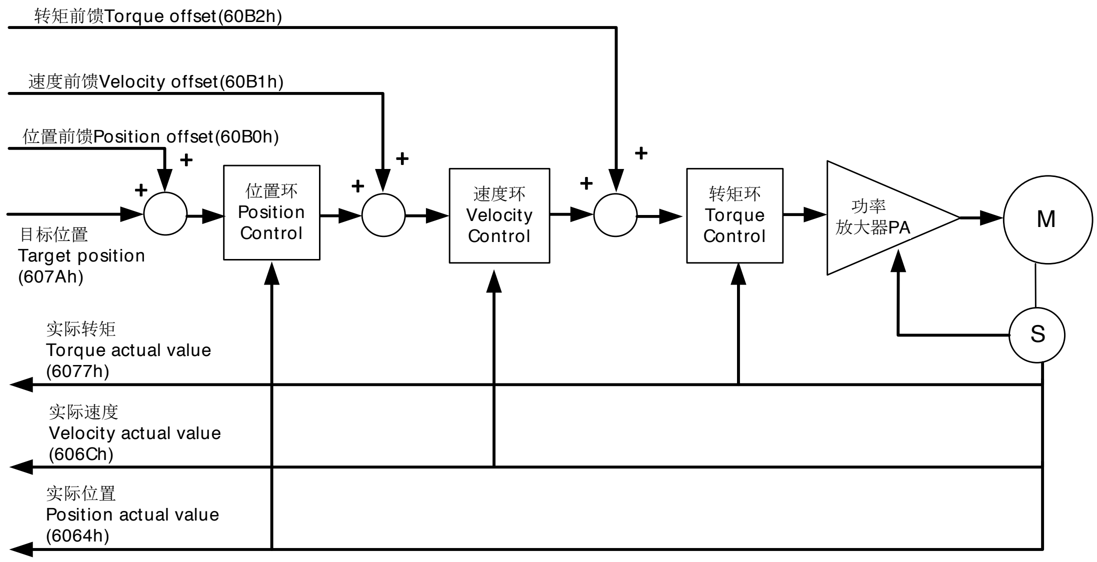



Figure 7.4.1-1 Block diagram of cycle synchronous position control

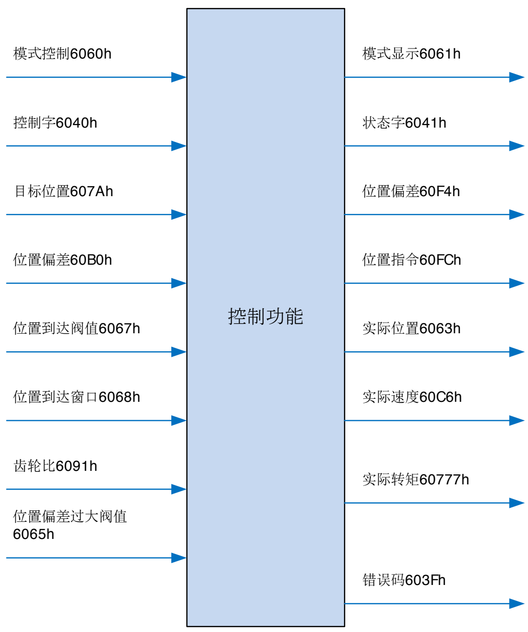



Figure 7.4.1-2 Input and output objects

## 7.4.2 Related objects

| Control word 6040h | | |
|---|---|---|
| **position** | **Name** | **Description** |
| 0 | Servo ready<br>Switch on | bit0~bit3 are 1, which means start operation |
| 1 | Turn on the main circuit electrical<br>Enable voltage | |
| 2 | Quick stop<br>Quick stop | |
| 3 | Servo operation<br>Enable operation | |
| 8 | Pause<br>Halt | 0: Servo is set by Bit0~bit3<br>1: Servo is set by 605Dh to pause. |

| Status word 6041h | | |
|---|---|---|
| **position** | **Name** | **Description** |
| 10 | Target Reach | 0: Target position not reached<br>1: Target position reached |
| 11 | Internal limit actice for software<br>Internal location overrun | 0<br>: Position command and position feedback are not exceeded<br>1: Position command or position feedback is exceeded |
| 12 | Slaves follow command<br>Drive follows the command Value | 0: The slave does not follow the instruction<br>1: The slave follows the instruction The slave is in the running state and starts to execute the position instruction, the position is 1; otherwise, it is 0 |
| 13 | Following error<br>Following error | 0: No excessive<br>position deviation fault<br>1: Excessive position deviation fault occurs |
| 15 | Return to start<br>Home Find | 0: Return to start not completed<br>1: Reture to start completed |

| Index (hex) | Subindex (hex) | Name | Access | Data Type | Unit | Setting range | Default Value |
|---|---|---|---|---|---|---|---|
| 603F | 0 | Error Code | RO | Uint16 | - | 0~65535 | 0 |
| 6040 | 0 | Control word | RW | Uint16 | - | 0~65535 | 0 |
| 6041 | 0 | Status word | RO | Uint16 | - | 0~65535 | 0 |
| 6060 | 0 | Operation Mode | RW | Int8 | - | 0~10 | 0 |
| 6061 | 0 | Mode Display | RO | Int8 | - | 0~10 | 0 |
| 6062 | 0 | Location commands | RO | Int32 | Command unit | - | - |

| Index (hex) | Subindex (hex) | Name | Access | Data Type | Unit | Setting range | Default Value |
|---|---|---|---|---|---|---|---|
| 6063 | 0 | Location Feedback | RO | Int32 | Encoder units | - | - |
| 6064 | 0 | Location Feedback | RO | Int32 | Command unit | - | - |
| 6065 | 0 | Position Deviation Excess Threshold | RW | Uint32 | Command unit | 0~(232-1) | 3145728 |
| 6067 | 0 | Position reaches threshold | RW | Uint32 | Encoder units | 0~65535 | 734 |
| 6068 | 0 | Location arrival window | RW | Uint16 | ms | 0~65535 | x10 |
| 606C | 0 | Actual speed | RO | Int32 | Command unit/s | - | - |
| 6072 | 0 | Maximum torque | RPDO | Uint16 | 0.10% | 0~5000 | 5000 |
| 6077 | 0 | Actual torque | RO | Int16 | 0.10% | -5000~5000 | 0 |
| 607A | 0 | Target Location | RW | Int32 | Command unit | -231~(231-1) | 0 |
| 6091 | 1 | Motor resolution | RW | Uint32 | - | 0~(232-1) | 1 |
| | 2 | Axis Resolution | RW | Uint32 | - | 1~(232-1) | 1 |
| 60B0 | 0 | Position bias | RW | Int32 | Command unit | -231~(231-1) | 0 |
| 60B1 | 0 | Speed bias | RW | Int32 | Command unit/s | -231~(231-1) | 0 |
| 60B2 | 0 | Torque bias | RW | Int32 | 0.10% | -5000~5000 | 0 |
| 60F4 | 0 | Position deviation | RO | Int32 | Command unit | - | - |
| 60FC | 0 | Location commands | RO | Int32 | Encoder units | - | - |
| Note: See "Section 8 Parameter and Object Dictionary Details" for more details on using the relevant objects. | | | | | | | |

## 7.4.3 Related function settings

1) Positioning completed

| Index | Sub-index | Name | Description |
|---|---|---|---|
| 6067 | 0 | Position reaches threshold | When the position deviation is within the ±6067h interval and the time reaches 6068, the DO signal of positioning completion is valid, while bit10=1 of 6041. if either of the two conditions is not satisfied, the position arrival is invalid. |
| 6068 | 0 | Location arrival window | |

2) Position Deviation Excess Threshold

| Index | Sub-index | Name | Description |
|---|---|---|---|
| 6065 | 0 | Position Deviation Excess Threshold | When the position deviation is greater than this value, a position deviation too large fault occurs and the panel displays an alarm, while bit 13 of the status word is set. When 6065h=0xFFFFFFFF, the drive does not perform excessive position deviation detection. |

## 7.4.4 Recommended configuration

1) Cyclic synchronous position mode (csp) with the following basic configuration:

| RxPDO | TxPDO | Remarks |
|---|---|---|
| 6040：control word | 6041: Status word status word | Must |
| 607A: target position target position | 6064: Position feedback position actual value | Must |
| 6060: Mode selection modes of operation | 6061: modes of operation display | Optional |

# 7.5 Cyclic synchronous velocity mode (csv)

In the cyclic synchronous speed mode, the upper controller sends the calculated target speed of 60FF cyclically synchronized to the servo driver, and the speed and torque adjustment is executed by the servo internally.

## 7.5.1 Control Block Diagram

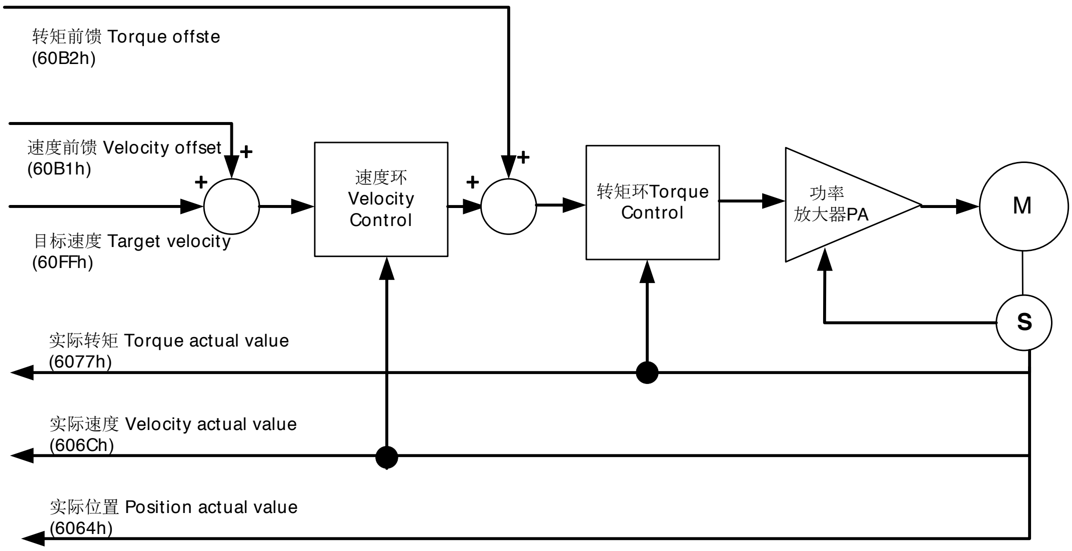



Figure 7.5.1-1 Block diagram of cycle synchronous speed control

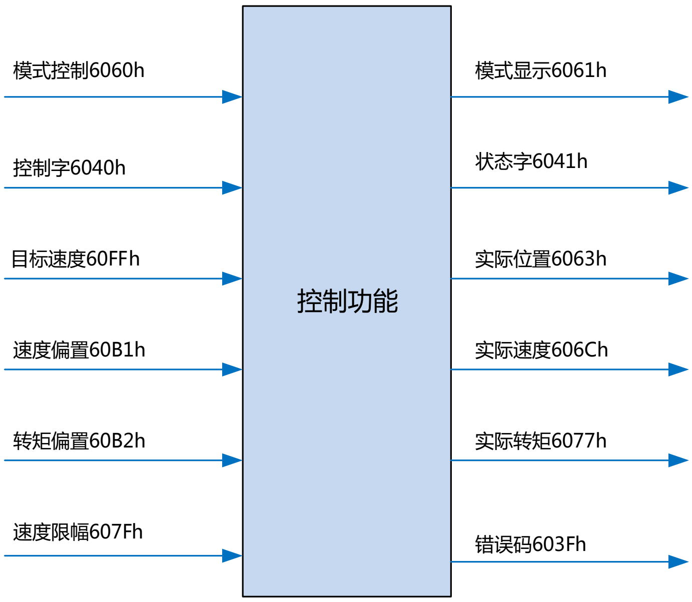



Figure 7.5.1-2 Input and output objects

## 7.5.2 Related objects

| Control word 6040h | | |
|---|---|---|
| **position** | **Name** | **Description** |
| 0 | Servo ready<br>Switch on | bit0~bit3 are 1, which means start operation |
| 1 | Turn on the main circuit electrical<br>Enable voltage | |
| 2 | Quick stop | |
| 3 | Servo operation<br>Enable operation | |
| 8 | Pause Halt | 0: Servo set by bit0~bit3<br>1: Servo set by 605Dh to pause. |

| Status word 6041h | | |
|---|---|---|
| **position** | **Name** | **Description** |
| 10 | Target Reach | 0:<br>Target speed not reached<br>1: Target speed reached |
| 12 | Slaves follow command<br>Drive follows the command Value | 0: Slave does not<br>follow the command 1: Slave follows the command |
| 13 | | Undefined |
| 15 | Return to start<br>Home Find | 0: Return to start not completed<br>1: Return to start completed |

| Index(hex) | Subindex (hex) | Name | Access | Data Type | Unit | Setting range | Default Value |
|---|---|---|---|---|---|---|---|
| 603F | 0 | Error Code | RO | Uint16 | - | 0~65535 | 0 |
| 6040 | 0 | Control words | RW | Uint16 | - | 0~65535 | 0 |
| 6041 | 0 | Status word | RO | Uint16 | - | 0~65535 | 0 |
| 6060 | 0 | Operation Mode | RW | Int8 | - | 0~10 | 0 |
| 6061 | 0 | Mode Display | RO | Int8 | - | 0~10 | 0 |
| 6063 | 0 | Location Feedback | RO | Int32 | Encoder units | - | - |
| 6064 | 0 | Location Feedback | RO | Int32 | Command unit | - | - |
| 606C | 0 | Actual speed | RO | Int32 | Command unit/s | - | - |
| 606D | 0 | Speed reaches threshold | RW | Uint32 | Encoder units | 0~65535 | 0 |
| 606E | 0 | Speed to window | RW | Uint16 | ms | 0~65535 | 0 |
| 6077 | 0 | Actual torque | RO | Int16 | 0.10% | -5000~5000 | 0 |
| 607F | 0 | Maximum speed | RW | Uint32 | Command unit/s | 0~(232-1) | 230 |
| 6083 | 0 | Acceleration | RW | Uint32 | Command unit/S2 | 0~(232-1) | 100 |

| Index(hex) | Subindex (hex) | Name | Access | Data Type | Unit | Setting range | Default Value |
|---|---|---|---|---|---|---|---|
| 6084 | 0 | Deceleration | RW | Uint32 | Command unit/S$^{2}$ | 0~(232-1) | 100 |
| 60B1 | 0 | Speed Offset | RW | Int32 | Command unit/s | -231~(231- 1) | 0 |
| 60B2 | 0 | Torque bias | RW | Int32 | 0.10% | -5000~5000 | 0 |
| 60E0 | 0 | Forward torque limiting | RW | Uint16 | 0.10% | 0~5000 | 5000 |
| 60E1 | 0 | Reverse torque limiting | RW | Uint16 | 0.10% | 0~5000 | 5000 |
| 60FF | 0 | Target speed | RW | Int32 | Command unit /s | -231~(231-1) | 0 |

Note: Please refer to "Section 8 Parameter and Object Dictionary Details" for detailed descriptions of related objects.

## 7.5.3 Related function settings

- Speed arrival function

| Index | Sub-index | Name | Description |
|---|---|---|---|
| 606Dh | 0 | Speed reaches threshold value | When the difference between the target speed 60FF (converted to motor speed/rpm) and the actual motor speed is within ±606D and the time reaches 606E, the speed is reached and bit 10 of status word 6041 = 1, while the speed reached DO function is valid. This flag bit is meaningful when the servo enable is valid in wheel speed mode and cycle synchronous speed mode; otherwise, it is meaningless. |
| 606Eh | 0 | Speed to window | |

## 7.5.4 Recommended configuration

- Periodic synchronous velocity mode (csv) with the following basic configuration.

| RxPDO | TxPDO | Remarks |
|---|---|---|
| 6040: control word | 6041: Status word | Must |
| 60FF: Target Velocity | | |
| | 6064: position actual value | Optional |
| | 606C: velocity actual value | Optional |
| 6060: modes of operation | 6061: modes of operation display | Optional |

## 7.6 Periodic synchronous torque mode (cst)

In this mode, the upper controller sends the calculated target torque 6071h to the servo driver periodically and synchronously, and the torque regulation is executed by the servo internally. When the speed reaches the limit value it will enter the speed regulation phase.

### 7.6.1 Control Block Diagram

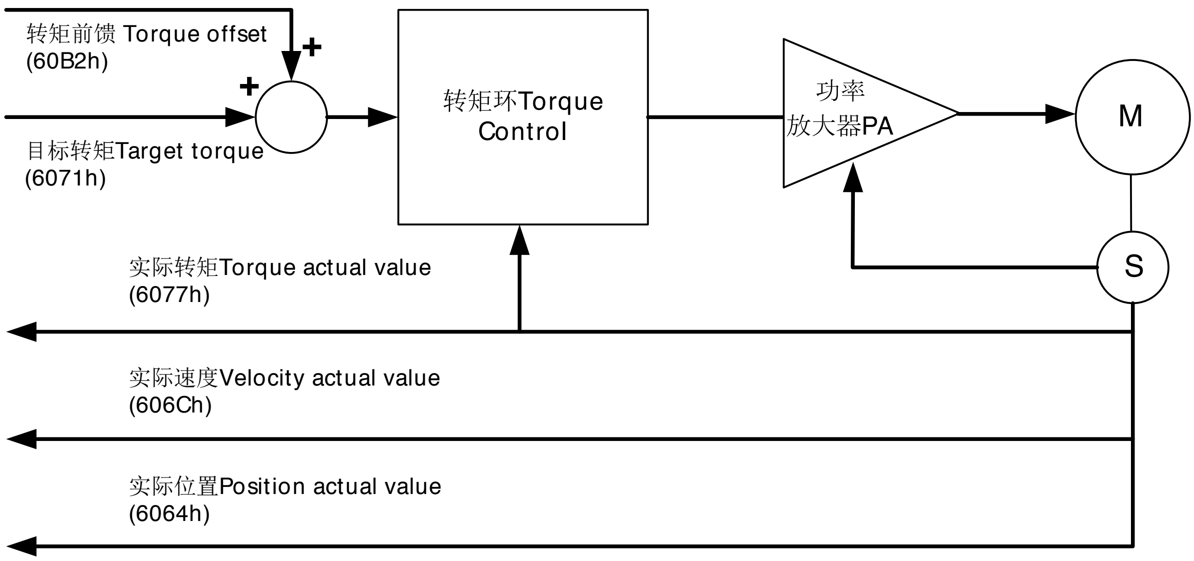



Figure 7.6.1-1 Block diagram of cycle synchronous torque mode

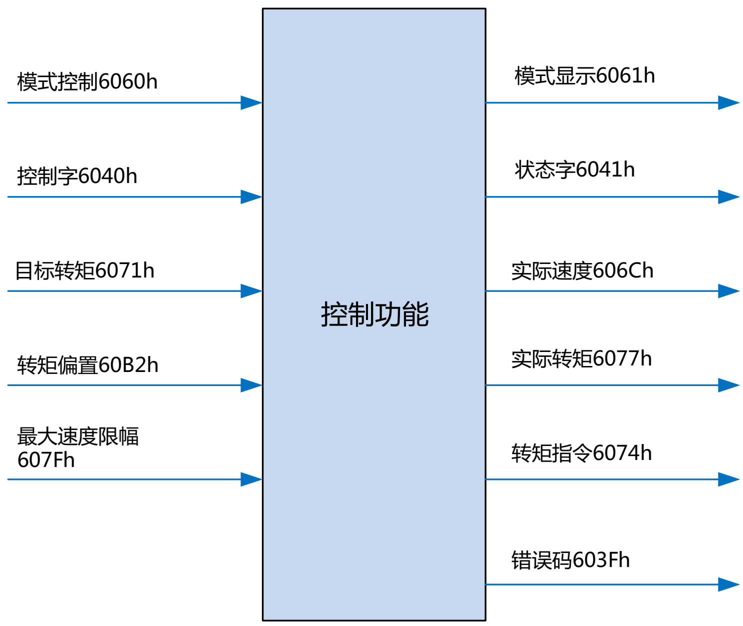



Figure 7.6.1-2 Periodic synchronous torque mode input and output objects

## 7.6.2 Related objects

| Control word 6040h | | |
|---|---|---|
| **position** | **Name** | **Description** |
| 0 | Switch on | bit0~bit3 are 1, which means start operation |
| 1 | Enable voltage | |
| 2 | Quick stop | |
| 3 | Enable operation | |
| 8 | Halt | 0：Servo set by bit0~bit3<br>1：Servo set by 605Dh Pause |

| Control word 6041h | | |
|---|---|---|
| **position** | **Name** | **Description** |
| 10 | Target Reach | 0: Target torque not reached<br>1: Target torque reached |
| 12 | Drive follows the command Value | 0: Slave does not follow the command<br>1: Slave follows the command |
| 13 | | Undefined |
| 15 | Home Find | 0: Home return to zero not completed<br>1: Home return to zero completed |

| Index (hex) | Subindex (hex) | Name | Access | Data Type | Unit | Setting range | Default Value |
|---|---|---|---|---|---|---|---|
| 603F | 0 | Error Code | RO | Uint16 | - | 0~65535 | 0 |
| 6040 | 0 | Control word | RW | Uint16 | - | 0~65535 | 0 |
| 6041 | 0 | Status word | RO | Uint16 | - | 0~x65535 | 0 |
| 6060 | 0 | Operation Mode | RW | Int8 | - | 0~10 | 0 |
| 6061 | 0 | Mode Display | RO | Int8 | - | 0~10 | 0 |
| 606C | 0 | Actual speed | RO | Int32 | Command unit/s | - | - |
| 6071 | 0 | Target torque | RW | Int16 | 0.10% | -5000~5000 | 0 |
| 6074 | 0 | Torque command | RO | Int16 | 0.10% | -5000~5000 | 0 |
| 6077 | 0 | Actual torque | RO | Int16 | 0.10% | -5000~5000 | 0 |
| 607F | 0 | Maximum speed | RW | Uint32 | Command unit/s | $0\sim(2^{32}-1)$ | 230 |
| 60B2 | 0 | Torque bias | RW | Int32 | 0.10% | -5000~5000 | 0 |
| 60E0 | 0 | Forward torque limiting | RW | Uint16 | 0.10% | 0~5000 | 5000 |
| 60E1 | 0 | Reverse torque limiting | RW | Uint16 | 0.10% | 0~5000 | 5000 |

Note: See "Section 8 Parameter and Object Dictionary Details" for details on using the related objects.

## 7.6.3 Recommended configuration

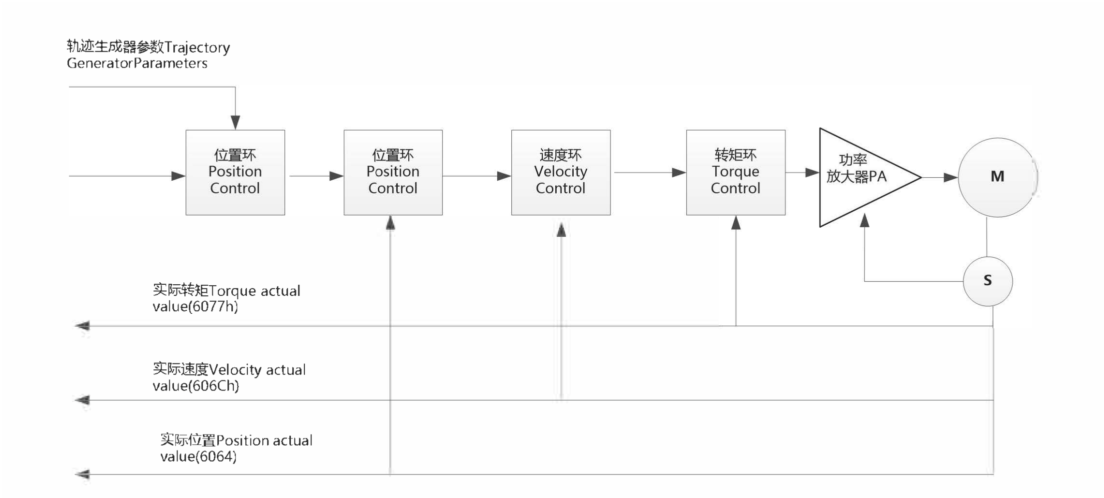
Periodic synchronous torque mode (cst) with the following basic configuration.

| RxPDO | TxPDO | Remarks |
|---|---|---|
| 6040: control wordcontrol word | 6041: Status word | Must |
| 6071: Target Torque | | |
| | 6064: Position actual value | Optional |
| | 606C: Velocity actual value | Optional |
| | 6077: Torque actual value | Optional |
| 6060: Mode selection modes of operation | 6061: Modes of operation display | Optional |

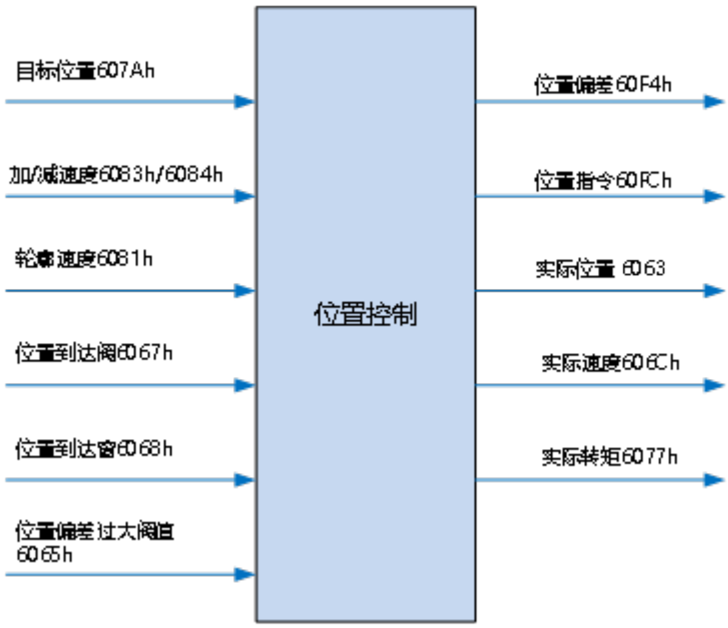
# 7.7 Wheel position mode (pp)

This mode is mainly used for point-to-point positioning applications. In this mode, the upper computer gives the target position (absolute or relative), speed, acceleration, deceleration and deceleration of the position curve, and the trajectory generator inside the servo will generate the target position curve command according to the setting, and the drive will complete the position control, speed control and torque control internally.

## 7.7.1 Control Block Diagram




7.7.1-1 Wheel position mode control block diagram




7.7.1-2 Wheel position mode (pp) input and output block diagram

## 7.7.2 Related objects

| Control word 6040h | | |
|---|---|---|
| **position** | **Name** | **Description** |
| 0 | Switch on | bit0~bit3 are 1, which means start operation |
| 1 | Enable voltage | |
| 2 | Quick stop | |
| 3 | Enable operation | |

| | | |
|---|---|---|
| 4 | New set-point | The rising edge of this bit from 0 to 1 indicates the pre-trigger of the new target position 607Ah, wheel velocity 6081h, acceleration 6083h and deceleration 6084h given |
| 5 | Change set immediately | 0：Not updated immediately<br>1：Updated immediately |
| 6 | abs/rel | 0: The target position is an absolute position command<br>1: The target position is a relative position command |

| Status word 6041h | | |
|---|---|---|
| **position** | **Name** | **Description** |
| 10 | Target Reach | 0: Target position not reached<br>1: Target position reached |
| 12 | Set point acknowledge | 0: the slave does not follow the instruction<br>1: the slave does not follow the instruction, the slave is in the running state and starts to execute the position instruction, the position 1; otherwise, 0 |
| 13 | Following error | 0: No excessive position deviation fault<br>1: Excessive position deviation fault occurs |
| 15 | Home Find | 0: Return to start not completed<br>1: Return to start completed |

| Index (hex) | Subindex (hex) | Name | Access | Data Type | Unit | Setting range | Default Value |
|---|---|---|---|---|---|---|---|
| 603F | 0 | Error Code | RO | Uint16 | - | 0~65535 | 0 |
| 6040 | 0 | Control words | RW | Uint16 | - | 0~65535 | 0 |
| 6041 | 0 | Status word | RO | Uint16 | - | 0~xFFFF | 0 |
| 6060 | 0 | Operation Mode | RW | Int8 | - | 0~10 | 0 |
| 6061 | 0 | Mode Display | RO | Int8 | - | 0~10 | 0 |
| 6062 | 0 | Location commands | RO | Int32 | Command unit | - | - |
| 6063 | 0 | Location Feedback | RO | Int32 | Encoder units | - | - |
| 6064 | 0 | Location Feedback | RO | Int32 | Command unit | - | - |
| 6065 | 0 | Position Deviation Excess Threshold | RW | Uint32 | Command unit | 0~(232-1) | 1048576 |
| 6067 | 0 | Position reaches threshold | RW | Uint32 | Encoder units | 0~65535 | 734 |
| 6068 | 0 | Location arrival window | RW | Uint16 | ms | 0~65535 | x10 |
| 606C | 0 | Actual speed | RO | Int32 | Command unit/s | - | - |
| 6077 | 0 | Actual torque | RO | Int16 | 0.10% | -5000~5000 | 0 |
| 607A | 0 | Target Location | RW | Int32 | Command unit | -231~(231-1) | 0 |
| 6083 | 0 | Acceleration | RW | Uint32 | Command unit/S2 | 0~(232-1) | 100 |
| 6084 | 0 | Deceleration | RW | Uint32 | Command unit/S2 | 0~(232-1) | 100 |
| 6091 | 1 | Motor resolution | RW | Uint32 | - | 0~(232-1) | 1 |
| | 2 | Axis Resolution | RW | Uint32 | - | 1~(232-1) | 1 |
| 60E0 | 0 | Forward torque limiting | RW | Uint16 | 0.10% | 0~5000 | 5000 |
| 60E1 | 0 | Reverse torque limiting | RW | Uint16 | 0.10% | 0~5000 | 5000 |
| 60F4 | 0 | Position deviation | RO | Int32 | Command unit | | |
| 60FC | 0 | Location commands | RO | Int32 | Encoder units | | |

Note: See "Section 8 Parameter and Object Dictionary Details" for details on using related objects.

### 7.7.3 Related function settings

1) Positioning completed

| Index | Sub-index | Name | Description |
|---|---|---|---|
| 6067 | 0 | Position reaches threshold | When the position deviation is within the ±6067h interval and the time reaches 6068, the DO signal of positioning completion is valid, while bit10=1 of 6041. if either of the two conditions is not satisfied, the position arrival is invalid. |
| 6068 | 0 | Location arrival window | |

2) Position Deviation Excess Threshold

| Index | Sub-index | Name | Description |
|---|---|---|---|
| 6065 | 0 | Position Deviation Excess Threshold | When the position deviation is greater than this value, a position deviation too large fault occurs and the panel displays an alarm, while bit 13 of the status word is set. When 6065h=0xFFFFFFFF, the drive does not perform excessive position deviation detection. |

### 7.7.4 Position curve generator

The curve generator contains two modes, which are divided into single-point mode and multi-point mode. When 6040h.bit5=1, it is single-point operation mode, i.e., immediate update mode.

When 6040.bit5=0, it is multi-point operation mode. After setting a new point in the 607Ah object dictionary, by controlling 6040h.bit4 a rising edge, the newly established point can be enabled, and the drive can control the motor to run to the newly set coordinates. At the same time the status word 6041h.bit12 will give a 1 status, and the new set point can only be accepted if 6041h.bit12 = 0.

1) Single point of operation mode

When 6040h.bit5=1 it is single point operation mode as shown in the figure below. When a new Target position is set, a rising edge is given using 6040h.bit4 to trigger the setpoint to run. When the point is run and a new point is set, a rising edge needs to be given again using 6040h.bit4 and the driver immediately uses the new Target position to set the trajectory parameters for trajectory planning, as shown in the figure below.

2) Multi-point movement mode

When 6040h.bit5=0, it is multi-point operation mode. This mode of operation is divided into two types, as follows:
The first one is 6040h. bit9=0 is the sequential planning mode, as shown in the figure below, one point is being processed, and when the planning of that point is completed, the second set point will be run immediately after the planning.
The second one is 6040h.bit9=1, keeping the speed of 6040h.bit4 trigger moment to finish the current position planning, and using this speed as the starting speed for the next position planning.
The planning is shown as the solid line in the figure, and the dotted line is the planning diagram in the case of bit9=0. When the planning of the first point set is completed, the position of the next point will be started for planning.

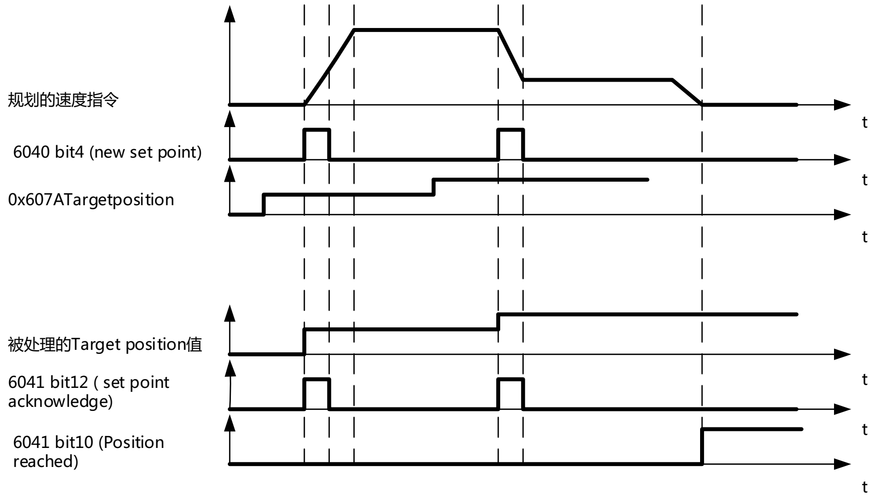



Figure 7.7.4-1 Single-point operation mode update TargetPosition diagram

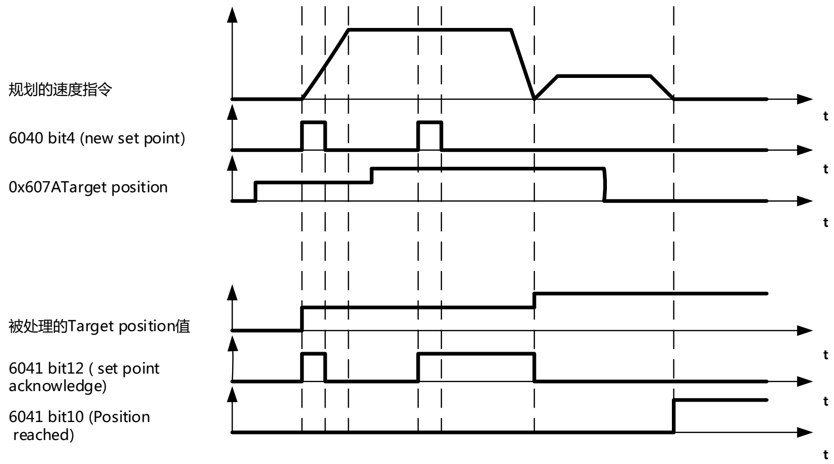



Figure 7.7.4-2 Multipoint operation mode 6040.bit9=0 operation diagram

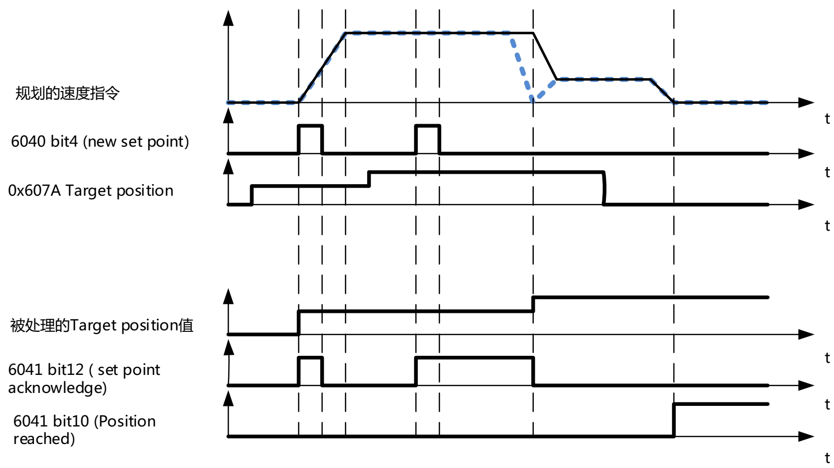



Figure 7.7.4-3 Multipoint operation mode 6040.bit9=1 operation diagram

## 7.7.5 Recommended configuration

Wheel position mode (pp) with the following basic configuration:

| RxPDO | TxPDO | Remarks |
|---|---|---|
| 6040：control word | 6041: Status word status word | Must |
| 607A: target position | 6064: Position feedback position actual value | Must |

| RxPDO | TxPDO | Remarks |
|---|---|---|
| 6081: wheel velocity | | Must |
| 6083: wheel acceleration | | Optional |
| 6084: wheel deceleration | | Optional |
| 6060: modes of operation | 6061: modes of operation display | Optional |

# 7.8 Wheel speed mode (pv)

In this mode, the upper controller sends the target speed, acceleration, and deceleration to the servo driver, and the speed and torque adjustment is performed internally by the servo.

## 7.8.1 Control Block Diagram

Figure 7.8.1-1 Block diagram of contour speed mode control

## 7.8.2 Related objects

| Control word 6040h | | |
|---|---|---|
| **position** | **Name** | **Description** |
| 0 | Switch on | Bit0~bit3 are 1, which means start running |
| 1 | Enable voltage | |
| 2 | Quick stop | |
| 3 | Enable operation | |
| 8 | Halt | 0：Servo set by Bit0~bit3<br>1：Servo set by 605Dh Pause |

| Status word 6041h | | |
|---|---|---|
| **position** | **Name** | **Description** |
| 10 | Target Reach | 0: Target position not reached<br>1: Target position reached |
| 11 | Internal limit actice | 0: Position command and position feedback are not exceeded<br>1: Position command or position feedback is exceeded |
| 15 | Home Find | 0: Return to start not completed<br>1: Retuen to start completed |

| Index (hex) | Subindex (hex) | Name | Access | Data Type | Unit | Setting range | Default Value |
|---|---|---|---|---|---|---|---|
| 603F | 0 | Error Code | RO | Uint16 | - | 0~65535 | 0 |
| 6040 | 0 | Control words | RW | Uint16 | - | 0~65535 | 0 |
| 6041 | 0 | Status word | RO | Uint16 | - | 0~65535 | 0 |
| 6060 | 0 | Operation Mode | RW | Int8 | - | 0~10 | 0 |
| 6061 | 0 | Mode Display | RO | Int8 | - | 0~10 | 0 |
| 607F | 0 | Maximum sheel speed | RW | Uint32 | Command unit /s | $0\sim(2^{32}-1)$ | 230 |
| 6063 | 0 | Location Feedback | RO | Int32 | Encoder units | - | - |
| 6064 | 0 | Location Feedback | RO | Int32 | Command unit | - | - |
| 60FF | 0 | Target speed | RW | Int32 | Command unit /s | $-2^{31}\sim(2^{31}-1)$ | 0 |
| 60E0 | 0 | Forward torque limiting | RW | Uint16 | 0.10% | 0~5000 | 5000 |
| 60E1 | 0 | Reverse torque limiting | RW | Uint16 | 0.10% | 0~5000 | 5000 |
| 606C | 0 | Actual speed | RO | Int32 | Command unit /s | - | - |
| 6077 | 0 | Actual torque | RO | Int16 | 0.10% | -5000~5000 | 0 |

Note: See "Section 8 Object Dictionary Details" for detailed instructions on using related objects.

## 7.8.3 Related function settings

- Speed arrival function

| Index | Sub-index | Name | Description |
|---|---|---|---|

| | | | |
|---|---|---|---|
| 606Dh | 0 | Speed reaches threshold value | When the difference between the target speed 60FF (converted to motor speed/rpm) and the actual motor speed is within ±606D and the time reaches 606E, the speed is reached and bit 10 of status word 6041 = 1, and the speed reached DO function is valid at the same time. This flag bit is meaningful when the servo enable is valid in profile speed mode and cycle synchronous speed mode; otherwise, it is meaningless. |
| 606Eh | 0 | Speed to window | |

### 7.8.4 Recommended configuration

- Profile velocity mode (pv) with the following basic configuration:

| RxPDO | TxPDO | Remarks |
|---|---|---|
| 6040：control word | 6041: status word | Must |
| 60FF: target Velocity | | Must |
| | 6064: position actual value | Optional |
| | 606C: velocity actual value | Optional |
| 6083: Wheel acceleration | | Optional |
| 6084: Wheel deceleration | | Optional |
| 6060: Mode selection modes of operation | 6061: modes of operation display | Optional |

## 7.9 Wheel torque mode (pt)

This function is not supported by bus type Servo Drive.

## 7.10 Return to start mode (hm)

Return to start mode is used to find the mechanical home point and locate the position of the mechanical home point in relation to the mechanical zero point. Mechanical home point: a fixed position on the machinery, which can correspond to a certain determined home switch and can correspond to the motor Z signal. Mechanical zero point: the absolute 0 position on the machinery. After the origin back to zero into, the motor stop position is the mechanical origin, by setting 607Ch, you can set the relationship between mechanical origin and mechanical zero: mechanical origin = mechanical zero + 607Ch (origin offset). When 607Ch=0, the mechanical origin coincides with the mechanical zero point.

### 7.10.1 Control Block Diagram

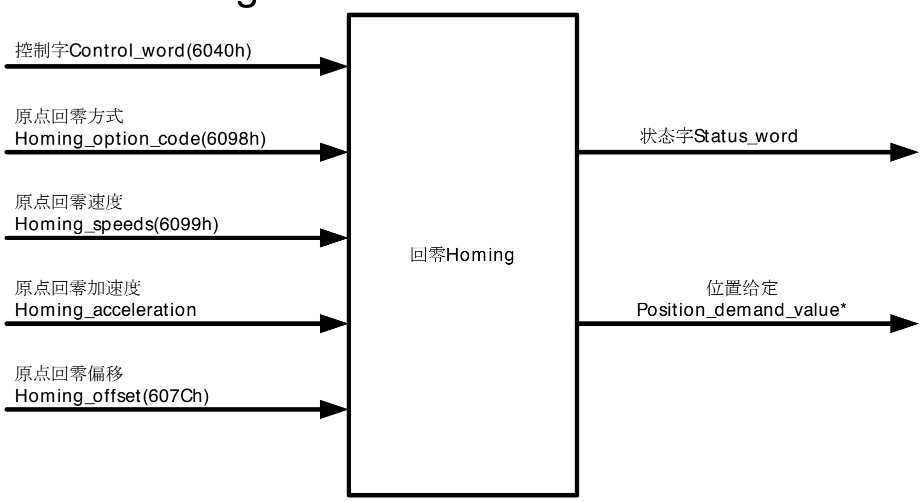



Figure 7.10.1-1 Home return to zero control block diagram

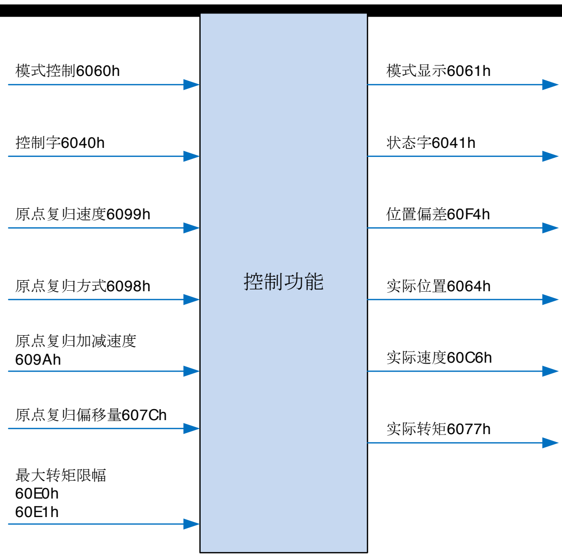



Figure 7.10.1-2 Home return to zero input and output objects

## 7.10.2 Related objects

| Control word 6040h | | |
|---|---|---|
| **position** | **Name** | **Description** |
| 0 | Switch on | bit0~bit3 are 1, which means start operation |
| 1 | Enable voltage | |
| 2 | Quick stop | |
| 3 | Enable operation | |
| 4 | Homing start | 0->1: Start zero return<br>1: Zero return in progress<br>1->0: End zero return |
| 8 | Halt | 0：Servo set by Bit0~bit3 1：Servo set by 605Dh Pause |

| Status word 6041h | | |
|---|---|---|
| **position** | **Name** | **Description** |
| 10 | Target Reach | 0: Target torque not reached<br>1: Target torque reached |
| 12 | Homing attained | 0: zero return is not successful<br>1: zero return is successful; this flag is valid after the target reach signal is set when the servo is in zero return mode operation |
| 13 | Homing error | 0: Zero return error did not occur<br>1: Zero return timeout or excessive deviation error occurred |
| 15 | Home Find | 0: Home zero return is not completed<br>1: Home zero return is completed; this flag is set when the home signal is encountered |

| Index (hex) | Subindex (hex) | Name | Access | Data Type | Unit | Setting range | Default Value |
|---|---|---|---|---|---|---|---|
| 603F | 0 | Error Code | RO | Uint16 | - | 0~65535 | 0 |
| 6040 | 0 | Control word | RW | Uint16 | - | 0~65535 | 0 |
| 6041 | 0 | Status word | RO | Uint16 | - | 0~xFFFF | 0 |
| 6060 | 0 | Operation Mode | RW | Int8 | - | 0~10 | 0 |
| 6061 | 0 | Mode Display | RO | Int8 | - | 0~10 | 0 |
| 6062 | 0 | Actual Location | RO | Int32 | Command unit | - | - |
| 6064 | 0 | Location Feedback | RO | Int32 | Command unit | - | - |
| 6067 | 0 | Position reaches threshold | RW | Uint32 | Encoder units | 0~65535 | 734 |
| 6068 | 0 | Location arrival window | RW | Uint16 | ms | 0~65535 | x10 |
| 6077 | 0 | Actual torque | RO | Int16 | 0.10% | -5000~5000 | 0 |
| 606C | 0 | Actual speed | RO | Int32 | Command unit /s | - | - |
| 6098 | 0 | Origin restoration method | RW | Int8 | - | 1~35 | 1 |
| 6099 | 1 | High-speed search for deceleration points | RW | Uint32 | Command unit/s | $0\sim2^{32}$ --1) | 100 |
| | 2 | Search origin low speed | RW | Uint32 | Command unit/s | $10\sim(2^{32}$ ---1) | 100 |
| 609A | 0 | Acceleration | RW | Udint32 | Command unit/s2 | $0\sim(2^{32}$ ---1) | 100 |
| 60F4 | 0 | Position deviation | RO | Dint32 | Command unit | - | - |

Note: See "Section 8 Parameter and Object Dictionary Details" for details on using the related objects.

## 7.10.3 Related function settings

- Current position calculation method

| Index | Sub-index | Name | Description |
|---|---|---|---|
| 60E6 | 0 | Current position Calculation method | 60E6 determines whether the user uses absolute or relative return to zero in incremental systems<br>60E6=0 (absolute return to zero):<br>after the return to zero is complete, position feedback 6064 is set to home bias 607C<br>60E6=1 (relative return to zero):<br>after the return to zero is complete, position feedback 6064 is superimposed on the original position bias 607C |

## 7.10.4 Introduction to Zero Return Operation

- Back to zero mode introduction:

1) Zero return method 1 (6098h=1) uses negative limit and motor encoder index pulse (Z-phase pulse) signals

The driver drives the motor to move rapidly in the negative direction at 6099h.01h until it detects the negative limit signal to slow down and stop, and then moves in the positive direction at a low speed of 6099h.02h to find the zero position, which is the position of the first encoder index pulse (Z-phase pulse) signal after the falling edge of the negative limit signal is detected. This is shown in the figure below. (Note: Index Pulse: Encoder Index Pulse Negative Limit Switch: Negative Limit Switch Positive Limit Switch: Positive Limit Switch Home Switch Same as below)

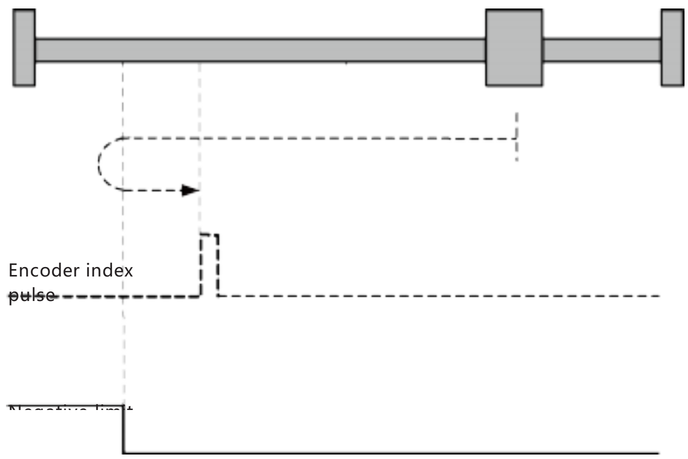



Figure 7.10.4-1 Zero return method 1

2) Zero return method 2 (6098h=2) uses the forward limit and motor encoder index pulse (Z-phase pulse) signals

The servo motor moves rapidly in the positive direction at the speed of 6099h.01h object until it detects the positive limit signal to decelerate and stop and moves negatively at the low speed of 6099h.02h object to find the zero position, which is the position of the first encoder index pulse (Z-phase pulse) signal after the falling edge of the positive limit signal is detected. The following figure shows:

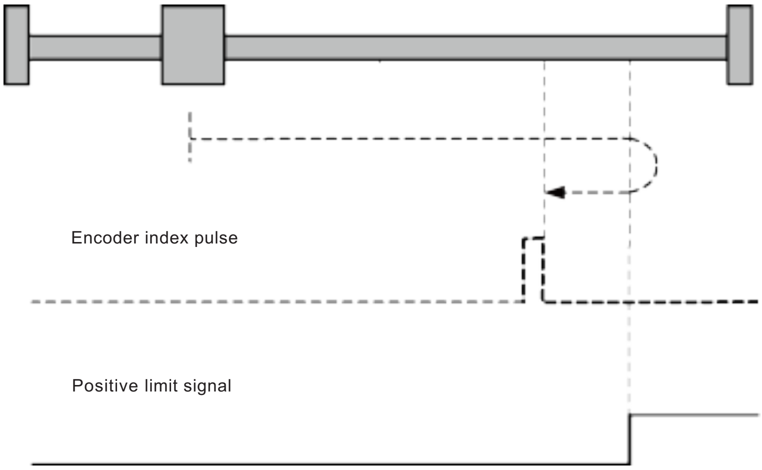



Figure 7.10.4-2 Zero return method 2

3) Zero return method 3 Using home and motor encoder index pulse (Z-phase pulse)

a. The deceleration point signal is invalid at zero return start.

When starting to return to zero, the home limit signal is 0. The driver drives the motor to start returning to zero at high speed in the forward direction until the rising edge of the home limit signal is detected, decelerates, reverses, and runs at low speed to find the zero position, which is the position of the first encoder index pulse (Z-phase pulse) signal after the rising edge of the home limit signal is detected.

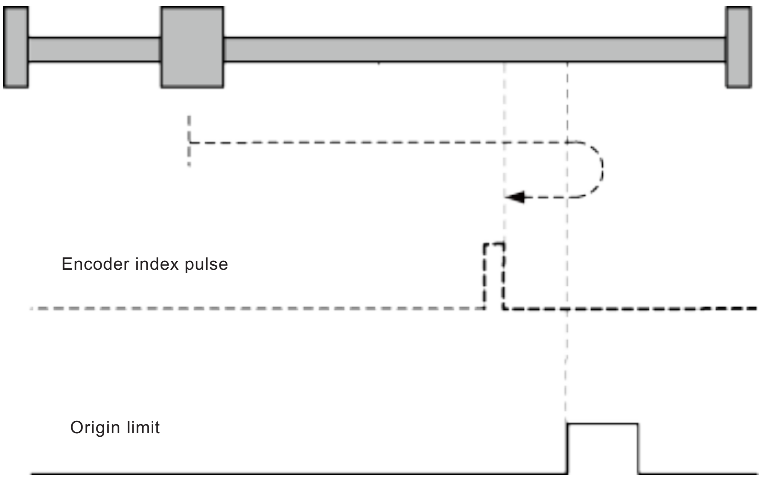



Figure 7.10.4-3-1 Zero return method 3

b. The deceleration point signal is valid at zero start.

Start back to zero when the home limit signal is 1, the driver directly drives the motor to reverse low speed to start back to zero, looking for the zero position, the zero point for the check

The position of the first encoder index pulse (Z-phase pulse) signal after the falling edge of the home signal is measured.

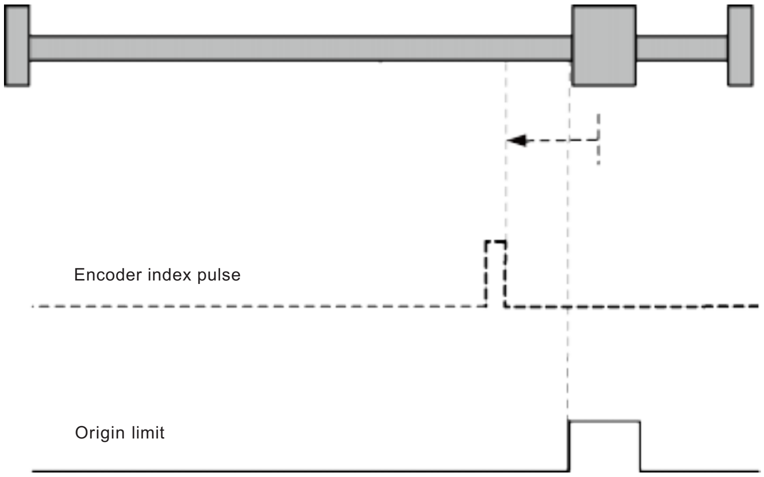



Figure 7.10.4-3-2 Zero return method 3

4) Zero return method 4 Using home and motor encoder index pulses (Z-phase pulses)

a. The deceleration point signal is invalid at zero return start.

The zero point is the position of the first encoder index pulse (Z-phase pulse) signal after the rising edge of the home limit signal is detected.

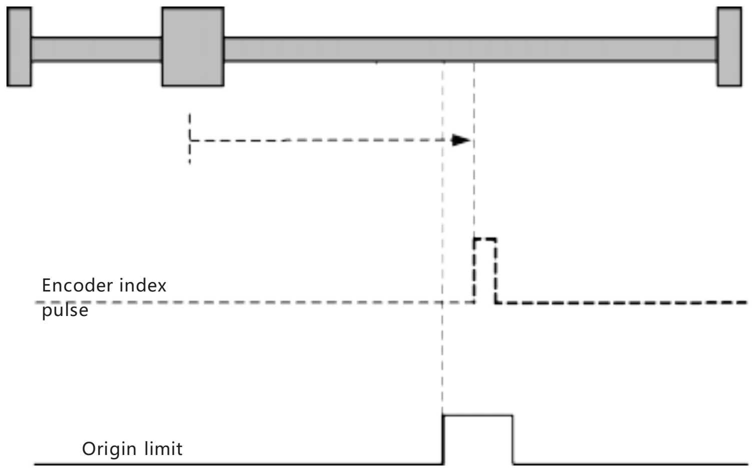



Figure 7.10.4-4-1 Zero return method 4

b. The deceleration point signal is valid at zero start.

Start to return to zero when the home limit signal is 0, the driver drives the motor to start to return to zero at reverse high speed until the falling edge of the home limit signal is detected, decelerate, reverse and run at low speed to find the zero position, the zero point is the position of the first encoder index pulse (Z-phase pulse) signal after the falling edge of the home limit signal is detected.

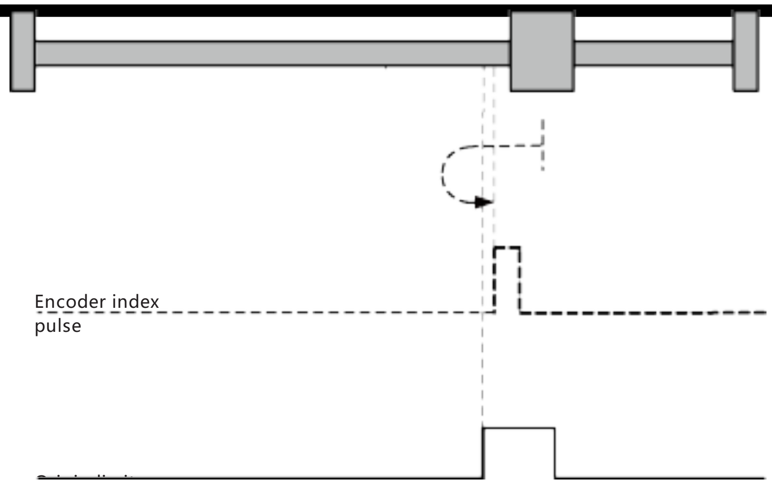



Figure 7.10. 3-4-2 Zero return method4

5) When the zero return mode is 5 (6098h=5) use the home and motor encoder index pulse (Z signal)

a. Back to zero start when the deceleration point signal is invalid , start back to zero when the home limit signal is 0, the drive drives the motor to 6099h.01h speed to move rapidly in the negative direction until the negative limit signal is detected to decelerate and stop, and to 6099h.02h object low speed positive movement to find the zero position, zero point for the first encoder index pulse after the detection of the falling edge of the negative limit signal ( Z-phase pulse) signal position.

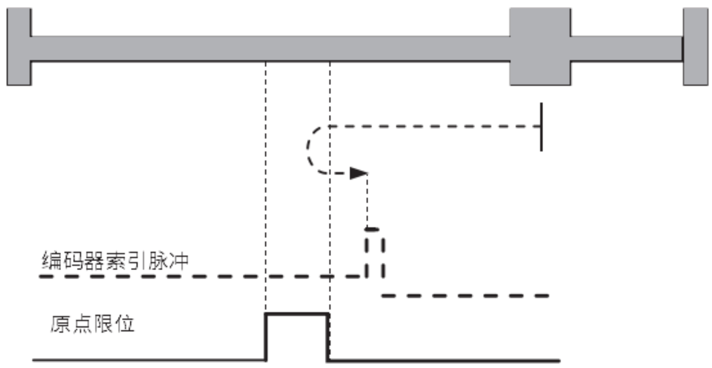



Figure 7. 10.3 5-1 Zero Return Method 5

b. The deceleration point signal is valid at the start of zero return, i.e., the limit signal is 1 at the start of zero return, and the servo motor starts zero return directly at a low positive speed until the position of the first encoder index pulse (Z-phase pulse) after the falling edge of the limit signal is detected.

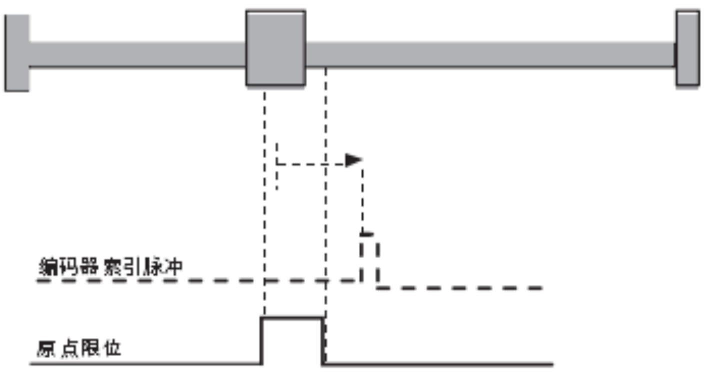



Figure 7.10. 3-5-2 Zero return method 5

6) Zero return method 6 (6098=6) uses the home and motor encoder index pulses (Z-phase pulses)

a. Invalid decelerations point signal when starting back to zero: the home limit signal is 0 when starting back to zero, the drive drives the motor to start moving directly in reverse at low speed to find the zero position, the zero point is the position after detecting the rising edge signal of the limit signal to the first encoder index pulse (Z-phase pulse) signal.

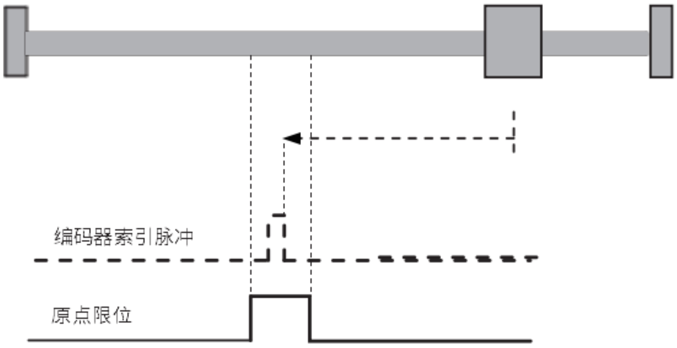



Figure 7.10. 3-6-1 Zero return method6

b. The deceleration point signal is valid when starting back to zero: the home limit signal is 1 when starting back to zero, the drive drives the motor to start moving at high speed in the forward direction to find the zero position, the zero point is the position where the falling edge of the limit signal is detected, deceleration starts and runs at low speed in the reverse direction to encounter the first encoder index pulse (Z-phase pulse) signal.

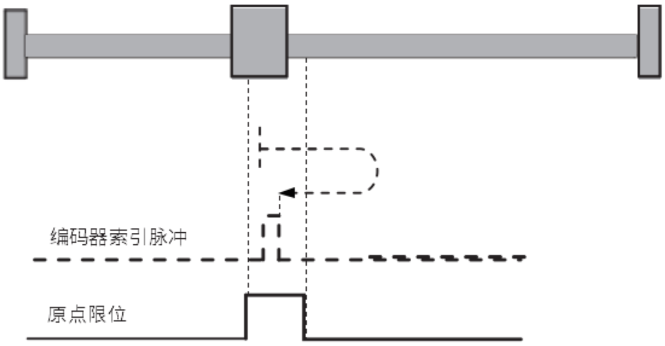



Figure 7.10. 3-6-2 Zero return method6

7) Zero return method 7 (6098=7) uses the index pulse (Z-phase pulse) of the home and motor encoder

a. Invalid decelerations point signal at return to zero start, no positive limit switch encountered:
Start back to zero when the forward pulse signal is 0, the driver drives the motor to start back to zero at high speed, if it does not encounter the forward limit switch, after encountering the rising edge of the home limit signal, the motor decelerates and runs at low speed in reverse, the zero point is the position of the first encoder index pulse after the falling edge of the home signal is detected.

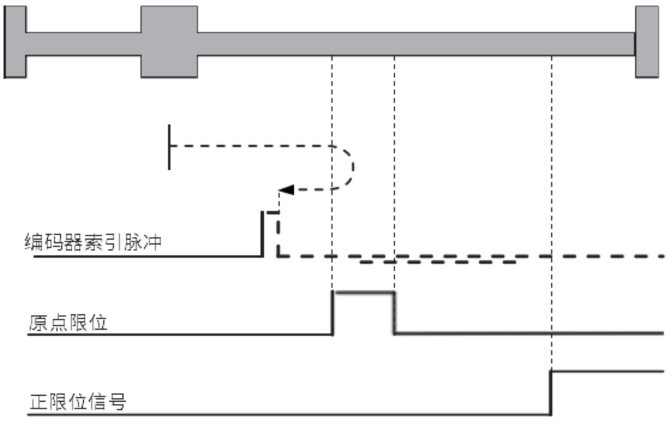



Figure 7.10. 3-7-1 Zero return method 7

b. Invalid decelerations point signal at return to zero start, positive limit switch encountered:
When starting to return to zero, the home limit signal is 0. The driver takes the motor to start to return to zero at high speed in the forward direction, and if it meets the forward limit switch, it automatically reverses and runs at high speed until it meets the rising edge of the home limit signal, then the motor decelerates and continues to run at low speed in the reverse direction, and the zero point is the position where the first encoder index pulse (Z-phase pulse) is detected.

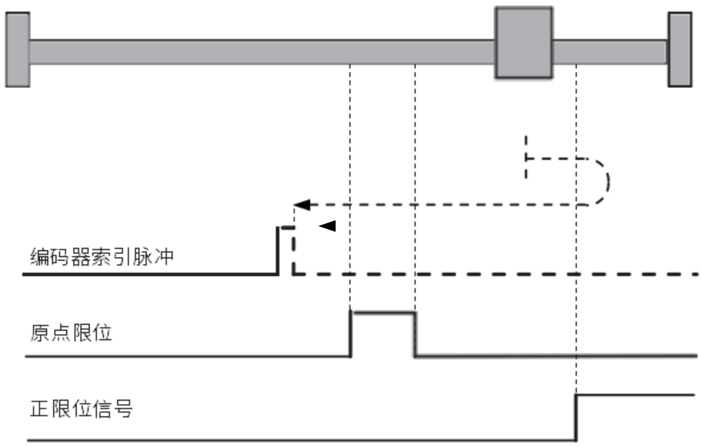



Figure 7.10. 3-7-2 Zero return method7

c. The deceleration point signal is valid at zero start.
Return to zero start, the home limit signal is 1, the drive drives the motor directly reverse low speed to start back to zero, the zero point is the position of the first motor encoder index pulse after the falling edge of the home limit signal is detected.

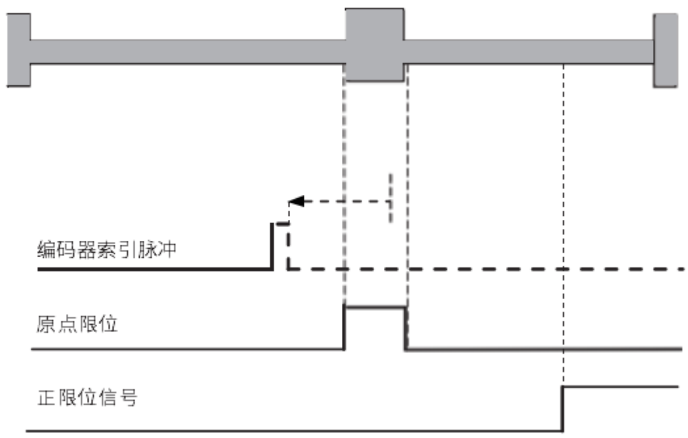



Figure 7.10. 3-7-3 Zero return method7

8) Return to zero mode 8 (6098=8) uses the index pulse (Z-phase pulse) of the home and motor encoder
a. Invalid decelerations point signal at return to zero start, no positive limit switch encountered.
When starting to return to zero, the home limit signal is 0. The driver drives the motor to start returning to zero at a positive high speed, and if it does not encounter the limit switch until it encounters the rising edge of the home limit signal, it decelerates and reverses to run at low speed until it encounters the falling edge of the home signal, then it starts to reverse and the motor runs at a positive low speed, and the zero point is the position of the first motor encoder index pulse after the rising delay of the home signal is detected.

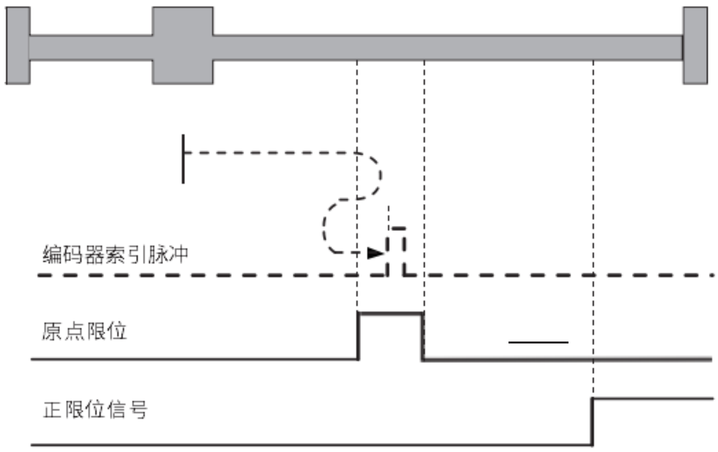



Figure 7. 10. 3-8-1 Zero return method 8

b. Invalid decelerations point signal at return to zero start, positive limit switch encountered:
When starting to return to zero, the home limit signal is 0, the driver drives the motor to start to return to zero at high speed in the forward direction, and if it encounters the limit switch, it will automatically reverse and run at high speed; until it encounters the rising edge of the home limit signal, the motor decelerates and runs at low speed in the reverse direction, and the zero point is the position of the first motor encoder index pulse after the rising edge of the home limit signal is detected.

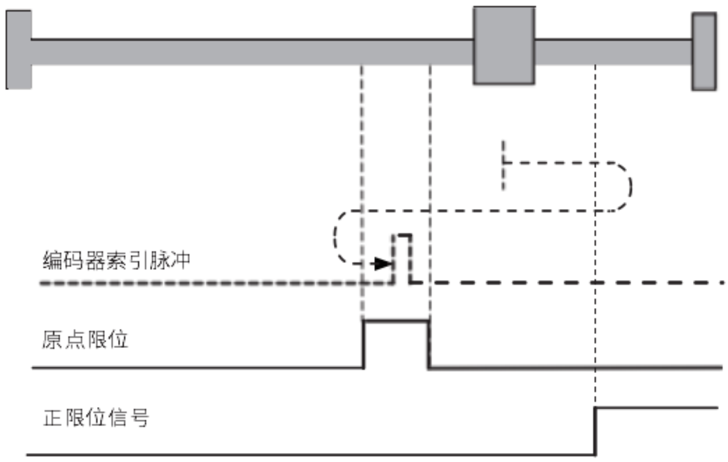



Figure 7.10. 3-8-2 Zero return method8

c. The deceleration point signal is valid at zero start.

When starting to return to zero, the home limit signal is 1, the driver drives the motor to move directly in the reverse direction at low speed until after encountering the falling edge of the home limit signal, the motor reverses and runs positively at low speed, and the zero point is the position of the first motor encoder index pulse after the home limit signal is detected.

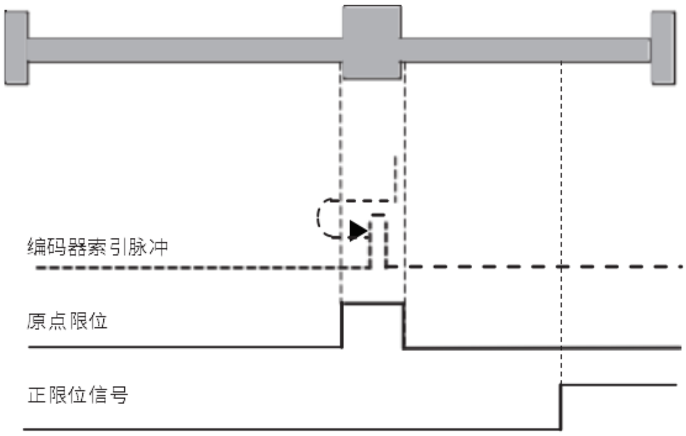



Figure 7.10. 3-8-3 Zero return method 8

9) Zero return method 9 (6098=9) uses the index pulse (Z-phase pulse) of the home and motor encoder

a. Invalid decelerations point signal at return to zero start, no positive limit switch encountered:

When starting to return to zero, the home switch signal is 0. The driver drives the motor to start returning to zero at a positive high speed, and if it does not encounter the limit switch, it will decelerate and run at a positive low speed after encountering the home switch signal until the motor runs at a reverse low speed after the falling edge of the home signal is detected.

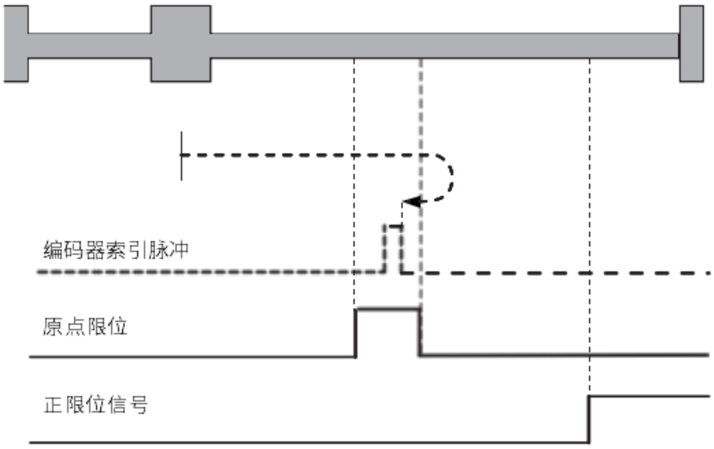



Figure 7.10. 3-9-1 Zero return method9

b. Invalid decelerations point signal at return to zero start, positive limit switch encountered.

When starting to return to zero, the home switch signal is 0, the driver drives the motor to start to return to zero at high speed in the forward direction, and if it meets the limit switch, it will automatically reverse and run at high speed until it detects the rising edge of the home signal, the motor decelerates and reverses to resume forward operation, and after the falling edge of the home signal, the motor reverses to run at low speed, and the zero point is the first motor encoder index pulse after the rising edge of the home signal is detected. The zero point is the position of the first motor encoder index pulse after the rising edge of the home signal is detected.

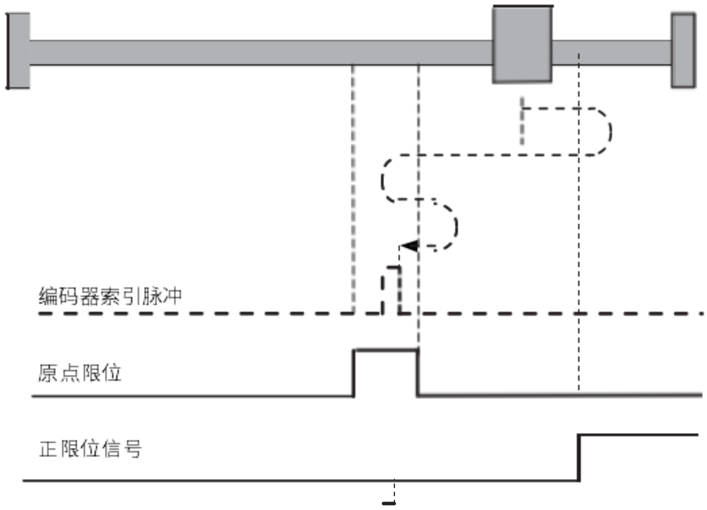



Figure 7.10. 3-9-2 Zero return method9

c. The deceleration point signal is valid at zero return start:

When starting to return to zero, the home switch signal is 1, and the driver drives the motor directly to start returning to zero at low speed in the forward direction until the motor runs at low speed in the reverse direction after encountering the falling edge of the home switch signal, and the zero point is the position of the first motor encoder index pulse after the rising edge of the home switch signal is detected.

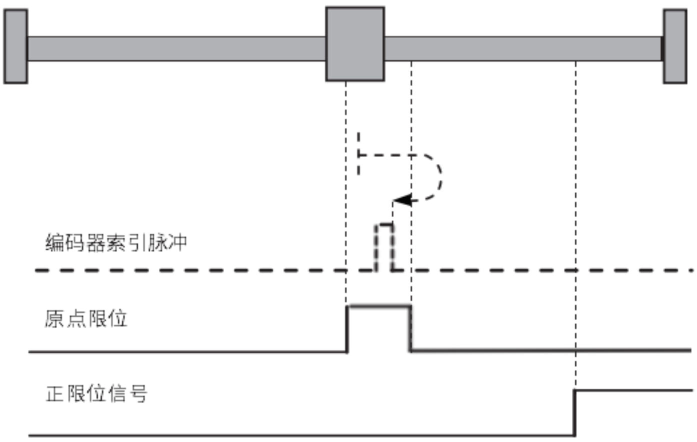



Figure 7.10. 3-9-3 Zero return method9

10) Return to zero method 10 (6098=10) uses the index pulse (Z-phase pulse) of the home and motor encoder

a. Invalid decelerations point signal at return to zero start, no positive limit switch encountered:

When starting to return to zero, the home switch signal is 0. The driver drives the motor to start returning to zero at a positive high speed. If the limit switch is not encountered, the motor decelerates and continues to run in a positive direction after encountering the rising edge of the home signal until it continues to run in a positive low speed after encountering the falling edge of the home signal, with the zero point being the position of the first motor index pulse detected afterwards.

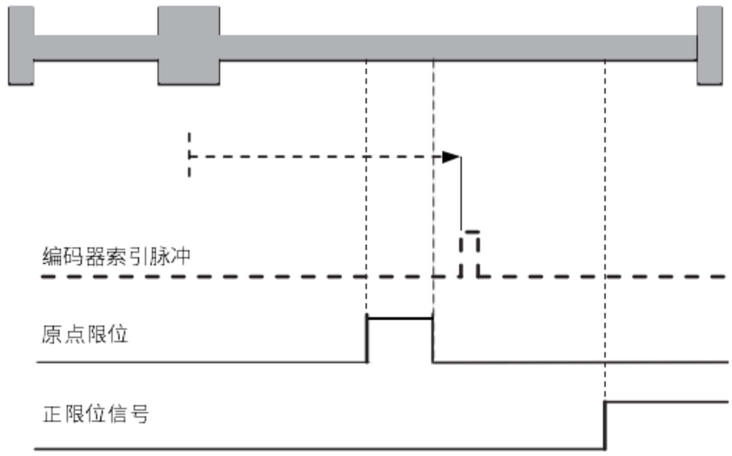



Figure 7.10.3-10-1 Zero return method 10

b. Invalid decelerations point signal at return to zero start, encountering positive limit switch.

Start back to zero, the home switch signal is 0, the driver drives the motor to start back to zero at high speed in the forward direction, if it encounters the limit switch, automatically reverse and reverse high-speed operation; until it encounters the rising edge of the home switch signal, decelerate and reverse that is to resume forward operation, the zero point is the position of the first motor encoder index pulse after the falling edge of the home switch signal is detected at low speed in the forward direction.

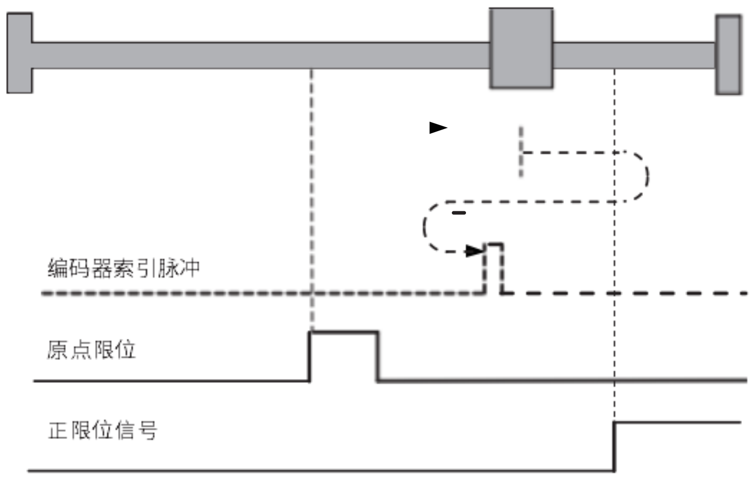



Figure 7.10. 3-10-2 Zero return method 10

c. The deceleration point signal is valid at zero return start:

When starting to return to zero, the home switch signal is 1, and the driver drives the motor to start running directly at low speed in the positive direction to find the zero point, which is the position of the first motor encoder index pulse after the falling edge of the home switch signal is detected.

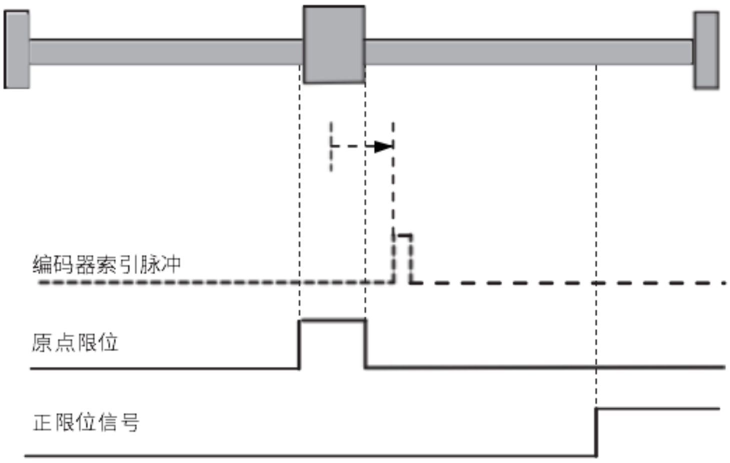



Figure 7.10. 3-10-3 Zero return method 10

11) Zero return method 11 (6098=11) uses the index pulse (Z-phase pulse) of the home and motor encoder

a. Invalid decelerations point signal at return to zero start, no reverse limit switch encountered:

When starting to return to zero, the home switch signal is 0. The driver drives the motor to start running at reverse high speed to find the zero position. If the limit switch is not encountered, the motor decelerates and reverses after encountering the rising edge of the home signal, that is, positive low speed operation, and the zero point is the position of the first motor encoder index pulse after detecting the falling edge of the home limit signal.

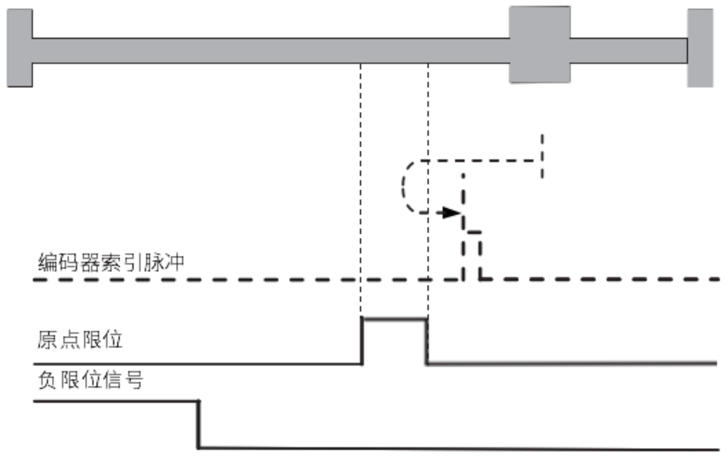



Figure 7. 10. 3-11-1 Zero return method 11

b. Invalid decelerations point signal at return to zero start, reverse limit switch encountered:

When starting to return to zero, the home switch signal is 0, the driver drives the motor to start running at high speed in reverse to find the zero position, and if it encounters the limit switch, the motor automatically reverses, that is, runs at high speed in forward direction until after the rising edge of the home switch signal is detected, the motor decelerates and continues to run at low speed in forward direction, and the zero point is the bit of the first motor encoder index pulse after the falling edge of the home switch signal is detected .

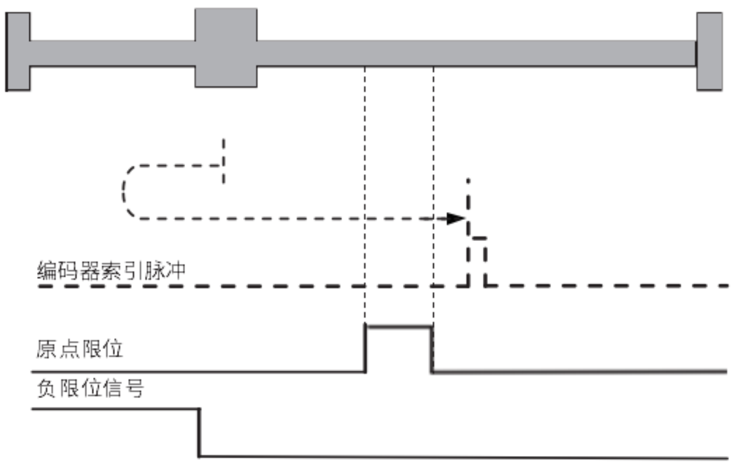



Figure 7. 10. 3-11-2 Zero return method 11

c. The deceleration point signal is valid at zero start.

When starting to return to zero, the home switch signal is 1 and the drive drives the motor to run directly at low speed in the positive direction, with zero being the position of the first motor encoder index pulse after the falling edge of the home signal is detected.

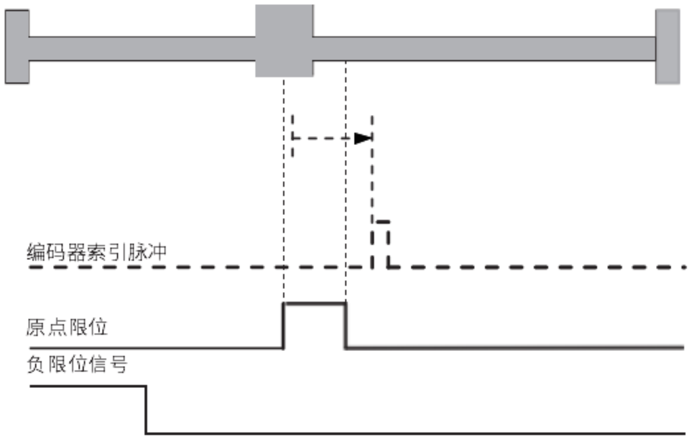



Figure 7. 10. 3-11-3 Zero return method 11

12) Return to zero method 12 (6098=12) uses the index pulse (Z-phase pulse) of the home and motor encoder

a. Invalid decelerations point signal at return to zero start, no reverse limit switch encountered:

When starting to return to zero, the home switch signal is 0. The driver drives the motor to run at high speed in reverse to find the zero position. After not encountering the limit switch and detecting the rising edge of the home switch signal, the motor decelerates and reverses and runs at low speed in the positive direction, with the zero point being the position of the first motor encoder index pulse after detecting the rising edge of the home switch signal.

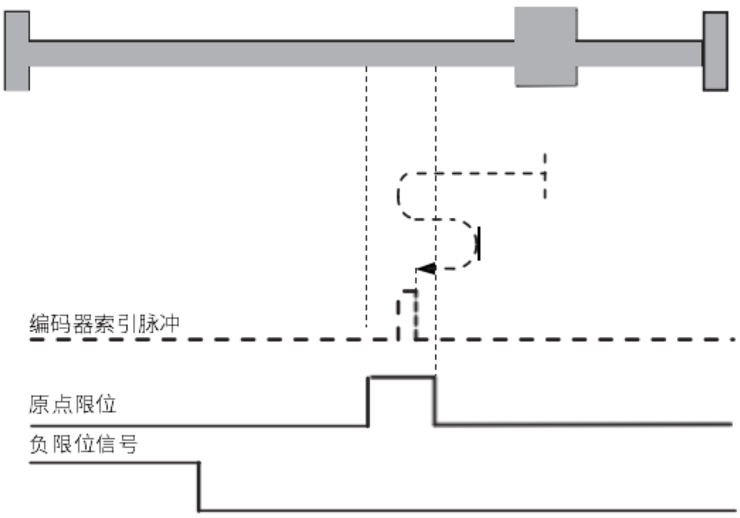



Figure 7.10. 3-12-1 Zero return method 12

b. Invalid decelerations point signal at return to zero start, reverse limit switch encountered.

When starting to return to zero, the home switch signal is 0, the driver drives the motor to reverse high-speed operation to find the zero position, encounter the limit switch, the motor automatically reverses and begins to run at high speed in the forward direction, after encountering the rising edge of the home switch signal, the motor decelerates and runs at low speed in the forward direction, the zero point is the position of the first motor encoder index pulse after the rising edge of the home switch signal is detected

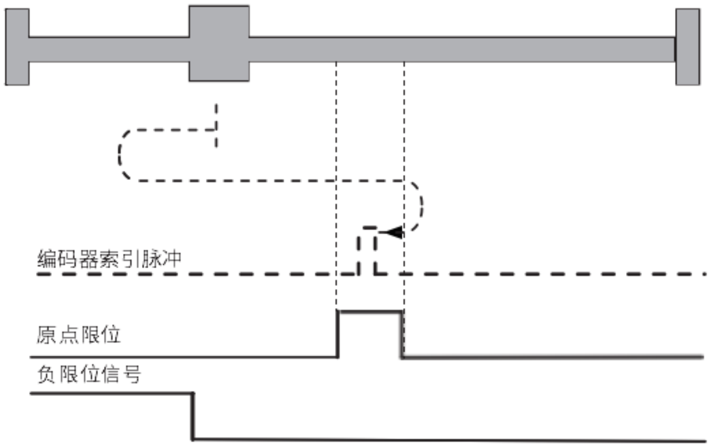



Figure 7. 10. 3-12-2 Zero return method 12

c. The deceleration point signal is valid at zero return start:

When starting to return to zero, the home switch signal is 1, the drive electric motor runs directly forward and low speed to find the zero position, and after encountering the falling edge of the home switch signal, the motor starts to run in reverse and low speed, and the zero point is the position of the first motor encoder index pulse after detecting the home switch signal.

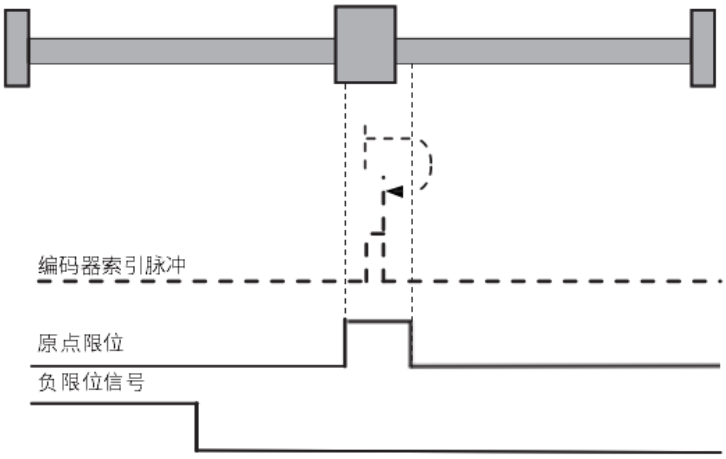



Figure 7. 10. 3-12-3 Zero return method 12

13) Zero return method 13 (6098=13) uses the index pulse (Z-phase pulse) of the home and motor encoder

a. Invalid decelerations point signal at return to zero start, no reverse limit switch encountered.

When starting to return to zero, the home switch signal is 0. The driver drives the motor to run at reverse high speed to find the zero position. If the limit switch is not encountered, the motor decelerates and runs at reverse low speed after the rising edge of the home switch signal is detected, and the zero point is the position of the first motor encoder index pulse after the rising edge of the home switch signal is detected.

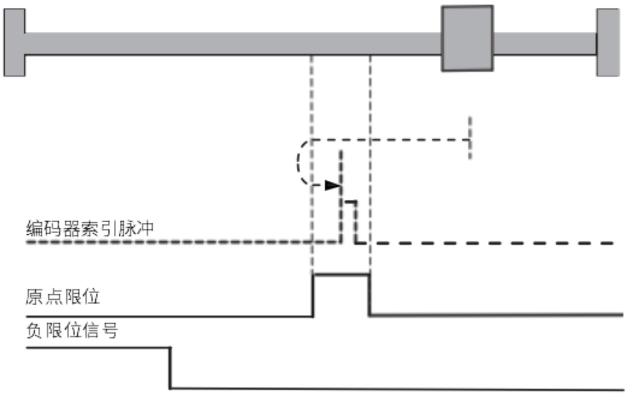



Figure 7. 10. 3-13-1 Zero return method 13

b. Invalid decelerations point signal at return to zero start, reverse limit switch encountered.

When starting to return to zero, the home switch signal is 0. The driver drives the motor to run at reverse high speed to find the zero point. If the motor decelerates and runs at reverse low speed after encountering the rising edge of the limit switch signal, the zero point is the position of the first motor encoder index pulse after the rising edge of the home switch signal is detected when the motor is running in the forward direction.

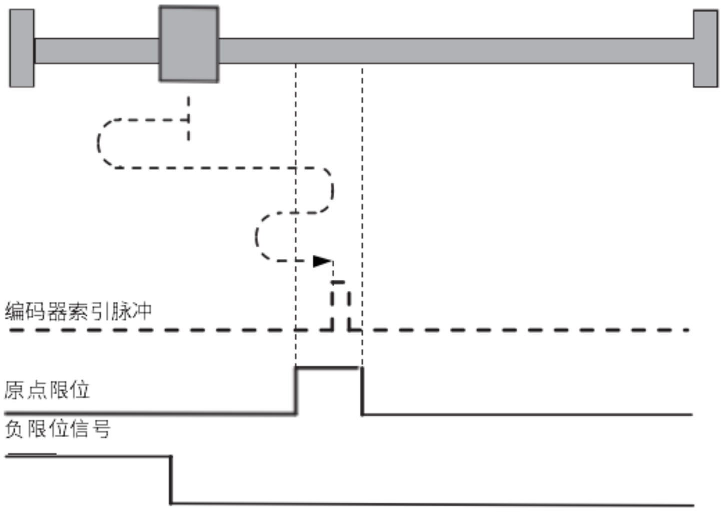



Figure 7.10. 3-13-2 Zero return method 13

c. The deceleration point signal is valid at zero start.

When starting to return to zero, the home switch signal is 1, the driver drives the motor to run directly in reverse at low speed to find the zero position, if after detecting the falling edge of the home switch signal, the motor starts to run in reverse that is forward at low speed, the zero point is the position of the first motor encoder index pulse after detecting the rising edge of the original electric switch signal.

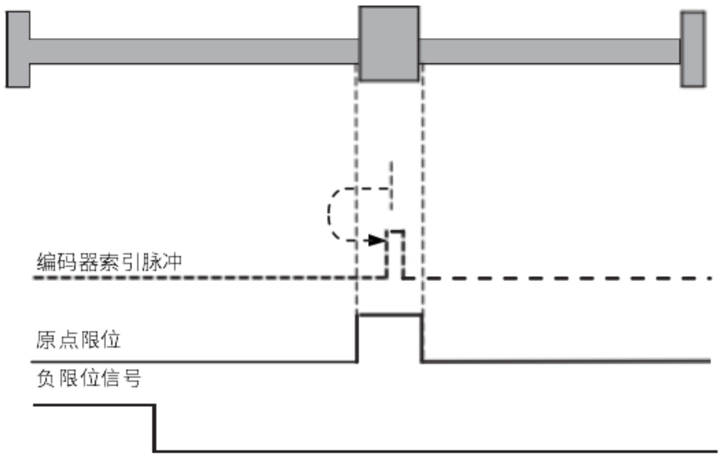



Figure 7.10. 3-13-3 Zero return method 13

14) Return to zero method 14 (6098=14) uses the index pulse (Z-phase pulse) of the home and motor encoder

a. Invalid decelerations point signal at return to zero start, no reverse limit switch encountered:

When starting to return to zero, the home switch signal is 0. The driver drives the motor to start running at reverse high speed to find the zero position. After not encountering the limit switch and detecting the rising edge of the home switch signal, the motor starts to decelerate and run at reverse low speed, and the zero point is the position where the first motor encoder index pulse is detected after detecting the falling edge of the home switch signal.

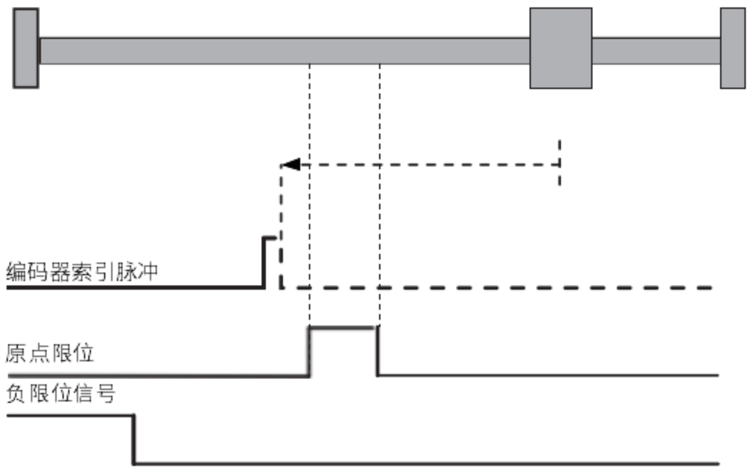



Figure 7.10. 3-14-1 Zero return method 14

b. Invalid decelerations point signal at return to zero start, reverse limit switch encountered.

When starting to return to zero, the home switch signal is 0, the driver drives the motor to run at high speed in reverse to find the zero position, and when it encounters the limit switch, the motor automatically reverses, that is, runs at high speed in the forward direction until it encounters the rising edge of the home switch signal, the motor decelerates and runs in reverse, and the zero point is the position of the first motor encoder index pulse after detecting the rising edge of the home switch signal.

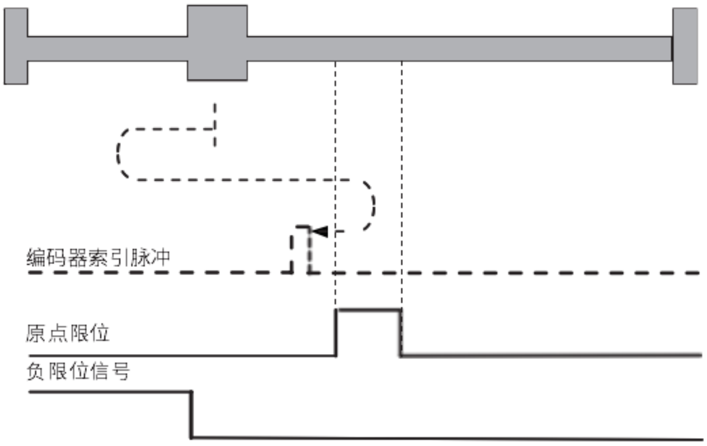



Figure 7.10.4-14-2 Zero return method 14

c. The deceleration point signal is valid at zero start.

When starting to return to zero, the home switch signal is 1 and the drive drives the motor to run directly in reverse at low speed, with the zero point being the position of the first motor encoder index pulse after the falling edge of the home switch signal is detected.

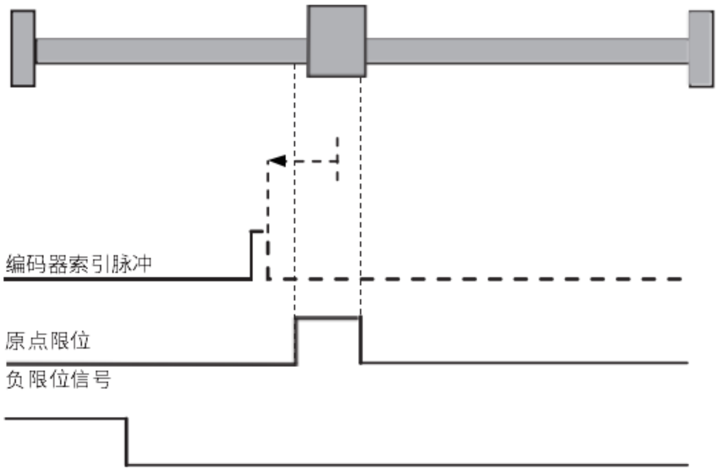



Figure 7.10. 3-14-3 Zero return method 14

15) Return to zero mode 17 (6098=17) using mechanical home and reverse overtravel switches

a. Invalid decelerations point signal at return to zero start:

When it starts to return to zero, the reverse overtravel switch signal is 0. The driver drives the motor to run at reverse high speed to find the zero position. After the rising edge of the reverse overtravel switch signal is detected, the motor starts to decelerate and reverse that is forward low speed operation, and the zero point is the position where the falling edge of the reverse overtravel switch signal is detected.

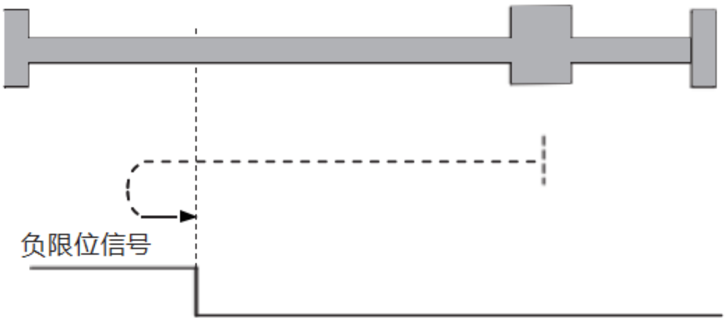



Figure 7.10. 3-15-1 Zero return method 17

b. The deceleration point signal is valid at zero return start:

When starting to return to zero, the reverse overtravel switch signal is 1, and the driver drives the motor to run directly at low speed in the forward direction, with the zero point being the position where the falling edge of the overtravel switch signal is detected.

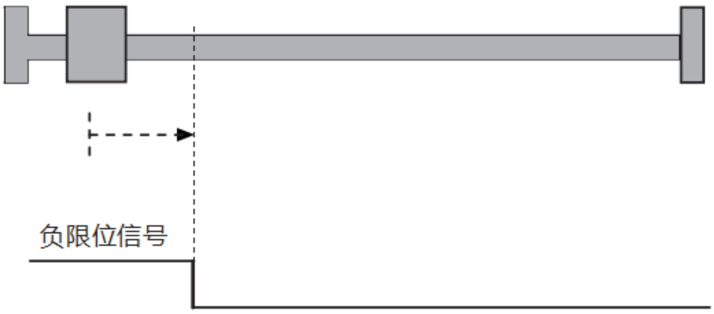



Figure 7.10. 3-15-2 Zero return method 17

16) Return to zero mode 18 (6098=18) using mechanical home and forward overtravel switch

a. Invalid decelerations point signal at return to zero start:

When starting to return to zero, the forward overtravel switch signal is 0. The driver drives the motor to run at high speed in the forward direction to find the zero position. After detecting the rising edge of the forward overtravel switch signal, the motor decelerates and runs at low speed in the reverse direction, and the zero point is the position where the falling edge of the forward overtravel switch is detected.

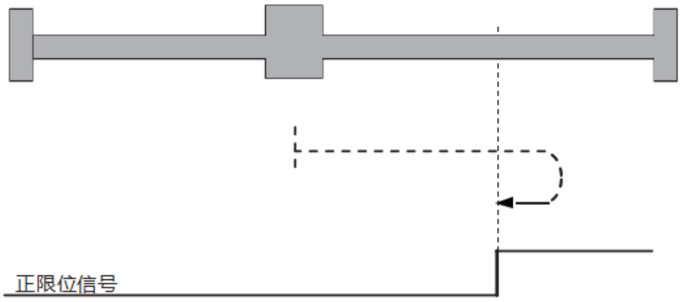



Figure 7.10. 3-16-1 Zero return method 18

b. The deceleration point signal is valid at zero return start:

When starting to return to zero, the forward overtravel switch signal is 1, and the driver drives the motor to start returning to zero at a reverse low speed, with the zero point being the position where the falling edge of the overtravel switch signal is detected.

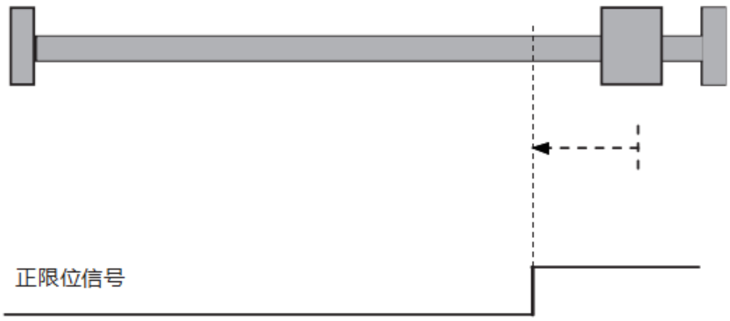



Figure 7.10. 3-16-2 Zero return method 18

17) Return to zero mode 19 (6098=19) using home switch

a. Invalid decelerations point signal at return to zero start:

When starting to return to zero, the home switch signal is 0. The driver drives the motor to run at high speed in the forward direction to find the zero position until after the rising edge of the home switch signal is detected, the motor decelerates and runs at low speed in the reverse direction, and the zero point is the position where the falling edge of the home switch signal is detected.

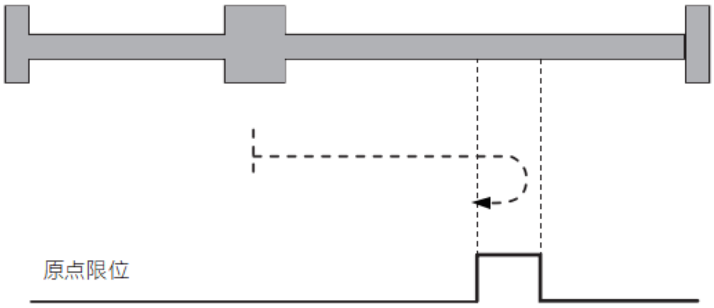



Figure 7. 10. 3-17-1 Zero return method 19

b. The deceleration point signal is valid at zero return start:

When starting to return to zero, the home switch signal is 1, and the driver drives the motor to directly reverse the low speed to start returning to zero, and the zero point is the position where the falling edge of the home switch signal is detected.

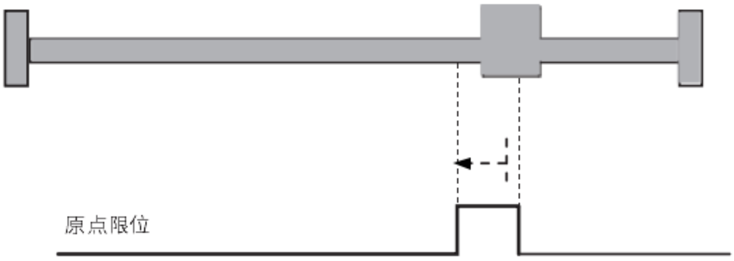



Figure 7.10. 3-17-2 Zero return method19

18) Return to zero mode 20 (6098=20) using home switch

a. The deceleration point signal is invalid at zero return start.

When starting to return to zero, the home switch signal is 0. The driver drives the motor directly to start returning to zero at low speed, and the zero point is the position where the rising edge of the home switch signal is detected.

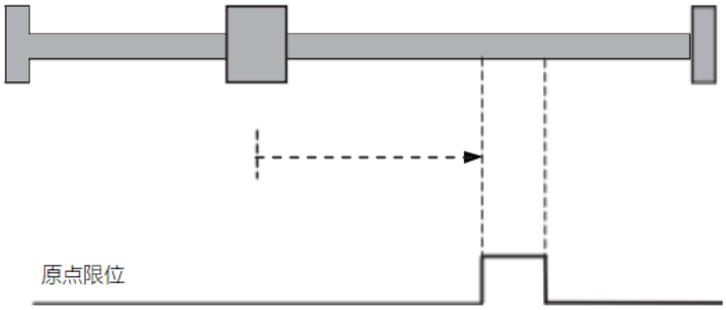



Figure 7.10. 3-18-1 Zero return method 20

b. The deceleration point signal is valid at zero return start:

When starting to return to zero, the home switch signal is 1, the driver drives the motor to start running at reverse high speed to find the zero position, until after detecting the falling edge of the home switch signal, the motor decelerates and reverses, i.e., runs at positive low speed, and the zero point is the position where the rising edge of the home switch signal is detected.

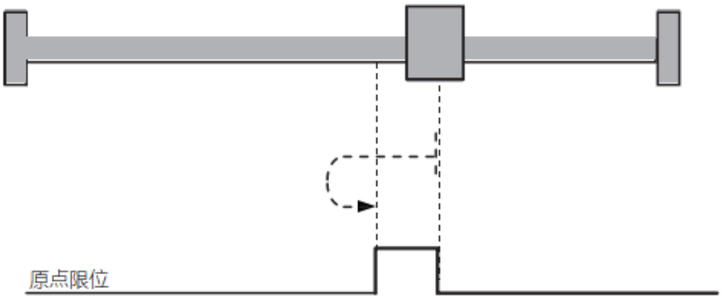



Figure 7.10. 3-18-2 Zero return method2

19) Return to zero mode 21 (6098=21) using home switch

a. The deceleration point signal is invalid at zero return start.

When starting to return to zero, the home switch signal is 0. The driver drives the motor to run at high speed in reverse to find the zero position until after the rising edge of the home switch signal is detected, the motor decelerates and reverses, i.e., runs at low speed in the forward direction, and the zero point is the position of the falling edge after the home switch signal is detected.

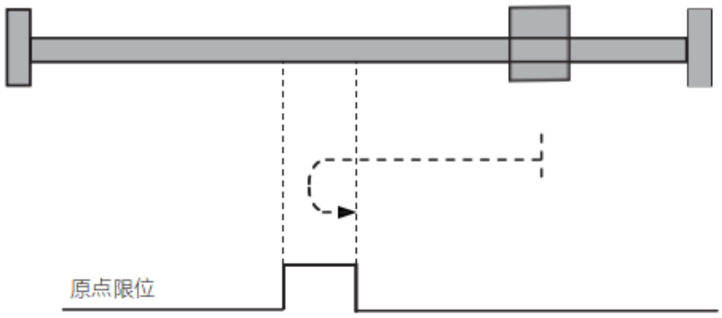



Figure 7.10. 3-19-1 Zero return method 21

b. The deceleration point signal is valid at zero return start:

When starting to return to zero, the home switch signal is 1, and the driver drives the motor directly to start returning to zero at a positive low speed, with the zero point being the position of the falling edge of the home switch detected.

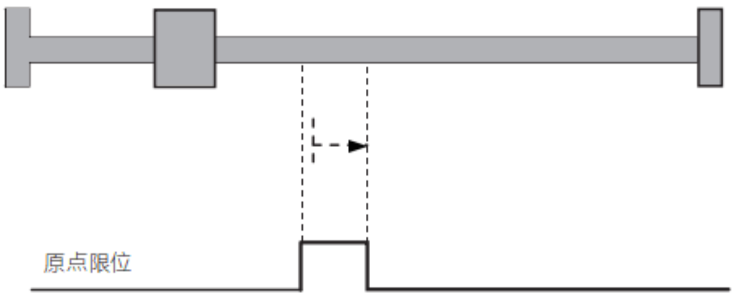



Figure 7.10. 3-19-2 Zero return method

20) Return to zero mode 22 (6098=22) using home switch

a. The deceleration point signal is invalid at zero return start.

When starting to return to zero, the home switch signal is 0, and the driver drives the motor to directly reverse the low speed to start returning to zero, and the zero point is the position where the rising edge of the home switch signal is detected.

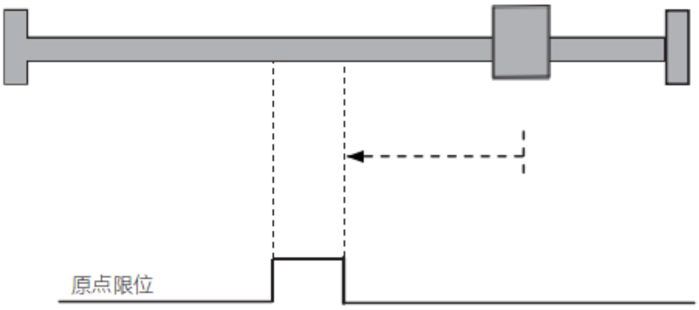



Figure 7.10. 3-20-1 Zero return method 22

b. The deceleration point signal is valid at zero start.

When starting to return to zero, the home switch signal is 1, and the driver drives the motor to run at high speed in the forward direction to find the zero position. Until after encountering the falling edge of the home switch signal, the motor decelerates and runs at low speed in the reverse direction, and the zero point is the position where the rising edge of the home switch signal is detected.

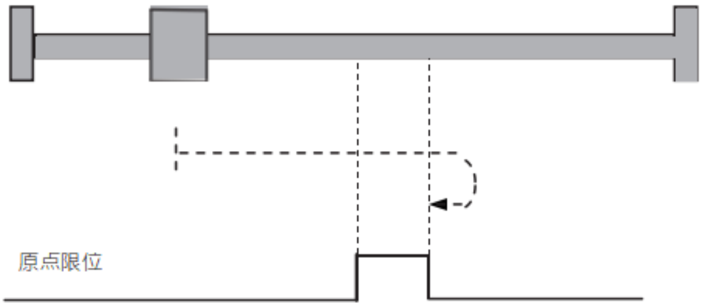



Figure 7.10. 3-20-2 Zero return method 22

21) Return to zero mode 23 (6098=23) using home switch

a. Invalid decelerations point signal at return to zero start, no positive limit switch encountered:

When starting to return to zero, the home switch signal is 0. The driver drives the motor to run at high speed in the forward direction to find the zero position. If the limit switch is not encountered until the rising edge of the home switch signal is detected, the motor decelerates and runs at low speed in the reverse direction, and the zero point is the position where the falling edge of the home switch signal is detected.

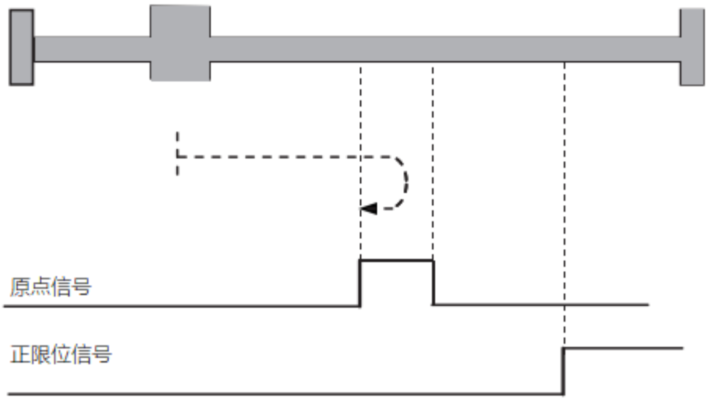



Figure 7.10. 3-21-1 Zero return method 23

b. Invalid decelerations point signal at return to zero start, positive limit switch encountered.

When starting to return to zero, the home switch signal is 0, the driver drives the motor to start to return to zero at high speed in the forward direction, and if it meets the limit switch, the motor automatically runs at high speed in the reverse direction until the rising edge of the home switch signal is detected, the motor decelerates and continues to run at low speed in the reverse direction, and the zero point is the position where the falling edge of the home switch signal is detected.

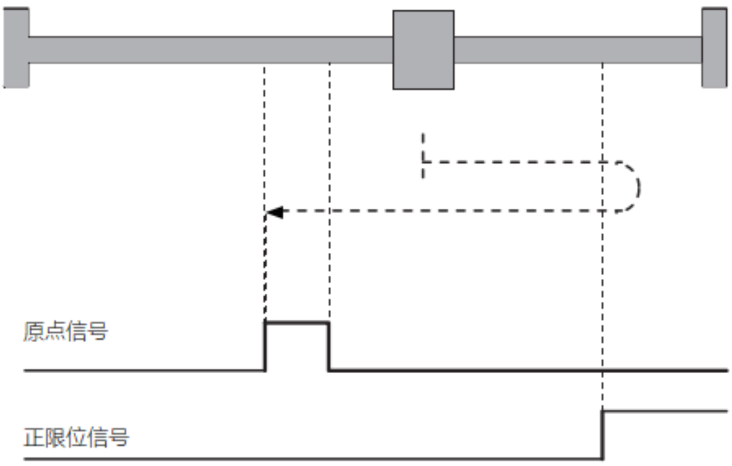



Figure 7.10. 3-21-2 Zero return method 23

c. The deceleration point signal is valid at zero return start:

When starting to return to zero, the home switch signal is 1, and the driver drives the motor to directly reverse the low speed to start returning to zero, and the zero point is the position where the falling edge of the home switch signal is detected.

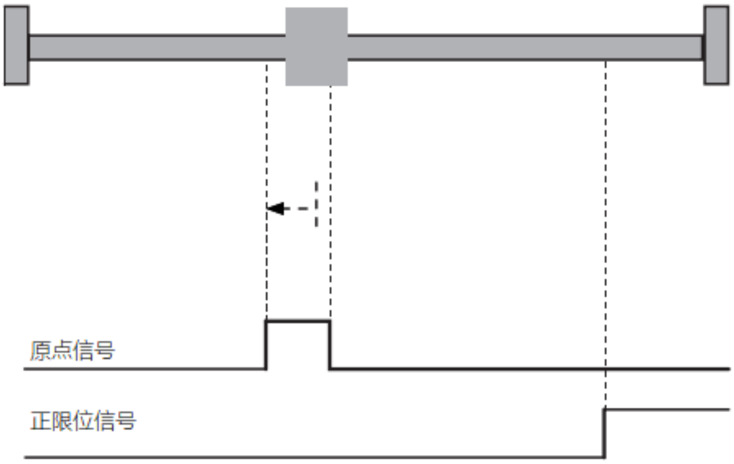



Figure 7.10. 3-21-3 Zero return method 23

22) Return to zero mode 24 (6098=24) using home switch

a. Invalid decelerations point signal at return to zero start, no positive limit switch encountered:

When starting to return to zero, the home switch signal is 0, the driver drives the motor to start returning to zero at high speed in the forward direction, without encountering the limit switch until after detecting the rising edge of the home switch signal, the motor decelerates and runs at low speed in the reverse direction, and the zero point is the position where the rising edge of the home switch limit is detected.

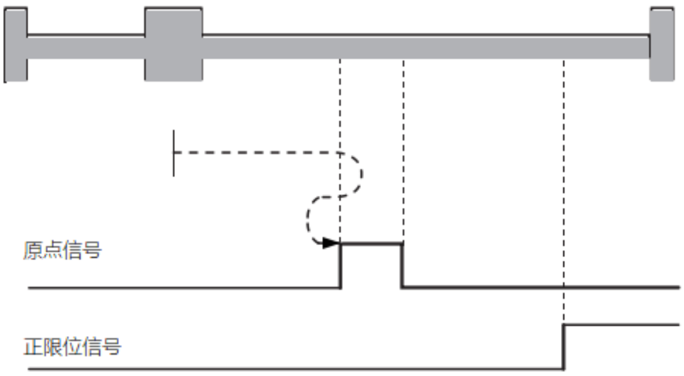



Figure 7.10. 3-22-1 Zero return method 24

b. Invalid decelerations point signal at return to zero start, positive limit switch encountered.

When starting to return to zero, the home switch signal is 0, the driver drives the motor to start to return to zero at high speed in the forward direction, and when it meets the limit switch, the motor automatically reverses and runs at high speed until the rising edge of the home switch signal is detected, then the motor starts to decelerate and run at low speed in the reverse direction, and the zero point is the position where the rising edge of the home switch signal is detected.

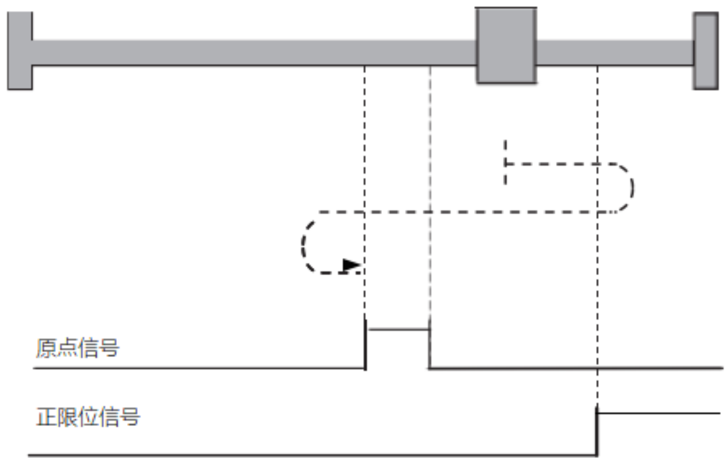



Figure 7.10. 3-22-2 Zero return method 24

c. The deceleration point signal is valid at zero return start:

When starting to return to zero, the home switch signal is 1, the driver drives the motor directly reverse low speed to start returning to zero, until after detecting the falling edge of the home switch signal, the motor reverses and runs forward low speed, the zero point is the position where the rising edge of the original electric switch signal is detected.

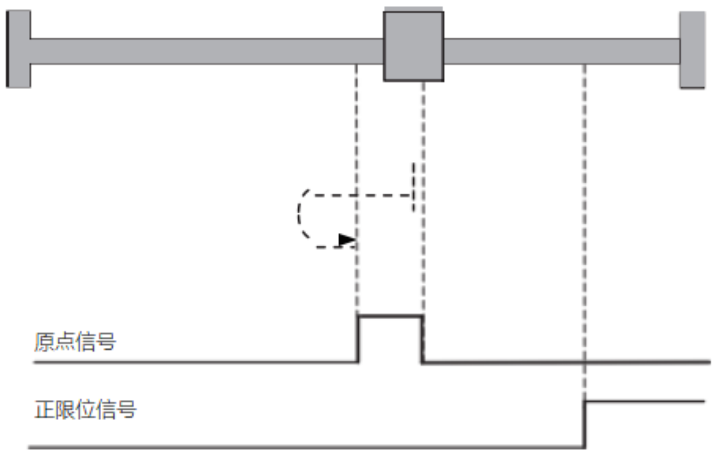



Figure 7.10. 3-22-3 Zero return method 24

23) Return to zero mode 25 (6098=25) using home switch

a. Invalid decelerations point signal at return to zero start, no positive limit switch encountered:

When starting to return to zero, the home switch signal is 0. The driver drives the motor to start returning to zero at a positive high speed, without encountering the limit switch, until after detecting the rising edge of the home switch signal, the motor decelerates and runs at a positive low speed, with the zero point being the position where the rising edge of the home switch signal is detected.

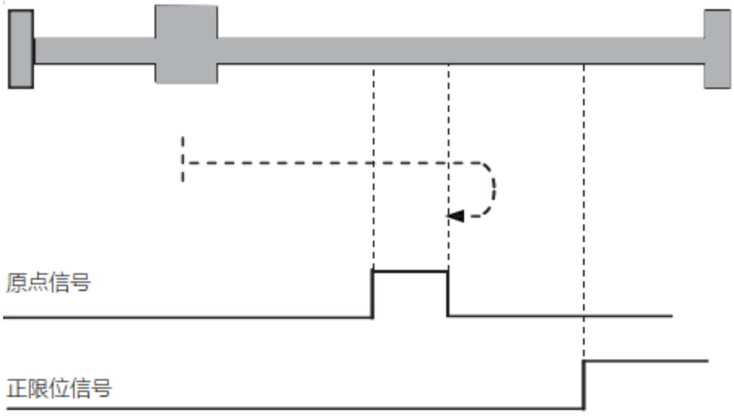



Figure 7.10. 3-23-1 Zero return method 25

b. Invalid decelerations point signal at return to zero start, positive limit switch encountered.

When starting to return to zero, the home switch signal is 0. When the driver drives the motor to start to return to zero at high speed in the forward direction, the motor will automatically reverse and run at high speed when it meets the limit switch until it detects the rising edge of the home switch signal, the motor decelerates and reverses that it resumes forward running, and the motor reverses to run at low speed after the falling edge of the home switch signal is detected in the forward low speed operation, and the zero point is the position after the rising edge of the home switch signal is detected. position.

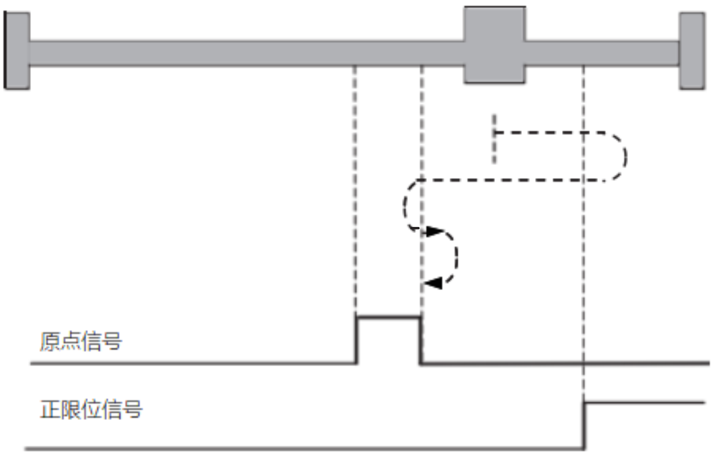



Figure 7.10. 3-23-2 Zero return method 25

c. The deceleration point signal is valid at zero start.

When starting to return to zero, the home switch signal is 1, and the driver drives the motor directly to start returning to zero at low speed until after the falling edge of the home switch signal is detected, the motor reverses and runs at low speed, and the zero point is the position where the rising edge of the home switch signal is detected.

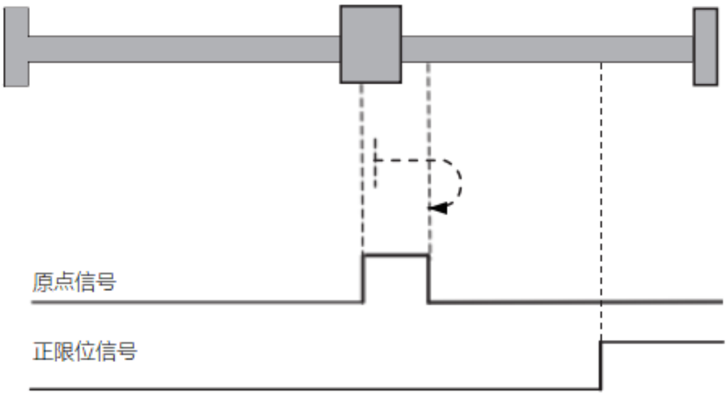



Figure 7.10. 3-23-3 Zero Return Method 25

24) Return to zero mode 26 (6098=26) using home switch

a. Invalid decelerations point signal at return to zero start, no positive limit switch encountered:

When starting to return to zero, the home switch signal is 0. The driver drives the motor to start returning to zero at a positive high speed without encountering the limit switch until after the rising edge of the home switch signal is detected, the motor decelerates and runs at a positive low speed, with the zero point being the position where the falling edge of the home switch signal is detected.

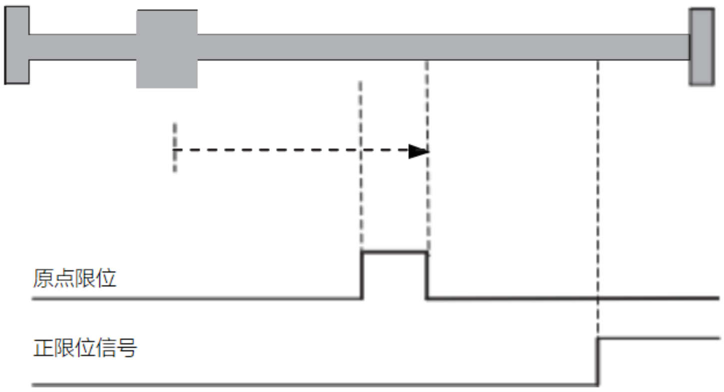



Figure 7.10. 3-24-1 Zero return method26

b. Invalid decelerations point signal at return to zero start, positive limit switch encountered:

When starting to return to zero, the home switch signal is 0, the driver drives the motor to run at high speed in the forward direction to find the zero position. If the limit switch is encountered, the motor automatically reverses and runs at high speed until the rising edge of the home switch signal is detected, the motor decelerates and reverses to resume forward operation, and the zero point is the position where the falling edge of the home switch signal is detected.

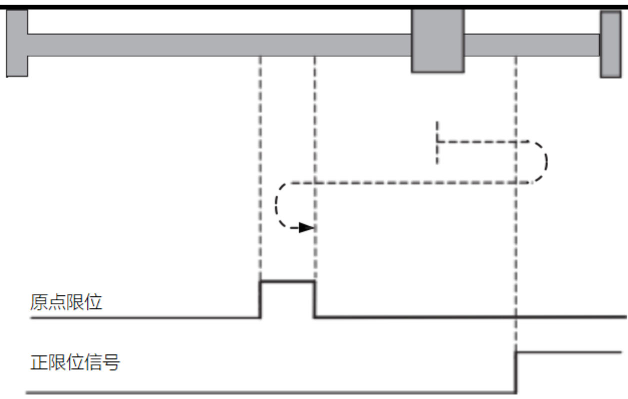



Figure 7.10. 3-24-2 Zero return method26

c. The deceleration point signal is valid at zero return start:

When starting to return to zero, the home switch signal is 1, and the driver drives the motor directly to start returning to zero at low speed, and the zero point is the position where the falling edge of the home signal is detected.

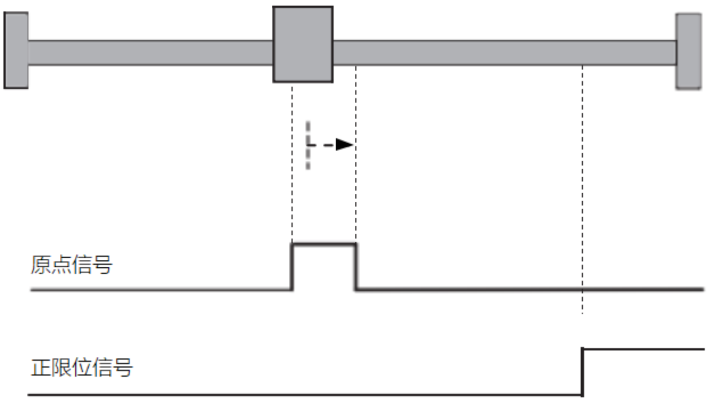



Figure 7.10. 3-24-3 Zero return method26

25) Return to zero mode 27 (6098=27) using home switch

a. Invalid decelerations point signal at return to zero start, no reverse limit switch encountered:

When starting to return to zero, the home switch signal is 0, the driver drives the motor to reverse the high speed to start back to zero, not encountering the limit switch, after detecting the rising edge of the home switch signal, the motor decelerates and reverses, that is, the positive low speed operation, the zero point is the position where the falling edge of the home switch signal is detected.

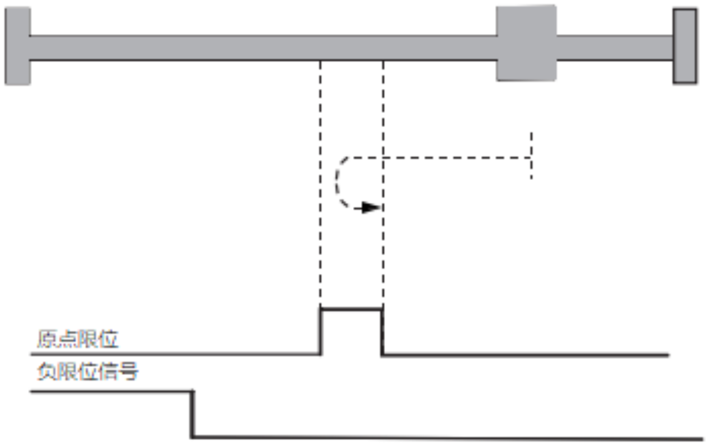



Figure 7.10. 3-25-1 Zero return method 27

b. Invalid decelerations point signal at return to zero start, reverse limit switch encountered.

When starting to return to zero, the home switch signal starts to return to zero at reverse high speed, if it meets the limit switch, the motor automatically reverses and runs at high speed in the forward direction until the rising edge of the home switch signal is detected, then the motor starts to decelerate and continues to run at low speed in the forward direction, and the zero point is the position where the falling edge of the home switch signal is detected.

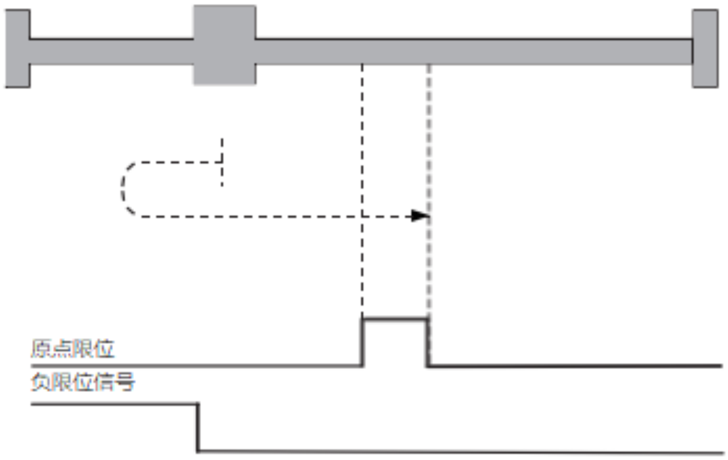



Figure 7.10. 3-25-2 Zero return method27

c. The deceleration point signal is valid at zero return start:

When starting to return to zero, the home switch signal is 1, and the driver drives the motor directly to start returning to zero at low speed, and the zero point is the position where the falling edge of the home switch signal is detected.

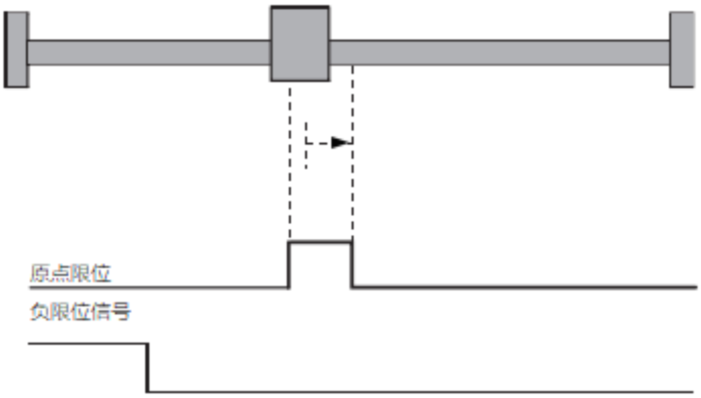



Figure 7.10. 3-25-3 Zero return method27

26) Return to zero mode 28 (6098=28) using home switch

a. Invalid decelerations point signal at return to zero start, no reverse limit switch encountered:

When starting to return to zero, the home switch signal is 0, the driver drives the motor to run at high speed in the reverse direction to find the zero position. When the limit switch is not encountered, after the rising edge of the home switch signal is detected, the motor decelerates and reverses, and the motor runs at low speed in the positive direction until after the falling edge of the home switch signal is detected, the motor reverses and runs at low speed, and the zero point is the position where the rising edge of the home switch signal is detected.

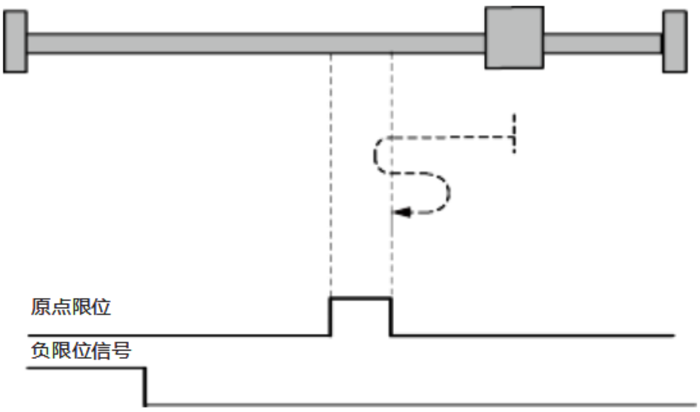
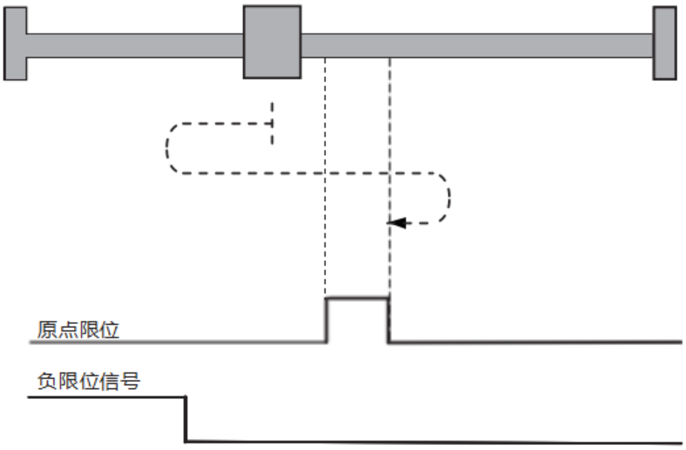


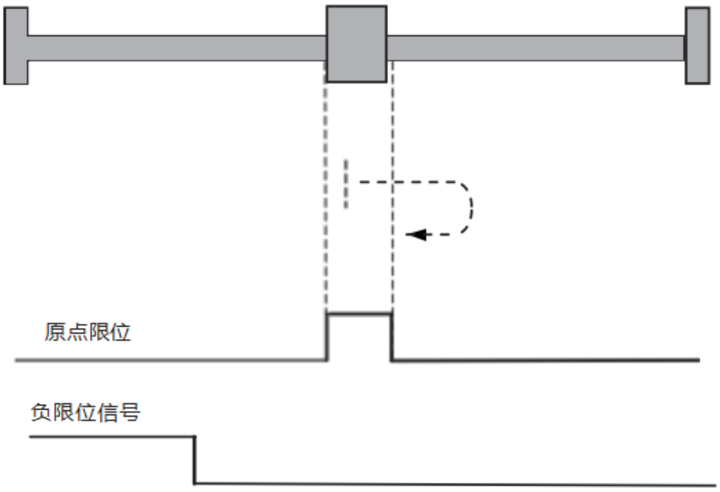

Figure 7.10. 3-26-1 Zero return method 28

b. Invalid decelerations point signal at return to zero start, reverse limit switch encountered




HW=0 at the beginning of zero return, start zero return at reverse high speed, encounter limit switch, automatically reverse, forward high-speed operation, after encountering HW rising edge, decelerate, forward low speed operation, after encountering HW falling edge, reverse, reverse low speed operation, encounter HW rising edge stop.

c. The deceleration point signal is valid at zero return start




Back to zero start with HW = 1, then directly forward low speed to start back to zero, after encountering the falling edge of HW, reverse, reverse low speed, encountering the rising edge of HW to stop.

27) Return to zero mode 29 (6098=29) using home switch

a. Invalid decelerations point signal at return to zero start, no reverse limit switch encountered.

When starting to return to zero, the home switch signal is 0, and the driver drives the motor to run at reverse high speed to find the zero position. If the limit switch is not encountered, after the rising edge of the home switch signal is detected, the motor decelerates and runs at low speed in the reverse direction, and the zero point is the position where the rising edge of the home switch signal is detected.

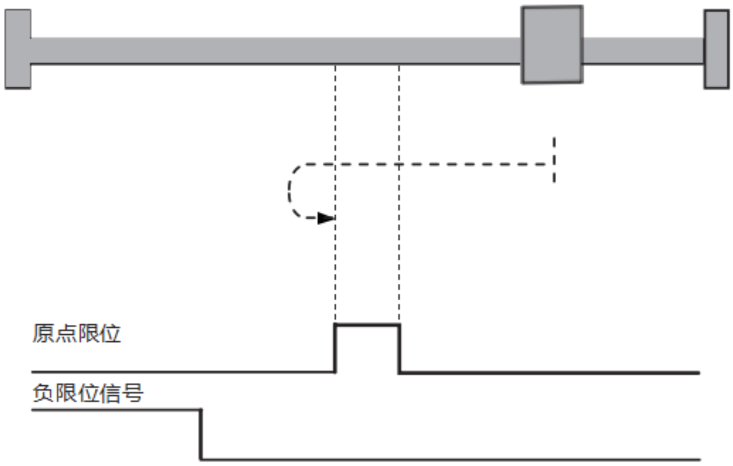



Figure 7.10. 3-27-1 Zero return method 29

b. Invalid decelerations point signal at return to zero start, reverse limit switch encountered.

Start back to zero, the origin switch signal is 0, the driver drives the motor to reverse high speed to start back to zero, if it encounters the limit switch, the motor automatically reverses, the motor starts positive high speed operation until after detecting the rising edge of the origin switch signal, the motor starts to decelerate reverse operation, reverse low speed operation after detecting the falling edge of the origin switch signal, the motor reverses and starts positive low speed operation, the zero point is the detection of the original electric switch signal The position of the rising edge.

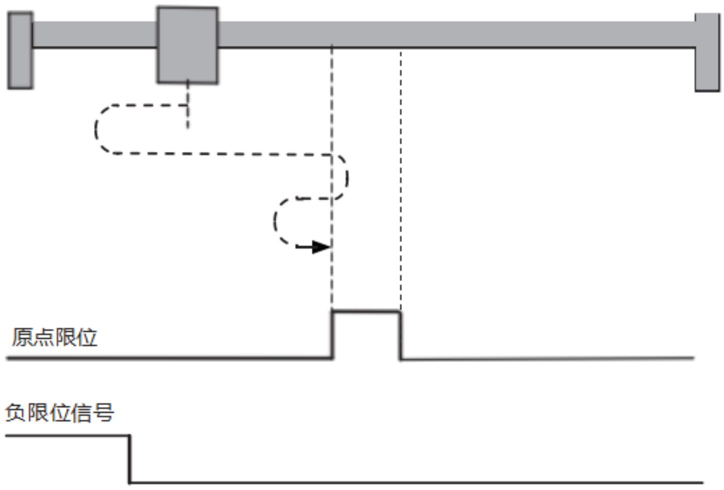



Figure 7.10. 3-27-2 Zero return method29

c. The deceleration point signal is valid at zero return start:

When starting to return to zero, the home switch signal is 1, the driver drives the motor directly reverse low speed to start back to zero, until after detecting the falling edge of the home switch signal, the motor reverses that is positive low speed operation, the zero point is the position where the rising edge of the home switch signal is detected.

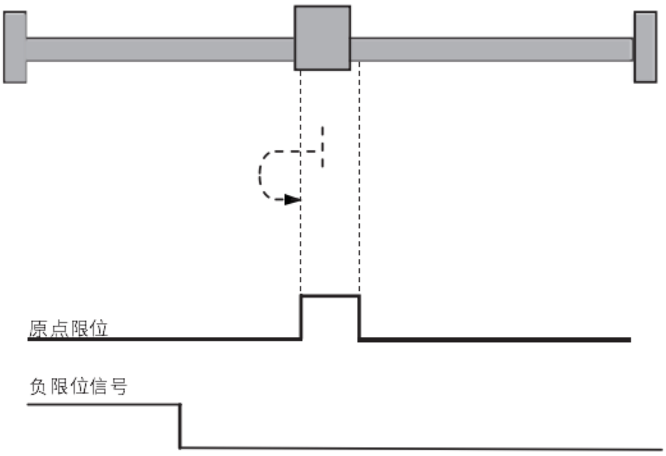



Figure 7.10. 3-27-3 Zero return method29

28) Return to zero mode 30 (6098=30) using home switch

a. Invalid decelerations point signal at return to zero start, no reverse limit switch encountered.

When starting to return to zero, the home switch signal is 0, the driver drives the motor to start to return to zero at reverse high speed, if it does not encounter the limit switch, after detecting the rising edge of the home switch signal, the motor decelerates and runs at reverse low speed, and the zero point is the position where the falling edge of the home switch signal is detected.

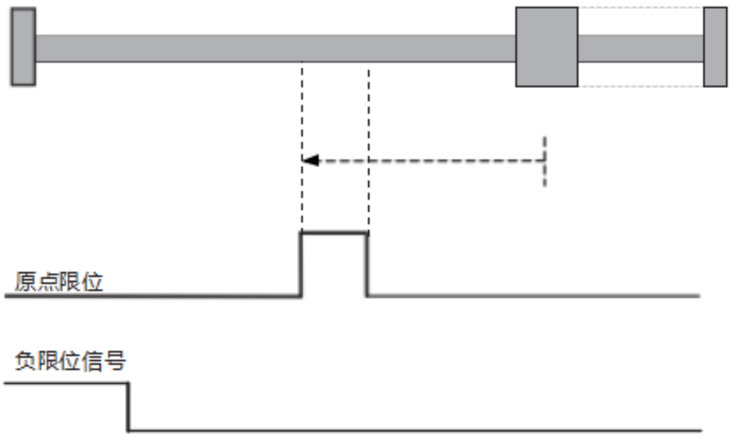



Figure 7.10. 3-28-1 Zero return method 30

b. Invalid decelerations point signal at return to zero start, reverse limit switch encountered:

When starting to return to zero, the home switch signal is 0, the driver drives the motor to start to return to zero at reverse high speed, if it meets the limit switch, the motor automatically reverses and runs at high speed in the forward direction until the rising edge of the home switch signal is detected, the motor decelerates and runs in the reverse direction, and the zero point is the position where the falling edge of the home switch signal is detected.

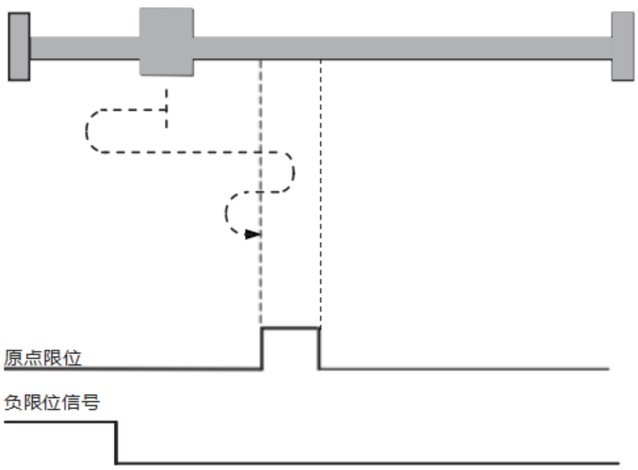



Figure 7.10. 3-28-2 Zero return method 30

c. The deceleration point signal is valid at zero start.

When starting to return to zero, the home switch signal is 1, and the driver drives the motor to directly reverse low speed to start returning to zero, and the zero point is the position where the falling edge of the home switch signal is detected.

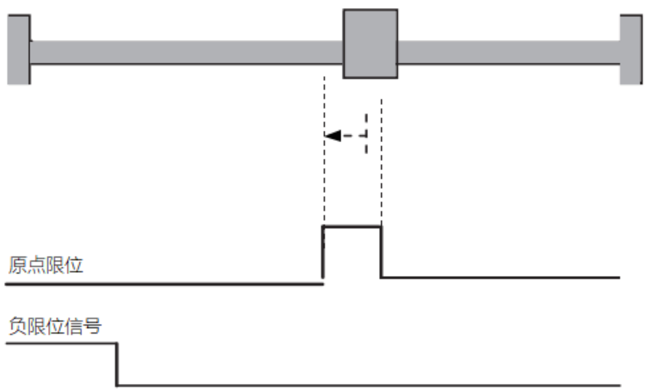



Figure 7.10.4-28-3 Zero return method 30

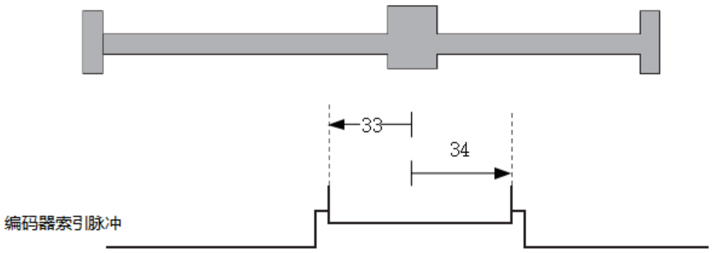
29) Return to zero mode 31/32 (6098=31/32)

This mode is not defined in the standard 402 protocol and can be used for extensions.

30) Zero return method 33/34 (6098=33/34) using motor encoder index pulse (Z believe signal)

Zero return mode 33: Reverse low speed operation, first Z signal encountered stops

Return to zero mode 34: Forward low speed operation, stop at the first Z signal encountered




31) Return to zero mode 35 (6098=35)

Zero return mode 35, with the current position as the mechanical home, after triggering the home return to zero (6040 control word: 0x0F → 0x1F):

- 60E6= 0 (absolute return to zero):

When the return to zero is complete, position feedback 6064 is set to home bias 607C.

- 60E6 = 1 (relative return to zero):

After the return to zero is complete, position feedback 6064 is superimposed on the original position offset 607C.

### 7.10.5 Recommended configuration

- Back to zero mode, the basic configuration is as follows:

| RxPDO | TxPDO | Remarks |
|---|---|---|
| 6040: Control word | 6041: Status word | Must |
| 6098: Homing method | | Optional |
| 6099-01: Speed during search for switch | | Optional |
| 6099-02: Speed during search for zero | | Optional |
| 609A: Homing acceleration | | Optional |
| | 6064: Position feedback position actual value | Optional |
| 6060: Modes of operation | 6061: Modes of operation display | Optional |

## 7.11 Auxiliary Functions

- The drive provides the following auxiliary functions:

(1) Input phase loss detection function.
(2) Motor protection function.
(3) Probe function.

### 7.11.1 Input phase loss detection function

The AD2 series bus servo has a mains RST input phase loss detection function. When enabled on the servo, it detects whether the main power input is out of phase according to parameter P31.08 setting.

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| Serial number P31.08 | Name | Input phase loss detection configuration | | | Setting effective | Effective immediately | Data Range | 0~2 |
| | Accessibility | RW | Unit | - | Related Models | ALL | Factory settings | 1 |
| This parameter is used to enable the servo's input out-of-phase detection function.<br>0: detection not enabled: disables the servo's input out-of-phase detection function.<br>1: Input single-phase detection: When using single-phase AC220V power supply, enable the servo's input phase-loss detection function, which will alarm and stop when single-phase power input is detected to have a deteriorating effect on the servo's current operating performance.<br>2: Input three-phase detection: When using three-phase AC220V power supply, enable the servo's input phase-loss detection function, which will alarm and stop when the three-phase power input is detected to have a deteriorating effect on the servo's current operating performance. | | | | | | | | |

## 7.11.2 Motor protection function

- Motor overload protection:

After the servo motor is energized, heat is continuously generated due to the thermal effect of the current, and heat is released to the surrounding environment at the same time. When the generated heat exceeds the released heat, the motor temperature rises and the temperature is too high, which will cause the motor to burn up. Therefore, the driver provides motor overload protection function to prevent the motor from burning up due to high temperature.

The time at which the motor overload fault (E71.80) is reported can be adjusted by setting the time for the corresponding overload multiplier (relevant parameters: P31.01, P31.02, P31.03, P31.04). P31.01, P31.02, P31.03, P31.04 generally remain as default values, but can be changed according to the actual motor heating when the following conditions occur Change:

Servo motors operating in high ambient temperatures.

Servo motor cyclic motion, and single motion cycle is short, frequent acceleration and deceleration occasions.

Associated parameters:

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| Serial number P31.01 | Name | 1.5 times overload time | | | Setting effective | Break Enable | Data Range | 1~1000000 |
| | Accessibility | RW | Unit | ms | Related Models | ALL | Factory settings | 100000 |
| This parameter is used to set the time required for the overload alarm to last after the servo current exceeds 1.5 times the rated current. To better protect the motor from damage under overload conditions, this parameter needs to be set correctly according to the motor's overload operating curve. | | | | | | | | |

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| Serial number P31.02 | Name | 2.5 times overload time | | | Setting effective | Break Enable | Data Range | 1~1000000 |
| | Accessibility | RW | Unit | ms | Related Models | ALL | Factory settings | 20000 |
| This parameter is used to set the time required for the overload alarm to last after the servo current exceeds 2.5 times the rated current. To better protect the motor from damage under overload conditions, this parameter needs to be set correctly according to the motor's overload operating curve. | | | | | | | | |

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| Serial number P31.03 | Name | Motor maximum overload multiplier | | | Setting effective | Break Enable | Data Range | 300~400 |
| | Accessibility | RW | Unit | % | Related Models | ALL | Factory settings | 400 |
| The maximum allowable motor current is a multiple of the rated motor current. To better protect the motor from damage under overload conditions, this parameter needs to be set correctly according to the motor's overload operating curve. | | | | | | | | |

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| Serial number P31.04 | Name | Maximum overload current time | | | Setting effective | Break Enable | Data Range | 1~50000 |
| | Accessibility | RW | Unit | ms | Related Models | ALL | Factory settings | 1000 |
| The maximum time that the maximum motor current is allowed to last. To better protect the motor from damage under overload conditions, this parameter needs to be set correctly according to the motor's overload operating curve. | | | | | | | | |

- Motor speed protection:

Excessive servo motor speed will lead to motor damage or mechanical damage. Therefore, the Servo Drive provides motor over maximum speed protection and motor stall protection functions.

1) Over maximum speed protection

A motor speed exceeding P11.05 motor maximum speed for 300ms continuously is reported as exceeding maximum speed fault (E84.82).

Associated parameters:

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| Serial number P11.05 | Name | Maximum motor speed | | | Setting effective | Downtime effective | Data Range | 1~30,000 |
| | Accessibility | RW | Unit | rpm | Related Models | ALL | Factory setting | 3000 |
| This parameter is used to enter the maximum speed of the motor; or it is automatically filled in by P10.02 after selecting the model. | | | | | | | | |

2) Motor stall protection

A motor stall fault (E84.85) is reported when the difference between the motor speed feedback and the speed command exceeds the P50.16 stall threshold for a sustained P50.17 stall filter time.

Associated parameters:

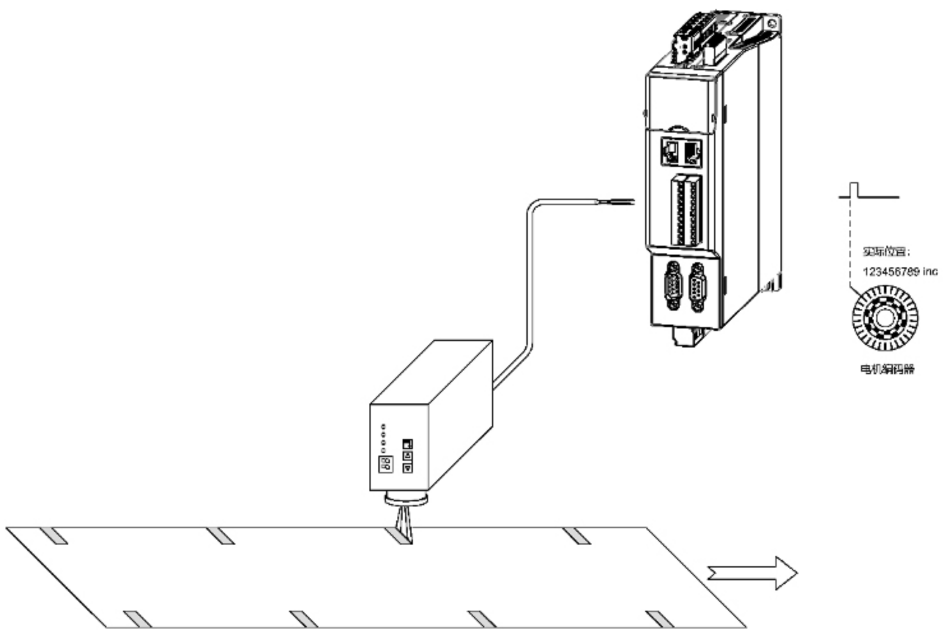
| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| Serial number P50.16 | Name | Stall Threshold | | | Setting effective | Effective immediately | Data Range | 0~200 |
| | Accessibility | RW | Unit | % | Related Models | P/S | Factory settings | 100 |
| This parameter is used to set the threshold value for stall protection, with the base value being the current speed given. When the difference between the speed feed and speed feedback reaches or exceeds the threshold set in P50.16 and the duration exceed the filter time set in P50.17 (e.g., flywheel), the servo drive will stop and report a fault. | | | | | | | | |

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| Serial number P50.17 | Name | Stall filtering time | | | Setting effective | Effective immediately | Data Range | 0~2000 |
| | Accessibility | RW | Unit | ms | Related Models | P/S | Factory settings | 100 |
| This parameter is used to set the filtering time of stall protection, which is generally not adjusted and set according to the default value. | | | | | | | | |

### 7.11.3 Probe Function

The probe function is the position latching function. It can latch the position information (command unit) when the external DI signal or motor Z signal (real Z signal or analog Z signal) changes.

AD2 servo driver supports 2 probes enabled at the same time, which can record the position information corresponding to the rising and falling edges of each probe signal at the same time, that is, 4 position information can be latched at the same time. Probe 1/2 can select DI or motor Z signal as the probe signal.




- Related objects

| Index | Sub-index | Name | Access | Data Type | Unit | Setting range | Default Value |
|---|---|---|---|---|---|---|---|

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| 0x60B8 | 00 | Probe Function | RW | Uint16 | - | 0~65535 | 0 |
| 0x60B9 | 00 | Probe Status | RO | Uint16 | - | - | 0 |
| 0x60BA | 00 | Probe 1 rising edge latch position | RO | Int32 | inc | - | 0 |
| 0x60BB | 00 | Probe 1 falling edge latch position | RO | Int32 | inc | - | 0 |
| 0x60BC | 00 | Probe 2 rising edge latch position | RO | Int32 | inc | - | 0 |
| 0x60BD | 00 | Probe 2 falling edge latch position | RO | Int32 | inc | - | 0 |

Note: See "Section 8 Object Dictionary Details" for detailed instructions on using related objects.

1) Setting steps

① Set DI

If you use external DI signal as probe trigger signal, you need to set P70.01 and P70.02 for probe function and set 11 (probe 1 normally open) or 12 (probe 2 normally open) when the valid logic of DI terminal is positive logic and set 111 (probe 1) and 112 (probe 2) when the valid logic of DI terminal is negative logic.

② Set the probe function

The meaning of each of the probe functions (0x60B8) is as follows:

| Bit | Description | Description |
|---|---|---|
| 0 | Probe 1 enables:<br>0 - Probe 1 is not enabled<br>1 - Probe 1 enable | bit0~bit5: Probe 1 related settings.<br>Bit 0 of 60B8h must remain valid during the action of probe 1<br>For absolute encoders, the Z signal refers to the zero point of the motor's single-turn position feedback |
| 1 | Probe 1 trigger mode<br>0-Single trigger, only trigger when the trigger signal is valid for the first time<br>1-Continuous trigger | |
| 2 | Probe 1 trigger signal selection<br>0-DI input signal<br>1-Z signal | |
| 3 | NA | |
| 4 | Probe 1 rising edge enable<br>0 - No latching on rising edge<br>1 - Rising edge latching | |
| 5 | Probe 1 falling edge enable<br>0 - No latching on falling edge<br>1 - Falling edge latching | |
| 6~7 | NA | NA |
| 8 | Probe 2 enables:<br>0 - Probe 2 is not enabled<br>1 - Probe 2 enable | bit8~bit13: Probe 2 related settings.<br>The bit8 of 60B8h must remain active during the action of probe 2<br>For absolute encoders, the Z signal refers to the zero point of the motor's single-turn position feedback |
| 9 | Probe 2 trigger mode<br>0-Single trigger, only trigger when the trigger signal is valid for the first time<br>1-Continuous trigger | |
| 10 | Probe 2 trigger signal selection<br>0-DI input signal<br>1-Z signal | |
| 11 | NA | |
| 12 | Probe 2 rising edge enable<br>0 - No latching on rising edge<br>1 - Rising edge latching | |
| 13 | Probe 2 falling edge enable<br>0 - No latching on falling edge<br>1 - Falling edge latching | |
| 14~15 | NA | NA |

2) Read probe status 0x60B9

| Bit | Description | Remarks |
|---|---|---|
| 0 | Probe 1 enables:<br>0 - Probe 1 not enabled<br>1 - Probe 1 enable | bit0~bit2: Response probe 1 status |

| | | |
|---|---|---|
| 1 | Probe 1 rising edge latch execution<br>0 - rising edge latch not executed<br>1 - Rising edge latch is executed | |
| 2 | Probe 1 falling edge latch execution<br>0 - Falling edge latch not executed<br>1 - Falling edge latch is executed | |
| 3~7 | NA | NA |
| 8 | Probe 2 enables:<br>0 - Probe 2 not enabled<br>1 - Probe 2 enable | bit8~bit10: Response probe 2 status |
| 9 | Probe 2 rising edge latch execution<br>0 - rising edge latch not executed<br>1 - Rising edge latch is executed | |
| 10 | Probe 2 falling edge latch execution<br>0 - Falling edge latch not executed<br>1 - Falling edge latch is executed | |
| 11~15 | NA | NA |

3) Read Probe Latch Position

The information of the 4 positions of the probe is recorded in objects 0x60BA~0x60BD.

Examples:

Set 0x60B8=0x0013, i.e., DI signal as probe 1 trigger signal, rising edge single trigger.

By reading bit1 of 0x60B9, you can determine whether the servo driver has executed the probe 1 rising edge position latch function.

If it is judged that the probe 1 rising edge position latch function has been executed, the position information can be read by reading 0x60BA (probe 1 rising edge position feedback latch value, command unit).

Use the legend.

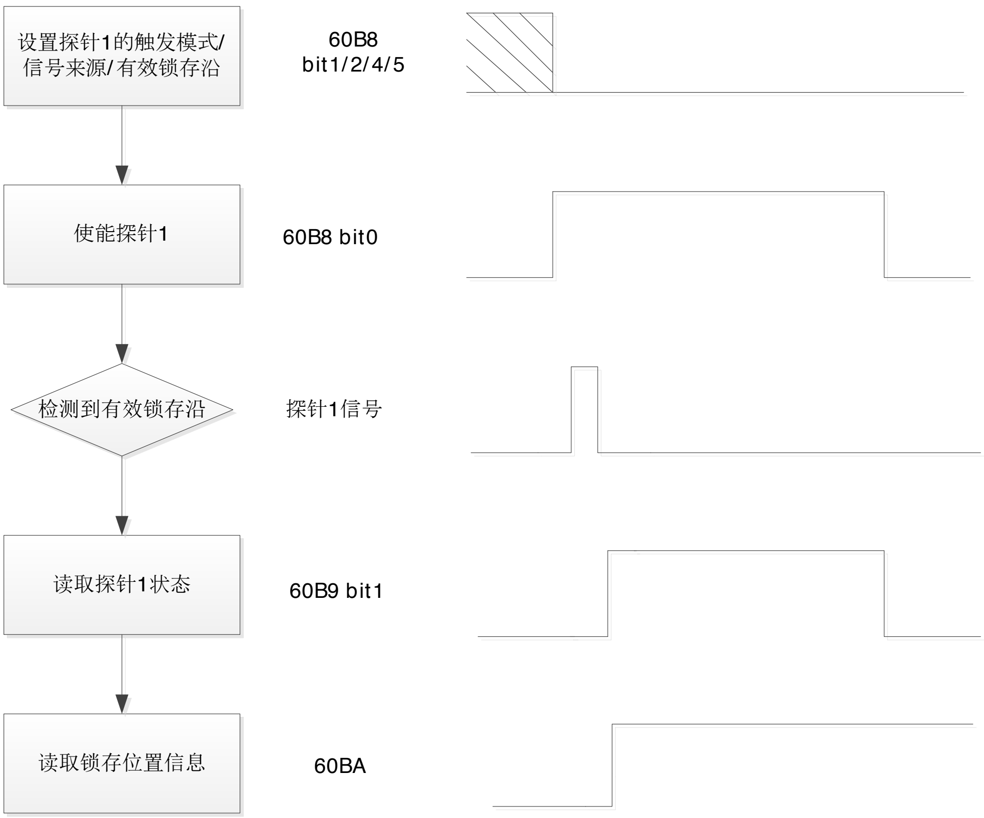



Figure 7.11.4-1 Probe use step by step illustration

# Section 8 Object Dictionary

- Terminology.

| Name | Explanation |
|---|---|
| Protection level | 0 general browsing privileges.<br>1 Operator rights.<br>2 Engineer Permissions. |
| Access Properties | RW read/write.<br>RO Read-only.<br>WO only writes. |
| Setting method | 0: shutdown setting.<br>1 Run settings. |
| Effective method | 0 effective immediately.<br>1 Shutdown effective.<br>2 Power on again. |
| Can you map | NO: not mappable in PDO.<br>RPDO: Can be mapped to RPDO. |
| Mapping | TPDO: can be mapped to TPDO.<br>RTPDO: can be mapped to RPDO or TPDO |

Note: The units in the parameter object table of this chapter refer to the units when reading and writing parameters using the upper controller. It is not the same as the unit in the interface of debugging software, so please pay attention to distinguish the unit and factory value when setting parameters with debugging software.

- P00 general configuration parameter group

| Index 0X3000 (P00) | Name | Data Type | Data Structure | Access Properties | Setting method | Effective mode | Factory value |
|---|---|---|---|---|---|---|---|
| | General configuration | - | ARR | - | - | - | - |
| | | Data Range | - | | Can you map | Related Models | Protection level |
| | | Unit | - | | - | - | - |

| Sub-index 0X01 (P00.01) | Name | Data Type | Access Properties | Setting method | Effective mode | Factory value |
|---|---|---|---|---|---|---|
| | Permission password | DINT32 | WO | Operation settings | Effective immediately | 0 |
| | | Data Range | 0~65535 | Can you map | Related Models | Protection level |
| | | Unit | - | NO | ALL | 0 |
| | This parameter is used to enter the login password. When using the operation panel to set parameters, the corresponding parameters of the servo are allowed to be modified only after successful login; when using the debugging software to set parameters, the corresponding password can be entered in the login interface and is not restricted by this parameter. | | | | | |

| Sub-index 0X02 (P00.02) | Name | Data Type | Access Properties | Setting method | Effective mode | Factory value |
|---|---|---|---|---|---|---|
| | Control channel selection | DINT32 | RW | Shutdown settings | Effective immediately | 1 |
| | | Data Range | 0~4 | Can you map | Related Models | Protection |

| | | | | | | |
|---|---|---|---|---|---|---|
| | | | | | | level |
| | | Unit | - | NO | ALL | 1 |
| | This parameter is used to set how the control commands are given in different control modes.<br>0: Control panel control 1: Controller control 2: AD commissioning software control<br>3：Analog 1 control 4：Analog 2 control 5：Reserve | | | | | |

| Sub-index 0X03 (P00.03) | Name | Data Type | Access Properties | Setting method | Effective mode | Factory value |
|---|---|---|---|---|---|---|
| | Motor configuration selection | DINT32 | RW | Shutdown settings | Power on again | 0 |
| | | Data Range | 0~2 | Can you map | Related Models | Protection level |
| | | Unit | - | NO | ALL | 2 |
| | This parameter is used to set the way of giving the motor parameters. The modification of this parameter should be operated under the protection level 2 (engineer level).<br>0: Motor reading<br>Matching the 0x3010 motor model parameters, the 0x3011 motor nameplate parameters, the 0x3002:02 and 0x3002:03 encoder parameters for single-turn multi-turn resolution, and the 0x3002:07 encoder position angle parameters by reading the internal data of the motor encoder.<br>When using this mode, please note that the matching motor is our ASK series motor, and should confirm 0x3002:01<br>The encoder type parameter matches the current matching motor type.<br>1: User settings<br>When the motor used is another series motor, you need to manually configure the parameter groups 0x3010, 0x3011, 0x3020, 0x3021, etc.<br>2: Bus configuration<br>Temporarily invalid. | | | | | |

- P01 bus control parameter group

| Index 0X3001 (P01) | Name | Data Type | Data Structure | Access Properties | Setting method | Effective mode | Factory value |
|---|---|---|---|---|---|---|---|
| | Communication parameters | - | ARR | - | - | - | - |
| | | Data Range | - | | Can you map | Related Models | Protection level |
| | | Unit | - | | - | - | - |

| Sub-index 0X01 (P01.01) | Name | Data Type | Access Properties | Setting method | Effective mode | Factory value |
|---|---|---|---|---|---|---|
| | Bus Type Selection | DINT32 | RW | Operation settings | Power on again | 1 |
| | | Data Range | 0~2 | Can you map | Related Models | Protection level |
| | | Unit | - | NO | ALL | 1 |
| | This parameter is used to select the communication method selected for the servo; the default is EtherCAT communication:<br>0: No bus interface 1: EtherCAT 2: CANopen (reserved) | | | | | |

| Sub-index 0X02 (P01.02) | Name | Data Type | Access Properties | Setting method | Effective mode | Factory value |
|---|---|---|---|---|---|---|
| | Local Node Number | DINT32 | RW | Shutdown settings | Power on again | 1 |
| | | Data Range | 0~240 | Can you map | Related Models | Protection level |
| | | Unit | - | NO | ALL | 0 |
| | This parameter is used to set the node number of the servo in the bus topology for bus | | | | | |

<table>
<tr><td></td><td colspan="6">communication; when the bus type is EtherCAT, the node setting supports two setting methods, see parameter 0x3001:05, Node number configuration selection.</td></tr>
<tr><td rowspan="5">Sub-index 0X03 (P01.03)</td><td>Name</td><td>Data Type</td><td>Access Properties</td><td>Setting method</td><td>Effective mode</td><td>Factory value</td></tr>
<tr><td rowspan="3">Master communication cycle</td><td>DINT32</td><td>RO</td><td>-</td><td>Downtime effective</td><td>2000</td></tr>
<tr><td>Data Range</td><td>200~1000000</td><td>Can you map</td><td>Related Models</td><td>Protection level</td></tr>
<tr><td>Unit</td><td>us</td><td>NO</td><td>ALL</td><td>1</td></tr>
<tr><td colspan="6">This parameter shows the communication period during bus communication EtherCAT does not require a user setting and automatically gets the communication period of the master.</td></tr>
<tr><td rowspan="5">Sub-index 0X04 (P01.04)</td><td>Name</td><td>Data Type</td><td>Access Properties</td><td>Setting method</td><td>Effective mode</td><td>Factory value</td></tr>
<tr><td rowspan="3">Synchronization detection enable</td><td>DINT32</td><td>RW</td><td>Operation settings</td><td>Power on again</td><td>1</td></tr>
<tr><td>Data Range</td><td>0~1</td><td>Can you map</td><td>Related Models</td><td>Protection level</td></tr>
<tr><td>Unit</td><td>-</td><td>NO</td><td>ALL</td><td>1</td></tr>
<tr><td colspan="6">This parameter is used to set whether to enable synchronous data detection during bus communication:<br>0: No 1: Yes</td></tr>
</table>

<table>
<tr><td rowspan="5">Sub-index 0X05 (P01.05)</td><td>Name</td><td>Data Type</td><td>Access Properties</td><td>Setting method</td><td>Effective mode</td><td>Factory value</td></tr>
<tr><td rowspan="3">Node number configuration selection</td><td>DINT32</td><td>RW</td><td>Operation settings</td><td>Effective immediately</td><td>0</td></tr>
<tr><td>Data Range</td><td>0~1</td><td>Can you map</td><td>Related Models</td><td>Protection level</td></tr>
<tr><td>Unit</td><td>-</td><td>NO</td><td>ALL</td><td>1</td></tr>
<tr><td colspan="6">This parameter is used to set the station number setting method:<br>0: Bus setting<br>Station address can be written by the upper controller via the bus<br>1：P01.02 parameter setting<br>The station address is determined by the drive local parameter P01.02. However, please note that some master controllers, such as Pepperl+Fuchs, do not allow the slave to write the station number in this way, so please be careful to distinguish whether the master controller supports this method when setting the slave address.</td></tr>
</table>

- P10~P11 Motor parameter group

<table>
<tr><th rowspan="4">Index 3010h (P10)</th><th>Name</th><th>Data Type</th><th>Data Structure</th><th>Access Properties</th><th>Setting method</th><th>Effective mode</th><th>Factory value</th></tr>
<tr><td rowspan="3">Motor model parameters</td><td>-</td><td>ARR</td><td>-</td><td>-</td><td>-</td><td>-</td></tr>
<tr><td>Data Range</td><td colspan="2">-</td><td>Can you map</td><td>Related Models</td><td>Protection level</td></tr>
<tr><td>Unit</td><td colspan="2">-</td><td>-</td><td>-</td><td>-</td></tr>
<tr><th rowspan="5">Sub-index 01h (P10.01)</th><th>Name</th><th>Data Type</th><th colspan="2">Access Properties</th><th>Setting method</th><th>Effective mode</th><th>Factory value</th></tr>
<tr><td rowspan="3">Motor Series</td><td>DINT32</td><td colspan="2">RW</td><td>Shutdown settings</td><td>Downtime effective</td><td>0</td></tr>
<tr><td>Data Range</td><td colspan="2">0~6</td><td>Can you map</td><td>Related Models</td><td>Protection level</td></tr>
<tr><td>Unit</td><td colspan="2">-</td><td>NO</td><td>ALL</td><td>0</td></tr>
<tr><td colspan="7">This parameter is used to select the motor series:<br>0：Other series motors<br>1: ASK 200V motor<br>2: ASK 400V motor<br>3: ASK 200V motor<br>4: ASK 400V motor</td></tr>
</table>

<table>
<tr><th rowspan="8">Sub-index 02h (P10.02)</th><th>Name</th><th>Data Type</th><th>Access Properties</th><th>Setting method</th><th>Effective mode</th><th>Factory value</th></tr>
<tr><td rowspan="3">Motor Model</td><td>DINT32</td><td>RW</td><td>Shutdown settings</td><td>Downtime effective</td><td>0</td></tr>
<tr><td>Data Range</td><td>0~40</td><td>Can you map</td><td>Related Models</td><td>Protection level</td></tr>
<tr><td>Unit</td><td>-</td><td>NO</td><td>ALL</td><td>0</td></tr>
<tr><td colspan="6">This parameter is used to select the motor type based on the 3010h:01h motor series parameters:</td></tr>
<tr><td colspan="2">0: Other series motors</td><td colspan="4">0: Custom motor</td></tr>
<tr><td colspan="2">1: ASK 200V motor</td><td colspan="4">Examples:<br>1: ASK40-2-002M30</td></tr>
<tr><td colspan="2">2: ASK 400V motor</td><td colspan="4">Examples:<br>1: ASK180-4-480H1518B-A1 2: ASKM130H-08315</td></tr>
</table>

| **Sub-index 03h (P10.03)** | **Name** | **Data Type** | **Access Properties** | **Setting method** | **Effective mode** | **Factory value** |
|---|---|---|---|---|---|---|
| | Motor type | DINT32 | RW | Shutdown settings | Downtime effective | 0 |
| | | Data Range | 0~2 | Can you map | Related Models | Protection level |
| | | Unit | - | NO | ALL | 1 |
| | This parameter is used to set the type of motor:<br>0: Synchronous motor<br>1: Asynchronous motor<br>2: Linear motor | | | | | |

| **Index 3011h (P11)** | **Name** | **Data Type** | **Data Structure** | **Access Properties** | **Setting method** | **Effective mode** | **Factory value** |
|---|---|---|---|---|---|---|---|
| | Motor nameplate parameters | - | ARR | - | - | - | - |
| | | Data Range | - | | Can you map | Related Models | Protection level |
| | | Unit | - | | - | - | - |

| **Sub-index 01h (P11.01)** | **Name** | **Data Type** | **Access Properties** | **Setting method** | **Effective mode** | **Factory value** |
|---|---|---|---|---|---|---|
| | Motor rated power | DINT32 | RW | Operation Settings | Downtime effective | 68 |
| | | Data Range | 1~20,000 | Can you map | Related Models | Protection level |
| | | Unit | 0.01kW | NO | ALL | 1 |
| | This parameter is used to enter the rated power of the motor; or it is filled in automatically when the motor model is selected by P10.01 and P10.02. | | | | | |

| **Sub-index 02h (P11.02)** | **Name** | **Data Type** | **Access Properties** | **Setting method** | **Effective mode** | **Factory value** |
|---|---|---|---|---|---|---|
| | Motor rated current | DINT32 | RW | Operation Settings | Downtime effective | 20 |
| | | Data Range | 1~4000 | Can you map | Related Models | Protection level |
| | | Unit | 0.1A | NO | ALL | 1 |
| | This parameter is used to enter the rated current rms value of the motor; or it is automatically filled in after the motor model is selected by P10.01 and P10.02. | | | | | |

| **Sub-index 03h (P11.03)** | **Name** | **Data Type** | **Access Properties** | **Setting method** | **Effective mode** | **Factory value** |
|---|---|---|---|---|---|---|
| | Motor quiescent current | DINT32 | RW | Operation settings | Downtime effective | 25 |
| | | Data Range | 1~4000 | Can you map | Related Models | Protection level |
| | | Unit | 0.1A | NO | ALL | 1 |
| | This parameter is used to enter the quiescent current of the motor; or it is automatically filled in after the model is selected by 10.02. | | | | | |

| **Sub-index 04h (P11.04)** | **Name** | **Data Type** | **Access Properties** | **Setting method** | **Effective mode** | **Factory value** |
|---|---|---|---|---|---|---|
| | | DINT32 | RW | Operation settings | Downtime effective | 3000 |

| | | | | | | |
|---|---|---|---|---|---|---|
| | Motor rated speed | Data Range | 1~30,000 | Can you map | Related Models | Protection level |
| | | Unit | rpm | NO | ALL | 1 |
| | This parameter is used to enter the rated speed of the motor; or it is filled in automatically when the motor model is selected by P10.01 and P10.02. | | | | | |
| **Sub-index 04h (P11.04)** | **Name** | **Data Type** | **Access Properties** | **Setting method** | **Effective mode** | **Factory value** |
| | Maximum motor speed | UDINT32 | RW | Operation settings | Downtime effective | 4000 |
| | | Data Range | 1~30,000 | Can you map | Related Models | Protection level |
| | | Unit | rpm | NO | ALL | 1 |
| | This parameter is used to enter the maximum speed of the motor; or it is filled in automatically when the motor model is selected by P10.01 and P10.02. | | | | | |
| **Sub-index 06h (P11.06)** | **Name** | **Data Type** | **Access Properties** | **Setting method** | **Effective mode** | **Factory value** |
| | Number of motor pole pairs | UDINT32 | RW | Operation settings | Downtime effective | 5 |
| | | Data Range | 1~80 | Can you map | Related Models | Protection level |
| | | Unit | Pn | NO | ALL | 1 |
| | This parameter is used to enter the number of pole pairs of the motor; or it is automatically filled in after the motor model is selected by P10.01 and P10.02. When using a custom motor<br>It can be obtained by the method of self-tuning of the logarithm of the poles or filled in by looking up the technical data of the motor. | | | | | |
| **Sub-index 07h (P11.07)** | **Name** | **Data Type** | **Access Properties** | **Setting method** | **Effective mode** | **Factory value** |
| | Rated torque of motor | DINT32 | RW | Operation settings | Downtime effective | 2150 |
| | | Data Range | 1~1000000 | Can you map | Related Models | Protection level |
| | | Unit | 0.001N.m | NO | ALL | 1 |
| | This parameter is used to enter the rated torque of the motor; or it can be filled in automatically after selecting the model from 10.02. | | | | | |
| **Sub-index 08h (P11.08)** | **Name** | **Data Type** | **Access Properties** | **Setting method** | **Effective mode** | **Factory value** |
| | Motor stator phase resistance | DINT32 | RW | Operation settings | Downtime effective | 505 |
| | | Data Range | 1~100000 | Can you map | Related Models | Protection level |
| | | Unit | 0.01ohm | NO | ALL | 1 |
| | This parameter is used to enter the stator phase resistance of the motor; or it is automatically filled in after the motor model is selected by P10.01 and P10.02.<br>Note: Pay attention to the calculation of different brands of motors. | | | | | |
| **Sub-index 09h (P11.09)** | **Name** | **Data Type** | **Access Properties** | **Setting method** | **Effective mode** | **Factory value** |
| | Motor D-axis inductance | DINT32 | RW | Operation settings | Downtime effective | 1620 |
| | | Data Range | 1~100000 | Can you map | Related Models | Protection level |
| | | Unit | 0.01mH | NO | ALL | 1 |

| | | | | | | |
|---|---|---|---|---|---|---|
| | This parameter is used to enter the D-axis inductance of the motor; or it can be filled in automatically when the motor model is selected by P10.01 and P10.02. | | | | | |
| **Sub-index 0Ah (P11.0A)** | **Name** | **Data Type** | **Access Properties** | **Setting method** | **Effective mode** | **Factory value** |
| | Motor Q axis inductance | DINT32 | RW | Operation settings | Downtime effective | 1620 |
| | | Data Range | 1~100000 | Can you map | Related Models | Protection level |
| | | Unit | 0.01mH | NO | ALL | 1 |
| | This parameter is used to enter the Q-axis inductance of the motor; or it can be filled in automatically when the motor model is selected by P10.01 and P10.02. | | | | | |
| **Sub-index 0Bh (P11.0B)** | **Name** | **Data Type** | **Access Properties** | **Setting method** | **Effective mode** | **Factory value** |
| | Motor rotor inertia | DINT32 | RW | Operation settings | Downtime effective | 223 |
| | | Data Range | 1~100000 | Can you map | Related Models | Protection level |
| | | Unit | 0.01Kc2 | NO | ALL | 1 |
| | This parameter is used to enter the rotor inertia of the motor; or it is filled in automatically when the motor model is selected by P10.01 and P10.02. | | | | | |

| | | | | | | |
|---|---|---|---|---|---|---|
| **Sub-index 0Ch (P11.0C)** | **Name** | **Data Type** | **Access Properties** | **Setting method** | **Effective mode** | **Factory value** |
| | Motor counter emf constant | DINT32 | RW | Operation settings | Downtime effective | 73 |
| | | Data Range | 1~2000 | Can you map | Related Models | Protection level |
| | | Unit | Vkr | NO | ALL | 1 |
| | This parameter is used to enter the motor's counter emf constant; or it can be filled in automatically when the motor model is selected by P10.01 and P10.02. | | | | | |
| **Sub-index 0Dh (P11.0D)** | **Name** | **Data Type** | **Access Properties** | **Setting method** | **Effective mode** | **Factory value** |
| | Self-adjusting motor pole pair number | DINT32 | RW | Operation settings | Effective immediately | 5 |
| | | Data Range | 1~80 | Can you map | Related Models | Protection level |
| | | Unit | Pn | | ALL | 2 |
| | This parameter indicates the number of motor pole pairs automatically obtained by the servo driver after the self-tuning operation of the servo motor. This parameter will be used when the motor pole<br>The logarithmic self-tuning process is automatically saved in the servo drive until the motor pole logarithmic self-tuning is performed again. | | | | | |

- P20~P21 encoder parameter group

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| **Index 0X3020 (P20)** | **Name** | **Data Type** | **Access Properties** | | **Setting method** | **Effective mode** | **Factory value** |
| | Encoder basic parameters | - | ARR | - | - | - | - |
| | | Data Range | - | | Can you map | Related Models | Protection level |
| | | Unit | - | | - | - | - |
| **Sub-index 0X01 (P20.01)** | **Name** | **Data Type** | **Access Properties** | | **Setting method** | **Effective mode** | **Factory value** |
| | Encoder | DINT32 | RW | | Operatio | Power on | 0 |

| | | | | | | |
|---|---|---|---|---|---|---|
| | type | | | n settings | again | |
| | | Data Range | 0~6 | Can you map | Related Models | Protection level |
| | | Unit | - | NO | ALL | 0 |
| | This parameter sets the encoder communication protocol type, when setting motor parameters by motor reading, this parameter needs to be set first and then powered on again to obtain.<br>0：Tamagawa encoder 1：ENDAT encoder<br>2：NIKON encoder<br>3: SICK encoders<br>4: Rotary encoder<br>5: ABZ encoder<br>6: Panasonic encoder | | | | | |

| | Name | Data Type | Access Properties | Setting method | Effective mode | Factory value |
|---|---|---|---|---|---|---|
| **Sub-index 0X02 (P20.02)** | Encoder single-turn resolution | DINT32 | RW | Operation settings | Power on again | 17 |
| | | Data Range | 10~24 | Can you map | Related Models | Protection level |
| | | Unit | - | | ALL | 0 |

| | Name | Data Type | Access Properties | Setting method | Effective mode | Factory value |
|---|---|---|---|---|---|---|
| **Sub-index 0X03 (P20.03)** | Encoder multi-turn resolution | DINT32 | RW | Operation Settings | Power on again | 16 |
| | | Data Range | 0~99 | Can you map | Related Models | Protection level |
| | | Unit | - | | ALL | 0 |
| | | | | | | |

| | Name | Data Type | Access Properties | Setting method | Effective mode | Factory value |
|---|---|---|---|---|---|---|
| **Sub-index 0X04 (P20.04)** | ABZ encoder pulse count | DINT32 | RW | Operation settings | Power on again | 2500 |
| | | Data Range | 0~2097152 | Can you map | Related Models | Protection level |
| | | Unit | ppr | | ALL | 1 |
| | When the encoder is ABZ | | | | | |

| | Name | Data Type | Access Properties | Setting method | Effective mode | Factory value |
|---|---|---|---|---|---|---|
| **Sub-index 0X07 (P20.07)** | Encoder position angle | DINT32 | RO | | Effective immediately | 24567 |
| | | Data Range | 0~33554432 | Can you map | Related Models | Protection level |
| | | Unit | inc | NO | ALL | 1 |
| | This parameter shows the motor encoder position angle obtained after self-learning the encoder zero point by "Encoder Micro Zero", "Encoder Offset Zero", "Encoder Write Zero", "Encoder Offset Zero 2" and "Encoder Write Zero 2". 2" and "encoder write zero 2", the motor encoder position angle obtained after self-learning the encoder zero point in five ways. | | | | | |

| | Name | Data Type | Access Properties | Setting method | Effective mode | Factory value |
|---|---|---|---|---|---|---|
| **Sub-index 0X08 (P20.08)** | Resolver polar logarithm | DINT32 | RW | Operation settings | Downtime effective Power on again | 1 |
| | | Data | 1~10 | Can you | Related | Protectio |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| | | Range | | map | Models | n level | |
| | | Unit | - | | ALL | 2 | |
| | This parameter is used to set the polar logarithm of the Resolver | | | | | | |
| **Index 0X3021 (P21)** | **Name** | **Data Type** | **Data Structure** | **Access Properties** | **Setting method** | **Effective mode** | **Factory value** |
| | Encoder parameters | - | ARR | - | - | - | - |
| | | Data Range | - | | Can you map | Related Models | Protection level |
| | | Unit | - | | - | - | - |

| | | | | | | |
|---|---|---|---|---|---|---|
| **Sub-index 0X01 (P21.01)** | **Name** | **Data Type** | **Access Properties** | **Setting method** | **Effective mode** | **Factory value** |
| | Encoder faults enable | DINT32 | RW | Operation Settings | Power on again | 1 |
| | | Data Range | 0~1 | Can you map | Related Models | Protection level |
| | | Unit | - | NO | ALL | 1 |
| | Set whether to enable the encoder's own alarm except for "encoder connection error". In applications where the absolute position information of the motor rotor does not need to be saved after a servo power failure, the encoder's power supply battery can be left installed.<br>0: No<br>1: Yes | | | | | |
| **Sub-index 0X02 (P21.02)** | **Name** | **Data Type** | **Access Properties** | **Setting method** | **Effective mode** | **Factory value** |
| | Maximum acceleration of encoder | DINT32 | RW | Operation settings | Downtime effective | 50 |
| | | Data Range | 50~5000 | Can you map | Related Models | Protection level |
| | | Unit | inc | NO | ALL | 2 |
| | Sets the maximum encoder acceleration deviation allowed between encoder read cycles. In the case of poorly grounded encoders or severe disturbances or static electricity, this prevents fly-by or overcurrent faults. This parameter is set automatically according to the resolution of the connected encoder and does not normally need to be set. | | | | | |
| **Sub-index 0X03 (P21.03)** | **Name** | **Data Type** | **Access Properties** | **Setting method** | **Effective mode** | **Factory value** |
| | Acceleration overrun enable | DINT32 | RW | Operation settings | Effective immediately | 1 |
| | | Data Range | 0~1 | Can you map | Related Models | Protection level |
| | | Unit | - | NO | - | 1 |
| | This parameter is used to set whether to enable the acceleration overrun fault alarm.<br>0: No<br>1: Yes | | | | | |
| **Sub-index 0X04** | **Name** | **Data Type** | **Access Properties** | **Setting method** | **Effective mode** | **Factory value** |

| | | | | | | |
|---|---|---|---|---|---|---|
| (P21.04) | Self-learning current threshold | DINT32 | RW | Operation settings | Effective immediately | 100 |
| | | Data Range | 10~300 | Can you map | Related Models | Protection level |
| | | Unit | 1% | NO | ALL | 1 |
| | This parameter is used to set the amount of current given in the self-learning case, which is a percentage of the rated motor current. | | | | | |

- P30~P31 motor control parameter group

| Index 0X3030 (P30) | Name | Data Type | Data Structure | Access Properties | Setting method | Effective mode | Factory value |
|---|---|---|---|---|---|---|---|
| | Contracting brake and motor control parameters | - | ARR | - | - | - | - |
| | | Data Range | - | | Can you map | Related Models | Protection level |
| | | Unit | - | | - | - | - |

| Sub-index 0X02 (P30.02) | Name | Data Type | Access Properties | Setting method | Effective mode | Factory value |
|---|---|---|---|---|---|---|
| | Contracting brake opening time delay | DINT32 | RW | Operation settings | Effective immediately | 100 |
| | | Data Range | 1~1000 | Can you map | Related Models | Protection level |
| | | Unit | ms | NO | ALL | 1 |
| | When using the negative timing of contracting brake, it means the delay time from the output torque after servo enable to the command of motor contracting brake coil opening, the longer the time, the more obvious the effect of preventing falling, but generally not more than 500ms. this parameter should be adjusted according to the characteristics of motor contracting brake and load condition.<br>If the contracting brake timing sequence is used, it indicates the delay time between the opening of the motor contracting brake coil and the start of torque output from the motor. | | | | | |

| Sub-index 0X03 (P30.03) | Name | Data Type | Access Properties | Setting method | Effective mode | Factory value |
|---|---|---|---|---|---|---|
| | Contracting brake locking delay time | DINT32 | RW | Operation settings | Effective immediately | 100 |
| | | Data Range | 1~1000 | Can you map | Related Models | Protection level |
| | | Unit | ms | NO | ALL | 1 |
| | The longer the time, the more obvious the effect of fall prevention, but generally not more than 500ms.<br>If using contracting brake timing sequence, it indicates the delay time from motor servo stop output torque to motor contracting brake coil holding command. | | | | | |

| Sub-index 0X04 (P30.04) | Name | Data Type | Access Properties | Setting method | Effective mode | Factory value |
|---|---|---|---|---|---|---|
| | Locking Timing | DINT32 | RW | Operation settings | Effective immediately | 1 |
| | | Data Range | 0~1 | Can you map | Related Models | Protection level |
| | | Unit | - | | ALL | 1 |

| | |
|---|---|
| | This parameter is used to set the sequence of servo output and contracting brake action.<br>0: Positive timing sequence of contracting brake<br>1: Negative timing sequencr of contracting brake |

| | Name | Data Type | Access Properties | | Setting method | Effective mode | Factory value |
|---|---|---|---|---|---|---|---|
| **Sub-index 0X05 (P30.05)** | Contracting brake starting speed (r) | UDINT32 | RW | | Operation settings | Effective immediately | 30 |
| | | Data Range | 0~3000 | | Can you map | Related Models | Protection level |
| | | Unit | rmp | | | | 1 |
| | When an error occurs in servo operation or when an emergency stop command is received to enter the braking state, the servo driver will issue a contracting brake hold command if the motor rotation speed is less than the set value. | | | | | | |
| **Index 0X3031 (P31)** | **Name** | **Data Type** | **Data Structure** | **Access Properties** | **Setting method** | **Effective mode** | **Factory value** |
| | Motor control parameters | - | ARR | - | - | - | - |
| | | Data Range | - | | Can you map | Related Models | Protection level |
| | | Unit | - | | - | - | - |
| **Sub-index 0X01 (P31.01)** | **Name** | **Data Type** | **Access Properties** | | **Setting method** | **Effective mode** | **Factory value** |
| | 1.5 times overload time | DINT32 | RW | | Operation settings | Downtime effective | 100000 |
| | | Data Range | 1~1000000 | | Can you map | Related Models | Protection level |
| | | Unit | ms | | | ALL | 1 |
| | This parameter is used to set the time the motor is allowed to run under 1.5 times rated current overload. To better protect the motor from damage under overload conditions, this parameter needs to be set correctly according to the motor's overload operation curve. | | | | | | |
| **Sub-index 0X02 (P31.02)** | **Name** | **Data Type** | **Access Properties** | | **Setting method** | **Effective mode** | **Factory value** |
| | 2.5 times overload time | DINT32 | RW | | Operation settings | Downtime effective | 20000 |
| | | Data Range | 1~50000 | | Can you map | Related Models | Protection level |
| | | Unit | ms | | NO | ALL | 1 |
| | This parameter is used to set the time the motor is allowed to run under 2.5 times rated current overload. To better protect the motor from damage under overload conditions, this parameter needs to be set correctly according to the motor's overload operation curve. | | | | | | |
| **Sub-index 0X03 (P31.03)** | **Name** | **Data Type** | **Access Properties** | | **Setting method** | **Effective mode** | **Factory value** |
| | Motor maximum overload multiplier | DINT32 | RW | | Operation settings | Downtime effective | 400 |
| | | Data | 300~500 | | Can you | Related | Protectio |

| | | | | | |
|---|---|---|---|---|---|
| | Range | | map | Models | n level |
| | Unit | % | NO | ALL | 1 |

The maximum allowable motor current is a multiple of the rated motor current. To better protect the motor from damage under overload conditions, this parameter needs to be set correctly according to the motor's overload operating curve.

**Sub-index 0X04 (P31.04)**

| Name | Data Type | Access Properties | Setting method | Effective mode | Factory value |
|---|---|---|---|---|---|
| Maximum overload current time | DINT32 | RW | Operation settings | Downtime effective | 1000 |
| | Data Range | 1~10000 | Can you map | Related Models | Protection level |
| | Unit | ms | NO | ALL | 1 |

The maximum motor current (parameter 0x3031:03) is the maximum time allowed to last. To better protect the motor from damage under overload conditions, this parameter needs to be set correctly according to the motor's overload operating curve.

**Sub-index 0X08 (P31.08)**

| Name | Data Type | Access Properties | Setting method | Effective mode | Factory value |
|---|---|---|---|---|---|
| Input phase loss detection configuration | DINT32 | RW | Operation settings | Effective immediately | 1 |
| | Data Range | 0~2 | Can you map | Related Models | Protection level |
| | Unit | - | NO | ALL | 1 |

This parameter is used to enable the servo's input out-of-phase detection function. This function will alarm and stop when it detects that the single-phase power input is having a deteriorating effect on the current operating performance of the servo.
0: Detection is not enabled
1: Input single-phase detection.
2: Input three-phase detection;

**Sub-index 0X09 (P31.09)**

| Name | Data Type | Access Properties | Setting method | Effective mode | Factory value |
|---|---|---|---|---|---|
| Output out-of-phase detection enable | DINT32 | RW | Operation Settings | Effective immediately | 1 |
| | Data Range | 0~1 | Can you map | Related Models | Protection level |
| | Unit | - | NO | ALL | 1 |

This parameter is used to enable the servo's output out-of-phase detection function (reserved parameter).
0: No
Disable the output phase loss detection function of the servo, when the servo output occurs disconnection or leakage, the servo does not report the output phase loss fault but may report other faults and stop. When the servo drive power is seriously mismatched with the servo motor power, the output phase-loss false alarm may occur. At this time, the output phase-loss detection function can be shielded by this parameter, but it is necessary to confirm that the servo system really has no output phase-loss problem, otherwise it may affect the operation performance of the servo.
1: Yes
Enable the servo's output out-of-phase detection function, which will alarm and stop when 1-3 phases between the servo output and the motor are detected to be not reliably connected.

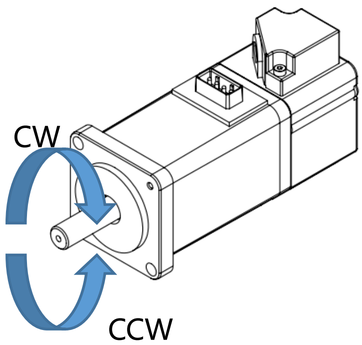
**(Reserved parameters)**

| Name | Data Type | Access Properties | Setting method | Effective mode | Factory value |
|---|---|---|---|---|---|
| Out-of-phase protection current threshold | DINT32 | RW | Operation settings | Effective immediately | 10 |
| | Data | 5~100 | Can you | Related | Protectio |

| | | | | | | |
|---|---|---|---|---|---|---|
| | | Range | | map | Models | n level |
| | | Unit | % | | - | 1 |
| | This parameter is used to set the out-of-phase protection current threshold size, which is a percentage of the motor's rated current. | | | | | |

| | Name | Data Type | Access Properties | Setting method | Effective mode | Factory value |
|---|---|---|---|---|---|---|
| **Sub-index 0X0B (P31.0B)** | Motor rotation positive direction | DINT32 | RW | Operation settings | Downtime effective | 0 |
| | | Data Range | 0~1 | Can you map | Related Models | Protection level |
| | | Unit | - | NO | ALL | 2 |

This parameter is used to set the positive direction of motor rotation.
0 means the CCW direction is forward when viewed from the shaft side: When forward command, the motor rotates in the CCW direction when viewed from the motor shaft side, i.e., the motor rotates counterclockwise.
1 means the CW direction is forward when viewed from the shaft side: When the forward command is given, the motor rotates in the CW direction when viewed from the motor shaft side, i.e., the motor rotates clockwise.




| | Name | Data Type | Access Properties | Setting method | Effective mode | Factory value |
|---|---|---|---|---|---|---|
| **Sub-index 0X0C (P31.0C)** | Filter Enable | DINT32 | RW | Operation settings | Downtime effective | 1 |
| | | Data Range | 0~1 | Can you map | Related Models | Protection level |
| | | Unit | - | | ALL | 1 |

This parameter is used to enable the filter enable of the servo.
0: Disable all filters 1: Enable all filters

| | Name | Data Type | Access Properties | Setting method | Effective mode | Factory value |
|---|---|---|---|---|---|---|
| **Sub-index 0X0D (P31.0D)** | Carrier frequency | DINT32 | RO | - | - | 10000 |
| | | Data Range | 1000~20000 | Can you map | Related Models | Protection level |
| | | Unit | Hz | NO | ALL | 2 |

| | |
|---|---|
| | This parameter shows the carrier frequency of PWM and cannot be modified. The higher the carrier frequency, the faster the current transient response, but the higher the heat generation of the power module, the higher the heat loss. The lower the carrier frequency, the less the power module heats up and the heat loss is smaller, but the current transient response is slower. |

| | Name | Data Type | Access Properties | Setting method | Effective mode | Factory value |
|---|---|---|---|---|---|---|
| **Sub-index 0X0E (P31.0E)** | Modulation mode | DINT32 | RW | Operation settings | Power on again | 0 |
| | | Data Range | 0~1 | Can you map | Related Models | Protection level |
| | | Unit | - | NO | ALL | 2 |
| | This parameter sets the modulation mode of the PWM: 0: bilateral modulation; 1: single-sided modulation.<br>Bilateral modulation mode can expand the current loop bandwidth, mainly used to adjust the control performance of the current loop, generally do not adjust, set according to the default value. | | | | | |

| | Name | Data Type | Access Properties | Setting method | Effective mode | Factory value |
|---|---|---|---|---|---|---|
| **Sub-index 0X10 (P31.10)** | Braking resistor resistance value | DINT32 | RW | Operation settings | Downtime effective | 80 |
| | | Data Range | 0~10000 | Can you map | Related Models | Protection level |
| | | Unit | ohm | NO | ALL | 1 |
| | This parameter is used to set the resistance value of the braking resistor connected to the servo, and the servo will protect the braking resistor from overload according to the set value. If the value is not set (0), no braking resistor overload protection will be performed.<br>The ASK-AD2 driver has built-in resistors as follows:<br>A1 (600, 750W) driver: 40W 80Ω<br>A2 size drive: 60W 40Ω<br>A3 size drive: 100W 40Ω<br>If you need to use an external braking resistor, you need to disconnect the shorting terminals D and D of CN10,$P_3$ and connect the two ends of the braking resistor to C, C, and C respectively,$P_3$ .<br>When the selected model uses built-in braking resistor, it will automatically match the braking resistor parameters, such as external braking resistor, it needs to be configured according to the actual value. | | | | | |

| | Name | Data Type | Access Properties | Setting method | Effective mode | Factory value |
|---|---|---|---|---|---|---|
| **Sub-index 0X11 (P31.11)** | Braking resistor power | DINT32 | RW | Operation Settings | Downtime effective | 40 |
| | | Data Range | 0~10000 | Can you map | Related Models | Protection level |
| | | Unit | W | NO | ALL | 1 |
| | This parameter is used to set the power of the braking resistor connected to the servo, and the servo will protect the braking resistor from overload according to the set value. If not set (value is 0), no braking resistor overload protection will be performed. | | | | | |

- P40 current loop parameter set

| Index | Name | Data | Data | Access | Setting | Effectiv | Factory |
|---|---|---|---|---|---|---|---|

| Index | Name | Type | Structure | Properties | method | e mode | value |
|---|---|---|---|---|---|---|---|
| 0X3040 (P40) | Current loop parameters | - | ARR | - | - | - | - |
| | | Data Range | - | | Can you map | Related Models | Protection level |
| | | Unit | - | | - | - | - |

| Sub-index | Name | Data Type | Access Properties | Setting method | Effective mode | Factory value |
|---|---|---|---|---|---|---|
| Sub-index 0X01 (P40.01) | Current Kp | DINT32 | RW | Operation settings | Downtime effective | 54 |
| | | Data Range | 0~9999 | Can you map | Related Models | Protection level |
| | | Unit | 0.01 | | ALL | 2 |
| | The three parameters P40.01, P40.02 and P40.03 are mainly for the PID adjustment of the current loop, which is generally not adjusted and set according to the default value. The larger the Kp, the faster the response, but too large is prone to oscillation; Kp cannot completely eliminate the deviation, and Ti can be used to eliminate the residual deviation; the smaller the Ti, the faster the response to the deviation change, but too small is prone to oscillation; if the system often has jumping feedback, Kd should be used, which can quickly respond to the deviation change between the system feedback and the given deviation. The larger the Kd, the faster the response, but too large is likely to cause oscillation. | | | | | |

| Sub-index | Name | Data Type | Access Properties | Setting method | Effective mode | Factory value |
|---|---|---|---|---|---|---|
| Sub-index 0X02 (P40.02) | Current Ti | DINT32 | RW | Operation settings | Downtime effective | 1000 |
| | | Data Range | 1~99999 | Can you map | Related Models | Protection level |
| | | Unit | 0.1ms | NO | ALL | 2 |
| | Sets the value of the current loop integration time. | | | | | |

| Sub-index | Name | Data Type | Access Properties | Setting method | Effective mode | Factory value |
|---|---|---|---|---|---|---|
| Sub-index 0X03 (P40.03) | Current Kd | DINT32 | RW | Operation settings | Downtime effective | 0 |
| | | Data Range | 0~9999 | Can you map | Related Models | Protection level |
| | | Unit | 0.1 | NO | ALL | 2 |
| | Sets the value of the current loop differential constant. | | | | | |

| Sub-index | Name | Data Type | Access Properties | Setting method | Effective mode | Factory value |
|---|---|---|---|---|---|---|
| Sub-index 0X04 (P40.04) | Dead time | DINT32 | RW | Operation settings | Power on again | 4000 |
| | | Data Range | 2000~20000 | Can you map | Related Models | Protection level |
| | | Unit | ns | NO | ALL | 2 |
| | This parameter is used to set the dead time, which is generally not adjusted and set according to the default value. | | | | | |

| Sub-index | Name | Data Type | Access Properties | Setting method | Effective mode | Factory value |
|---|---|---|---|---|---|---|
| Sub-index 0X05 (P40.05) | Deadband compensation factor | UDINT32 | RW | Operation settings | Downtime effective | 500 |
| | | Data | 0~200 | Can you | Related | Protectio |

| | | | | | | |
|---|---|---|---|---|---|---|
| | | Range | | map | Models | n level |
| | | Unit | % | | ALL | 2 |
| | 3040-05h, 3040-06h two parameters mainly affect the compensation effect of deadband compensation in current control. Increasing the deadband compensation coefficient helps to reduce the torque pulsation in the high-speed section of the motor, and the deadband compensation threshold mainly affects the sinusality of the current when it passes the zero point. | | | | | |

| | Name | Data Type | Access Properties | Setting method | Effective mode | Factory value |
|---|---|---|---|---|---|---|
| **Sub-index 0X06 (P40.06)** | Deadband compensation threshold | UDINT32 | RW | Operation settings | Downtime effective | 100 |
| | | Data Range | 0~100 | Can you map | Related Models | Protection level |
| | | Unit | % | | ALL | 2 |
| | 3040-05h, 3040-06h two parameters mainly affect the compensation effect of deadband compensation in current control. Increasing the deadband compensation coefficient helps to reduce the torque pulsation in the high-speed section of the motor, and the deadband compensation threshold mainly affects the sinusality of the current when it passes the zero point. | | | | | |
| **Sub-index 0X07 (P40.07)** | **Name** | **Data Type** | **Access Properties** | **Setting method** | **Effective mode** | **Factory value** |
| | Weak magnetic control Kp | DINT32 | RW | Operation settings | Downtime effective | 100 |
| | | Data Range | 1~9999 | Can you map | Related Models | Protection level |
| | | Unit | 0.01AS | NO | P/T | 2 |
| | This parameter is used to set the control parameters of the weak magnetic control, the current loop proportionality coefficient, which is generally not modified. | | | | | |
| **Sub-index 0X08 (P40.08)** | **Name** | **Data Type** | **Access Properties** | **Setting method** | **Effective mode** | **Factory value** |
| | Weak magnetic control Ti | DINT32 | RW | Operation settings | Downtime effective | 150 |
| | | Data Range | 1~99999 | Can you map | Related Models | Protection level |
| | | Unit | 0.1ms | NO | P/T | 2 |
| | This parameter is used to set the control parameters of the weak magnetic control, the current loop integration time, and is generally not modified. | | | | | |
| **Sub-index 0X09 (P40.09)** | **Name** | **Data Type** | **Access Properties** | **Setting method** | **Effective mode** | **Factory value** |
| | Upper limit of torque giving | DINT32 | RW | Operation settings | Downtime effective | 300 |
| | | Data Range | 0~1000 | Can you map | Related Models | Protection level |
| | | Unit | 1% rated torque | NO | P/S | 1 |
| | This parameter refers to the percentage of the maximum forward torque allowed by the servo drive to drive the motor and the quota torque and is used for the current given limit of the speed loop output. When the value set for this parameter exceeds the drive capability of the current model drive inverter module, it is automatically limited to the maximum limit of the module. | | | | | |
| **Sub-index** | **Name** | **Data** | **Access Properties** | **Setting** | **Effectiv** | **Factory** |

| 0X0A (P40.0A) | | Type | | method | e mode | value |
|---|---|---|---|---|---|---|
| | Lower limit of torque giving | DINT32 | RW | Operation settings | Downtime effective | -300 |
| | | Data Range | -1000~0 | Can you map | Related Models | Protection level |
| | | Unit | 1% rated torque | NO | P/S | 1 |
| | This parameter refers to the percentage of the maximum reverse torque allowed for the servo drive motor versus the quota torque and is used for the current given limit of the speed loop output. When the value set for this parameter exceeds the drive capability of the current model drive inverter module, it is automatically limited to the maximum limit of the module. | | | | | |

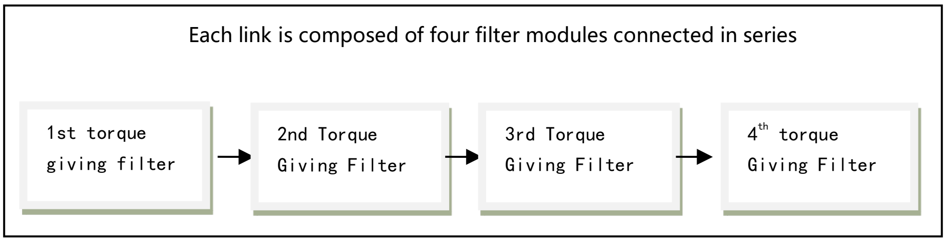
| Sub-index 0X0D (P40.0D) | Name | Data Type | Access Properties | Setting method | Effective mode | Factory value |
|---|---|---|---|---|---|---|
| | Torque acceleration limitation | DINT32 | RW | Operation settings | Effective immediately | 50 |
| | | Data Range | 5~1000 | Can you map | Related Models | Protection level |
| | | Unit | 1% rated torque | NO | ALL | 2 |
| | Torque acceleration limit refers to the incremental limit value of two adjacent torque giving commands, and the setting value is a percentage of the motor's frontal torque. This parameter affects the servo's response speed and anti-interference ability. Increasing the setting value will speed up the servo response and reduce the servo anti-interference ability; decreasing the setting value will slow down the servo response and improve the servo anti-interference ability. This parameter is generally not adjusted and set according to the default value. | | | | | |

| Sub-index 0X0E (P40.0E) | Name | Data Type | Access Properties | Setting method | Effective mode | Factory value |
|---|---|---|---|---|---|---|
| | Torque control speed limit | DINT32 | RW | Operation settings | Effective immediately | 1200 |
| | | Data Range | 0~3000 | Can you map | Related Models | Protection level |
| | | Unit | rpm | NO | T | 2 |
| | This parameter is used for the speed limit value in torque control mode when the external load is less than the given torque and the motor accelerates continuously. This parameter is effective when not controlled by the controller. When using the controller control mode, the speed limit value is set via 0x6081. | | | | | |

- P41~P42 current loop filter parameter set

| Index 0X3041 (P41) | Name | Data Type | Data Structure | Access Properties | Setting method | Effective mode | Factory value |
|---|---|---|---|---|---|---|---|
| | Torque-giving filter parameters | - | ARR | - | - | - | - |
| | | Data Range | - | | Can you map | Related Models | Protection level |
| | | Unit | - | | - | - | - |
| | To enable a certain filter function of the current loop, first set the filter enable (3031-0Ch) to 1; if 3031-0Ch is 0, the filter does not take effect in the current loop control even if the relevant filters of the current loop groups 3041h to 3042h are configured.<br>ASK-AD2 series servo drives are equipped with filter functions in the torque feed and torque feedback sections respectively. Each filter link is made up of four separate filter modules in series. Taking torque feed as an example, the torque feed link is made up of four separate filter modules in series, such as current feed filters 1, 2, 3 and 4, as shown | | | | | | |

in the figure.




Each filter module has four control parameters, which are described in terms of current-fed filter 1 (current-fed filters 2, 3 and 4 are not repeated):

| | Name | Data Type | Access Properties | Setting method | Effective mode | Factory value |
|---|---|---|---|---|---|---|
| **Sub-index 0X01 (P41.01)** | 1st Torque Giving Filter Type | DINT32 | RW | Operation settings | Downtime effective | 0 |
| | | Data Range | 0~4 | Can you map | Related Models | Protection level |
| | | Unit | - | NO | ALL | 1 |
| | The 1st torque giving filter represents the torque giving filter module 1, this parameter is used to select the type of the 1st torque giving filter module, the meaning of the parameter is as follows:<br>0: No filter is used<br>1: First-order low-pass filter<br>2: Second-order low-pass filter<br>3: Second order with zero-point low pass<br>4: Notch filter | | | | | |

| | Name | Data Type | Access Properties | Setting method | Effective mode | Factory value |
|---|---|---|---|---|---|---|
| **Sub-index 0X02 (P41.02)** | Torque-giving cut-off frequency1 | DINT32 | RW | Operation settings | Downtime effective | 3500 |
| | | Data Range | 200~5000 | Can you map | Related Models | Protection level |
| | | Unit | Hz | NO | ALL | 1 |
| | Torque-giving cutoff frequency 1 represents the low-pass cutoff frequency of the 1st torque-giving filter (This parameter is meaningful when the 1st torque-giving filter type is selected as 1 or 2 or 3; when the 1st torque-giving filter type is selected as 0 or 4, the value of this parameter has no meaning.)<br>The low-pass filter is used to filter out high frequency noise. When the input signal frequency is higher than the low-pass cutoff frequency, the signal amplitude at the output of the filter will be attenuated significantly, for a fixed frequency input signal, the lower the cutoff frequency of the filter, the greater the phase delay to the signal. The default current loop filter low-pass cutoff frequency is 3500Hz. choose to adjust the three-loop performance by rigid, the system will calculate the default torque given cutoff frequency 1, but 0x3041:01 filter type is still not used filter, such as through the oscilloscope observation torque given spurious frequency is significantly higher than this given value, can be considered to configure the first-order low-pass filter. | | | | | |

| | Name | Data Type | Access Properties | Setting method | Effective mode | Factory value |
|---|---|---|---|---|---|---|
| **Sub-index 0X03 (P41.03)** | Torque-giving notch frequency1 | DINT32 | RW | Operation settings | Downtime effective | 100 |
| | | Data Range | 3~5000 | Can you map | Related Models | Protection level |
| | | Unit | Hz | NO | ALL | 1 |
| | When the torque given filter 1 type is configured as notch filter (4), this parameter is used to set the notch center frequency of the 1st torque given filter, and the parameter | | | | | |

3041-04h torque given notch filter set the notch depth of the current given filter module 1 (when the current given filter type is 0, 1, 2, 3, the values of these two parameters have no meaning). Notch filter, also known as bandstop filter, is a filter that can pass most of the frequency components but attenuate some range of frequency components to a very low level; notch filter attenuation of the signal near the center frequency is very strong, the signal away from the center frequency basically has little effect; the greater the notch depth, the stronger the attenuation effect on the center frequency point.
In general, the notch filter will be enabled only after the vibration of the motor is detected and the vibration frequency is detected, please refer to "Filter Usage" for detailed configuration.

| | Name | Data Type | Access Properties | Setting method | Effective mode | Factory value |
|---|---|---|---|---|---|---|
| **Sub-index 0X04 (P41.04)** | Torque given notch depth 1 | DINT32 | RW | Operation settings | Downtime effective | 5 |
| | | Data Range | 3~50 | Can you map | Related Models | Protection level |
| | | Unit | db | NO | ALL | 1 |

Set the value of the 1st torque to give the filter notch depth.

| | Name | Data Type | Access Properties | Setting method | Effective mode | Factory value |
|---|---|---|---|---|---|---|
| **Sub-index 0X05 (P41.05)** | 2nd Torque Giving Filter | UDINT32 | RW | Operation settings | Downtime effective | 0 |
| | | Data Range | 0~4 | Can you map | Related Models | Protection level |
| | | Unit | - | NO | ALL | 1 |

0: No filter is used
1: First-order low-pass filter
2: Second-order low-pass filter
3: Second order with zero-point low pass
4: Notch filter

| | Name | Data Type | Access Properties | Setting method | Effective mode | Factory value |
|---|---|---|---|---|---|---|
| **Sub-index 0X06 (P41.06)** | Torque-giving cutoff frequency2 | UDINT32 | RW | Operation settings | Downtime effective | 3500 |
| | | Data Range | 200~5000 | Can you map | Related Models | Protection level |
| | | Unit | Hz | NO | ALL | 1 |

| | Name | Data Type | Access Properties | Setting method | Effective mode | Factory value |
|---|---|---|---|---|---|---|
| **Sub-index 0X07 (P41.07)** | Torque-giving notch frequency 2 | DINT32 | RW | Operation settings | Downtime effective | 100 |
| | | Data Range | 3~5000 | Can you map | Related Models | Protection level |
| | | Unit | Hz | NO | ALL | 1 |

| | Name | Data Type | Access Properties | Setting method | Effective mode | Factory value |
|---|---|---|---|---|---|---|
| **Sub-index 0X08 (P41.08)** | Torque given notch depth 2 | DINT32 | RW | Operation settings | Downtime effective | 5 |
| | | Data Range | 3~50 | Can you map | Related Models | Protection level |
| | | Unit | db | NO | ALL | 1 |

| | Name | Data Type | Access Properties | Setting method | Effective mode | Factory value |
|---|---|---|---|---|---|---|
| **Sub-index 0X09 (P41.09)** | 3rd Torque Giving Filter Type | DINT32 | RW | Operation settings | Downtime effective | 0 |
| | | Data Range | 0~4 | Can you map | Related Models | Protection level |
| | | Unit | - | NO | ALL | 2 |
| | 0: No filter is used<br>1: First-order low-pass filter<br>2: Second-order low-pass filter<br>3: Second order with zero-point low pass<br>4: Notch filter | | | | | |

| | Name | Data Type | Access Properties | Setting method | Effective mode | Factory value |
|---|---|---|---|---|---|---|
| **Sub-index 0X0A (P41.0A)** | Torque-giving cut-off frequency3 | DINT32 | RW | Operation Settings | Downtime effective | 3500 |
| | | Data Range | 200~5000 | Can you map | Related Models | Protection level |
| | | Unit | Hz | NO | ALL | 2 |

| | Name | Data Type | Access Properties | Setting method | Effective mode | Factory value |
|---|---|---|---|---|---|---|
| **Sub-index 0X0B (P41.0B)** | Torque-giving notch frequency 3 | DINT32 | RW | Operation Settings | Downtime effective | 100 |
| | | Data Range | 3~5000 | Can you map | Related Models | Protection level |
| | | Unit | Hz | NO | ALL | 2 |

| | Name | Data Type | Access Properties | Setting method | Effective mode | Factory value |
|---|---|---|---|---|---|---|
| **Sub-index 0X0C (P41.0C)** | Torque given notch depth 3 | DINT32 | RW | Operation Settings | Downtime effective | 5 |
| | | Data Range | 3~50 | Can you map | Related Models | Protection level |
| | | Unit | db | NO | ALL | 2 |

| | Name | Data Type | Access Properties | Setting method | Effective mode | Factory value |
|---|---|---|---|---|---|---|
| **Sub-index 0X0D (P41.0D)** | 4th Torque Giving Filter | DINT32 | RW | Operation Settings | Downtime effective | 0 |
| | | Data Range | 0~4 | Can you map | Related Models | Protection level |
| | | Unit | - | NO | ALL | 2 |
| | 0: No filter is used<br>1: First-order low-pass filter<br>2: Second-order low-pass filter<br>3: Second order with zero-point low pass<br>4: Notch filter | | | | | |

| Sub-index 0X0E (P41.0E) | Name | Data Type | Access Properties | Setting method | Effective mode | Factory value |
|---|---|---|---|---|---|---|
| | Torque-giving cut-off frequency4 | DINT32 | RW | Operation settings | Downtime effective | 3500 |
| | | Data Range | 200~5000 | Can you map | Related Models | Protection level |
| | | Unit | Hz | NO | ALL | 2 |

| Sub-index 0X0F (P41.0F) | Name | Data Type | Access Properties | Setting method | Effective mode | Factory value |
|---|---|---|---|---|---|---|
| | Torque-giving notch frequency 4 | DINT32 | RW | Operation settings | Downtime effective | 100 |
| | | Data Range | 3~5000 | Can you map | Related Models | Protection level |
| | | Unit | Hz | NO | ALL | 2 |

| Sub-index 0X10 (P41.10) | Name | Data Type | Access Properties | Setting method | Effective mode | Factory value |
|---|---|---|---|---|---|---|
| | Torque-giving notch depth 4 | DINT32 | RW | Operation settings | Downtime effective | 5 |
| | | Data Range | 3~50 | Can you map | Related Models | Protection level |
| | | Unit | db | NO | ALL | 2 |

| Index 0X3042 (P42) | Name | Data Type | Data Structure | Access Properties | Setting method | Effective mode | Factory value |
|---|---|---|---|---|---|---|---|
| | Torque feedback filter | - | ARR | - | - | - | - |
| | | Data Range | - | | Can you map | Related Models | Protection level |
| | | Unit | - | | - | - | - |

| Sub-index 0X01 (P42.01) | Name | Data Type | Access Properties | Setting method | Effective mode | Factory value |
|---|---|---|---|---|---|---|
| | 1st Torque Feedback Filter | DINT32 | RW | Operation settings | Downtime effective | 0 |
| | | Data Range | 0~4 | Can you map | Related Models | Protection level |
| | | Unit | - | NO | ALL | 1 |
| | 0: No filter is used<br>1: First-order low-pass filter<br>2: Second-order low-pass filter<br>3: Second order with zero-point low pass<br>4: Notch filter | | | | | |

| Sub-index 0X02 (P42.02) | Name | Data Type | Access Properties | Setting method | Effective mode | Factory value |
|---|---|---|---|---|---|---|
| | Torque feedback cutoff frequency1 | DINT32 | RW | Operation settings | Downtime effective | 3500 |
| | | Data Range | 200~5000 | Can you map | Related Models | Protection level |
| | | Unit | Hz | NO | ALL | 1 |

| **Sub-index 0X03 (P42.03)** | **Name** | **Data Type** | **Access Properties** | **Setting method** | **Effective mode** | **Factory value** |
|---|---|---|---|---|---|---|
| | Torque feedback notch frequency1 | DINT32 | RW | Operation settings | Downtime effective | 100 |
| | | Data Range | 3~5000 | Can you map | Related Models | Protection level |
| | | Unit | Hz | NO | ALL | 1 |

| **Sub-index 0X04 (P42.04)** | **Name** | **Data Type** | **Access Properties** | **Setting method** | **Effective mode** | **Factory value** |
|---|---|---|---|---|---|---|
| | Torque feedback notch depth 1 | DINT32 | RW | Operation settings | Downtime effective | 5 |
| | | Data Range | 3~50 | Can you map | Related Models | Protection level |
| | | Unit | db | NO | ALL | 1 |

| **Sub-index 0X05 (P42.05)** | **Name** | **Data Type** | **Access Properties** | **Setting method** | **Effective mode** | **Factory value** |
|---|---|---|---|---|---|---|
| | 2nd Torque Feedback Filter Type | UDINT32 | RW | Operation settings | Downtime effective | 0 |
| | | Data Range | 0~4 | Can you map | Related Models | Protection level |
| | | Unit | - | NO | ALL | 1 |
| | 0: No filter is used<br>1: First-order low-pass filter<br>2: Second-order low-pass filter<br>3: Second order with zero-point low pass<br>4: Notch filter | | | | | |

| **Sub-index 0X06 (P42.06)** | **Name** | **Data Type** | **Access Properties** | **Setting method** | **Effective mode** | **Factory value** |
|---|---|---|---|---|---|---|
| | Torque feedback cutoff frequency 2 | UDINT32 | RW | Operation settings | Downtime effective | 3500 |
| | | Data Range | 200~5000 | Can you map | Related Models | Protection level |
| | | Unit | Hz | NO | ALL | 1 |

| **Sub-index 0X07 (P42.07)** | **Name** | **Data Type** | **Access Properties** | **Setting method** | **Effective mode** | **Factory value** |
|---|---|---|---|---|---|---|
| | Torque feedback notch frequency 2 | DINT32 | RW | Operation settings | Downtime effective | 100 |
| | | Data Range | 3~5000 | Can you map | Related Models | Protection level |
| | | Unit | Hz | | ALL | 1 |

| **Sub-index 0X08 (P42.08)** | **Name** | **Data Type** | **Access Properties** | **Setting method** | **Effective mode** | **Factory value** |
|---|---|---|---|---|---|---|
| | Torque feedback notch depth 2 | DINT32 | RW | Operation settings | Downtime effective | 5 |
| | | Data Range | 3~50 | Can you map | Related Models | Protection level |

| | | | | | | |
|---|---|---|---|---|---|---|
| | | Unit | db | | ALL | 1 |
| | | | | | | |

| Sub-index 0X09 (P42.09) | Name | Data Type | Access Properties | Setting method | Effective mode | Factory value |
|---|---|---|---|---|---|---|
| | 3rd Torque feedback filter type | DINT32 | RW | Operation settings | Downtime effective | 0 |
| | | Data Range | 0~4 | Can you map | Related Models | Protection level |
| | | Unit | - | NO | ALL | 2 |
| | 0: No filter is used<br>1: First-order low-pass filter<br>2: Second-order low-pass filter<br>3: Second order with zero-point low pass<br>4: Notch filter | | | | | |

| Sub-index 0X0A (P42.0A) | Name | Data Type | Access Properties | Setting method | Effective mode | Factory value |
|---|---|---|---|---|---|---|
| | Torque feedback cutoff frequency3 | DINT32 | RW | Operation settings | Downtime effective | 3500 |
| | | Data Range | 200~5000 | Can you map | Related Models | Protection level |
| | | Unit | Hz | NO | ALL | 2 |
| | | | | | | |

| Sub-index 0X0B (P42.0B) | Name | Data Type | Access Properties | Setting method | Effective mode | Factory value |
|---|---|---|---|---|---|---|
| | Torque feedback notch frequency 3 | DINT32 | RW | Operation settings | Downtime effective | 100 |
| | | Data Range | 3~5000 | Can you map | Related Models | Protection level |
| | | Unit | Hz | | ALL | 2 |
| | | | | | | |

| Sub-index 0X0C (P42.0C) | Name | Data Type | Access Properties | Setting method | Effective mode | Factory value |
|---|---|---|---|---|---|---|
| | Torque feedback notch depth 3 | DINT32 | RW | Operation settings | Downtime effective | 5 |
| | | Data Range | 3~50 | Can you map | Related Models | Protection level |
| | | Unit | db | | ALL | 2 |
| | | | | | | |

| Sub-index 0X0D (P42.0D) | Name | Data Type | Access Properties | Setting method | Effective mode | Factory value |
|---|---|---|---|---|---|---|
| | 4th torque feedback filter | DINT32 | RW | Operation settings | Downtime effective | 0 |
| | | Data Range | 0~4 | Can you map | Related Models | Protection level |
| | | Unit | - | NO | ALL | 2 |
| | 0: No filter is used<br>1: First-order low-pass filter<br>2: Second-order low-pass filter<br>3: Second order with zero-point low pass<br>4: Notch filter | | | | | |

| Sub-index 0X0E (P42.0E) | Name | Data Type | Access Properties | Setting method | Effective mode | Factory value |
|---|---|---|---|---|---|---|
| | Torque feedback cut-off frequency 4 | DINT32 | RW | Operation Settings | Downtime effective | 3500 |
| | | Data Range | 200~5000 | Can you map | Related Models | Protection level |
| | | Unit | Hz | NO | ALL | 2 |
| | | | | | | |

| Sub-index 0X0F (P42.0F) | Name | Data Type | Access Properties | Setting method | Effective mode | Factory value |
|---|---|---|---|---|---|---|
| | Torque feedback notch frequency 4 | DINT32 | RW | Operation settings | Downtime effective | 100 |
| | | Data Range | 3~5000 | Can you map | Related Models | Protection level |
| | | Unit | Hz | NO | ALL | 2 |
| | | | | | | |

| Sub-index 0X10 (P42.10) | Name | Data Type | Access Properties | Setting method | Effective mode | Factory value |
|---|---|---|---|---|---|---|
| | Torque feedback notch depth 4 | DINT32 | RW | Operation settings | Downtime effective | 5 |
| | | Data Range | 3~50 | Can you map | Related Models | Protection level |
| | | Unit | db | NO | ALL | 2 |
| | | | | | | |

- P50 speed loop parameter set

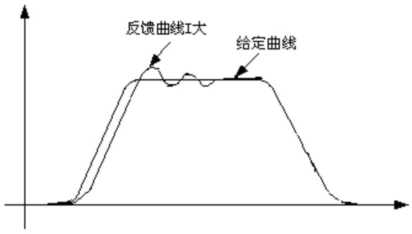
| Index 0X3050 (P50) | Name | Data Type | Data Structure | Access Properties | Setting method | Effective mode | Factory value |
|---|---|---|---|---|---|---|---|
| | Speed loop parameters | - | ARR | - | - | - | - |
| | | Data Range | - | | Can you map | Related Models | Protection level |
| | | Unit | - | | - | - | - |

| Sub-index 0X01 (P50.01) | Name | Data Type | Access Properties | Setting method | Effective mode | Factory value |
|---|---|---|---|---|---|---|
| | Speed loop gain 1 | DINT32 | RW | Operation Settings | Downtime effective | 270 |
| | | Data Range | 1~5000 | Can you map | Related Models | Protection level |
| | | Unit | 0.1Hz | NO | P/S | 1 |
| | Set the proportional gain of the speed loop.<br>This parameter determines the response of the velocity loop, the larger it is, the faster the response of the velocity loop will be, but too large a setting may cause vibration and needs attention.<br>In position mode, if you want to increase the position loop gain, you need to increase the speed loop gain at the same time. | | | | | |

| Sub-index | Name | Data | Access Properties | Setting | Effectiv | Factory |
|---|---|---|---|---|---|---|

| 0X02 (P50.02) | | Type | | method | e mode | value |
|---|---|---|---|---|---|---|
| | Speed loop integration time 1 | DINT32 | RW | Operation settings | Downtime effective | 210 |
| | | Data Range | 1~3700 | Can you map | Related Models | Protection level |
| | | Unit | 0.1ms | NO | P/S/HM | 1 |

Set the integration time constant of the speed loop. The smaller the value set, the stronger the integration effect is, and the deviation value at the time of stopping is closer to 0. When the Ti setting is small, the system response is fast, but oscillation may occur when it is too small; when the Ti setting is large, the system response is slow. When Ti is set to 9999.9, it means that the integration is invalid (Kp is controlled separately).
The effect of the integration time constant Ti on the velocity tracking is shown in Fig:




| Sub-index 0X03 (P50.03) | Name | Data Type | Access Properties | Setting method | Effective mode | Factory value |
|---|---|---|---|---|---|---|
| | Speed loop Kd1 | DINT32 | RW | Operation settings | Downtime effective | 0 |
| | | Data Range | 0-120 | Can you map | Related Models | Protection level |
| | | Unit | - | NO | P/S/HM | 1 |
| | Differential time Kd: generally not adjusted, according to the default setting, this parameter can quickly respond to the system feedback and the given deviation change. the larger the value of Kd, the faster the response, but too large may cause oscillation. When set to 0, the differentiation is invalid. | | | | | |

| Sub-index 0X04 (P50.04) | Name | Data Type | Access Properties | Setting method | Effective mode | Factory value |
|---|---|---|---|---|---|---|
| | Speed loop gain 2 | DINT32 | RW | Operation settings | Downtime effective | 270 |
| | | Data Range | 1~5000 | Can you map | Related Models | Protection level |
| | | Unit | 0.1Hz | NO | P/S | 1 |
| | 2nd speed loop gain. | | | | | |

| Sub-index 0X05 (P50.05) | Name | Data Type | Access Properties | Setting method | Effective mode | Factory value |
|---|---|---|---|---|---|---|
| | Speed loop integration time 2 | UDINT32 | RW | Operation settings | Downtime effective | 210 |
| | | Data Range | 1~3700 | Can you map | Related Models | Protection level |
| | | Unit | ms | NO | P/S | 1 |
| | 2nd speed loop integration time constant. | | | | | |

| Sub-index 0X06 (P50.06) | Name | Data Type | Access Properties | Setting method | Effective mode | Factory value |
|---|---|---|---|---|---|---|
| | Speed loop Kd2 | UDINT3 | RW | Operatio | Downtim | 0 |

| | | | | | | |
|---|---|---|---|---|---|---|
| | | 2 | | Operation settings | Downtime effective | |
| | | Data Range | 0~120 | Can you map | Related Models | Protection level |
| | | Unit | - | | P/S | 1 |
| | 2nd speed loop differential time coefficient. | | | | | |

| Sub-index 0X10 (P50.10) | Name | Data Type | Access Properties | Setting method | Effective mode | Factory value |
|---|---|---|---|---|---|---|
| | Torque feedforward control selection | DINT32 | RW | Operation settings | Downtime effective | 2 |
| | | Data Range | 0~2 | Can you map | Related Models | Protection level |
| | | Unit | - | NO | ALL | 1 |
| | 0: No torque feedforward<br>1: Internal torque feedforward<br>2: 60B2h torque feedforward<br>Only 2 options are currently supported. | | | | | |

| Sub-index 0X11 (P50.11) | Name | Data Type | Access Properties | Setting method | Effective mode | Factory value |
|---|---|---|---|---|---|---|
| | Speed control cycle | DINT32 | RW | Operation settings | Downtime effective | 4 |
| | | Data Range | 2~40 | Can you map | Related Models | Protection level |
| | | Unit | - | NO | P/S | 2 |
| | Sets the ratio of the speed control cycle to the current control cycle. This parameter is mainly used to adjust the control period of the speed loop.<br>Velocity loop period = (P50.11*1000000)/(P31.0D*(2-P31.0E)) microseconds.<br>When using bus control, the master communication period 0x3001:03 needs to be an integer multiple of the speed loop period. | | | | | |

| Sub-index 0X12 (P50.12) | Name | Data Type | Access Properties | Setting method | Effective mode | Factory value |
|---|---|---|---|---|---|---|
| | Upper speed limit | DINT32 | RW | Operation settings | Effective immediately | 200 |
| | | Data Range | 0~1000 | Can you map | Related Models | Protection level |
| | | Unit | 1% rated speed | NO | P/S | 2 |
| | This parameter is used to set the upper speed limit as a percentage of the motor's rated speed. In both position and speed control modes, the speed is limited to the range of this parameter during forward rotation. | | | | | |

| Sub-index 0X13 (P50.13) | Name | Data Type | Access Properties | Setting method | Effective mode | Factory value |
|---|---|---|---|---|---|---|
| | Lower speed limit | DINT32 | RW | Operation settings | Effective immediately | -200 |
| | | Data Range | -1000~0 | Can you map | Related Models | Protection level |
| | | Unit | 1% rated speed | NO | P/S | 2 |
| | This parameter is used to set the lower speed limit as a percentage of the motor's rated speed. In both position and speed control modes, the speed is limited to the range of this parameter during forward rotation. | | | | | |

| Sub-index 0X14 | Name | Data Type | Access Properties | Setting method | Effective mode | Factory value |
|---|---|---|---|---|---|---|

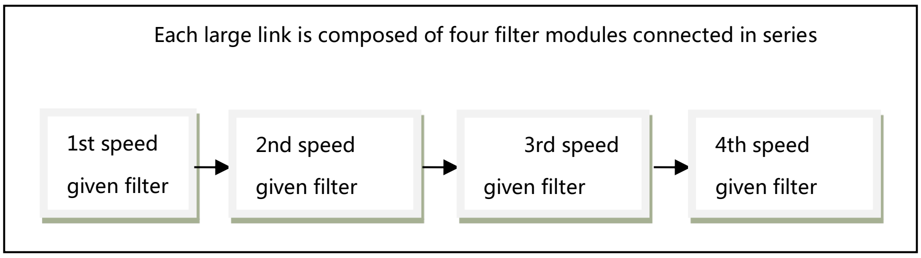
| Sub-index | Name | Data Type | Access Properties | Setting method | Effective mode | Factory value |
|---|---|---|---|---|---|---|
| **(P50.14)** | Speed tracking error threshold | DINT32 | RW | Operation settings | Effective immediately | 500 |
| | | Data Range | 0~1000 | Can you map | Related Models | Protection level |
| | | Unit | 0.1% of rated speed | NO | ALL | 1 |
| | This parameter is used to set the threshold value of the speed tracking error, the base value is the current speed given. When the difference between the speed feed and speed feedback reaches or exceeds the threshold set by this parameter and the duration exceeds the filter time set by 0x3050:15 (e.g., flywheel), the servo drive will stop and report a fault. | | | | | |
| **Sub-index 0X15 (P50.15)** | **Name** | **Data Type** | **Access Properties** | **Setting method** | **Effective mode** | **Factory value** |
| | Tracking error filtering time | DINT32 | RW | Operation settings | Effective immediately | 500 |
| | | Data Range | 0~2000 | Can you map | Related Models | Protection level |
| | | Unit | ms | NO | ALL | 1 |
| | This parameter is used to set the filtering time for speed tracking error protection, which is generally not adjusted and set according to the default value. | | | | | |
| **Sub-index 0X16 (P50.16)** | **Name** | **Data Type** | **Access Properties** | **Setting method** | **Effective mode** | **Factory value** |
| | Stall Threshold | DINT32 | RW | Operation settings | Effective immediately | 1000 |
| | | Data Range | 0~2000 | Can you map | Related Models | Protection level |
| | | Unit | 0.1% of rated speed | NO | ALL | 1 |
| | This parameter is used to set the threshold value for stall protection, with the base value being the current speed given. When the difference between the speed feed and the speed feedback reaches or exceeds the threshold value set by this parameter and the duration exceeds the filter time set by 0X3050:17 (e.g., flywheel), the servo drive will stop and report a fault. | | | | | |
| **Sub-index 0X17 (P50.17)** | **Name** | **Data Type** | **Access Properties** | **Setting method** | **Effective mode** | **Factory value** |
| | Stall filtering time | DINT32 | RW | Operation settings | Effective immediately | 100 |
| | | Data Range | 0~2000 | Can you map | Related Models | Protection level |
| | | Unit | ms | NO | ALL | 1 |
| | This parameter is used to set the filtering time of stall protection, which is generally not adjusted and set according to the default value. | | | | | |
| **Sub-index 0X18 (P50.18)** | **Name** | **Data Type** | **Access Properties** | **Setting method** | **Effective mode** | **Factory value** |
| | Stall protection enable | DINT32 | RW | Operation settings | Effective immediately | 1 |
| | | Data Range | 0~1 | Can you map | Related Models | Protection level |
| | | Unit | - | NO | ALL | 1 |
| | This parameter is used to set whether stall protection fault detection is performed.<br>0: No<br>1: Yes | | | | | |

| | Name | Data Type | Access Properties | Setting method | Effective mode | Factory value |
|---|---|---|---|---|---|---|
| **Sub-index 0X19 (P50.19)** | Overspeed filtering time | DINT32 | RW | Operation settings | Effective immediately | 100 |
| | | Data Range | 0~2000 | Can you map | Related Models | Protection level |
| | | Unit | ms | NO | ALL | 1 |
| | This parameter is used to set the filtering time of overspeed protection, which is generally not adjusted and set according to the default value. | | | | | |

- P51~P52 speed loop filter parameter set

| | Name | Data Type | Data Structure | Access Properties | Setting method | Effective mode | Factory value |
|---|---|---|---|---|---|---|---|
| **Index 0X3051 (P51)** | Speed Giving Filter | - | ARR | - | - | - | - |
| | | Data Range | - | | Can you map | Related Models | Protection level |
| | | Unit | - | | - | - | - |

To enable some kind of filter function for the speed loop, first set the filter enable (3031-0Ch) to 1; if (3031-0Ch) is 0, there will be no actual filtering effect even if 0x3051 and 0x3052 groups of relevant filters for the speed loop are configured.
The servo system's velocity loop has 2 large links configured with filter functions, namely the velocity feed filter and the velocity feedback filter, which have the same function and are explained together. Each large link is made up of 4 separate filter modules in series, for example, the speed feed link is made up of 4 separate filter modules in series, such as speed feed filters 1, 2, 3 and 4, as shown in the figure.




Each filter module has 4 control parameters, which are described for the 1st speed-given filter (2nd, 3rd and 4th speed-given filters are not described separately).

| | Name | Data Type | Access Properties | Setting method | Effective mode | Factory value |
|---|---|---|---|---|---|---|
| **Sub-index 0X01 (P51.01)** | 1st speed Given filter type | DINT32 | RW | Operation settings | Downtime effective | 0 |
| | | Data Range | 0~4 | Can you map | Related Models | Protection level |
| | | Unit | - | NO | P/HM | 1 |
| | Default does not turn on speed given filter<br>0: No filter is used<br>1: First-order low-pass filter<br>2: Second-order low-pass filter<br>3: Second order with zero-point low pass<br>4: Notch filter | | | | | |

| | Name | Data Type | Access Properties | Setting method | Effective mode | Factory value |
|---|---|---|---|---|---|---|
| **Sub-index 0X02 (P51.02)** | Speed given cutoff frequency1 | DINT32 | RW | Operation Settings | Downtime effective | 2500 |
| | | Data | 200~5000 | Can you | Related | Protectio |

| | | | | | | |
|---|---|---|---|---|---|---|
| | | Range | | map | Models | n level |
| | | Unit | Hz | NO | P/HM | 1 |

This parameter is used to set the low-pass cutoff frequency of the speed-given filter module 1 (this parameter is meaningful when the 0x3051:01 parameter is set to 1 or 2 or 3; when the 0x3051:01 parameter is set to 0 or 4, the value of this parameter has no meaning)
Low-pass filters are used to filter out high-frequency noise. When the input signal frequency is higher than the low-pass cutoff frequency, the signal amplitude at the output of the filter will be attenuated significantly, for a fixed frequency input signal, the lower the cutoff frequency of the filter, the greater the phase delay to the signal. The default speed loop filter low-pass cutoff frequency is 2500Hz.

| **Sub-index 0X03 (P51.03)** | **Name** | **Data Type** | **Access Properties** | **Setting method** | **Effective mode** | **Factory value** |
|---|---|---|---|---|---|---|
| | Speed given notch frequency 1 | DINT32 | RW | Operation Settings | Downtime effective | 100 |
| | | Data Range | 3~5000 | Can you map | Related Models | Protection level |
| | | Unit | Hz | NO | P/HM | 1 |

Speed given notch frequency 1 is used to set the notch center frequency of the 1st speed given filter, speed given notch depth 1 is used to set the notch depth of the 1st speed given filter (when 0x3051:01 is selected as 4, these two parameters are meaningful; when 0x3051:01 is selected as 0, 1, 2, 3, the values of these two parameters are meaningless)
The notch filter, also known as bandstop filter, is a filter that can pass most of the frequency components, but attenuate some range of frequency components to a very low level; the notch filter has a very strong attenuation effect on the signal near the center frequency, and basically has little effect on the signal far from the center frequency; the greater the notch depth, the stronger the attenuation effect on the center frequency point. In general, the notch filter is only enabled after vibration has occurred in the motor and the vibration frequency has been detected.

| **Sub-index 0X04 (P51.04)** | **Name** | **Data Type** | **Access Properties** | **Setting method** | **Effective mode** | **Factory value** |
|---|---|---|---|---|---|---|
| | Speed given notch depth 1 | DINT32 | RW | Operation Settings | Downtime effective | 5 |
| | | Data Range | 3~50 | Can you map | Related Models | Protection level |
| | | Unit | db | NO | P/HM | 1 |

As described in 0x3051:04, used to set the notch depth of the 1st speed given notch filter, the greater the notch depth, the stronger the attenuation effect on the center frequency point.

| **Sub-index 0X05 (P51.05)** | **Name** | **Data Type** | **Access Properties** | **Setting method** | **Effective mode** | **Factory value** |
|---|---|---|---|---|---|---|
| | 2nd speed given filter type | UDINT32 | RW | Operation settings | Downtime effective | 0 |
| | | Data Range | 0~4 | Can you map | Related Models | Protection level |
| | | Unit | - | NO | P/HM | 1 |

0: No filter is used
1: First-order low-pass filter

| | |
|---|---|
| | 2: Second-order low-pass filter<br>3: Second order with zero-point low pass<br>4: Notch filter |

| Sub-index 0X06 (P51.06) | Name | Data Type | Access Properties | Setting method | Effective mode | Factory value |
|---|---|---|---|---|---|---|
| | Speed given cutoff frequency2 | UDINT32 | RW | Operation settings | Downtime effective | 2500 |
| | | Data Range | 200~5000 | Can you map | Related Models | Protection level |
| | | Unit | Hz | NO | P/HM | 1 |

| Sub-index 0X07 (P51.07) | Name | Data Type | Access Properties | Setting method | Effective mode | Factory value |
|---|---|---|---|---|---|---|
| | Speed given notch frequency 2 | DINT32 | RW | Operation settings | Downtime effective | 100 |
| | | Data Range | 3~5000 | Can you map | Related Models | Protection level |
| | | Unit | Hz | NO | P/HM | 1 |

| Sub-index 0X08 (P51.08) | Name | Data Type | Access Properties | Setting method | Effective mode | Factory value |
|---|---|---|---|---|---|---|
| | Speed given notch depth 2 | DINT32 | RW | Operation settings | Downtime effective | 5 |
| | | Data Range | 3~50 | Can you map | Related Models | Protection level |
| | | Unit | db | NO | P/HM | 1 |

| Sub-index 0X09 (P51.09) | Name | Data Type | Access Properties | Setting method | Effective mode | Factory value |
|---|---|---|---|---|---|---|
| | 3rd speed given filter type | DINT32 | RW | Operation settings | Downtime effective | 0 |
| | | Data Range | 0~4 | Can you map | Related Models | Protection level |
| | | Unit | - | NO | P/HM | 2 |
| | 0: No filter is used<br>1: First-order low-pass filter<br>2: Second-order low-pass filter<br>3: Second order with zero-point low pass<br>4: Notch filter | | | | | |

| Sub-index 0X0A (P51.0A) | Name | Data Type | Access Properties | Setting method | Effective mode | Factory value |
|---|---|---|---|---|---|---|
| | Speed given cutoff frequency3 | DINT32 | RW | Operation settings | Downtime effective | 2500 |
| | | Data Range | 200~5000 | Can you map | Related Models | Protection level |
| | | Unit | Hz | NO | P/HM | 2 |

| Sub-index 0X0B (P51.0B) | Name | Data Type | Access Properties | Setting method | Effective mode | Factory value |
|---|---|---|---|---|---|---|
| | Speed given notch frequency 3 | DINT32 | RW | Operation settings | Downtime effective | 100 |

| | | | | | | |
|---|---|---|---|---|---|---|
| | | Data Range | 3~5000 | Can you map | Related Models | Protection level |
| | | Unit | Hz | NO | P/HM | 2 |

| Sub-index 0X0C (P51.0C) | Name | Data Type | Access Properties | Setting method | Effective mode | Factory value |
|---|---|---|---|---|---|---|
| | Speed given notch depth 3 | DINT32 | RW | Operation settings | Downtime effective | 5 |
| | | Data Range | 3~50 | Can you map | Related Models | Protection level |
| | | Unit | db | NO | P/HM | 2 |

| Sub-index 0X0D (P51.0D) | Name | Data Type | Access Properties | Setting method | Effective mode | Factory value |
|---|---|---|---|---|---|---|
| | 4th speed given filter type | DINT32 | RW | Operation settings | Downtime effective | 0 |
| | | Data Range | 0~4 | Can you map | Related Models | Protection level |
| | | Unit | - | NO | P/HM | 2 |
| | 0: No filter is used<br>1: First-order low-pass filter<br>2: Second-order low-pass filter<br>3: Second order with zero-point low pass<br>4: Notch filter | | | | | |

| Sub-index 0X0E (P51.0E) | Name | Data Type | Access Properties | Setting method | Effective mode | Factory value |
|---|---|---|---|---|---|---|
| | Speed given cut-off frequency 4 | DINT32 | RW | Operation settings | Downtime effective | 2500 |
| | | Data Range | 200~5000 | Can you map | Related Models | Protection level |
| | | Unit | Hz | NO | P/HM | 2 |

| Sub-index 0X0F (P51.0F) | Name | Data Type | Access Properties | Setting method | Effective mode | Factory value |
|---|---|---|---|---|---|---|
| | Speed given notch frequency 4 | DINT32 | RW | Operation settings | Downtime effective | 100 |
| | | Data Range | 3~5000 | Can you map | Related Models | Protection level |
| | | Unit | Hz | NO | P/HM | 2 |

| Sub-index 0X10 (P51.10) | Name | Data Type | Access Properties | Setting method | Effective mode | Factory value |
|---|---|---|---|---|---|---|
| | Speed given notch depth 4 | DINT32 | RW | Operation settings | Downtime effective | 5 |
| | | Data Range | 3~50 | Can you map | Related Models | Protection level |
| | | Unit | db | NO | P/HM | 2 |

| Index 0X3052 (P52) | Name | Data Type | Data Structure | Access Properties | Setting method | Effective mode | Factory value |
|---|---|---|---|---|---|---|---|
| | Speed feedback | - | ARR | - | - | - | - |
| | | Data | - | | Can you | Related | Protectio |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| | filter | Range | | map | Models | n level |
| | | Unit | - | - | - | - |
| | This group of parameters is used to set the speed feedback filter, mainly used to eliminate the high frequency harmonics in the speed feedback and mechanical vibration caused by the noise, to protect the system operation | | | | | |
| **Sub-index 0X01 (P52.01)** | **Name** | **Data Type** | **Access Properties** | **Setting method** | **Effective mode** | **Factory value** |
| | 1st speed feedback filter type | DINT32 | RW | Operation settings | Downtime effective | 1 |
| | | Data Range | 0~4 | Can you map | Related Models | Protection level |
| | | Unit | - | NO | P/S/HM | 1 |
| | The 1st velocity feedback filter is turned on by default as a first-order low-pass filter;<br>0: No filter is used<br>1: First-order low-pass filter<br>2: Second-order low-pass filter<br>3: Second order with zero-point low pass<br>4: Notch filter | | | | | |
| **Sub-index 0X02 (P52.02)** | **Name** | **Data Type** | **Access Properties** | **Setting method** | **Effective mode** | **Factory value** |
| | Speed feedback 1 cutoff frequency | DINT32 | RW | Operation Settings | Downtime effective | 1000 |
| | | Data Range | 200~5000 | Can you map | Related Models | Protection level |
| | | Unit | Hz | NO | P/S | 1 |
| | Turn on by default the 1st velocity feedback filter as a first order low-pass filter with a cut-off frequency of 1000hz.<br>The smaller the setting, the smaller the speed feedback fluctuation, but also the larger the feedback delay. The<br>cutoff frequency is 5000Hz with no filtering effect. | | | | | |
| **Sub-index 0X03 (P52.03)** | **Name** | **Data Type** | **Access Properties** | **Setting method** | **Effective mode** | **Factory value** |
| | Speed feedback 1 notch frequency | DINT32 | RW | Operation settings | Downtime effective | 100 |
| | | Data Range | 3~5000 | Can you map | Related Models | Protection level |
| | | Unit | Hz | NO | P/S/HM | 1 |
| | | | | | | |
| **Sub-index 0X04 (P52.04)** | **Name** | **Data Type** | **Access Properties** | **Setting method** | **Effective mode** | **Factory value** |
| | Speed feedback 1 notch depth | DINT32 | RW | Operation settings | Downtime effective | 5 |
| | | Data Range | 3~50 | Can you map | Related Models | Protection level |
| | | Unit | db | NO | P/S | 1 |
| | | | | | | |
| **Sub-index 0X05 (P52.05)** | **Name** | **Data Type** | **Access Properties** | **Setting method** | **Effective mode** | **Factory value** |
| | 2nd speed feedback filter type | UDINT32 | RW | Operation settings | Downtime effective | 0 |
| | | Data Range | 0~4 | Can you map | Related Models | Protection level |

| | | | | | | |
|---|---|---|---|---|---|---|
| | | Unit | - | NO | P/S | 1 |
| | 0: No filter is used<br>1: First-order low-pass filter<br>2: Second-order low-pass filter<br>3: Second order with zero-point low pass<br>4: Notch filter | | | | | |

| | Name | Data Type | Access Properties | Setting method | Effective mode | Factory value |
|---|---|---|---|---|---|---|
| **Sub-index 0X06 (P52.06)** | Speed feedback 2 cut-off frequency | UDINT32 | RW | Operation settings | Downtime effective | 2500 |
| | | Data Range | 200~5000 | Can you map | Related Models | Protection level |
| | | Unit | Hz | NO | P/S | 1 |
| | | | | | | |

| | Name | Data Type | Access Properties | Setting method | Effective mode | Factory value |
|---|---|---|---|---|---|---|
| **Sub-index 0X07 (P52.07)** | Speed feedback 2 notch frequency | DINT32 | RW | Operation settings | Downtime effective | 100 |
| | | Data Range | 3~5000 | Can you map | Related Models | Protection level |
| | | Unit | Hz | NO | P/S | 1 |
| | | | | | | |

| | Name | Data Type | Access Properties | Setting method | Effective mode | Factory value |
|---|---|---|---|---|---|---|
| **Sub-index 0X08 (P52.08)** | Speed feedback 2 notch depth | DINT32 | RW | Operation settings | Downtime effective | 5 |
| | | Data Range | 3~50 | Can you map | Related Models | Protection level |
| | | Unit | db | NO | P/S | 1 |
| | | | | | | |

| | Name | Data Type | Access Properties | Setting method | Effective mode | Factory value |
|---|---|---|---|---|---|---|
| **Sub-index 0X09 (P52.09)** | No. 3 Speed Feedback Filter Type | DINT32 | RW | Operation settings | Downtime effective | 0 |
| | | Data Range | 0~4 | Can you map | Related Models | Protection level |
| | | Unit | - | NO | P/S | 2 |
| | 0: No filter is used<br>1: First-order low-pass filter<br>2: Second-order low-pass filter<br>3: Second order with zero-point low pass<br>4: Notch filter | | | | | |

| | Name | Data Type | Access Properties | Setting method | Effective mode | Factory value |
|---|---|---|---|---|---|---|
| **Sub-index 0X0A (P52.0A)** | Speed feedback 3 cut-off frequency | DINT32 | RW | Operation | Downtime | 2500 |

| | | | | | | |
|---|---|---|---|---|---|---|
| | | | | settings | effective | |
| | | Data Range | 200~5000 | Can you map | Related Models | Protection level |
| | | Unit | Hz | NO | P/S | 2 |

| | Name | Data Type | Access Properties | Setting method | Effective mode | Factory value |
|---|---|---|---|---|---|---|
| **Sub-index 0X0B (P52.0B)** | Speed feedback 3 notch frequency | DINT32 | RW | Operation settings | Downtime effective | 100 |
| | | Data Range | 3~5000 | Can you map | Related Models | Protection level |
| | | Unit | Hz | | P/S | 2 |

| | Name | Data Type | Access Properties | Setting method | Effective mode | Factory value |
|---|---|---|---|---|---|---|
| **Sub-index 0X0C (P52.0C)** | Speed feedback 3 notch depth | DINT32 | RW | Operation settings | Downtime effective | 5 |
| | | Data Range | 3~50 | Can you map | Related Models | Protection level |
| | | Unit | db | NO | P/S | 2 |

| | Name | Data Type | Access Properties | Setting method | Effective mode | Factory value |
|---|---|---|---|---|---|---|
| **Sub-index 0X0D (P52.0D)** | No. 4 Speed Feedback Filter Type | DINT32 | RW | Operation settings | Downtime effective | 0 |
| | | Data Range | 0~4 | Can you map | Related Models | Protection level |
| | | Unit | - | NO | P/S | 2 |
| | 0: No filter is used<br>1: First-order low-pass filter<br>2: Second-order low-pass filter<br>3: Second order with zero-point low pass<br>4: Notch filter | | | | | |

| | Name | Data Type | Access Properties | Setting method | Effective mode | Factory value |
|---|---|---|---|---|---|---|
| **Sub-index 0X0E (P52.0E)** | Speed feedback 4 cut-off frequency | DINT32 | RW | Operation settings | Downtime effective | 2500 |
| | | Data Range | 200~5000 | Can you map | Related Models | Protection level |
| | | Unit | Hz | NO | P/S | 2 |

| | Name | Data Type | Access Properties | Setting method | Effective mode | Factory value |
|---|---|---|---|---|---|---|
| **Sub-index 0X0F (P52.0F)** | Speed feedback 4 notch frequency | DINT32 | RW | Operation settings | Downtime effective | 100 |
| | | Data Range | 3~5000 | Can you map | Related Models | Protection level |
| | | Unit | Hz | NO | P/S | 2 |

| | Name | Data Type | Access Properties | Setting method | Effective mode | Factory value |
|---|---|---|---|---|---|---|
| **Sub-index 0X10 (P52.10)** | Speed feedback 4 notch depth | DINT32 | RW | Operation | Downtime effective | 5 |

| | | | | | | |
|---|---|---|---|---|---|---|
| | | | | settings | | |
| | | Data Range | 3~50 | Can you map | Related Models | Protection level |
| | | Unit | db | NO | P/S | 2 |
| | | | | | | |

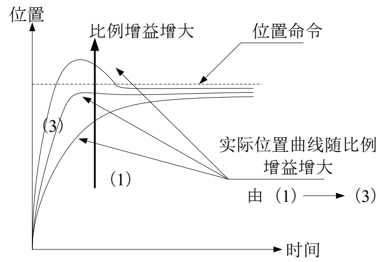
- P60 position loop parameter set

| Index 0X3060 (P60) | Name | Data Type | Data Structure | Access Properties | Setting method | Effective mode | Factory value |
|---|---|---|---|---|---|---|---|
| | Position control parameters | - | ARR | - | - | - | - |
| | | Data Range | - | | Can you map | Related Models | Protection level |
| | | Unit | - | | - | - | - |

| Sub-index 0X01 (P60.01) | Name | Data Type | Access Properties | Setting method | Effective mode | Factory value |
|---|---|---|---|---|---|---|
| | Position loop gain | DINT32 | RW | Operation settings | Downtime effective | 1500 |
| | | Data Range | 0~10000 | Can you map | Related Models | Protection level |
| | | Unit | 0.1Hz | NO | P/HM | 1 |

P60.01 and P60.02 parameters mainly adjust the proportional gain and feedforward gain of the position regulator.

When the position control gain value is increased, the position response can be improved, and the amount of position control error can be reduced. However, if the setting is too large, it is easy to generate vibration and noise. The effect of proportional gain is shown in the figure:

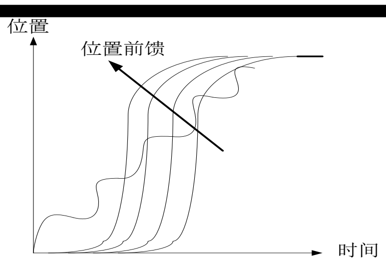



| Sub-index 0X02 (P60.02) | Name | Data Type | Access Properties | Setting method | Effective mode | Factory value |
|---|---|---|---|---|---|---|
| | Position feedforward coefficient | DINT32 | RW | Operation Settings | Downtime effective | 500 |
| | | Data Range | 0~10000 | Can you map | Related Models | Protection level |
| | | Unit | 0.1% of position loop given value | NO | P/HM | 1 |

Set the value of the position feedforward factor, the percentage of feedforward speed, usually set to no more than 100%.

In position control mode, increasing the feedforward value improves the amount of position following error. Decreasing the feedforward value can reduce the vibration phenomenon in the operation of the mechanism.

When the proportional gain is too large, the motor rotor will oscillate at this time, and the proportional gain is adjusted down until the motor rotor no longer oscillates. When the external torque increases, the proportional gain is too low to meet the reasonable position tracking error requirement. At this time, feedforward gain can effectively reduce the position dynamic tracking error. The effect of feedforward gain is shown in the figure:




| Sub-index 0X0B (P60.0B) | Name | Data Type | Access Properties | Setting method | Effective mode | Factory value |
|---|---|---|---|---|---|---|
| | Position tracking error detection enable | DINT32 | RW | Operation Settings | Downtime effective | 1 |
| | | Data Range | 0~1 | Can you map | Related Models | Protection level |
| | | Unit | - | NO | P/HM | 1 |
| | This parameter is used to set whether to perform position tracking error fault detection<br>0: Turn off position tracking error fault detection<br>1: Enables position tracking error fault detection | | | | | |

| Sub-index 0X0C (P60.0C) | Name | Data Type | Access Properties | Setting method | Effective mode | Factory value |
|---|---|---|---|---|---|---|
| | Position tracking error threshold | DINT32 | RW | Operation settings | Effective immediately | 131072 |
| | | Data Range | 0~16777216 | Can you map | Related Models | Protection level |
| | | Unit | inc | | P/HM | 1 |
| | This parameter sets the threshold value of the position tracking error in the position control loop, with the base value being the encoder single-turn resolution. When the difference between position giving and position feedback reaches or exceeds the threshold value (e.g., flywheel, motor shaft jamming), the servo drive will stop and report a fault. | | | | | |

| Sub-index 0X0D (P60.0D) | Name | Data Type | Access Properties | Setting method | Effective mode | Factory value |
|---|---|---|---|---|---|---|
| | Soft limit function setting | DINT32 | RW | Operation settings | Downtime effective | 0 |
| | | Data Range | 0~1 | Can you map | Related Models | Protection level |
| | | Unit | - | NO | ALL | 1 |
| | 0: Do not enable the soft limit function. | | | | | |

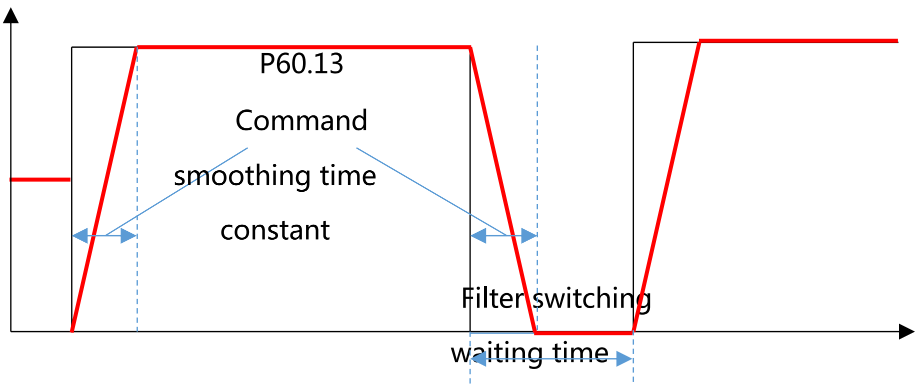
| Sub-index 0X0E (P60.0E) | Name | Data Type | Access Properties | Setting method | Effective mode | Factory value |
|---|---|---|---|---|---|---|
| | Soft limit maximum | UDINT32 | RW | Operation settings | Effective immediately | 2147483647 |
| | | Data Range | 0~2147483647 | Can you map | Related Models | Protection level |
| | | Unit | inc | NO | ALL | 1 |
| | Maximum software absolute position limit. | | | | | |

| Sub-index 0X0F (P60.0F) | Name | Data Type | Access Properties | Setting method | Effective mode | Factory value |
|---|---|---|---|---|---|---|
| | Soft limit min. | DINT32 | RW | Operation settings | Effective immediately | -2147483647 |
| | | Data Range | -2147483647~0 | Can you map | Related Models | Protection level |
| | | Unit | inc | NO | ALL | 1 |

| | | | | | | |
|---|---|---|---|---|---|---|
| | Minimum software absolute position limit. | | | | | |
| **Sub-index 0X10 (P60.10)** | **Name** | **Data Type** | **Access Properties** | **Setting method** | **Effective mode** | **Factory value** |
| | Command exception detection enable | UDINT32 | RW | Operation settings | Effective immediately | 1 |
| | | Data Range | 0~1 | Can you map | Related Models | Protection level |
| | | Unit | - | NO | ALL | 1 |
| | It is used to detect whether the given control command data is abnormal. When the acceleration speed corresponding to two adjacent given control commands is greater than the acceleration indicated by the parameter 0x3060:11 (P60.11), the given command is determined to be abnormal, and the servo is alarmed. Excessive command acceleration or abnormal command may cause motor overload or flywheel. To prevent causing equipment damage, it is recommended to turn on this function. | | | | | |
| **Sub-index 0X11 (P60.11)** | **Name** | **Data Type** | **Access Properties** | **Setting method** | **Effective mode** | **Factory value** |
| | Command detection acceleration time | UDINT32 | RW | Operation settings | Effective immediately | 5000 |
| | | Data Range | 200~100000 | Can you map | Related Models | Protection level |
| | | Unit | μs | NO | ALL | 1 |
| | During the command abnormality detection, the maximum acceleration required for the motor speed to accelerate from zero speed to rated speed in this time according to the trapezoidal plan is calculated. When the acceleration speed corresponding to two adjacent given control commands is greater than the acceleration indicated by this parameter, the given command is determined to be abnormal and the servo is alarmed. | | | | | |

| | | | | | | |
|---|---|---|---|---|---|---|
| **Sub-index 0X13 (P60.13)** | **Name** | **Data Type** | **Access Properties** | **Setting method** | **Effective mode** | **Factory value** |
| | Command smoothing time constant | UDINT32 | RW | Operation settings | Effective immediately | 0 |
| | | Data Range | 0~20 | Can you map | Related Models | Protection level |
| | | Unit | ms | NO | ALL | 1 |

The position loop command gives a smooth FIR filter shift time constant to effectively suppress the speed feedforward jitter caused by position command fluctuations and avoid sharp fluctuations in torque feed during rapid acceleration.




- P61~P62 Position loop filter parameter set

| Index 0X3061 (P61) | Name | Data Type | Data Structure | Access Properties | Setting method | Effective mode | Factory value |
|---|---|---|---|---|---|---|---|
| | Position loop given filtering (This feature is not supported at this time) | - | ARR | - | - | - | - |
| | | Data Range | - | | Can you map | Related Models | Protection level |
| | | Unit | - | | - | - | - |

| Sub-index 0X01 (P61.01) | Name | Data Type | Access Properties | Setting method | Effective mode | Factory value |
|---|---|---|---|---|---|---|
| | Position 1 given filter type | DINT32 | RW | Operation settings | Downtime effective | 0 |
| | | Data Range | 0~4 | Can you map | Related Models | Protection level |
| | | Unit | - | NO | P/HM | 1 |
| | 0: No filter is used<br>1: First-order low-pass filtering<br>2: Second-order low-pass filtering<br>3: Second order with zero low-pass<br>4: Notch filter | | | | | |

| Sub-index 0X02 (P61.02) | Name | Data Type | Access Properties | Setting method | Effective mode | Factory value |
|---|---|---|---|---|---|---|
| | Position given cutoff frequency 1 | DINT32 | RW | Operation settings | Downtime effective | 1500 |
| | | Data Range | 200~5000 | Can you map | Related Models | Protection level |
| | | Unit | Hz | NO | P/HM | 1 |
| | | | | | | |

| Sub-index 0X03 (P61.03) | Name | Data Type | Access Properties | Setting method | Effective mode | Factory value |
|---|---|---|---|---|---|---|
| | Position given | DINT32 | RW | Operati | Downti | 100 |

| | | | | | | |
|---|---|---|---|---|---|---|
| | notch frequency 1 | | | on settings | me effective | |
| | | Data Range | 3~500 | Can you map | Related Models | Protection level |
| | | Unit | Hz | NO | P/HM | 1 |
| | | | | | | |
| **Sub-index 0X04 (P61.04)** | **Name** | **Data Type** | **Access Properties** | **Setting method** | **Effective mode** | **Factory value** |
| | Position given notch depth 1 | DINT32 | RW | Operation settings | Downtime effective | 5 |
| | | Data Range | 3~50 | Can you map | Related Models | Protection level |
| | | Unit | db | NO | P/HM | 1 |
| | | | | | | |
| **Sub-index 0X05 (P61.05)** | **Name** | **Data Type** | **Access Properties** | **Setting method** | **Effective mode** | **Factory value** |
| | 2nd position given filter type | UDINT32 | RW | Operation settings | Downtime effective | 0 |
| | | Data Range | 0~4 | Can you map | Related Models | Protection level |
| | | Unit | - | NO | P/HM | 1 |
| | 0: No filter is used<br>1: First-order low-pass filtering<br>2: Second-order low-pass filtering<br>3: Second order with zero low-pass<br>4: Notch filter | | | | | |
| **Sub-index 0X06 (P61.06)** | **Name** | **Data Type** | **Access Properties** | **Setting method** | **Effective mode** | **Factory value** |
| | Position given cutoff frequency 2 | UDINT32 | RW | Operation settings | Downtime effective | 1500 |
| | | Data Range | 200~5000 | Can you map | Related Models | Protection level |
| | | Unit | Hz | NO | P/HM | 1 |
| | | | | | | |

| | | | | | | |
|---|---|---|---|---|---|---|
| **Sub-index 0X07 (P61.07)** | **Name** | **Data Type** | **Access Properties** | **Setting method** | **Effective mode** | **Factory value** |
| | Position given notch frequency 2 | DINT32 | RW | Operation settings | Downtime effective | 100 |
| | | Data Range | 3~5000 | Can you map | Related Models | Protection level |
| | | Unit | Hz | | P/HM | 1 |
| | | | | | | |
| **Sub-index 0X08 (P61.08)** | **Name** | **Data Type** | **Access Properties** | **Setting method** | **Effective mode** | **Factory value** |
| | Position given notch depth 2 | DINT32 | RW | Operation settings | Downtime effective | 5 |
| | | Data Range | 3~50 | Can you map | Related Models | Protection level |

| | | | | | | |
|---|---|---|---|---|---|---|
| | | Unit | db | | P/HM | 1 |
| | | | | | | |

| Sub-index 0X09 (P61.09) | Name | Data Type | Access Properties | Setting method | Effective mode | Factory value |
|---|---|---|---|---|---|---|
| | Position 3 given filter type | DINT32 | RW | Operation settings | Downtime effective | 0 |
| | | Data Range | 0~4 | Can you map | Related Models | Protection level |
| | | Unit | - | | P/HM | 2 |
| | 0: No filter is used<br>1: First-order low-pass filtering<br>2: Second-order low-pass filtering<br>3: Second-order low-pass with zero point<br>4: Notch filter | | | | | |

| Sub-index 0X0A (P61.0A) | Name | Data Type | Access Properties | Setting method | Effective mode | Factory value |
|---|---|---|---|---|---|---|
| | Position given cutoff frequency 3 | DINT32 | RW | Operation settings | Downtime effective | 1500 |
| | | Data Range | 200~5000 | Can you map | Related Models | Protection level |
| | | Unit | Hz | | P/HM | 2 |
| | | | | | | |

| Sub-index 0X0B (P61.0B) | Name | Data Type | Access Properties | Setting method | Effective mode | Factory value |
|---|---|---|---|---|---|---|
| | Position given notch frequency 3 | DINT32 | RW | Operation settings | Downtime effective | 100 |
| | | Data Range | 3~5000 | Can you map | Related Models | Protection level |
| | | Unit | Hz | | P/HM | 2 |
| | | | | | | |

| Sub-index 0X0C (P61.0C) | Name | Data Type | Access Properties | Setting method | Effective mode | Factory value |
|---|---|---|---|---|---|---|
| | Position given notch depth 3 | DINT32 | RW | Operation settings | Downtime effective | 5 |
| | | Data Range | 3~50 | Can you map | Related Models | Protection level |
| | | Unit | db | | P/HM | 2 |
| | | | | | | |

| Sub-index 0X0D (P61.0D) | Name | Data Type | Access Properties | Setting method | Effective mode | Factory value |
|---|---|---|---|---|---|---|
| | Position 3 given filter type | DINT32 | RW | Operation settings | Downtime effective | 0 |
| | | Data Range | 0~4 | Can you map | Related Models | Protection level |
| | | Unit | - | | P/HM | 2 |
| | 0: No filter is used<br>1: First-order low-pass filtering<br>2: Second-order low-pass filtering<br>3: Second-order low-pass with zero point<br>4: Notch filter | | | | | |

| Sub-index 0X0E | Name | Data Type | Access Properties | Setting method | Effective mode | Factory value |
|---|---|---|---|---|---|---|

| | | | | | | |
|---|---|---|---|---|---|---|
| (P61.0E) | Position given cutoff frequency 4 | DINT32 | RW | Operation settings | Downtime effective | 1500 |
| | | Data Range | 200~5000 | Can you map | Related Models | Protection level |
| | | Unit | Hz | | P/HM | 2 |
| | | | | | | |

| | Name | Data Type | Access Properties | Setting method | Effective mode | Factory value |
|---|---|---|---|---|---|---|
| Sub-index 0X0F (P61.0F) | Position given notch frequency 4 | DINT32 | RW | Operation settings | Downtime effective | 100 |
| | | Data Range | 3~5000 | Can you map | Related Models | Protection level |
| | | Unit | Hz | | P/HM | 2 |
| | | | | | | |

| | Name | Data Type | Access Properties | Setting method | Effective mode | Factory value |
|---|---|---|---|---|---|---|
| Sub-index 0X10 (P61.10) | Position given notch depth 4 | DINT32 | RW | Operation settings | Downtime effective | 5 |
| | | Data Range | 3~50 | Can you map | Related Models | Protection level |
| | | Unit | db | NO | P/HM | 2 |
| | | | | | | |

| | Name | Data Type | Data Structure | Access Properties | Setting method | Effective mode | Factory value |
|---|---|---|---|---|---|---|---|
| Index 0X3062 (P62) | Position feedback filtering (this function is not supported currently) | - | ARR | - | - | - | - |
| | | Data Range | - | | Can you map | Related Models | Protection level |
| | | Unit | - | | - | - | - |

| | Name | Data Type | Access Properties | Setting method | Effective mode | Factory value |
|---|---|---|---|---|---|---|
| Sub-index 0X01 (P62.01) | 1st position feedback filter type | DINT32 | RW | Operation settings | Downtime effective | 0 |
| | | Data Range | 0~4 | Can you map | Related Models | Protection level |
| | | Unit | - | NO | P/HM | 1 |
| | 0: No filter is used<br>1: First-order low-pass filter<br>2: Second-order low-pass filter<br>3: Second order with zero-point low pass<br>4: Notch filter | | | | | |

| | Name | Data Type | Access Properties | Setting method | Effective mode | Factory value |
|---|---|---|---|---|---|---|
| Sub-index 0X02 (P62.02) | Position feedback cutoff frequency 1 | DINT32 | RW | Operation settings | Downtime effective | 1500 |
| | | Data Range | 200~5000 | Can you map | Related Models | Protection level |
| | | Unit | Hz | NO | P/HM | 1 |
| | | | | | | |

| | Name | Data Type | Access Properties | Setting method | Effective mode | Factory value |
|---|---|---|---|---|---|---|
| Sub-index 0X03 (P62.03) | Position | DINT32 | RW | Operatio | Downtim | 100 |

| | Name | Data Type | Access Properties | Setting method | Effective mode | Factory value |
|---|---|---|---|---|---|---|
| | feedback notch frequency 1 | | | Operation settings | Downtime effective | |
| | | Data Range | 3~5000 | Can you map | Related Models | Protection level |
| | | Unit | Hz | NO | P/HM | 1 |
| | | | | | | |

| | Name | Data Type | Access Properties | Setting method | Effective mode | Factory value |
|---|---|---|---|---|---|---|
| **Sub-index 0X04 (P62.04)** | Position feedback notch depth 1 | DINT32 | RW | Operation settings | Downtime effective | 5 |
| | | Data Range | 3~50 | Can you map | Related Models | Protection level |
| | | Unit | db | NO | P/HM | 1 |
| | | | | | | |

| | Name | Data Type | Access Properties | Setting method | Effective mode | Factory value |
|---|---|---|---|---|---|---|
| **Sub-index 0X05 (P62.05)** | 2nd position feedback filter type | UDINT32 | RW | Operation settings | Downtime effective | 0 |
| | | Data Range | 0~4 | Can you map | Related Models | Protection level |
| | | Unit | - | NO | P/HM | 1 |
| | 0: No filter is used<br>1: First-order low-pass filter<br>2: Second-order low-pass filter<br>3: Second order with zero-point low pass<br>4: Notch filter | | | | | |

| | Name | Data Type | Access Properties | Setting method | Effective mode | Factory value |
|---|---|---|---|---|---|---|
| **Sub-index 0X06 (P62.06)** | Position feedback cutoff frequency 2 | UDINT32 | RW | Operation settings | Downtime effective | 1500 |
| | | Data Range | 200~5000 | Can you map | Related Models | Protection level |
| | | Unit | Hz | NO | P/HM | 1 |
| | | | | | | |

| | Name | Data Type | Access Properties | Setting method | Effective mode | Factory value |
|---|---|---|---|---|---|---|
| **Sub-index 0X07 (P62.07)** | Position feedback notch frequency 2 | DINT32 | RW | Operation Settings | Downtime effective | 100 |
| | | Data Range | 3~5000 | Can you map | Related Models | Protection level |
| | | Unit | Hz | NO | P/HM | 1 |
| | | | | | | |

| | Name | Data Type | Access Properties | Setting method | Effective mode | Factory value |
|---|---|---|---|---|---|---|
| **Sub-index 0X08 (P62.08)** | Position feedback notch depth 2 | DINT32 | RW | Operation settings | Downtime effective | 5 |
| | | Data Range | 3~50 | Can you map | Related Models | Protection level |
| | | Unit | db | NO | P/HM | 1 |
| | | | | | | |

| | Name | Data Type | Access Properties | Setting method | Effective mode | Factory value |
|---|---|---|---|---|---|---|
| **Sub-index 0X09 (P62.09)** | 3rd position feedback filter type | DINT32 | RW | Operation settings | Downtime effective | 0 |
| | | Data Range | 0~4 | Can you map | Related Models | Protection level |
| | | Unit | - | NO | P/HM | 2 |
| | 0: No filter is used<br>1: First-order low-pass filter<br>2: Second-order low-pass filter<br>3: Second order with zero-point low pass<br>4: Notch filter | | | | | |

| | Name | Data Type | Access Properties | Setting method | Effective mode | Factory value |
|---|---|---|---|---|---|---|
| **Sub-index 0X0A (P62.0A)** | Position feedback cutoff frequency3 | DINT32 | RW | Operation Settings | Downtime effective | 1500 |
| | | Data Range | 200~5000 | Can you map | Related Models | Protection level |
| | | Unit | Hz | NO | P/HM | 2 |

| | Name | Data Type | Access Properties | Setting method | Effective mode | Factory value |
|---|---|---|---|---|---|---|
| **Sub-index 0X0B (P62.0B)** | Position feedback notch frequency 3 | DINT32 | RW | Operation Settings | Downtime effective | 100 |
| | | Data Range | 3~5000 | Can you map | Related Models | Protection level |
| | | Unit | Hz | NO | P/HM | 2 |

| | Name | Data Type | Access Properties | Setting method | Effective mode | Factory value |
|---|---|---|---|---|---|---|
| **Sub-index 0X0C (P62.0C)** | Position feedback notch depth 3 | DINT32 | RW | Operation Settings | Downtime effective | 5 |
| | | Data Range | 3~50 | Can you map | Related Models | Protection level |
| | | Unit | db | NO | P/HM | 2 |

| | Name | Data Type | Access Properties | Setting method | Effective mode | Factory value |
|---|---|---|---|---|---|---|
| **Sub-index 0X0D (P62.0D)** | 4th position feedback filter type | DINT32 | RW | Operation Settings | Downtime effective | 0 |
| | | Data Range | 0~4 | Can you map | Related Models | Protection level |
| | | Unit | - | NO | P/HM | 2 |
| | 0: No filter is used<br>1: First-order low-pass filter<br>2: Second-order low-pass filter<br>3: Second order with zero-point low pass<br>4: Notch filter | | | | | |

| Sub-index 0X0E (P62.0E) | Name | Data Type | Access Properties | Setting method | Effective mode | Factory value |
|---|---|---|---|---|---|---|
| | Position feedback cutoff frequency 4 | DINT32 | RW | Operation settings | Downtime effective | 1500 |
| | | Data Range | 200~5000 | Can you map | Related Models | Protection level |
| | | Unit | Hz | NO | P/HM | 2 |
| | | | | | | |

| Sub-index 0X0F (P62.0F) | Name | Data Type | Access Properties | Setting method | Effective mode | Factory value |
|---|---|---|---|---|---|---|
| | Position feedback notch frequency 4 | DINT32 | RW | Operation settings | Downtime effective | 100 |
| | | Data Range | 3~5000 | Can you map | Related Models | Protection level |
| | | Unit | Hz | NO | P/HM | 2 |
| | | | | | | |

| Sub-index 0X10 (P62.10) | Name | Data Type | Access Properties | Setting method | Effective mode | Factory value |
|---|---|---|---|---|---|---|
| | Position feedback notch depth 4 | DINT32 | RW | Operation settings | Downtime effective | 5 |
| | | Data Range | 3~50 | Can you map | Related Models | Protection level |
| | | Unit | db | NO | P/HM | 2 |
| | | | | | | |

- P63 Inertia and rigidity setting parameter group

| Index 0X3063 (P63) | Name | Data Type | Data Structure | Access Properties | Setting method | Effective mode | Factory value |
|---|---|---|---|---|---|---|---|
| | Inertia and rigidity setting | - | ARR | - | - | - | - |
| | | Data Range | - | | Can you map | Related Models | Protection level |
| | | Unit | - | | - | - | - |

| Sub-index 0X01 (P63.01) | Name | Data Type | Access Properties | Setting method | Effective mode | Factory value |
|---|---|---|---|---|---|---|
| | Inertia ratio | DINT32 | RW | Operation settings | Downtime effective | 250 |
| | | Data Range | 0~5000 | Can you map | Related Models | Protection level |
| | | Unit | 1% | NO | ALL | 1 |
| | Load inertia ratio, when the external mechanical load converted to the mechanical inertia of the motor shaft, divided by the motor's own rotational inertia, to obtain the inertia ratio. This value can be entered manually or filled in automatically by the inertia self-learning method.<br>Note: This drive supports a maximum of 20 times the load inertia ratio when applied to rough position accuracy control applications. Please consider carefully in the mechanical design selection stage. | | | | | |

| Sub-index 0X02 | Name | Data Type | Access Properties | Setting method | Effective mode | Factory value |
|---|---|---|---|---|---|---|

| (P63.02) | Mechanical rigidity setting | DINT32 | RW | Operation settings | Downtime effective | 13 |
|---|---|---|---|---|---|---|
| | | Data Range | 0~31 | Can you map | Related Models | Protection level |
| | | Unit | - | NO | ALL | 1 |

Mechanical rigidity level setting, the level from 0 ~ 31, 0 represents the weakest gain, 31 represents the strongest gain. Each rigidity level corresponds to a set of three-loop gain data.

| Grade | Position loop gain | Speed loop gain | Speed loop integration time | Current given filtering time constant |
|---|---|---|---|---|
| 0 | 2 | 1.5 | 370 | 15 |
| 1 | 2.5 | 2 | 280 | 11 |
| 2 | 3 | 2.5 | 220 | 9 |
| 3 | 4 | 3 | 190 | 8 |
| 4 | 4.5 | 3.5 | 160 | 6 |
| 5 | 5.5 | 4.5 | 120 | 5 |
| 6 | 7.5 | 6 | 90 | 4 |
| 7 | 9.5 | 7.5 | 70 | 3 |
| 8 | 11.5 | 9 | 60 | 3 |
| 9 | 14 | 11 | 50 | 2 |
| 10 | 17.5 | 14 | 40 | 2 |
| 11 | 32 | 18 | 40 | 1.26 |
| 12 | 39 | 22 | 40 | 1.03 |
| 13 | 48 | 27 | 40 | 0.84 |
| 14 | 63 | 35 | 40 | 0.64 |
| 15 | 72 | 40 | 40 | 0.57 |
| 16 | 90 | 50 | 40 | 0.45 |
| 17 | 108 | 60 | 40 | 0.38 |
| 18 | 135 | 75 | 40 | 0.29 |
| 19 | 162 | 90 | 40 | 0.25 |
| 20 | 206 | 115 | 40 | 0.19 |
| 21 | 251 | 140 | 40 | 0.16 |
| 22 | 305 | 170 | 40 | 0.13 |
| 23 | 377 | 210 | 40 | 0.11 |
| 24 | 449 | 250 | 40 | 0.09 |
| 25 | 500 | 280 | 40 | 0.08 |
| 26 | 560 | 310 | 40 | 0.07 |
| 27 | 610 | 340 | 40 | 0.07 |
| 28 | 660 | 370 | 40 | 0.06 |
| 29 | 720 | 400 | 40 | 0.06 |
| 30 | 810 | 450 | 40 | 0.05 |
| 31 | 900 | 500 | 40 | 0.05 |

| Sub-index 0X03 (P63.03) | Name | Data Type | Access Properties | Setting method | Effective mode | Factory value |
|---|---|---|---|---|---|---|
| | Inertia recognition frequency | DINT32 | RW | Operation settings | Downtime effective | |
| | | Data Range | 1~2000 | Can you map | Related Models | Protection level |
| | | Unit | | NO | ALL | 1 |

- P70~P73 IO parameter group

| Index 0X3070 (P70) | Name | Data Type | Data Structure | Access Properties | Setting method | Effective mode | Factory value |
|---|---|---|---|---|---|---|---|
| | I/O parameters | - | ARR | - | - | - | - |
| | | Data Range | - | | Can you map | Related Models | Protection level |
| | | Unit | - | | - | - | - |

| Sub-index 0X01 (P70.01) | Name | Data Type | Access Properties | Setting method | Effective mode | Factory value |
|---|---|---|---|---|---|---|
| | Input DI1 function | DINT32 | RW | Operation settings | Effective immediately | 2 |
| | | Data Range | 0~112 | Can you map | Related Models | Protection level |

| | | | | | | |
|---|---|---|---|---|---|---|
| | | Unit | - | NO | ALL | 1 |
| | NO for normally open logic and options without NO for normally closed logic.<br>0: No DI function defined<br>1: Servo operation NO<br>2: Positive movement is prohibited NO<br>3: Reverse movement is prohibited NO<br>6: Retention<br>9: Zero return proximity switch NO<br>10: Bus IO input NO<br>11: Probe 1NO<br>12: Probe 2NO<br>101: Servo operation<br>102: Forward motion is prohibited<br>103: Reverse movement is prohibited<br>106: Reserved<br>109: Zero return proximity switch<br>110: Bus IO input<br>111: Probe 1<br>112: Probe 2 | | | | | |

| Sub-index 0X02 (P70.02) | Name | Data Type | Access Properties | Setting method | Effective mode | Factory value |
|---|---|---|---|---|---|---|
| | Input DI2 function | DINT32 | RW | Operation settings | Effective immediately | 3 |
| | | Data Range | 0~112 | Can you map | Related Models | Protection level |
| | | Unit | - | NO | ALL | 1 |
| | Same as DI1 input function configuration description | | | | | |

| Sub-index 0X03 (P70.03) | Name | Data Type | Access Properties | Setting method | Effective mode | Factory value |
|---|---|---|---|---|---|---|
| | Input DI3 function | DINT32 | RW | Operation settings | Effective immediately | 10 |
| | | Data Range | 0~112 | Can you map | Related Models | Protection level |
| | | Unit | - | NO | ALL | 1 |
| | NO for normally open logic and options without NO for normally closed logic.<br>0: No DI function defined<br>1: Servo operation NO<br>2: Positive movement is prohibited NO<br>3: Reverse movement is prohibited NO<br>6: Retention<br>9: Zero return proximity switch NO<br>10: Bus IO input NO<br>101: Servo operation<br>102: Forward motion is prohibited<br>103: Reverse movement is prohibited<br>106: Reserved<br>109: Zero return proximity switch<br>110: Bus IO input | | | | | |

| Sub-index 0X04 (P70.04) | Name | Data Type | Access Properties | Setting method | Effective mode | Factory value |
|---|---|---|---|---|---|---|
| | Input DI4 function | DINT32 | RW | Operation settings | Effective immediately | 10 |

| | | | | | | |
|---|---|---|---|---|---|---|
| | | Data Range | 0~112 | Can you map | Related Models | Protection level |
| | | Unit | - | NO | ALL | 1 |
| | Same as DI3 input function configuration description. | | | | | |

| | Name | Data Type | Access Properties | Setting method | Effective mode | Factory value |
|---|---|---|---|---|---|---|
| **Sub-index 0X05 (P70.05)** | Input DI5 function | DINT32 | RW | Operation settings | Effective immediately | 10 |
| | | Data Range | 0~112 | Can you map | Related Models | Protection level |
| | | Unit | - | NO | ALL | 1 |
| | Same as DI3 input function configuration description. | | | | | |

| | Name | Data Type | Access Properties | Setting method | Effective mode | Factory value |
|---|---|---|---|---|---|---|
| **Sub-index 0X06 (P70.06)** | Emergency stop logic | UDINT32 | RW | Operation settings | Effective immediately | 6 |
| | | Data Range | 6~106 | Can you map | Related Models | Protection level |
| | | Unit | - | NO | ALL | 1 |
| | This parameter is used to select the logic setting for the emergency stop:<br>6: normally open logic: emergency stop is set to normally open logic, for the valid input state, the servo is in the emergency stop state.<br>106: Normally closed logic: the emergency stop is set to normally closed logic, for the high resistance state and valid input state, the servo is in the emergency stop state; | | | | | |

| | Name | Data Type | Access Properties | Setting method | Effective mode | Factory value |
|---|---|---|---|---|---|---|
| **Sub-index 0X07 (P70.07)** | Digital input filtering time | DINT32 | RW | Operation settings | Effective immediately | 5 |
| | | Data Range | 0~500 | Can you map | Related Models | Protection level |
| | | Unit | ms | NO | ALL | 1 |
| | This parameter is used to set the filtering time of the digital quantity. | | | | | |

| | Name | Data Type | Access Properties | Setting method | Effective mode | Factory value |
|---|---|---|---|---|---|---|
| **Sub-index 0X08 (P70.08)** | Input Status | DINT32 | RW | Operation settings | Effective immediately | 0 |
| | | Data Range | 0~31 | Can you map | Related Models | Protection level |
| | | Unit | - | | | 1 |
| | The logic state of DI is displayed. The bit4~bit0 of this parameter binary corresponds to the logic state of DI5~DI1 respectively. | | | | | |

| | Name | Data Type | Access Properties | Setting method | Effective mode | Factory value |
|---|---|---|---|---|---|---|
| **Sub-index 0X09 (P70.09)** | Analog input enables | DINT32 | RW | Operation settings | Effective immediately | 0 |
| | | Data Range | 0~1 | Can you map | Related Models | Protection level |

<table>
<tr><td rowspan="2"></td><td></td><td>Unit</td><td colspan="2">-</td><td>NO</td><td>ALL</td><td>1</td></tr>
<tr><td colspan="7">0: No<br>1: Yes<br>This parameter setting allows you to determine whether to turn on the input analog function of DI~DI5. When this function is turned on, the DI logic can be given through parameter P70.0A; when this function is turned off, the DI logic is given through the corresponding DI physical interface.</td></tr>
<tr><td rowspan="5">Sub-index 0X10 (P70.0A)</td><td>Name</td><td>Data Type</td><td colspan="2">Access Properties</td><td>Setting method</td><td>Effective mode</td><td>Factory value</td></tr>
<tr><td rowspan="3">Analog Inputs</td><td>DINT32</td><td colspan="2">RW</td><td>Operation settings</td><td>Effective immediately</td><td>0</td></tr>
<tr><td>Data Range</td><td colspan="2">0~31</td><td>Can you map</td><td>Related Models</td><td>Protection level</td></tr>
<tr><td>Unit</td><td colspan="2">-</td><td>NO</td><td>ALL</td><td>1</td></tr>
<tr><td colspan="7">When parameter P70.09 is 1, the DI analog input function is enabled. The bit4~bit0 of this parameter binary corresponds to the logic given by DI5~DI1 respectively, which determines whether the function logic set by DI is triggered or not;</td></tr>
<tr><td rowspan="4">Index 0X3071 (P71)</td><td>Name</td><td>Data Type</td><td>Data Structure</td><td>Access Properties</td><td>Setting method</td><td>Effective mode</td><td>Factory value</td></tr>
<tr><td rowspan="3">DO Parameters</td><td>-</td><td>ARR</td><td>-</td><td>-</td><td>-</td><td>-</td></tr>
<tr><td>Data Range</td><td colspan="2">-</td><td>Can you map</td><td>Related Models</td><td>Protection level</td></tr>
<tr><td>Unit</td><td colspan="2">-</td><td>-</td><td>-</td><td>-</td></tr>
<tr><td rowspan="5">Sub-index 0X01 (P71.01)</td><td>Name</td><td>Data Type</td><td colspan="2">Access Properties</td><td>Setting method</td><td>Effective mode</td><td>Factory value</td></tr>
<tr><td rowspan="3">Output DO1 function</td><td>DINT32</td><td colspan="2">RW</td><td>Operation settings</td><td>Effective immediately</td><td>2</td></tr>
<tr><td>Data Range</td><td colspan="2">0~108</td><td>Can you map</td><td>Related Models</td><td>Protection level</td></tr>
<tr><td>Unit</td><td colspan="2">-</td><td>NO</td><td>ALL</td><td>1</td></tr>
<tr><td colspan="7">N0 is normally open logic, NC is normally closed logic<br>0: No DO function defined<br>1: Servo return to zero completed NO<br>2: Servo operation enable NO<br>3: Servo alarm NO<br>4: Position tracking overrun NO<br>5: The target location reaches NO<br>6: Contracting brake output NO<br>7: Bus IO output NO<br>101: Servo return to zero completed NC<br>102: Servo operation enable NC<br>103: Servo alarm NC<br>104: Position tracking overrun NC<br>105: Target location reached NC<br>106: Contracting brake output NC<br>107: Bus IO output NC</td></tr>
<tr><td rowspan="5">Sub-index 0X02 (P71.02)</td><td>Name</td><td>Data Type</td><td colspan="2">Access Properties</td><td>Setting method</td><td>Effective mode</td><td>Factory value</td></tr>
<tr><td rowspan="3">Output DO2 function</td><td>DINT32</td><td colspan="2">RW</td><td>Operation settings</td><td>Effective immediately</td><td>3</td></tr>
<tr><td>Data Range</td><td colspan="2">0~108</td><td>Can you map</td><td>Related Models</td><td>Protection level</td></tr>
<tr><td>Unit</td><td colspan="2">-</td><td>NO</td><td>ALL</td><td>1</td></tr>
<tr><td colspan="7">N0 is normally open logic, NC is normally closed logic<br>Same as 0x3070:01 parameter description.</td></tr>
</table>

| | |
|---|---|
| | 0: No DO function defined<br>1: Servo return to zero completed<br>2: Servo operation enable<br>3: Servo alarm<br>4: Position tracking overrun<br>5: Target location reached<br>6: Contracting brake output<br>7: Bus IO output<br>101: Servo return to zero completed<br>102: Servo operation enable<br>103: Servo alarm<br>104: Position tracking overrun<br>105: Target location reached<br>106: Contracting brake output<br>107: Bus IO output |

| | Name | Data Type | Access Properties | Setting method | Effective mode | Factory value |
|---|---|---|---|---|---|---|
| **Sub-index 0X03 (P71.03)** | Output DO3 function | DINT32 | RW | Operation settings | Effective immediately | 5 |
| | | Data Range | 0~108 | Can you map | Related Models | Protection level |
| | | Unit | - | NO | ALL | 1 |
| | N0 is normally open logic, NC is normally closed logic<br>Same as 0x3070:01 parameter description.<br>0: No DO function defined<br>1: Servo return to zero completed<br>2: Servo operation enable<br>3: Servo alarm<br>4: Position tracking overrun<br>5: Target location reached<br>6: Contracting brake output<br>7: Bus IO output<br>101: Servo return to zero completed<br>102: Servo operation enable<br>103: Servo alarm<br>104: Position tracking overrun<br>105: Target location reached<br>106: Contracting brake output<br>107: Bus IO output | | | | | |

| Sub-index 0X04 (P71.04) | Name | Data Type | Access Properties | Setting method | Effective mode | Factory value |
|---|---|---|---|---|---|---|
| | Output DO4 function | DINT32 | RW | Operation settings | Effective immediately | 6 |
| | | Data Range | 0~108 | Can you map | Related Models | Protection level |
| | | Unit | - | NO | ALL | 1 |
| | N0 is normally open logic, NC is normally closed logic<br>Same as 0x3070:01 parameter description, DO4 is configured to hold the brake normally open output by default<br>0: No DO function defined<br>1: Servo return to zero completed<br>2: Servo operation enable<br>3: Servo alarm<br>4: Position tracking overrun<br>5: Target location reached<br>6: Contracting brake output<br>7: Bus IO output<br>101: Servo return to zero completed<br>102: Servo operation enable<br>103: Servo alarm<br>104: Position tracking overrun<br>105: Target location reached<br>106: Contracting brake output<br>107: Bus IO output | | | | | |

| Sub-index 0X05 (P71.05) | Name | Data Type | Access Properties | Setting method | Effective mode | Factory value |
|---|---|---|---|---|---|---|
| | DO1 turn-on filtering time | DINT32 | RW | Operation settings | Effective immediately | 0 |
| | | Data Range | 0~500 | Can you map | Related Models | Protection level |
| | | Unit | ms | | ALL | 1 |
| | Setting of the signal turn-on filtering time at DO1 output. | | | | | |

| Sub-index 0X06 (P71.06) | Name | Data Type | Access Properties | Setting method | Effective mode | Factory value |
|---|---|---|---|---|---|---|
| | DO2 turn-on filtering time | DINT32 | RW | Operation settings | Effective immediately | 0 |
| | | Data Range | 0~500 | Can you map | Related Models | Protection level |
| | | Unit | ms | | ALL | 1 |
| | Setting of the signal turn-on filter time at DO2 output. | | | | | |

| Sub-index 0X07 (P71.07) | Name | Data Type | Access Properties | Setting method | Effective mode | Factory value |
|---|---|---|---|---|---|---|
| | DO3 turn-on | DINT32 | RW | Operatio | Effective | 0 |

| | | | | | | |
|---|---|---|---|---|---|---|
| | filtering time | | | Operation settings | Effective immediately | |
| | | Data Range | 0~500 | Can you map | Related Models | Protection level |
| | | Unit | ms | NO | ALL | 1 |
| | Setting of the signal turn-on filter time at DO3 output. | | | | | |

| **Sub-index 0X08 (P71.08)** | **Name** | **Data Type** | **Access Properties** | **Setting method** | **Effective mode** | **Factory value** |
|---|---|---|---|---|---|---|
| | DO4 turn-on filtering time | DINT32 | RW | Operation settings | Effective immediately | 0 |
| | | Data Range | 0~500 | Can you map | Related Models | Protection level |
| | | Unit | ms | NO | ALL | 1 |
| | Setting of the signal turn-on filtering time at DO4 output. | | | | | |

| **Sub-index 0X09 (P71.09)** | **Name** | **Data Type** | **Access Properties** | **Setting method** | **Effective mode** | **Factory value** |
|---|---|---|---|---|---|---|
| | DO1 shutdown filter time | DINT32 | RW | Operation settings | Effective immediately | 0 |
| | | Data Range | 0~500 | Can you map | Related Models | Protection level |
| | | Unit | ms | NO | ALL | 1 |
| | Setting of the signal shutdown filter time at the DO1 output. | | | | | |

| **Sub-index 0X0A (P71.0A)** | **Name** | **Data Type** | **Access Properties** | **Setting method** | **Effective mode** | **Factory value** |
|---|---|---|---|---|---|---|
| | DO2 shutdown filter time | DINT32 | RW | Operation settings | Effective immediately | 0 |
| | | Data Range | 0~500 | Can you map | Related Models | Protection level |
| | | Unit | ms | NO | ALL | 1 |
| | Setting of the signal shutdown filter time at the DO2 output. | | | | | |

| **Sub-index 0X0B (P71.0B)** | **Name** | **Data Type** | **Access Properties** | **Setting method** | **Effective mode** | **Factory value** |
|---|---|---|---|---|---|---|
| | DO3 shutdown filter time | DINT32 | RW | Operation settings | Effective immediately | 0 |
| | | Data Range | 0~500 | Can you map | Related Models | Protection level |
| | | Unit | ms | NO | ALL | 1 |
| | Setting of the signal shutdown filter time at the DO3 output. | | | | | |

| **Sub-index 0X0C (P71.0C)** | **Name** | **Data Type** | **Access Properties** | **Setting method** | **Effective mode** | **Factory value** |
|---|---|---|---|---|---|---|
| | DO4 shutdown filter time | DINT32 | RW | Operation settings | Effective immediately | 0 |
| | | Data Range | 0~500 | Can you map | Related Models | Protection level |
| | | Unit | ms | NO | ALL | 1 |
| | Setting of signal shutdown filtering time at DO4 output | | | | | |

| **Sub-index 0X0D (P71.0D)** | **Name** | **Data Type** | **Access Properties** | **Setting method** | **Effective mode** | **Factory value** |
|---|---|---|---|---|---|---|
| | Output Status | DINT32 | RW | Operatio | Effective | 0 |

| | | | | | | |
|---|---|---|---|---|---|---|
| | | | | n settings | immediately | |
| | | Data Range | 0~15 | Can you map | Related Models | Protection level |
| | | Unit | - | NO | ALL | 1 |
| | Displays the current output logic state of DO1-DO4, the value of the binary Bit0-Bit3 corresponds to the actual output state of D01-DO4 ports in turn.<br>Take DO1 terminal is low level and DO2~DO4 terminals are high level as an example: the corresponding binary code is "1110". | | | | | |

| **Sub-index 0X14 (P71.0E)** | **Name** | **Data Type** | **Access Properties** | **Setting method** | **Effective mode** | **Factory value** |
|---|---|---|---|---|---|---|
| | Forced output enable | DINT32 | RW | Operation settings | Effective immediately | 0 |
| | | Data Range | 0~1 | Can you map | Related Models | Protection level |
| | | Unit | - | NO | ALL | 1 |
| | The setting of this parameter allows the DO output terminal logic to be selected as the functional logic of the DO configuration, or the user can directly control the DO output logic via 0x3071:0F.<br>0: No, the DO output is controlled by the internal function logic set by 0x3070:01~0x3070:04.<br>1: Yes, the user controls the DO output logic directly via 0x3070:0F. | | | | | |

| **Sub-index 0X0F (P71.0F)** | **Name** | **Data Type** | **Access Properties** | **Setting method** | **Effective mode** | **Factory value** |
|---|---|---|---|---|---|---|
| | Forced output | DINT32 | RW | Operation settings | Effective immediately | 0 |
| | | Data Range | 0~15 | Can you map | Related Models | Protection level |
| | | Unit | - | NO | ALL | 1 |
| | When the 0x3071:0E parameter is set to 1, the user directly controls the DO output logic through this parameter. To control the actual output of D01-DO4 ports in order with this value binary Bit0-Bit3, taking DO1 terminal as low level and DO2~DO4 terminals as high level for example: corresponding to the binary code "1110"; | | | | | |

| **Index 0X3072 (P72)** | **Name** | **Data Type** | **Data Structure** | **Access Properties** | **Setting method** | **Effective mode** | **Factory value** |
|---|---|---|---|---|---|---|---|
| | Analog input parameters | - | ARR | - | - | - | - |
| | | Data Range | - | | Can you map | Related Models | Protection level |
| | | Unit | - | | - | - | - |
| | 0x3072:01~0x3072:06 and 0x3072:08~0x3072:0D set the bias, gain, filtering time, and limit of the two analog inputs, respectively.<br>The gain is a scaling factor, typically 100%<br>The appropriate adjustment of the filtering time can improve the anti-interference ability of the terminal input because the analog input through Ai1 and Ai2 terminals in the field application usually has a certain interference signal, but the longer the terminal filtering time, the longer the response delay of the terminal action.<br>Limiting is simply limiting the final processed signal of the analog input to a certain control need<br>Actual input = (analog input - bias) * gain<br>Bus analog input 1 is mapped to the bus 0x5000:0h, external input ±10V corresponds to the number internal digital -10000-10000; it can also be read via 0x3072:07.<br>Bus analog input 2 is mapped to 0x5000:02 of the bus, external input ±10V corresponds to the number internal digital -10000-10000; it can also be read via 0x3072:0E. | | | | | | |

| **Sub-index 0X01 (P72.01)** | **Name** | **Data Type** | **Access Properties** | **Setting method** | **Effective mode** | **Factory value** |
|---|---|---|---|---|---|---|
| | Ai1 Features | DINT32 | RW | Operatio | Downtim | 1 |

| | | | | | | |
|---|---|---|---|---|---|---|
| | | | | n settings | e effective | |
| | | Data Range | 0~4 | Can you map | Related Models | Protection level |
| | | Unit | - | NO | ALL | 1 |
| | Set the input function of the analog AiI:<br>0: No function defined<br>1: Target speed input<br>2: Target torque input<br>3: Bus analog input 1<br>4: Bus analog input 2 | | | | | |
| **Sub-index 0X02 (P72.02)** | **Name** | **Data Type** | **Access Properties** | **Setting method** | **Effective mode** | **Factory value** |
| | Ai1 bias | DINT32 | RW | Operation settings | Downtime effective | 0 |
| | | Data Range | -10000~10000 | Can you map | Related Models | Protection level |
| | | Unit | 0.001V | NO | ALL | 1 |
| | This parameter is used to set the value of the Ai1 bias, similar to the correction effect of the zero drift. | | | | | |
| **Sub-index 0X03 (P72.03)** | **Name** | **Data Type** | **Access Properties** | **Setting method** | **Effective mode** | **Factory value** |
| | Ai1 gain | DINT32 | RW | Operation settings | Downtime effective | 1000 |
| | | Data Range | 0~3000 | Can you map | Related Models | Protection level |
| | | Unit | 0.1% | NO | ALL | 1 |
| | This parameter is used to set the value of the Ai1 gain, which is normally 100%, e.g. 200% when the external voltage signal is 5V. | | | | | |
| **Sub-index 0X04 (P72.04)** | **Name** | **Data Type** | **Access Properties** | **Setting method** | **Effective mode** | **Factory value** |
| | Ai1 filtering | DINT32 | RW | Operation settings | Downtime effective | 0 |
| | | Data Range | 0~320 | Can you map | Related Models | Protection level |
| | | Unit | 0.1ms | NO | ALL | 1 |
| | This parameter is used to set the input filtering time of Ai1. The appropriate adjustment of the filtering time can improve the interference immunity of the terminal input, because the analog input through Ai1 in field applications usually has some interference signal, but the longer the terminal filtering time, the longer the response delay of the terminal action. | | | | | |

| | | | | | | |
|---|---|---|---|---|---|---|
| **Sub-index 0X05 (P72.05)** | **Name** | **Data Type** | **Access Properties** | **Setting method** | **Effective mode** | **Factory value** |
| | Ai1 cap | DINT32 | RW | Operation settings | Downtime effective | 1000 |
| | | Data Range | 0~10500 | Can you map | Related Models | Protection level |
| | | Unit | 0.001V | NO | ALL | 1 |
| | Sets the value of the Ai1 upper limit. | | | | | |
| **Sub-index** | **Name** | **Data** | **Access Properties** | **Setting** | **Effectiv** | **Factory** |

| 0X06 (P72.06) | | Type | | method | e mode | value |
|---|---|---|---|---|---|---|
| | Ai1 lower limit | DINT32 | RW | Operation settings | Downtime effective | -1000 |
| | | Data Range | -10500~0 | Can you map | Related Models | Protection level |
| | | Unit | 0.001V | NO | ALL | 1 |
| | Sets the value of the lower Ai1 limit. | | | | | |

| Sub-index 0X07 (P72.07) | Name | Data Type | Access Properties | Setting method | Effective mode | Factory value |
|---|---|---|---|---|---|---|
| | Analog input value 1 | DINT32 | RO | - | - | 0 |
| | | Data Range | -1050~1050 | Can you map | Related Models | Protection level |
| | | Unit | 0.01V | NO | ALL | 1 |
| | The input value of the analog input Ai1 port. | | | | | |

| Sub-index 0X08 (P72.08) | Name | Data Type | Access Properties | Setting method | Effective mode | Factory value |
|---|---|---|---|---|---|---|
| | Ai2 Features | DINT32 | RW | Operation settings | Downtime effective | 2 |
| | | Data Range | 0~4 | Can you map | Related Models | Protection level |
| | | Unit | - | NO | ALL | 1 |
| | 0: No function defined<br>1: Target speed input<br>2: Target torque input<br>3: Bus analog input 1<br>4: Bus analog input 2 | | | | | |

| Sub-index 0X09 (P72.09) | Name | Data Type | Access Properties | Setting method | Effective mode | Factory value |
|---|---|---|---|---|---|---|
| | Ai2 bias | DINT32 | RW | Operation settings | Downtime effective | 0 |
| | | Data Range | -10000~10000 | Can you map | Related Models | Protection level |
| | | Unit | 0.001V | NO | ALL | 1 |
| | Sets the value of Ai2 bias. | | | | | |

| Sub-index 0X0A (P72.0A) | Name | Data Type | Access Properties | Setting method | Effective mode | Factory value |
|---|---|---|---|---|---|---|
| | Ai2 gain | DINT32 | RW | Operation settings | Downtime effective | 1000 |
| | | Data Range | 0~3000 | Can you map | Related Models | Protection level |
| | | Unit | 0.1% | NO | ALL | 1 |
| | Set the value of Ai2 gain. | | | | | |

| Sub-index 0X0B (P72.0B) | Name | Data Type | Access Properties | Setting method | Effective mode | Factory value |
|---|---|---|---|---|---|---|
| | Ai2 filtering | DINT32 | RW | Operation settings | Downtime effective | 0 |
| | | Data Range | 0~320 | Can you map | Related Models | Protection level |
| | | Unit | 0.1ms | NO | ALL | 1 |
| | Set the value of Ai2 filtering. | | | | | |

| Sub-index 0X0C (P72.0C) | Name | Data Type | Access Properties | Setting method | Effective mode | Factory value |
|---|---|---|---|---|---|---|
| | Ai2 cap | DINT32 | RW | Operatio | Downtim | 1000 |

| | | | | | | |
|---|---|---|---|---|---|---|
| | | | | n settings | e effective | |
| | | Data Range | 0~10500 | Can you map | Related Models | Protection level |
| | | Unit | 0.001V | NO | ALL | 1 |
| | Set the value of Ai2 upper limit. | | | | | |
| **Sub-index 0X0D (P72.0D)** | **Name** | **Data Type** | **Access Properties** | **Setting method** | **Effective mode** | **Factory value** |
| | Ai2 lower limit | DINT32 | RW | Operation settings | Downtime effective | -1000 |
| | | Data Range | -10500~0 | Can you map | Related Models | Protection level |
| | | Unit | 0.001V | NO | ALL | 1 |
| | Sets the value of the lower limit of Ai2. | | | | | |
| **Sub-index 0X0E (P72.0E)** | **Name** | **Data Type** | **Access Properties** | **Setting method** | **Effective mode** | **Factory value** |
| | Analog input value2 | DINT32 | RO | - | - | 0 |
| | | Data Range | -1050~1050 | Can you map | Related Models | Protection level |
| | | Unit | 0.01V | NO | ALL | 1 |
| | The input value of the analog input Ai2 port. | | | | | |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| **Index 0X3073 (P73)** | **Name** | **Data Type** | **Data Structure** | **Access Properties** | **Setting method** | **Effective mode** | **Factory value** |
| | -Analog output parameters | - | ARR | - | - | - | - |
| | | Data Range | - | | Can you map | Related Models | Protection level |
| | | Unit | - | | - | - | - |
| | Set the analog output terminal 1 (AO1) output signal to monitor the internal operation variables or output bus analog variables. | | | | | | |

| | | | | | | |
|---|---|---|---|---|---|---|
| **Sub-index 0X01 (P73.01)** | **Name** | **Data Type** | **Access Properties** | **Setting method** | **Effective mode** | **Factory value** |
| | Ao1 Function | DINT32 | RW | Operation settings | Effective immediately | 0 |
| | | Data Range | 0~30 | Can you map | Related Models | Protection level |
| | | Unit | - | NO | ALL | 1 |
| | 0: No function defined<br>1: Retention 2: Position loop accumulation error<br>3: Encoder single-turn position<br>4: Encoder multi-turn position<br>5: Speed loop feed<br>6: Speed loop feedback<br>7: Speed loop out<br>8: Current loop Id given<br>9: Current loop Id feedback | | | | | |

| | |
|---|---|
| | 10: Current loop IdOut<br>11: Current loop Iq given<br>12: Current loop Iq feedback<br>13: Current loop IqOut<br>14: Output current Ia<br>15: Output current Ib<br>16: Output current Ic<br>17: Output voltage Ua<br>18: Output voltage Ub<br>19: Output voltage Uc<br>20: DC voltage VDC<br>21: Motor temperature Mth<br>22: Drive temperature Pth<br>23: Analog input Ai0<br>24: Analog input Ai1<br>25: Reference voltage 5V<br>26: Reference voltage-5V<br>27: Reference voltage 0V<br>28: Reference voltage 10V<br>29: Bus analog output 1<br>30: Bus analog output 2 |

| Sub-index 0X02 (P73.02) | Name | Data Type | Access Properties | Setting method | Effective mode | Factory value |
|---|---|---|---|---|---|---|
| | Ao1 bias | DINT32 | RW | Operation settings | Downtime effective | |
| | | Data Range | -10000~10000 | Can you map | Related Models | Protection level |
| | | Unit | 0.001V | NO | P | |
| | Set the actual output voltage value of AO1 after biasing when the theoretical output voltage is 0V. | | | | | |

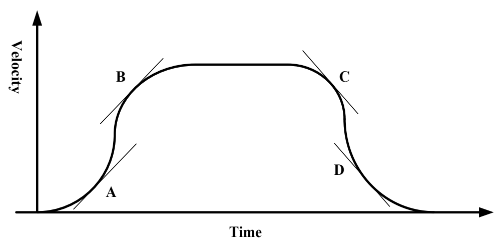
| Sub-index 0X03 (P73.03) | Name | Data Type | Access Properties | Setting method | Effective mode | Factory value |
|---|---|---|---|---|---|---|
| | Ao1 gain | DINT32 | RW | Operation settings | Downtime effective | 1000 |
| | | Data Range | 0~10000 | Can you map | Related Models | Protection level |
| | | Unit | 0.1% | NO | ALL | 1 |
| | | | | | | |

| Sub-index 0X04 (P73.04) | Name | Data Type | Access Properties | Setting method | Effective mode | Factory value |
|---|---|---|---|---|---|---|
| | Analog output value 1 | DINT32 | RW | - | - | 0 |
| | | Data Range | -1050~1050 | Can you map | Related Models | Protection level |
| | | Unit | 0.01V | NO | ALL | 1 |
| | The analog output value after bias and gain processing. | | | | | |

- P80 internal speed profile setting parameter group

| Index 0X3080 (P80) | Name | Data Type | Data Structure | Access Properties | Setting method | Effective mode | Factory value |
|---|---|---|---|---|---|---|---|
| | Speed planning parameters | - | ARR | - | - | - | - |
| | | Data Range | - | | Can you map | Related Models | Protection level |
| | | Unit | - | | - | - | - |

<table>
<tr><td></td><td colspan="6">This parameter group is used for velocity planning for velocity mode control or acceleration planning for torque mode when the channel is not controlled by the controller.</td></tr>
<tr><td rowspan="5">Sub-index 0X01 (P80.01)</td><td>Name</td><td>Data Type</td><td>Access Properties</td><td>Setting method</td><td>Effective mode</td><td>Factory value</td></tr>
<tr><td rowspan="3">Speed profile type</td><td>DINT32</td><td>RW</td><td>Operation settings</td><td>Effective immediately</td><td>2</td></tr>
<tr><td>Data Range</td><td>0~3</td><td>Can you map</td><td>Related Models</td><td>Protection level</td></tr>
<tr><td>Unit</td><td>-</td><td>NO</td><td>S</td><td>1</td></tr>
<tr><td colspan="6">0: Trapezoidal curve<br>1: sin2 curve (not supported at this time)<br>2: Jerk-free curve<br>3: Jerk-limited curve</td></tr>
</table>

<table>
<tr><td rowspan="5">Sub-index 0X02 (P80.02)</td><td>Name</td><td>Data Type</td><td>Access Properties</td><td>Setting method</td><td>Effective mode</td><td>Factory value</td></tr>
<tr><td rowspan="3">Acceleration</td><td>DINT32</td><td>RW</td><td>Operation settings</td><td>Effective immediately</td><td>20</td></tr>
<tr><td>Data Range</td><td>0~3000</td><td>Can you map</td><td>Related Models</td><td>Protection level</td></tr>
<tr><td>Unit</td><td>rpm/ms</td><td>NO</td><td>S</td><td>1</td></tr>
<tr><td colspan="6">The parameter gives the acceleration and deceleration of the speed profile</td></tr>
<tr><td rowspan="5">Sub-index 0X03 (P80.03)</td><td>Name</td><td>Data Type</td><td>Access Properties</td><td>Setting method</td><td>Effective mode</td><td>Factory value</td></tr>
<tr><td rowspan="3">Deceleration</td><td>DINT32</td><td>RW</td><td>Operation Settings</td><td>Effective immediately</td><td>20</td></tr>
<tr><td>Data Range</td><td>0~3000</td><td>Can you map</td><td>Related Models</td><td>Protection level</td></tr>
<tr><td>Unit</td><td>rpm/ms</td><td>NO</td><td>S</td><td>1</td></tr>
<tr><td colspan="6">This parameter gives the acceleration and deceleration of the velocity profile</td></tr>
<tr><td rowspan="5">Sub-index 0X04 (P80.04)</td><td>Name</td><td>Data Type</td><td>Access Properties</td><td>Setting method</td><td>Effective mode</td><td>Factory value</td></tr>
<tr><td rowspan="3">Accelerated rounded corners Jerk0</td><td>DINT32</td><td>RW</td><td>Operation Settings</td><td>Effective immediately</td><td>1000</td></tr>
<tr><td>Data Range</td><td>1~1000</td><td>Can you map</td><td>Related Models</td><td>Protection level</td></tr>
<tr><td>Unit</td><td>nT</td><td>NO</td><td>S</td><td>1</td></tr>
<tr><td colspan="6">This parameter is used to set the value of the acceleration rounding Jerk0.<br>The parameters 0x3080:04~0x3080:07 are used to set the profile of curve planning. The unit is nT, the velocity loop period, which indicates the time (in ms) for Jerk to accelerate from 0 to acceleration or deceleration. As shown in the figure: Jerk0 represents the A section, Jerk1 represents the B section, Jerk2 represents the C section, and Jerk3 represents the D section.<br><br></td></tr>
</table>

| | Name | Data Type | Access Properties | Setting method | Effective mode | Factory value |
|---|---|---|---|---|---|---|
| **Sub-index 0X05 (P80.05)** | Accelerated rounded corners Jerk1 | UDINT32 | RW | Operation settings | Effective immediately | 1000 |
| | | Data Range | 1~1000 | Can you map | Related Models | Protection level |
| | | Unit | nT | NO | S | 1 |
| | This parameter is used to set the value of the acceleration rounding Jerk1. | | | | | |

| | Name | Data Type | Access Properties | Setting method | Effective mode | Factory value |
|---|---|---|---|---|---|---|
| **Sub-index 0X06 (P80.06)** | Deceleration rounding Jerk2 | UDINT32 | RW | Operation settings | Effective immediately | 1000 |
| | | Data Range | 1~1000 | Can you map | Related Models | Protection level |
| | | Unit | nT | NO | S | 1 |
| | This parameter is used to set the value of the deceleration circle Jerk2. | | | | | |

| | Name | Data Type | Access Properties | Setting method | Effective mode | Factory value |
|---|---|---|---|---|---|---|
| **Sub-index 0X07 (P80.07)** | Deceleration rounding Jerk3 | DINT32 | RW | Operation settings | Effective immediately | 1000 |
| | | Data Range | 1~1000 | Can you map | Related Models | Protection level |
| | | Unit | nT | NO | S | 1 |
| | This parameter is used to set the value of the deceleration circle Jerk3. | | | | | |

- P81 internal position curve setting parameter group

| | Name | Data Type | Data Structure | Access Properties | Setting method | Effective mode | Factory value |
|---|---|---|---|---|---|---|---|
| **Index 0X3081 (P81)** | Location planning parameters | - | ARR | - | - | - | - |
| | | Data Range | - | | Can you map | Related Models | Protection level |
| | | Unit | - | | - | - | - |
| | This parameter group is used for position profile curve planning for position mode control when the non-controller controls the channel. | | | | | | |

| | Name | Data Type | Access Properties | Setting method | Effective mode | Factory value |
|---|---|---|---|---|---|---|
| **Sub-index 0X01 (P81.01)** | Uniform velocity | DINT32 | RW | Operation settings | Effective immediately | 100 |
| | | Data Range | 0~5000 | Can you map | Related Models | Protection level |
| | | Unit | rpm | NO | P | 1 |
| | This parameter is used for the uniform segment speed for a given position profile. | | | | | |

| | Name | Data Type | Access Properties | Setting method | Effective mode | Factory value |
|---|---|---|---|---|---|---|
| **Sub-index 0X02 (P81.02)** | Acceleration | DINT32 | RW | Operation settings | Effective immediately | 10 |
| | | Data Range | 0~1000 | Can you map | Related Models | Protection level |
| | | Unit | rpm/ms | NO | P | 1 |

| | | | | | | |
|---|---|---|---|---|---|---|
| | This parameter group is used for velocity planning for position mode control when the channel is not controlled by the controller. | | | | | |
| **Sub-index 0X03 (P81.03)** | **Name** | **Data Type** | **Access Properties** | **Setting method** | **Effective mode** | **Factory value** |
| | Deceleration | DINT32 | RW | Operation settings | Effective immediately | 10 |
| | | Data Range | 0~1000 | Can you map | Related Models | Protection level |
| | | Unit | rpm/ms | NO | P | 1 |
| | This parameter group is used for velocity planning for position mode control when the channel is not controlled by the controller. | | | | | |

- P82~P83 Zero return/emergency stop function parameter group

| **Index 0X3082 (P82)** | **Name** | **Data Type** | **Data Structure** | **Access Properties** | **Setting method** | **Effective mode** | **Factory value** |
|---|---|---|---|---|---|---|---|
| | Return to zero parameter | - | ARR | - | - | - | - |
| | | Data Range | - | | Can you map | Related Models | Protection level |
| | | Unit | - | | - | - | - |
| | | | | | | | |

| | | | | | | |
|---|---|---|---|---|---|---|
| **Sub-index 0X01 (P82.01)** | **Name** | **Data Type** | **Access Properties** | **Setting method** | **Effective mode** | **Factory value** |
| | Back to zero mode | DINT32 | RW | Operation settings | | 53 |
| | | Data Range | 0~53 | Can you map | Related Models | Protection level |
| | | Unit | - | NO | HM | 1 |
| | No function at the moment, please use CiA402 standard object setting (to be associated). | | | | | |
| **Sub-index 0X02 (P82.02)** | **Name** | **Data Type** | **Access Properties** | **Setting method** | **Effective mode** | **Factory value** |
| | Return to zero bias | DINT32 | RW | Operation settings | | 0 |
| | | Data Range | -2147483647~2147483647 | Can you map | Related Models | Protection level |
| | | Unit | inc | NO | | 1 |
| | No function for now, please use CiA402 standard object setting. | | | | | |
| **Sub-index 0X03 (P82.03)** | **Name** | **Data Type** | **Access Properties** | **Setting method** | **Effective mode** | **Factory value** |
| | Return to zero speed1 | DINT32 | RW | Operation settings | | 600 |
| | | Data Range | 0~3000 | Can you map | Related Models | Protection level |
| | | Unit | rpm/ms | NO | | 1 |
| | No function at the moment, please use CiA402 standard object setting (to be associated). | | | | | |
| **Sub-index 0X04** | **Name** | **Data Type** | **Access Properties** | **Setting method** | **Effective mode** | **Factory value** |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| (P82.04) | Return to zero speed 2 | DINT32 | RW | | Operation settings | Effective immediately | 300 |
| | | Data Range | 0~1000 | | Can you map | Related Models | Protection level |
| | | Unit | rpm/ms | | NO | | 1 |
| | No function now, please use CiA402 standard object setting (to be associated). | | | | | | |

| Index 0X3083 (P83) | Name | Data Type | Data Structure | Access Properties | Setting method | Effective mode | Factory value |
|---|---|---|---|---|---|---|---|
| | Emergency stop parameters | - | ARR | - | - | - | - |
| | | Data Range | - | | Can you map | Related Models | Protection level |
| | | Unit | - | | - | - | - |
| | | | | | | | |

| Sub-index 0X01 (P83.01) | Name | Data Type | Access Properties | Setting method | Effective mode | Factory value |
|---|---|---|---|---|---|---|
| | Emergency stop selection code | DINT32 | RW | Operation settings | Effective immediately | 1 |
| | | Data Range | -32~32 | Can you map | Related Models | Protection level |
| | | Unit | - | NO | | 1 |
| | Please set via 0x605A | | | | | |

| Sub-index 0X02 (P83.02) | Name | Data Type | Access Properties | Setting method | Effective mode | Factory value |
|---|---|---|---|---|---|---|
| | Emergency stop acceleration | DINT32 | RW | Operation settings | | 300 |
| | | Data Range | 0~3000 | Can you map | Related Models | Protection level |
| | | Unit | rpm/ms | NO | | 1 |
| | No function now, please use CiA402 standard object setting (to be associated). | | | | | |

- P90 control commissioning parameter group

| Index 0X3090 (P90) | Name | Data Type | Data Structure | Access Properties | Setting method | Effective mode | Factory value |
|---|---|---|---|---|---|---|---|
| | Control debugging | - | ARR | - | - | - | - |
| | | Data Range | - | | Can you map | Related Models | Protection level |
| | | Unit | - | | - | - | - |

| Sub-index 0X01 (P90.01) | Name | Data Type | Access Properties | Setting method | Effective mode | Factory value |
|---|---|---|---|---|---|---|
| | M control mode selection | DINT32 | RW | Operation settings | Downtime effective | 1 |
| | | Data Range | 0~2 | Can you map | Related Models | Protection level |
| | | Unit | - | NO | ALL | 1 |
| | This parameter is used to set the control operation mode of the Servo Drive when the command channel of the Servo Drive is selected as Panel Control, AD Commissioning Software Control, Analog 1, or Analog 2. This parameter is not valid under controller control.<br>0: Torque control mode<br>1: Speed control mode<br>2: Position control mode | | | | | |

| Sub-index 0X02 (P90.02) | Name | Data Type | Access Properties | Setting method | Effective mode | Factory value |
|---|---|---|---|---|---|---|
| | Reciprocating motion enables | DINT32 | RW | Operation settings | Effective immediately | 0 |
| | | Data Range | 0~1 | Can you map | Related Models | Protection level |
| | | Unit | - | NO | P/S | 1 |
| | This parameter is used for the setting of the reciprocating motion and is controlled in the panel control and AD commissioning software.<br>0: No<br>1: Yes | | | | | |

- P91 display parameter group

| Index 0X3091 (P91) | Name | Data Type | Data Structure | Access Properties | Setting method | Effective mode | Factory value |
|---|---|---|---|---|---|---|---|
| | Display Parameters | - | ARR | - | - | - | - |
| | | Data Range | - | | Can you map | Related Models | Protection level |
| | | Unit | - | | - | - | - |

| Sub-index 0X15 (P91.15) | Name | Data Type | Data Structure | Access Properties | Setting method | Effective mode |
|---|---|---|---|---|---|---|
| | Total power-up time | DINT32 | RO | Operation settings | - | 0 |
| | | Data Range | 0~2147483647 | Can you map | Related Models | Protection level |
| | | Unit | 0.1s | NO | ALL | 1 |
| | Total system power-up time, cumulative display. This function code is used to record the total time the servo drive has been running.<br>When multiple consecutive power-ups and power-downs occur in a short period of time for the drive, the total power-up time record may be off by a few minutes. | | | | | |

| Sub-index 0X16 (P91.16) | Name | Data Type | Access Properties | Setting method | Effective mode | Factory value |
|---|---|---|---|---|---|---|
| | Maximum load factor | DINT32 | RO | Operation settings | - | 0 |
| | | Data Range | 0~10 | Can you map | Related Models | Protection level |
| | | Unit | - | NO | ALL | 1 |
| | Reserved parameters, no function for now. | | | | | |

| Sub-index 0X17 (P91.17) | Name | Data Type | Access Properties | Setting method | Effective mode | Factory value |
|---|---|---|---|---|---|---|
| | Average load factor | DINT32 | RO | Operation settings | - | 0 |
| | | Data Range | 0~10 | Can you map | Related Models | Protection level |
| | | Unit | - | NO | ALL | 1 |
| | Reserved parameters, no function for now. | | | | | |

| Sub-index 0X18 (P91.18) | Name | Data Type | Access Properties | Setting method | Effective mode | Factory value |
|---|---|---|---|---|---|---|
| | Fault log selection | DINT32 | RW | Operation settings | Effective immediately | 0 |

| | | | | | | |
|---|---|---|---|---|---|---|
| | | Data Range | 0~9 | Can you map | Related Models | Protection level |
| | | Unit | - | NO | ALL | 1 |
| | Selecting in order to display the faults that occurred in the servo drive and the system power-up time when the faults occurred, a total of 10 records of the most recent faults can be recorded, where 0 is the most recent fault: | | | | | |
| **Sub-index 0X19 (P91.19)** | **Name** | **Data Type** | **Access Properties** | **Setting method** | **Effective mode** | **Factory value** |
| | Selected fault code | DINT32 | RO | Operation settings | - | 0 |
| | | Data Range | 0~65535 | Can you map | Related Models | Protection level |
| | | Unit | - | NO | ALL | 1 |
| | The fault code selected by 0x3091:18 is displayed. Note that the values displayed in the error code table are in hexadecimal. | | | | | |

| | | | | | | |
|---|---|---|---|---|---|---|
| **Sub-index 0X1A (P91.1A)** | **Name** | **Data Type** | **Access Properties** | **Setting method** | **Effective mode** | **Factory value** |
| | Fault occurrence time | DINT32 | RO | Operation settings | - | 1 |
| | | Data Range | 0~2147483647 | Can you map | Related Models | Protection level |
| | | Unit | 0.1s | NO | ALL | 1 |
| | Displays the system power-up time when the selected fault record occurred for 0x3091:18. | | | | | |
| **Sub-index 0X2A (P91.2A)** | **Name** | **Data Type** | **Access Properties** | **Setting method** | **Effective mode** | **Factory value** |
| | EtherCAT Communication Status | DINT32 | RO | Operation settings | - | 1 |
| | | Data Range | 0~8 | Can you map | Related Models | Protection level |
| | | Unit | - | NO | | 1 |
| | 1: INT communication initialization<br>2: PreOP<br>3: SafeOP, the controller can read the communication object of the servo driver TPDO normally<br>4: OP, this state can be normal operation communication state | | | | | |

- P0A drive information parameter group

| **Sub-index 0X11 (PA0.0B)** | **Name** | **Data Type** | **Access Properties** | **Setting method** | **Effective mode** | **Factory value** |
|---|---|---|---|---|---|---|
| | Software Version | DINT32 | RO | Operation settings | - | 2313 |
| | | Data Range | 0~2147483647 | Can you map | Related Models | Protection level |
| | | Unit | - | | - | 3 |
| | This parameter mainly shows the fixed parameters of the servo, which are usually set directly by the manufacturer and need not be set by the user. | | | | | |

# Section 9 Commissioning Software

- Software installation environment:

1) Support Windows 7 (32-bit/64-bit), 10 (32-bit/64-bit) operating system, Windows 10 (64-bit) operating system is recommended.
2) Microsoft .NET Framework 4.5 is required.

Note: In V0.9.4 and earlier debugging software versions, if the computer display resolution is 1080P or higher, you need to set "Change the size of text, application items" to 100% in the "Zoom and Layout" setting, otherwise the cursor display Otherwise, there will be errors when the cursor is displayed.

## 9.1 Software and Driver Installation

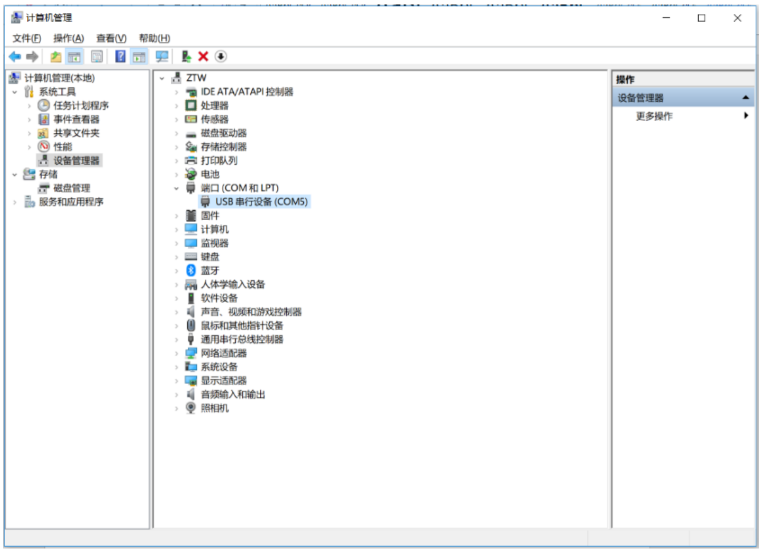
### 9.1.1 Driver Installation

1) Find the driver folder in the installation package USB驱动 Virtual COM Port Driver(V1.3.1)
2) Select the corresponding driver file according to the computer operating system, where x64 is the driver for 64-bit operating system.

VCP V1.3.1 Setup.exe

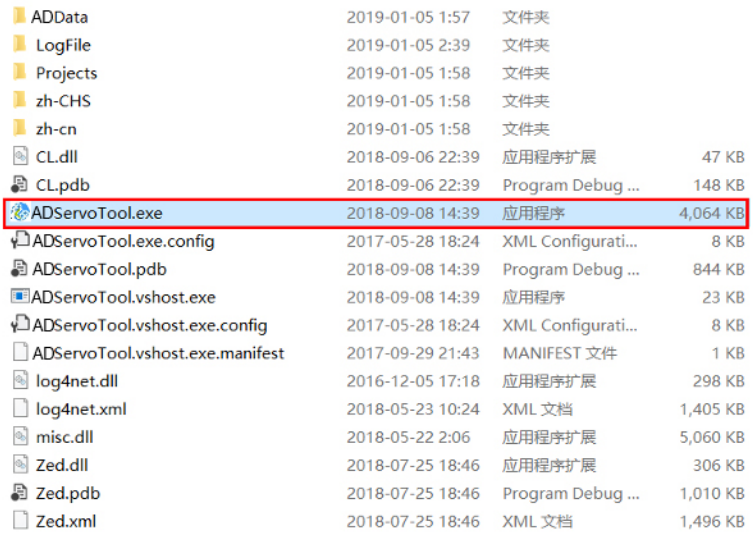
VCP V1.3.1 Setup x64.exe

3) Once the driver is successfully installed, connecting the servo drive will display the newly installed USB port in the computer device manager.



### 9.1.2 Commissioning software installation

AD-setup Servo Tool commissioning software is free of installation, unzip it and find the "AD-setup Servo Tool.EXE" file, double-click it to run.



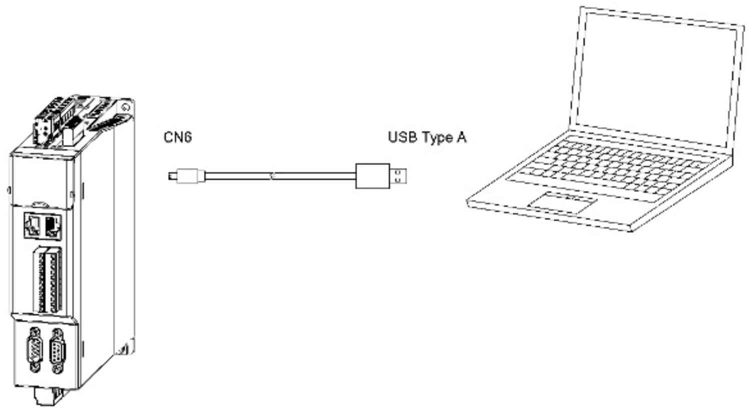
| | | | |
|---|---|---|---|
| ADData | 2019-01-05 1:57 | 文件夹 | |
| LogFile | 2019-01-05 2:39 | 文件夹 | |
| Projects | 2019-01-05 1:58 | 文件夹 | |
| zh-CHS | 2019-01-05 1:58 | 文件夹 | |
| zh-cn | 2019-01-05 1:58 | 文件夹 | |
| CL.dll | 2018-09-06 22:39 | 应用程序扩展 | 47 KB |
| CL.pdb | 2018-09-06 22:39 | Program Debug ... | 148 KB |
| ADServoTool.exe | 2018-09-08 14:39 | 应用程序 | 4,064 KB |
| ADServoTool.exe.config | 2017-05-28 18:24 | XML Configurati... | 8 KB |
| ADServoTool.pdb | 2018-09-08 14:39 | Program Debug ... | 844 KB |
| ADServoTool.vshost.exe | 2018-09-08 14:39 | 应用程序 | 23 KB |
| ADServoTool.vshost.exe.config | 2017-05-28 18:24 | XML Configurati... | 8 KB |
| ADServoTool.vshost.exe.manifest | 2017-09-29 21:43 | MANIFEST 文件 | 1 KB |
| log4net.dll | 2016-12-05 17:18 | 应用程序扩展 | 298 KB |
| log4net.xml | 2018-05-23 10:24 | XML 文档 | 1,405 KB |
| misc.dll | 2018-05-22 2:06 | 应用程序扩展 | 5,060 KB |
| Zed.dll | 2018-07-25 18:46 | 应用程序扩展 | 306 KB |
| Zed.pdb | 2018-07-25 18:46 | Program Debug ... | 1,010 KB |
| Zed.xml | 2018-07-25 18:46 | XML 文档 | 1,496 KB |

## 9.2 Connecting the drive

After the drive is powered on, use the Mini USB debug cable to connect the drive's CN6 interface to the computer with the AD Servo Tool software installed.

Note: Please use the standard debugging cable from AUCTECH, if you need to use the third-party cable, please ensure the shielding effect, and add the magnetic ring.

The length of the debugging cable should not exceed 3m, otherwise it may lead to unstable software connection, and please install magnetic ring and other anti-interference measures to ensure the quality of communication.




## 9.3 Commissioning software usage

### 9.3.1 Software interface introduction

1) Toolbar Introduction

| Icons | Name | Explanation |
|---|---|---|
|  | New Project | Create a new project |
|  | Open Project | Open a project that already exists |
|  | Save Project | Save current project |
|  | Connect | After the drive is powered on and connected with the debug cable, clicking the button will establish a communication connection with the drive, and the button will show green when communication is successfully established. |
|  | Login | When you are not logged in, you can observe only a limited amount of parameter information. If you click the Login button, you will login with the default password (normal privileges), and you can see most of the parameter information, or you can enter the advanced password to login (advanced privileges 58Ks), and you can edit the advanced user parameters at this time.<br>When you are not logged in, the icon is grayed out, so you cannot download parameters and perform servo debugging operations at this time.<br>After logging in, the icon is shown in green, and the operations corresponding to the login privileges can be performed at this time. |
|  | Enable | Enable button, if the current servo command mode is controller control, this button is only the enable status display, gray when not enabled, green when enabled. And when the drive command mode is AD debug software control, this icon is the function of enable button, click to realize the enable operation, and click again to realize the shutdown enable operation. |
| 2 | Nodes | Display/Set the servo node number. After the servo driver is successfully connected, if the servo node number saved in the project is not consistent with the actual node number, it will be displayed in red here, and the node number is consistent in green.<br>When the connection is successful, click on the node to set the node number (This operation may cause the communication between the host computer and the servo driver to be impossible. (For details, please refer to the chapter of parameter setting) |
|  | Fault display | When there is a fault, the current fault status and alarm information will be displayed and hidden when there is no fault. |

2) Menu bar tabs and corresponding ribbon introduction

| Menu bar tab | Function | Description |
|---|---|---|
| Parameter List | Save | Save the EEPROM. |
| | Upload | Uploads information about the parameters in the connection drive. |
| | Download | Download the parameters to the connected drive. |
| | Import | Import parameters from a file to the current project. |
| | Export | Export the parameters in the current project to a separate file. |
| | Quick Setup | Quickly set the drive and motor related parameters in the pop-up page. |
| | Three-lopp parameters | Quickly set the rigid or tri-loop gain of the current drive. |
| | Parameter Comparison | You can cross-reference and compare the data contents of "Interface value", "Default value", and "Servo value". |
| | Parameter Search | Quickly filter parameters by parameter group. |
| | Parameter Search | Parameter content can be retrieved based on keywords. |
| | Parameter Reset | Perform a parameter reset (restore factory values) operation on the connected drive. |

| Menu bar tab | Function | | Description |
|---|---|---|---|
| | Upload information | | When the parameter list in the driver is not consistent with the debug software, click Upload Information to synchronize the parameter list in the driver to the debug software (for example, after the driver firmware version is updated, the parameter list has N parameters, while the parameter list in the debug software only has X parameters. At this time, you need to upload information to synchronize the debug software parameter list to N and get the latest parameters and content). |
| Servo Control | Fault Reset | | When the drive fault alarm and the control mode is "AD commissioning software" control, it can be used to reset the fault after the fault is eliminated. |
| | Positive rotation | | When the control mode is "AD Commissioning Software", this button is used to set the forward motion command in the speed and torque control mode and to set the motion direction in the forward direction in the position control mode. |
| | Reversal | | When the control mode is "AD Commissioning Software", this button is used to set the reverse motion command in the speed and torque control mode and to set the direction of motion in the reverse direction in the position control mode. |
| | back and forth | | Only valid in position mode. When the control mode is "AD commissioning software" control and parameter P90.02 is set to "1: Yes", this button is used to turn on the position reciprocating operation. When switching to speed control or torque control, P90.02 must be set to "0", otherwise the speed and torque modes will not operate properly. |
| | Location Mode | Run button | When the control mode is "AD Commissioning Software" control and the operation mode is position mode, this button is used to give the relative position motion command. |
| | | Lap setting | When debugging the software servo control, set the distance of movement in position control mode, in unit turns. |
| | | Lap Slider | When debugging software servo control, the sliding method sets the movement distance in unit turns when the position control mode. |
| | | Speed Settings | When debugging the software servo control, set the motion speed in rpm for the position control mode. |
| | | Acceleration settings | When debugging software servo control, set the acceleration of motion in rpm/ms in position control mode. |
| | | Deceleration settings | When debugging the software servo control, set the motion deceleration in rpm/ms for the position control mode. |
| | Speed Mode | Speed Settings | When debugging the software servo control, set the running speed of the speed mode in percent (100% is equal to the rated speed). |
| | | Speed Slider | When debugging the software servo control, the sliding method sets the running speed of the speed mode, in percentage (100% equals to the rated speed). |
| | | Speed profile type | When debugging the software servo control, set the speed acceleration curve type. |
| | | Acceleration settings | When debugging the software servo control, set the acceleration of motion in rpm/ms for speed control mode. |

| Menu bar tab | Function | | Description |
|---|---|---|---|
| | | Deceleration settings | When debugging the software servo control, set the motion deceleration in rpm/ms for the speed control mode. |
| | Torque mode | Torque setting | When debugging the software servo control, set the target torque in percent (100% equals the rated torque) for the torque control mode. |
| | Torque mode | Speed limit setting | When debugging the software servo control, set the speed limit value during torque control mode (during torque control, the motor accelerates all the way to the set target torque, and the speed limit is used to limit the maximum speed at this point), unit: percentage (100% equals the rated torque). |
| | Torque mode | Torque Slider | When debugging the software servo control, the sliding method sets the target torque for the torque mode, in percentage (100% is equal to the rated torque. |
| | Self-learning | | Used for various types of self-learning functions when debugging software servo control. |
| Signal Sampling | Start sampling | | Start sampling the already configured data. |
| Signal Sampling | Stop sampling | | Stop the data being sampled. |
| Signal Sampling | Save data | | Save the sampled data to a file. |
| Signal Sampling | Number of channels | | Configure the number of data channels to be captured. |
| Signal Sampling | Sampling period | | The sampling period is generally proportional to the number of channels, the more channels, the larger the period. It is generally recommended to set it to "Number of channels + 1". |
| Signal Sampling | Sampling frequency | | Automatic calculation based on sampling period, no setup required. |
| Signal Sampling | Event Trigger | | Sampling is triggered according to the set conditions. |
| Signal Sampling | Sampling data | | To display the configured sample channels, you can click the "CH" button to the left of the sample channel to hide or display the sample channel data in the current curve. |
| Waveform Analysis | Loading Waveforms | | Load the waveform file. |
| Waveform Analysis | Frequency domain analysis | | Convert waveforms in the frequency and time domains. |
| Waveform Analysis | Reset bias | | Restores all bias settings to their initial values. |
| Waveform Analysis | Sampling data | | To display the sampling data in the waveform file, you can click the "CH" button on the left side of the sampling channel to hide or display the sampling channel data in the current curve. |
| Waveform Analysis | Data Gain | | The raw data channels can be scaled proportionally to the gain multiplier. |
| Waveform Analysis | Data Bias | | The set offset can be superimposed on the original data channel. |
| Fault Information | Fault Reset | | When the drive has a fault alarm, this button can reset the fault when the fault is eliminated. |
| Fault Information | Clear records | | Clears current and historical fault alarms from the project. |
| Fault Information | Current Failure | | Displays the current drive fault alarm. |
| Fault Information | History of failures | | Displays the history of faults in the project (history of faults cannot be saved after the project is closed). |

3) Actual state area

| Name | Description |
|---|---|
| Given position | Position loop given value in inc. |
| Actual Location | Encoder feedback actual position value in inc. |
| Given speed | Speed loop given value in rpm. |
| Actual speed | Encoder feedback actual speed value in rpm. |
| Given torque | Torque given value in Nm. |

| | |
|---|---|
| Actual torque | The actual torque value measured by the drive in Nm. |
| Probe 1 position | The actual encoder position value recorded when Probe 1 is triggered, in inc. |
| Probe 2 position | The actual encoder position value recorded when Probe 2 is triggered, in inc. |
| DI Status | The actual status feedback of DI1~DI5 digital input channels. |
| DO Status | The actual control status of DO1~DO4 digital output channels. |
| AI Status | AI1~AI2 Actual voltage feedback for analog input channels in V. |
| AO Status | AO analog output channel, the actual voltage value output in V. |
| Bus voltage | The actual voltage value on the DC bus in V. |
| Output Voltage | The actual voltage value of the servo driver output in V. |
| Output Current | The actual current value of the servo drive output in A. |
| Servo temperature | Servo drive internal temperature in °C. |
| Active power | The active power of the servo, in kW. |
| Operation Mode | The current operating mode of the Servo Drive (see Chapter 7, 6060 Servo Operating Mode Introduction section for details). |
| Control words | The current control word received by the servo drive (see Chapter 7, 6040 Control Word Introduction section for details). |
| Status word | The actual status word of the Servo Drive (see Chapter 7, 6041 Status Word Introduction section for details). |
| Status of the drive | Displays the actual status of the connected servo, including "ready", "main power on", "running", and "fault error ". |
| Drive firmware version number | Displays the firmware version number of the connected Servo Drive. |

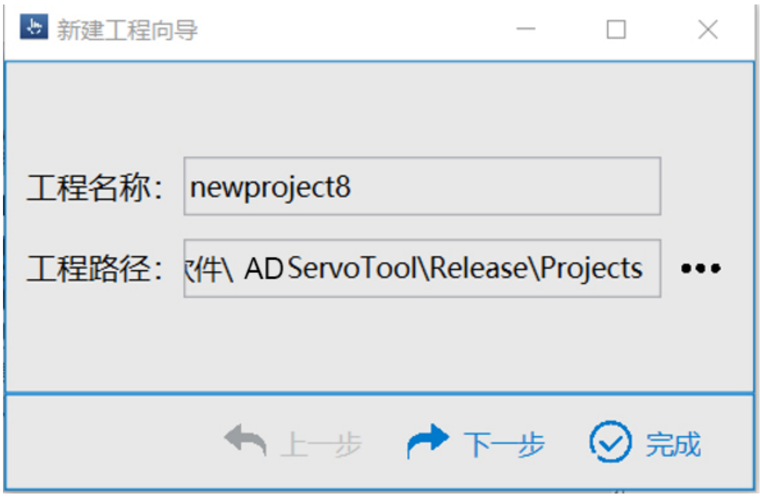
4) Operation area

| Menu tab | Operation area | Description |
|---|---|---|
| Parameter List | Parameter View Edit | View and edit all or filter parameters. |
| Servo Control | Signal sampling recording | Displays the currently performed signal sampling. |
| Signal Acquisition | | |
| Waveform Analysis | | |
| Failure Analysis | Fault logging, analysis, and processing | Displays records of current and historical faults, cause analysis and treatment countermeasures. |

## 9.3.2 Create a new project

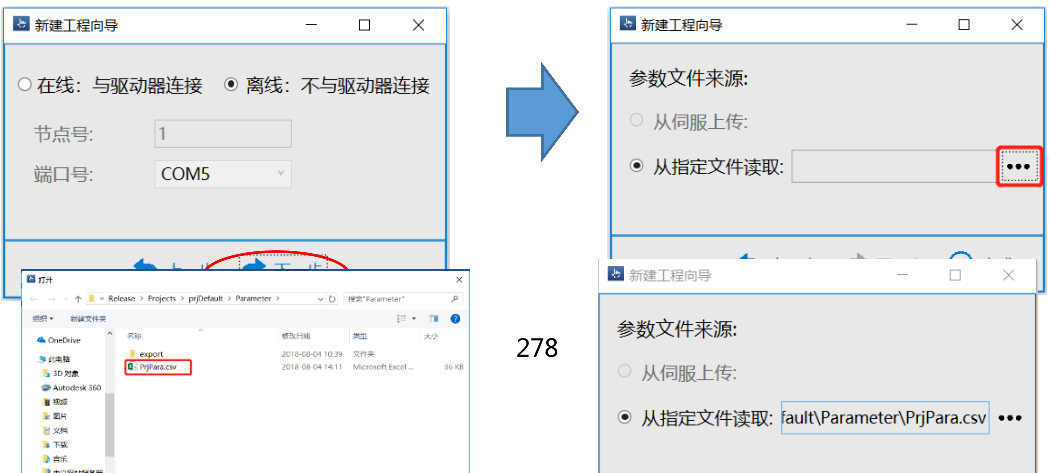
1) Run AD Servo Tool debugging software
2) Click the "New Project" button

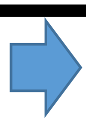

3) In the pop-up dialog box, enter the project name and save path, the default path is the installation directory \Projects.




- Create project offline

1) Choose to create the project offline or online. To create a project offline, you need to use a template file
2) The default path is the installation directory Projects\prjDefault\Parameter\PrjPara.csv

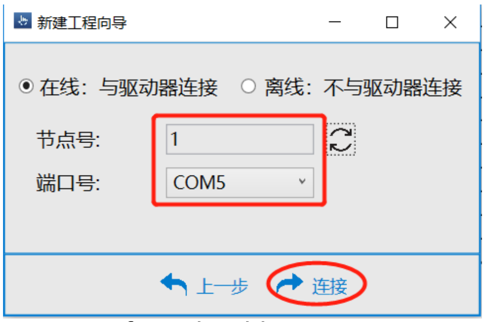




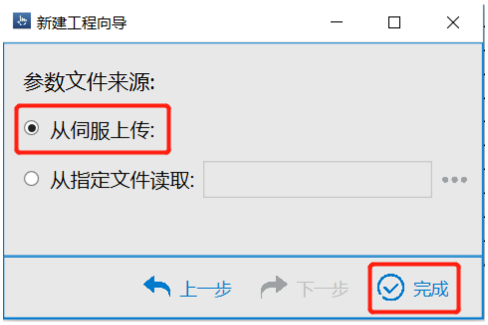
3) The offline creation project is completed.

- Online Project Creation

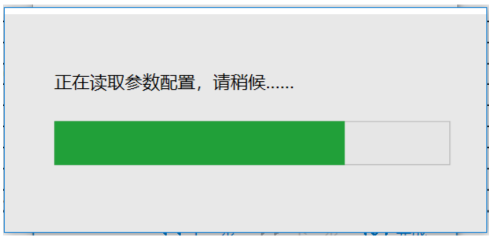
1) And in case the drive is successfully connected, you can use the online method to create a project, fill in the actual connected drive node number and select the port number of the USB driver.




2) Choose to upload parameters from the driver or use a template file (the online method is usually chosen to upload parameters).




3) After selecting Upload from Servo and clicking Finish, the software will read all parameters of the upload from the connected drive.




4) This completes the new project.

### 9.3.3 Quick Setup

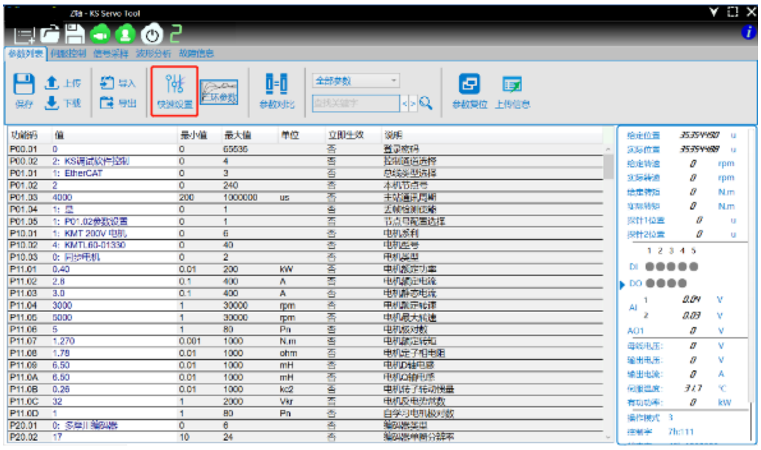
For users who are new to AD2 servo, the basic setup of a servo system can be done quickly and easily through the "Quick Setup".

For the following configuration, we will show you how to use "Quick Setup" to set up an AD2 servo system easily and quickly.

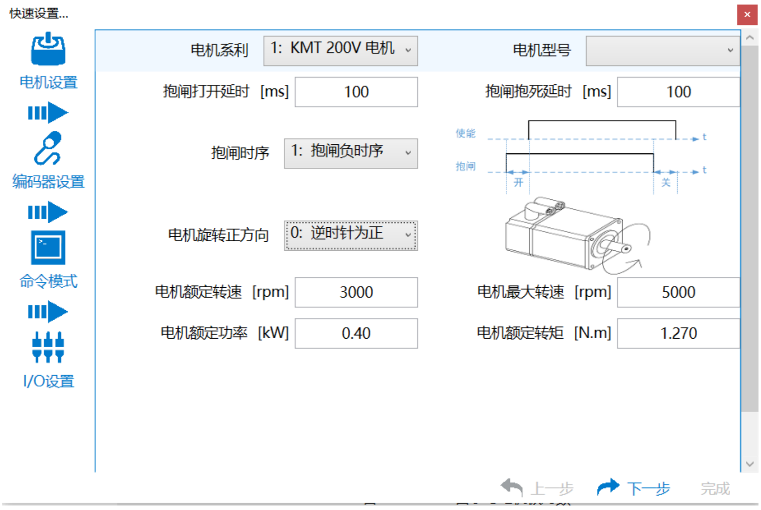
Note: Servo motors shipped by our company since March 1, 2019 (must be Tamagawa encoder type) have built-in electronic nameplate. Every time after restarting the drive power, the drive will automatically get the parameter information from the motor, so there is no need to manually select the motor type and encoder-related parameters, but for motors shipped before March 1, 2019, or non-Tamagawa encoder type servo motors, you still need to manually set the motor type and encoder and other related parameters.

| Example of project configuration | |
|---|---|
| **Projects** | **Description** |
| Servo Drives | AD2 Series |
| Servo Motor | ASK80-02430 |
| Encoder type | Tamagawa 23-bit multi-turn absolute value (single-turn 23-bit, multi-turn 16-bit) |
| Hold gate | There are |
| Emergency stop | Normally open signal |
| IO | All DIs are configured as bus IO (when bus IO is used, the servo DI status can be transmitted to the upper controller in real time via the bus) |

1) Open the software and in the ribbon of the "Parameter List" tab, select the "Quick Settings" button.



2) Make the relevant settings in the pop-up dialog box

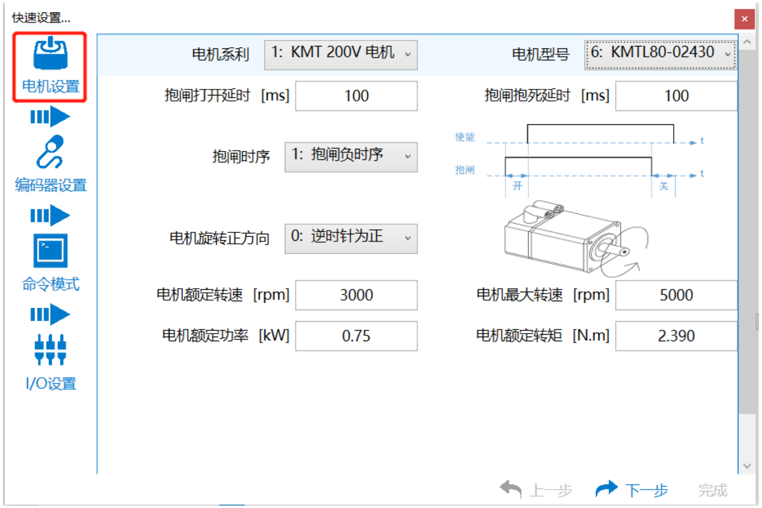



3) Quick Setup is divided into "Motor Setup", "Encoder Setup", "Command Mode", and "IO Setup". Four pages

电机设置

In the motor setting option, you can configure the motor series and model, as well as select the motor holding control timing and motor rotation direction, and other operations.

Motor rated speed, maximum speed, rated power, and rated torque are automatically presented according to the selected motor, no manual filling is required. electronic nameplate function is integrated in firmware versions after V11.3. By default, no configuration is required for AUCTECH brand servo motor parameters.



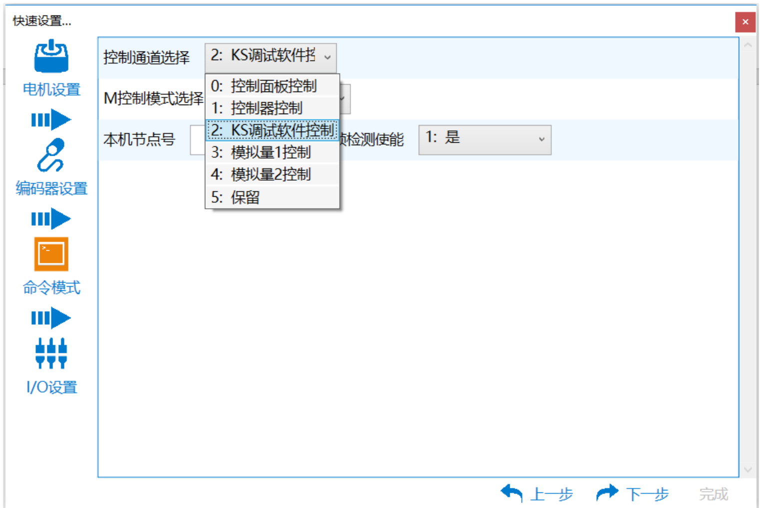
编码器设置

- The encoder settings option allows you to configure the encoder type and accuracy.


| Projects | Description |
|---|---|
| Encoder type | Tamagawa, Nikon, Panasonic, etc. Please determine the specific type according to the actual motor nameplate junction and selection information |
| Encoder faults enable | Used for absolute encoder related fault masking and display. When this enable is turned on, alarms such as encoder battery undervoltage, encoder battery disconnection, etc. related to the absolute value storage battery can be displayed, otherwise these alarms will be masked. |
| Encoder position angle | Zero self-study gained through encoder school. |
| Encoder single-turn resolution | Determined by the encoder type and model, which can be determined by the actual motor nameplate in combination with the selection data. For example, the Tamagawa 23-bit multiturn encoder refers to a single-turn resolution of 23 bits, i.e., $2^{23}$ pulse units. |
| Encoder multi-turn resolution | This is determined by the encoder type and model number, which can be determined by the actual motor nameplate in conjunction with the user manual. For example, the Tamagawa 23-bit multiturn encoder has a multiturn value of 16 bits, i.e., $2^{16}$, which is 65536 turns. |

命令模式

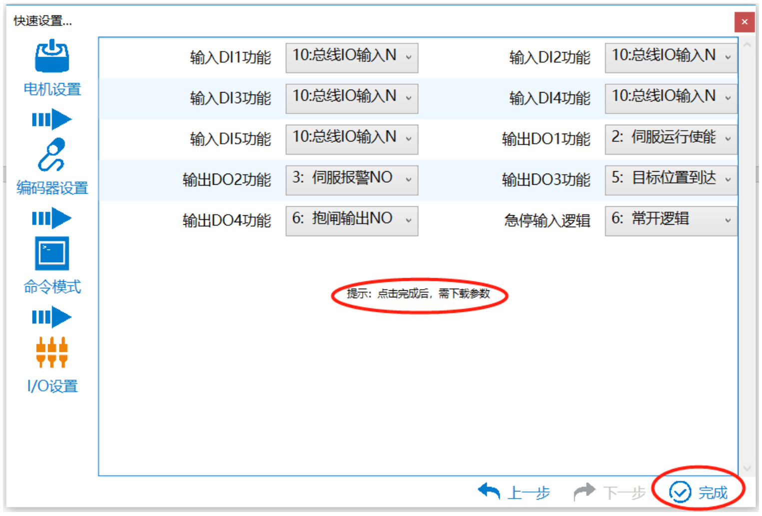
- In the command mode option, you can select the current control channel, as well as set the servo current node number, etc.




| Name | Details | Remarks |
|---|---|---|
| Control channel selection | 0: Control panel control<br>1: Controller control<br>2: AD commissioning software control<br>3: Analog 1 control<br>4: Analog 2 control<br>5: Retention | 0: Controlled using the LED operation panel.<br>1: Control with upper controller<br>2: Use debugging software for control<br>3: Use analog channel 1 for speed or torque control.<br>4: Use analog channel 2 for speed or torque control.<br>5: Retention |
| Local Node Number | To set the node number of the current driver, you need to combine the parameter "P01.05 node number configuration selection". When the parameter P01.05 is the bus configuration, this is not valid; when the parameter P01.05 is the local parameter setting, this is valid; | |
| Frame loss detection enable | Off by default. | |
| M mode selection | Invalid | |

I/O设置

- The IO setting option allows you to configure the DI, DO function and the emergency stop input logic.

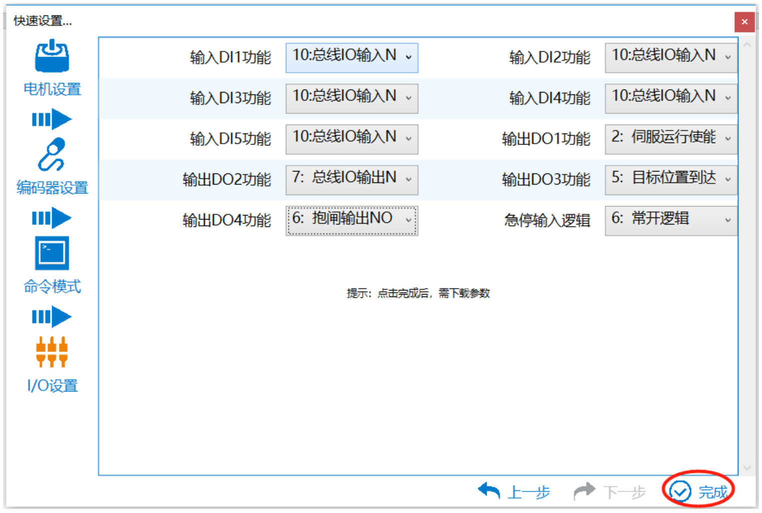



| DI input settings | | |
|---|---|---|
| **Serial number** | **Name** | **Remarks** |
| 1 | Servo START NO | Normally open signal, used for servo enable when the command channel uses analog control. Not valid under other control modes. |
| 2 | Positive motion is prohibited NO | Forward motion disables normally open signal, when the servo is in forward motion, triggering this signal will cause the servo to stop immediately, and a fault alarm E86.13 will appear. |
| 3 | Reverse motion is prohibited NO | Reverse motion disables normally open signal, when the servo is in reverse motion, triggering this signal will cause the servo to stop immediately and a fault alarm E86.14 will appear. |
| 9 | Zero return proximity switch NO | Return to zero proximity switch normally open signal, when using the servo internal return to zero function, this signal is used as the return to zero proximity switch signal. (If you use the upper computer to return to zero, there is no need to configure to this function, just use the bus IO). |
| 10 | Bus IO input NO | Bus IO input, normally open signal. The status of this digital input channel is transmitted to the upper controller via the bus. the DI channel corresponds to the PDO object address as follows:<br>DI channel: Bus Address<br>DI1: 60FD.20<br>DI2: 60FD.21<br>DI3: 60FD.22<br>DI4: 60FD.23<br>DI5: 60FD.24 |
| 11 | Probe 1 NO | Probe 1 normally open signal, note that probe 1 can only be configured for DI1 channel (probe that is high-speed position latching function), it can latch the motor position information when the external DI signal or motor Z believe signal is changed. |
| 12 | Probe 2NO | Probe 2 normally open signal, note that probe 2 can only be configured for DI2 channel (probe that is high-speed position latching function), it can latch the motor position information when the external DI signal or motor Z believe signal is changed. |
| 101~112 | 1, 101; 2, 102; 3, 103; 4, 104; 5, 105; 9, 109; 10, 110; 11, 111; 12, 112; the interpretation is the same as above, except that the signal logic is reversed and is normally closed. | |

| DO Output Function | | |
|---|---|---|
| **Serial number** | **Name** | **Remarks** |
| 1 | Servo return to | Servo zero return completion signal, active high. When the servo |

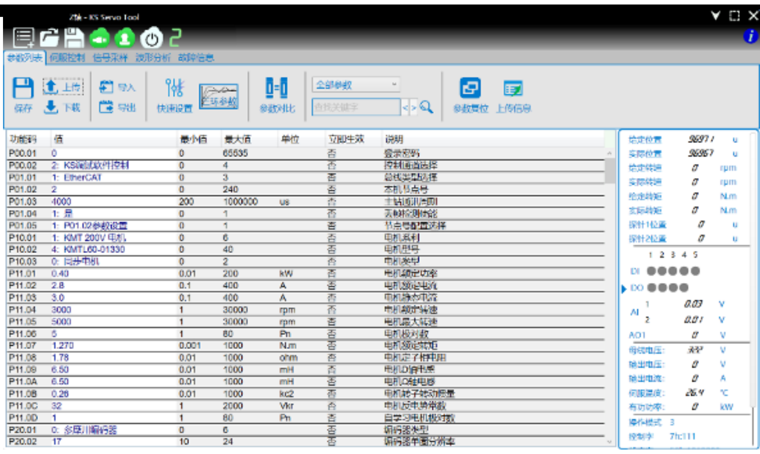
<table>
<tr><td></td><td>zero completed NO</td><td>internal zero return function is used and zero return is completed, this signal is valid. This signal is cleared when the zero-return operation is restarted.</td></tr>
<tr><td>2</td><td>Servo operation enable NO</td><td>Servo run enable signal, active high. This signal is output when the servo drive is enabled. When the enable is turned off, this signal is cleared to zero.</td></tr>
<tr><td>3</td><td>Servo alarm NO</td><td>Servo alarm output, valid at high level. This signal is output when an alarm occurs in the servo. After the alarm is reset, this signal is cleared to zero.</td></tr>
<tr><td>4</td><td>Position tracking overrun NO</td><td>Position tracking over-limit alarm, valid at high level. This signal is output when the servo occurs position tracking error exceeds the limit value. After resetting the alarm, this signal is cleared to zero.</td></tr>
<tr><td>5</td><td>Target location reached NO</td><td>Target position arrival output, active high. This signal is output when the positioning is completed, and the target position is reached. When starting a new movement, the change signal is cleared to zero.</td></tr>
<tr><td>6</td><td>Gate output NO</td><td>The brake output signal is active at high level. When enabled, the signal is output after delaying the set time according to the set holding timing. When shutdown is enabled, this signal is cleared according to the set holding timing.</td></tr>
<tr><td>7</td><td>Bus IO output NO</td><td>The DO channel can be switched on and off by the upper controller when configured for this function:<table><tr><td>DO Channel</td><td>Bus Address</td></tr><tr><td>DO1</td><td>60FE_01.16</td></tr><tr><td>DO2</td><td>60FE_01.17</td></tr><tr><td>DO3</td><td>60FE_01.18</td></tr><tr><td>DO4</td><td>60FE_01.19</td></tr></table>Note: 60FE_01 that is index 60FE sub-index 01; when using the upper control, 60FE sub-index 02, needs to be configured as 16#FFFFFFFF.</td></tr>
<tr><td>101~107</td><td colspan="2">1,101; 2,102; 3,103; 4,104; 5,105; 6,106; 7,107. The interpretation is the same as above, except that the logic is inverted, and the output is active low.</td></tr>
</table>

- After completing the IO settings, click the Finish button to complete the quick setup operation.




Note: After completing the quick setup, you need to save and download the parameters to take effect.

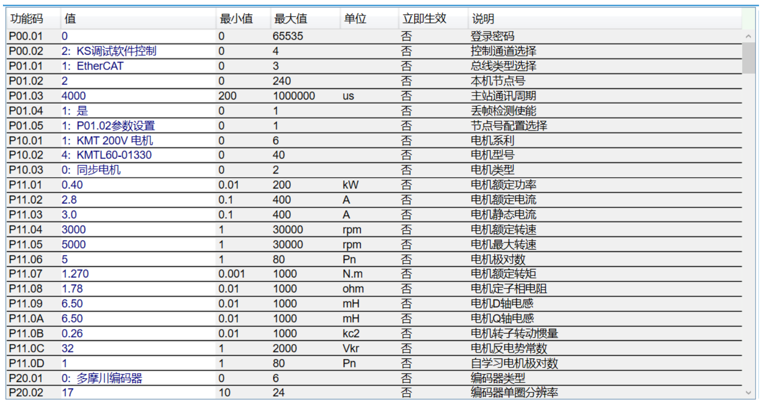
## 9.3.4 Configuration parameters



1) Introduction to the function area buttons

| Menu bar tab | Function | Description |
|---|---|---|
| Parameter List | Save | Save the EEPROM. |
| | Upload | Uploads information about the parameters in the connection drive. |
| | Download | Download the parameters to the connected drive. |
| | Import | Import parameters from a file to the current project. |
| | Export | Export the parameters in the current project to a separate file. |
| | Quick Setup | Quickly set to drive and motor related parameters. |
| | Three-loop parameters | Quickly set the rigid or tri-loop gain of the current drive. |
| | Parameter Comparison | You can cross-reference and compare the data contents of "Interface value", "Default value", and "Servo value". |
| | Parameter Search | Quickly filter parameters by parameter group. |
| | Parameter Search | Parameter content can be retrieved based on keywords. |
| | Parameter Reset | Perform a parameter reset (restore factory values) operation on the connected drive. |
| | Upload information | When the parameter list in the driver is not consistent with the debug software, click Upload Information to synchronize the parameter list in the driver to the debug software (for example, after the driver firmware version is updated, the parameter list has N parameters, while the parameter list in the debug software only has X parameters. At this time, you need to upload information to synchronize the debug software parameter list to N and get the latest parameters and content). |

2) All parameters



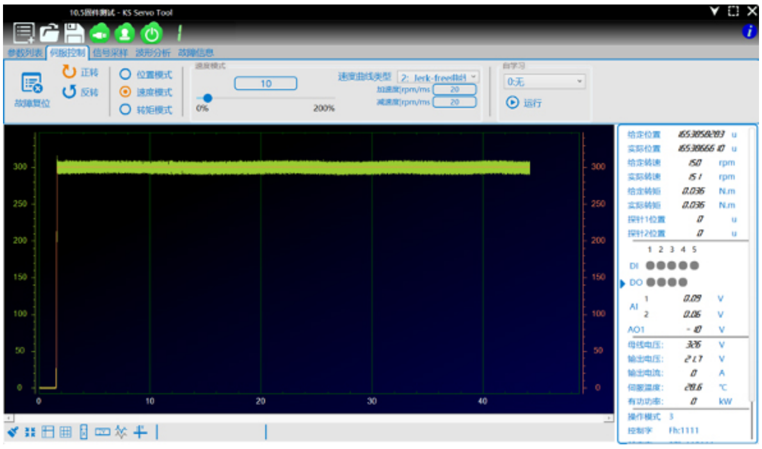
| 功能码 | 值 | 最小值 | 最大值 | 单位 | 立即生效 | 说明 |
|---|---|---|---|---|---|---|
| P00.01 | 0 | 0 | 65535 | | 否 | 登录密码 |
| P00.02 | 2: KS调试软件控制 | 0 | 4 | | 否 | 控制通道选择 |
| P01.01 | 1: EtherCAT | 0 | 3 | | 否 | 总线类型选择 |
| P01.02 | 2 | 0 | 240 | | 否 | 本机节点号 |
| P01.03 | 4000 | 200 | 1000000 | us | 否 | 主站通讯周期 |
| P01.04 | 1: 是 | 0 | 1 | | 否 | 丢帧检测使能 |
| P01.05 | 1: P01.02参数设置 | 0 | 1 | | 否 | 节点号配置选择 |
| P10.01 | 1: KMT 200V 电机 | 0 | 6 | | 否 | 电机系列 |
| P10.02 | 4: KMTL60-01330 | 0 | 40 | | 否 | 电机型号 |
| P10.03 | 0: 同步电机 | 0 | 2 | | 否 | 电机类型 |
| P11.01 | 0.40 | 0.01 | 200 | kW | 否 | 电机额定功率 |
| P11.02 | 2.8 | 0.1 | 400 | A | 否 | 电机额定电流 |
| P11.03 | 3.0 | 0.1 | 400 | A | 否 | 电机静态电流 |
| P11.04 | 3000 | 1 | 30000 | rpm | 否 | 电机额定转速 |
| P11.05 | 5000 | 1 | 30000 | rpm | 否 | 电机最大转速 |
| P11.06 | 5 | 1 | 80 | Pn | 否 | 电机极对数 |
| P11.07 | 1.270 | 0.001 | 1000 | N.m | 否 | 电机额定转矩 |
| P11.08 | 1.78 | 0.01 | 1000 | ohm | 否 | 电机定子相电阻 |
| P11.09 | 6.50 | 0.01 | 1000 | mH | 否 | 电机D轴电感 |
| P11.0A | 6.50 | 0.01 | 1000 | mH | 否 | 电机Q轴电感 |
| P11.0B | 0.26 | 0.01 | 1000 | kc2 | 否 | 电机转子转动惯量 |
| P11.0C | 32 | 1 | 2000 | Vkr | 否 | 电机反电势常数 |
| P11.0D | 1 | 1 | 80 | Pn | 否 | 自学习电机极对数 |
| P20.01 | 0: 多摩川编码器 | 0 | 6 | | 否 | 编码器类型 |
| P20.02 | 17 | 10 | 24 | | 否 | 编码器单圈分辨率 |

- For viewing and editing any parameter, you can operate in all parameters. When placing the mouse over the operation area, you can use the mouse wheel or drag the scroll bar on the right to page through the parameters.

- The set value of the parameter needs to be between the minimum and maximum value of the corresponding parameter, otherwise the input is invalid.
- Effective immediately is No, which means that the parameter cannot take effect immediately after modification and download and needs to be broken to enable processing. Effective immediately is Yes, which means the parameter modification will take effect immediately after downloading.

Note: Motor stator phase resistance and D-axis inductance, both phase to phase values. Most motor manuals express them as interlinear values, so when using third-party motors, you need to fill in the interphase value here (interphase value = interlinear value / 2).

# 9.4 Commissioning software servo control



## 9.4.1 Functional Area Introduction

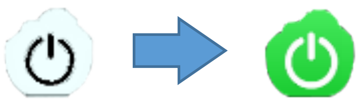
| Menu bar tab | Function | | Description |
|---|---|---|---|
| Servo Control | Fault Reset | | When the drive fault alarm and the control mode is "KS commissioning software" control, it can be used to reset the fault after the fault is eliminated. |
| | Positive rotation | | When the control mode is "AD Commissioning Software", this button is used to set the forward motion command in the speed and torque control mode and to set the motion direction in the forward direction in the position control mode. |
| | Reversal rotation | | When the control mode is "AD Commissioning Software", this button is used to set the reverse motion command in the speed and torque control mode and to set the direction of motion in the reverse direction in the position control mode. |
| | back and forth | | Only valid in position mode. When the control mode is "AD commissioning software" control and parameter P90.02 is set to "1: Yes", this button is used to turn on the position reciprocating operation. When switching to speed control or torque control, P90.02 must be set to "0", otherwise the speed and torque modes will not operate properly. |
| | Location Mode | Run button | When the control mode is "AD Commissioning Software" control and the operation mode is position mode, this button is used to give the relative position motion command. |
| | | Lap setting | When debugging the software servo control, set the distance of movement in position control mode, in unit turns. |
| | | Lap Slider | When debugging software servo control, the sliding method sets the movement distance in unit turns when the position control mode. |
| | | Speed Settings | When debugging the software servo control, set the motion speed in rpm for the position control mode. |
| | | Acceleration settings | When debugging software servo control, set the acceleration of motion in rpm/ms in position control mode. |
| | | Deceleration settings | When debugging the software servo control, set the motion deceleration in rpm/ms for the position control |

| Menu bar tab | Function | | Description |
|---|---|---|---|
| | | | mode. |
| | Speed Mode | Speed Settings | When debugging the software servo control, set the running speed of the speed mode in percent (100% is equal to the rated speed). |
| | | Speed Slider | When debugging the software servo control, the sliding method sets the running speed of the speed mode, in percentage (100% equals to the rated speed). |
| | | Speed profile type | When debugging the software servo control, set the speed acceleration curve type. |
| | | Acceleration settings | When debugging the software servo control, set the acceleration of motion in rpm/ms for speed control mode. |
| | | Deceleration settings | When debugging the software servo control, set the motion deceleration in rpm/ms for the speed control mode. |
| | Torque mode | Torque setting | When debugging the software servo control, set the target torque in percent (100% equals the rated torque) for the torque control mode. |
| | | Speed limit setting | When debugging the software servo control, set the speed limit value during torque control mode (during torque control, the motor accelerates all the way to the set target torque, and the speed limit is used to limit the maximum speed at this point), unit: percentage (100% equals the rated torque). |
| | | Torque Slider | When debugging the software servo control, the sliding method sets the target torque for the torque mode, in percentage (100% is equal to the rated torque. |
| | Self-learning | | Used for various types of self-learning functions when debugging software servo control. |

**Note**: Servo control is only effective when the command channel is selected as "AD debug software control".

- Position mode control


- For position mode control, you need to use the enable button in the interface toolbar to enable the servo first.



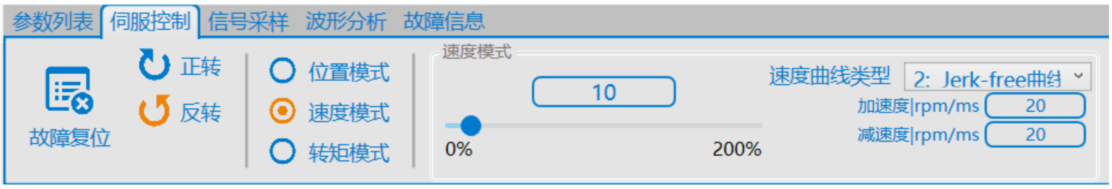
| Buttons | Description |
|---|---|
| Fault Reset | When the drive fault alarm and the control mode is "AD commissioning software" control, it can be used to reset the fault after the fault is eliminated. |
| Positive rotation | When the control mode is "AD Commissioning Software" control, this button is used to set the direction of motion to positive in the position control mode. |

| Buttons | Description |
|---|---|
| Reversal rotation | When the control mode is "AD Commissioning Software" control, this button is used to set the direction of motion to reverse in the position control mode. |
| back and forth | Only valid in position mode. When the control mode is "AD commissioning software" control and parameter P90.02 is set to "1: Yes", this button is used to turn on the position reciprocating operation. When switching to speed control or torque control, P90.02 must be set to "0", otherwise the speed and torque modes will not operate properly. |
| Run button | When the control mode is "AD Commissioning Software" control and the operation mode is position mode, this button is used to give the relative position motion command. |
| Lap setting | When debugging the software servo control, set the distance of movement in position control mode, in unit turns. |
| Lap Slider | When debugging software servo control, the sliding method sets the movement distance in unit turns when the position control mode. |
| Speed Settings | When debugging the software servo control, set the motion speed in rpm for the position control mode. |
| Acceleration settings | When debugging software servo control, set the acceleration of motion in rpm/ms in position control mode. |
| Deceleration settings | When debugging the software servo control, set the motion deceleration in rpm/ms for the position control mode. |

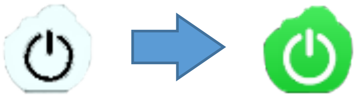
- General operating procedure for position control:
  1) Set the reciprocating motion mode, if necessary, set parameter P90.02 reciprocating motion mode.
  2) Set the position movement distance, speed, acceleration, and deceleration.
  3) Set the direction of movement.
  4) Click the "Run" button, and the servo will stop automatically after running the set motion distance.

| ⚠ Caution |
|---|
| 0.9.3 and previous software versions are unable to terminate the positioning movement after the position mode positioning has started. Unless a break enable operation is performed, which is not suitable for some loads with particularly high inertia, and the servo will be in a coasting stop or dragged by the load. Therefore, when using the positioning mode, please make sure to operate with caution and ensure the safety of personal equipment. |

### 9.4.3 Speed mode control




For speed mode control, first use the Enable button on the interface toolbar to enable the servo.



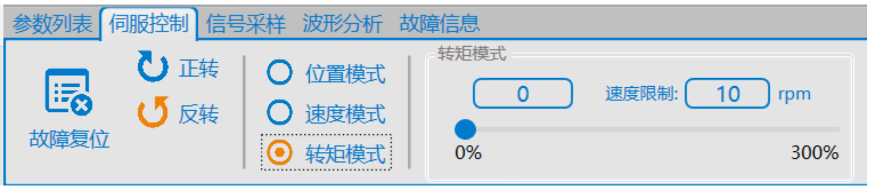
| Buttons | Description |
|---|---|
| Fault Reset | When the drive fault alarm and the control mode is "AD commissioning software" control, it can be used to reset the fault after the fault is eliminated. |
| Positive rotation | When the control mode is "AD Commissioning Software" control, this button is used to give the forward motion command in the speed control mode. |
| Reversal rotation | When the control mode is "AD Commissioning Software" control, this button is used to give the reverse motion command in the speed control mode. |
| Speed Settings | When debugging the software servo control, set the running speed of the speed mode in percent (100% is equal to the rated speed). |
| Speed Slider | When debugging the software servo control, the sliding method sets the running speed of the speed mode, in percentage (100% equals to the rated speed). |
| Speed profile type | When debugging the software servo control, set the speed acceleration curve type. |
| Acceleration settings | When debugging the software servo control, set the acceleration of motion in rpm/ms for speed control mode. |
| Deceleration settings | When debugging the software servo control, set the motion deceleration in rpm/ms for the speed control mode. |

- General operating procedure for speed control:

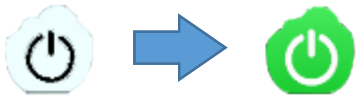
1) Set the speed profile type.
2) Set the speed, acceleration, and deceleration values.
3) Click the motion direction button to make the motor start running in the selected direction and at the set speed.
4) Click the motion direction button again to stop the motor movement; or set the running speed to "0" and then click the motion direction button again to terminate the motor movement.

| **Caution** |
|---|
| When commissioning the servo, it is necessary to do a good job of emergency stop protection, mechanical protection, and other measures to ensure maximum personal safety of the equipment during servo enablement and operation. To avoid misoperation such as on-site interference signals, all operating parameters should be reset after the servo trial run to prevent accidental start-up and other situations. |

## 9.4.4 Torque control mode




For torque mode control, first use the Enable button on the interface toolbar to enable the servo.

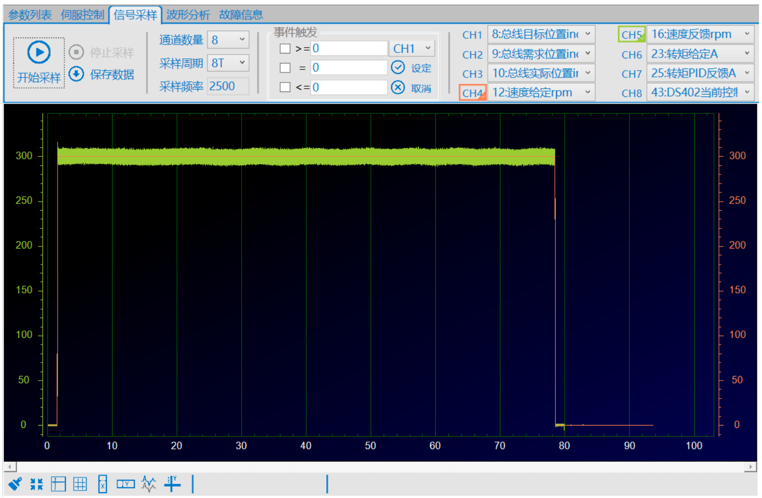


| Buttons | Description |
|---|---|
| Fault Reset | When the drive fault alarm and the control mode is "AD commissioning software" control, it can be used to reset the fault after the fault is eliminated. |
| Positive rotation | When the control mode is "AD Commissioning Software" control, this button is used to give the forward motion command in the torque control mode. |
| Reversal rotation | When the control mode is "AD Commissioning Software" control, this button is used to give the reverse motion command in the torque control mode. |
| Torque setting | When debugging the software servo control, set the target torque in percent (100% equals the rated torque) for the torque control mode. |
| Speed limit setting | When debugging the software servo control, set the speed limit value during torque control mode (during torque control, the motor accelerates all the way to the set target torque, and the speed limit is used to limit the maximum speed at this point), unit: percentage (100% equals the rated torque). |
| Torque Slider | When debugging the software servo control, the sliding method sets the target torque for the torque mode, in percentage (100% is equal to the rated torque. |

- General operating procedure for speed control:
  1) Set the target torque and speed limit value (for safety reasons, the speed limit value should be as low as possible during commissioning).
  2) Click the motion direction button to make the motor start running in the selected direction with the set torque and speed limit.
  3) Click the motion direction button again to stop the motor motion; or set the running torque and speed limit to "0" and then click the motion direction button again to terminate the motor motion.

| ⚠ **Caution** |
|---|
| When commissioning the servo, it is necessary to do a good job of emergency stop protection, mechanical protection, and other measures to ensure maximum personal safety of the equipment during servo enablement and operation. To avoid misoperation such as on-site interference signals, all operating parameters should be reset after the servo trial run to prevent accidental start-up and other situations.<br>When the actual motor torque is less than the given torque, the servo will accelerate to the current set speed limit value. And when the actual torque is greater than or equal to the set torque, the servo will keep outputting according to the given torque. If you want to stop the motion, you can cancel the motion direction or set the given torque or speed limit to 0 to stop the motion. Therefore, please consider the torque target value and speed limit value with the machine condition. |

# 9.5 Waveform acquisition and analysis




| Menu bar tab | Function | Description |
|---|---|---|
| Signal Sampling | Start sampling | Start sampling the already configured data. |
| | Stop sampling | Stop the data being sampled. |
| | Save data | Save the sampled data to a file. |
| | Number of channels | Configure the number of data channels to be acquired. |
| | Sampling period | 1T=50μs sampling period is proportional to the number of channels, the more channels, the larger the period. It is generally recommended to set "Number of channels + 1". |
| | Sampling frequency | Automatic calculation based on sampling period; no setup required. |
| | Event Trigger | Sampling is triggered according to the set conditions. |
| | Sampling data | To display the configured sample channels, you can click the "CH" button to the left of the sample channel to hide or display the sample channel data in the current curve. |

## 9.5.1 Acquisition channel list

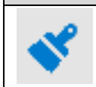
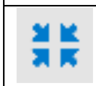
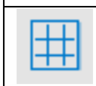
| Summary table of sampling data | | | |
|---|---|---|---|
| Serial number | Name | Unit | Explanation |
| 1 | Command pulse | Pulse | Single position loop gives the command increment value. |
| 2 | Command filter pulse | Pulse | |
| 3 | Encoder position | Pulse | |
| 4 | Encoder filter position | Pulse | |
| 5 | Position tracking error | Pulse | 0x60FC bus demand position for the previous position loop cycle (channel 9) - 0x60FC encoder actual position value for the current position loop cycle (channel 10); can be used to represent system position following dynamic and steady-state errors; |
| 6 | Encoder multi-turn value | Circle | Actual single-turn value for multi-turn encoder feedback; current loop cycle update |
| 7 | Encoder single-turn value | Pulse | Single-turn value of encoder feedback; current loop cycle update |
| 8 | Bus target location | Pulse | Absolute target position sent down by controller, communication object 0x607A; communication cycle update |
| 9 | Bus demand location | Pulse | Absolute position given by the controller down to the absolute position of the absolute target position within the |

| Summary table of sampling data | | | |
|---|---|---|---|
| **Serial number** | **Name** | **Unit** | **Explanation** |
| | | | differential decomposition to the position loop, communication object 0x60FC; position loop cycle update |
| 10 | Bus physical location | Pulse | Feedback to the actual position of the motor of the controller, communication object 0x6063; |
| 11 | Bus physical location | uu | Feedback to the actual position of the motor of the controller, communication object 0x6064; current loop cycle update |
| 12 | Speed given | RPM | The speed feed command, connected to the speed feed filter input; |
| 13 | Speed filtering given | RPM | Speed loop feed command, speed feed filter output value; |
| 14 | Speed Feedback | RPM | Velocity feedback, calculated for each velocity loop cycle from the actual encoder value, connected to the velocity feedback filter input; the recommended observation channel for dynamic velocity performance; |
| 15 | Speed filter feedback | RPM | Speed loop feedback command, speed feedback filter output value; |
| 16 | Speed Feedback | RPM | Speed feedback filter values, recommended observation channel for steady speed errors; |
| 17 | Speed PID output | A | Output value of speed loop PID calculation |
| 18 | Id given | A | |
| 19 | given after Id filtering | A | |
| 20 | Id PID feedback | A | |
| 21 | Id PID feedback filtering | A | |
| 22 | Id PID output | V | |
| 23 | Torque Feeding | A | Current value corresponding to the given torque = torque given / torque constant; connected to the input of the torque giving filter; torque related channels such as 24, 25 and 26 show the corresponding current rms value; |
| 24 | Torque filtering given | A | The output value of the torque-giving filter; |
| 25 | Torque feedback | A | Torque feedback value from the sensor; connected to the input of the torque feedback filter |
| 26 | Torque feedback filtering | A | The output value of the torque feedback filter; |
| 27 | Q-axis PID output | V | The voltage demand value calculated by the current PID of the current loop Q-axis; |
| 28 | Bus voltage | V | Busbar voltage; |
| 29 | A-phase feedback current | A | A-phase feedback current instantaneous value |
| 30 | B-phase feedback current | A | B-phase feedback current instantaneous value |
| 31 | C-phase feedback current | A | C-phase feedback current instantaneous value |
| 32 | A-phase voltage | V | A-phase output voltage |
| 33 | B-phase voltage | V | B-phase output voltage |
| 34 | C-phase voltage | V | C-phase output voltage |
| 35 | Output Voltage RMS | V | |
| 36 | Analog 0 voltage | V | Analog input Ai0 voltage |
| 37 | Analog 1 voltage | V | Analog input Ai1 voltage |
| 38 | Last Error Index | - | |
| 39 | Servo Enable | - | Servo enable flag bit, 1 when serving enable, 0 when not enabled; |

| Summary table of sampling data | | | |
|---|---|---|---|
| **Serial number** | **Name** | **Unit** | **Explanation** |
| 40 | Encoder communication status | - | Prompt the encoder communication status, when this channel is 0, it means the communication status is good; if it is not 0, please check whether the communication protocol matches and whether the cable is good. |
| 41 | Control words | - | Control word sent by controller, communication status 0x6040 |
| 42 | Status word | - | Feedback to the controller's servo status word, communication status 0x6041 |
| 43 | DS402 current control mode | - | Feedback to the controller's servo current control mode, communication status 0x6061 |
| 44 | EtherCAT communication status | - | EtherCAT communication status, defined as follows:<br>1: Iint.<br>2: PreOP.<br>4: SafeOP.<br>8: OP |
| 45 | Zero deviation angle of micro-action calibration | Pulse | |
| 46 | Micro-action zero proportional output | - | |
| 47 | Microschool zero credit time | ms | |
| 60 | Overcurrent A-phase feedback current | A | The instantaneous value of the A-phase current when the most recent overcurrent error occurred; |
| 61 | Overcurrent B-phase feedback current | A | The instantaneous value of the B-phase current when the most recent overcurrent error occurred; |
| 62 | Overcurrent C-phase feedback current | A | The instantaneous value of the C-phase current when the most recent overcurrent error occurred; |
| 63 | Overcurrent A-phase voltage | V | |
| 64 | Overcurrent B-phase voltage | V | |
| 65 | Overcurrent C-phase voltage | V | |
| 66 | Overcurrent Q axis current giving | A | The value of the torque given when the most recent overcurrent error occurred; |
| 67 | Overcurrent Q-axis current feedback | A | The torque feedback value at the time of the most recent overcurrent error; |
| 68 | Overcurrent bus voltage | V | The bus voltage value when the most recent overcurrent error occurred; |
| 69 | Probe 1 position | Pulse | Communication object 0x60BA |
| 70 | Probe 2 position | Pulse | Communication object 0x60BB |
| 88 | Inertia recognition speed | - | Inertia recognition speed |
| 89 | Inertia recognition torque | - | Inertia recognition torque curve |
| 90 | Inertia identification results | - | Inertia identification result curve |
| 91 | Self-learning status | - | |

| Summary table of sampling data | | | |
|---|---|---|---|
| Serial number | Name | Unit | Explanation |
| 96 | Memory 0 | - | Internal test variables |
| 97 | Memory1 | - | Internal test variables |
| 98 | Memory 2 | - | Internal test variables |
| 99 | Memory3 | - | Internal test variables |

## 9.5.2 Waveform sampling and analysis controls

| Icons | Name | Explanation |
|---|---|---|
|  | Clear Graphics | Clear the currently recorded waveform |
|  | Default View | Zoom back to the default view size |
|  | Toggle Cursor Visibility | Show/hide cursors, which can be used to make measurements on waveforms. |
|  | Reset Cursor | Restore the cursor to its default state |
|  | X-axis scaling | Select X-axis for scaling |
|  | Y-axis scaling | Select Y-axis for scaling |
|  | Cursor channel selection | Select the channel object for cursor measurement |
|  | Y-axis coordinate range grouping | Y-axis coordinate grouping |

## 9.5.3 Waveform Analysis


| Menu bar tab | Function | Description |
|---|---|---|
| Waveform Analysis | Loading Waveforms | Loads a saved waveform file. |
| | Frequency domain analysis | Convert waveforms in the frequency and time domains.<br>By default, the waveform is a time domain waveform. When you need to perform frequency domain analysis, you can click this function button to convert the view to a frequency domain waveform and click this function button again to revert to a time domain waveform. Under the frequency domain waveform, the horizontal coordinate is frequency (in Hz) and the vertical coordinate is decibel (in dB). You can also use the waveform controls to zoom in and out, measure, etc. |
| | Reset bias | Restores all bias settings to their initial values. |
| | Sampling data | To display the sampling data in the waveform file, you can click the "CH" button on the left side of the sampling channel |

| Menu bar tab | Function | Description |
|---|---|---|
| | | to hide or display the sampling channel data in the current curve. |
| | Data Gain | The raw data channels can be scaled proportionally to the gain multiplier. |
| | Data Bias | The set offset can be superimposed on the original data channel. |

## 9.6 Rigidity and three-loop parameters adjustment

To make the drive better adapted to the mechanical load, to drive the motor quickly and accurately and to follow the relevant commands from the host computer, it is necessary to make appropriate adjustments to the servo gain.

The servo gain is set by a combination of several parameters (rigidity table, inertia ratio, position loop PID parameters, velocity loop PID parameters, filter settings, etc.), which affect each other, so the setting of the servo gain must consider the balance between each parameter.

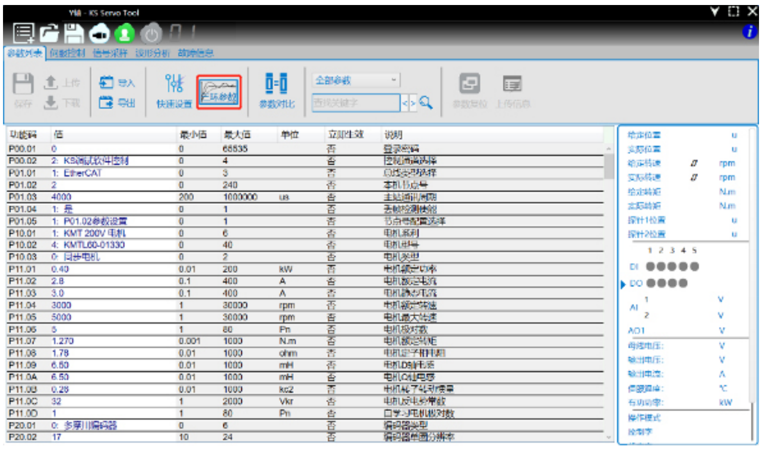
- In the AD Servo Tool commissioning software, the three-loop parameters can be adjusted in two ways
  1) The "Three loop parameters" in the parameter list selection.
  2) Go through all parameters to find "rigidity", "inertia ratio", "position loop parameters", and " velocity loop parameters" to set.

**Caution**

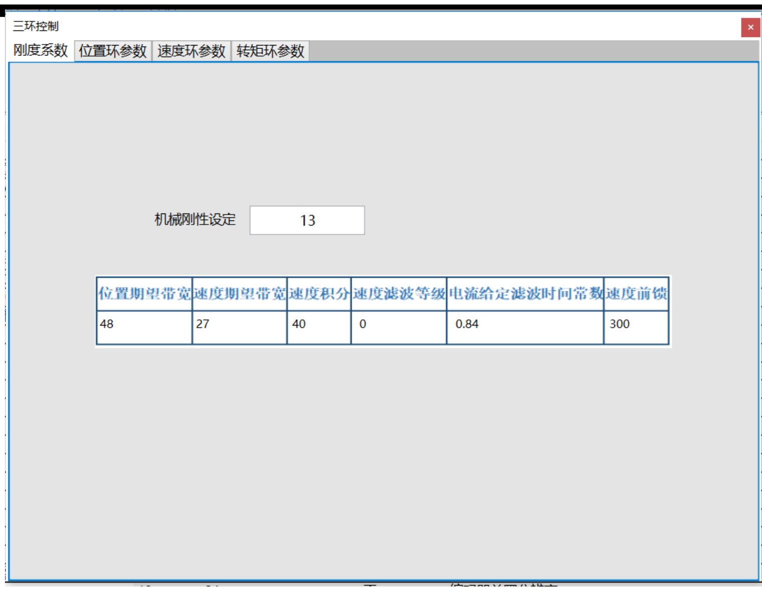
- When commissioning the servo, it is necessary to do a good job of emergency stop protection, mechanical protection, and other measures to ensure maximum personal safety of the equipment during servo enablement and operation. To avoid misoperation such as on-site interference signals, all operating parameters should be reset after the servo trial run to prevent accidental start-up and other situations.
- Before adjusting the servo three-loop parameters, please make sure that the motor, encoder and other parameters are correct, and make sure that the emergency stop, and other safety protection facilities operate normally and reliably. And before running point test run servo to ensure normal action.

### 9.6.1 "Three-loop of parameters" function setting

1) Open the software, in the "Parameter List" tab, find "Three-loop Parameters" and click into it.



2) In the pop-up page, there are settings for the stiffness coefficient, position loop parameters, speed loop parameters, and torque loop parameters. Through the corresponding settings, the gain adjustment of the servo three lopps can be realized.




- Stiffness factor

By adjusting the rigidity setting level P63.02, a set of three-loop parameters can be quickly obtained.

1) Position loop parameters

| Name | Unit | Remarks |
|---|---|---|
| Position loop gain | Hz | For adjusting the position loop response |
| Position loop feedforward coefficient | % | Feed forward for position adjustment |
| Soft limit setting | - | This function is not available for bus control |
| Position loop tracking error detection | - | Whether to detect position loop tracking error |
| Position loop tracking error setting | Pulse | Default is the encoder's single-turn resolution |

2) Speed loop parameters

| Name | Unit | Remarks |
|---|---|---|
| Speed loop gain 1 | Hz | For adjusting the speed loop response |
| Speed loop integral 1 | ms | For adjusting the speed loop response time |
| Speed tracking error threshold | % | Used to set the error alarm threshold during speed tracking |
| Tracking error filtering time | ms | Protection filter time for setting speed tracking error |
| Stall Threshold | % | Threshold value for setting stall protection |
| Stall filtering time | ms | Filter time for setting stall protection |
| Stall protection enable | - | For turning stall protection detection on and off |

3) Current loop parameters

| Name | Unit | Remarks |
|---|---|---|
| Torque feedforward selection | - | For turning on and off the torque feedforward function (currently not available) |
| Current loop gain (Kp) | | For adjusting the current loop response |
| Current loop | ms | For adjusting the current loop response time |

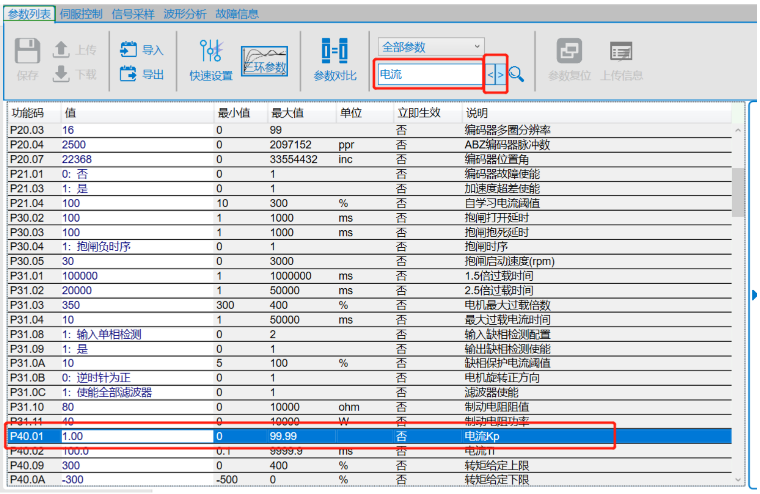
| | | |
|---|---|---|
| integral (Ti) | | |
| Upper limit of torque giving | % | Used to set the forward maximum output limit of the torque loop. |
| Lower limit of torque giving | % | Used to set the reverse maximum output limit of the torque loop. |

Note: The parameters set in "Three Loop Parameters" will not take effect immediately, you need to download the parameters and save them.

## 9.6.2 Find relevant parameters by parameter list

1) You can find the relevant parameters to set by selecting the parameter group.


2) Or enter a keyword to find the parameters and set them.



## 9.6.3 General setting for three-loop parameters

1) Position loop parameters

| Parameter Address | Name | Unit | Remarks |
|---|---|---|---|
| P60.01 | Position loop gain | Hz | For adjusting the position loop response |
| P60.02 | Position loop feedforward coefficient | % | Feed forward for position adjustment |
| P60.0C | Position loop tracking error setting | Pulse | Default is the encoder's single-turn resolution |

2) Speed loop parameters

| Parameter Address | Name | Unit | Remarks |
|---|---|---|---|
| P50.01 | Speed loop gain 1 | Hz | For adjusting the speed loop response |
| P50.02 | Speed loop intergral credit 1 | ms | For adjusting the speed loop response time |

3) Current loop parameters

| Parameter Address | Name | Unit | Remarks |
|---|---|---|---|
| P40.09 | Upper limit of torque giving | % | Used to set the forward maximum output limit of the torque loop. |
| P40.0A | Lower limit of torque giving | % | Used to set the reverse maximum output limit of the torque loop. |

## 9.7 Self-learning function

1) Encoder zeroing function
Manufacturers use the function, if you need to use third party servo motor on site, please contact AUCTECH.
2) Motor Pole Log Learning
Manufacturers use the function, if you need to use third party servo motor on site, please contact AUCTECH.
3) Inertia self-learning

The inertia ratio (P63.01) is the

Inertia ratio P63.01$= \frac{\text{load total inertia/reduction ratio}^2}{\text{inertia of motor}} * 100\%$

Note: When there is no reducer, the reduction ratio is 1.

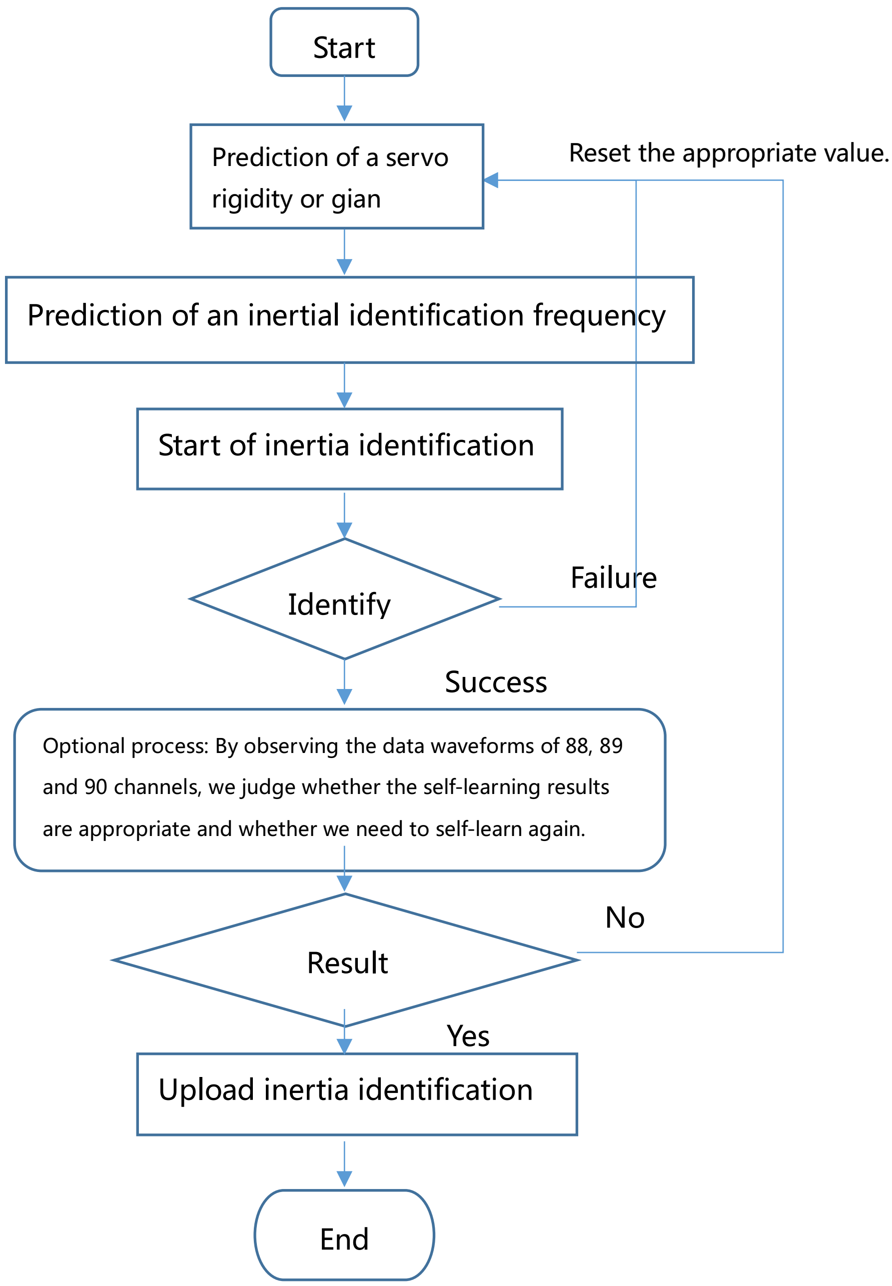
The load inertia ratio is an important parameter of servo system, and the correct setting of the load inertia ratio helps to finish the commissioning quickly.
The load inertia ratio can be entered manually or recognized by the servo drive's inertia self-learning function. By applying a certain frequency and amplitude of motion to the servo motor and reading the feedback from the implementation, the inertia of the field load converted to the motor shaft can be predicted during the inertia self-learning. And the result is automatically filled into parameter P63.01.

## 9.7.1 Inertia self-learning notes

- When using inertia self-learning, the following conditions need to be met to accurately calculate the load inertia ratio:

1) The maximum speed of the actual motor used is higher than 500 rpm.
2) Acceleration of 3000 rpm/s² or more when using the motor for acceleration and deceleration.
3) The load connection is solid and stable and cannot change drastically.
4) The actual load inertia ratio must not exceed 50 times, otherwise phenomena such as stall overload may occur during the learning process.
5) The use of the inertia self-learning function is not recommended for large transmission backlash, or for elastic loads.
6) If the actual load inertia ratio is large, and the drive gain or system rigidity is low, it will cause the motor action to be sluggish and cannot reach the maximum motor speed and acceleration requirements, which will lead to inertia self-learning failure, and the system rigidity or speed loop gain should be increased appropriately, and then the inertia recognition should be performed again.
7) If the drive gain or system rigidity is low, and the inertia recognition frequency is also small, it will also lead to inertia recognition failure, then the system rigidity or speed loop gain should be adjusted appropriately, and then inertia recognition should be performed again (the maximum system rigidity setting for inertia self-learning is 18).
8) If vibration or even oscillation occurs during inertia self-learning, inertia discrimination should be stopped immediately and the system rigidity, servo gain or inertia discrimination frequency should be reduced.
9) Before the inertia self-learning begins, it should make a good emergency stop, safety limit (leave more than 3 turns of movable travel between the mechanical limits) and other protective measures.

### 9.7.2 Inertia self-learning process



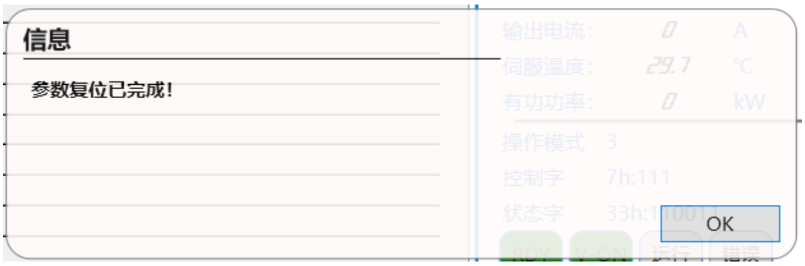

## 9.8 Parameter reset and information upload

### 9.8.1 Parameter Reset

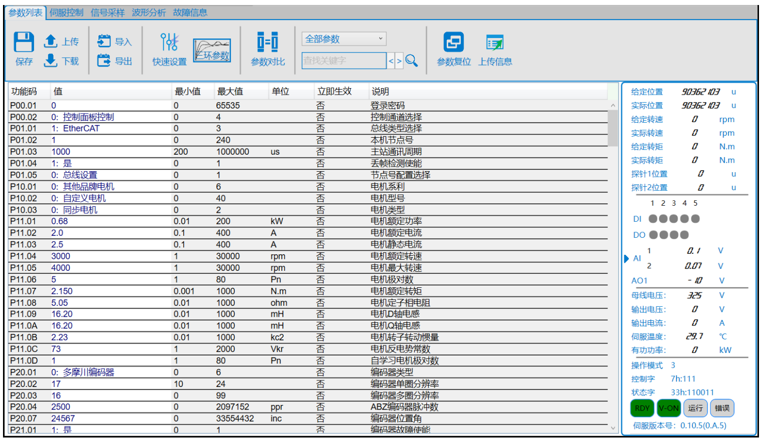
- In some cases, it is necessary to carry out the operation of restoring the factory value of parameters. The following describes the steps of parameters reset by the commissioning software:

1) After the driver is successfully connected, log in with the password, enter the parameter list tab and select the parameter reset function


2) Click Parameter Reset The drive will perform the parameter reset function and a dialog box will pop up after completion to inform the completion status.



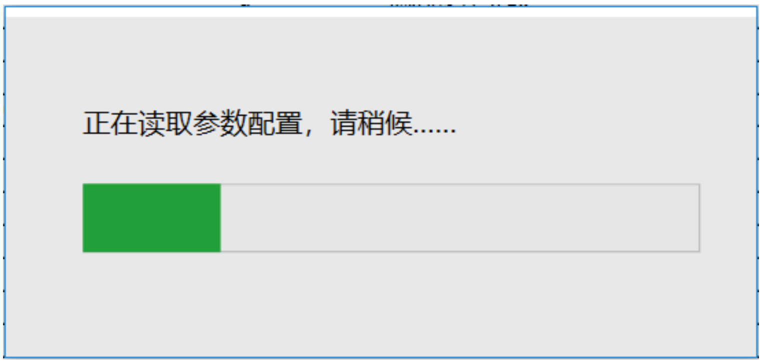

3) After the reset is complete, it is recommended to power off and reboot. After reconnecting the drive, click Upload Parameters and you will see that all parameters in the drive have been restored to factory default parameters.



## 9.8.2 Information Upload

- When the parameter template in the project used does not match the parameter information in the actual drive, the software will prompt whether to upload the information, and selecting "Yes" will automatically synchronize the parameter list in the project with the drive. If you select "No", you can also use the Upload Information button to update the parameter list manually.


- Once the upload message starts, a progress bar will show the current progress. When the progress bar is full, a pop-up message will appear indicating whether the upload message is complete or failed.




Note: The upload information is only to synchronize the parameter list in the project with the one in the driver. After the upload is completed, you still need to upload the parameters before you can upload the parameter values in the driver to the PC.

# 9.9 Troubleshooting

After the drive is successfully connected, if a fault occurs, you will see the current fault information and historical fault information on the fault information page. The alarm number of the current alarm will be displayed in the toolbar.

If the current control channel is "AD commissioning software control", the fault reset button can be used to reset the fault. If the controller is controlled, the control word needs to be operated by the host computer to complete the alarm reset.

Please refer to Troubleshooting to troubleshoot the cause of the current alarm. For details, refer to the Troubleshooting Chapter

Note: For certain faults such as continuous overcurrent, to protect the internal components of the drive, the alarm message must be eliminated by power off and restart after troubleshooting.

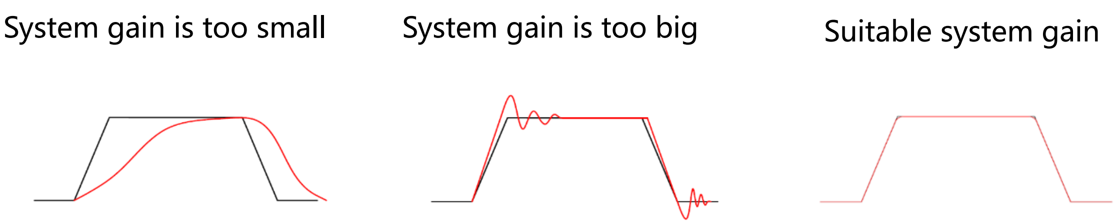
# Section 10

# Section 11 AD2 commissioning and trial run

## 11.1 Overview

The characteristic of servo is to be able to follow the change of command signal quickly and precisely. In actual application, the mechanical characteristics of the servo system will cause the response performance of the servo system to decline. In this case, the gain of the servo system must be adjusted reasonably, so that the system can achieve the purpose of fast and accurate response to the command signal to the maximum extent.

- Examples to illustrate the significance of system gains:




The system gain is set by a combination of several parameters (position loop gain, velocity loop gain, velocity loop integral, filter, inertia ratio, etc.), which interact with each other. Therefore, the gain adjustment of the servo system must consider the balance between the setting values of each parameter.

| **Caution** |
| --- |
| ● Before making system gain adjustments, it is recommended to use a jog test run to confirm that the motor can work properly.<br>● Gain adjustment process, the adjustment range should be gradually increase or decrease, to avoid excessive changes in the adjustment. |

## 10.1.1 General flow of system gain adjustment

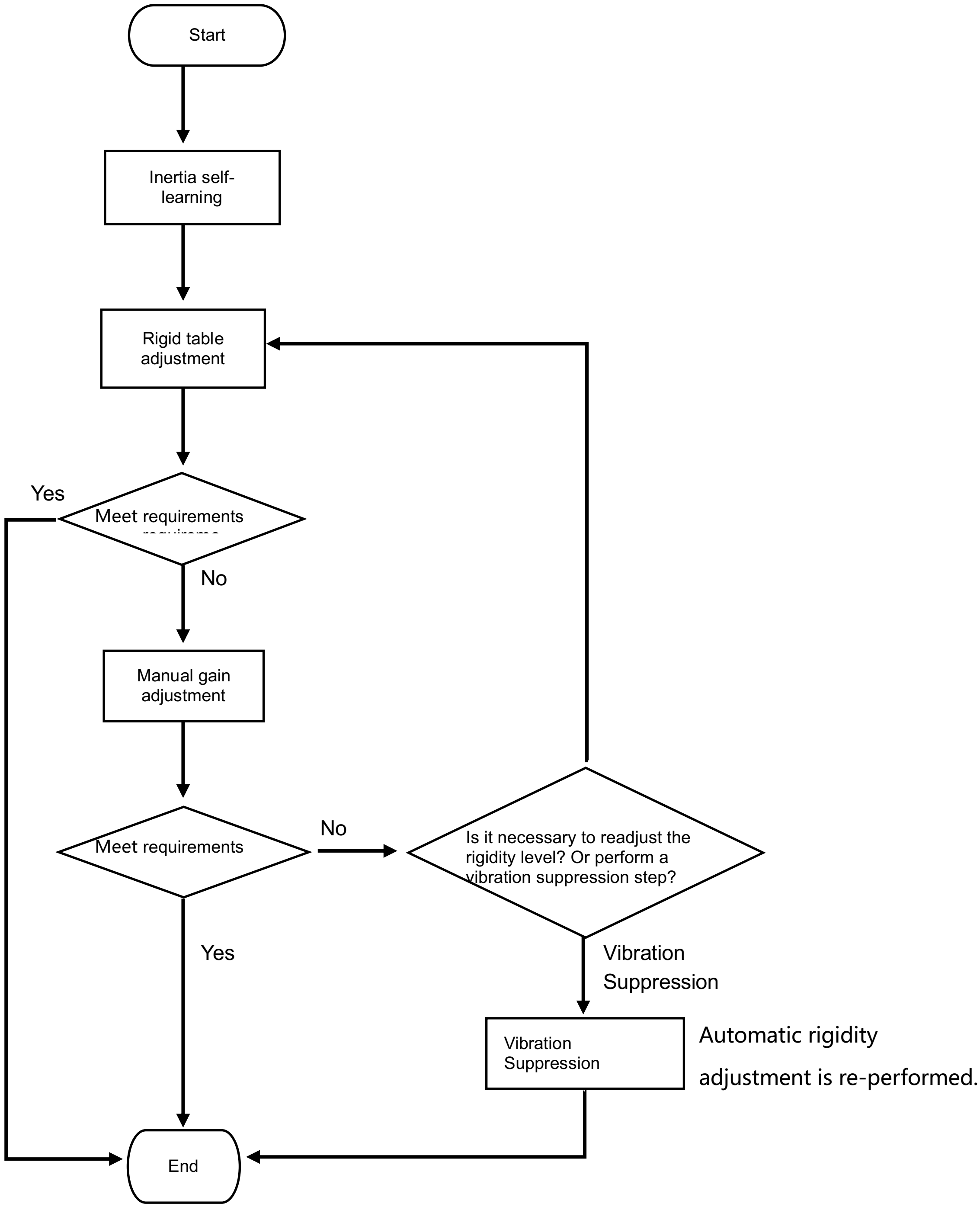



Figure - Gain adjustment flow

Table - Gain adjustment process description

| Adjustment Process | | | Function |
|---|---|---|---|
| 1 | Inertia self-learning | | Automatic calculation of load inertia ratio by drive inertia self-learning function |
| 2 | Rigid table adjustment | | With the inertia ratio set correctly, a set of gain parameters can be quickly obtained by setting the stiffness level. |
| 3 | Manual gain adjustment | Basic Gain | Based on the automatic gain adjustment, the speed and position loop gains are manually fine-tuned to optimize the effect. |
| | | Feedforward gain | Adjust feedforward settings to optimize response performance. |
| | | Filter settings | Filter settings for position, speed, and torque commands. |
| 4 | Vibration Suppression | Mechanical Resonance | Based on the observed frequency waveform, a suitable notch frequency is set to suppress mechanical resonance. |
| | | Low Frequency Resonance | Set low-frequency suppression filter to suppress low-frequency resonance. |

## 11.2 Pre-run preparation

1) Check the wiring, see "Section 4 Wiring" for details.
2) Check the operating environment, see "Section 1 Safety and Precautions".
3) Is the motor a AUCTECH brand motor? If it is a third-party brand motor, it needs to be zeroed for encoder self-learning.
4) Check the security protection measures.
5) Check the load connection and mechanical drive section.
6) Check if the drive and motor parameters are configured properly.

## 11.3 Inertia identification

Concept of load inertia ratio

$$\text{Inertia ratio } = \frac{\text{load total inertia/reduction ratio}^2}{\text{inertia of motor}} * 100\%$$

The load inertia ratio is an important parameter of servo system, and the correct setting of the load inertia ratio helps to finish the commissioning quickly.

The load inertia ratio can be set manually or identified using the inertia self-learning function.

| ⚠ **Caution** |
| --- |
| When using the inertia self-learning function, the following conditions need to be met to accurately calculate the load inertia ratio:<br>● The maximum speed of the actual motor is higher than 500 rpm.<br>● Acceleration and deceleration of the actual motor at 3000rpm/s or more.<br>● Stable and stable load connection and no drastic changes in load torque.<br>● The actual load inertia ratio must not exceed 50 times, otherwise stalls and overloads may occur during the learning process.<br>● Large transmission backlash or elastic load may cause inertia recognition failure or large vibration. Please use the inertia self-learning function with caution when such loads are applied.<br>● If the actual load inertia ratio is large and the drive gain is low, it will cause the motor to be sluggish and cannot achieve the highest speed requirement and acceleration requirement of the motor, which will lead to the failure of inertia self-learning, and the inertia self-learning should be performed again after increasing the speed loop gain appropriately.<br>● If the drive gain is low and the inertia recognition frequency is low, it will lead to inertia recognition failure. In this case, the system gain should be increased (system rigidity ≤ 18 is recommended for inertia recognition) and inertia recognition frequency (recommended recognition frequency 200, the maximum shall not exceed 400) and then re-inertia self-learning.<br>● Inertia self-learning process, if vibration or oscillation occurs, inertia recognition should be stopped immediately. and reduce the system gain or inertial discrimination frequency and then re-learn.<br>● Before the inertia self-learning begins, it should do a good job of emergency stop, safety limit and other protective measures, and ensure that the motor has 3 or more turns of forward and backward movable travel to prevent overtravel during the inertia self-learning process, causing accidents! |

## 10.3.1 Inertia self-learning process

- Before performing inertia self-learning, please reconfirm and satisfy the following motor motion requirements:

1) Between the mechanical limit switches, leave 3 or more turns of movable travel each positive and negative.
2) Before performing the inertia self-learning, make sure that the limit switch is installed on the machine and operates properly.
3) Allow ±3 turns of moveable travel between mechanical limits to avoid overtravel during inertia recognition, which can cause accidents!
4) The load allows for frequent forward and reverse motion.
5) Machinery and equipment and liabilities are allowed to carry out forward and reverse motion, the amplitude of forward and reverse motion is about 60°, and the forward and reverse frequency is about 100~500.

- Predicted load inertia ratio

  If the inertia ratio P63.01 is the default value and the actual load inertia ratio is greater than 30 times, the inertia self-learning may fail due to slow motor action, and the following two measures can be taken at this time:

1) Preset inertia ratio P63.01 parameters

   A larger initial value can be preset, and it is recommended to start from 500% and gradually increase in 200% increments until the inertia self-learning succeeds.

2) Increase the drive stiffness level P63.02 to make the motor self-learning speed and acceleration meet the inertia recognition requirements.

Note: Too much rigidity is likely to cause motor overload and other failures, please be careful to increase the rigidity, the recommended rigidity for self-learning ≤ 18.

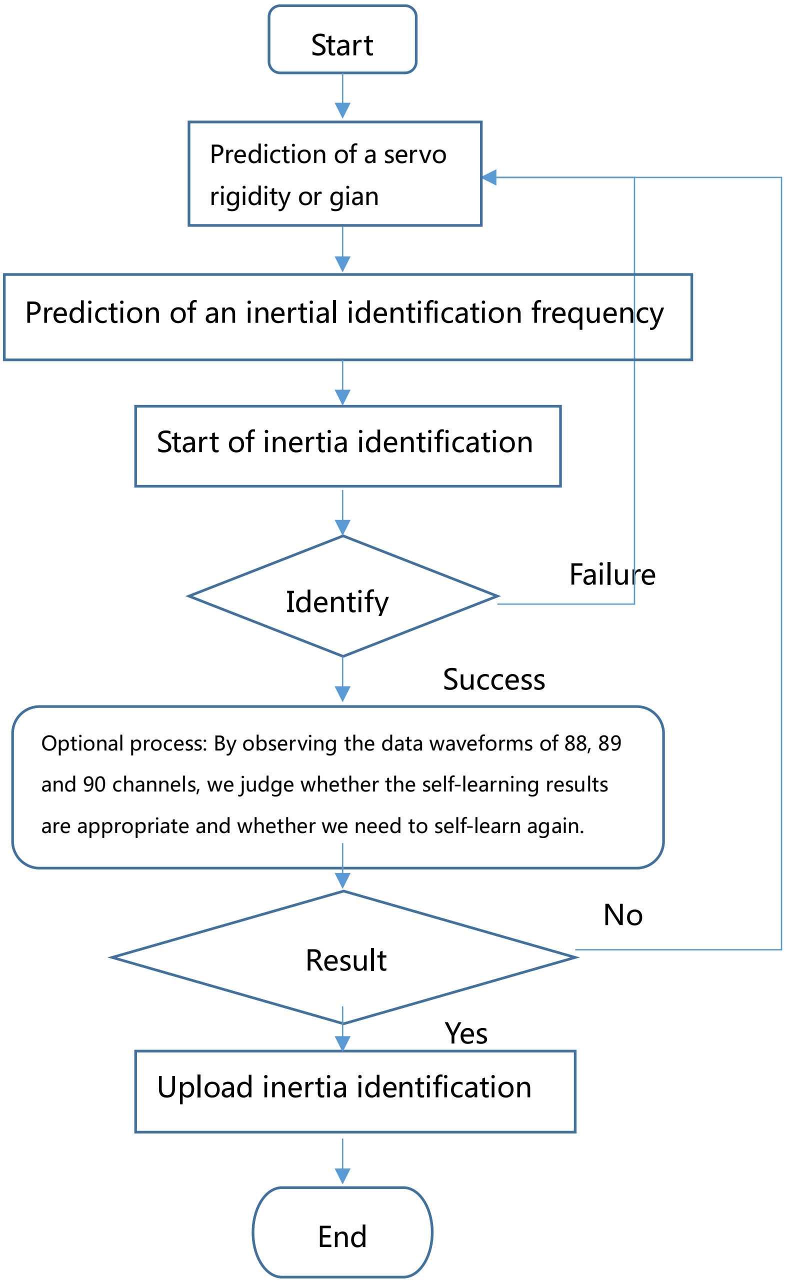



Figure - Inertia self-learning process

- Associated parameters:

| Parameter group | Serial number | Name | Unit | Data Range | Factory value | Change method | Effective method |
|---|---|---|---|---|---|---|---|
| P63 | 01 | Inertia ratio | % | 0~5000 | 250 | Shutdown settings | Downtime effective |
| | 02 | Mechanical rigidity setting | - | 0~31 | 13 | Shutdown settings | Downtime effective |
| | 03 | Inertia identification frequency | | 1~2000 | 200 | Shutdown settings | Downtime effective |

# 11.4 Gain adjustment

## 10.4.1 Rigid meter fast gain setting

By selecting one of the rigidity levels in the rigidity table, the servo drive will automatically generate a matched set of gain parameters to meet the speed and stability requirements.

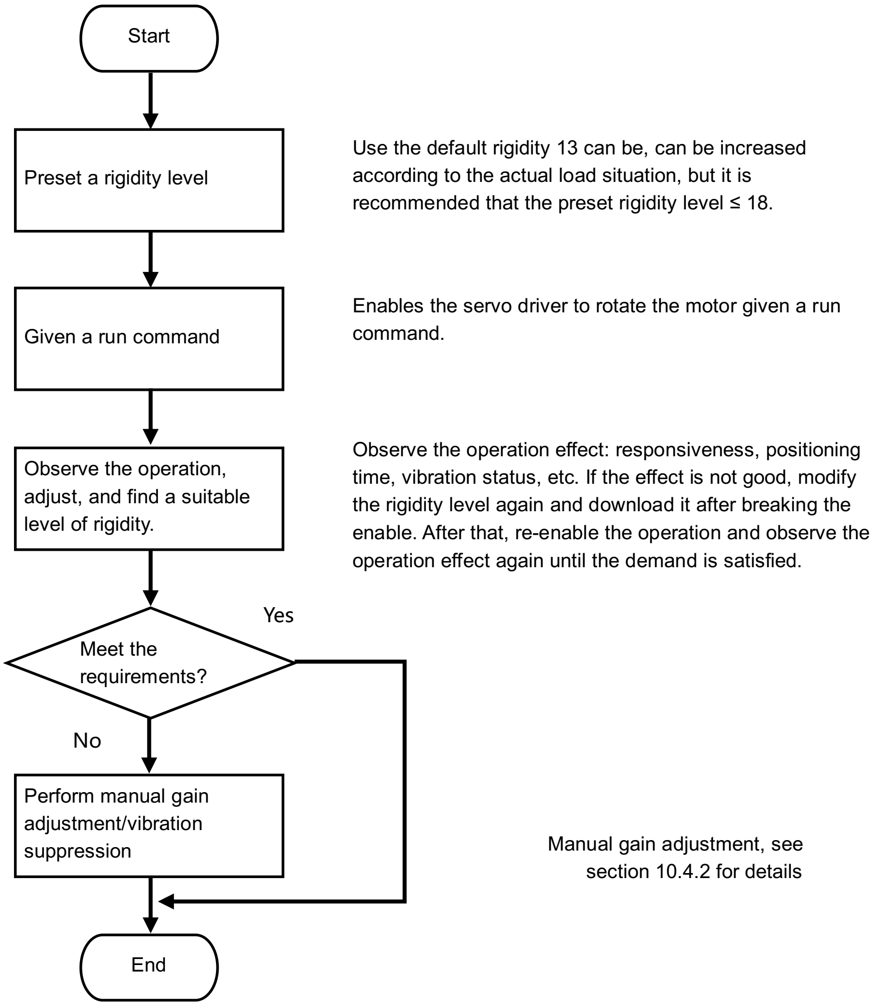



Figure - rigidity level adjustment steps

The rigidity level is taken in the range of 0~31. Level 0 corresponds to the weakest rigidity and the smallest system gain; level 31 corresponds to the strongest rigidity and the largest gain. Depending on the type of load, the following empirical values are available for reference:

Table Empirical values of rigidity levels for general applications

| Rigid level experience value | Type of load structure |
|---|---|
| Level 4~8 | Some large machinery, where responsiveness and positioning accuracy are very low. |
| Level 8~15 | Applications with low rigidity such as belts. |
| Level 15~20 | Ball screw, direct link, and other occasions with high rigidity requirements. |

- Associated parameters:

| Parameter group | Serial number | Name | Unit | Data Range | Factory value | Change method | Effective method |
|---|---|---|---|---|---|---|---|
| P60 | 01 | Position loop gain | Hz | 0~1000 | 48 | Shutdown settings | Downtime effective |
| P50 | 01 | Speed loop gain | Hz | 0.1~500 | 27 | Shutdown settings | Downtime effective |
| | 02 | Speed loop integration time | ms | 0.1~370 | 40 | Shutdown settings | Downtime effective |
| / | / | Current given filtering time | ms | / | / | Shutdown settings | Downtime effective |

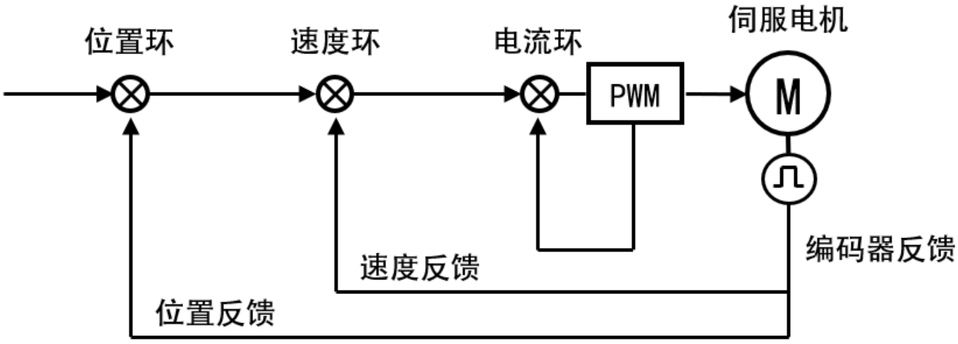
| ⚠ Caution |
|---|
| Be sure to obtain the correct load inertia ratio before using the rigid setting. |

| ⚠ Caution |
|---|
| The manual is written based on the V11.2 servo firmware version. In this firmware version, the gain and rigidity parameters must be set and take effect after disabling. If the firmware version is updated later, please check whether the firmware version supports online setting and online effect. |

## 10.4.2 Manual gain adjustment

When the automatic gain adjustment does not achieve the desired effect, the gain can be manually fine-tuned. Optimize the control effect through more detailed adjustment.

- The servo system is a closed-loop control system composed of three control loops, from the outside to the inside in the order of position, speed, and current loops whose basic control block diagram is shown below:




Note: In servo control, the more inward the loop, the higher the required responsiveness. Please follow this principle in the actual gain adjustment, otherwise it will lead to system instability!

PID structure of AD2 drive current, speed and position controller

Current, speed controller

- The current and speed controllers in the AD2 series servo system use a PID architecture to ensure fast response while improving anti-disturbance capability. The designed PID controller architecture, after ignoring the filtering and other links in the forward and feedback channels, is shown in the following figure:

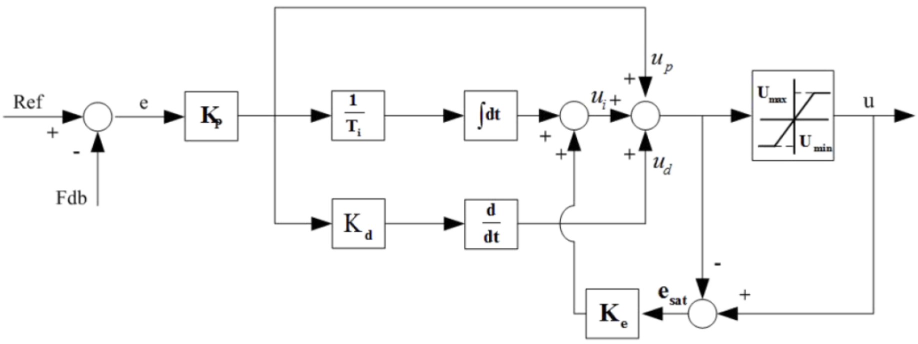



Figure - sketch of current and speed PID controller structure

- Position Controller

The position controller in the AD2 series servo system uses a compound feedforward proportional regulator with a proportional + feedforward architecture to ensure fast response to position giving and to eliminate steady-state errors. Ignoring the filtering link in the controller, the framework structure of the designed position controller is shown in the following figure:

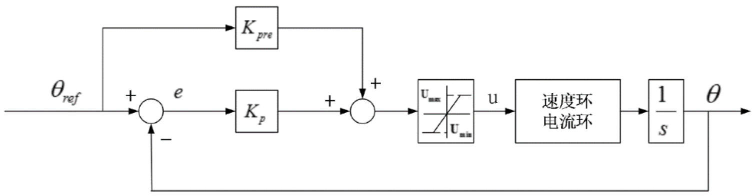



Figure - Position controller structure sketch

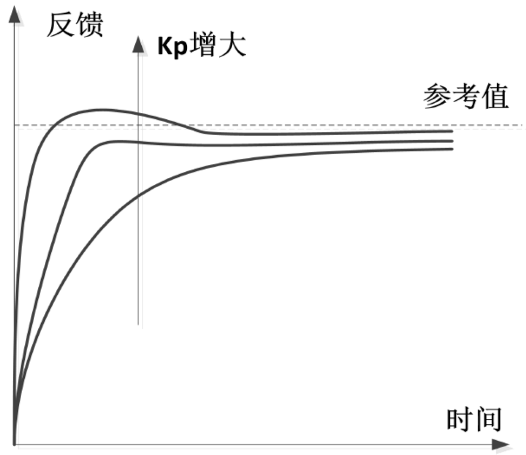
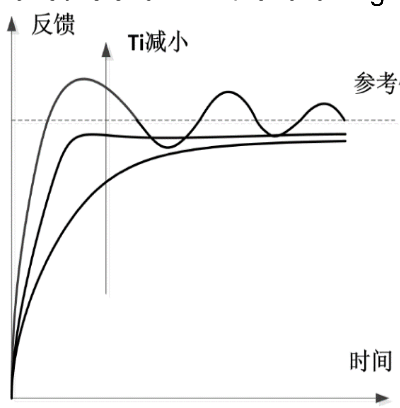
Position servo system does not allow position overshoot and oscillation to avoid production accidents such as crashing and machining scrap. If the integral controller is used, it will appear that when the position is given to reach the target value, the speed is still given to maintain a high value, and the motor runs at high speed thus causing position overshoot. To reduce the position control steady-state error, the proportional gain of the position controller needs to be increased, but too much gain will lead to system instability or oscillation, so the feed-forward control link is added to improve the position response of the servo system and eliminate the steady-state error.

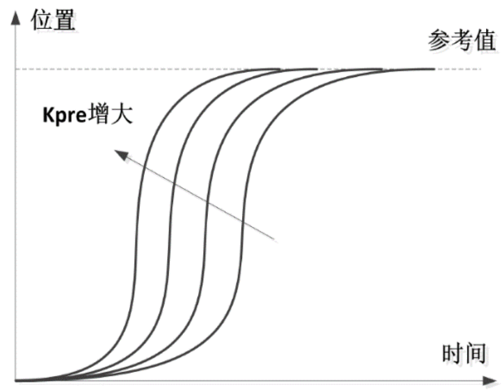
- PID parameter debugging method

When gain adjustment, the more inside the loop, the higher the required responsiveness. Please follow this principle in actual gain adjustment, otherwise it will lead to system instability! Since the default current loop gain of the Servo Drive already ensures sufficient responsiveness, no adjustment is generally required. Only the speed loop, position loop gain and other auxiliary gains need to be adjusted. Therefore, when adjusting the gain in the position control mode, in order to ensure system stability, it is necessary to increase the position loop gain and also increase the speed loop gain and ensure that the position loop response is lower than the speed loop response.

- The role of each parameter in the PID is as follows:

| PID parameter adjustment and role | |
|---|---|
| **Name** | **Adjustment instructions** |
| Proportional gain parameter Kp (Position loop gain parameter; velocity loop gain parameter; current loop gain parameter) | Parameter role:<br>Speeds up the response of the system and improves the regulation accuracy of the system.<br>Adjustment method:<br>With the increase of Kp, the response speed of the system is accelerated, and the regulation accuracy of the system is improved. However, the system is easy to produce overshoot, and the stability of the system |

| PID parameter adjustment and role | |
|---|---|
| **Name** | **Adjustment instructions** |
| | becomes worse, even leading to system oscillation. too small a value of Kp, the regulation accuracy decreases, the response speed becomes slower, and the regulation time is longer, making the dynamic and static performance of the system worse.<br>The trend of the step response when the proportional gain is varied is shown in the following figure:<br><br> |
| Integration time parameter Ti<br>(Speed loop integration time parameter; current loop integration time parameter) | Parameter role: Eliminate the system steady-state error.<br>Adjustment method: The smaller the Ti is, the faster the steady-state error of the system will be eliminated, but the Ti should not be too small, otherwise the integration saturation phenomenon will occur at the beginning of the response process. However, if Ti is too large, the steady-state error of the system will be difficult to eliminate and affect the regulation accuracy of the system. In addition, in the forward channel of the control system, if there is an integration link can always achieve a steady state without static difference. From the point of view of phase an integration link has 90° of phase delay, which may destroy the stability of the system.<br>The trend of the step response when the integration time constant is varied is shown in the following figure:<br><br> |
| Differential parameter Kd<br>(Speed loop differential parameters; current loop differential parameters) | Parameter role:<br>Improving the dynamic performance of the system, whose main role is to suppress the deviation in any direction during the response and to forecast the deviation changes in advance.<br>Adjustment method:<br>Since the control loop of the AD2 servo system has a high-speed refresh rate, there is generally no need to use a differential link. |
| Feedforward gain coefficient Kper<br>(Position feed forward) | Parameter role:<br>Improves the position response of the system and eliminates steady-state |

| PID parameter adjustment and role | |
|---|---|
| **Name** | **Adjustment instructions** |
| | errors.<br>Adjustment method:<br>Increasing the feedforward coefficient can improve the position tracking performance and eliminate the steady-state error faster, but too large a feedforward coefficient will still cause system instability. Decreasing Kper can improve the stability of the system, but the system response will become slower.<br>The effect of the feedforward scaling factor on the position tracking performance is shown in the following figure:<br> |

- Associated parameters:

1) Current loop parameter adjustment

| Serial number P40.01 | Name | Current loop Kp | | | Setting effective | Break Enable | Data Range | 0.1~99.99 |
|---|---|---|---|---|---|---|---|---|
| | Access Properties | RW | Unit | 0.01 | Related Models | ALL | Factory settings | 0.54 |

| Serial number P40.02 | Name | Current loop Ti | | | Setting effective | Break Enable | Data Range | 0.1~999.9 |
|---|---|---|---|---|---|---|---|---|
| | Access Properties | RW | Unit | 0.1 | Related Models | ALL | Factory settings | 100 |

In general, the current loop does not need to be adjusted. The current curve in speed mode, or torque mode can be observed to analyze its followability, jitter, oscillation, and burr, and decide whether it needs to be fine-tuned according to actual needs.

2) Speed loop parameter adjustment

| Serial number P50.01 | Name | Speed loop gain 1 | | | Setting effective | Break Enable | Data Range | 0.1~500 |
|---|---|---|---|---|---|---|---|---|
| | Access Properties | RW | Unit | Hz | Related Models | ALL | Factory settings | 27 |

| Serial number P50.02 | Name | Speed loop integration time 1 | | | Setting effective | Break Enable | Data Range | 0.1~370 |
|---|---|---|---|---|---|---|---|---|
| | Access Properties | RW | Unit | ms | Related Models | ALL | Factory setting | 40 |

The speed loop gain parameter can determine the velocity loop following performance when the load inertia ratio is set correctly. Increasing this parameter can speed up the positioning time and bring better speed following and stability without generating noise and vibration. If whistling or noise is generated, the parameter setting needs to be reduced.

The speed loop integration time can be used to eliminate the speed loop deviation. Reducing the integration time can strengthen the integration effect and speed up the positioning time, but too small a setting value is likely to cause mechanical vibration. If the setting value is too high, the deviation of the speed loop will not return to zero.

3) Position loop parameter adjustment

| Serial number P60.01 | Name | Position loop gain | | | Setting effective | Break Enable | Data Range | 0~1000 |
|---|---|---|---|---|---|---|---|---|
| | Access Properties | RW | Unit | Hz | Related Models | ALL | Factory settings | 48 |

| Serial number P60.02 | Name | Position loop feedforward coefficient | | | Setting effective | Break Enable | Data Range | 0~1000 |
|---|---|---|---|---|---|---|---|---|
| | Access Properties | RW | Unit | % | Related Models | ALL | Factory settings | 50 |

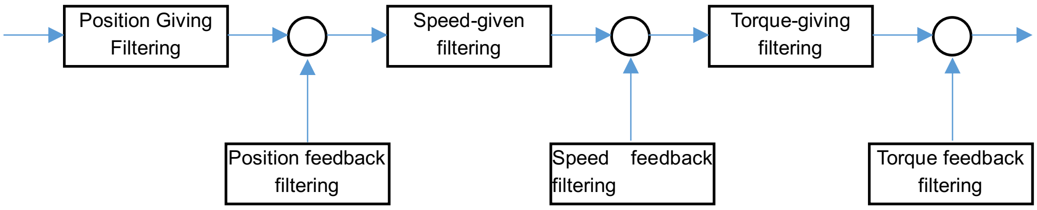
The position loop gain determines the frequency of position command changes that the position loop can follow. Increasing the setting value helps speed up the positioning time and improves the ability to resist external disturbances when the motor is stationary. However, too large a setting value is likely to cause system instability, oscillation, overload, and other phenomena.

### 10.4.3 Vibration Suppression

The mechanical system has a certain resonance frequency, and when the servo gain is increased, resonance may be generated near the mechanical resonance frequency, resulting in the gain cannot be further increased. Suppressing mechanical resonance can be achieved by setting filters reasonably, but if the filter parameters are set incorrectly, it will lead to system vibration or even damage the motor.

1) Filter Structure

The AD2 servo system has six filter links: torque feed, torque feedback, speed feed, speed feedback, position feed, and position feedback, and each filter link contains four separate filter modules connected in series. Take the speed feedback filter set as an example, as shown in the following figure:




Note: Currently, the position giving, and position feedback filtering group is not valid, only the relevant interface is reserved.

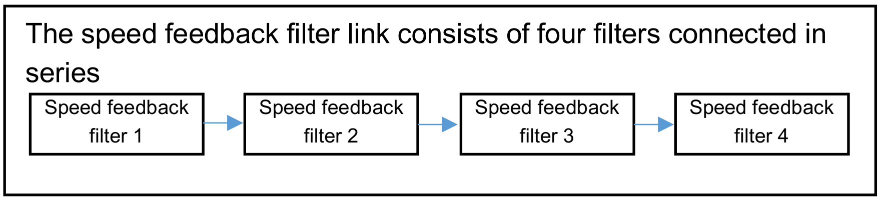



Figure - Structure of the filter

2) Filter Function Introduction

The AD2 servo system contains a low-pass filter and a notch filter. The functions of these two filters are described below.

- Low-pass filter

An ideal low-pass filter is a filter that allows signals below the cutoff frequency to pass, but signals above the cutoff frequency cannot pass. However, an actual digital filter is one in which when the signal frequency is above the cutoff frequency, the amplitude of the signal is attenuated at the rate of the square of that frequency.

The following figure shows the Byrd diagram of a first-order low-pass filter with a cutoff frequency of 1 kHz. The higher the input signal frequency, the stronger the filter's attenuation of the signal, and the greater the phase delay.

The second-order low-pass filter has a stronger attenuation effect on the signal after the cutoff frequency, but the phase delay at the cutoff frequency position is also greater.

The third-order low-pass filter may cause overshoot and is not recommended for customers in servo systems. Second-order low-pass filters are generally used in AD2 servo systems.

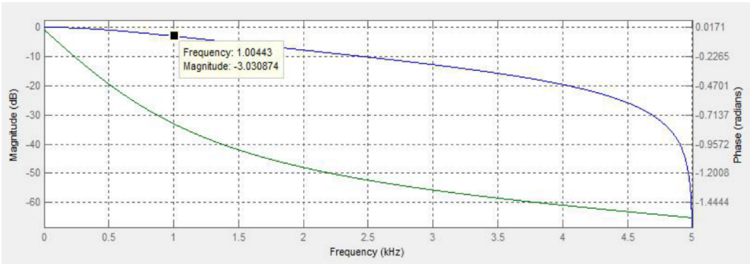



Figure - Bode diagram of low-pass filter

- Notch filter

A notch filter, also known as a bandstop filter, is a filter that passes most of the frequency components but attenuates certain ranges of frequency components to very low levels.

The following figure shows the Byrd diagram of the second-order notch filter. The center frequency of the notch is 1 kHz, and the filter has the strongest attenuation effect on the signal near this frequency, and basically has no effect on the signal far from the center frequency. The greater the notch depth, the stronger the attenuation effect on the center frequency point.

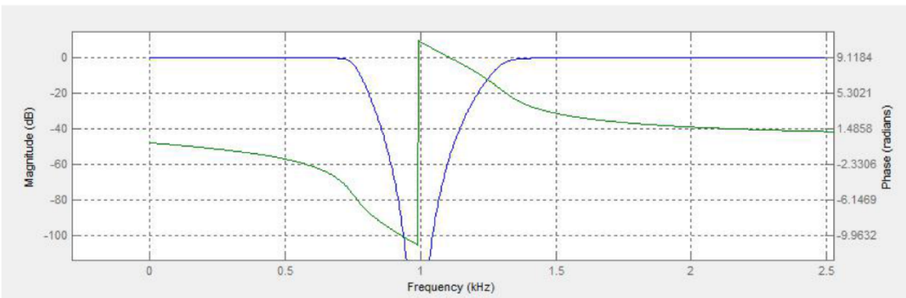



Figure - Notch filter Byrd diagram

- Filter parameter setting

The speed feedback filter link is used as an example to introduce the filter parameter settings. The speed feedback filter link consists of speed feedback filters 1, 2, 3 and 4, four filter modules connected in series. Each filter module in turn has 4 control parameters, as follows:

| | | | | | | |
|---|---|---|---|---|---|---|
| P52.01 | 0: 不使用滤波器 | 0 | 4 | | 否 | 第1速度反馈滤波器类型 |
| P52.02 | 1000 | 200 | 5000 | Hz | 否 | 速度反馈1截止频率 |
| P52.03 | 100 | 3 | 5000 | Hz | 否 | 速度反馈1陷波频率 |
| P52.04 | 5 | 3 | 50 | db | 否 | 速度反馈1陷波深度 |

- Associated parameters:

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| Parameter number P52.01 | Name | Speed feedback filter type 1 | | | Setting effective | Break Enable | Data Range | 0~4 |
| | Accessibility | RW | Unit | - | Related Models | | Factory settings | 0 |
| 0: Do not enable the filter<br>1: First-order low-pass filter<br>2: Second-order low-pass filter<br>3: Second-order low-pass filter with zero point<br>4: Notch filter | | | | | | | | |

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| Parameter number P52.02 | Name | Speed feedback 1 cutoff frequency | | | Setting effective | Break Enable | Data Range | 200~5000 |
| | Accessibility | RW | Unit | Hz | Related Models | | Factory settings | 200 |
| This parameter is used to set the cutoff frequency of the velocity feedback filter type 1 when it is set as a low-pass filter. And when the filter type parameter is set to the case of no enable or notch filter, this parameter has no meaning. | | | | | | | | |

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| Parameter number P52.03 | Name | Speed feedback 1 notch frequency | | | Setting effective | Break Enable | Data Range | 3~5000 |
| | Accessibility | RW | Unit | Hz | Related Models | | Factory settings | 100 |
| This parameter is used to set the notch center frequency of the velocity feedback filter type 1 when it is set as a notch filter. This parameter has no meaning when the filter type parameter is set to not enable or low-pass filter. | | | | | | | | |

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| Parameter number P52.04 | Name | Speed feedback 1 notch depth | | | Setting effective | Break Enable | Data Range | 3~50 |
| | Accessibility | RW | Unit | db | Related Models | | Factory settings | 5 |
| This parameter is used to set the notch depth of the velocity feedback filter type 1 when it is set as a notch filter. This parameter has no meaning when the filter type parameter is set to not enable or low-pass filter. | | | | | | | | |

Generally, notch filters are only used after vibration has occurred in the motor and the vibration frequency has been detected.

During the commissioning process, if you need to enable the filter, it is generally recommended to use the filter in the speed feedback or current feedback link. And the speed feed and current feed

Caution:

1) Before setting the filter, you need to rectify the inertia ratio, rigidity (position loop and speed loop gain) parameters, and then configure the filter reasonably since the appropriate parameters.
2) By default, a first-order low-pass filter with a cutoff frequency of 1000 Hz is added to the speed feedback link to facilitate proper filtering of interference or noise signals.

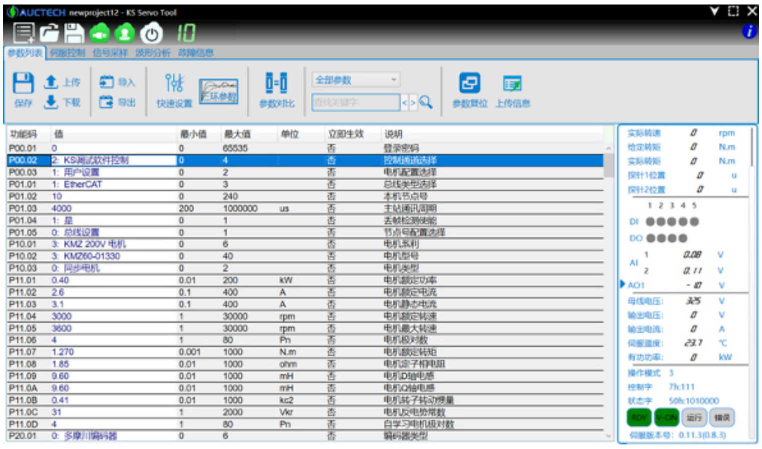
3) The filter can cause phase delays that can be severe enough to cause system response oscillations. If oscillations occur, try increasing the filter cutoff frequency or turning off the filter enable.
4) For industrial robots and enabling speed feedback low-pass filters, it is recommended that the cut-off frequency be no less than 2500 Hz.
5) If the servo is in the position control mode, excluding the change of the position setting and unsuitable parameters of the three-loop, if the fluctuation of the speed setting is less than ±1.5‰, the default filter configuration can be used without modification. If the fluctuation is more than ±1.5‰

## 11.5 Encoder zero-point correction

If the motor used is a servo motor of a brand other than AUCTECH, and the encoder is one of Tamagawa, Nikon, Panasonic or EnDat protocol, the encoder zero-point correction of the motor must be performed before the official operation. Otherwise, the direct use of servo motors without encoder zero-point correction will lead to lower performance of the drive, fault alarm, and in serious cases, risk of flywheel and other risks to the safety of personal equipment! Be sure to pay attention to.

- The following zero-point calibration is described for each encoder protocol type:
  Tamagawa, Nikon, Panasonic encoder zero-point correction
  Make sure the motor is in bare shaft condition (the shaft is completely off the load to ensure zero calibration accuracy).
  After correctly wiring and connecting the servo motor to the AD2 driver, use the KsServoTool debugging software on the PC to connect the AD2 driver.

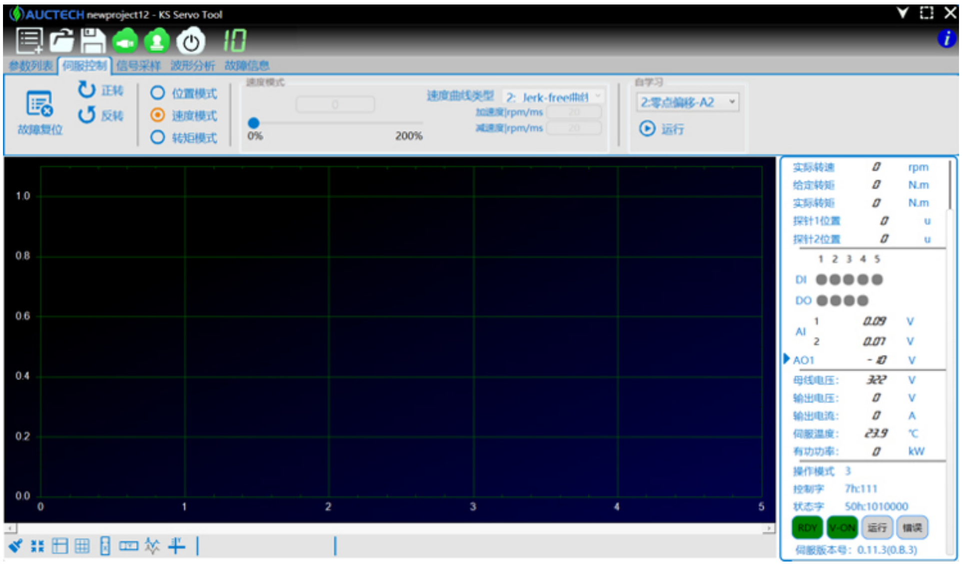
1) Select P00.02 control channel as "AD-Setup Commissioning Software Control" and download the parameters.



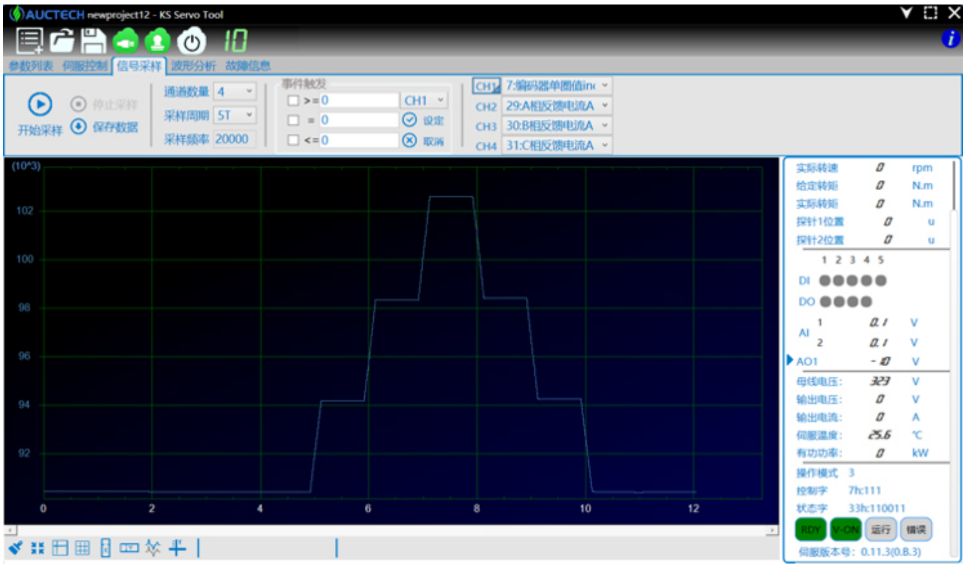
2) Confirm that the servo is currently alarm-free, accurately input and confirm the motor parameters of the third-party servo motor, P10.01~P11.0C; P20.01~P20.03 parameters are correct and then download the parameters and restart the servo control power.

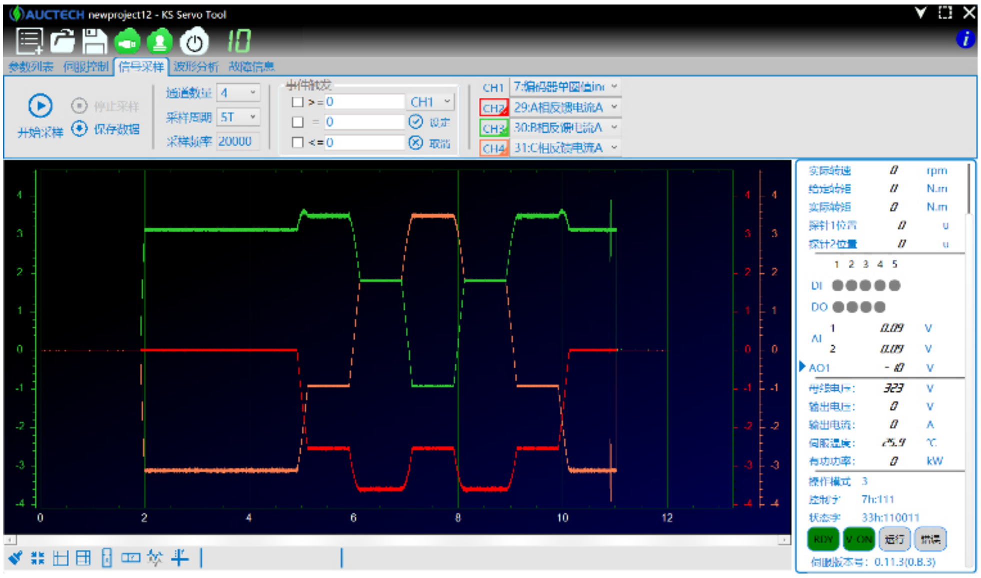
| | | | | | | |
|---|---|---|---|---|---|---|
| P10.01 | 0: 其他系列电机 | 0 | 6 | | 否 | 电机系利 |
| P10.02 | 0: 自定义电机 | 0 | 40 | | 否 | 电机型号 |
| P10.03 | 0: 同步电机 | 0 | 2 | | 否 | 电机类型 |
| P11.01 | 7.50 | 0.01 | 200 | kW | 否 | 电机额定功率 |
| P11.02 | 32.0 | 0.1 | 400 | A | 否 | 电机额定电流 |
| P11.03 | 38.4 | 0.1 | 400 | A | 否 | 电机静态电流 |
| P11.04 | 1500 | 1 | 30000 | rpm | 否 | 电机额定转速 |
| P11.05 | 1800 | 1 | 30000 | rpm | 否 | 电机最大转速 |
| P11.06 | 4 | 1 | 80 | Pn | 否 | 电机极对数 |
| P11.07 | 48.000 | 0.001 | 1000 | N.m | 否 | 电机额定转矩 |
| P11.08 | 0.05 | 0.01 | 1000 | ohm | 否 | 电机定子相电阻 |
| P11.09 | 0.39 | 0.01 | 1000 | mH | 否 | 电机D轴电感 |
| P11.0A | 0.39 | 0.01 | 1000 | mH | 否 | 电机Q轴电感 |
| P11.0B | 95.00 | 0.01 | 1000 | kc2 | 否 | 电机转子转动惯量 |
| P11.0C | 94 | 1 | 2000 | Vkr | 否 | 电机反电势常数 |

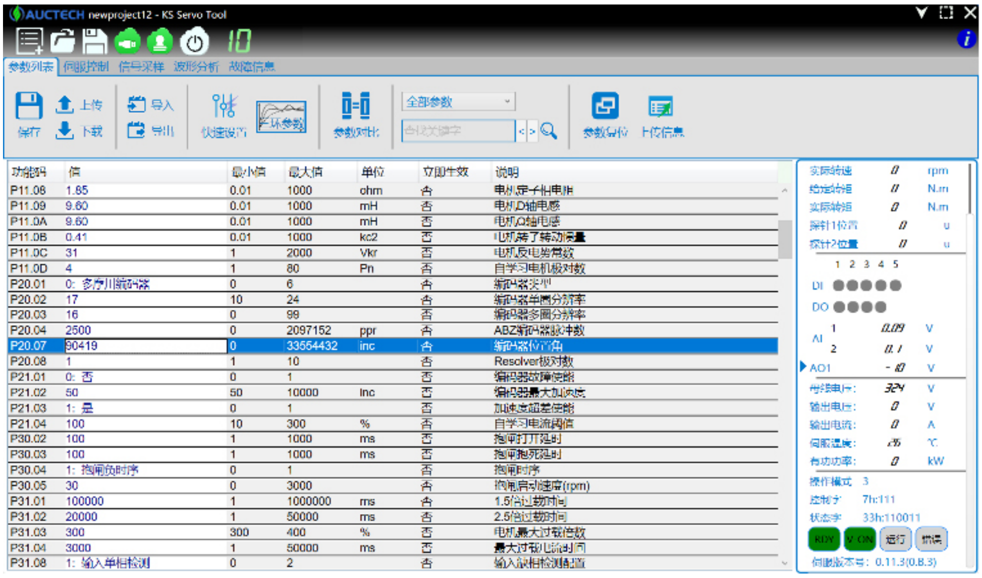
3) After reconnecting, switch the page to "Servo Control" page, find the self-learning area, select mode No. 2 "Zero Offset-A2", click the Run button below, and the servo motor will perform zero-point self-learning.




4) The normal encoder zeroing state is that the servo motor will automatically enable first, then the motor shaft will rotate counterclockwise 3 times (about 15° each time), then clockwise 3 times (about 15° each time), then the zeroing process will be completed, and the zeroing result will be written into the EEPROM of the motor encoder, the result will be read from the encoder EEPROM when the drive is powered up again, the zeroing result can be The zero calibration result can be uploaded in P20.07 for viewing.






This method can ensure that after the motor has been successfully zeroed and self-learned once, even if the motor is replaced by another AD2 drive, it does not need to be zeroed and self-learned again and can drive the motor directly. However, occasionally there may be some reasons for the failure of the zero calibration, then the corresponding alarm will be generated, please refer to the troubleshooting chapter for details.

**Caution**:

1) In some cases, the current loop Kp is too large, which may cause motor oscillation during zero calibration, resulting in false alarms such as out-of-phase, overload and so on. In this case, you can reduce the current loop Kp value (experience value Kp=0.54, Ti=100) and download it, and then perform the zero-calibration procedure again, usually it will be successful.
2) If the third-party motor of Panasonic encoder is only for trial, the above method is not recommended because once the zero-calibration result is written into the encoder EEPROM by "zero offset-A2", only the Servo Drive of Coopers & Lybrand can recognize the zero-calibration result in the future, and the original Panasonic drive may not recognize it.

Therefore, if the third-party motor is only for trial use, and later to use the original drive back to the case. We recommend using the "6: Zero Offset" zero calibration method, which follows the same procedure as the "Zero Offset-A2" method, except that the zero-calibration result of the "6: Zero Offset" method is not written to the EEPROM of the motor encoder, but to the EEPROM of the drive. The result is not written to the EEPROM of the motor encoder, but to the EEPROM of the drive. When the drive is re-powered, the result is read internally and the data in the original encoder EEPROM is not erased, so when the third-party motor is replaced with the original drive, it can continue to work normally. However, the problem is that the third-party motor must be matched one-to-one with a drive that has been zeroed using the "6: Zero Shift" calibration, and the drive will not operate properly when the motor is replaced by the drive, or the motor is replaced by the drive! Please be sure to pay attention to.

## 11.6 Third-party motor use

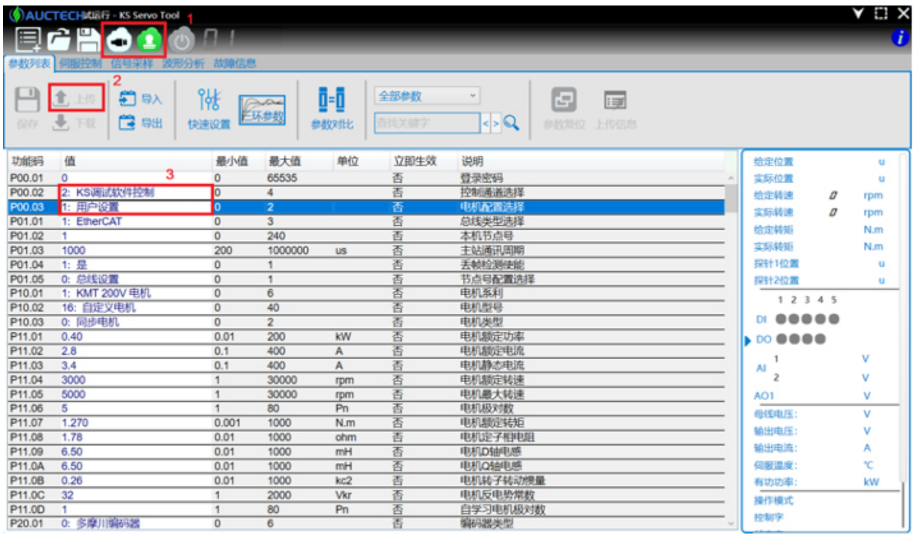
In practice, if you need to match the third-party servo motor, you need to strictly follow the following steps. Otherwise, the motor will not be used normally, and in serious cases, it will cause a danger to the safety of personal equipment such as flywheel, so please pay attention to it!

1) Verify that the servo motor type is a three-phase AC permanent magnet synchronous servo motor and that its voltage level matches the AD2 drive.
2) Confirm that the servo motor encoder type is one of the Tamagawa, Nikon, or Panasonic protocols.
3) Verify that the encoder pinout is securely connected according to the AD2 driver pinout definition, as described in the Wiring section.
4) Confirm that the power line phase sequence is correct (in some cases, the power line phase sequence may be reversed due to manufacturer's customization, so be sure to pay attention when using it).
5) Modify the parameters related to motor settings in the driver and download and save them.
6) After connecting the Servo Drive, log in with the "58Ks" advanced password.

Upload parameters.

Modify the control channel to "AD Commissioning Software Control".

Modify the motor configuration by selecting "User Settings", download the parameters and power off and restart.




7) Confirm that the motor parameter data is filled in correctly
8) Modify motor series as "0 other series motors"
9) Modify the motor model to "0 custom motor"
10) Motor type is "0 synchronous motor"
11) According to the data provided by the third-party motor manufacturer, fill in the P11.01~P11.0C motor parameters correctly.

Note: that the inductance and resistance in the AD2 drive motor parameters are phase-to-phase values; the unit of rotational inertia is kgcm²; and the unit of counter EFM is V/1000rpm.

| | | | | | | |
|---|---|---|---|---|---|---|
| P10.01 | 0: 其他系列电机 | 0 | 6 | | 否 | 电机系列 |
| P10.02 | 0: 自定义电机 | 0 | 40 | | 否 | 电机型号 |
| P10.03 | 0: 同步电机 | 0 | 2 | | 否 | 电机类型 |
| P11.01 | 7.50 | 0.01 | 200 | kW | 否 | 电机额定功率 |
| P11.02 | 32.0 | 0.1 | 400 | A | 否 | 电机额定电流 |
| P11.03 | 38.4 | 0.1 | 400 | A | 否 | 电机静态电流 |
| P11.04 | 1500 | 1 | 30000 | rpm | 否 | 电机额定转速 |
| P11.05 | 1800 | 1 | 30000 | rpm | 否 | 电机最大转速 |
| P11.06 | 4 | 1 | 80 | Pn | 否 | 电机极对数 |
| P11.07 | 48.000 | 0.001 | 1000 | N.m | 否 | 电机额定转矩 |
| P11.08 | 0.05 | 0.01 | 1000 | ohm | 否 | 电机定子相电阻 |
| P11.09 | 0.39 | 0.01 | 1000 | mH | 否 | 电机D轴电感 |
| P11.0A | 0.39 | 0.01 | 1000 | mH | 否 | 电机Q轴电感 |
| P11.0B | 95.00 | 0.01 | 1000 | kc2 | 否 | 电机转子转动惯量 |
| P11.0C | 94 | 1 | 2000 | Vkr | 否 | 电机反电势常数 |

12) Confirm that the encoder parameters are filled in correctly.

Fill in the encoder parameters P11.01~P11.0C correctly according to the data provided by the third-party motor manufacturer.

If the encoder is a multi-turn absolute encoder and the actual position of the multi-turn needs to be recorded, parameter P21.01 needs to be set to "1".

Modify the position tracking threshold size, typically to the resolution of one revolution of the encoder. For example, the 23-bit encoder is set to 8388608, the 20-bit encoder is set to 1048576, and the 17-bit encoder is set to 131072.

| | | | | | | |
|---|---|---|---|---|---|---|
| P20.01 | 0: 多摩川编码器 | 0 | 6 | | 否 | 编码器类型 |
| P20.02 | 23 | 10 | 24 | | 否 | 编码器单圈分辨率 |
| P20.03 | 16 | 0 | 99 | | 否 | 编码器多圈分辨率 |

| | | | | | | |
|---|---|---|---|---|---|---|
| P21.01 | 1: 是 | 0 | 1 | | 否 | 编码器故障使能 |

| | | | | | | |
|---|---|---|---|---|---|---|
| P60.0C | 8388608 | 0 | 16777216 | inc | 否 | 位置跟踪误差阈值 |

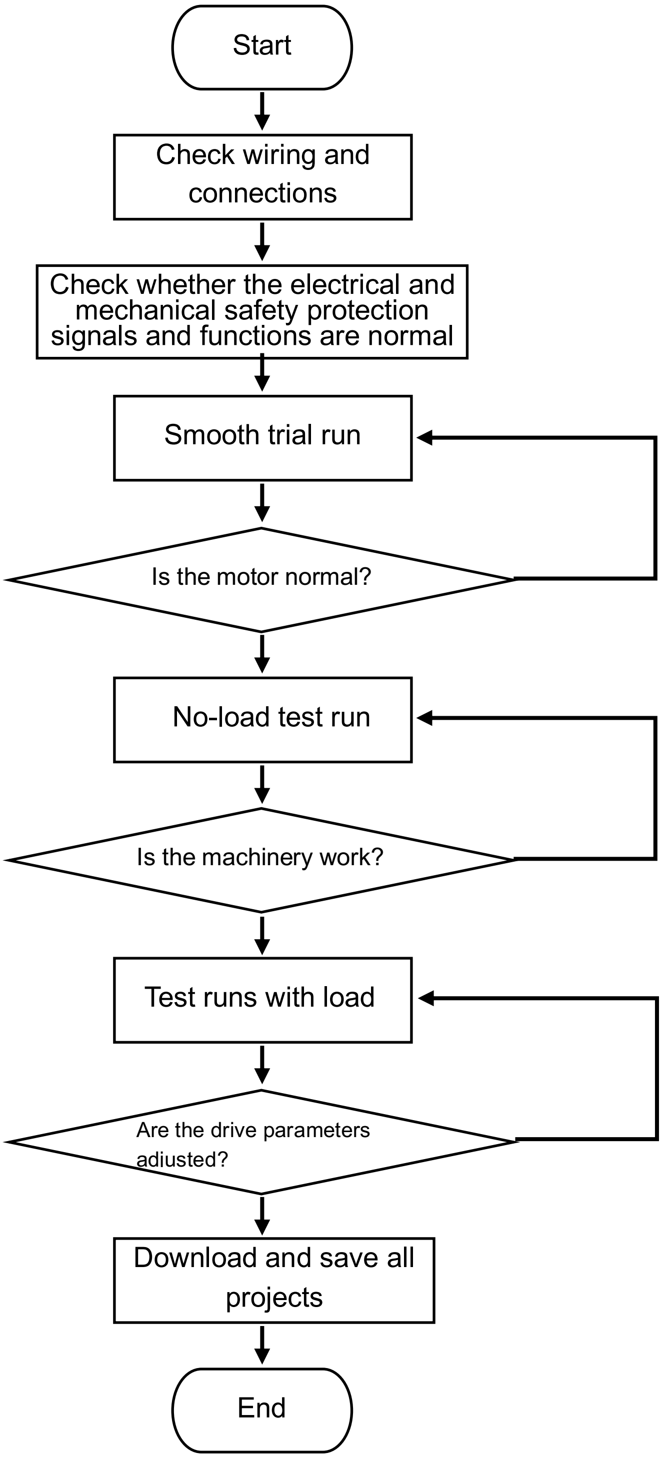
13) Download the parameters and restart the servo drive power supply.
14) Perform encoder zeroing operation (operate according to the encoder zeroing section).
15) No-load test run.
16) Test runs with load.

**Note**: When using a third-party motor, be sure to confirm that the motor current, overload factor, voltage level and other parameters match the AD2 drive.

# 11.7 Trial run with ADServoTool commissioning software

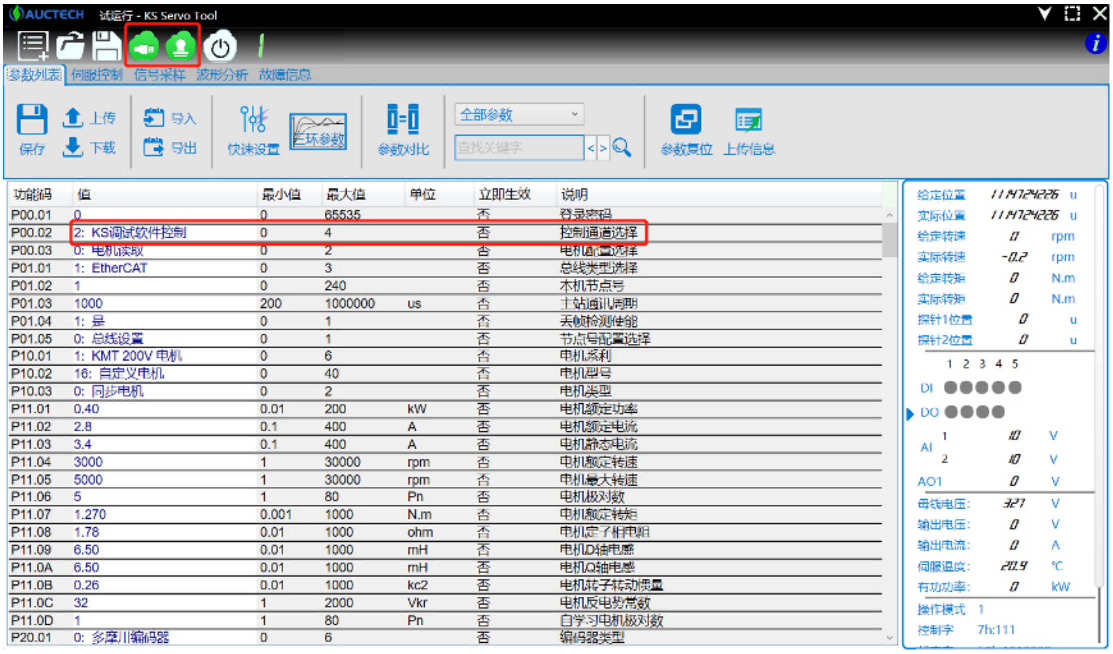
To check the effect of servo parameter adjustment and mechanical condition, please use ADServoTool commissioning software for trial run first to make sure the drive parameters, electrical connection, signal, and mechanical are correct.

For the trial run, follow these steps:

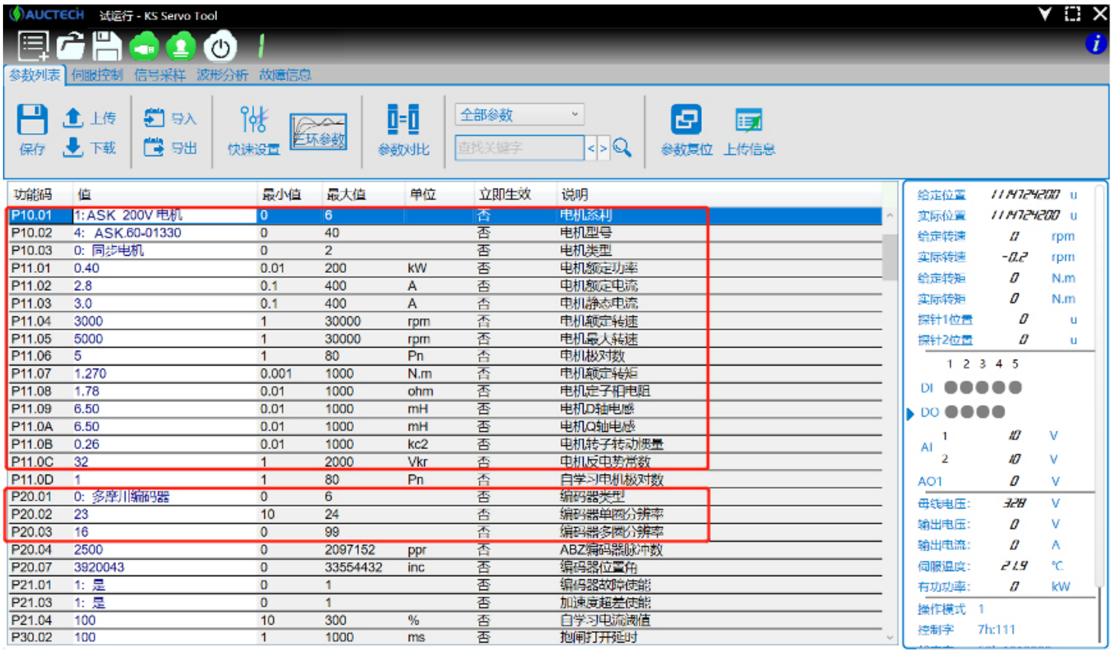



- After making sure the wiring and connections are correct, use the "ADServoTool" software on the PC to connect the drive.

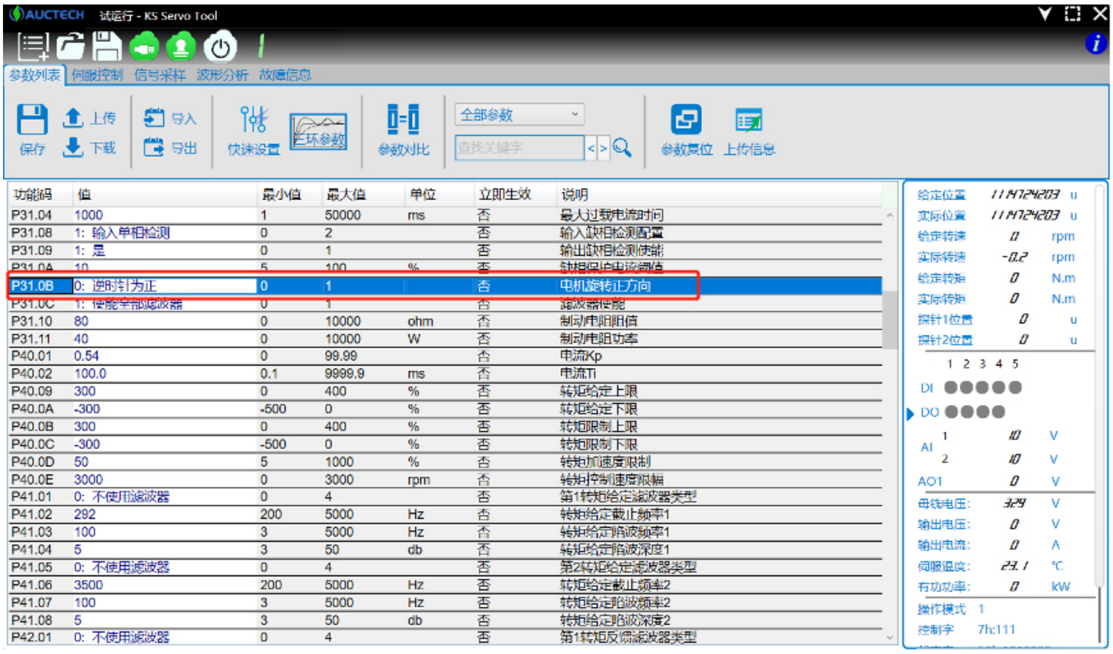
1) After uploading the parameters, change the control channel selection to "KS commissioning software control" and download and save.



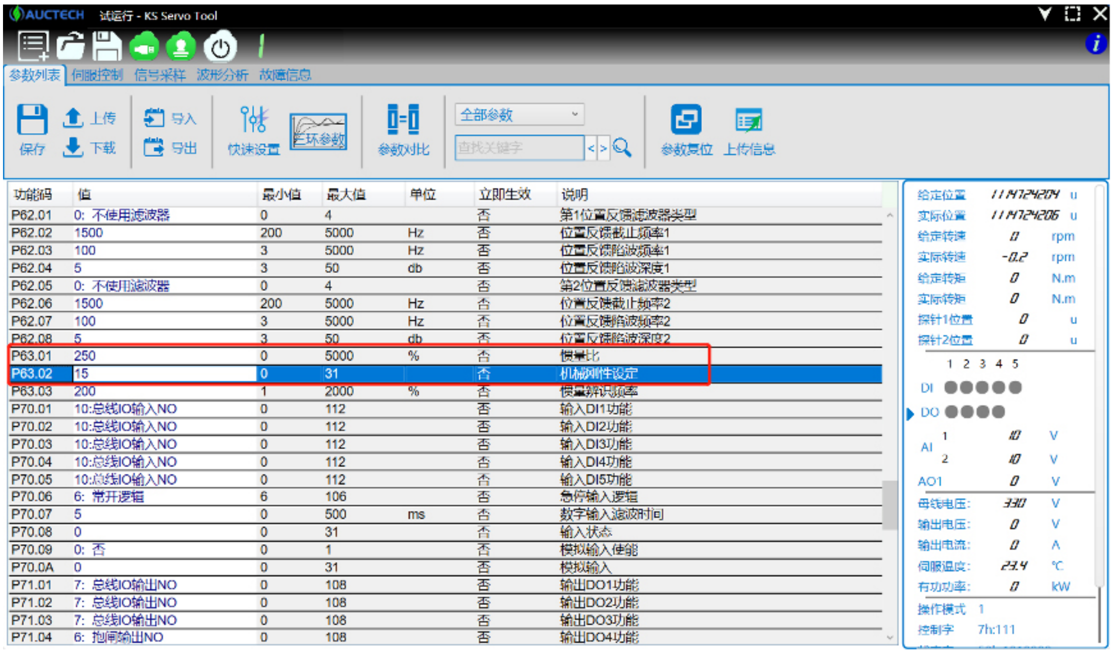

2) Upload the parameters again and confirm that the motor data and encoder-related settings are consistent with the actual motor.



3) Confirm that the direction of motor rotation is the same as the actual desired direction.



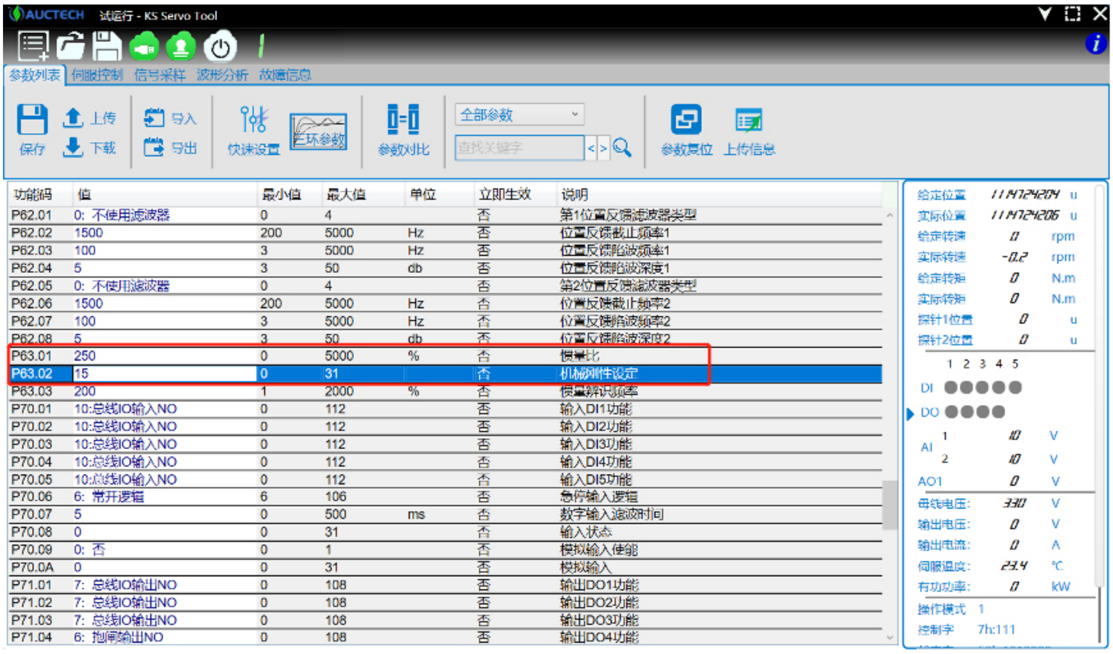

4) To check whether the stiffness setting, and inertia ratio are within a reasonable range, please refer to the table "Experienced values of stiffness level for general applications".



5) Select the appropriate operating mode according to the load.

- Speed runs using commissioning software:

Speed mode operation means that the servo motor runs continuously according to the set acceleration and deceleration speed with the target speed.




a) Click the toolbar "Enable" button to enable the servo.

b) Select the operation mode as "Speed Mode".

c) Set the speed curve type and acceleration/deceleration speed.

d) Fill in the running speed (or drag the scroll bar below to set) in percentage 100% = rated motor speed, it is recommended to set a lower running speed for easy observation, for example 2% or 5%.

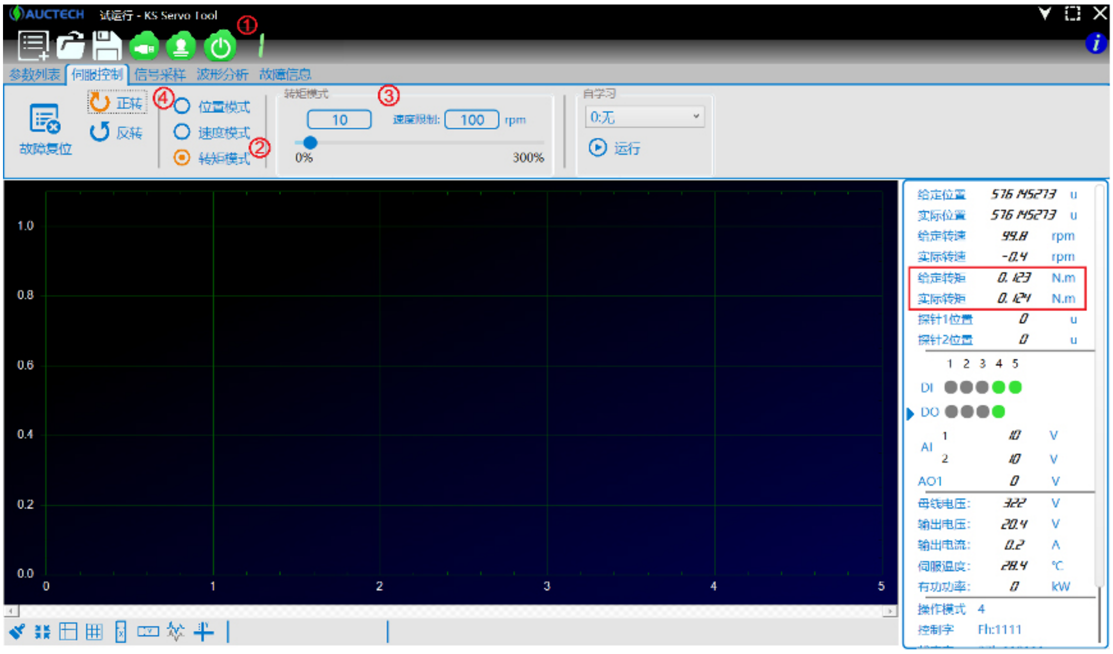
e) Triggering the forward (or reverse) button will move at the set speed and clicking the forward (or reverse) button again will stop the movement command.

f) After starting the motion, you can see the current given speed and the actual speed in the actual status area on the right side.

**Note**: The speed operation mode is suitable for applications with no mechanical limits and no mechanical interference, such as conveyor belts, conveying rollers, rewinding, and unwinding. The motion mode should not be used for applications with mechanical limits, such as screws, to prevent overtravel or collision of machinery by misoperation, which may cause harm to personal equipment.

- Torque runs using commissioning software:

Torque operation mode means, after setting the target torque and speed limit value. If the actual torque does not reach the target torque, it will continuously accelerate to the set speed limit value. If the actual torque reaches or exceeds the target torque, the motor will output according to the set torque, and the speed and position on the motor shaft will be determined by the actual external load at this time. For example, if 10% target torque is set and the force of external load is also at 10%, the motor shaft will be stationary; if the external load force is greater than 10%, the motor shaft will be dragged to move in the direction of super load force.
During the commissioning of some stations, the torque mode is used to simulate the actual operation. In this case, it is important to pay attention to the correct setting of torque and speed limits.



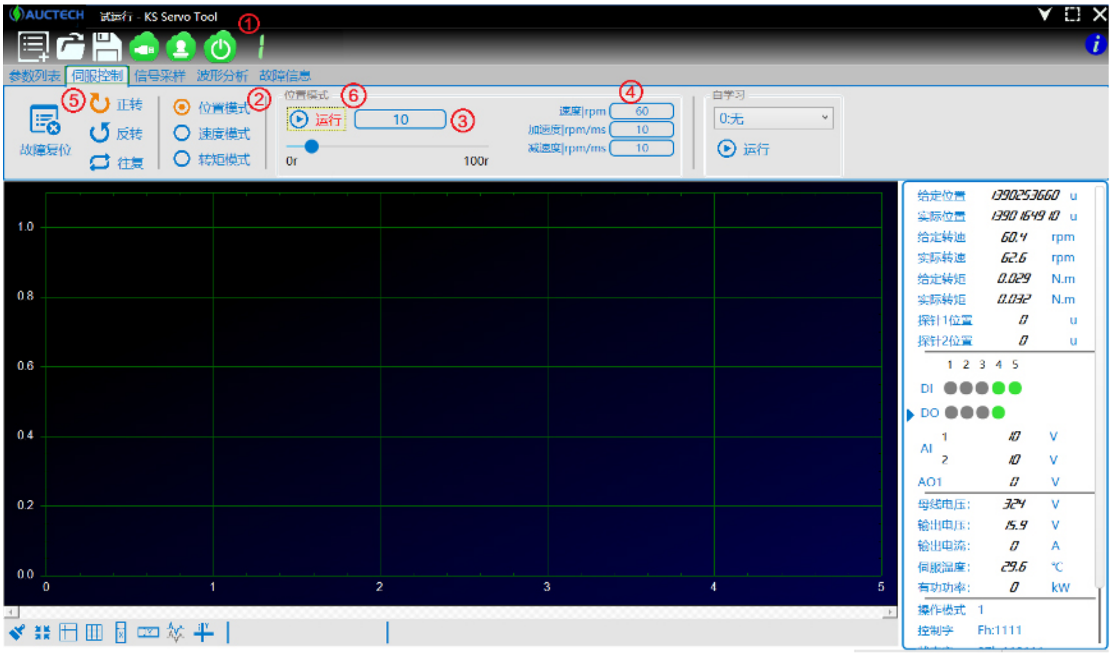

a) Click the toolbar "Enable" button to enable the servo.
b) Select the operation mode "Torque mode" in the function area.
c) Set the running torque and speed limit, the running torque is in percentage, 100% = rated torque of the motor. The speed limit refers to the maximum speed during torque mode and is generally used to set a limit speed to protect machinery or materials when the set torque is not reached. The unit is RPM.
d) Triggering the forward (or reverse) button will move according to the set target torque and speed limit and clicking the forward (or reverse) button again will stop the motion command.

After starting the movement, the current given torque and the actual torque can be seen in the actual status area on the right side.

Note: Please be sure to set the torque target value and speed limit value correctly in the torque operation mode, otherwise the machine may be overtraveled or collided due to misoperation, which may cause harm to personal equipment.

- Position mode operation using debugging software:

Position mode means relative positioning control according to the set target position, target speed, acceleration, and deceleration, etc. It is suitable for applications with mechanical limit requirements.




a) Click the toolbar "Enable" button to enable the servo.

b) In the ribbon, select the operation mode as "Location Mode".

c) Set the relative target distance in laps, with a maximum setting of 100 laps.

d) Target speed and acceleration/deceleration settings, note that the acceleration/deceleration unit is rpm/ms.

e) Trigger the forward (or reverse) button to select the direction of relative positioning movement.

f) Triggering the "Run" button in the blinker will perform the relative positioning movement according to the set target distance and speed.

Note: In 0.9.3 and previous versions of the debugging software, once the relative positioning motion starts, the motion cannot be interrupted. If it must be interrupted in an emergency, the motion can be stopped by breaking the enable, or by triggering the external emergency stop button. However, currently, it is necessary to consider the risk of stopping when the load stops freely. To avoid such situations, please use the latest version of AUCTECH commissioning software!

# 11.8 Sampling and analysis of data by commisioning software

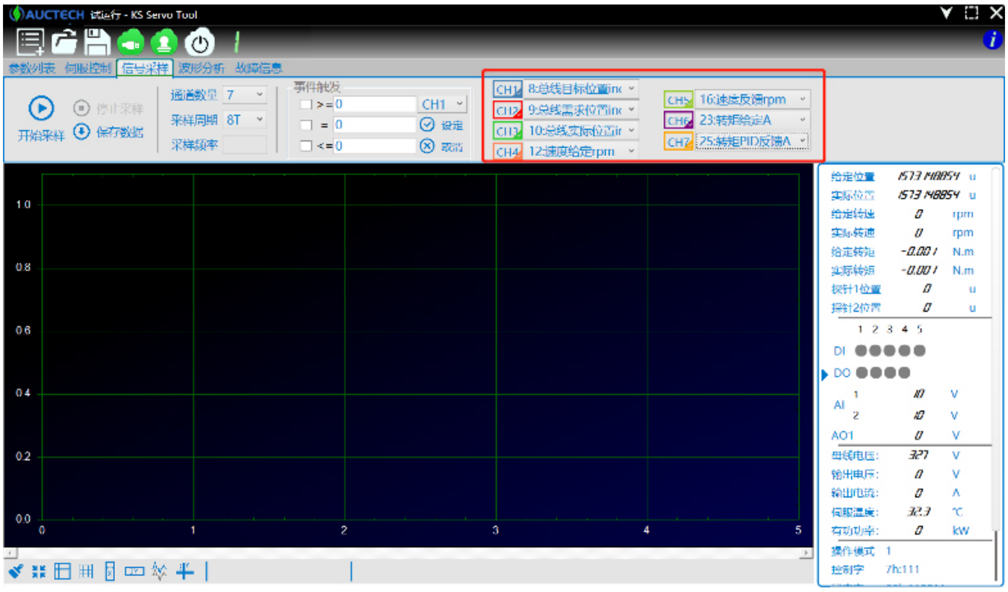
## 10.8.1 Signal Sampling

Usually, the commissioning process needs to analyze the curve data to determine whether the gain parameters have optimization space and adjustment direction.

- The following describes the steps of signal sampling:
  1) Open the debug software, connect the servo driver, and find the "Signal Sampling" page.
  2) Configure the data channels that need to be acquired. In general, we help analyze whether the system gain is appropriate by monitoring the following channels

| Passage | Explanation |
|---|---|
| 8 | The target location under the main line, unit inc. |
| 9 | The driver automatically interpolates the "target position from the bus" into the subdivided demand position, unit inc, according to the bus control cycle and the position loop cycle. |
| 10 | Actual feedback position, unit inc |
| 12 | The speed loop gives the speed in rpm. |
| 16 | Actual feedback speed in rpm. |
| 23 | The current loop gives the current in A. |
| 25 | Actual feedback current in A. |

Note: Channel 8 only has data when the upper computer is controlled, and the channel is meaningless when using AD commissioning software.



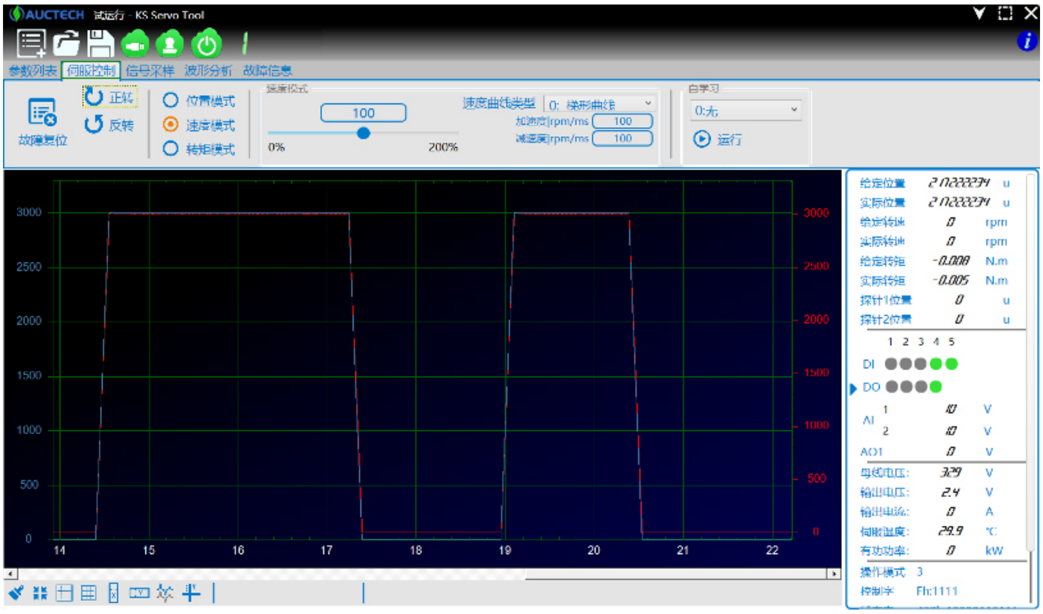
## 10.8.2 Example of speed loop gain adjustment

The following is an example of how to better adjust the speed loop gain by collecting and analyzing data curves.

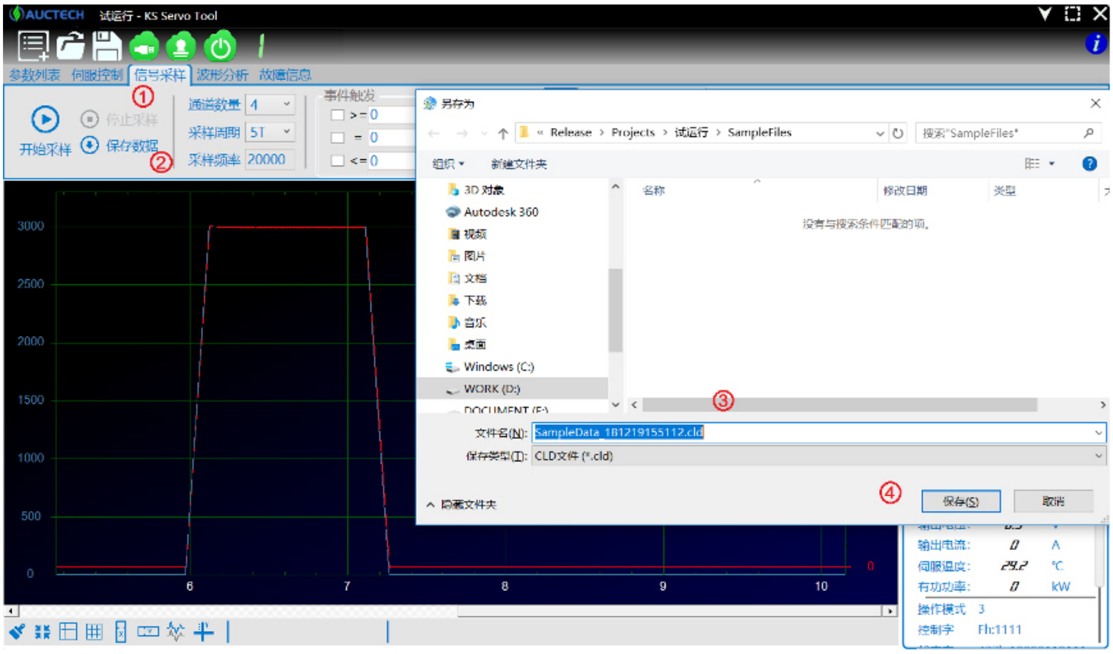
1) After successfully connecting the servo driver, configure the relevant channels, select 12, 16, 23, 25 channels for data acquisition, and click the "Start Sampling" button for data sampling.


2) On the servo control page, select the speed mode after enabling, set the target speed and curve type and acceleration/deceleration.

Here we set 100% target speed; the curve is trapezoidal; acceleration and deceleration can be set to 100rpm/ms because it is no-load. click the forward button to trigger the motion, and the data on the monitoring page below will then change.



**3)** Save the collection data.




a) Stop current sampling

b) Save the current sampling data

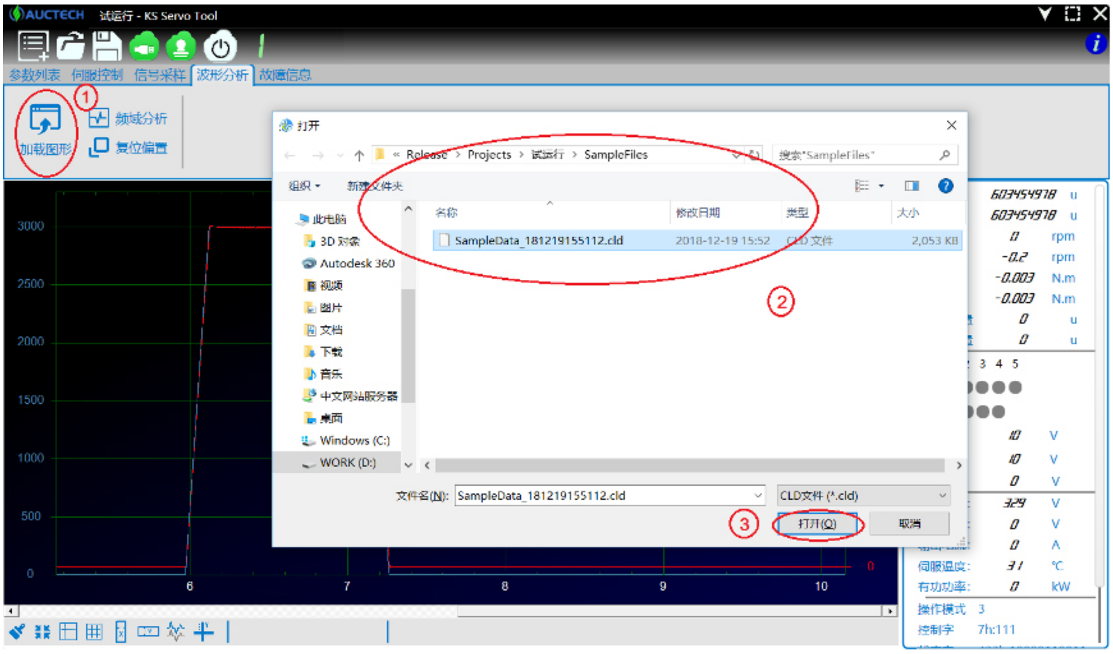
c) Select the path and name the save file name. By default, it will be saved in the current project folder with the current system date as the file name.

d) Save as a sample file.

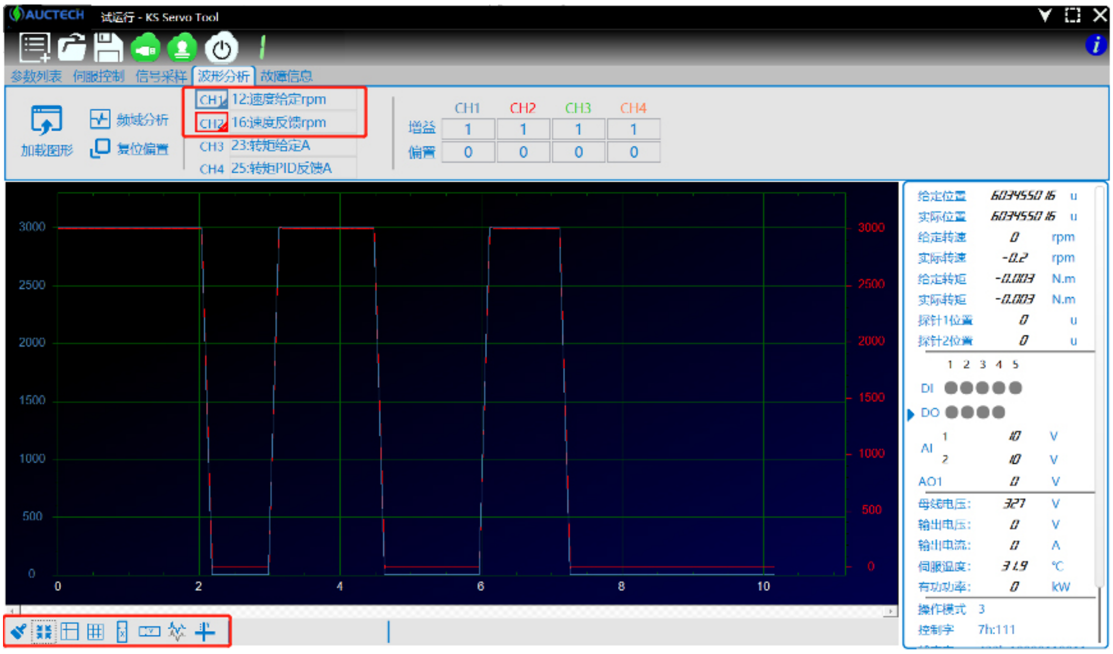
Note: The maximum number of data points for a single save file is 600,000, beyond this size, only 600,000 data points can be saved before the end of sampling (data points, one data point per channel in each sampling period. The shorter the sampling period, the more samples, the shorter the total recording time accordingly).

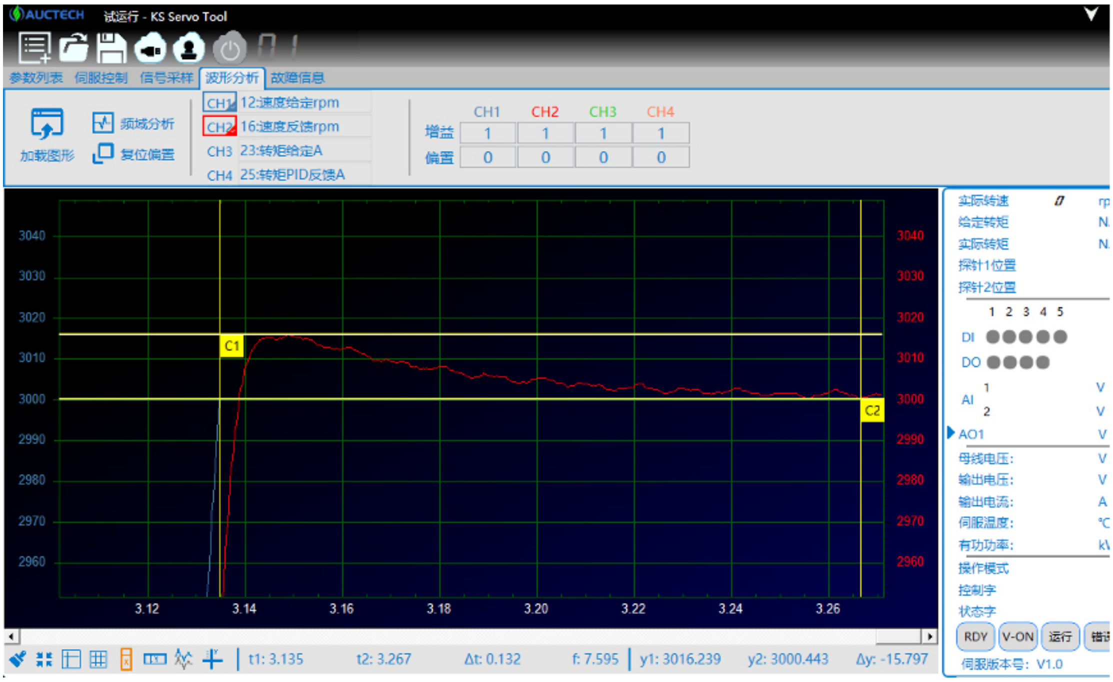
- Waveform Analysis

After sampling the waveform file, it can be imported for detailed analysis.



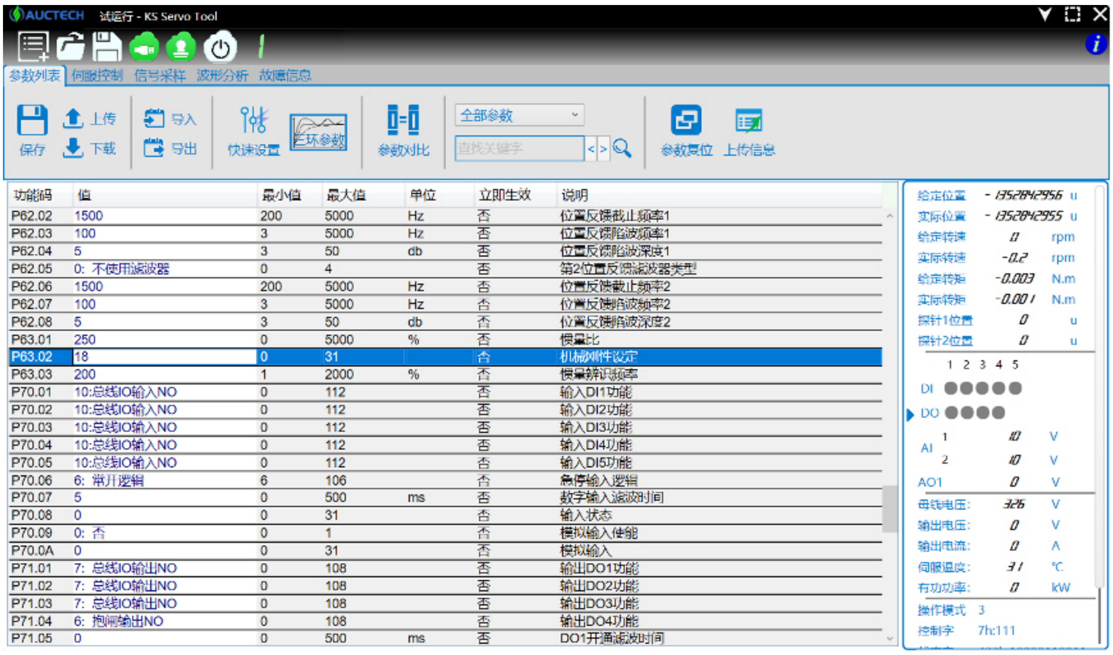

Click the "CH" icon on the left side of the data channel and check the data to be analyzed. The tool control below allows you to zoom in and out, restore, cursor measurement, align data coordinates, and other operations.






By vernier measurement, it was found that the overshoot was 5‰, and there was no repeated adjustment, and it could converge to the target speed within 132ms, so it was within the acceptable range and generally no optimization was needed.

However, we try to increase the system rigidity to 18, download and save. Run again at the same speed and observe the effect of the changes.




After changing the rigidity of the system, the performance changed significantly, and the overshoot was reduced to 2.6‰.

Note: This is only a demonstration of the adjustment under no-load condition, the actual system rigidity with load is too large, but more likely to cause overshoot and oscillation, please consider the appropriate system gain according to the actual situation when adjusting.

## 10.8.3 General experience of waveform analysis

1) For current waveform analysis

When the servo is in position mode or velocity mode, the current feed mainly depends on the first two links, so it is only necessary to observe that the actual current waveform does not oscillate, has no burr, and can follow the current feed waveform better. That is, the current loop response is considered good, and no optimization is needed.

When a burr occurs, the first thing to analyze is whether it is caused by the given current. If it is not caused by the given current, you need to analyze whether the grounding is good, whether there is resonance, etc. The current loop TI can be adjusted appropriately, and second-order filtering can also be given to the current feedback.

2) For velocity waveform analysis

The main consideration is whether the actual speed feedback follows well, whether there is overshoot, oscillation. Whether the speed convergence time is too long, etc. If the actual speed feedback has a more serious burr, it needs to analyze whether the grounding is good, whether there is resonance and so on. The speed loop TI can be adjusted appropriately, and second-order filtering can also be applied to the speed feedback.

3) For position waveform analysis

Generally, when the speed loop gain is adjusted correctly, the position loop is guaranteed, and only the actual position response needs to be considered at this point.

# Section 12 Fault information and handling

## 12.1 Troubleshooting

Failure at start-up and handling

Start normal process

Drive wiring is correct, motor connection is normal

LED start-up process display

Power-on initialization in progress

Drive is ready

Main power is on

- The general phenomenon of abnormal starting and how to deal with it.

| Failure phenomenon | Reason | Confirmation method |
|---|---|---|
| Digital tube does not light up | Control power supply voltage failure | Measure the AC voltage between L1c, L2c, normal should be AC220V. |
| | Firmware burn-in switch position error | Check that the firmware burn-in switch is at 0. |
| | Servo drive failure | Please contact AUCTECH after-sales service. |
| LED left one uppermost horizontal not light | Initialization failure or internal driver failure. | Please contact AUCTECH after-sales service. |
| LED left a middle cross not light | RST main power is not on, or the LED is damaged. | Measure the AC voltage across the RST, see the product information section for standard values. |
| LED with fault code flashing | Refer to the troubleshooting section to find the cause and troubleshoot | |
| After the above troubleshooting, restart the power supply, the LED panel should be the display when the main power has been turned on. | | |

# 12.2 Fault Code List

## 11.2.1 Fault classification

Servo Drive failures and warnings are graded according to severity and can be divided into three classes, class 1, class 2, and class 3. On the severity level, class 1 > class 2 > class 3, the specific classification is as follows:

Class 1 Non-resettable faults.

Class 2 Resettable faults.

Class 3 Resettable warnings.

Resettable means that the fault display can be cleared after a reset signal is given.

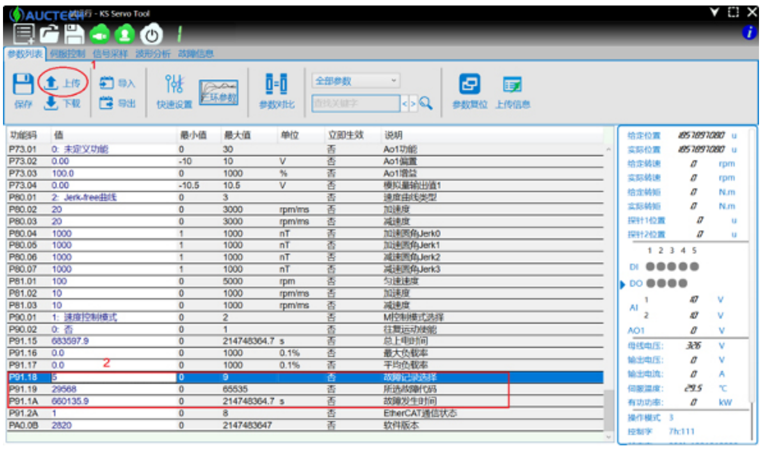
- There are three ways of resetting the operation:
  1) Fault reset using LED panel, valid only for panel control.
  2) Reset using the AD commissioning software interface reset button, valid only when controlled by AD commissioning software.
  3) The reset operation of bit7 of control word 6040 using the upper computer is valid only when the upper computer is controlling.

## 11.2.2 Fault and warning logs

The AD2 Servo Drive has a fault log function that records the last 10 faults and warning codes, as well as the system time when the fault occurred. After the fault or warning is reset, the fault record will still save the change of fault and warning.

- Through the AD commissioning software or LED panel, the fault code records can be retrieved and accessed as follows:

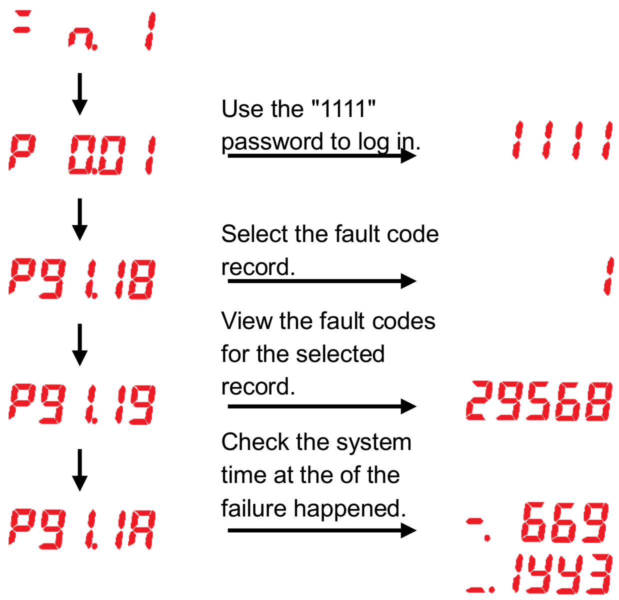
  Use AD commissioning software to view historical fault records
- Use USB to connect the driver with the commissioning software on PC.



1. Click Upload Parameters to upload the driver information.
2. The history of faults can be displayed in the three parameters P91.18, P91.19 and P91.1A.

| Parameter Code | Examples | Explain by example |
|---|---|---|
| P91.18 | 0 | The most recent fault, with larger numbers representing earlier faults, the maximum number being 9. |
| P91.19 | 29568 | This is shown as a decimal number, need to manually convert to hexadecimal, decimal 29568 that is, 7380 in hexadecimal, that is, E73.80 Encoder connection failure. |
| P91.1A | 660135.9 | The system time in seconds of the fault happened. |

- Use the LED panel to view fault logs




Note: The unit of the parameter P91.1A in the LED panel is 0.1S.

### 11.2.3 List of fault codes

| LED display | Fault Definition | Fault Type | Fault stopping time sequence (*1) | CiA402 fault code |
|---|---|---|---|---|
| no.SS | Emergency stop effective | - | - | / |
| no.STO | STO function in effect | - | - | / |
| E.2230 | Busbar overcurrent | Resettable fault | 1 | 2230h |
| E.2310 | Continuous overcurrent | Non-resettable fault | 1 | 2310h |
| E.2320 | Output overcurrent | Non-resettable fault | 1 | 2320h |
| E.2340 | Software Overcurrent | Resettable fault | 1 | 2340h |
| E.2350 | Module overload (I²T) | Non-resettable fault | 1 | 2350h |
| E.3130 | Input out of phase | Resettable fault | 0 | 3130h |
| E.3210 | Servo overvoltage | Resettable fault | 0 | 3210h |
| E.3220 | Servo undervoltage | Resettable fault | 1 | 3220h |
| E.3380 | Output phase sequence error | Resettable fault | 1 | 3380h |
| E.3381 | Output out of phase | Resettable fault | 1 | 3381h |
| E.4310 | Servo overtemperature | Resettable | 0 | 4310h |
| E.5210 | Power ID error | Non-resettable fault | 1 | 5210h |
| E.5280 | Driver internal error 1 | Non-resettable fault | 1 | 5280h |
| E.5281 | Driver internal error 2 | Non-resettable fault | 1 | 5281h |
| E.5282 | Driver internal error 3 | Non-resettable fault | 1 | 5282h |
| E.5283 | Inertia identification error | Resettable fault | 0 | 5283h |
| E.5284 | Parameter check error | Resettable fault | 0 | 5284h |
| E.5480 | Servo overload | Resettable fault | 1 | 5480h |
| E.7180 | Motor overload (I²T) | Resettable fault | 0 | 7180h |
| E.7182 | Braking resistor overload | Resettable fault | 0 | 7182h |
| E.7380 | Encoder connection error | Resettable fault | 1 | 7380h |
| E.7381 | Encoder battery undervoltage | Non-resettable fault | 0 | 7381h |
| E.7382 | Encoder battery disconnected | Non-resettable fault | 0 | 7382h |
| E.7383 | Encoder overheating | Non-resettable fault | 0 | 7383h |
| E.7384 | Encoder count error | Non-resettable | 1 | 7384h |

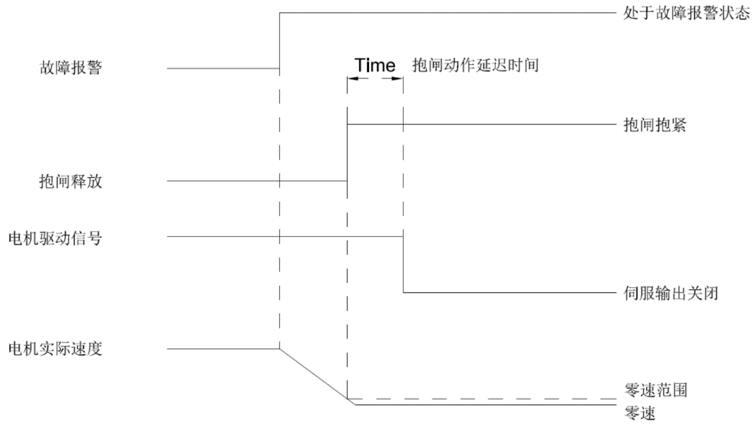
| LED display | Fault Definition | Fault Type | Fault stopping time sequence (*1) | CiA402 fault code |
|---|---|---|---|---|
| | | fault | | |
| E.7385 | Encoder overspeed | Resettable fault | 1 | 7385h |
| E.7386 | Internal encoder failure | Non-resettable fault | 1 | 7386h |
| E.7387 | Motor information error | Resettable fault | 1 | 7387h |
| E.7388 | Missing encoder zero point | Resettable fault | 1 | 7388h |
| E.7581 | EtherCAT Communication Failure | Resettable fault | 0 | 7581h |
| E.7582 | Wrong sync period setting | Resettable fault | 0 | 7582h |
| E.7591 | EtherCAT communication initialization error | Resettable fault | 0 | 7591h |
| E.7592 | ECAT EEPROM error | Resettable fault | 0 | 7592h |
| E.8480 | Same direction speeding | Resettable fault | 1 | 8480h |
| E.8481 | Reverse speeding | Resettable fault | 1 | 8481h |
| E.8482 | Exceeds maximum speed | Resettable fault | 0 | 8482h |
| E.8483 | Excessive speed tracking error | Resettable fault | 0 | 8483h |
| E.8484 | Super poor acceleration | Resettable fault | 1 | 8484h |
| E.8485 | Motor stall | Resettable fault | 1 | 8485h |
| E.8611 | Excessive position deviation | Resettable fault | 0 | 8611h |
| E.8612 | Instruction given to detect exceptions | Resettable fault | 0 | 8612h |
| E.8613 | Positive motion prohibition | Resettable fault | 0 | 8613h |
| E.8614 | Reverse motion prohibition | Resettable fault | 0 | 8614h |

Note:
1. SS is used to indicate that the servo is in the emergency stop state, which is a normal status display and does not represent servo failure.
2. STO is used to indicate that the servo is in STO status, which is a normal status display and does not represent servo failure.

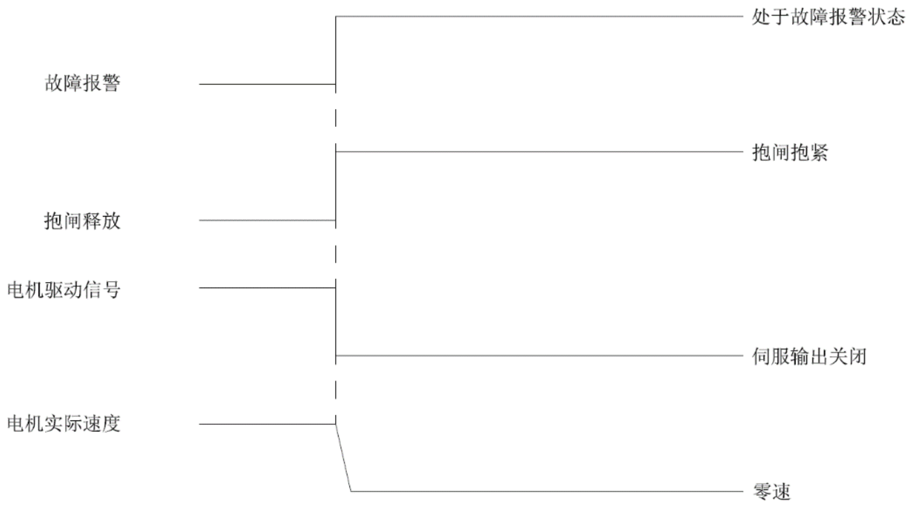
- Explanation of Fault Stop Timing

Fault Stop Timing 0: means that the drive is still controllable when this fault occurs. After a fault occurs, the drive internally uses an emergency stop to reduce the motor speed to the zero-speed range, after which the contracting brake is shut off (if the motor has a contracting brake) before finally shutting down the motor output.

- Fault Stop Timing 0 Timing Chart




- Fault Stop Timing 1: means that the drive is not controllable at the time of this fault. Immediately after the fault occurs, the drive will shut down the contracting brake (if the motor has a contracting brake) and shut down the motor output at the same time.
- Fault Stop Timing 1 Timing Chart



### 11.2.4 Troubleshooting methods

1) LED display: no.SS

| Reason | Treatment |
|---|---|
| Servo emergency stop function is triggered | Checking that the external emergency stop button has not been pressed.<br>Checking external emergency stop lines for broken wires or other causes.<br>Check that the emergency stop input signal logic is consistent with the valid logic configured in the servo drive.<br>Check that the emergency stop wiring is correct according to the wiring section in the user manual. |

2) LED display: no.STO

Fault definition: STO function is in effect

Mechanism: Since the STO function is normally closed, signal triggering, line interruption, unconnected terminals, and incorrect use of high- and low-level logic will cause the STO function to take effect, resulting in this state.

| Reason | Treatment |
|---|---|
| Servo STO function is triggered | Checking that the external STO button is triggered.<br>Checking external STO lines for disconnections or other causes.<br>Whether the STO terminal is loose or missed.<br>Check that the STO wiring is correct according to the wiring section in the user manual. |

3) LED display: E.2230

Fault definition: Busbar overcurrent

Mechanism: The servo internally detects that the current on the DC bus is greater than the overcurrent point specified by the driver.

| Reason | Treatment |
|---|---|
| DC bus voltage is too high | Checking whether the grid voltage is too high.<br>Check for rapid shutdown of large inertia loads, or no energy braking. |
| There is a short circuit on the outside | Test the servo power output wiring for short circuit, short circuit to ground, and short circuit to brake resistor. |
| Encoder failure | Checking that the encoder is not damaged and that the grounding is correct.<br>Check whether the encoder cable shield is well grounded and whether there are strong interference sources near the cable. |
| Servo internal device damage | Please contact the after-sales staff for maintenance by professional technicians. |

4) LED display: E.2310

Fault definition: Continuous overcurrent

Mechanism: The servo detects multiple module overcurrents within a short period of time.

| Reason | Treatment |
|---|---|
| There is a short circuit on the outside | Test the servo power output wiring for short circuit, short circuit to ground, and short circuit to brake resistor. |
| Encoder failure | Check that the encoder is not damaged and that the grounding is correct.<br>Check whether the encoder cable shield is well grounded and whether there are strong interference sources near the cable. |
| Motor parameters or wiring errors | The actual motor used does not match the motor parameters set by the user, for example, the actual motor is 4 pairs of poles, and the configuration is 5 pairs of poles. Or the motor encoder is 17 bits, the configuration is 23 bits, etc.<br>The motor encoder is not zeroed, or the zeroing data is missing.<br>Motor wiring failure, such as power line phase short circuit, etc. |
| External load causes | The load inertia ratio is too large, causing the motor to fly after this fault is easily caused. |
| Servo internal device damage | Please contact the after-sales staff for maintenance by professional technicians. |

5) LED display: E.2320

Fault definition: Output overcurrent

Mechanism: The servo internally detects that the phase current is greater than the overcurrent point specified by the driver.

| Reason | Treatment |
|---|---|
| DC bus voltage is too high | Checking whether the grid voltage is too high.<br>Check for rapid shutdown of large inertia loads, or no energy braking. |
| There is a short circuit on the outside | Test the servo power output wiring for short circuit, short circuit to ground, and short circuit to brake resistor. |
| Encoder failure | Check that the encoder is not damaged and that the grounding is correct.<br>Check whether the encoder cable shield is well grounded and whether there are strong interference sources near the cable. |
| Motor parameters or wiring errors | The actual motor used does not match the motor parameters set by the user, for example, the actual motor is 4 pairs of poles, and the configuration is 5 pairs of poles. Or the motor encoder is 17 bits, the configuration is 23 bits, etc.<br>The motor encoder is not zeroed, or the zeroing data is missing.<br>Motor wiring faults, such as power line phase shorts, etc. |
| External load causes | The load inertia ratio is too large, causing the motor to fly after this fault is easily caused.<br>Load jamming. |
| Servo internal device damage | Please contact the after-sales staff for maintenance by professional technicians. |

6) LED display: E.2340

Fault Definition: Software Overcurrent

Mechanism: The servo output phase current sampling value is greater than the overcurrent point specified by the servo driver.

| Reason | Treatment |
|---|---|
| There is a short circuit on the outside | Test the servo power output wiring for short circuit, short circuit to ground, and short circuit to brake resistor. |
| Encoder failure | Check that the encoder is not damaged and that the grounding is correct.<br>Check whether the encoder cable shield is well grounded and whether there are strong interference sources near the cable. |
| Motor failure | The actual motor used is not the same as the motor parameters set by the user, for example, the actual motor is 4 pairs of poles, and the configuration is 5 pairs of poles. Or the motor encoder is 17 bits, the configuration is 23 bits, etc.<br>The motor encoder is not zeroed, or the zeroing data is missing.<br>Motor wiring fault, such as power line out of phase or phase sequence error, etc. |
| Servo internal device damage | Please contact the after-sales staff for maintenance by professional technicians. |

7) LED display: E.2350

Fault definition: Module overload ($I^2T$)

Generating mechanism: The temperature rise of the module is greater than 75 degrees, and the temperature rise is greater than 60 degrees when used in derating.

| Reason | Treatment |
|---|---|
| Power Module Overload | Replacement of higher power servo drives; |
| Motor power cable failure | Check the wiring on the servo output side according to the operating procedures to exclude leakage, disconnection, phase sequence error, short circuit, etc. |
| Motor blocking | Check whether the motor load is too large, or there is mechanical jamming, or the contracting brake is not opened properly. |

8) LED display: E.3130

Fault definition: Input out of phase

Mechanism: There is a problem with the servo main power input.

| Reason | Treatment |
|---|---|
| The main power input circuit wiring is abnormal, missed connection or there is a broken wire | Check the wiring on the input side of the servo main power supply according to the operating procedures, and exclude the phenomenon of leakage, broken wire, and false connection. |
| Servo main power input terminal is loose | Check whether the terminal connection is stable, whether the terminal wiring is loose or falsely connected, and measure whether the power supply voltage is within a reasonable range. |
| The configuration of the drive detection parameters does not match the actual power supply | The driver parameter P31.08 does not match the actual power supply, for example, if the parameter is configured as "input three-phase detection", but the actual power supply is single-phase, it will cause a fault alarm. |

9) LED display: E.3210

Fault definition: Servo overvoltage

Generation mechanism: AC 400V servo driver, DC bus voltage is higher than 810V and lasts for 6ms; AC 200V class servo driver, DC bus voltage is higher than 410V and lasts for 6ms.

| Reason | Treatment |
|---|---|

| | |
|---|---|
| High power supply input voltage | Test the phase-to-phase voltage of the servo input main power supply to see if it is higher than the maximum operating voltage allowed for the drive. |
| Excessive fluctuations in power supply voltage | Check the input power supply, reset the fault alarm after the supply voltage is restored to normal, and restart the servo driver. |
| Servo braking when the braking energy is too large, not connected to the braking resistor, or braking resistor resistance value is too large, or braking resistor damage, etc. | Check that the braking resistor is normal, and the connection is secure.<br>Select the appropriate resistance and power of the braking resistor. |

10) LED display: E.3220

Fault definition: Servo undervoltage

Generating mechanism: AC 400V servo driver, DC bus voltage is lower than 380V and lasts for 2ms; AC 200V class servo driver, DC bus voltage is lower than 160V and lasts for 2ms.

| Reason | Treatment |
|---|---|
| Power input voltage is too low | Test the phase-to-phase voltage of the servo input main power supply to see if it is below the minimum operating voltage allowed for the drive. |
| Servo work, the instantaneous load is too large, exceed the rated overload power time limit | Please use according to the maximum overload factor and overload time limit of the actual drive. |
| Instantaneous power failure, or the power supply voltage fluctuates too much | Check the input power, and after the supply voltage is normal, reset the fault alarm and restart the servo drive. |
| Loose power terminals | Check the wiring on the input side of the servo main power supply according to the operating procedures to exclude loose and false connections. |
| In the same power system, there is a large starting current load equipment | Improve the power supply system to ensure that the servo drive power environment meets its specification values. |
| Servo internal device damage | Please contact after-sales staff for maintenance by professional technicians |

11) LED display: E.3380

Fault definition: Output phase sequence error

Mechanism: The actual running direction of the servo motor is opposite to the given direction, or the actual running electric angle deviates too much from the given electric angle.

| Reason | Treatment |
|---|---|
| Servo output power line sequence error | Check the servo power output wiring according to the operating procedures to exclude phase sequence errors, missed connections, broken wires, etc. |

12) LED display: E.3381

Fault definition: Output out of phase

Mechanism: The servo driver's three-phase current output is abnormal.

| Reason | Treatment |
|---|---|
| The servo output circuit wiring is abnormal, or there is | Check the wiring of the servo output circuit according to the operating procedures to exclude leakage, broken wire, |

| | |
|---|---|
| leakage, broken wire, loose false connection, and other phenomena | misconnection, loose false connection, and other phenomena. |
| Loose servo output terminal | Check the wiring of the servo output circuit according to the operating procedures to exclude leakage, broken wire, misconnection, loose false connection, and other phenomena. |
| Three-phase output unbalance | Check whether the motor winding is normal and whether the resistance value between the three phase windings is equal. |
| Motor and driver mismatch | When the rated motor current is less than 1/5 of the rated drive current, it may cause the output phase loss detection function to be abnormal, so please replace the matching drive. If you need to use this kind of situation for temporary commissioning, you can set the parameter P31.09 "Output out-of-phase detection enable" to "0", so as to block this fault alarm. |

13) LED display: E.4310

Fault definition: Servo over temperature

Generation Mechanism: For AC200V class driver, the internal temperature of servo exceeds 85℃; for AC200V class driver, the internal temperature of servo exceeds 90℃.

| Reason | Treatment |
|---|---|
| High ambient temperature | Reduce the ambient temperature and enhance ventilation and heat dissipation. |
| Abnormal servo cooling system | Check whether the cooling fan is running normally, whether the speed and airflow are normal, and if there is any abnormality, the cooling fan needs to be replaced.<br>Check whether the heat dissipation channel is blocked by foreign objects, and whether there are cables or foreign objects around the heat dissipation space to block the heat dissipation effect. |
| Temperature detection circuit failure | Contact after-sales staff for maintenance by professional technicians. |

14) LED display: E.5210

Fault definition: Power ID error

Mechanism: Unrecognized driver board ID number, possible causes include hardware damage or assembly error.

| Reason | Treatment |
|---|---|
| Power ID detection failure | Please contact the after-sales staff for maintenance by professional technicians. |

15) LED display: E.5280

Fault definition: Drive internal error 1

Mechanism: Driver internal hardware or software failure, please contact after-sales service.

| Reason | Treatment |
|---|---|
| Servo drive internal failure | Please contact after-sales staff for maintenance by professional technicians |

16) LED display: E.5281

Fault definition: Drive internal error 2

Mechanism: Driver internal hardware or software failure, please contact after-sales service.

| Reason | Treatment |
|---|---|
| Servo drive internal failure | Please contact after-sales staff for maintenance by professional technicians |

17) LED display: E.5282

Fault definition: Drive internal error 3

Mechanism: Driver internal hardware or software failure, please contact after-sales service.

| Reason | Treatment |
|---|---|
| Servo drive internal failure | Please contact after-sales staff for maintenance by professional technicians |

18) LED display: E.5283

Fault definition: Inertia recognition error

Mechanism: The fault is caused when the deviation between the actual torque feedback value and the torque value required by the given acceleration theory is large, or the actual inertia ratio is greater than 50 times during the self-learning process.

| Reason | Treatment |
|---|---|
| Excessive load inertia ratio | Please select or optimize the load inertia ratio according to the actual situation, as detailed in the relevant section of the adjustment. |
| Wrong setting of inertia recognition frequency | According to the actual load situation, choose the appropriate inertia identification frequency, see the relevant content of the adjustment chapter for details. |
| Inappropriate rigidity gain setting for inertia discrimination | According to the actual load situation, choose the appropriate system gain for inertia identification, see the relevant content in the adjustment chapter for details. |

19) LED display: E.5284

Fault definition: Parameter check error

Mechanism: The drive checks the parameters stored in the drive EEPROM during power-up, and this fault is caused when an abnormal parameter is detected.

| Reason | Treatment |
|---|---|
| Power-on self-test, servo storage parameters exceed the allowable range. | After this fault occurs, please sample channels 71, 72 and 74 through the debug software signal sampling function, save the samples and observe the results.<br>Please contact the after-sales staff for maintenance by professional technicians. |

20) LED display: E.5480

Fault definition: Servo overload

Mechanism: When the actual servo output power exceeds 1,1 times the rated power, the duration exceeds 120 seconds.

| Reason | Treatment |
|---|---|
| Output power exceeds 1.1 times the rated power and lasts 120S | Please select or optimize the load or replace the servo drive with a higher power according to the actual situation. |
| Motor power line failure | Check the wiring on the servo output side according to the operating procedures to exclude short circuit, leakage, disconnection, phase sequence error, etc. |
| Motor blocking | Check whether the motor is overloaded or mechanically jammed, |

| | |
|---|---|
| | or the contracting brake is not opened properly. |

21) LED display: E.7180

Fault definition: Motor overload (I²T)

Generation Mechanism: I²T operation is performed on the servo phase currents, and the I²T energy sum is calculated for 1.x, 2.x, and 3.x times the overload case when the energy threshold is greater than its corresponding overload time.

| Reason | Treatment |
|---|---|
| Motor power and load mismatch | Check if the motor power meets the load requirements. |
| Motor blocking | Check whether the motor is overloaded or mechanically jammed, or the contracting brake is not opened properly. |
| Motor power line phase sequence fault | Check if the motor power wire sequence is correct. |

22) LED display: E.7182

Fault definition: Overload of brake resistor

Generating mechanism: Servo internal calculation of braking resistor I²T energy accumulation is greater than 20 times the power of the equipped dynamic resistor and lasts for 1 second.

| Reason | Treatment |
|---|---|
| Improperly selected braking resistor | Follow the instructions in the specifications to select the appropriate braking resistor. |
| Improper setting of braking resistor parameters | The braking resistor configuration parameters in the drive do not match the actual braking resistor specifications.<br>AC200V, 400W and below drives do not have built-in braking resistors but rely on internal capacitors to absorb part of the braking energy. Therefore, the default configuration of the braking resistor parameters is 40W, 80Ω (not recommended to be set to 0. Because once set to 0, there is a risk of damage to the drive capacitors when used in a long-term with braking resistor overload). When this alarm occurs in this case, please externalize a suitable external braking resistor. |

23) LED display: E.7380

Fault definition: Encoder connection error

Mechanism: The servo and encoder cannot establish normal communication.

| Reason | Treatment |
|---|---|
| Encoder parameter error | Check the encoder parameter settings to see if they match the |

| | |
|---|---|
| | actual encoder. |
| Encoder cable failure | Check whether the encoder cable is broken, missed, misconnected, and whether the wire sequence is correct, etc. |
| Encoder cable not connected or loose connector | Check the encoder cable connection. |
| The encoder cable is too long and the encoder wire diameter used is too thin. Resulting in too high line impedance and significant voltage attenuation | Replace the cable with a length matching the wire gauge, see the encoder cable section for details. |
| Oxidation of the metal layer of the encoder connector, resulting in poor contact | Replace the connector. |
| Servo component damage | If the motor or drive components are damaged, please contact after-sales staff for maintenance by professional technicians. |

24) LED display: E.7381

Fault definition: Encoder battery undervoltage

Generation mechanism: Absolute encoder battery undervoltage

| Reason | Treatment |
|---|---|
| Absolute encoder battery voltage too low | Replace the battery. |

25) LED display: E.7382

Fault definition: Encoder battery disconnected

Mechanism: The absolute encoder detects no battery power.

| Reason | Treatment |
|---|---|
| Absolute encoder battery voltage is too low, or the battery is disconnected from the encoder | Replace the battery.<br>Check the connection between the absolute encoder battery and the encoder for broken wires, missed connections, etc. |

26) LED display: E.7383

Fault definition: Encoder overheating

Mechanism: The internal temperature of the encoder exceeds the alarm value.

| Reason | Treatment |
|---|---|
| High internal temperature of the encoder | Improve motor heat dissipation conditions or reduce the ambient temperature around the motor. |

27) LED display: E.7384

Fault definition: Encoder count error

Mechanism: Encoder count error.

| Reason | Treatment |
|---|---|
| Encoder count error | Servo power off and restart, if the fault can not be cleared, you need to contact professional technicians to replace the encoder. |

28) LED display: E.7385

Fault definition: Encoder overspeed

Mechanism: The error is fed back from the motor encoder and can be caused by the actual speed of the motor exceeding the allowable range of the encoder or by hardware damage to the encoder itself.

| Reason | Treatment |
|---|---|
| Actual speed before servo power up is too high | The motor should be kept stationary until the servo is powered on. |
| Motor Speeder | See motor stall troubleshooting |
| Instruction given error | Check if the position, speed and torque commands are given correctly. |
| Sudden load changes | Check if the external load connection is good and check the cause of the sudden change of external load. |
| Encoder internal error | Servo power off and restart, if the fault can not be cleared, you need to contact professional technicians to replace the encoder. |

29) LED display: E.7386

Fault definition: Internal encoder fault

Mechanism: An abnormality is detected inside the encoder.

| Reason | Treatment |
|---|---|
| Encoder internal error | Servo power off and restart, if the fault can not be cleared, you need to contact professional technicians to replace the encoder. |

30) LED display: E.7387

Fault definition: Motor information error

Mechanism: The servo does not detect the electronic nameplate of the motor, or the electronic nameplate data is wrong.

| Reason | Treatment |
|---|---|
| Use of third-party motors | When using third party motors, you need to log in with advanced password and modify parameter P00.03 to "User Settings" and enter relevant parameters according to the actual motor information, please refer to the chapter "Motor Configuration" of the commissioning software for details. |
| Electronic nameplate not written | Log in the advanced password, change parameter P00.03 to "User Settings" and configure the relevant motor and encoder parameters according to the actual motor, please refer to the chapter "Motor Configuration" of the commissioning software for details. |
| The electronic nameplate data is wrong | Try to use the above steps to solve the problem. If the problem still exists after power off and restart, please contact after-sales service for maintenance by professional technicians. |

31) LED display: E.7388

Fault definition: Motor encoder zero point is missing

Mechanism: The servo does not detect the encoder magnetic declination data, or the motor memory information is incorrect.

| Reason | Treatment |
|---|---|
| Use of third-party motors | When using a third-party motor, encoder zeroing is required, as described in the "Using Third-Party Motors" section. |
| Motor not zeroed by encoder | Refer to the Encoder Zeroing chapter for zeroing the encoder. |
| Incorrect encoder zero data | Try to use the above steps to solve the problem. If the problem still exists after power off and restart, please contact after-sales service for maintenance by professional technicians. |

32) LED display: E.7581

Fault definition: EtherCAT communication failure

Mechanism: When enabled, the EtherCAT bus between the Servo Drive and the host computer does not communicate properly.

| Reason | Treatment |
|---|---|
| Controller exception | Please check if the controller is down or otherwise abnormal. |
| Poor contact or disconnection of communication cable | Check that the communication cable connection is secure and reliable. |
| Communication cable not grounded or poorly grounded | Use communication cables with shields that are well grounded. |
| Poor network port contact | Poor contact caused by deformation of the golden finger of the mesh port, please contact the after-sales service for maintenance by professional technicians. |

33) LED display: E.7582

Fault definition: Sync period setting error

Mechanism: The bus cycle time cannot be divided by the speed loop cycle time.

| Reason | Treatment |
|---|---|
| The bus cycle time cannot be divided by the speed loop cycle time when controlled by the host computer (speed loop cycle time = current loop cycle time (100 microseconds for unilateral modulation, 50 microseconds for bilateral modulation) * speed loop cycle time) | Change the upper bus cycle time or modify the number of speed loop cycles (recommended setting value 3~5). |

34) LED display: E.7590

Fault definition: Drive communication error 1

Mechanism: Driver communication initialization error.

| Reason | Treatment |
|---|---|
| Internal drive error | Please contact after-sales for maintenance by professional technicians. |

35) LED display: E.7591

Fault definition: EtherCAT communication initialization error

Mechanism: Error during EtherCAT communication initialization of the driver.

| Reason | Treatment |
|---|---|
| EtherCAT communication chip EEPROM setting information is wrong | Check that the servo communication parameter P01.01 is "EtherCAT".<br>You can also reconfigure the XML via TwinCAT software, please refer to the chapter "AD2 Servo Drive and Pepperl+Fuchs Upper Unit Use" for more details. |
| EtherCAT board damaged | Please contact after-sales for maintenance by professional technicians. |
| Servo drive internal damage | Please contact after-sales for maintenance by professional technicians. |

36) LED display: E.7592

Fault definition: ECAT EEPROM

Mechanism: The error returned when reading or writing ECAT EEPROM through ESC interface can be caused by read/write permission failure or EEPROM hardware failure.

| Reason | Treatment |
|---|---|
| The controller disables the EtherCAT slave's permission to modify the EEPROM | Check parameter P01.05 "Node number configuration selection". Some master controllers such as Pepperl+Fuchs do not allow the slave to change the node number. Therefore, when using such controllers, please make sure that P01.05 "Node number configuration selection" is changed to bus configuration. |
| EtherCAT Hardware Failures | Please contact after-sales for maintenance by professional technicians. |

37) LED display: E.8480

Fault Definition: Same direction overspeed

Mechanism: When the actual speed is in the same direction as the given speed, the speed error value exceeds the rated value of the motor by more than 20%.

| Reason | Treatment |
|---|---|
| Motor Speeder | See "Motor Stall" troubleshooting. |
| Motor parameters are wrong | Check whether the motor parameters are set correctly, such as the number of pole pairs, encoder single-turn value, etc. |
| Wrong encoder parameters | Check whether the encoder parameter setting is consistent with the actual motor. |
| Encoder failure | Check whether the encoder is damaged, the wiring is correct, the grounding is good, etc. |
| Excessive positive load | Check if the actual motor power meets the load demand. |
| Improper parameter setting | Check if the P50.17 stall filter time parameter is set correctly. |

38) LED display: E.8481

Fault definition: Reverse overspeed

Mechanism: When the actual speed is reversed from the given speed, the speed error value is more than 20% of the rated value of the motor.

| Reason | Treatment |
|---|---|
| Motor Speeder | See "Motor Stall" troubleshooting. |
| Motor parameters are wrong | Check whether the motor parameters are set correctly, such as the number of pole pairs, encoder single-turn value, etc. |
| Wrong encoder parameters | Check whether the encoder parameter setting is consistent with the actual motor. |
| Encoder failure | Check whether the encoder is damaged, the wiring is correct, the grounding is good, etc. |
| Excessive reverse load | Check if the actual motor power meets the load demand. |
| Improper parameter setting | Check if the P50.17 stall filter time parameter is set correctly. |

39) LED display: E.8482

Fault definition: Maximum speed exceeded

Mechanism: The actual speed exceeds the maximum speed of the motor, and the duration exceeds the alarm value.

| Reason | Treatment |
|---|---|
| Motor Speeder | See "Motor Stall" troubleshooting. |
| Motor parameters are wrong | Check whether the motor parameters are set correctly, such as the number of pole pairs, encoder single-turn value, etc. |
| Wrong encoder parameters | Check whether the encoder parameter setting is consistent with the actual motor. |
| Encoder failure | Check whether the encoder is damaged, the wiring is correct, the grounding is good, etc. |
| Instruction given error | Check if the position, speed and torque commands are given correctly. |
| Sudden load changes | Check the cause of the sudden external load change. |

40) LED display: E.8483

Fault Definition: Excessive speed tracking error

Mechanism: The absolute value of the speed error is still greater than the speed error threshold after the filtering time.

| Reason | Treatment |
|---|---|
| Excessive acceleration | Check that the acceleration given by the command does not exceed the response of the load, causing the actual speed to lag significantly behind the given speed. |
| Improper parameter setting | Check whether the parameters P50.14 "Speed following error threshold" and P50.15 "Following error filtering time" are set properly.<br>Increase the parameter P50.01 "Speed loop gain 1" to speed up the motor response. |
| Excessive load | Check that the selected motor torque meets the load requirements. |
| Output out of phase | Refer to the "output out of phase" fault handling. |

41) LED display: E.8484

Fault Definition: Acceleration overrun

Mechanism: The acceleration calculated inside the servo is greater than the set acceleration threshold for 300 current loop cycles, or the encoder data frame is wrong for 300 consecutive times.

| Reason | Treatment |
|---|---|
| Excessive acceleration | Check that the acceleration given by the command does not |

| | |
|---|---|
| | exceed the response of the load, causing the actual speed to lag significantly behind the given speed. |
| Encoder failure | Check whether the encoder is damaged, and the wiring is normal.<br>Check whether the encoder cable shield is well grounded and whether there are strong interference sources near the cable. |
| Encoder interface short circuit | Check the encoder and cable for short circuit between pins, short circuit to ground or strong interference, etc. |

42) LED display: E.8485

Fault definition: Motor stall

Generation Mechanism: Motor speed continuous stall filtering time exceeds the stall threshold (when the speed is below 10% of rated speed, the stall threshold is 30% of rated speed).

| Reason | Treatment |
|---|---|
| Motor power cable failure | Check the servo output side wiring according to the operating procedures to exclude short circuit, leakage, broken wire, loose false connection, phase sequence connection reversal, etc. |
| Motor blocking | Check whether the motor is overloaded, or the machinery is stuck, or the contracting brake is not opened properly. |
| Servo internal device damage | Contact after-sales for maintenance by professional technicians. |

43) LED display: E.8611

Fault definition: Excessive position deviation

Mechanism: The  position deviation is greater than the set position deviation threshold and lasts for 100ms.

| Reason | Treatment |
|---|---|
| Excessive acceleration | Check that the acceleration given by the command does not exceed the response of the load, causing the actual speed to lag significantly behind the given speed. |
| Improper parameter setting | Check whether the parameter P60.0C "Position following error threshold" is set appropriately, which is generally set to the Inc value corresponding to one revolution of the motor encoder. For example, 23-bit encoder is set to 8388608; 17-bit encoder is set to 131072.<br>Increase parameters P60.01 "Position loop gain" and P60.02 "Position loop feedforward" as appropriate. |
| Motor blocking | Check whether the motor is overloaded, or the machinery is stuck, or the contracting brake is not opened properly. |
| Excessive load | Check that the selected motor torque meets the load requirements. |
| Output out of phase | Refer to the "output out of phase" fault handling. |

44) LED display: E.8612

Fault Definition: Command Giving Abnormality Detection

Mechanism: In position or velocity control mode, it detects whether the given acceleration is less than parameter P60.11, and the fault will be triggered when there is a large abrupt change in the given command, to prevent the servo system from risks such as flywheel.

| Reason | Treatment |
|---|---|
| Position command given mutation | Check if the given command is appropriate. |
| Speed giving command mutation | Check if the given command is appropriate. |
| In torque mode, the difference between the current moment and the previous moment speed limit value exceeds the rated speed | Check if the given command is appropriate. |
| Parameter P60.11 is set too large | Reduce parameter P60.11 "Command detection acceleration time" as appropriate. |
| EtherCAT communication frame loss | Check if the communication is good in real time. |
| The return to zero deviation data is lost, causing the difference between the given position and the current position to be too large. | Check whether the actual feedback position is consistent with the mechanical position |

45) LED display: E.8613

Fault definition: Forward motion prohibited

Mechanism: The forward motion disable function is triggered.

| Reason | Treatment |
|---|---|
| Forward motion disable function is triggered | Check whether the DI function group function and DI logic configuration are correct.<br>Check that the DI channel configured for the forward motion disable function is consistent with the actual wiring.<br>Verify that the external DI input line is normal, that the wiring is good, and that there is no poor contact, etc. |

46) LED display: E.8614

Fault definition: Reverse motion prohibited

Mechanism: The reverse motion disable function is triggered.

| Reason | Treatment |
|---|---|
| Reverse motion disable function is triggered | Check whether the DI function group function and DI logic configuration are correct.<br>Check that the DI channel configured for reverse motion disable function is consistent with the actual wiring.<br>Verify that the external DI input line is normal, that the wiring is good, and that there is no poor contact, etc. |

Revision: V2.0

# AD2 Series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