# Just motion control EC Series Drives User's Manual

V1.42

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# Preface

JMC bus driver series products cover R series of Modbus RTU protocol based on RS485 communication network, RC series of CANopen protocol based on CAN communication network and COE (CANopen over) based on EtherCAT communication network The EC series of EtherCAT protocol and other three bus communication modes of digital stepping, hybrid stepping servo, integrated stepping servo, low-voltage servo, high-voltage servo and integrated AC servo are intelligent bus driven products.

The application layer of JMC bus drive series slave station adopts ds402 standard motion control protocol, which supports the control modes of CSP, PP, PV, HM and Pt. Support CW / HW / CCW limit (origin) and two high-speed probe digital input, support brake, in place, alarm digital output. The communication port adopts RJ45 network interface and standard Ethernet communication cable to realize the serial network connection of multi axis slave station. It has the advantages of strong anti-interference ability, high control accuracy and good expansibility. It is the ideal choice of multi axis Industrial Ethernet bus control system!

This manual mainly introduces EC series products:

JMC EC series bus driver refers to the slave driver whose hardware adopts 100Mbps full duplex EtherCAT communication circuit and whose software adopts COE communication protocol and cia402 motion control protocol. EtherCAT is a high-performance Ethernet technology developed by Beckhoff company in Germany, which has high performance, low cost, simple application and flexible topology. It can be applied to the ultra-high speed network at the industrial site level.

This manual will be divided into four parts: hardware, communication, control and routine. The hardware part describes the hardware performance and operation usage of each specific model of product in detail to facilitate users to understand our product; the communication part introduces the EtherCAT protocol in detail to help users understand the protocol and better use our product; the control part is the basic control mode of synchronous cycle position, contour position, contour speed and zero return The operation is introduced in detail to help users quickly get familiar with the operation of our product; the routine part gives an example of programming examples of EtherCAT communication, and provides some communication demos of mainstream brands of controllers. Users can refer to these demos to get started quickly.

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there is any loss of profits caused by any direct or indirect outflow of information about the products mentioned in this manual, Shenzhen Just Motion Control Just motion control Electromechanics Co., Ltd. and its employees shall not be liable for it

In addition, the products and materials mentioned in this manual are for reference only. If the contents are updated, NO further notice will be given.

# directory

# *IHSV-EC Integrated field-bus AC servo motor series*

## ➢ Product introduction

The IHSV-EC integrated field bus AC servo motor product is an EtherCAT integrated field bus AC servo motor. It uses the standard CoE communication protocol and has built-in CIA402 motion control protocol for cycle synchronization position (CSP), cycle synchronization speed (CSV), and cycle synchronization torque ( CST), contour position (PP), contour speed (PV), contour torque (PT) and homing (HM) mode; through the optimized PID control algorithm, to achieve full digital control of position, speed, torque, with Compared with the combination of traditional servo drive and servo motor, the cost is lower, the installation is more convenient, the temperature rise of the motor is effectively suppressed, the vibration of the motor is significantly reduced, and the high-speed performance of the motor is greatly enhanced. Comes with 3 digital signal inputs for zero return reference, positive and negative limit input and probe function; comes with 1 digital signal output for in-place output signal and alarm signal selection output; built-in brake control circuit; Current, overvoltage, undervoltage, and position tolerance protection; RJ45 network communication interface, highly integrated design, eliminating encoder, motor power line and signal line, convenient wiring, reducing system complexity; is a cost-effective Very high industrial bus motion control products.

## ➢ Technical characteristics

- ✧ ☐ NO lost steps, accurate positioning
- ✧ ☐ Support standard EtherCAT bus
- ✧ ☐ CSP / CSV / CST / PP / PV / PT / HM and other modes following the CIA402 motion control protocol, easy to develop
- ✧ ☐ Built-in CW, CCW, SW three 5V or 24V IO signal input for limit and zero return reference
- ✧ ☐ Built-in brake circuit, external input 24VDC power supply is eNOugh
- ✧ ☐ RJ45 standard network connection, the slave stations can be connected by twisted pair network cable
- ✧ ☐ 100% rated torque drive motor
- ✧ ☐ Variable current control technology, high current efficiency
- ✧ ☐ Low vibration, stable operation at low speed
- ✧ ☐ Built-in acceleration and deceleration control to improve the smoothness of start and stop
- ✧ ☐ User can customize subdivision

- ☐ Compatible with 1000 line and 2500 line encoder
- ☐ NO need to adjust general application parameters
- ☐ Overcurrent protection, overvoltage protection, undervoltage protection and over-tolerance protection
- ☐ Strong compatibility, can communicate with mainstream brand PLC controllers, such as: Beckhoff, Panasonic, Omron, Panasonic, Keyence, InNOvance, JMC, etc.

## ➢ Application

Suitable for various point-to-point control automation equipment and instruments that require large torque, such as: wire stripping machine, marking machine, cutting machine, laser phototypesetting, plotter, CNC machine tool, logistics storage equipment, new energy lithium battery equipment, automatic assembly equipment. The application effect is particularly good in devices that users expect bus control, low NOise and high speed

# 1 Safety Precautions

The following explanations are for things that must be observed in order to prevent harm to people and damage to property, classified Specially below.

| | |
|---|---|
| ⚠Danger | Indicates great possibility of death or serious injury. |
| ⚠Caution | Indicates possibility of injury or property damage. |
| ⊘ | Indicates something that must NOt be done. |

## 1.1 Precaution of receiving and installation

⚠Danger:

1. Please connect motor and drive according to assigned methods in case of damaging machine or fire.
2. Don’t use at places with thick steam, combustible, corrosive gas in case of electrical shocks, damages or fire etc.

## 1.2 Connection

⚠Danger:

1. Please don’t connect drive power supply to motor output port U,V,W in case of damaging drive and even causing injury or fire.
2. Please confirm if power supply cable is connected with motor output connector, in case of fire caused by sparks.
3. Please select correct power cable and motor power extended cable to avoid fire caused by overcurrent.
4. Please be sure drive case and motor is connected to ground to avoid possible electric shock caused by imperfect earth.

⚠Caution:

1. Please don’t bind motor power cable with signal cable, or pass through same tube in case of signal interference.

2. Please use multistrand shielding power cable for signal line and encoder feedback extended cable in order to strength the anti-interference.
3. Please don't touch power supply connector, and confirm discharge indicator light is off before operate again. There is still high voltage inside after drive is powered off.
4. Please confirm all connection is correct before power on.

## 1.3 Precaution of operation

⚠ Danger:

1. Please make NO-load test before installation to avoid accident.
2. Please don't be operated by people without training in case of injury or damage caused by misoperation.
3. Please don't touch heat sink or inside part of drive while running in case of burn or electric shock.

⚠ Caution:

1. Please set drive parameters first, and then do long-term test in case of NOt working properly.
2. Please confirm switches like start, stop, turn off are work well before running the machine.
3. Please don't turn on or off power supply frequently.

## 1.4 Maintenance & Inspection

⃠:

1、Don't touch drive or motor inside while running in case of electric shock.
2、Don't touch power supply or wiring connector of power line in case of electric shock.
3、Don't change wires while power is on in case of electric shock or injury.
4、Operation and daily maintenance must be done by trained professionals.
10. Please don't dis-assembly or repair except JMC technicians.

# 2 Product description

## 2.1 Technical index

Table 1 IHSV-EC Technical index

| IHSV57/60/86-R/RCTechnical index | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| Input Power (VDC) | | 42 Base | 57 Base | | 60 Base | | 86 Base | |
| | | 78W | 140W | 180W | 200W | 400W | 440W | 660W |
| | | 24 | 36 | | 48 | | 72 | |
| Communication type | | EtherCATProtocol | | | | | | |
| Maximum communication distance | | Between slaves 100M | | | | | | |
| Maximum support slave station number | | 65535 | | | | | | |
| Protection | | Overload I2t current action value 300% 3S | | | | | | |
| Environment | Occasion | Try to avoid dust, oil mist and corrosive gas | | | | | | |
| | Working Temperature | 0~+70℃ | | | | | | |
| | Storage temperature | -20℃~+80℃ | | | | | | |
| | Humidity | 40~90%RH | | | | | | |
| | Cooling method | Natural cooling or strong cooling air | | | | | | |

## 2.2 Naming rules

IHSV57 - 30 - 14 - 36 - EC - XXX

① ② ③ ④ ⑤ ⑥ ⑦

① Series name:IHSV: Integrated AC servo motor
② Motor Base: 42: 42 Base57: 57 Base 60: 60 Base 86: 86 Base
③ Rated Speed: 30: 3000RPM
④ Rated Power: 07: 78W 14: 140W 18: 180W 20: 200W 40: 400W 44: 440W 66: 660W
⑤ Supply Voltage: 24:24VDC36:36VDC 48:48VDC 72:72VDC
⑥ Field-Bus communication: R: RS485 RC: RS485+CAN EC: EtherCAT
⑦ Product design serial number: special function module, the default is the standard model

# 3 interface and wiring of driver

## 3.1 Interface definition

### 3.1.1Power port

Table 2 Power port

| Port | Symbol | Name | Explanation |
|---|---|---|---|
| 1 | DC+ | Power input + | DC power supply |
| 2 | GND | Power input ground | |

### 3.1.2 Control signal port (10 pin)

Table 3 Control signal port

| Port | Symbol | Name | Explanation |
|---|---|---|---|
| 1 | COM | Public end | 24VDC/GND |
| 2 | CW- | Clockwise limit - | |
| 3 | HW+ | Mechanical origin limit + | Compatible with 5V and 24V |
| 4 | CCW+ | Counterclockwise limit + | |
| 5 | DI3 | Probe 1 input | Compatible with 5V and 24V |
| 6 | DI4 | Probe 2 input | |
| 7 | DO0+ | Alarm Output + | |
| 8 | DO0- | Alarm Output - | |
| 9 | DO1+ | Output in place + |  |
| 10 | DO1- | Output in place - | |

Remarks: EC series brake power input BK24V, BK0V are located beside the power input NOte: For the communication port, see "Communication Interface and Wiring" "*Communication Interface and Wiring*" in the communication section (Ctrl + left mouse button or click the text to jump).

## 3.2 Control signal interface circuit diagram

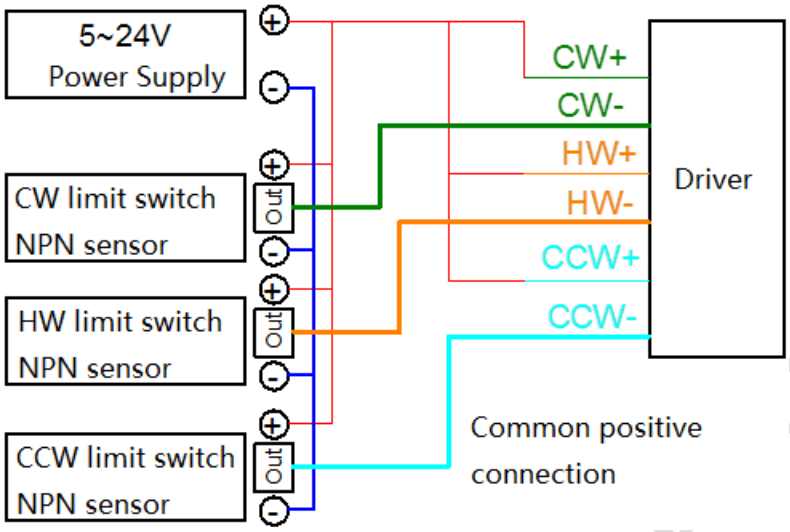



Figure 4 Common positive connection

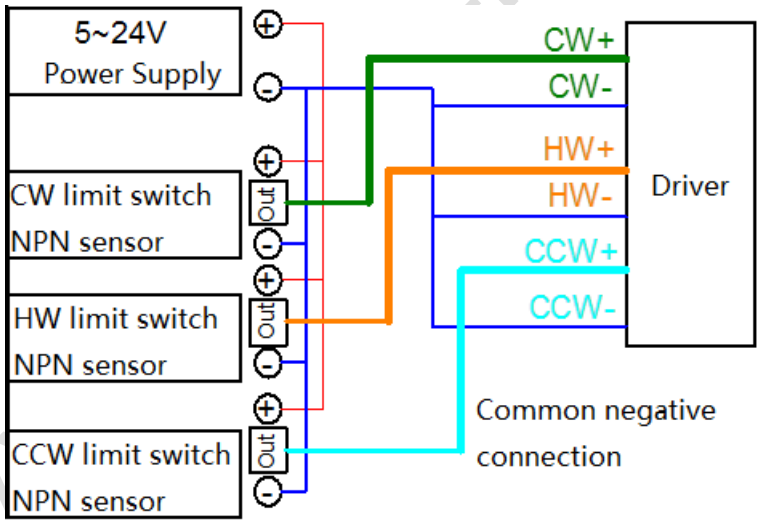



Figure 5 Common negative connection

NOte: The control signal level can be compatible with 5V and 24V.

## 3.3 Serial interface 232 wiring diagram

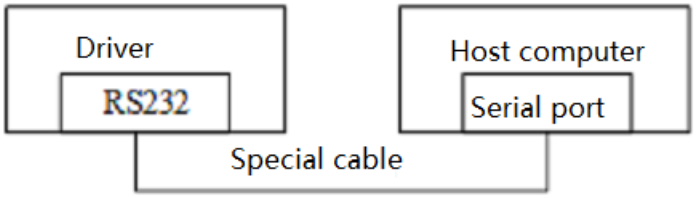



Figure 6 Schematic diagram of parameter debugging wiring

NOte: The cable connecting the IHSV-EC and the PC must be a special cable, the special cable model JMC-RS232-HL340 + JMC-RS232-USB; please confirm before use to avoid damage.

## 3.4 Typical application wiring diagram

The typical wiring diagram composed of IHSV-EC driver is shown in the figure. The power supply is selected according to the matching motor voltage level.

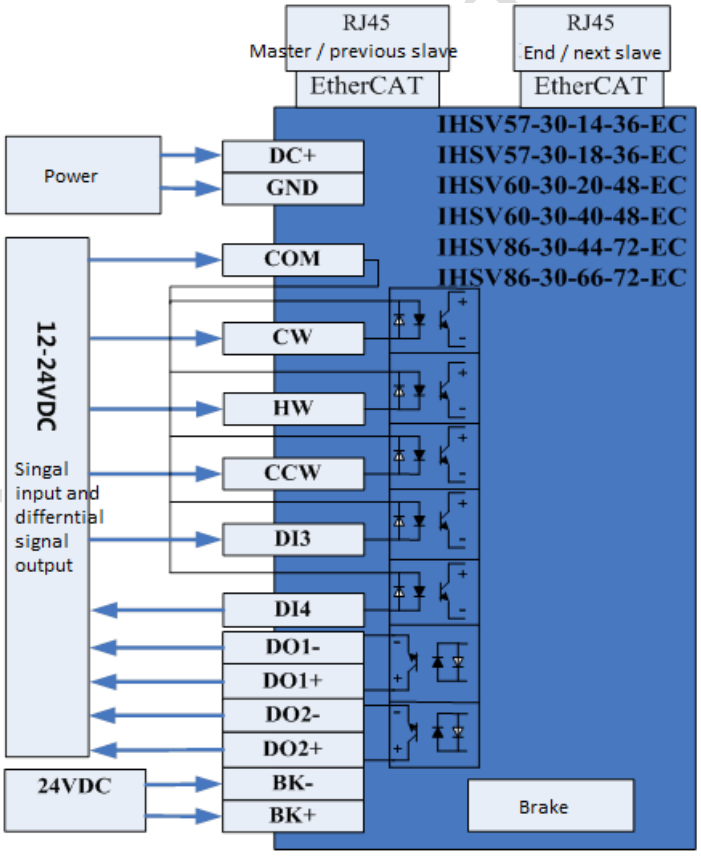



Figure 7 Typical wiring diagram of IHSV-EC

# 4 Installation instructions and fault alarm

## 4.1Installation dimensions

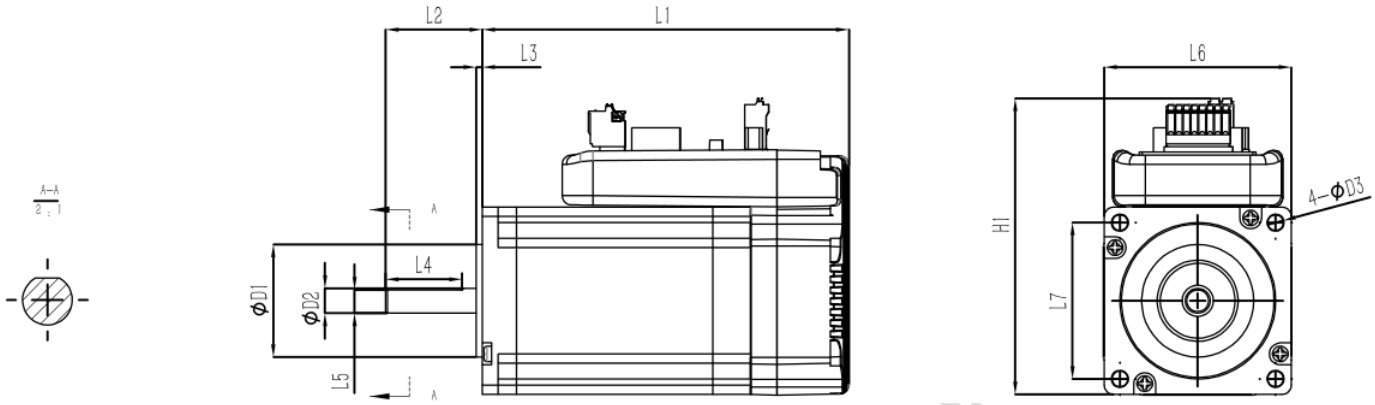



Figure 8 JMC IHSV-EC Integrated motor installation size

| Model | L1 (mm) | L2 (mm) | L6 (mm) | L7 (mm) | D1 (mm) | D2 (mm) | H1 (mm) |
|---|---|---|---|---|---|---|---|
| IHSV57-30-14-36-EC | 130 | 33 | 57 | 47 | 38 | 8 | 90 |
| IHSV57-30-18-36-EC | 150 | 33 | 57 | 47 | 38 | 8 | 90 |
| IHSV60-30-20-48-EC | 112 | 27 | 60 | 49.5 | 50 | 14 | 94 |
| IHSV60-30-20-48-EC | 142 | 27 | 60 | 49.5 | 50 | 14 | 94 |
| IHSV86-30-44-72-EC | 162 | 38 | 86 | 69.5 | 73 | 14 | 121.8 |
| IHSV86-30-66-72-EC | 189 | 38 | 86 | 69.5 | 73 | 14 | 121.8 |

Remarks: The standard 57/60 base motor output shaft is a flat port without key. There are two types of 86 motor output shafts: flat mouth and key; please contact us for the detailed shaft size drawing.

## 4.2 Installation environment

Using environment will directly affects the normal work and life of product directly, so it must meet the following conditions:

1. Working environment temperature : 0 to 55℃. Work environment humidity: 10% to 90% or less (free from condensation).
2. Storage environment: -20℃～+85℃; Storage humidity: 90% or less (free from condensation).
3. Vibration : 0.5G or less
4. To prevent rain or damp environment.
5. Avoid exposure in the sun.

6. To prevent oil mist, the erosion of salt.
7. To prevent corrosive liquid, gas, etc.
8. To prevent dust, lint and metal fines.
9. Stay away from the radioactive material and fuel.
10. Reserve space around the drive in the oven for easy loading , unloading and maintenance.
11. Pay attention to the tank in the air flow, if necessary, add outer fan to enhance the air flow, reduce drive environmental temperature for heat dissipation; The long-term working temperature should under 55 ℃.
12. Try to avoid near the vibration source, adding damping device such as vibration absorber or antivibration rubber gasket.
13. If there is electromagnetic interference sources, the power of the drive and control line Louis interference caused by misoperation, NOise filter can be added or used in a variety of effective anti-interference measures in order to ensure the normal operation of the drive (NOise filter can increase the leakage current, need to load an isolation transformer on the drive power input end).

## 4.3 LED Indicator light

### 4.3.1 Alarm timing diagram

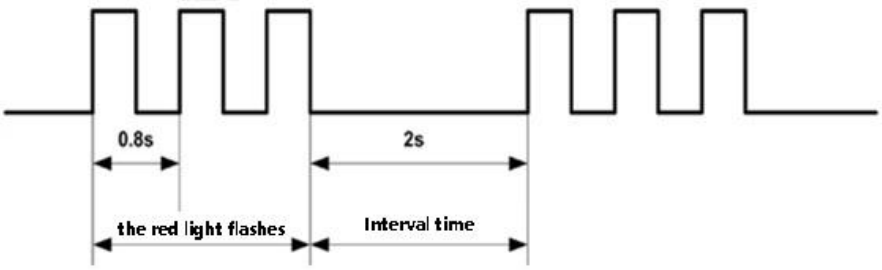



Figure 9 Integrated motor alarm timing of IHSV-EC

### 4.3.2 flashing times of Signal light

Table 4 Error Alarm

| Red light Flashing | Alarm description |
|---|---|

| Times | |
|---|---|
| Red off, green flashing | Drive CAN communication is NOt linked |
| Red off, green on | The drive is powered on normally |
| Red flash once, green on | Drive overcurrent |
| Red flash twice, green on | Drive supply voltage exceeds maximum |
| Red flash 3 times, green on | Drive supply voltage is below the minimum |
| Red flash 4 times, green on | Drive position is out of tolerance |
| Red flash 5 times, green on | Drive communication error |
| Red flash 6 times, green on | CCW direction limit |
| Red flash 7 times, green on | CW direction limit |
| Red flash 8 times, green on | SW direction limit |
| Red flash 9 times, green on | Drive encoder error |
| Red flash 10 times, green on | Overload alarm |
| Red flash 11 times, green on | EEPROM read and write errors |
| Red flash 12 times, green on | Incorrect electronic gear ratio setting |
| Red flash 13 times, green on | The host computer needs to be powered on to modify the parameters |
| Red flash 14 times, green on | Incorrect current range |

# 5 Physical reference


Figure 1 Picture of integrated motor IHSV-EC

# 6 Use of servo adjustment software

Select JmcServoPcControl servo adjustment software, double-click to open the following figure:

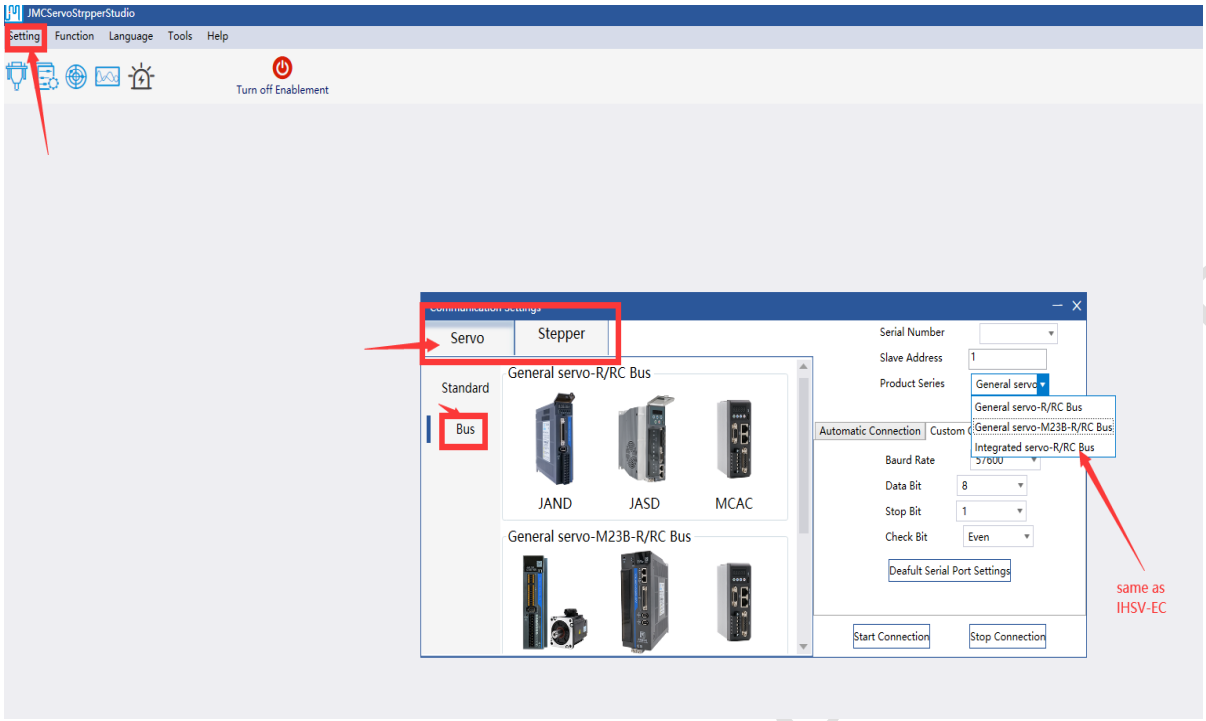



Figure 2 Servo adjustment software

- In the pop-up dialog box, set the corresponding options, click to open, the operation is as follows:

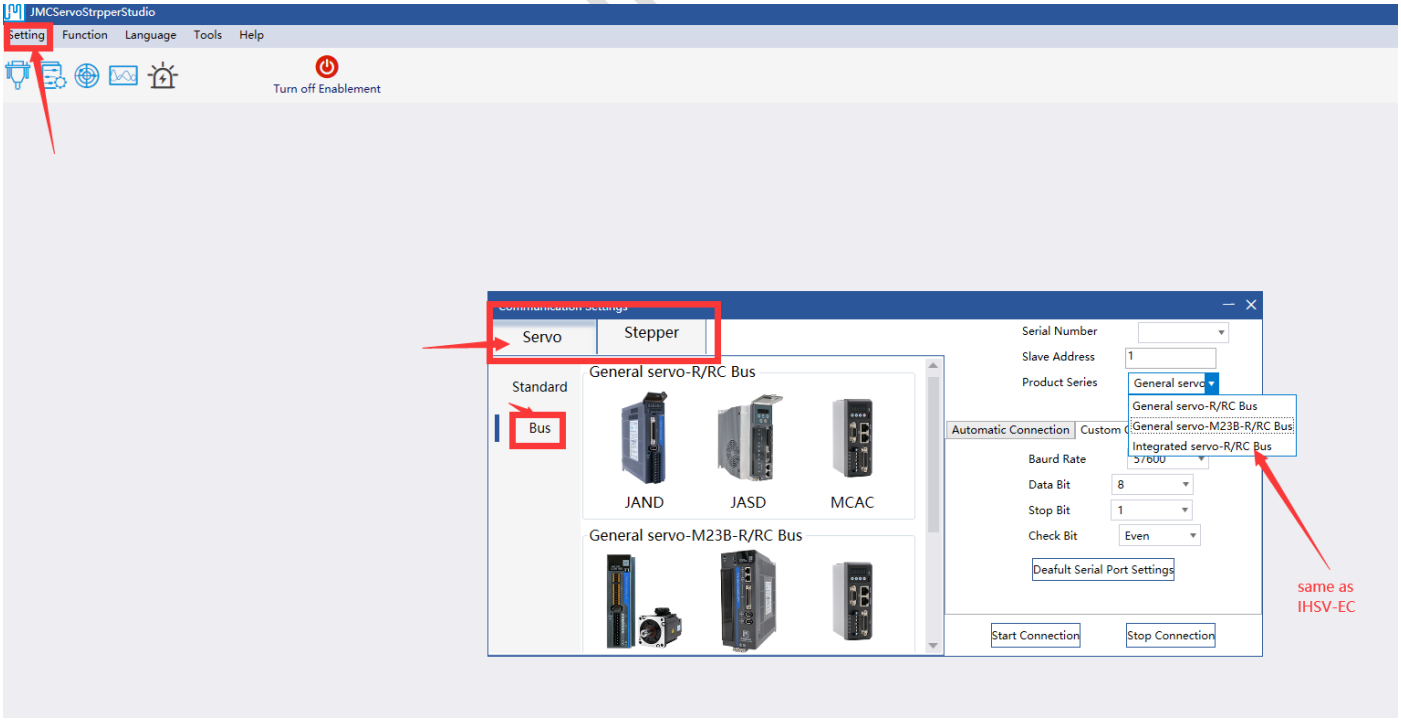



Figure 96 serial port setting of servo debugging software

- After clicking Open, if the communication is successful, the following picture

will be displayed:

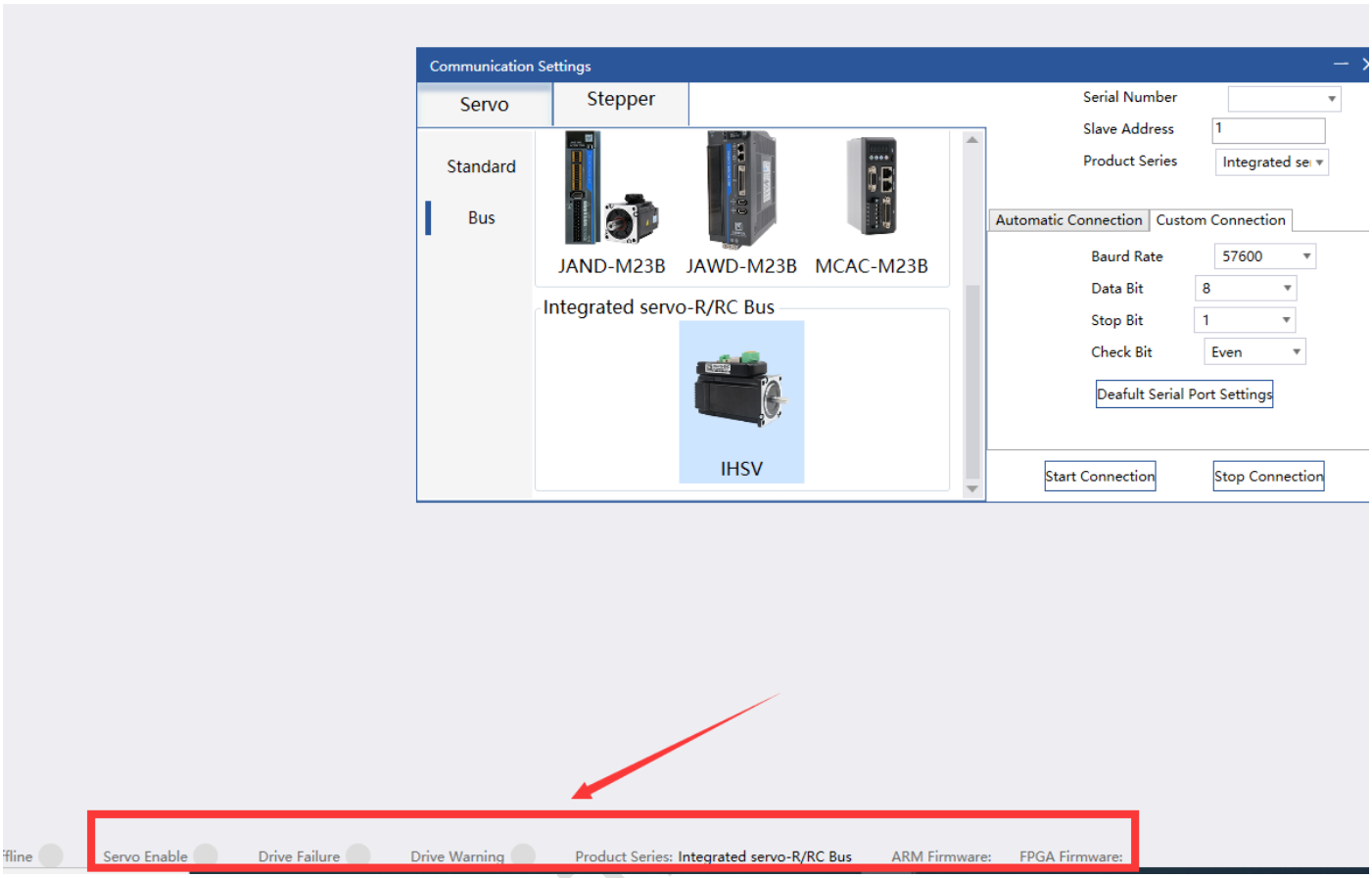
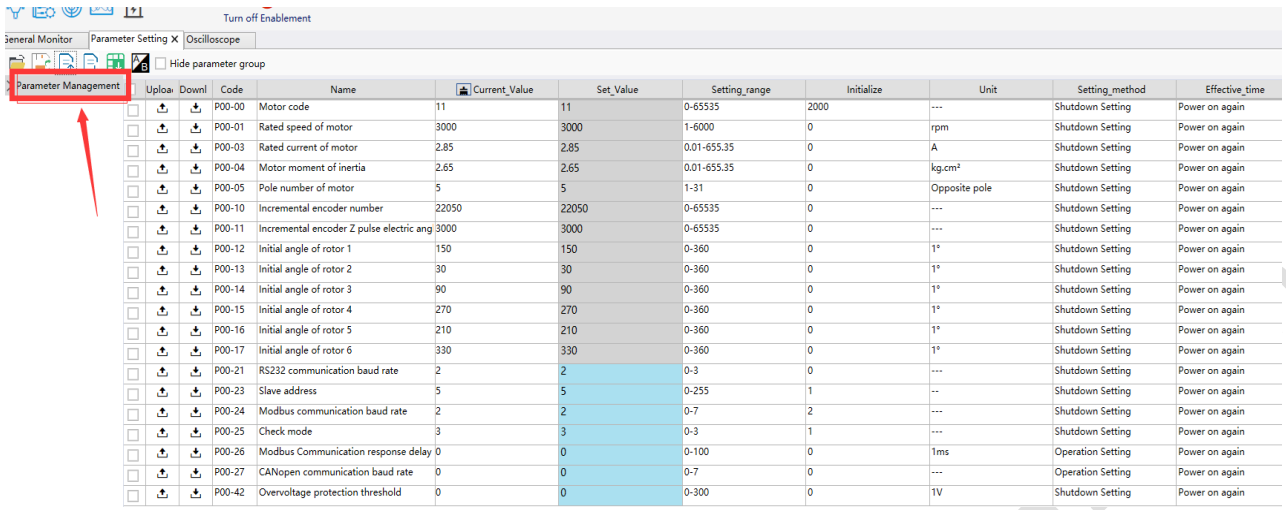



Figure 3 Software communication Successful

NOte: If the connection canNOt be made, please confirm whether the COM port is selected correctly and whether the communication line is connected. After confirming the connection, follow the above steps to reconnect.

Click the option 【Parameter】 on the upper left, and the following window will pop up. At this time, the internal parameters of the drive will be automatically uploaded. After the upload is completed, the customer can change the parameters according to the needs.

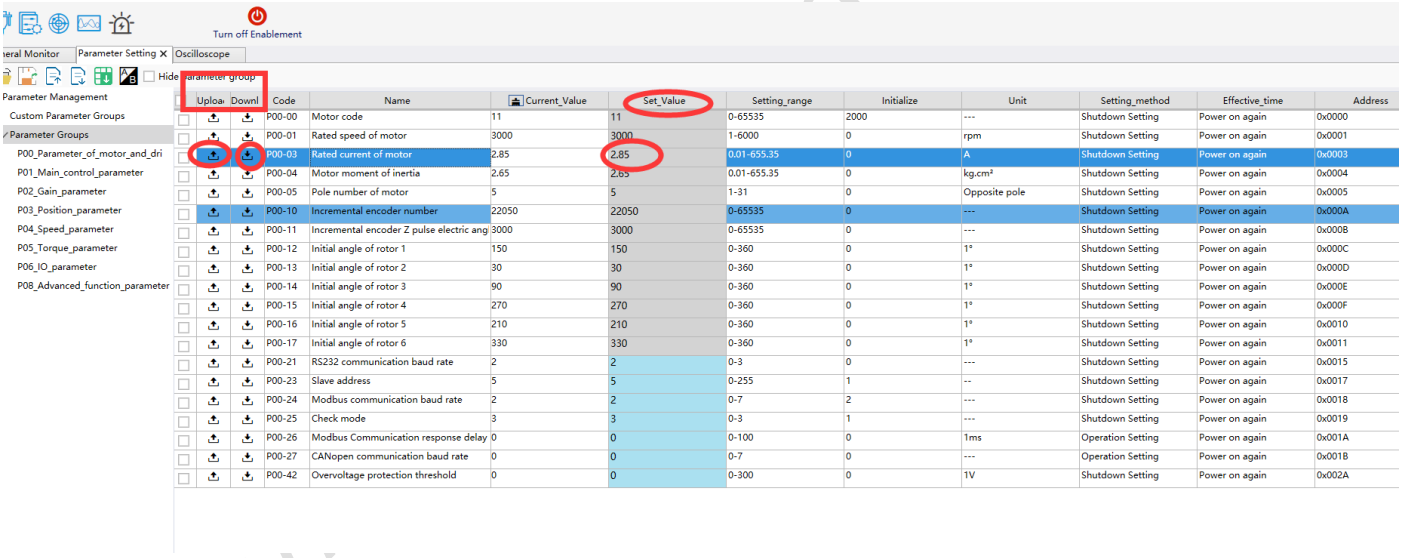



| Upload | Download | Code | Name | Current_Value | Set_Value | Setting_range | Initialize | Unit | Setting_method | Effective_time |
|---|---|---|---|---|---|---|---|---|---|---|
| | | P00-00 | Motor code | 11 | 11 | 0-65535 | 2000 | --- | Shutdown Setting | Power on again |
| | | P00-01 | Rated speed of motor | 3000 | 3000 | 1-6000 | 0 | rpm | Shutdown Setting | Power on again |
| | | P00-03 | Rated current of motor | 2.85 | 2.85 | 0.01-655.35 | 0 | A | Shutdown Setting | Power on again |
| | | P00-04 | Motor moment of inertia | 2.65 | 2.65 | 0.01-655.35 | 0 | kg.cm² | Shutdown Setting | Power on again |
| | | P00-05 | Pole number of motor | 5 | 5 | 1-31 | 0 | Opposite pole | Shutdown Setting | Power on again |
| | | P00-10 | Incremental encoder number | 22050 | 22050 | 0-65535 | 0 | --- | Shutdown Setting | Power on again |
| | | P00-11 | Incremental encoder Z pulse electric ang | 3000 | 3000 | 0-65535 | 0 | --- | Shutdown Setting | Power on again |
| | | P00-12 | Initial angle of rotor 1 | 150 | 150 | 0-360 | 0 | 1° | Shutdown Setting | Power on again |
| | | P00-13 | Initial angle of rotor 2 | 30 | 30 | 0-360 | 0 | 1° | Shutdown Setting | Power on again |
| | | P00-14 | Initial angle of rotor 3 | 90 | 90 | 0-360 | 0 | 1° | Shutdown Setting | Power on again |
| | | P00-15 | Initial angle of rotor 4 | 270 | 270 | 0-360 | 0 | 1° | Shutdown Setting | Power on again |
| | | P00-16 | Initial angle of rotor 5 | 210 | 210 | 0-360 | 0 | 1° | Shutdown Setting | Power on again |
| | | P00-17 | Initial angle of rotor 6 | 330 | 330 | 0-360 | 0 | 1° | Shutdown Setting | Power on again |
| | | P00-21 | RS232 communication baud rate | 2 | 2 | 0-3 | 0 | --- | Shutdown Setting | Power on again |
| | | P00-23 | Slave address | 5 | 5 | 0-255 | 1 | -- | Shutdown Setting | Power on again |
| | | P00-24 | Modbus communication baud rate | 2 | 2 | 0-7 | 2 | --- | Shutdown Setting | Power on again |
| | | P00-25 | Check mode | 3 | 3 | 0-3 | 1 | --- | Shutdown Setting | Power on again |
| | | P00-26 | Modbus Communication response delay | 0 | 0 | 0-100 | 0 | 1ms | Operation Setting | Power on again |
| | | P00-27 | CANopen communication baud rate | 0 | 0 | 0-7 | 0 | --- | Operation Setting | Power on again |
| | | P00-42 | Overvoltage protection threshold | 0 | 0 | 0-300 | 0 | 1V | Shutdown Setting | Power on again |

Figure 4Parameter reading completed

NOte: P00-xx are motor and driver parameters, which have been set at the factory and will NOt be provided to customers for modification.

- The parameter settings follow the three steps of Modify → Download → Upload, as shown in the figure below:




| Upload | Download | Code | Name | Current_Value | Set_Value | Setting_range | Initialize | Unit | Setting_method | Effective_time | Address |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | P00-00 | Motor code | 11 | 11 | 0-65535 | 2000 | --- | Shutdown Setting | Power on again | 0x0000 |
| | | P00-01 | Rated speed of motor | 3000 | 3000 | 1-6000 | 0 | rpm | Shutdown Setting | Power on again | 0x0001 |
| | | P00-03 | Rated current of motor | 2.85 | 2.85 | 0.01-655.35 | 0 | A | Shutdown Setting | Power on again | 0x0003 |
| | | P00-04 | Motor moment of inertia | 2.65 | 2.65 | 0.01-655.35 | 0 | kg.cm² | Shutdown Setting | Power on again | 0x0004 |
| | | P00-05 | Pole number of motor | 5 | 5 | 1-31 | 0 | Opposite pole | Shutdown Setting | Power on again | 0x0005 |
| | | P00-10 | Incremental encoder number | 22050 | 22050 | 0-65535 | 0 | --- | Shutdown Setting | Power on again | 0x000A |
| | | P00-11 | Incremental encoder Z pulse electric ang | 3000 | 3000 | 0-65535 | 0 | --- | Shutdown Setting | Power on again | 0x000B |
| | | P00-12 | Initial angle of rotor 1 | 150 | 150 | 0-360 | 0 | 1° | Shutdown Setting | Power on again | 0x000C |
| | | P00-13 | Initial angle of rotor 2 | 30 | 30 | 0-360 | 0 | 1° | Shutdown Setting | Power on again | 0x000D |
| | | P00-14 | Initial angle of rotor 3 | 90 | 90 | 0-360 | 0 | 1° | Shutdown Setting | Power on again | 0x000E |
| | | P00-15 | Initial angle of rotor 4 | 270 | 270 | 0-360 | 0 | 1° | Shutdown Setting | Power on again | 0x000F |
| | | P00-16 | Initial angle of rotor 5 | 210 | 210 | 0-360 | 0 | 1° | Shutdown Setting | Power on again | 0x0010 |
| | | P00-17 | Initial angle of rotor 6 | 330 | 330 | 0-360 | 0 | 1° | Shutdown Setting | Power on again | 0x0011 |
| | | P00-21 | RS232 communication baud rate | 2 | 2 | 0-3 | 0 | --- | Shutdown Setting | Power on again | 0x0015 |
| | | P00-23 | Slave address | 5 | 5 | 0-255 | 1 | -- | Shutdown Setting | Power on again | 0x0017 |
| | | P00-24 | Modbus communication baud rate | 2 | 2 | 0-7 | 2 | --- | Shutdown Setting | Power on again | 0x0018 |
| | | P00-25 | Check mode | 3 | 3 | 0-3 | 1 | --- | Shutdown Setting | Power on again | 0x0019 |
| | | P00-26 | Modbus Communication response delay | 0 | 0 | 0-100 | 0 | 1ms | Operation Setting | Power on again | 0x001A |
| | | P00-27 | CANopen communication baud rate | 0 | 0 | 0-7 | 0 | --- | Operation Setting | Power on again | 0x001B |
| | | P00-42 | Overvoltage protection threshold | 0 | 0 | 0-300 | 0 | 1V | Shutdown Setting | Power on again | 0x002A |

Figure 5Parameter setting process

NOte: After setting the corresponding parameters in the settings, press the download option to download the changed parameters to the drive, and then press the upload option to upload the parameters to the interface to verify whether the parameters have been changed.

# 7 Gain adjustment by hand

When the automatic gain adjustment does NOt reach the expected effect, you can manually fine-tune the gain to optimize the effect. The servo system consists of three control

loops, the basic control block diagram is as follows:

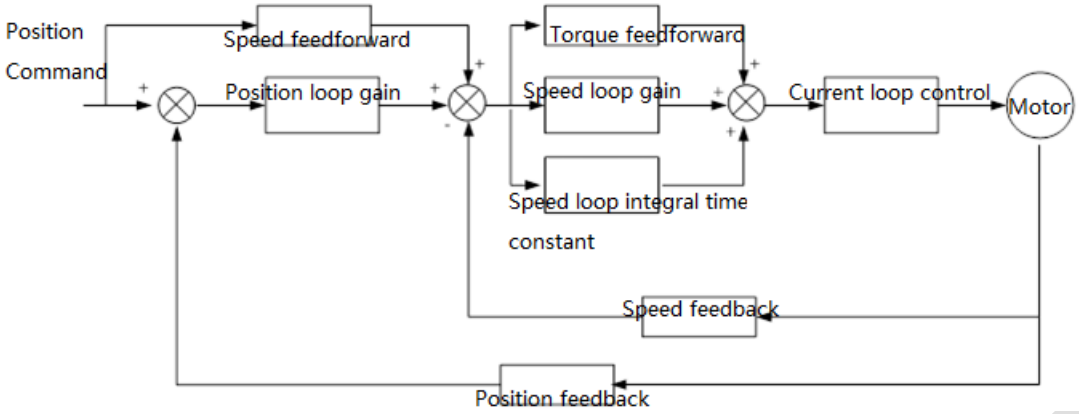



Figure 6 Servo system control block diagram

Gain adjustment needs to follow the order of inner ring and then outer ring, first set the load inertia ratio P01-04, then adjust the speed loop gain, and finally adjust the position loop gain

Speed loop gain: Increase the setting value as much as possible without vibration and NOise, which can improve the speed following performance and speed up the positioning time.

Speed integration constant: The smaller the setting value, the faster the integration speed and the stronger the integration effect. If it is too small, it will easily cause vibration and NOise.



Table 1 Basic gain parameter

| Parameter code | Name | Setting range | Default | Description |
|---|---|---|---|---|

| | | | | |
|---|---|---|---|---|
| P01-02 | Real-time automatic adjustment mode | 0-2 | 2 | 0: Manually adjust the rigidity.<br>1: Standard mode automatically adjusts rigidity. In this mode, the parameters P02-00, P02-01, P02-10, P02-11, P02-13, P02-14, P08-20 will be based on the rigidity level set by P01-03<br>Automatic setting, manual adjustment of these parameters will have NO effect. To The following parameters are set by the user:<br>P02-03 (speed feedforward gain), P02-04 (speed feedforward leveling Slip constant).<br>2: The positioning mode automatically adjusts the rigidity. In this mode, this mode<br>Next, the parameters P02-00, P02-01, P02-10, P02-11,<br>P02-13, P02-14, P08-20 will be set according to P01-03<br>Rigidity level is set automatically, manual adjustment of these parameters will NOt be able to<br>effect. The following parameters will be fixed values and canNOt be changed:<br>P02-03 (Speed feedforward gain): 30.0%<br>P02-04 (Speed feedforward smoothing constant): 0.50 |
| P01-03 | Real-time automatic adjustment of rigidity settings | 0-31 | 13 | Built-in 32 kinds of gain parameters, when P01-02 is set to 1, or<br>2 time to work. Can be directly called and set according to the actual situation<br>The larger the value, the stronger the rigidity. |
| P02-00 | Position control gain 1 | 0-3000. 0 | 80.0 | ▸ The larger the setting value, the higher the gain, the greater the rigidity, and the position lags<br>The smaller it is, but the value is too large, the system will oscillate and overshoot.<br>▸ Gain at rest. |

| | | | | |
|---|---|---|---|---|
| P02-01 | Position control gain 2 | 0-3000.0 | 80.0 | ▸ The larger the setting value, the higher the gain, the greater the rigidity, and the position lags<br>The smaller the value, but the larger the value, the more shock and overshoot.<br>▸ Increase the value as much as possible without vibration.<br>For gain during exercise. |
| P02-03 | Speed feedforward gain | 0-100.0 | 30.0 | For the feedforward gain of the speed loop, the larger the parameter value, the smaller the system position tracking error and the faster the response. But if the feedforward gain is too large, it will<br>Make the position loop of the system unstable, and it is easy to produce overshoot and vibration. |
| P02-04 | Speed feedforward Smoothing constant | 0-64.00 | 0 | This parameter is used to set the time constant of the speed loop feedforward filter. value<br>The larger, the filtering effect increases, but at the same time the phase lag increases. |
| P02-10 | Speed ratio Gain 1 | 1-2000.0 | 40.0 | ▸ The larger the setting value, the greater the gain and rigidity.<br>Machine and load settings.<br>▸ Increase the value as much as possible without vibration.<br>▸ Gain at rest. |
| P02-11 | Speed integral Constant 1 | 0.1-1000.0 | 10.0 | ▸ Integral time constant of speed regulator, the smaller the setting value, the integral<br>The faster the speed, the greater the stiffness.<br>Out of NOise.<br>▸Under the condition of NO vibration in the system, try to reduce the value of this parameter |

| | | | | |
|---|---|---|---|---|
| P02-12 | Pseudo-differential Feed Control System Number 1 | 0-100.0 | 100.0 | ▸When set to 100.0%, the speed loop adopts PI control, and the dynamic response is fast; when set to 0, the integral effect of the speed loop is obvious,<br>Low frequency interference can be filtered, but the dynamic response is slow.<br>▸By adjusting this coefficient, the speed loop can have better dynamics<br>Response, while increasing the resistance to low-frequency interference. |
| P02-13 | Speed proportional gain 2 | 1-2000.0 | 45.0 | ▸ The larger the setting value, the greater the gain and rigidity. The parameter value is set according to the motor and load conditions.<br>▸ Increase the value as much as possible without vibration.<br>▸ Gain during exercise. |
| P02-14 | Speed integral constant 2 | 0.1-1000.0 | 1000.0 | The integral time constant of the speed regulator. The smaller the setting value, the faster the integral speed and the greater the stiffness. If it is too small, it will easily cause vibration and NOise.<br>▸Under the condition that the system does NOt oscillate, try to reduce the value of this parameter.<br>▸ This parameter is for steady state response. |
| P02-15 | Pseudo-differential feedforward control coefficient 2 | 0-100.0 | 100.0 | ▸When set to 100.0%, the speed loop adopts PI control, and the dynamic response is fast; when set to 0, the integral effect of the speed loop is obvious, which can filter low-frequency interference, but the dynamic response is slow.<br>▸By adjusting this coefficient, the speed loop can have better dynamics<br>Response, while increasing the resistance to low-frequency interference. |

# 8 Parameter and Function

## 8.1 Parameter list

P00-xx: motor and drive’s parameter
P01-xx: Main Control parameter
P02-xx: Gain parameter
P03-xx: Position parameter
P04-xx: Speed parameter
P05-xx: Torque parameter
P06-xx: I/O parameter
P08-xx: Advanced Function parameter

Table 65 parameter list

| Type | Parameter code | Name | Range | Default | Unit | Set method | Effective time |
|---|---|---|---|---|---|---|---|
| Motor and driver parameters | P00-00 | Motor SN | 0-65535 | --- | | Stop & set | Power-On again |
| | P00-01 | Motor rated speed | 1-6000 | --- | rpm | Stop & set | Power-On again |
| | P00-02 | Motor rated torque | 0.01-655.35 | --- | N.M | Stop & set | Power-On again |
| | P00-03 | Motor rated current | 0.01-655.35 | --- | A | Stop & set | Power-On again |
| | P00-04 | Motor rotary inertia | 0.01-655.35 | --- | kg.cm² | Stop & set | Power-On again |
| | P00-05 | Motor pole pairs | 1-31 | --- | Polar logarithm | Stop & set | Power-On again |
| | P00-10 | Incremental encoder PPR | 0-65535 | --- | | Stop & set | Power-On again |
| | P00-11 | Incremental encoder Z pulse electrical angle | 0-65535 | --- | | Stop & set | Power-On again |
| | P00-12 | Rotor initial angel 1 | 0-360 | --- | 1° | Stop & set | Power-On again |
| | P00- | Rotor initial | 0-360 | --- | 1° | Stop & | Power-On |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| | 13 | angel 2 | | | | set | again |
| | P00-14 | Rotor initial angel 3 | 0-360 | --- | 1° | Stop & set | Power-On again |
| | P00-15 | Rotor initial angel 4 | 0-360 | --- | 1° | Stop & set | Power-On again |
| | P00-16 | Rotor initial angel 5 | 0-360 | --- | 1° | Stop & set | Power-On again |
| | P00-17 | Rotor initial angel 6 | 0-360 | --- | 1° | Stop & set | Power-On again |
| | P00-21 | RS232 baud rate | 0-3 | 2 | --- | Stop & set | Power-On again |
| | P00-23 | Slave address | 0-255 | 1 | --- | Stop & set | Power-On again |
| | P00-25 | Verification method | 0-3 | 1 | --- | Stop & set | Power-On again |
| | P00-42 | Overvoltage protection threshold | 0-300 | 0 | 1V | Stop & set | Power-On again |
| Main control parameters | P01-01 | Control mode setup | 0-6 | 0 | --- | Stop & set | Immediate |
| | P01-02 | Real-time automatic adjustment mode | 0-2 | 1 | --- | Running & set | Immediate |
| | P01-03 | Real-time automatic adjustment of rigidity settings | 0-31 | 13 | --- | Running & set | Immediate |
| | P01-04 | Inertia ratio | 0-100.00 | 1 | 1 time | Running & set | Immediate |
| | P01-30 | Brake-command-servo off, delay time(brake open delay) | 0-255 | 100 | 1ms | Running & set | Immediate |
| | P01-31 | brake output speed limitation | 0-3000 | 100 | 1rpm | Running & set | Immediate |
| | P01-32 | Servo OFF brake command waiting time | 0-255 | 100 | 1ms | Running & set | Immediate |
| Gain parameters | P02-00 | Position control gain 1 | 0-3000.0 | 48.0 | 1/S | Running & set | Immediate |
| | P02-01 | Position control gain 2 | 0-3000.0 | 57.0 | 1/S | Running & set | Immediate |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| | P02-03 | Speed feedforward gain | 0-100.0 | 30.0 | 1.0% | Running & set | Immediate |
| | P02-04 | Speed feedforward smooth constant | 0-64.00 | 0.5 | 1ms | Running & set | Immediate |
| | P02-10 | Speed ratio gain 1 | 1.0-2000.0 | 27.0 | 1Hz | Running & set | Immediate |
| | P02-11 | Speed integral constant 1 | 0.1-1000.0 | 10.0 | 1ms | Running & set | Immediate |
| | P02-12 | Fake differential feed-forward control ratio 1 | 0-100.0 | 100.0 | 1.0% | Running & set | Immediate |
| | P02-13 | Speed ratio gain 2 | 1.0-2000.0 | 27.0 | 1Hz | Running & set | Immediate |
| | P02-14 | Speed integral gain 2 | 0.1-1000.0 | 1000.0 | 1ms | Running & set | Immediate |
| | P02-15 | Fake differential feed-forward control ratio 2 | 0-100.0 | 100.0 | 1.0% | Running & set | Immediate |
| | P02-19 | Torque feedforward gain | 0-30000 | 0 | 1.0% | Running & set | Immediate |
| | P02-20 | Torque feedforward smooth constant | 0-64.00 | 0.8 | 1ms | Running & set | Immediate |
| | P02-30 | Gain switching mode | 0-10 | 0 | --- | Running & set | Immediate |
| | P02-31 | Gain switching grade | 0-20000 | 800 | --- | Running & set | Immediate |
| | P02-32 | Gain switching lag | 0-20000 | 100 | --- | Running & set | Immediate |
| | P02-33 | Gain switching delay | 0-1000.0 | 10.0 | 1ms | Running & set | Immediate |
| | P02-34 | Position gain switching time | 0-1000.0 | 10.0 | 1ms | Running & set | Immediate |
| | P02-41 | Mode switch selection | 0-20000 | 10000 | --- | Running & set | Immediate |
| | P02-50 | Torque command added value | -100.0-100.0 | 0 | 1.0% | Running & set | Immediate |
| | P02-51 | CW torque compensation | -100.0-100.0 | 0 | 1.0% | Running & set | Immediate |
| | P02-52 | Reverse torque compensation | -100.0-100.0 | 0 | 1.0% | Running & set | Immediate |
| Positional | P03-00 | Source of location command | 0-1 | 0 | --- | Stop & set | Immediate |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| parameter | P03-03 | Instruction Pulse Inversion | 0-1 | 0 | --- | Stop & set | Immediate |
| | P03-04 | Position Pulse filtering | 0-3 | 2 | --- | Running & set | Immediate |
| | P03-05 | Positioning completion criteria | 0-2 | 1 | --- | Running & set | Immediate |
| | P03-06 | Location complete range | 0-65535 | 30 | Encoder Unit | Running & set | Immediate |
| | P03-09 | Number of instruction pulses per turn of motor | 0-65535 | 4000 | Pulse | Running & set | Power-On again |
| | P03-10 | Electron Gear 1 molecule | 1-65535 | 4000 | --- | Running & set | Power-On again |
| | P03-11 | Electronic gear 1 DeNOminator | 1-65535 | 4000 | --- | Running & set | Power-On again |
| | P03-15 | Excessive position deviation setting | 0-65535 | 0 | Command unit *10 | Running & set | Immediate |
| | P03-16 | Position Instruction smoothing filter time constant | 0-1000.0 | 0 | 1ms | Running & set | Immediate |
| Speed parameter | P04-00 | Speed instruction source | 0-1 | 1 | --- | Stop & set | Immediate |
| | P04-01 | Speed instruction analog counter | 0-1 | 0 | --- | Stop & set | Immediate |
| | P04-02 | Digital speed given value | -6000—6000 | 0 | 1rpm | Running & set | Immediate |
| | P04-05 | Overspeed alarm value | 0-6500 | 6400 | 1rpm | Running & set | Immediate |
| | P04-06 | Forward speed limit | 0-6000 | 5000 | 1rpm | Running & set | Immediate |
| | P04-07 | Reverse speed limit | 0-6000 | -5000 | 1rpm | Running & set | Immediate |
| | P04-10 | Zero velocity detection value | 0-200.0 | 40 | 1rpm | Running & set | Immediate |
| | P04-14 | Acceleration time | 0-10000 | 500 | 1ms/1000rpm | Running & set | Immediate |
| | P04-15 | Deceleration time | 0-10000 | 500 | | Running & set | Immediate |
| Torque | P05- | Internal Forward | 0-300.0 | 200. | 1.0% | Running | Immediate |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| parameters | 10 | Torque limit | | 0 | | & set | |
| | P05-11 | Internal reverse torque limit | 0-300.0 | 200.0 | 1.0% | Running & set | Immediate |
| I/O | P06-00 | Enable the effective level of the input port | 0-4 | 1 | --- | Running & set | Power-On again |
| | P06-20 | Alarm output port effective level | 0-1 | 1 | --- | Running & set | Power-On again |
| | P06-22 | Effective level of output port | 0/1 | 1 | --- | Running & set | Power-On again |
| Advanced function parameters | P08-19 | Feedback speed low-pass filter constant | 0-25.00 | 0.8 | 1ms | Running & set | Immediate |
| | P08-20 | Torque command filter constant | 0-25.00 | 0.84 | 1ms | Running & set | Immediate |
| | P08-25 | Disturbance torque compensation gain | 0-100.0 | 0 | % | Running & set | Immediate |
| | P08-26 | Disturbance torque filtering time constant | 0-25.00 | 0.8 | 1ms | Running & set | Immediate |

## 8.2 Explanation of parameter

### 8.2.1 P00-xx P00-xx Motor and driver parameters

Table 2 P00-xx Motor & driver parameter

| Parameters Code | Name | Description |
|---|---|---|
| P00-00 | Motor number | Default set<br>0: P0-01 to P0-17 is available |
| P00-01 | Rated speed | Set range: 1~6000 rpm; unit: rpm;<br>default value. |
| P00-02 | rated torque | Set range 0.01-655.35 N.m;unit: N.M<br>Default value. |
| P00-03 | Rated current | Set range: 0.01-655.35A,unit: A<br>Default value |
| P00-04 | Rotor inertia | Set range: 0.01-655.35kg.cm²; unit: kg.cm²<br>Default value |

| | | |
|---|---|---|
| P00-05 | Pole pairs | Set range:1-31 pairs; unit: pairs<br>Default value |
| P00-10 | Incremental encoder lines | Default set |
| P00-11 | incremental encoder Z pulse electric angle | Default set |
| P00-12 | Rotor initial angle 1 | Default set |
| P00-13 | Rotor initial angle 2 | Default set |
| P00-14 | Rotor initial angle 3 | Default set |
| P00-15 | Rotor initial angle 4 | Default set |
| P00-16 | Rotor initial angle 5 | Default set |
| P00-17 | Rotor initial angle 6 | Default set |
| P00-21 | RS232 communication baud rate selection | Set range: 0-3;<br>Choose baud rate to communicate with PC:<br>0: 9600<br>1: 19200<br>2: 57600<br>3: 115200 |
| P00-23 | Slave address | Set range: 0-255; Default:1;<br>Set according to device required. |
| P00-25 | Calibration method | Set range: 0-3; Default: 1.<br>0: NO calibration, 2 stop bit.<br>1: even calibration, 1 stop bit.<br>2: odd calibration, 1 stop bit.<br>3.NO calibration, 1 stop bit. |
| P00-42 | Overvoltage protection threshold | Setting range: 0-300, unit V |

### 8.2.2 P01-xx Main control parameters

| Parameters Code | Name | Description |
|---|---|---|
| P01-01 | Control mode setting | Setting range:0-6<br>0: Position control mode.<br>1: Speed control mode.<br>2: Torque control mode<br>3: Speed, torque control mode. Need to use an external input port in CN1 to switch, set the selected DI port input port function selection to 5 (control mode switching). Control the logic |

<table>
<tr>
<td></td>
<td></td>
<td>state of the port to switch the control mode
<table>
<tr><td>Port logic</td><td>Control mode</td></tr>
<tr><td>Valid</td><td>Speed mode</td></tr>
<tr><td>Invalid</td><td>Torque mode</td></tr>
</table>
4: Position and speed control mode. Need to use an external input port in CN1 to switch, set the selected DI port input port function selection to 5 (control mode switching). Control the logic state of the port to switch the control mode.
<table>
<tr><td>Port logic</td><td>Control mode</td></tr>
<tr><td>Valid</td><td>Position mode</td></tr>
<tr><td>Invalid</td><td>Speed mode</td></tr>
</table>
5: Position and torque control mode. Need to use an external input port in CN1 to switch, set the selected DI port input port function selection to 5 (control mode switching). Control the logic state of the port to switch the control mode.
<table>
<tr><td>Port logic</td><td>Control mode</td></tr>
<tr><td>Valid</td><td>Position mode</td></tr>
<tr><td>Invalid</td><td>Torque mode</td></tr>
</table>
6: Fully closed loop</td>
</tr>
<tr>
<td>P01-02</td>
<td>Real time automatic adjustment mode</td>
<td>Setting range:0-2<br>0: Manual adjustment of rigidity<br>1 : Standard mode automatically adjusts rigidity. In this mode, parameters P02-00, P02-01, P02-10, P02-11, P02-13, P02-14, P08-20 will be set<br>automatically according to the stiffness level set by P01-03, and these parameters can NOt be adjusted by manual. The following parameters are set by the user:<br>P02-03 (speed feedforward gain), P02-04 (speed feedforward smoothing constant).<br>2 : Positioning mode automatically adjusts rigidity. In this mode, parameters P02-00, P02-01, P02-10, P02-11, P02-13, P02-14, P08-20 will be set automatically according to the rigidity level set by P01-03. and these parameters can NOt be adjusted by manual.. The following</td>
</tr>
</table>

| | | |
|---|---|---|
| | | parameters will be fixed and canNOt be changed:<br>P02-03 (speed feedforward gain), 30%<br>P02-04 (speed feedforward smoothing constant).0.5 |
| P01-03 | Automatically adjust the rigidity setting | Setting range: 0-31<br>Built-in 32 kinds of gain parameters. It works when P01-02 is set to 1, 2, or 3. It can be called directly according to the actual situation. The larger the set value, the stronger the rigidity. |
| P01-04 | Rotor inertia ratio | Setting range: 0-100, unit: times<br>Set the load inertia ratio to related motor. The setting method is as follows:<br>P01-04 = Load inertia / motor inertia<br>This inertia ratio can use the value after AF-J-L automatic inertia recognition, write the recognized value into the parameter |
| P01-30 | Brake command-Servo OFF delay time (brake open delay) | Setting range: 0-255, unit: ms<br>When enabling: The drive will only receive the position command after the time of P01-30 is executed under the enable command is executed.<br>When the enable is off: When the motor is at a static state, after the close enable command is executed, the time after the brake is closed and the motor becomes NOn-energized. |
| P01-31 | Speed limit value of brake command output | Setting range: 0-3000, unit: rpm<br>Motor speed threshold when the brake output is active when the motor is rotating. Less than this threshold, the brake output command is valid, otherwise it will wait for P01-32 time, the brake output command is valid. |
| P01-32 | Servo OFF-brake command waiting time | Setting range: 0-255, unit: ms<br>The maximum waiting time for the brake output when the motor is rotating. |



### 8.2.3 P02-xx Gain parameters

Table 3 P02-xx Gain parameters

| Parameters Code | Name | Description |
|---|---|---|

| | | |
|---|---|---|
| P02-00 | Position control gain 1 | Setting range: 0-3000.0, unit: 1 / S<br>Position loop regulator scale gain. The larger the parameter value set, the higher the gain ratio is, the greater the stiffness is, the smaller the position tracking error will be, and the faster the response. However, too large a parameter can easily cause vibration and overshoot.<br>This parameter is for steady state response. |
| P02-01 | Position control gain 2 | Setting range: 0-3000.0, unit: 1 / S<br>Position loop regulator scale gain. The larger the parameter value set, the higher the gain ratio is, the greater the stiffness is, the smaller the position tracking error will be, and the faster the response. However, too large a parameter can easily cause vibration and overshoot.<br>This parameter is for dynamic response. |
| P02-03 | Speed feedforward gain | Setting range: 0-100.0, unit: 1.0%<br>The feedforward gain of the speed loop. The larger the parameter value set, the smaller the system position tracking error and the faster the response. However, if the feedforward gain is too large, the position loop of the system will be unstable, which will easily cause overshoot and<br>vibration. |
| P02-04 | Speed feedforward smoothing constant | Setting range: 0-64.00, unit: ms<br>This parameter is used to set the speed loop feedforward filtering time constant. The larger the value set, the larger the filtering effect, but at the same time the phase lag increases. |
| P02-10 | Speed proportional gain 1 | Setting range: 1.0-2000.0, unit: Hz<br>The larger the speed proportional gain is, the larger the servo stiffness is and the faster the speed response is. However, if it is too large, it is easy to generate vibration and NOise.<br>Under the condition that the system does NOt oscillate, increase this parameter value as much as possible. |

| | | |
|---|---|---|
| | | This parameter is for a static response. |
| P02-11 | Speed integral constant 1 | Setting range: 1.0-1000, Unit: ms.<br>Speed regulator integration time constant. The smaller the setting value, the faster the integration speed, the greater the stiffness, and the vibration is too easy to produce NOise if it is too small.<br>When the system does NOt oscillate, reduce this parameter value as much as possible.<br>This parameter is for steady state response. |
| P02-12 | Pseudo-differential feedforward control coefficient 1 | Setting range: 0-100.0, unit: 1.0%<br>When set to 100.0%, the speed loop adopts PI control, and the dynamic response is fast; when set to 0, the speed loop integral effect is obvious, which can filter low-frequency interference, but the dynamic response is slow.<br>By adjusting this coefficient, the speed loop can have a better dynamic<br>response, and it can increase the resistance to low-frequency interference. |
| P02-13 | speed proportional gain 2 | Setting range: 1.0-2000.0, unit: Hz<br>The larger the speed proportional gain is, the larger the servo stiffness is and the faster the speed response is. However, if it is too large, it is easy to generate vibration and NOise.<br>Under the system has NO vibration, increase this parameter value as much as possible.<br>This parameter is for dynamic response. |
| P02-14 | Speed integral constant 2 | Setting range: 1.0-1000.0, unit: ms<br>Speed regulator integration time constant. The smaller the setting value, the faster the integration speed, the greater the stiffness is, and the vibration is too easy to produce NOise if it is too small.<br>Under the system has NO vibration, reduce this parameter value as much as possible.<br>This parameter is for dynamic response. |
| P02-15 | Pseudo-differential feedforward control coefficient 2 | Setting range: 0-100.0, unit: 1.0%<br>When set to 100.0%, the speed loop PI control, and the dynamic response is fast; when set to 0, the speed loop integral effect is obvious, |

<table>
<tr><td></td><td></td><td>which can filter low-frequency interference, but the dynamic response is slow.<br>By adjusting this coefficient, the speed loop can have a better dynamic<br>response, and at the same time, it can increase the resistance to low-frequency interference.</td></tr>
<tr><td>P02-19</td><td>Torque feedforward gain</td><td>Setting range: 0-30000, unit: 1.0%<br>Set the current loop feedforward weighting value. This parameter adds the current loop after weighting the differential of the speed command.</td></tr>
<tr><td>P02-20</td><td>Torque feed-forward smoothing constant</td><td>Setting range: 0-64.00, unit: ms<br>This parameter is used to set the torque feedforward filtering time constant.</td></tr>
<tr><td>P02-30</td><td>Gain switching mode</td><td>Setting range: 0-10<br>The condition to set the 1st and 2nd gain switching mode
<table>
<tr><td>Value</td><td>Switch condition</td><td>Remark</td></tr>
<tr><td>0</td><td>fix to the 1st gain</td><td>P02-00、P02-10、P02-11、P02-12</td></tr>
<tr><td>1</td><td>fix to the 2nd gain</td><td>P02-01、P02-13、P02-14、P02-15</td></tr>
<tr><td>2</td><td>Use DI input switching</td><td>Need to set the DI port to 9 (gain switching input)<br>Invalid: first gain<br>Effective: second gain</td></tr>
<tr><td>3</td><td>Big torque command value</td><td>When the torque command is greater than the threshold (determined by P02-31 and P02-32), it switches to the second gain. When it is less than the threshold and exceeds the P02-33 delay setting, it switches to the first gain.</td></tr>
<tr><td>4</td><td>Speed command changes a lot</td><td>When the speed command change is greater than the threshold (determined by P02-31 and P02-32), it switches to the second gain. When it is less than</td></tr>
</table></td></tr>
</table>

| | | | | |
|---|---|---|---|---|
| | | | | the threshold and exceeds the P02-33 delay setting, it switches to the first gain. |
| | | 5 | Big speed command | When the speed command is greater than the threshold (determined by P02-31 and P02-32), it switches to the second gain. When it is less than the threshold and exceeds the P02-33 delay setting, it switches to the first gain. |
| | | 6 | Large position deviation | When the position deviation is greater than the threshold (determined by P02-31 and P02-32), switch to the second gain. When it is less than the threshold and exceeds the P02-33 delay setting, it switches to the first gain. |
| | | 7 | There is position command | Switch to the second gain when there is a position command. When the position command ends and the P02-33 delay setting is exceeded, it switches to the first gain. |
| | | 8 | Incomplete positioning | Switch to the second gain when positioning is NOt completed. When the positioning is completed and the P02-33 delay setting is exceeded, it switches to the first gain. |
| | | 9 | Actual speed is big | Switch to the second gain when the actual speed is greater than the threshold (determined by P02-31 and |

| | | | | |
|---|---|---|---|---|
| | | | | P02-32). When it is less than the threshold and exceeds the P02-33 delay setting, it switches to the first gain. |
| | | 10 | With position command + actual speed | Switch to the second gain when there is a position command. When there is NO position command and the actual speed is less than the threshold (determined by P02-31 and P02-32), and when the delay setting of P02-33 is exceeded, it switches to the first gain. |
| P02-31 | Gain switching level | Setting range: 0-20000<br>Judgment threshold when gain is switched.<br>Torque unit: 1000bit = 25% of rated torque<br>Speed unit: 1000bit = 200 rpm<br>Position unit: 131072bit per revolution | | |
| P02-32 | Gain switching hysteresis | Setting range: 0-20000<br>Hysteresis level at gain switching<br>Torque unit: 1000bit = 25% of rated torque<br>Speed unit: 1000bit = 200 rpm<br>Position unit: 131072bit per revolution | | |
| P02-33 | Gain switching delay | Setting range: 0-1000.0, unit: ms<br>When switching from the second gain to the first gain, the time from when the trigger condition is met to the actual switching. | | |
| P02-34 | Position gain switching time | Setting range: 0-1000.0, unit: ms<br>Time for position control gain 1 to smoothly switch to position control gain 2 | | |
| P02-41 | Mode switch level | Setting range: 0-20000<br>Set the threshold for switching.<br>Torque unit: 1000bit = 25% of rated torque<br>Speed unit: 1000bit = 200 rpm<br>Position unit: 131072bit per revolution | | |
| P02-50 | Torque command added value | Setting range: -100.0-100, unit: 1.0%<br>Valid in position control mode. This value is superimposed on the torque reference value and is used for vertical axis static torque | | |

| | | |
|---|---|---|
| | | compensation. |
| P02-51 | Forward torque compensation | Setting range: -100.0-100.0, unit: 1.0%<br>Valid in position control mode. For compensating forward static friction |
| P02-52 | Reverse torque compensation | Setting range: -100.0-100.0, unit: 1.0%<br>Valid in position control mode. Used to compensate reverse static friction |

### 8.2.4 P03-xx Position parameters

Table 4 P03-xx Position parameters

| Parameters Code | Name | Description |
|---|---|---|
| P03-00 | Source of position command | 0: pulse command<br>1: Given the number, use it when communicating with control |
| P03-03 | Instruction Pulse Inversion | Used to adjust the direction of the pulse instruction count 0: normal<br>1: In The Opposite Direction |
| P03-04 | Position Pulse filter setting | Set range:0-1 Unit:us<br>0: 0.1us。<br>1: 0.4us<br>2: 0.8us。<br>3: 1.6us |
| P03-05 | Positioning completion criteria | 0: Output when position deviation is less than P03-06 setting value<br>1: Output when position is given, and output when position deviation is less than P03-06 setting value<br>2: Output when position is given (after filtering) , and output when<br>position deviation is less than P03-06 setting value |
| P03-06 | Location complete range | Setting range: 0-65535, unit: encoder unit<br>Used to set the threshold value for positioning completion output. If an incremental encoder motor is used, the number of encoder lines per revolution is calculated by * 4 |
| P03-09 | Number of | Setting range: 0-65535 |

| | | |
|---|---|---|
| | instruction pulses per turn of motor | Absolute encoder motor is effectively used to set motor rotation number of instructions pulse. When this parameter is set to 0, P03-10 and P03-11 are valid |
| P03-10 | Electric gear 1 Molecule | Calculation formula of incremental motor electronic gear ratio:<br>$G = \frac{C \times 4}{P} = \frac{\text{Molecule}}{\text{Denominator}}$<br>C: Encoder line P: No.of input pulse per turn<br>Eg: encoder line 2500; pulse per turn 3200; Electronic gear ratio?<br>$G = \frac{C \times 4}{P} = \frac{2500 \times 4}{3200} = \frac{10000}{3200} = \frac{25}{8}$ |
| P03-11 | Electric gear 1 DeNOminator | |
| P03-15 | Position deviation setting is too big | Setting range: 0-65535, Unit: Instruction Unit * 10<br>set the number of pulse to allow deviation, more than the set value will alarm. EXAMPLE: Setting a value of 20, the drive alerts Al. 501 when the follow deviation exceeds 20 * 10(position deviation is too large) |
| P03-16 | Position Instruction smoothing filter constant | Setting range: 1000, unit: ms<br>Set the time constant of the position command smoothing filter |

## 8.2.5 P04-xx Speed Parameter

Table 5 P04-xx Speed parameter

| Parameter code | Name | Description |
|---|---|---|
| P04-00 | Speed instruction source | 0: External Analog Instruction<br>1: Digital Instruction (Parameter Setting)<br>2: Digital Instruction (Communication)<br>3: Internal Multiple instruction sets |
| P04-01 | Speed command analog inversion | Used to adjust the polarity relationship of analog quantity<br>0: normal<br>1: Polarity is inversion |

| | | |
|---|---|---|
| P04-02 | Digital speed given value | Setting range: -6000 - 6000, Unit: rpm<br>when P04-00 is set to 1, P04-02 is the speed control setting |
| P04-05 | Overspeed alarm value | Setting range: 0-6500, unit: rpm<br>Set the maximum allowable speed value, if it exceeds the set value, AL.420 overspeed alarm |
| P04-06 | Forward speed limit | Set range: 0-6000, Unit: rpm<br>Limit forward speed of motor |
| P04-07 | Reverse speed limit | Set range: -6000-0, Unit: rpm<br>Limit reverse speed of motor |
| P04-10 | Zero speed detection value | Zero speed detection value<br>Set Zero speed detection threshold, motor speed below the threshold can be output through the output port "zero speed motor output" signal |
| P04-14 | Acceleration time | Set range: 0-10000, Unit: 1ms/1000rpm Set the acceleration time in speed control |
| P04-15 | Deceleration time | Set range: 0-10000, Unit: 1ms/1000rpm<br>Set the deceleration time in speed control |

## 8.2.6 P05-xx Torque parameter

Table 6 P05-xx Torque parameter

| Parameter code | Name | Description |
|---|---|---|
| P05-10 | Internal Forward Torque limit | Setting range: 0-300.0, unit: 1.0%<br>limit motor forward output, 100 means 1 times Torque, 300 means 3 times torque<br>when the torque output reaches the limit value, the output signal can be detected through DO port output torque limit |
| P05-11 | Internal reverse torque limit | Setting range: -300.0-0, unit: 1.0%<br>limit motor reverse output, 100 means 1 times Torque, 300 means 3 times torque<br>when the torque output reaches the limit value, the output signal can be detected through the DO port output torque limit |

## 8.2.7 P06-xx I/O Parameter

Table 7 P06-xx I/O parameter

| Parameter code | Name | Description |
|---|---|---|
| P06-00 | Enable output port effective level | Setting range: 0-1, Default: 1 |
| P06-20 | Alarm output port effective level | Setting range: 0-1, Default: 1 |
| P06-22 | In place output port effective level | Setting range: 0-1, Default: 1 |

## 8.2.8 P08-xx Advanced function parameters

Table 8 P08-xx Advanced function parameters

| Parameter code | Name | Description |
|---|---|---|
| P08-19 | Feedback speed low-pass filter constant | Set range: 0-25.00, Unit: ms<br>Feedback speed low-pass filter time constant, when the motor running when there is a howling, the value can be set up properly |
| P08-20 | Torque command filter constant | Set range: 0-25.00, Unit: ms<br>Torque instruction filter time constant 1, when there is a motor running, the value can be appropriately set to large. |
| P08-25 | Disturbance torque compensation gain | Set range: 0-100.0<br>Observed Gain Coefficient of disturbing torque. The larger the value is, the stronger the anti-disturbance Torque is, but the action NOise may also be increased. |
| P08-26 | Disturbance torque filtering time constant | Set range: 0-25.00, Unit: ms<br>The bigger the value is, the stronger the filtering effect is, and the action NOise can be suppressed. However, if the disturbance is too large, the phase delay will result and the disturbance torque will be suppressed. |

## 8.3 List of monitoring items

Table 9 List of monitoring items

| Display serial number | Display item | Description | Unit |
|---|---|---|---|
| d00.C.PU | Sum of position instruction pulses | This parameter can monitor the number of pulses sent by the user to the servo driver, which can confirm whether there is the pheNOmeNOn of missing pulses | User unit |
| d01.F.PU | Sum of position feedback pulses | This parameter can monitor the pulse number of servo motor feedback. The unit is consistent with the User Input Instruction Unit | User unit |
| d02.E.PU | Number of position deviation pulses | This parameter can monitor the pulse number of the position lag in the process of the SERVO system. The unit is consistent with the User Input Instruction Unit | User unit |
| d03.C.PE | Sum of position given pulses / Gantry motor feedback pulse | This parameter can monitor the number of pulses sent by the user to the servo drive.<br>Unit: When using the absolute value motor, it is calculated as 131072bit per revolution. If an incremental encoder motor is used, the number of encoder lines per revolution is calculated by * 4. | Encoder unit/ User unit |
| d04.F.PE | Sum of position feedback pulses | This parameter can monitor the pulse number of servo motor feedback.<br>Unit: 131072 bit per turn when using absolute value motor. Use Incremental encoder motor, then each turn according to encoder line number * 4 calculate. | Encoder unit/ User unit |
| d05.E.PE | Position deviation pulse number / Gantry pulse deviation | This parameter can monitor the pulse number of the position lag in the process of the SERVO system. Unit: 131072 bit per turn when using absolute value motor. Use | Encoder unit/ User unit |

| | | | |
|---|---|---|---|
| | | Incremental encoder motor, then each turn according to encoder line number * 4 calculate. | |
| d06.C.Fr | Pulse Command input frequency | This parameter can monitor the input frequency of external pulse instruction | KPPS |
| d07.C.SP | Speed Control Command | | rpm |
| d08.F.SP | Motor speed | This parameter can monitor the speed of servo motor when it is running | rpm |
| d09. C.tQ | Torque instruction | This parameter can monitor the Torque of the servo motor when it is running | % |
| d10. F.tQ | Feedback value of torque | This parameter can monitor the Torque of the servo motor when it is running | % |
| d11.AG.L | Average torque | This parameter can monitor the average torque of the servo motor in the past 10 seconds | % |
| d12.PE.L | Peak torque | This parameter can monitor the peak torque of servo motor after power-on | % |
| d13.oL | Overload rate | This parameter can monitor the servo motor's load occupancy in the past 10 seconds | % |
| d14.rG | Regeneration load rate | This parameter monitors the load rate of the regeneration resistor | % |
| d16.I.Io | Input IO status | This parameter can monitor the input port status of CN1. The upper vertical bar represents the high level (photocoupler cut-off), and the lower vertical bar represents the low-level photocoupler conduction). The corresponding relationship with the input port is that the operation panel from right to left 4 vertical bars correspond to DI1-DI4 respectively | Binary |
| d17.o.Io | Output IO status | This parameter can monitor the output port status of CN1. The upper vertical bar represents the | Binary |

| | | | |
|---|---|---|---|
| | | optocoupler conduction, the lower vertical bar represents the optocoupler cutoff, and the corresponding relationship with the output port is the operation panel from right to left. | |
| d18.AnG | Mechanical angle of motor | This parameter can monitor the mechanical angle of the motor and rotate 1 turn is 360 degrees | 0.1 degree |
| d19.HAL | Motor UVW phase sequence | This parameter can monitor the phase sequence position of the incremental encoder motor | |
| d20.ASS | Absolute Value Encoder single-loop value | This parameter can monitor the feedback value of absolute encoder, rotating a circle for 0xffff | 0-0xFFFF |
| d21.ASH | Absolute Value Encoder multi-loop value | This parameter can monitor the number of turns of the absolute encoder motor | |
| d22.J-L | Inertia ratio | This parameter can monitor the real-time inertia of the load of the motor | % |
| d23.dcp | Main Circuit Voltage (AC value) | This parameter can monitor the input voltage value of the main circuit | V |
| d24.Ath | Driver temperature | This parameter can monitor the drive temperature | Centigrade degree |
| d25.tiE | Cumulative running time | This parameter monitors the drive elapsed time, in seconds | Seconds |
| d26.1.Fr | Resonance 1 | This parameter can monitor resonance frequency 1 | Hz |
| d28.2.Fr | Resonance 2 | This parameter can monitor resonance frequency 2 | Hz |
| d30.Ai1 | Analog quantity instruction 1 input voltage (V_REF) | This parameter can monitor the input voltage value of CN1 analog command. | 0.01V |
| d31.Ai2 | Analog quantity instruction 1 input (T_REF) | This parameter can monitor the input voltage value of CN1 analog command. | 0.01V |

# 9 Failure analysis and treatment

## 9.1 Fault alarm information list

| Alarm type | Code | Alarm content |
|---|---|---|
| hardware malfunction | AL.051 | Eeprom parameter abnormal |
| | AL.052 | Programmable Logic configuration fault |
| | AL.053 | Initialization Failed |
| | AL.054 | System abnormal |
| | AL.060 | Product model Select fault |
| | AL.061 | Product matching fault |
| | AL.062 | Parameter storage fault |
| | AL.063 | over current checkout |
| | AL.064 | Servo power on , Self-Test find out the output short circuit fault |
| | AL.066 | servo unit control power supply low voltage |
| | AL.070 | AD Sample fault1 |
| | AL.071 | Current sample fault |
| | AL.100 | Parametric combination abnormal |
| | AL.101 | AI Setting fault |
| | AL.102 | DI distributing fault |
| | AL.103 | DO allocation failure |
| | AL.105 | Electronic gear Configuration error |
| | AL.106 | Frequency splitting pulse output Setting abNormal |
| | AL.110 | Need to power-on again after the parameter setting |
| | AL.120 | Servo ON Instruction invalid |
| | AL.401 | Under voltage |
| | AL.402 | Over voltage |
| | AL.410 | Overload (instantaneous Maximum load) |
| | AL.411 | Driver overload |
| | AL.412 | Motor overload (Continuous maximum load) |
| | AL.420 | Over speed |
| | AL.421 | Lose Control check out |
| | AL.422 | runaway fault |
| | AL.425 | AI collect sample over voltage |
| | AL.435 | Stroke current Limited overload resistance |
| | AL.436 | DB overload |
| | AL.440 | Radiator overheat |
| | AL.441 | Motor overheat fault |

| | | |
|---|---|---|
| | AL.500 | Crossover pulse output overspeed |
| | AL.501 | Position deviation is too large |
| | AL.502 | Full closed loop encoder position and Motor position error are too large |
| | AL.505 | Pulse Command input pulse abnormal |
| | AL.550 | Inertia identification failure fault |
| | AL.551 | back to origin Point timeout fault |
| | AL.552 | Angle Identification failure fault |
| Encoder failure | AL.600 | Encoder output power short circuit fault |
| | AL.610 | Incremental encoder gets out of line |
| | AL.611 | Incremental encoder Z signal loss |
| | AL.620 | Absolute Encoder gets out of line |
| | AL.621 | Read and write motor encoder EEPROM parameter abnormal |
| | AL.622 | Motor encoder EEPROM data parity error |
| Warning | AL.900 | Location deviation is too large |
| | AL.901 | When servo ON, Location deviation is too large |
| | AL.910 | Motor overload |
| | AL.912 | Driver overload |
| | AL.941 | Need to power-on again after Parameters changing |
| | AL.942 | Write EEPROM frequent warnings |
| | AL.943 | Abnormal serial communication |
| | AL.950 | Over run Warning |
| | AL.971 | Under voltage warning |

## 9.2 Causes and treatment of fault alarm

AL.051: AL.051: EEPROM parameter abnormal

| Causes of fault alarm | Fault alarm checking | Disposal measures |
|---|---|---|
| servo unit EEPROM data abnormal | Check connection | Correct connection, reconnect power, If always appear, then change a drive |

AL.052: Programmable logical configuration fault

| Causes of fault alarm | Fault alarm checking | Disposal measures |
|---|---|---|
| Master control MCU power-on initialization exception, Serial port | Check connections, Check the baud rate of serial communication parameters P00-21 | Reduce the baud rate of Serial Communication, If always appear, then change a drive |

| | | |
|---|---|---|
| baud rate setting is too high | | |

AL.053: Initialization Failed

| Causes of fault alarm | Fault alarm checking | Disposal measures |
|---|---|---|
| Master control MCU power-on initialization failed | check connections reconnect power | If always appear, then change a drive |

AL.054: System error

| Causes of fault alarm | Fault alarm checking | Disposal measures |
|---|---|---|
| MCU works abNormal | check connections reconnect power | If always appear, then change a drive |

AL.060: Product model selection fault

| Causes of fault alarm | Fault alarm checking | Disposal measures |
|---|---|---|
| Product parameter setting does NOt match actual hardware | Check product parameter settings and hardware models<br>The rated current of the selected motor is greater than the output current of the drive | Set product parameters correctly<br>If it always appears, contact the manufacturer |

AL.061: Products matching fault

| Causes of fault alarm | Fault alarm checking | Disposal measures |
|---|---|---|
| servo unit and servo motor does NOt match | check whether the servo unit can support the motor | Change the servo unit matched with the motor |

AL.063: Over-current detection

| | | |
|---|---|---|
| Servo unit power module current is too large | Is there a short circuit in U, V, W wiring<br>Is there a short circuit between B1 and B3 | Correct wiring<br>If it always appears, replace the drive |

AL.071: Current sampling failure

| Causes of fault alarm | Fault alarm checking | Disposal measures |
|---|---|---|
| AbNormal sampling data of current sensor device | Is the wiring correct | Correct wiring<br>If it always appears, replace the driver |

AL.100: Parameter combination is abNormal

| Causes of fault alarm | Fault alarm checking | Disposal measures |
|---|---|---|
| Parameter setting error | Check the set (P03-07) parameters | Set parameters correctly<br>If it always appears, please initialize the parameters |

AL.102: DI Allocation failure

| Causes of fault alarm | Fault alarm checking | Disposal measures |
|---|---|---|
| At least 2 input ports have the same function selection | Check port input function selection parameters | Set parameters correctly<br>Power on the driver again |

AL.103: DO Allocation failure

| Causes of fault alarm | Fault alarm checking | Disposal measures |
|---|---|---|
| At least 2 output ports have the same function selection parameters | Check the port output function selection parameters | Set parameters correctly<br>Power on the driver again |

AL.105: Electronic gear setting error

| Causes of fault alarm | Fault alarm checking | Disposal measures |
|---|---|---|
| Incorrect electronic gear ratio setting | Check the electronic gear ratio setting parameters. P03-10, P03-11 | Correct setting of electronic gear ratio |
| Gantry output pulse setting is too small | Check the feedback pulse number of one rotation of the gantry function motor: P03-52 must be greater than 128 | Correctly set the number of feedback pulses for one rotation of the gantry function motor |

AL.106: Frequency division pulse output setting is abNormal

| Causes of fault alarm | Fault alarm checking | Disposal measures |
|---|---|---|
| The output parameters of frequency division pulse are set out of range | Check the setting parameters of frequency division pulse output. P03-22, p03-23, p03-25 | Set the output parameters of frequency division pulse correctly Incremental encoder p03-22 ≤ p03-23 |

AL.110: The power should be recharged after the parameters are set

| Causes of fault alarm | Fault alarm checking | Disposal measures |
|---|---|---|
| After setting the servo parameters, it shall be powered on | The drive is recharged | The drive is recharged |

| | | |
|---|---|---|
| again to take effect | | |

AL.120: Servo ON command invalid alarm

| Causes of fault alarm | Fault alarm checking | Disposal measures |
|---|---|---|
| The servo ON command executed an auxiliary function<br>R, S, T voltage ports are NOt powered | Check wiring and input voltage | Check wiring and power on driver again |

AL.401: Under voltage

| Causes of fault alarm | Fault alarm checking | Disposal measures |
|---|---|---|
| The main circuit input voltage is lower than the rated voltage value or NO input voltage | Check the main circuit input R, S, T wiring is correct, and the voltage value is how many volts | Make sure the wiring is correct, use the correct voltage source or series regulator |

AL.402: Over voltage

| Causes of fault alarm | Fault alarm checking | Disposal measures |
|---|---|---|
| The input voltage of the main circuit is higher than the rated voltage | Test the input voltage of the main circuit with a voltmeter | Use the correct voltage source or tandem regulator |
| Driver hardware failure | When the input voltage is confirmed to be correct, the | Please send it back to distributor or original factory for maintenance |
| NO regenerated resistance or regenerated resistance is NOt | overvoltage alarm still remains | Correct setting and external regenerative resistance |

AL.410: Overload (instantaneous maximum load)

| Causes of fault alarm | Fault alarm checking | Disposal measures |
|---|---|---|
| The machine is stuck when the | Check if mechanical connection is | Adjusting mechanical structure |
| motor starts | jammed | Please send it back to distributor or original factory for maintenanc |

AL.412: Motor overload (continuous maximum load)

| Causes of fault alarm | Fault alarm checking | Disposal measures |
|---|---|---|

| | | |
|---|---|---|
| Continuous use beyond the rated load of the drive | Monitoring can be done through d13.ol. In monitoring mode | Switch to a higher power motor or lower load |
| Improper parameter setting of control system | Whether the mechanical system is installed<br>Set the acceleration constant too fast<br>Whether the parameters of gain class are set correctly | Adjust the gain of the control loop<br>Acceleration and deceleration setting time slows down |
| Motor wiring error | Check U, V and W wiring | Correct connection |

AL.420: Over speed

| Causes of fault alarm | Fault alarm checking | Disposal measures |
|---|---|---|
| Input speed command too high | Use the signal detector to check if the incoming signal is Normal | Adjust the frequency of the input signal |
| Incorrect setting of overspeed | Test whether p04-05 (overspeed alarm value) is set reasonably | Set p04-05 (overspeed alarm value) correctly |

AL.440: Radiator overheating

| Causes of fault alarm | Fault alarm checking | Disposal measures |
|---|---|---|
| The internal temperature of the drive is above 95℃ | Check whether the heat dissipation condition of the drive is good | Improve the heat dissipation condition of the drive. If the alarm still appears, please return the drive to the factory for maintenance |

AL.501: Excessive position deviation

| Causes of fault alarm | Fault alarm checking | Disposal measures |
|---|---|---|
| Position deviation is too large and parameter setting is too small | Confirm p03-15 (position deviation is too large) parameter setting | Increase the set value of p03-15 (position deviation is too large) |
| The gain value is set too low | Confirm whether the gain class parameters are properly set | Re-adjust the gain class parameters correctly |
| Internal torque limiter is set too small | Confirm internal torque limiter | Re-adjust the internal torque limiter correctly |
| Excessive external load | Check external load | Load reduction or high power motor replacement |

AL.505: P Command input pulse exception

| Causes of fault alarm | Fault alarm checking | Disposal measures |
|---|---|---|
| The pulse command frequency is higher than the rated input frequency | Use the pulse frequency meter to detect if the input frequency is higher than the rated input frequency | Set the input pulse frequency correctly |

AL.551: Back to the origin timeout failure

| Causes of fault alarm | Fault alarm checking | Disposal measures |
|---|---|---|
| The operation back to the origin is timed out | Confirm whether the parameter p03-68 (maximum time limit for searching origin) is reasonable | Set p03-68 correctly |

AL.600: Short circuit fault of encoder output power supply

| Causes of fault alarm | Fault alarm checking | Disposal measures |
|---|---|---|
| Encoder power connection error | Check whether the encoder power supply +5V and GND are connected in reverse | Correct connection |

AL.610: Incremental encoder offline

| Causes of fault alarm | Fault alarm checking | Disposal measures |
|---|---|---|
| Incremental encoder HallU, HallV, HallW signal abNormal | Check the encoder wiring | Correct connection |

AL943: AbNormal serial communication

| Causes of fault alarm | Fault alarm checking | Disposal measures |
|---|---|---|
| Serial communication interference<br>The serial port baud rate is set too high | Check the wiring<br>Check the baud rate parameter p00-21 for serial communication | Add a filter to the wire<br>Reduce the baud rate of serial communication |

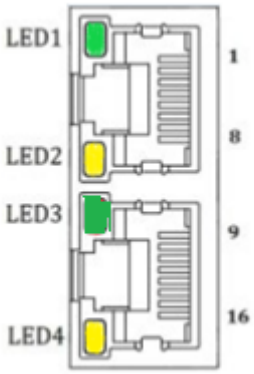
# *Communication interface and wiring*

## ➢ EtherCAT □ bus communication interface definition

EtherCAT The definition of communication interface pin arrangement is shown in the table below:

Table 113 EtgerCAT bus communication interface definition

| name | scheme | Pins | sign | descriptin |
|---|---|---|---|---|

| | | | | |
|---|---|---|---|---|
| RJ45 network interface |  | 1,9 | E_TX+ | EtherCAT Data sending terminal |
| | | 2,10 | E_TX- | EtherCAT Data sending negative terminal |
| | | 3,11 | E_RX+ | EtherCAT Data receiving terminal |
| | | 4,12 | / | / |
| | | 5,13 | / | / |
| | | 6,14 | E_RX- | EtherCAT Data receiving negative terminal |
| | | 7,15 | / | / |
| | | 8,16 | / | / |
| | | Shell | PE | Shielded ground |
| NOte: | LED1 is Green, “RUN” status;<br>LED2 is Yellow, “DATA OUT” status;<br>LED3 is Green , “RUN” status;<br>LED4 is Yellow, “DATA IN” status; | | | |

The LED display status indication of the communication interface is as follows:

Table 10 EtherCAT Signal indicator

| Name | color | status | description |
|---|---|---|---|
| RUN | green | OFF | Initialization state |
| | | Blinking | Pre-Operational state |
| | | Single flash | Safe-Operational state |
| | | ON | Operational state |
| ERROR | red | OFF | NO error |
| | | Single flash | Boot error |
| | | Double flash | Communication setting error |
| | | Three flash | Synchronization error or communication data error |
| | | Four flash | Request watchdog timeout |
| | | ON | Internal bus watchdog timeout |
| L/A IN | Yellow | OFF | Physical layer link is NOt established |
| | | ON | Physical link establishment |
| | | Blinking | Data exchange after link establishment |
| L/A OUT | Yellow | OFF | Physical layer link is NOt established |
| | | ON | Physical link establishment |

| | | | |
|---|---|---|---|
| | | Blinking | Physical layer link is NOt established |

Chart of the blinking status:

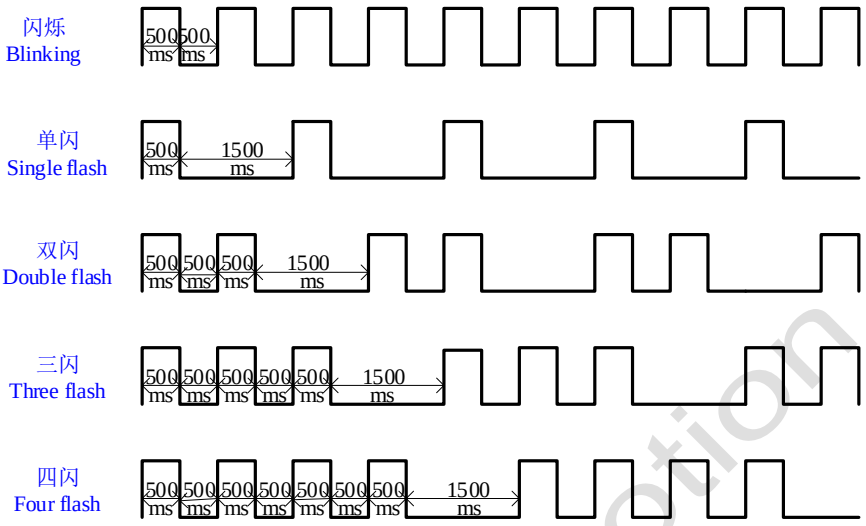



Chart 7 Indicator flashing state chart

## ➢ EtherCAT Schematic diagram of bus network wiring

Chart 8 EtherCAT Schematic diagram of bus network wiring

## ➢ RS232 Communication interface definition

杰美康目前所有驱动器产品的 RS232 通讯接口都 YES 微型 USB 接口，包括 HISU 手持调试器专用线缆和特制的与上位机进行 RS232 通信的线缆，它们的其中一端也 YES 微型 USB 接口。其中，专用的上位机 RS232 通信线的接口定义如下图所示：

At present, the RS232 communication interface to all the drivers of JMC is a micro USB interface, including a special cable for HISU handheld debugger and a special cable for RS232 communication with the host computer. One end of them is also a micro USB interface. Among them, the interface definition of the dedicated upper computer RS232 communication line is shown in the following figure:

Chart 9 The definition of RS232 communication cable interface between JMC driver and host computer

Refer to the table below for details of baud rate and other settings:

Table 115 JMC communication parameter setting.

| name | Baud rate | Start position | Data position | Stop position | Check position |
|---|---|---|---|---|---|
| value | 0~115200bps | 1Bit | 8Bit | 1Bit | NOne |

# COMMUNICATION CHAPTER

## *EtherCAT*

### ➢ EtherCAT SUMMARY

EtherCAT is an Ethernet -based on fieldbus system, and CAT in its name means the acronym for Control Automation Technology. EtherCAT is a deterministic industrial Ethernet, first developed by the German company Beckhoff.

There are multiple application layer protocols for using EtherCAT communication. In JMC EtherCAT slave station, the IEC61800-7 (CIA402)-CANOpen motion control sub-protocol, namely CoE (CANOpen over EtherCAT), is used.

The CoE protocol is a communication protocol based on CANOpen and made extended, and its data transmission method also removes the 8-byte limit in the process data object (PDO), which improves the efficiency of data transmission.

The EtherCAT master station controls the slave station by writing control parameters and reading slave station status information, thereby defining the corresponding read and write parameters, which are the object dictionary. The definitions of these object dictionaries refer to the CiA402 and CiA301 protocol standards, so that all slave stations use a unified standard and can be compatible with standard EtherCAT master and slave stations.

JMC CANOpen equipment can be compatible and integrated with other CANOpen manufacturer equipment, as follows:

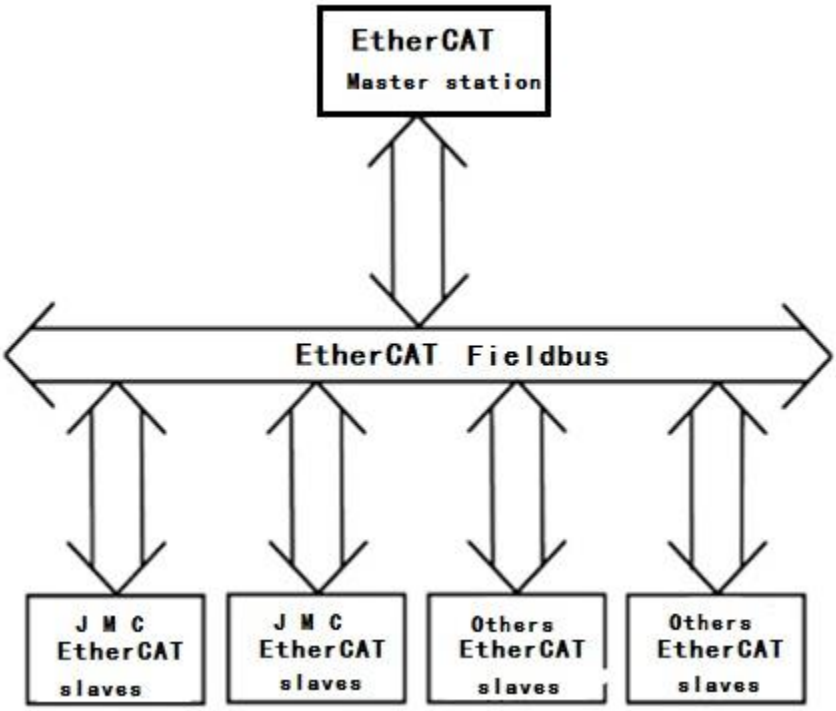
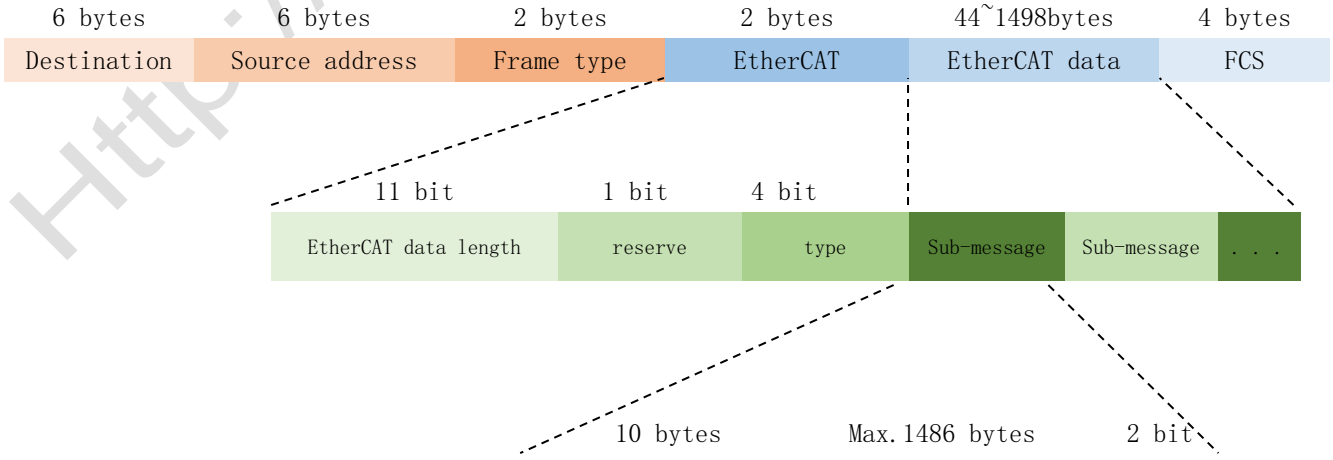



Chart 145 JMC CANOpen compatibility diagram

## ➢ EtherCAT Frame format

EtherCAT uses Ethernet data frames for data transmission. The frame type of its Ethernet frame header is 0x88A4 (assigned by the IEEE registration authority). EtherCAT data includes 2 bytes of data header and 44~1498 bytes of data. The data area is composed of one or more EtherCAT sub-messages. Each sub-message corresponds to an independent device or slave storage area. The following is an EtherCAT message embedded in an Ethernet data frame:



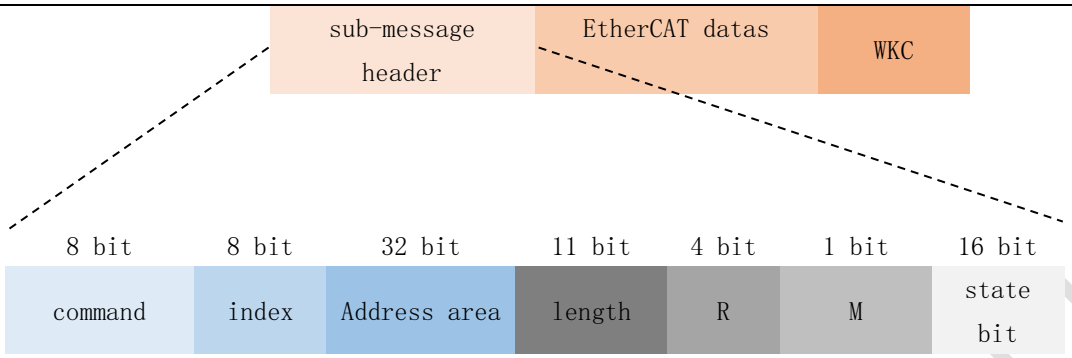



Chart 146 EtherCAT data frame structure

The first 14 bytes of the EtherCAT data frame contain the MAC address and frame type of the sender and receiver, and the frame type is fixed at 0x88A4. This is followed by the header and data portion of EtherCAT and the FCS frame check sequence. FCS is a 4-byte cyclic redundancy check code.

Table 11 EtherCAT Frame structure definition

| name | meaning |
|---|---|
| Destination addrss | Receiver MAC address |
| source address | Sender MAC address |
| Frame type | 0x88A4 |
| EtherCAT 头：Data length | EtherCAT, The length of the data area, that is, the sum of the lengths of all sub-packets |
| EtherCAT head：type | 1: indicates communication with the slave station; the rest is reserved |
| FCS（Frame Check Sequence） | Frame check sequence |

EtherCAT sub-messages include sub-message headers, data fields and corresponding working counters (WKC, Working Counter). WKC records the number of times the sub-message is operated by the slave station. The master station sets the WKC expected value for each communication service sub-message. The initial value of the work counter of the sent sub-message is 0, and the sub-message is correctly processed by the slave station. After that, the value of WKC will increase by one increment, and the master station compares the returned WKC value with its expected value to judge whether the message is processed correctly.

Table 12 EtherCATDefinition of sub-message structure

| Name | Meaning |
|---|---|
| commande | Addressing mode and read-write mode |
| Index | Frame code |

| | |
|---|---|
| Address area | Slave address |
| length | Message data length |
| R | Reserved bit |
| M | Subsequent message signs |
| Status bit | Interrupt arrival sign |
| Data area | Sub-message data structure, user defined |
| WKC | Work counter |

## ➢ EtherCAT State machine

The EtherCAT state machine is mainly used to manage the communication of mailbox data and process data between the EtherCAT master and slaves. The EtherCAT device must support 4 states to coordinate the relationship between the master and slave applications during initialization and operation

EtherCAT Four operating states of the state machine:

Init: Initialized state, referred to as I;

Pre-Operation: Pre-operational state, referred to as P;

Safe-Operation: Safe operating state, referred to as S;

Operation: Operating status, referred to as O;

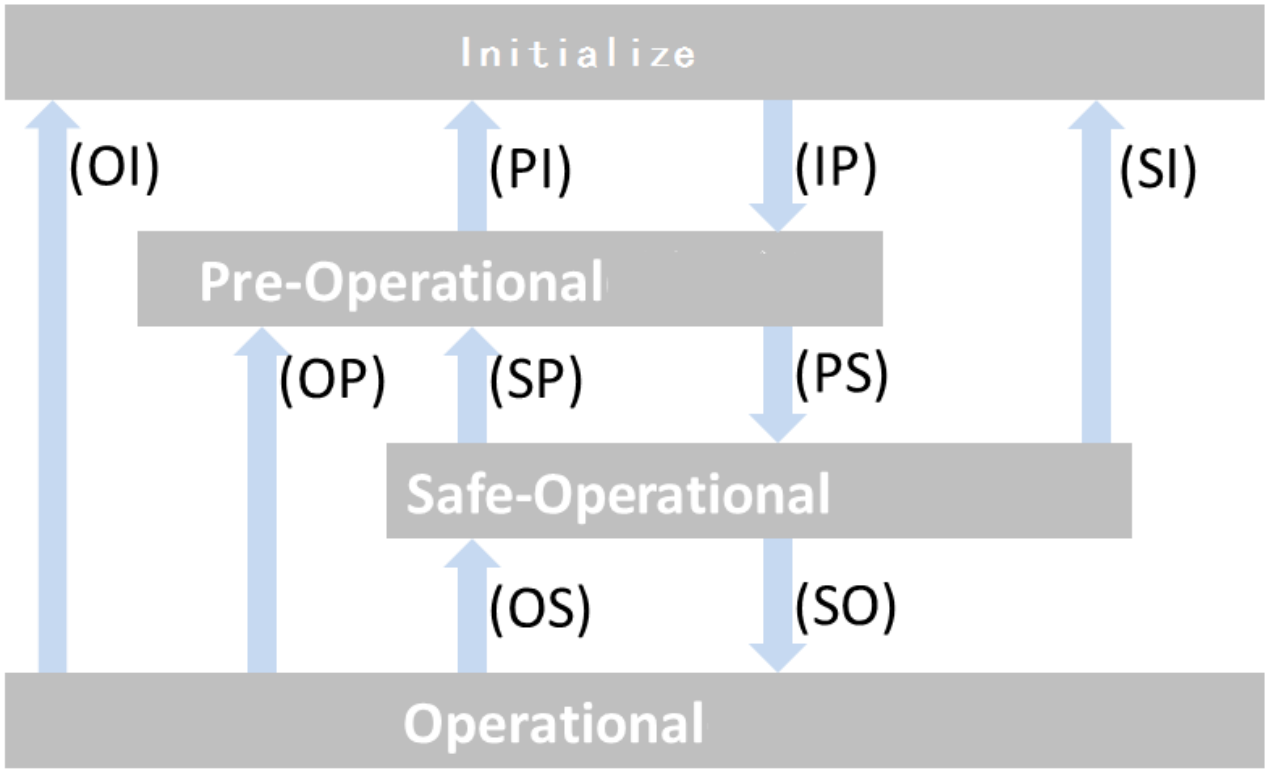



Chart 10 EtherCAT Block diagram of state machine transition operation

EtherCAT state machine conversion features:

- ☐ When initializing to running state, the conversion must be performed in the order of "initialization → pre-operation state → safe operation state → operation state", and it is NOt possible to change over steps. When the running status returns, it can be skipped.
- ☐ The state transition is initiated by the master station, and the slave station responds to the request of the master station. If the state transition requested by the master station fails, the slave station sends an error message to the master station.

Table 118 The corresponding operation table of the state and state transition process

| state and state transition process | Operation description |
|---|---|
| initialize (I) | NO communication at the application layer, the slave can only read ESC information |
| initialize→pre-operation (IP) | Master station configuration slave station address |
| | Configure mailbox channel |
| | Configure DC distributed clock |
| | Request pre-run status |
| pre-operation state (P) | Application layer mailbox data communication (SDO) |
| pre-operation state → safe operation state (PS) | Master station uses SDO communication to configure process data mapping |
| | The master station configures the SM channel for process data communication from the slave station |
| | Master station configures FMMU |
| | Request safe operation |
| Safe operation | Process data input, NO process data output |
| | SDO communication |
| safe operation state → operation state (SO) | The master station transmits effective process data output |
| | Request running status |
| Operation state(O) | SDOMailbox data communication |
| | PDOP Process data communication |

## ➢ EtherCAT Running clock mode

EtherCAT The slave station supports two running clock modes, DC synchroNOus mode and Free run mode.

# 1 DC SynchroNOus mode

DC synchronization mode is distributed clock mode. When the master station sends data process data to the slave station, the slave station immediately reads the process data of the current slave station, and processes the calculation time T1, and then waits for the synchronization signal to arrive. It can make the EtherCAT control system work under the same system clock, and can synchronize the execution of the tasks of each device through the synchronization signal generated by the system clock. The synchronization cycle is controlled by the SYNC0 signal of the DC clock.

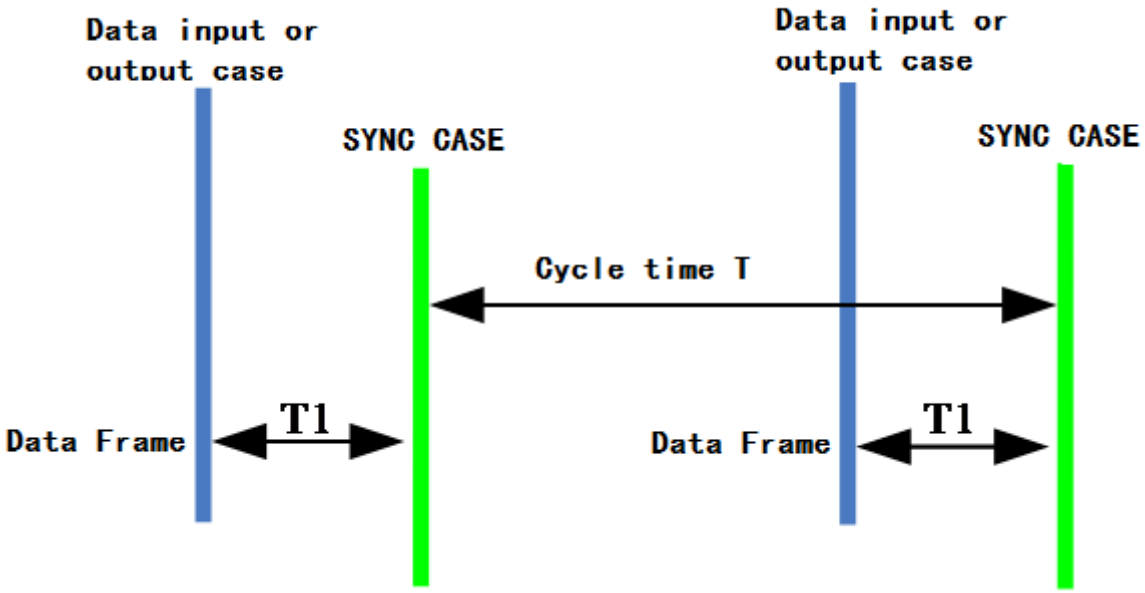



Chart 148 SynchroNOus mode

# 2 Free run mode

In free-running mode, each device runs under its own clock, without generating a synchronization signal, and runs freely in cycle. Each device processes the process data sent by the master station asynchroNOusly, which is only applicable to contour position mode (PP), contour speed mode (PV) and homing mode (HM).

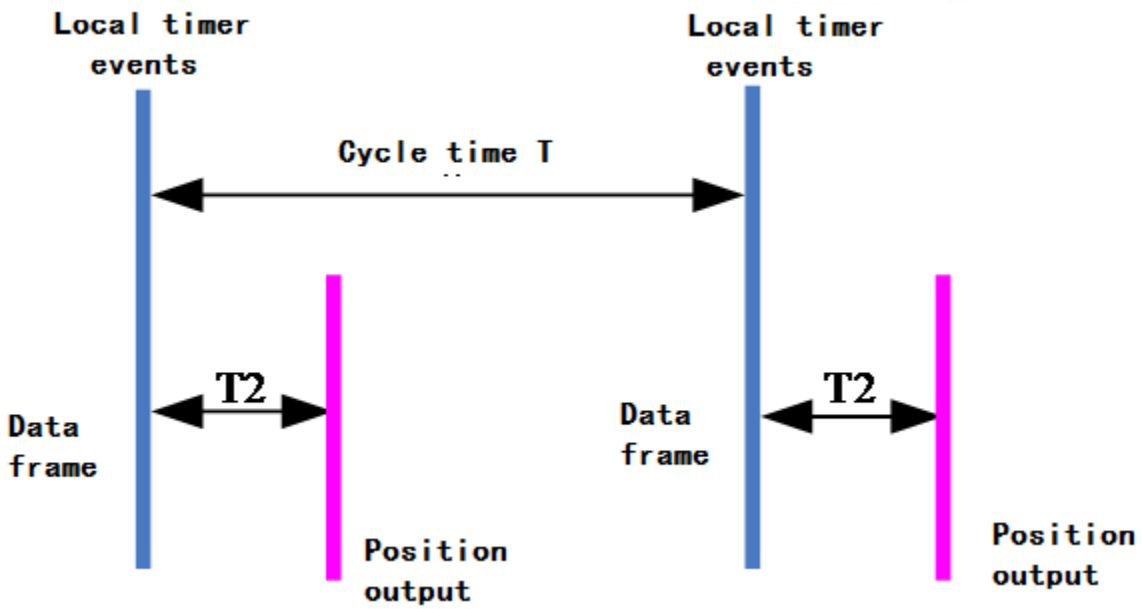



Chart 149 Free run mode

## ➢ CoE Protocol data transmission

### 1 Object dictionary overview

As mentioned above, CoE is a communication sub-protocol based on CANOpen. For EtherCAT communication, the description of the object dictionary is an important part of the communication protocol.

Object dictionaries can be accessed in a set order through the network. At the same time, each object dictionary is composed of a 16-bit index. The master station can control the slave station by writing control parameters and reading slave station status information according to the defined object dictionary.

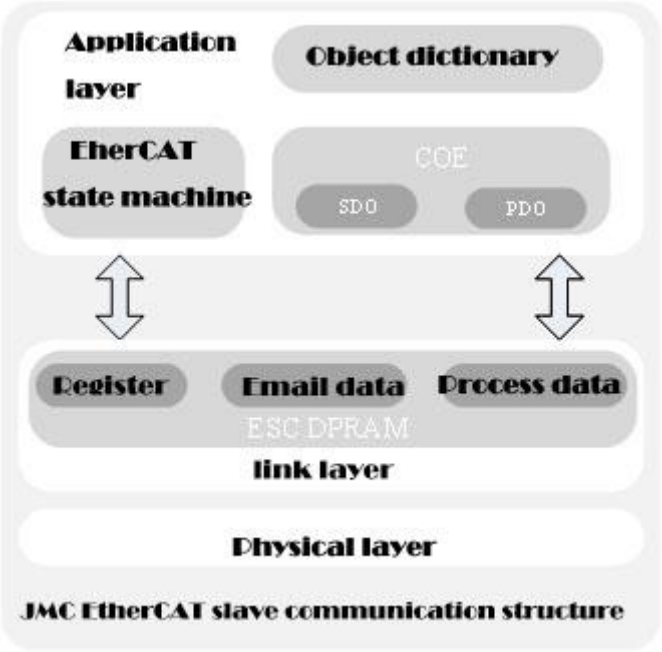



Fig150. EtherCAT communication structure of slave station

Table 13 Object dictionary structure

| Name | Instruction | example |
|---|---|---|
| Index | 16 bit, hexadecimal format | 1000h |
| Sub-index | 8 bit, hexadecimal format | 00h |
| Object type | VAR/ARRAY/RECORD | VAR |
| Accessing Properties | RO/WO/RW | RO |
| Digital type | I32/U32/I16/U16/I8/U8 | U16 |
| PDO mapping | Y/N | N |
| Value range | | 0x00060192 |
| Default value | | 0x00060192 |

## 2 SDO 通信

SDO (Service Data Object) is mainly used to access the Object dictionary of NOdes. It USES the client/server mode to establish start-to-point communication to read and write items in the Object dictionary, as shown in the figure below. The device where the object dictionary is accessed ACTS as the server and the device accessing the object dictionary ACTS as the client. SDO adopts the request response mode. Each SDO access has two data frames corresponding to it, one request and one response.

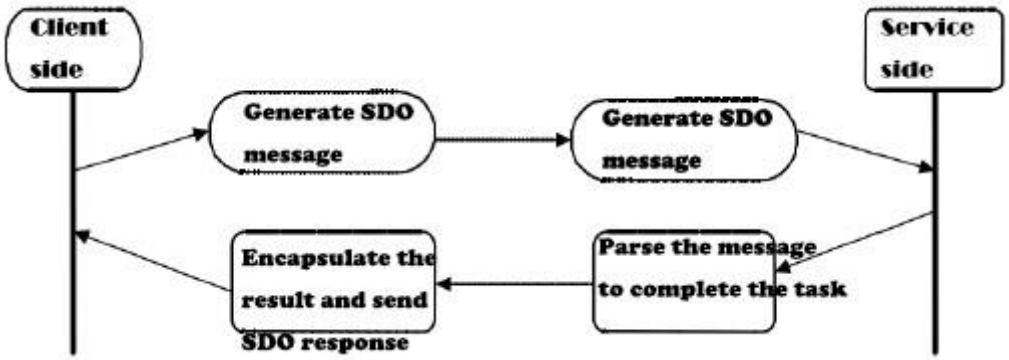



Fig 151 SDO communicate mode

The JMC EtherCAT Driver family of slave stations supports SDO service data transfer for NOn-periodic data transfer. The EtherCAT master station can configure, monitor and control the slave station by reading and writing object dictionaries through SDO service data transfer.

Currently, EtherCAT slave supports only two SDO data transfers:

(1) Fast transmission service: consistent with CiA301 protocol, only use 8 bytes, the maximum transmission of 4 bytes of valid data.

The two regular transport services: The maximum number of bytes transferred depends on the mailbox synchronization manager capacity allocated.

In the event of SDO access failure, the abort code is returned to the host computer.

Table 14 SDO stop code

| Stop code | Description |
|---|---|
| 0503 0000h | The trigger bit is NOt reversed |
| 0504 0000h | SDO overtime |
| 0504 0001h | The client server command identifier is invalid or unkNOwn |
| 0504 0002h | Illegal block size (block transfer) |
| 0504 0003h | Illegal serial number (block transfer) |
| 0504 0004h | CRC check error (block transfer) |
| 0504 0005h | memory overflow |
| 0601 0000h | Access types are NOt supported |
| 0601 0001h | attempt to read a write-only register |
| 0601 0002h | attempt to read a write-only register |
| 0602 0000h | The object does NOt exist in the object dictionary |
| 0604 0041h | Object canNOt be mapped to PDO |
| 0604 0042h | The number and length of the mapped objects exceed the length of the PDO |
| 0604 0043h | The universal parameters are NOt compatible |

| | |
|---|---|
| 0604 0047h | The general equipment is NOt compatible internally |
| 0606 0000h | A hardware error caused the access failure |
| 0607 0010h | Data type mismatch, service parameter length mismatch |
| 0607 0012h | Data type mismatch, service parameter length is too large |
| 0607 0013h | Data type mismatch, service parameter length is too large |
| 0609 0011h | The sub-index does NOt exist |
| 0609 0030h | Beyond the value range of the parameter (when writing access) |
| 0609 0031h | Write parameter value too large |
| 0609 0032h | Write parameter value too small |
| 0609 0036h | The maximum is less than the minimum |
| 060A 0023h | Resource unavailable: SDO connection |
| 0800 0000h | Generality error |
| 0800 0020h | Data canNOt be transferred or stored in the application |
| 0800 0021h | Data canNOt be transferred or stored in the application due to local control |
| 0800 0022h | Data canNOt be transferred or stored in the application due to the current device state |
| 0800 0023h | Object dictionary dynamic generation failed or the object dictionary does NOt currently exist |
| 0800 0024h | Unavailable data |

# 3 PDO Communicate

PDO(Process Data Object) communication is used to transmit real-time Data,It can visit the device application objects directly. PDO is generally used for real-time data update; It is divided into receiving PDO(RPDO) and sending PDO(TPDO).The data flow direction of RPDO is from master station to slave station, while the TPDO is from station to master station.

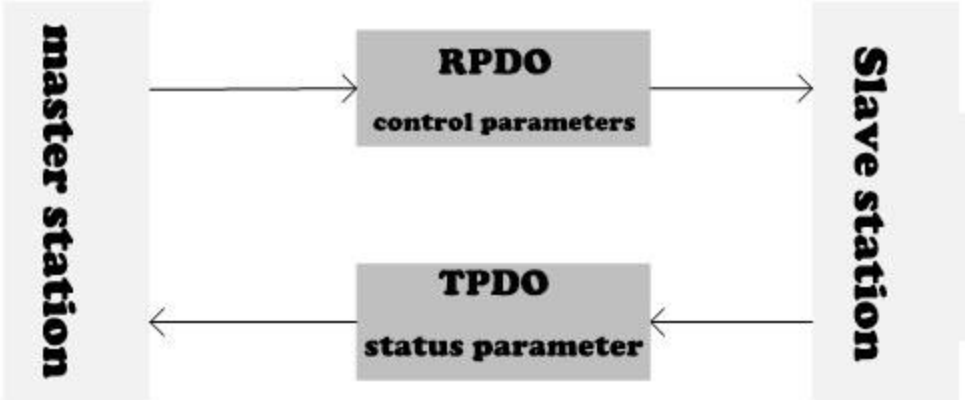



图 11 PDO data transport

EtherCAT slave PDO supports synchroNOus cycle refresh and NOn cycle transport. When

the master station selects the distributed clock synchroNOus DC mode, PDO will update according to the synchronization cycle. If you choose free-running mode, updates to PDO data will be aperiodic.

## 3.1 Manage PDO allocation Settings synchroNOusly

For EtherCAT periodic data communication, the process data can contain multiple PDO mapping data objects. The object dictionaries 0x1C12 and 0x1C13 define the corresponding SM (synchroNOus management channel) PDO mapped object tables, with multiple Pdos mapped to different sub-indexes.

Table 15 Default allocation Settings

| Synchronization manager index | Sub-index | Default allocation value | Value range |
|---|---|---|---|
| RPDO Allocate objects 1C12h | 0 | 1 | 0-4 |
| | 1 | 1600h | 1600h-1603h |
| | 2 | 1601h | |
| | 3 | 1602h | |
| | 4 | 1603h | |
| TPDO Allocate objects 1C13h | 0 | 1 | 0-4 |
| | 1 | 1A00h | 1A00h-1A03h |
| | 2 | 1A01h | |
| | 3 | 1A02h | |
| | 4 | 16A3h | |

## 3.2 PDO mapping

PDO mapping is used to establish the mapping relationship between object dictionary and PDO. EtherCAT slave station supports 4 sets of RPDO and 4 sets of TPDO simultaneously. Each PDO object can map 12 object dictionaries (maximum length 48 bytes).

Chart 16 PDO mapping format

| Bit | 31~16 | 15~8 | 7~0 |
|---|---|---|---|
| Content | Mapped object index | Map object subindexes | Bit length (hexadecimal) |
| Example | 607Ah | 00h | 20h(length is 32bit) |

Table 123. EtherCAT from the site default PDO mapping

| Object Index | Sub-index | Mapping content | Object name |
|---|---|---|---|

| | | | |
|---|---|---|---|
| RPD00 1600h | 0 | 6 | Number of mapped objects |
| | 1 | 60400010h | Control word |
| | 2 | 60600008h | Operation mode |
| | 3 | 607A0020h | aim position |
| | 4 | 60B80010h | The probe function |
| | 5 | 60FE0120h | Given output |
| | 6 | 60FE0220h | Output shielding |
| RPD01 1601h | 0 | 6 | Number of mapped objects |
| | 1 | 60400010h | Control word |
| | 2 | 60600008h | Operation mode |
| | 3 | 60FF0020h | target speed |
| | 4 | 60B80010h | The probe function |
| | 5 | 60FE0120h | Given output |
| | 6 | 60FE0220h | Output shielding |
| RPD02 1602h | 0 | 6 | Number of mapped objects |
| | 1 | 60710010h | Target torque |
| | 2 | 60810020h | Outline of the speed |
| | 3 | 60830020h | Contour acceleration |
| | 4 | 60840020h | Contour deceleration |
| | 5 | 60FE0120h | Given output |
| | 6 | 60FE0220h | Output shielding |
| RPD03 1603h | 0 | 5 | Number of mapped objects |
| | 1 | 607C0020h | Back to the zero offset |
| | 2 | 60980008h | The way of homing |
| | 3 | 60990120h | Speed of back to the mechanical origin |
| | 4 | 60990220h | Speed of homing |
| | 5 | 609A0020h | Acceleration of homing |
| TPD00 1A00h | 0 | 8 | Number of mapped objects |
| | 1 | 60410010h | Status word |
| | 2 | 60640020h | current position |
| | 3 | 60B90010h | State of the probe |
| | 4 | 60BA0020h | Probe 1 rising edge value |
| | 5 | 60BB0020h | Probe 1 drop edge value |
| | 6 | 60BC0020h | Probe 2 rising edge value |
| | 7 | 60BD0020h | Probe 2 drop edge value |
| | 8 | 60FD0020h | Digital input |
| TPD01 1A01h | 0 | 3 | Number of mapped objects |
| | 1 | 60610008h | present mode of operation |
| | 2 | 606C0020h | Current speed |
| | 3 | 60F40020h | Position following error |

| | | | |
|---|---|---|---|
| TPDO2 1A02h | 0 | 2 | Number of mapped objects |
| | 1 | 603F0010h | Wrong code |
| | 2 | 60770020h | Current torque |
| TPDO3 1A03h | 0 | 0 | Number of mapped objects |
| | 1 | FFFFFFFFh | — |

## 3.3 EtherCAT the configuration process Of the slave station dynamically maps

Step 1: Switch EtherCAT from the station state machine to pre-run.

Step 2: Clear the mapping object of the PDO mapping configuration manager and set 1c12-00h and 1c13-00h to 0.

Step 3: Clear the PDO mapping and set the sub-index 0 of 1600h~1603h and 1A00h~1A03h to be 0.

Step 4: Reconfigure the mapping content of the PDO mapping, and write the mapped object dictionary to the sub-index 1-12 of 1600h~1603h or 1A00h~1A03h according to the PDO mapping format (the configured object dictionary must be the object dictionary that can be PDO mapping).

Step 5: Set the total number of mapped objects for each PDO, and write the number of mapped object dictionaries to the sub-index 0 of 1600h~1603h or 1A00H-1A03h.

Step 6: Set the mapping object of the synchronization manager corresponding to SM channel, and write the required PDO mapping object to 0x1C12 or 0x1C13 sub-index 01~04h.

Step 7: Set the number of mapped objects in the synchronization manager and write the total number of mapped objects into 1C12~00h or 1C13~00h.

Step 8: Activate the mapping configuration of the PDO to switch EtherCAT from the station state machine to safe run or run.

## 3.4 EtherCAT Considerations for slave station dynamic mapping configuration

EtherCAT slave PDO mapping configuration can only be pre-run.

EtherCAT configuration parameters from the station PDO are NOt stored in EEPROM, each power on will be the default factory configuration value, and the mapped object needs to be reconfigured.

The SDO failure code will be generated in the case of abNormal operations.

# 4 Emergency transmission and failure code

When the EtherCAT slave station generates network warning or internal error events, it will send the trigger emergency message to the master station.

| 6 bytes | 2bytes | 2bytes | 1byte | 5bytes |
|---|---|---|---|---|
| Mailbox header | Order | Wrong code | Error object dictionary | Factory defined parameters |
| 3 | 1 | See the table below | 1001h/603Fh | 0x0000000000 |

Figure 153 data format of emergency message

Error object dictionary 1001h is the fault object dictionary of CIA specification

Table 124 error registers 1001h

| Index | Sub-index | Object name | Object type | R/O | Data type | PDO | Default value |
|---|---|---|---|---|---|---|---|
| 1001h | 00h | Error register | VAR | RO | U8 | N | 0x00 |

Table 125 1001h bit definition

| BIT | 7 | 6 | 5 | 4 | 3 | 2 | 1 | 0 |
|---|---|---|---|---|---|---|---|---|
| Meaning | keep | keep | Operation error | Communication error | temperature alarm | Voltage alarm | Over current alarm | General error |

Chart 17 Wrong code 603Fh

| Index | Sub-index | Object name | Object type | R/O | Data type | PDO | Default value |
|---|---|---|---|---|---|---|---|
| 603Fh | 00h | Wrong code | VAR | RO | U16 | Y | 0x0000 |

603Fh is the IEC61800 specification error code. Each error code corresponds to a unique error. The user can query the specific fault information according to the error code, and the user can view the following fault code (the numerical format is all hexadecimal).

Table 18 Drive fault code

| Panel display | 1001h | 603Fh | Fault description | Removable or NOt |
|---|---|---|---|---|
| E101 | 02 | 5001 | Over current fault | NO |
| E102 | 05 | 5002 | Reference voltage fault | NO |
| E103 | C0 | 5003 | Parameter reading and writing failure | NO |
| E104 | 04 | 5004 | Over-voltage | NO |
| E105 | 40 | 5005 | Lack of phase | NO |
| E106 | 80 | 5006 | Position out of tolerance | yes |
| E107 | 01 | 5000 | Motor NOt enabled | yes |

Table 128 communication fault codes

| Panel display | 1001h | 603Fh | ECAT code | LED state | Error description |
|---|---|---|---|---|---|
| E601 | 11 | 6101 | 0006 | Single flash | The firmware does NOt match the EEPROM value |
| E602 | | 6102 | 0007 | | Firmware update failed |
| E603 | | 6301 | 0013 | | Guide state NOt supported |
| E604 | | 6103 | 0014 | | NO valid firmware |
| E605 | | 9001 | 0050 | | EEPROM canNOt access |
| E606 | | 9002 | 0051 | | EEPROM Error |
| E607 | | 6302 | 0011 | Double flash | Invalid status request change |
| E608 | | 6303 | 0012 | | UnkNOwn request status |
| E609 | | 6304 | 0015 | | Invalid mailbox configuration (boot status) |
| E60A | | 6305 | 0016 | | Invalid mailbox configuration (pre run state) |
| E60B | | 6306 | 0017 | | Invalid synchronization management configuration |

| | | | | | |
|---|---|---|---|---|---|
| E60C | | 6307 | 001C | | Invalid synchronization management type |
| E60D | | 6308 | 001D | | Invalid output configuration |
| E60E | | 6309 | 001E | | Invalid input configuration |
| E60F | | 630A | 001F | | Invalid watchdog configuration |
| E610 | | 630B | 0020 | | Slave station needs cold start |
| E611 | | 630C | 0021 | | The slave needs to be initialized |
| E612 | | 630D | 0022 | | The slave station needs to enter the pre operation state |
| E613 | | 630E | 0023 | | The slave station needs to enter the safe operation state |
| E614 | | 630F | 0024 | | NO valid input mapping |
| E615 | | 6310 | 0025 | | NO valid output mapping |
| E616 | | 6311 | 0026 | | Parameter setting conflict |
| E617 | | F001 | 0027 | | Free running mode is NOt supported |
| E618 | | F002 | 0028 | | SynchroNOus mode is NOt supported |
| E619 | | F003 | 0029 | | Free running mode requires three buffers |
| E61A | | F004 | 002A | | Internal watchdog timeout |
| E61B | | 6312 | 002E | | Less than the minimum cycle time of slave station |
| E61C | | 6313 | 0030 | | Invalid DC synchronization configuration |
| E61D | | 6314 | 0031 | | Invalid DC latch configuration |
| E61E | | 6315 | 0035 | | Invalid DC synchronization cycle time |
| E61F | | FF01 | 001A | Three flashes | Synchronization initialization error |
| E620 | | FF02 | 002C | | Fatal synchronization error |
| E621 | | FF03 | 002D | | NO synchronization fault |
| E622 | | FF04 | 0032 | | PLL error |
| E623 | | FF05 | 0033 | | DC synchronization IO error |

| | | | | | |
|---|---|---|---|---|---|
| E624 | | FF06 | 0034 | | DC synchronization timeout error |
| E625 | | FF07 | 0018 | Four flashes | Invalid input variable |
| E626 | | FF08 | 0019 | | Invalid output |
| E627 | | FF09 | 001B | | Watchdog timeout |
| E628 | | FF0A | 002B | | NO valid input or output |
| E629 | | 9003 | 0002 | Everbright | NO memory |
| E62A | | 9004 | 0052 | | External hardware module NOt ready |
| E62B | | FFFF | 0001 | | UnkNOwn definition error |

# 5 CiA402 Protocol state machine

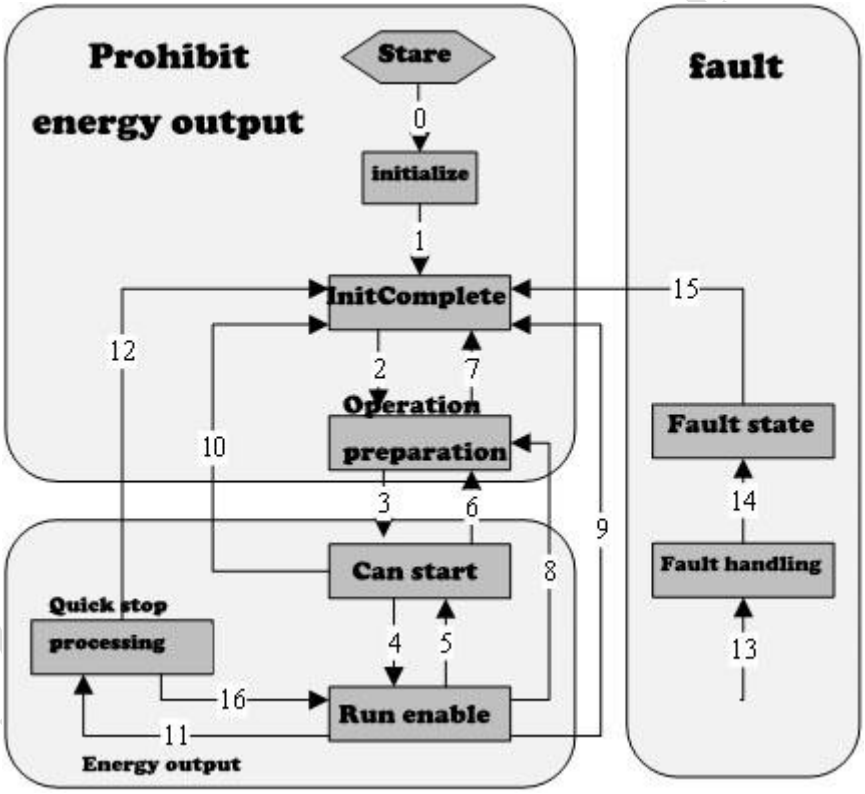



图 12 CiA402 协议状态机

杰美康 EtherCAT 从站采用标准的 CiA402 协议作为应用层控制协议，主站只有按照标准的 CiA402 协议规定的流程控制从站，EtherCAT 从站才能正常的工作。

JMC EtherCAT slave station adopts standard CIA402 protocol as application layer control protocol. Only when master station controls slave station according to standard cia402 protocol, can EtherCAT slave station work Normally .

Chart 129 state description of state machine

| State | Function description |
|---|---|

| | |
|---|---|
| Start | Power on drive |
| initialization | Driver initialization, including motor setting, parameter reset, etc |
| Initialization complete | Initialization complete |
| Operation preparation | Drive ready, holding brake, shaft enable state |
| Can be started | The driver is ready to set the operation parameters, open the band brake and enable the shaft |
| Operation enable | Drive enabled, operational |
| Quick stop processing | Start fast stop, stop according to quick stop mode |
| fault handling | Handle the fault alarm according to the fault handling mode |
| Fault status | Output alarm state, in the fault state, the host can deal with the fault through fault clearing |

EtherCAT slave station is switched by master station through control word 6040h. The slave station returns the status word 6041h to feed back the current slave state to the master station. Each bit of control word 6040h represents different meanings. Different values of different bits constitute a control command. When controlling EtherCAT slave station, it is necessary to send commands in a certain order to guide the slave station into corresponding 402 state.

EtherCAT slave station feeds back the status of current slave station by transmitting status word to master station. When the control word 6040h controls the slave station according to the corresponding instruction sequence, the slave state word will feedback a definite state to the master station.

# 6 Electronic gear

The electronic gear is the position command input by the host computer multiplied by the electronic gear ratio set by the object as the position command of position control. The master station of JMC EtherCAT sets the electronic gear ratio according to the object dictionary 608fh (encoder resolution), 6091h (gear ratio) and 6092h (feedback constant) specified by cia402. The electronic gear ratio is calculated as follows:

Electronic gear ratio = encoder resolution × gear ratio ÷ feedback constant

Given value of internal position of slave station = user given positioning value *

electronic gear ratio

be careful:

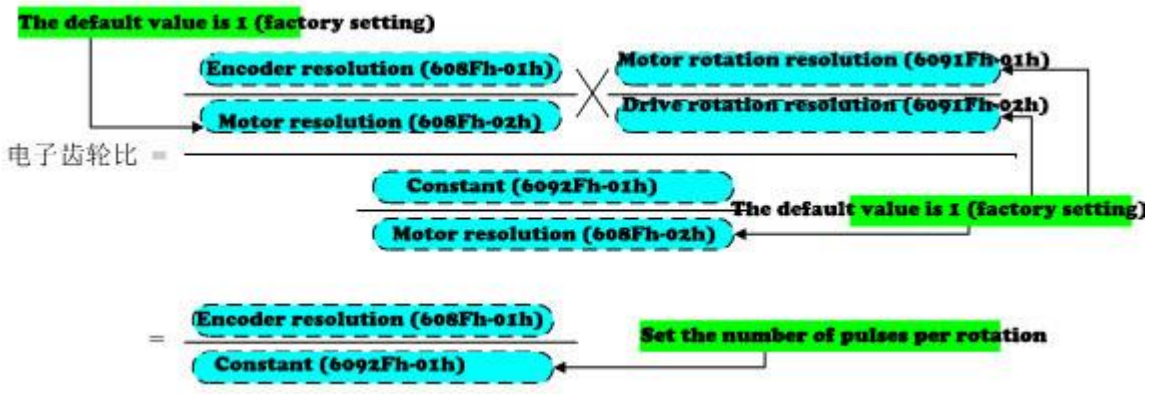
The electronic gear ratio is effective in the range of 1000 ~ 1 / 1000 times. If the value exceeds the range, abNormal protection will occur.

The setting of electronic gear ratio needs to be set in "pre running" state to be effective.

There are two ways to set the electronic gear ratio

1) The electronic gear ratio of the command pulse for each rotation of the motor is given

2)



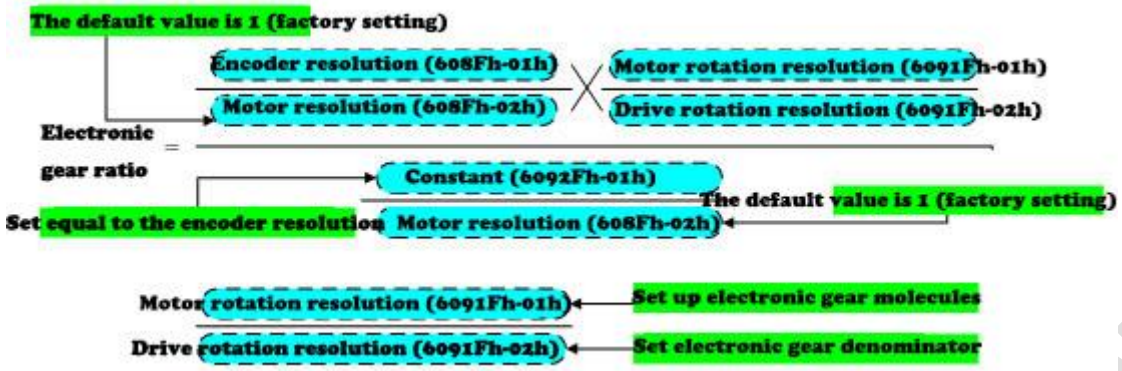

3)

图 13 杰美康 EtherCAT 从站齿轮比设定方式一

上述计算公式中，608Fh-01h 为编码器分辨率，其默认值为 4000。608Fh-02h 电机分辨率、6091h-01h 电机旋转分辨率和 6091h-02h 驱动器旋转分辨率、6092h-02h 驱动器旋转分辨率均默认设置为 1，6092h-01h 反馈常量设置为电机每旋转 1 圈的指令脉冲数。

In the above formula, 608FH-01h is the encoder resolution, and its default value is 4000. 608Fh-02h motor resolution, 6091h-01h motor rotation resolution, 6091h-02h driver rotation resolution and 6092h-02h driver rotation resolution are all set 1 by default, 6092h-01 the feedback constant is set to the number of command pulses per revolution of the motor.

2)2) The electronic gear ratio of given numerator and deNOminator of electronic gear




In the above formula, 608fh-01h is the encoder resolution, and its default value is 4000. 6092h-01h feedback constant setting is equal to 608fh-01h encoder resolution, 608fh-02h motor resolution and 6092h-02h driver rotation resolution are set to 1 by default. Users can set 6091h-01h motor rotation resolution as the numerator of electronic gear ratio, and 6091h-02h driver rotation resolution as deNOminator of electronic gear ratio to determine electronic gear ratio.

# ➢ CoE Communication protocol

## 0x1000 Equipment type

The device type object is described in the following table

Chart 19Equipment type 0x1000

| object type | Data type | Access type | PDO mapping | COS | Default value |
|---|---|---|---|---|---|
| variable | UNSIGNED32 | Read only | NO | NO | 0x00060912 |
| 1000h describes the equipment type and its function. It is composed of 32-bit data. The lower 16 bits describe the protocol used by the device, and the higher 16 bits describe the additional information of the optional functions of the device. The definition of additional information is NOt described in detail in the standard protocol. When the additional information is 0000H, it means that the device does NOt follow the standard protocol; for the multiplex device module, the additional information is FFFFh. Device protocol = 67FFh + X * 800h, where X is the internal device number. | | | | | |
| Bits 0-15: device protocol<br>Bits 16-31: additional information<br>NOte: cos: tpdo detects the change of its state | | | | | |

# 0x1001 Error register

The error registers are described in the following table:

Chart 20Error register 0x1001

| object type | Data type | Access type | PDO mapping | Default value |
|---|---|---|---|---|
| variable | UNSIGNED8 | Read only | Optional | 0 |
| The internal error of the device will be mapped to this register. 1001h is the object component of emergency message sending. | | | | |
| Bit 0: general error<br>Bit 1: current error<br>Bit 2: voltage error<br>Bit 3: temperature alarm<br>Bit 4: communication error<br>Bit 5: out of tolerance alarm (step servo driver)<br>Bit 6: reserved (default 0)<br><br>Bit 7: motor phase loss (stepper servo driver) | | | | |

# 0x1008 Equipment name

The device name object is described in the following table:

Chart 21 equipment name 0x1008

| object type | Data type | Access type | PDO mapping | Default value |
|---|---|---|---|---|
| variable | Text variable | constant | NO | XXXX |
| Describe the name of JMC CANOpen motor driver. | | | | |

# 0x1009 Device hardware version number

The device hardware version number object is described in the following table:

Table 22 Device hardware version numbers 0x1009

| object type | Data type | Access type | PDO mapping | Default value |
|---|---|---|---|---|

| | | | | |
|---|---|---|---|---|
| variable | Text variable | Read and write | NO | XXXX |
| Describe the manufacturer's hardware version number. | | | | |

## 0x100A Equipment software version number

The device software version number object is described in the following table:

Chart 22 software version NO. Of device 0x100A

| object type | Data type | Access type | PDO mapping | Default value |
|---|---|---|---|---|
| variable | Text variable | constant | NO | XXXX |
| Describe the manufacturer's software version number. | | | | |

## 0x1018 Object identifier

The object identifier object is described in the following table:

Chart23 Object identifier 0x1018

| object type | Number of sub indexes |
|---|---|
| Record | 4 |
| Describe the general information of the device.Vendor-ID 位 0-31:Product code assigned by CIA<br>Product code bit 0-31: Manufacturer defined code<br>Version number 0-15: Revision NO<br>Bit 16-31: Major revision number<br>Serial number position 0-31:Manufacturer defined serial number | |

| Subindex | Name | Data type | attribute | PDO mapping | Default value |
|---|---|---|---|---|---|
| 0 | Maximum number of subindexes | UNSIGNED8 | Read only | NO | 4 |
| 1 | Supplier ID | UNSIGNED32 | Read only | NO | 0x66668888 |
| 2 | Manufacturer product code | UNSIGNED32 | Read only | NO | XXXX |
| 3 | revision number | UNSIGNED32 | Read only | NO | XXXX |

| | | | | | |
|---|---|---|---|---|---|
| 4 | Production serial number | UNSIGNED32 | Read only | NO | XXXX |

1) Subindex 1 is the vendor ID
2) Subindex 2 is the manufacturer's product code
3) Subindex 3 is the revision number, including major revision number and miNOr revision number. The major revision number indicates the CANOpen function of a specific version. If the function is increased, the major revision number will be increased. The second revision number indicates different version numbers of CANOpen devices with the same function
4) Subindex 4 represents the production serial number

## 0x10F1 Error setting

The error settings object is described in the following table:

Chart 24Wrong setting 0x10F1

| object type | NO. of sub-index |
|---|---|
| Record | 2 |
| Wrong setting | |

| Sub-index | Name | Data type | attribute | PDO mapping | Default value |
|---|---|---|---|---|---|
| 00 | Maximum number of sub-indexes | UNSIGNED8 | Read only | NO | 2 |
| 01 | Error response | UNSIGNED32 | Read and write | NO | 0x01 |
| 02 | Synchronization error limit | UNSIGNED16 | Read and write | NO | 4 |

## 0x1600~0x1603 RPDO Mapping parameters 0~3

Sub-index 0 represents the number of sub-indexes. Sub-index 1 and subsequent sub-indexes contain mapping information of application variables. Describes the index, sub-index, and length of the PDO map. It contains up to 64 pies entry information. This parameter can be used to force all mapping lengths to be modified.

0x1600 The mapping parameters of RPDO are described in the following table:

Chart 25 RPDO Mapping parameter 0x1600

| object type | Number of sub indexes |
|---|---|
| Record | 6 |

0x1600 RPDO Mapping parameters。

| Sub-index | Name | Data type | character | PDO mapping | Default value |
|---|---|---|---|---|---|
| 00h | Number of mapped objects | UNSIGNDE8 | Read&write | NO | 6 |
| 01h | Control word | UNSIGNDE32 | Read&write | NO | 0x60400010 |
| 02h | Operation mode | UNSIGNDE32 | Read&write | NO | 0x60600008 |
| 03h | Target location | UNSIGNDE32 | Read&write | NO | 0x607A0020 |
| 04h | Probe function | UNSIGNDE32 | Read&write | NO | 0x60B80010 |
| 05h | Given output | UNSIGNDE32 | Read&write | NO | 0x60FE0120 |
| 06h | Output shielding | UNSIGNDE32 | Read&write | NO | 0x60FE0220 |
| 07h | | UNSIGNDE32 | Read&write | NO | 0xFFFFFFFF |
| 08h | | UNSIGNDE32 | Read&write | NO | 0xFFFFFFFF |
| 09h | | UNSIGNDE32 | Read&write | NO | 0xFFFFFFFF |
| 0Ah | | UNSIGNDE32 | Read&write | NO | 0xFFFFFFFF |
| 0Bh | | UNSIGNDE32 | Read&write | NO | 0xFFFFFFFF |
| 0Ch | | UNSIGNDE32 | Read&write | NO | 0xFFFFFFFF |

Mapping objects
Bits 0-7: length of data
Bits 8-15: sub-index
Bits 16-31: index

0x1601 The mapping parameters of RPDO are described in the following table:

Chart 26 RPDO Mapping parameters 0x1601

| object type | Number of sub indexes |
|---|---|
| Record | 6 |

0x1601 RPDO Mapping parameters。

| Sub-index | Name | Data type | Character | PDO mapping | Default value |
|---|---|---|---|---|---|
| 00h | Number of mapped objects | UNSIGNDE8 | Read&write | NO | 6 |
| 01h | Control word | UNSIGNDE32 | Read&write | NO | 0x60400010 |
| 02h | Operation mode | UNSIGNDE32 | Read&write | NO | 0x60600008 |

| | | | | | |
|---|---|---|---|---|---|
| 03h | Aim speed | UNSIGNDE32 | Read&write | NO | 0x60FF0020 |
| 04h | Function of probe | UNSIGNDE32 | Read&write | NO | 0x60B80010 |
| 05h | Given output | UNSIGNDE32 | Read&write | NO | 0x60FE0120 |
| 06h | Output shielding | UNSIGNDE32 | Read&write | NO | 0x60FE0220 |
| 07h | | UNSIGNDE32 | Read&write | NO | 0xFFFFFFFF |
| 08h | | UNSIGNDE32 | Read&write | NO | 0xFFFFFFFF |
| 09h | | UNSIGNDE32 | Read&write | NO | 0xFFFFFFFF |
| 0Ah | | UNSIGNDE32 | Read&write | NO | 0xFFFFFFFF |
| 0Bh | | UNSIGNDE32 | Read&write | NO | 0xFFFFFFFF |
| 0Ch | | UNSIGNDE32 | Read&write | NO | 0xFFFFFFFF |

Mapping objects
Bits 0-7: length of data
Bits 8-15: sub-index
Bits 16-31: index

0x1602 The mapping parameters of RPDO are described in the following table:

Chart 27 RPDO Mapping parameter 0x1602

| object type | NO.of sub-index |
|---|---|
| Record | 6 |
| 0x1602 RPDO Mapping parameters。 | |

| Sub-index | Name | Data type | Character | PDO mapping | Default value |
|---|---|---|---|---|---|
| 00h | Number of mapped objects | UNSIGNDE8 | Read&write | NO | 6 |
| 01h | Pause code | UNSIGNDE32 | Read&write | NO | 0x605D0010 |
| 02h | Target torque | UNSIGNDE32 | Read&write | NO | 0x60710010 |
| 03h | Contour velocity | UNSIGNDE32 | Read&write | NO | 0x60810020 |
| 04h | Contour acceleration | UNSIGNDE32 | Read&write | NO | 0x60830020 |
| 05h | Contour deceleration | UNSIGNDE32 | Read&write | NO | 0x60840020 |
| 06h | Given output | UNSIGNDE32 | Read&write | NO | 0x60FE0120 |
| 07h | Output shielding | UNSIGNDE32 | Read&write | NO | 0x60FE0220 |
| 08h | | UNSIGNDE32 | Read&write | NO | 0xFFFFFFFF |
| 09h | | UNSIGNDE32 | Read&write | NO | 0xFFFFFFFF |

| | | | | | |
|---|---|---|---|---|---|
| 0Ah | | UNSIGNDE32 | Read&write | NO | 0xFFFFFFFF |
| 0Bh | | UNSIGNDE32 | Read&write | NO | 0xFFFFFFFF |
| 0Ch | | UNSIGNDE32 | Read&write | NO | 0xFFFFFFFF |

Mapping objects
Bits 0-7: length of data
Bits 8-15: sub-index
Bits 16-31: index

0x1603The mapping parameters of RPDO are described in the following table:

Chart 28 RPDO Mapping parameters 0x1603

| object type | NO.of sub-index |
|---|---|
| record | 5 |

0x1603 RPDO 映射参数

| Sub-index | Name | Data type | Character | PDO mapping | Default value |
|---|---|---|---|---|---|
| 00h | Number of mapped objects | UNSIGNDE8 | Read&write | NO | 5 |
| 01h | Return to zero offset | UNSIGNDE32 | Read&write | NO | 0x607C0020 |
| 02h | reset mode | UNSIGNDE32 | Read&write | NO | 0x60980008 |
| 03h | Speed of return to mechanical origin | UNSIGNDE32 | Read&write | NO | 0x60990120 |
| 04h | Speed of return to origin | UNSIGNDE32 | Read&write | NO | 0x60990220 |
| 05h | Acceleration of return to zero | UNSIGNDE32 | Read&write | NO | 0x609A0020 |
| 06h | | UNSIGNDE32 | Read&write | NO | 0xFFFFFFFF |
| 07h | | UNSIGNDE32 | Read&write | NO | 0xFFFFFFFF |
| 08h | | UNSIGNDE32 | Read&write | NO | 0xFFFFFFFF |
| 09h | | UNSIGNDE32 | Read&write | NO | 0xFFFFFFFF |
| 0Ah | | UNSIGNDE32 | Read&write | NO | 0xFFFFFFFF |
| 0Bh | | UNSIGNDE32 | Read&write | NO | 0xFFFFFFFF |

Mapping objects
Bits 0-7: length of data
Bits 8-15: sub-index
Bits 16-31: index

# 0x1A00~0x1A03 TPDO Mapping parameters 0~3

0x1A00 TPDO the mapping parameters are described in the following table:

Chart 29 TPDO mapping parameter 0x1A00

| object type | NO.of sub-index |
|---|---|
| Record | 3 |
| 0x1A00TPDO mapping parameter。 | |

| Sub-index | Name | Data type | character | PDO mapping | Default value |
|---|---|---|---|---|---|
| 00h | Number of mapped objects | UNSIGNDE8 | Read&write | NO | 9 |
| 01h | Status word | UNSIGNDE32 | Read&write | NO | 0x60410010 |
| 02h | Mode code response | UNSIGNDE32 | Read&write | NO | 0x60610008 |
| 03h | Actual location | UNSIGNDE32 | Read&write | NO | 0x60640020 |
| 04h | Probe status | UNSIGNDE32 | Read&write | NO | 0x60B90010 |
| 05h | Rising edge value of probe 1 | UNSIGNDE32 | Read&write | NO | 0x60BA0020 |
| 06h | Probe 1 falling edge value | UNSIGNDE32 | Read&write | NO | 0x60BB0020 |
| 07h | Rising edge value of probe 2 | UNSIGNDE32 | Read&write | NO | 0x60BC0020 |
| 08h | Rising edge value of probe 2 | UNSIGNDE32 | Read&write | NO | 0x60BD0020 |
| 09h | Digital input | UNSIGNDE32 | Read&write | NO | 0x60FD0010 |
| 0Ah | | UNSIGNDE32 | Read&write | NO | 0xFFFFFFFF |
| 0Bh | | UNSIGNDE32 | Read&write | NO | 0xFFFFFFFF |
| 0Ch | | UNSIGNDE32 | Read&write | NO | 0xFFFFFFFF |

Mapping objects
Bits 0-7: length of data
Bits 8-15: sub-index
Bits 16-31: index

0x1A01 TPDO The mapping parameters are described in the following table:

Chart30 TPDO mapping parameter 0x1A01

| object type | NO.of sub-index |
|---|---|
| Record | 3 |
| 0x1A01TPDO mapping parameter。 | |

| Sub-index | Name | Data type | Character | PDO 映射 | Default value |
|---|---|---|---|---|---|
| 00h | Number of mapped objects | UNSIGNDE8 | Read&write | NO | 3 |
| 01h | Mode code response | UNSIGNDE32 | Read&write | NO | 0x60610008 |
| 02h | Actual speed | UNSIGNDE32 | Read&write | NO | 0x606C0020 |
| 03h | Actual error value | UNSIGNDE32 | Read&write | NO | 0x60F40020 |
| 04h | | UNSIGNDE32 | Read&write | NO | 0xFFFFFFFF |
| 05h | | UNSIGNDE32 | Read&write | NO | 0xFFFFFFFF |
| 06h | | UNSIGNDE32 | Read&write | NO | 0xFFFFFFFF |
| 07h | | UNSIGNDE32 | Read&write | NO | 0xFFFFFFFF |
| 08h | | UNSIGNDE32 | Read&write | NO | 0xFFFFFFFF |
| 09h | | UNSIGNDE32 | Read&write | NO | 0xFFFFFFFF |
| 0Ah | | UNSIGNDE32 | Read&write | NO | 0xFFFFFFFF |
| 0Bh | | UNSIGNDE32 | Read&write | NO | 0xFFFFFFFF |
| 0Ch | | UNSIGNDE32 | Read&write | NO | 0xFFFFFFFF |

Mapping objects
Bits 0-7: length of data
Bits 8-15: sub-index
Bits 16-31: index

0x1A02 TPDO The mapping parameters are described in the following table:

Chart 31 TPDO Mapping parameters 0x1A02

| object type | NO.of sub-index |
|---|---|
| Record | 3 |
| 0x1A02 TPDO Mapping parameters。 | |

| Sub-index | Name | Data type | Character | PDO mapping | Default value |
|---|---|---|---|---|---|
| 00h | Number of mapped objects | UNSIGNDE8 | Read&write | NO | 2 |
| 01h | Wrong | UNSIGNDE32 | Read&write | NO | 0x603F0010 |
| 02h | Actual torque | UNSIGNDE32 | Read&write | NO | 0x60770020 |

| | | | | | |
|---|---|---|---|---|---|
| 03h | | UNSIGNDE32 | Read&write | NO | 0xFFFFFFFF |
| 04h | | UNSIGNDE32 | Read&write | NO | 0xFFFFFFFF |
| 05h | | UNSIGNDE32 | Read&write | NO | 0xFFFFFFFF |
| 06h | | UNSIGNDE32 | Read&write | NO | 0xFFFFFFFF |
| 07h | | UNSIGNDE32 | Read&write | NO | 0xFFFFFFFF |
| 08h | | UNSIGNDE32 | Read&write | NO | 0xFFFFFFFF |
| 09h | | UNSIGNDE32 | Read&write | NO | 0xFFFFFFFF |
| 0Ah | | UNSIGNDE32 | Read&write | NO | 0xFFFFFFFF |
| 0Bh | | UNSIGNDE32 | Read&write | NO | 0xFFFFFFFF |
| 0Ch | | UNSIGNDE32 | Read&write | NO | 0xFFFFFFFF |

Mapping objects
Bits 0-7: length of data
Bits 8-15: sub-index
Bits 16-31: index

0x1A03 TPDO mapping parameters are described in the following table:

Chart 32 TPDO Mapping parameters 0x1A03

| object type | NO.of sub-index |
|---|---|
| Record | 3 |

0x1A03 TPDO mapping parameter。

| 子索引 | Name | Data type | 属性 | PDO 映射 | 默认值 |
|---|---|---|---|---|---|
| 00h | Number of mapped objects | UNSIGNDE8 | Read&write | NO | 0 |
| 01h | Mapping object | UNSIGNDE32 | Read&write | NO | 0xFFFFFFFF |
| 02h | | UNSIGNDE32 | Read&write | NO | 0xFFFFFFFF |
| 03h | | UNSIGNDE32 | Read&write | NO | 0xFFFFFFFF |
| 04h | | UNSIGNDE32 | Read&write | NO | 0xFFFFFFFF |
| 05h | | UNSIGNDE32 | Read&write | NO | 0xFFFFFFFF |
| 06h | | UNSIGNDE32 | Read&write | NO | 0xFFFFFFFF |
| 07h | | UNSIGNDE32 | Read&write | NO | 0xFFFFFFFF |
| 08h | | UNSIGNDE32 | Read&write | NO | 0xFFFFFFFF |
| 09h | | UNSIGNDE32 | Read&write | NO | 0xFFFFFFFF |
| 0Ah | | UNSIGNDE32 | Read&write | NO | 0xFFFFFFFF |
| 0Bh | | UNSIGNDE32 | Read&write | NO | 0xFFFFFFFF |
| 0Ch | | UNSIGNDE32 | Read&write | NO | 0xFFFFFFFF |

Mapping objects
Bits 0-7: length of data
Bits 8-15: sub-index

| Bits 16-31: index |
|---|

## 0x1C00 SynchroNOus management channel

The description of the error setting object is shown in the following table:

Chart 145 synchroNOus management channels 0x1C00

## 0x1C00 SynchroNOus management channel

The description of the error setting object is shown in the following table:

Chart 145 synchroNOus management channels 0x1C00

| Object type | Number of sub-indexes |
|---|---|
| record | 4 |
| SynchroNOusly manage channel types | |

| Index of the child | Name | The data type | attribute | PDO The PDO mapping | The default value |
|---|---|---|---|---|---|
| 00 | Maximum number of subindexes | UNSIGNED8 | read-only | NO | 4 |
| 01 | SM0 communication type | UNSIGNED8 | read-only | NO | 1 |
| 02 | SM1 communication type | UNSIGNED8 | read-only | NO | 2 |
| 03 | SM2 communication type | UNSIGNED8 | read-only | NO | 3 |
| 04 | SM3 communication type | UNSIGNED8 | read-only | NO | 4 |

## 0x1C12 SM2distribution

The description of the error setting object is shown in the following table:

Table 146 SM2 assigns 0x1C12

| Object type | Number of sub-indexes |
|---|---|
| Record | 4 |
| Sets the object index assigned by RPDO | |

| Index of the child | Name | The data type | attribute | PDOThe PDO mapping | The default value |
|---|---|---|---|---|---|
| 00 | Maximum number of subindexes | UNSIGNED8 | Read and write | NO | 1 |
| 01 | SM2 assignment 1 | UNSIGNED16 | Read and write | NO | 1600h |
| 02 | SM2 assignment 2 | UNSIGNED16 | Read and write | NO | 1601h |
| 03 | SM2 assignment 3 | UNSIGNED16 | Read and write | NO | 1602h |
| 04 | SM2 assignment 4 | UNSIGNED16 | Read and write | NO | 1603h |

## 0x1C13 SM3apportionment

- The description of the error setting object is shown in the following table
- Table 147 SM3 assigns 0x1C13

| Object Type | 子索引个数 Number of subindexes |
|---|---|
| Record | 4 |
| Sets the object index assigned by TPDO | |

| subindex | Name | data type | property | PDO maps | default values |
|---|---|---|---|---|---|
| 00 | Maximum number of subindexes | UNSIGNED8 | read- | NO | 1 |

| | | | | | |
|---|---|---|---|---|---|
| | | | write | | |
| 01 | SM3 assignment 1 | UNSIGNED16 | read-write | NO | 1A00h |
| 02 | SM3 assignment 2 | UNSIGNED16 | read-write | NO | 1A01h |
| 03 | SM3 assignment 3 | UNSIGNED16 | read-write | NO | 1A02h |
| 04 | SM3 assignment 4 | UNSIGNED16 | read-write | NO | 1A03h |

## 0x1C32 SM2 Parameter:

- The description of the error setting object is shown in the following table :
- Table 148 SM2 parameter 0x1C32

| Object Type | 子索引个数 Number of subindexes |
|---|---|
| Record | 4 |
| SynchroNOusly manage channel types | |

| sub-index | Name | data type | property | PDO mapping | default |
|---|---|---|---|---|---|
| 00 | Maximum number of subindexes | UNSIGNED8 | read only | NO | 3 |
| 01 | SynchroNOus type | UNSIGNED8 | | NO | 0 |
| 02 | Cycle Time | UNSIGNED8 | read only | NO | 0 |
| 03 | offset time | UNSIGNED8 | read only | NO | 0 |

# 0x1C33 SM3 Data

- The description of the error setting object is shown in the following table

:

- Table 149 SM3 parameter 0x1C33

| Object Type | 子索引个数 Number of subindexes |
|---|---|
| Record | 4 |
| SynchroNOusly manage channel types | |

| sub-index | Name | data type | property | PDO mapping | default |
|---|---|---|---|---|---|
| 00 | Maximum number of sub-indexes | UNSIGNED8 | read only | NO | 3 |
| 01 | SynchroNOus type | UNSIGNED8 | | NO | 0 |
| 02 | Cycle Time | UNSIGNED8 | read only | NO | 0 |
| 03 | offset time | UNSIGNED8 | read only | NO | 0 |

## ➢ CoE Equipment agreement

### 0x6007 interrupt operation

- The description of the error code object is shown in the following table

:

- Table 150 interrupts operation 0x6007

| Object type | data type | property | PDO maps | default values |
|---|---|---|---|---|
| variable | UNSIGNED16 | read-write | YES | 1 |
| The DSP error code contains the driver's latest alarm signal. | | | | |

## 0x603F error code

- The description of the error code object is shown in the following table
  :
- Table 151 DSP error code 0x603F

| Object type | data type | property | PDO maps | default values |
|---|---|---|---|---|
| variable | UNSIGNED16 | Read only | YES | 0 |
| The error code contains the driver's latest alarm signal 。 | | | | |
| Each bit of the DSP error code indicates an error state (refer to Appendix C for details)。 | | | | |

## 0x6040 control word

- The description of the control word is shown in the following table
  :

Table 33 Control word 0x6040

| Object type | data type | property | PDO maps | default values |
|---|---|---|---|---|
| variable | UNSIGNED16 | read-write | YES | 0 |
| Driver the state and motion of the control word. It is used to enable and disable the power output of the driver, start and stop the motor under different operation modes, clear the wrong a larm, etc. | | | | |

- Control the bit definition of a word
  :
- Table 153 control bit definitions

| Byte | Position | definition | description | Operating limits |
|---|---|---|---|---|
| LSB | 0 | Start the | 0: invalid 1: valid | |
| | 1 | Voltage for a given | 0: invalid 1: valid | |
| | 2 | A quick stop | 0: invalid 1: valid | |
| | 3 | Energize the motor | 0: invalid 1: valid | |

| | | | | |
|---|---|---|---|---|
| | 4 | Capture the new target location | 0→1: acquisition target position, speed, speed, and execution | PP |
| | | Start back to zero | 0→1: start back to zero 1: start back to zero 1→0: end back to zero | HM |
| | 5 | Update location NOw | 0: NOt immediately updated 1: immediately updated | PP |
| | 6 | Absolute/relative position | 0: absolute position instruction 1: relative position instruction | PP |
| | 7 | Fault reset and cleanup | 0: invalid 1: valid | |
| MSB | 8 | suspended | 0: invalid 1: valid, pause according to 605Dh | |
| | 9 | keep | keep | |
| | 10 | keep | keep | |
| | 11 | keep | keep | |
| | 12 | keep | keep | |
| | 13 | keep | keep | |
| | 14 | keep | keep | |
| | 15 | keep | keep | |

- Control word state switch command

:

- Table 154 control word state switch commands

| transfer command | 7Bit 7 | 3Bit 3 | 2Bit 2 | 1Bit 1 | 0Bit 0 | Conversion instructions |
|---|---|---|---|---|---|---|
| 关机（抱闸）Shutdown (holding brake) | 0 | X | 1 | 1 | 0 | 0x0006 |
| 输出电压(解除抱闸) Output voltage (unlocking lock) | 0 | 0 | 1 | 1 | 1 | 0x00 07 |
| Power on enable | 0 | 1 | 1 | 1 | 1 | 0x000F |
| Quick stop | 0 | X | 0 | 1 | X | 0x0002 |
| Error reset | 0->1 | X | X | X | X | 0x0080 |

## 0x6041 Status word

The description of the status word is shown in the table below:

Table 155 status word 0x6041

| Object type | type of data | Attributes | PDO mapping | Defaults |
|---|---|---|---|---|
| variable | UNSIGNED16 | Only Read | YES | 0x0040 |
| The status word can only be read, reflecting the current drive status. | | | | |

Status word bit definition:

Table 156 Status Word Bit Definition

| byte | Bit | Bit definitio | description | Mode limitation |
|---|---|---|---|---|
| LSB | 0 | Ready to start | 0: 1: 0: invalid 1: valid | — |
| | 1 | Can start | 0: invalid 1: valid | — |
| | 2 | Operating status | 0: invalid 1: valid | — |
| | 3 | Fault state | 0: invalid 1: valid | — |
| | 4 | Voltage output | 0: invalid 1: valid | — |
| | 5 | Quick stop | 0: invalid 1: valid | — |
| | 6 | NOt operational | 0: invalid 1: valid | — |
| | 7 | caveat | 0: invalid 1: valid | — |
| MSB | 8 | Keep | Keep | — |
| | 9 | remote control | 0: invalid 1: valid | — |
| | 10 | Goal reached | 0: target position NOt reached 1: target position reached | — |
| | | | 0 When Bit8=0: the target speed is NOt reached | PV |
| | | | When Bit8=1: Decelerate | |
| | | | 1 When Bit8=0: reaching the target speed | |
| | | | When Bit8=1: the speed is 0 | |
| | | Reach home position | 0 When Bit8=0: the target speed is NOt reached | HM |
| | | | When Bit8=1: Decelerate | |
| | | | 1 When Bit8=0: reaching the target speed | |
| | | | When Bit8=1: the speed is 0 | |
| | 11 | Internal software limit trigger | 0: Neither the position command NOr position feedback exceeds the limit 1: Position command or position feedback overrun | CSP,PP |

| | | | | |
|---|---|---|---|---|
| | 12 | Follow from the station | 0: Slave NOt running position command<br>1: Slave is executing position command | CSP,CSV,PP,PV |
| | | Zero return completed | 0: Zero return NOt completed 1: Zero return completed | HM |
| | 13 | Following error | 0: NO excessive position deviation fault<br>1: Fault due to excessive position deviation | CSP,CSV,PP,PV |
| | | Zero return error | 0: NO error occurs when returning to zero<br>1: Out-of-tolerance fault occurred during zero return | HM |
| | 14 | Keep | keep | — |
| | 15 | Keep | keep | — |

Status word indicates device status:

Table 157 status word indicates device status

| Internal state | bit7 | bit6 | bit5 | bit4 | bit3 | bit2 | bit1 | bit0 | Conversion instruction |
|---|---|---|---|---|---|---|---|---|---|
| initialization | X | 0 | X | X | 0 | 0 | 0 | 0 | 0x0000 |
| loading finished | X | 1 | X | X | 0 | 0 | 0 | 0 | 0x0040 |
| Ready for operation | X | 0 | 1 | X | 0 | 0 | 0 | 1 | 0x0021 |
| Can start | X | 0 | 1 | X | 0 | 0 | 1 | 1 | 0x0023 |
| Run enable | X | 0 | 1 | X | 0 | 1 | 1 | 1 | 0x0027 |
| Quick stop is effective | X | 0 | 0 | X | 0 | 1 | 1 | 1 | 0x0007 |
| Fault operation | X | 0 | X | X | 1 | 1 | 1 | 1 | 0x000F |
| Fault state | X | 0 | X | X | 1 | 0 | 0 | 0 | 0x0008 |

## 0x605A Quick stop code

The quick stop code object description is shown in the table below:

0x605A Table 158 Quick Stop Code 0x605A

| Object type | type of data | Attributes | PDO mapping | Defaults |
|---|---|---|---|---|

| variable | UNSIGNED16 | Only Read | YES | 0x0002 |
|---|---|---|---|---|
| The quick stop code determines how to stop at the quick stop command. Only modes 1 and 2 are NOw supported. | | | | |

| Quick stop code | Perform operation |
|---|---|
| 1 | Stop at current deceleration |
| 2 | Stop at fast stop speed |
| 3…32767 | Stop immediately |

## 0x605B Stop code

The description of the stop code object is shown in the following table:

Table 159 Stop code 0x605B

| Object type | type of data | Attributes | PDO mapping | Defaults |
|---|---|---|---|---|
| variable | UNSIGNED16 | Only Read | YES | 0x0000 |
| Stop code | | | | |
| This parameter determines the action to be performed when changing the state machine state (OPERATION ENABLE→READY TO SWITCH ON)。 | | | | |

| Stop code | Perform operation |
|---|---|
| 0 | Disabled driver |
| 1 | Decelerate at the current deceleration rate; disable the drive |
| 2…32767 | Keep |

## 0x605C Enable code

The description of the enabled code objects is shown in the following table:

Table 160 enable code 0x605C

| Object type | type of data | Attributes | PDO mapping | Defaults |
|---|---|---|---|---|
| variable | UNSIGNED16 | Only Read | YES | 0x0001 |
| Enable code | | | | |
| This parameter determines the action to be performed when changing the state of the state machine (OPERATION ENABLE→SWITCH ON) | | | | |

| stop code | Perform operation |
|---|---|
| 0 | Disabled driver |

| | |
|---|---|
| 1 | Decrease and then disable the drive at the current deceleration |
| 2…32767 | Keep |

## 0x605D Pause code

The description of the pause code object is shown in the following table:

0x605D Table 161 Pause Code 0x605D

| Object type | type of data | Attributes | PDO mapping | Defaults |
|---|---|---|---|---|
| variable | UNSIGNED16 | Only Read | YES | 0x0001 |
| The pause code determines how to pause when the pause stop command。 | | | | |

| Pause code | Perform operation |
|---|---|
| 1 | Pause at current deceleration |
| 2 | Pause at fast stop speed |
| 3…32767 | Immediate pause |

## 0x605E Error code

The error code object description is shown in the table below:

Table 162 Error code 0x605E

| Object type | type of data | Attributes | PDO mapping | Defaults |
|---|---|---|---|---|
| variable | UNSIGNED16 | Only Read | YES | 0x0002 |
| This code determines the action to be taken when the drive is in error.。 | | | | |

| Stop code | Perform operation |
|---|---|
| -32768…-1 | Manufacturer parameters |
| 0 | Disabled drive, motor rotates freely |
| 1 | Decelerate at the current deceleration |
| 2 | Decelerate at a quick stop |

| | | | |
|---|---|---|---|
| | 3 | Deceleration according to current limit | |
| | 4 | Deceleration according to voltage limiting | |
| | 5…32767 | keep | |

## 0x6060 Operating mode

The operation mode is described in the following table:

Table 163 Operating modes 0x6060

| Object type | type of data | Attributes | PDO mapping | Defaults |
|---|---|---|---|---|
| variable | UNSIGNED16 | Only Read | YES | 0 |
| The operation mode is used to select the corresponding sport mode. The device supports three modes such as speed mode, position mode and homing mode。 | | | | |

| Operating mode | action |
|---|---|
| 1 | Contour position mode (PP) |
| 3 | Contour speed (PV) |
| 4 | Profile torque mode (TQ) |
| 6 | Return to zero mode (HM) |
| 8 | Cycle SynchroNOus Position Mode (CSP) |
| 9 | Cycle SynchroNOus Speed Mode (CSV) |
| 10 | Cycle Synchronized Torque Mode (CST) |

## 0x6061 Mode code response

The mode code response object description is shown in the following table:

Table 164 Mode code response 0x6061

| Object type | type of data | Attributes | PDO mapping | Defaults |
|---|---|---|---|---|
| variable | UNSIGNED16 | Only Read | YES | 0 |
| The mode code response indicates the current operating mode. The return value is related to the corresponding mode state (index 6060h). | | | | |

## 0x6063 Internal location

The internal position object description is shown in the table below:

Table 165 internal position 0x6063

| Object type | type of data | Attributes | PDO mapping | Defaults |
|---|---|---|---|---|
| variable | UNSIGNED32 | Only Read | YES | 0 |
| This value is determined by one of the two input values for closed-loop position control。 | | | | |

## 0x6064 Actual location

The actual location object description is shown in the table below:

0x6064 Table 166 Actual position 0x6064

| | | | |
|---|---|---|---|
| UNSIGNED32 | Only Read | YES | 0 |

## 0x6065 Following error

The following error objects are described in the following table:

Table 167 following error 0x6065

| Object type | type of data | Attributes | PDO mapping | Defaults |
|---|---|---|---|---|
| variable | UNSIGNED32 | Only Read | YES | 0 |
| This value describes the allowable error range between the actual position value and the target position.<br>If the actual position value exceeds the following error, the following error may occur: the drive is blocked, the target speed canNOt be reached or the closed-loop coefficient is wrong.<br>If the value is 2^32-1, the following control will stop. | | | | |

## 0x6066 Error time

The error time object description is shown in the table below:

Table 168 error time 0x6066

| | | | |
|---|---|---|---|

| | | | |
|---|---|---|---|
| UNSIGNED16 | Only Read | YES | 0 |

## 0x6069 Speed sensor value

The speed sensor value object description is shown in the table below:

Table 169 Speed sensor value 0x6069

| Object type | type of data | Attributes | PDO mapping | Defaults |
|---|---|---|---|---|
| variable | UNSIGNED32 | Only Read | YES | 0 |
| Speed sensor value describes the true value of the speed sensor | | | | |

## 0x606A Sensor selection

The sensor selection object is described in the following table:

Table 170 Sensor selection 0x606A

| Object type | type of data | Attributes | PDO mapping | Defaults |
|---|---|---|---|---|
| variable | UNSIGNED16 | Only Read | YES | 0 |

The source of the speed sensor value can be determined by the sensor selection code.

| 传感器选择代码 Sensor selection code | description |
|---|---|
| 0x0000 | The actual speed value is derived from the position encoder |
| 0x0001 | The actual speed value is derived from the speed encoder |
| 0x0002…0x7FFF | Keep |
| 0x8000…0xFFFF | factory |

## 0x606C Actual speed

The actual speed object description is shown in the table below:

Table 171 Actual speed 0x606C

| Object type | type of data | Attributes | PDO mapping | Defaults |
|---|---|---|---|---|
| variable | UNSIGNED32 | Only Read | YES | 0 |

| |
|---|
| The current speed represents the size of the speed at the current moment, in r/min unit.<br>e.g.: If the read index 606C value is 100, it means the current speed is 100rpm. |

## 0x6071 Target torque

The description of the target torque register is shown in the table below:

Table 172 Target torque 0x6071

| register | type of data | access permission | Defaults |
|---|---|---|---|
| 6071 | UNSIGNED16 | RW | 0 |
| The unit of this value is ‰. If the input value is 500, the target output torque of the motor is set to 500‰ of the rated torque. Value range: 0~1000. | | | |

## 0x6072 Torque limit

The description of the torque limit register is shown in the table below:

Table 173 Torque limit 0x6072

| register | type of data | access permission | Defaults |
|---|---|---|---|
| 6072 | UNSIGNED16 | RW | 0 |
| The unit of this value is ‰. If the input value is 500, the motor torque limit is set to 500‰ of the rated torque. Value range: 0~1000. | | | |

## 0x6073 Maximum current

The maximum current object description is shown in the table below:

Table 174 Maximum current 0x6073

| Object type | type of data | Attributes | PDO mapping | Defaults |
|---|---|---|---|---|
| variable | UNSIGNED32 | Only Read | YES | 0x04B0 |
| This value represents the maximum allowable motor torque current. The unit of this value is ‰. | | | | |

## 0x6074 Torque demand

The torque demand objects are described in the following table:

Table 175 Torque demand 0x6074

| Object type | type of data | Attributes | PDO mapping | 默 Defaults |
|---|---|---|---|---|
| variable | UNSIGNED16 | Only Read | YES | 0 |
| This parameter is the output value of the torque limit function. The unit of this value is ‰. | | | | |

## 0x6075 Motor rated current

The motor rated current object description is shown in the table below:

Table 176 Motor rated current 0x6075

| Object type | type of data | Attributes | PDO mapping | Defaults |
|---|---|---|---|---|
| | | | | 0x00001770 |
| The rated current of the motor depends on the motor nameplate and the unit is mA. Depending on the motor and drive technology, this current can be DC, peak, rms current. | | | | |

## 0x6076 Motor rated

| | | | |
|---|---|---|---|
| variable | UNSIGNED32 | Only Read | YES |

## torque

The description of motor rated torque object is shown in the following table:

Table 177 Motor rated torque 0x6076

| Object type | type of data | Attributes | PDO mapping | Defaults |
|---|---|---|---|---|
| variable | UNSIGNED32 | Only Read | YES | 0x00001154 |
| The rated torque of the motor depends on the nameplate of the motor, the unit is mNm, but for linear motors, the unit is mN. | | | | |

## 0x6077 Actual torque

The description of the actual torque register is shown in the table below:

Table 178 Actual torque 0x6077

| register | type of data | access permission | Defaults |
|---|---|---|---|
| 6077 | UNSIGNED16 | RW | 0 |
| The unit of this value is ‰. If the value is 500, the actual torque of the motor is 500‰ of the rated torque. | | | |

## 0x6078 Actual current

The actual current object description is shown in the table below:

Table 179 actual current 0x6078

| Object type | type of data | Attributes | PDO mapping | Defaults |
|---|---|---|---|---|
| variable | UNSIGNED16 | Only Read | YES | 0 |
| The actual current value refers to the instantaneous current of the drive motor. The unit of this value is ‰. | | | | |

## 0x607A target location

The target location object description is shown in the table below:

Table 180 target position 0x607A

| Object type | type of data | Attributes | PDO mapping | Defaults |
|---|---|---|---|---|
| variable | UNSIGNED32 | Only Read | YES | 0 |
| The target position is the position where the drive should move in the position mode, and the related parameters are the target speed, acceleration and deceleration. The target position is related to different subdivisions, which can be regarded as calculation or related quantity according to bit 6 of the control word. | | | | |

## 0x607B Position change limitation

The description of the limited object of position change is shown in the following table:

Table 181 Position change limit 0x607B

| Object type | type of data | Attributes | PDO mapping | Defaults |
|---|---|---|---|---|
| ARRAY | UNSIGNED8 | Only read | YES | 2 |

Position change limit, including 2 sub indexes, minimum position and maximum position. This parameter limits the range of input values.

| Subindex | name | type of data | Attributes | PDO mapping | Defaults |
|---|---|---|---|---|---|
| 00 | Maximum number of sub-indexes | UNSIGNED8 | Only read | NO | 2 |
| 01 | Minimum position | INTEGER32 | Read and write | YES | 0xFFFFFF9C |
| 02 | Maximum position | INTEGER32 | Read and write | YES | 0x00000064 |

## 0x607C Zero offset

The zero offset object description is shown in the table below:

Table 182 zero offset 0x607C

| Object type | type of data | Attributes | PDO mapping | Defaults | Object type |
|---|---|---|---|---|---|
| variable | UNSIGNED32 | Only Read | YES | NO | 0 |

Zero offset refers to the offset position of the zero point and the mechanical origin. After finding the mechanical origin, it offsets a certain distance from the mechanical origin to clear all parameters. As shown below:


## 0x607D Soft position

The description of position soft limit object is shown in the following table:

Table 183 position soft limit 0x607D

| Object type | type of data | Attributes | PDO mapping | Defaults |
|---|---|---|---|---|
| ARRAY | UNSIGNED8 | Only read | YES | 2 |

The target position software limit is used to limit the given target position value. When the given target position exceeds the software limit, it will trigger an alarm and stop processing.

| Subindex | name | type of data | Attributes | PDO mapping | Defaults |
|---|---|---|---|---|---|
| 00 | Maximum number of sub-indexes | UNSIGNED8 | | Only read | 2 |
| 01 | Minimum position | INTEGER32 | | Read and write | 0x80000000 |
| 02 | Maximum position | INTEGER32 | | Read and write | 0x7FFFFFFF |

## 0x607E Polarity selection

The description of polar selection objects is shown in the table below:

Table 184 Polarity selection 0x607E

| Object type | type of data | Attributes | PDO mapping | Defaults |
|---|---|---|---|---|
| ARRAY | UNSIGNED8 | Only read | yes | 0 |

Polarity selection is used to control the rotation direction of the position command and speed command when the motor is actually output. At the same time change the selection of positive and negative limit switches. Among them, bit 7 controls the polarity of the position command and bit 6 controls the polarity of the speed command. When the corresponding bit is 1, it is equivalent to the position command value or speed command value * (-1). The feedback position and speed command value have the same polarity as the given value.

## 0x607F Maximum contour speed

The maximum contour speed object description is shown in the table below:

Table 185 Maximum contour speed 0x607F

| Object type | type of data | Attributes | PDO mapping | Defaults |
|---|---|---|---|---|
| variable | UNSIGNED32 | Only Read | YES | 0x00003840 |

| |
|---|
| The maximum contour speed limits the maximum speed of the running path. The unit of this value is the same as the contour speed (0x6081). |

## 0x6080 Motor speed

The maximum motor speed object description is shown in the table below:

Table 186 Maximum motor speed 0x6080

| Object type | type of data | Attributes | PDO mapping | Defaults |
|---|---|---|---|---|
| variable | UNSIGNED32 | Only Read | YES | 0x00003840 |
| The maximum motor speed limits the speed of the motor in any direction, and its unit is rpm. This parameter is used to protect the motor and can be set according to the motor data sheet. | | | | |

## 0x6081 Contour speed

The outline speed object description is shown in the table below:

Table 187 contour speed 0x6081

| Object type | type of data | Attributes | PDO mapping | Defaults |
|---|---|---|---|---|
| variable | UNSIGNED32 | Read andwrite | YES | 0 |
| The profile speed is the running speed in PP and PV modes. The maximum value of this speed depends on the minimum speed of 0x607F and 0x6080. When the given speed is greater than the maximum value, an alarm will be triggered and the operation will stop. The unit is command/s. | | | | |

## 0x6082 Takeoff speed

The description of takeoff speed objects is shown in the table below:

Table 188 take-off speed 0x6082

| Object type | type of data | Attributes | PDO mapping | Defaults |
|---|---|---|---|---|
| variable | UNSIGNED32 | Read &write | YES | 0 |

| |
|---|
| The take-off speed is the speed at which the motor starts directly and will run to the target speed in this speed mode. The unit is command/s. |

## 0x6083 Contour acceleration

The outline acceleration objects are described in the following table:

Table 189 contour acceleration 0x6083

| Object type | type of data | Attributes | PDO mapping | Defaults |
|---|---|---|---|---|
| variable | UNSIGNED32 | Read &write | YES | 0 |
| The contour acceleration is the speed acceleration in PP and PV modes. The maximum value of this acceleration depends on the maximum acceleration (0x60C5). When the input acceleration is greater than the maximum acceleration, the input acceleration is limited to the maximum acceleration and a warning is issued. Unit/s2. | | | | |

## 0x6084 Contour deceleration

The deceleration objects are described in the following table:

Table 190 Deceleration 0x6084

| Object type | type of data | Attributes | PDO mapping | Defaults |
|---|---|---|---|---|
| variable | UNSIGNED32 | Read &write | YES | 0 |
| The contour deceleration is the deceleration in PP and PV modes. The maximum value of this deceleration depends on the maximum deceleration 0x60C6. When the input deceleration is greater than the maximum deceleration, the input deceleration is limited to the maximum deceleration and a warning , The unit is the command unit/s2. | | | | |

## 0x6085 Quick stop deceleration

The quick stop deceleration objects are described in the following table:

Table 191 Quick stop deceleration 0x6085

| Object type | type of data | Attributes | PDO mapping | Defaults |
|---|---|---|---|---|
| variable | UNSIGNED32 | Read &write | YES | 0 |
| The quick stop deceleration is the deceleration of the motor when a quick stop is required during the execution of an emergency stop, and its unit is user command/s2. | | | | |

## 0x6086 Movement track type

The description of the motion track type objects is shown in the following table:

Table 192 Motion track type 0x6086

| Object type | type of data | Attributes | PDO mapping | Defaults |
|---|---|---|---|---|
| variable | UNSIGNED16 | Read &write | YES | 0 |

The motion track type is used to select the motion track type when the motor performs the action.

| value | description |
|---|---|
| -32768…-1 | Manufacturer parameters |
| 0 | Linear ramp (trapezoidal trajectory) |
| 1 | $\sin^2$ slope |
| 2 | Smooth slope |
| 3 | Jerk ramp |
| 4…32767 | Keep |

## 0x6087 Torque slope

The description of the torque slope register is shown in the table below:

Table 193 Torque slope 0x6087

| Register | Type of data | access permission | Defaults |
|---|---|---|---|
| 6087 | UNSIGNED16 | RW | 0 |
| The unit of this value is ‰, the parameter describes the rate of change of torque, and the unit is one thousandth of the rated torque per second | | | |

## 0x6088 Torque change type

The torque change rate object description is shown in the following table:

Table 194 Torque change type 0x6088

| Object type | type of data | Attributes | PDO mapping | Defaults |
|---|---|---|---|---|
| variable | UNSIGNED16 | Read &write | YES | 0 |

The torque change type is used to select the type of torque change when the torque change action is performed.

| value | description |
|---|---|
| 0x0000 | Linear ramp (trapezoidal trajectory) |
| 0x0001 | $\sin^2$ slope |
| 0x0002…0x7FFF | Keep |
| 0x8000…0xFFFF | factory |

## 0x608F Encoder resolution

The position encoder resolution object description is shown in the table below:

Table 195 Encoder resolution 0x608F

| Object type | Type of data | Attributes | PDO mapping | Defaults |
|---|---|---|---|---|
| ARRAY | UNSIGNED32 | Only read | NO | 2 |

Position encoder resolution is defined as the ratio of encoder resolution to motor resolution.

| Subindex | Name | Type of data | Attributes | PDO mapping | Defaults |
|---|---|---|---|---|---|
| 00 | Maximum number of sub-indexes | UNSIGNED8 | Read only | NO | 2 |
| 01 | Encoder resolution | UNSIGNED32 | Read and write | NO | 0x00000FA0 |
| 02 | Motor resolution | UNSIGNED32 | Read and write | NO | 0x00000001 |

## 0x6091 Gear ratio

The gear ratio objects are described in the table below:

Table 196 Gear ratio 0x6091

| Object type | type of data | Attributes | PDO mapping | Defaults |
|---|---|---|---|---|
| ARRAY | UNSIGNED32 | Only read | NO | 2 |

Gear ratio is defined as the ratio of motor resolution to drive subdivision in unit position.

| Sub-index | Name | Type of data | Attributes | PDO mapping | Defaults |
|---|---|---|---|---|---|
| 00 | Maximum number of sub-indexes | UNSIGNED8 | Read only | NO | 2 |
| 01 | Motor resolution | UNSIGNED32 | Read and write | NO | 0x00000001 |
| 02 | Drive segmentation | UNSIGNED32 | Read and write | NO | 0x00000001 |

## 0x6092 Feedback constant

The description of the feedback constant object is shown in the following table:

Table 197 Feedback constant 0x6092

| Object type | type of data | Attributes | PDO mapping | Defaults |
|---|---|---|---|---|
| ARRAY | UNSIGNED32 | Only read | NO | 2 |

The feedback constant is the ratio of the feedback amount and drive subdivision within the unit position.

| Subindex | Name | type of data | Attributes | PDO mapping | Defaults |
|---|---|---|---|---|---|
| 00 | Maximum number of sub-indexes | UNSIGNED8 | Read only | NO | 2 |
| 01 | Amount of feedback | UNSIGNED32 | Read and write | NO | 0x00000FA0 |
| 02 | Drive segmentation | UNSIGNED32 | Read and write | NO | 0x00000001 |

## 0x6098 Return to zero

The object description of the zero return mode is shown in the following table:

Table 198 Return to zero mode 0x6098

| Object type | type of data | Attributes | PDO mapping | Defaults |
|---|---|---|---|---|
| variable | INTEGER8 | Read and Write | YES | 0 |

The zero return method is that the user selects the corresponding zero return method to perform the zero return according to his own needs.

| value | description |
|---|---|
| -128…-1 | factory |
| 0 | Do NOt return to zero |
| 1…35 | Ways 1 to 35 (see below) |
| 36…127 | Keep |

## 0x6099 Return speed

The description of the zero return speed object is shown in the following table:

Table 199 home speed 0x6099

| Object type | Subindex | type of data | Attributes | PDO mapping | Defaults |
|---|---|---|---|---|---|
| Array | 3 | UNSIGNED32 | Read and write | YES | 0 |

Mechanical origin speed, find the speed of the mechanical origin (limit switch), that is, find the position of the deceleration point. The speed unit is the command unit/s. The zero offset speed is used to find the zero offset speed, and its unit is the command unit/s.

| Subindex | Name | Defaults |
|---|---|---|
| 0 | Maximum number of indexes | 2 |
| 1 | Back to machine origin speed | 0 |
| 2 | Return to zero speed | 0 |

## Return to zero acceleration/deceleration

The description of the object of returning to zero acceleration and deceleration is shown in the following table:

Table 200 Return to zero acceleration and deceleration 0x609A

| Object type | type of data | Attributes | PDO mapping | Defaults |
|---|---|---|---|---|
| variable | UNSIGNED16 | Read & write | YES | 0 |
| The zero return acceleration is the acceleration and deceleration of the slave station motor during zero return, that is, the acceleration and deceleration when it hits the limit. | | | | |

## 0x60B0 Position feedforward

The position feedforward objects are described in the following table:

Table 201 Position feedforward 0x60B0

| Object type | type of data | Attributes | PDO mapping | 默认值 Defaults |
|---|---|---|---|---|
| variable | INTEGER32 | Read and Write | YES | 0 |
| Position feed-forward. | | | | |

## 0x60B1 Speed feed-forward

The speed feed-forward objects are described in the following table:

表 34 速度前馈 0x60B1 Table 202 Speed feedforward 0x60B1

| Object type | type of data | Attributes | PDO mapping | Defaults |
|---|---|---|---|---|
| 变量 variable | INTEGER32 | 读写 Read and Write | YES | 0 |
| 速度前馈。Speed feed forward. | | | | |

## 0x60B2 Torque feed-forward

The torque feed-forward objects are described in the following table:

Table 203 Torque feedforward 0x60B2

| Object type | type of data | Attributes | PDO mapping | Defaults |
|---|---|---|---|---|
| variable | INTEGER32 | Read and Write | YES | 0 |

| Torque feedforward. |
|---|

## 0x60B8 Probe function

The probe function object description is shown in the table below:

Table 204 Probe function 0x60B8

| Object type | type of data | Attributes | PDO mapping | Defaults |
|---|---|---|---|---|
| variable | INTEGER16 | Read & Write | YES | 0 |

Set probe function

| 位 bit | 值 value | definition |
|---|---|---|
| 0 | 0 | Close probe 1 |
| | 1 | Enable Probe 1 |
| 1 | 0 | Trigger the first event |
| | 1 | Continuous trigger |
| 3, 2 | 00 | Probe 1 input trigger |
| | 01 | Z phase trigger of position encoder |
| | 10 | The probe source is defined by 60D0h-01 (NOt used) |
| | 11 | Keep |
| 4 | 0 | Probe 1 does NOt latch on the rising edge |
| | 1 | Probe 1 rising edge latch |
| 5 | 0 | Probe 1 falling edge is NOt latched |
| | 1 | Probe 1 falling edge latch |
| 6, 7 | - | factory |
| 8 | 0 | Close probe 2 |
| | 1 | Enable Probe 2 |
| 9 | 0 | Trigger the first event |
| | 1 | Continuous trigger |
| 11, 10 | 00 | Probe 1 input trigger |
| | 01 | Z phase trigger of position encoder |
| | 10 | Probe source is defined by 60D0h-02 (NOt used) |
| | 11 | Keep |
| 12 | 0 | Probe 2 does NOt latch on the rising edge |
| | 1 | Probe 2 rising edge latch |
| 13 | 0 | Probe 2 falling edge is NOt latched |
| | 1 | Probe 2 falling edge latch |

| | | | | |
|---|---|---|---|---|
| | 14, 15 | _ | factory | |

## 0x60B9 Probe status

The probe status object description is shown in the table below:

Table 205 Probe status 0x60B9

| Object type | type of data | Attributes | PDO mapping | Defaults |
|---|---|---|---|---|
| variable | INTEGER16 | 读写 Read and Write | YES | 0 |

Probe status.

| 位 bit | 值 value | 定义 definition |
|---|---|---|
| 0 | 0 | Probe 1 is off |
| | 1 | Probe 1 is enabled |
| 1 | 0 | Probe 1 has NO rising edge |
| | 1 | Probe 1 has a rising edge |
| 2 | 0 | Probe 1 has NO falling edge |
| | 1 | Probe 1 has a falling edge |
| 3-5 | 0 | Keep |
| 6, 7 | - | factory |
| 8 | 0 | Probe 2 is off |
| | 1 | Probe 2 is enabled |
| 9 | 0 | Probe 2 has NO rising edge |
| | 1 | Probe 2 has a rising edge |
| 10 | 0 | Probe 2 has NO falling edge |
| | 1 | Probe 2 has a falling edge |
| 11-13 | 0 | Keep |
| 14, 15 | _ | factory |

## 0x60BA Probe 1 rising edge value

The probe 1 rising edge value object is described in the following table:

Table 206 Probe 1 Rising Edge Value 0x60BA

| Object type | type of data | Attributes | PDO mapping | Defaults |
|---|---|---|---|---|

| | | | | |
|---|---|---|---|---|
| variable | INTEGER32 | Read & Write | YES | 0 |
| Probe 1 rising edge value. | | | | |

## 0x60BB Probe 1 falling edge value

The probe 1 falling edge value objects are described in the following table:

Table 207 Probe 1 falling edge value 0x60BB

| Object type | type of data | Attributes | PDO mapping | 默认值 Defaults |
|---|---|---|---|---|
| variable | INTEGER32 | Read and Write | YES | 0 |
| Probe 1 falling edge value. | | | | |

## 0x60BC Probe 2 rising edge value

The probe 2 rising edge value object is described in the following table:

Table 208 Probe 2 Rising Edge Value 0x60BC

| Object type | type of data | Attributes | PDO mapping | Defaults |
|---|---|---|---|---|
| variable | INTEGER32 | Read &Write | YES | 0 |
| Probe 2 rising edge value. | | | | |

## 0x60BD Probe 2 falling edge value

The probe 2 rising edge value object is described in the following table:

Table 209 Probe 2 falling edge value 0x60BD

| Object type | type of data | Attributes | PDO mapping | Defaults |
|---|---|---|---|---|
| variable | INTEGER32 | Read & Write | YES | 0 |
| Probe 2 falling edge value. | | | | |

# 0x60C2 Interpolation time period

The interpolation time period is described in the following table:

Table 210 Interpolation time period 0x60C2

| Object type | type of data | Attributes | PDO mapping | Defaults |
|---|---|---|---|---|
| ARRAY | UNSIGNED8 | Only read | NO | 2 |

The interpolation time period is used for the time-synchronized interpolation position pattern. The unit is 10 to the power of 0080h-02.

| Sub-index | name | type of data | Attributes | PDO mapping | Defaults |
|---|---|---|---|---|---|
| 00 | Maximum number of sub-indexes | UNSIGNED8 | Read only | NO | 2 |
| 01 | Base of interpolation cycle | UNSIGNED8 | Read and write | NO | 0x01 |
| 02 | Interpolation Period Index | INTEGER16 | Read and write | NO | 0xFD |

# 0x60C5 Acceleration

The maximum acceleration object is described in the following table:

Table 211 Maximum acceleration 0x60C5

| Object type | type of data | Attributes | PDO mapping | Defaults |
|---|---|---|---|---|
| variable | UNSIGNED32 | Read and write | YES | 0x000186A0 |

The maximum acceleration is the maximum value of the acceleration in the PP mode, and its unit is the command unit/s2.

# 0x60C6 Maximum deceleration

The maximum deceleration object is described in the following table:

Table 212 Maximum deceleration 0x60C6

| Object type | type of data | Attributes | PDO mapping | Defaults |
|---|---|---|---|---|
| variable | UNSIGNED32 | Read and write | YES | 0x000186A0 |

| |
|---|
| The maximum deceleration is the maximum value of the deceleration in PP mode, and its unit is the command unit/s2. |

## 0x60F4 Actual error value

The actual error value object description is shown in the following table:

Table 213 Actual error value 0x60F4

| Object type | type of data | Attributes | PDO PDO mapping | Defaults |
|---|---|---|---|---|
| variable | UNSIGNED32 | Read and write | YES | 0 |
| The actual value of the following error. | | | | |

## 0x60FC Internal position reference

The description of the internal position given value object is shown in the following table:

Table 214 Internal position given value 0x60FC

| Object type | type of data | Attributes | PDO mapping | Defaults |
|---|---|---|---|---|
| variable | UNSIGNED32 | Only read | YES | 0 |
| The given value of the internal position. | | | | |

## 0x60FD Digital input

The digital input objects are described in the following table:

Table 215 Digital input 0x60FD

| Object type | type of data | Attributes | PDO mapping | Defaults |
|---|---|---|---|---|
| variable | UNSIGNED32 | Only read | YES | 0 |

。The index defines the digital input of the device

| 31 16 | 15 11 | 10 | 9 | 8 3 | 2 | 1 | 0 |
|---|---|---|---|---|---|---|---|
| factory | keep | Probe 2 | Probe 1 | keep | Origin switch | Positive limit switch | Negative limit switch |
| MSB | | | | | | | LSB |

# 0x60FE Digital output

The digital output description is shown in the table below:

Table 216 Digital output 0x60FE

| Object type | type of data | Attributes | PDO mapping | Defaults |
|---|---|---|---|---|
| ARRAY | UNSIGNED8 | Only read | NO | 2 |

The index defines the digital output of the device.

| Sub-index | Name | Type of data | Attributes | PDO PDO mapping | Defaults |
|---|---|---|---|---|---|
| 00 | Maximum number of sub-indexes | UNSIGNED8 | Read only | NO | 2 |
| 01 | Output given | UNSIGNED32 | Read and write | YES | 0x00000000 |
| 02 | Output shield | UNSIGNED32 | Read and write | YES | 0x00000000 |

Sub-index [01] defines the output distribution:

| 31 ... 16 | 15 ... 1 | 0 |
|---|---|---|
| factory | keep | Setting the brake |
| MSB | | LSB |

Sub-index [02] Select whether to use digital output:

0 - NO output enable;

1 - Output enable;

# 0x60FF Target speed

The target speed object description is shown in the table below:

Table 217 target speed 0x60FF

| Object type | type of data | Attributes | PDO mapping | 默认值 Defaults |
|---|---|---|---|---|
| variable | UNSIGNED32 | Only read | YES | 0x00000000 |
| The target speed is a given speed command, and its maximum value should NOt be greater than the maximum speed value of the motor. When the given value is greater than the maximum speed value of the motor, an alarm will be triggered and stop. | | | | |

## 0x6502 Support mode

Support mode object description is shown in the following table:

Table 218 Support Mode 0x6502

| Object type | type of data | Attributes | PDO mapping | Defaults |
|---|---|---|---|---|
| variable | UNSIGNED32 | Only read | YES | 0x000003AD |

This object summarizes the operation modes supported by the device.

| 31 ... 16 | 15 ... 7 | 6 | 5 | 4 | 3 | 2 | 1 | 0 |
|---|---|---|---|---|---|---|---|---|
| Factory | keep | IP | HM | Keep | TQ | PV | VL | PP |

MSB LSB

## ➢ EtherCAT Object dictionary description

The following is the description of the object dictionary of the XML file of the EtherCAT device:

Table 219 EtherCAT object dictionary description

| index | Subindex | Object name | Object type | R/W | type of data | PDO | Defaults |
|---|---|---|---|---|---|---|---|
| 1000h | 00h | Equipment type | VAR | RO | U16 | N | 0x00060192 |
| 1001h | 00h | Error register | VAR | RO | U8 | N | 0x00 |
| 1008h | 00h | Device name | VAR | RO | STRING | N | XXXX |
| 1009h | 00h | hardware version | VAR | RO | STRING | N | XXXX |
| 100Ah | 00h | Software version | VAR | RO | STRING | N | XXXX |
| 1018h | 00h | Equipment Identity | RECAORD | RO | U8 | N | 4 |
| | 01h | Manufacturer ID | | RO | U32 | N | 0x66668888 |
| | 02h | Product Code | | RO | U32 | N | XXXX |
| | 03h | version number | | RO | U32 | N | XXXX |
| | 04h | serial number | | RO | U32 | N | XXXX |
| 10F1h | 00h | Wrong setting | RECORD | RO | U8 | N | 2 |
| | 01h | Error response | | RW | U32 | N | 0x01 |
| | 02h | Synchronization error limit | | RW | U16 | N | 4 |
| 1600h | 00h | RPDO0 | RECORD | RW | U8 | N | 0Bh |
| | 01h | Control word | | RW | U32 | N | 0x60400010 |
| | 02h | Operating mode | | RW | U32 | N | 0x60600008 |
| | 03h | target location | | RW | U32 | N | 0x607A0020 |
| | 04h | Probe function | | RW | U32 | N | 0x60B80010 |
| | 05h | Output given | | RW | U32 | N | 0x60FE0120 |
| | 06h | Output shield | | RW | U32 | N | 0x60FE0220 |
| | 07h | | | RW | U32 | N | 0xFFFFFFFF |
| | 08h | | | RW | U32 | N | 0xFFFFFFFF |
| | 09h | | | RW | U32 | N | 0xFFFFFFFF |
| | 0Ah | | | RW | U32 | N | 0xFFFFFFFF |
| | 0Bh | | | RW | U32 | N | 0xFFFFFFFF |
| | 0Ch | | | RW | U32 | N | 0xFFFFFFFF |
| 1601h | 00h | RPDO1 | RECORD | RW | U8 | N | 0Bh |
| | 01h | Control word | | RW | U32 | N | 0x60400010 |
| | 02h | Operating mode | | RW | U32 | N | 0x60600008 |
| | 03h | Target speed | | RW | U32 | N | 0x60FF0020 |
| | 04h | Probe function | | RW | U32 | N | 0x60B80010 |
| | 05h | Output given | | RW | U32 | N | 0x60FE0120 |
| | 06h | Output shield | | RW | U32 | N | 0x60FE0220 |
| | 07h | | | RW | U32 | N | 0xFFFFFFFF |
| | 08h | | | RW | U32 | N | 0xFFFFFFFF |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| | 09h | | | RW | U32 | N | 0xFFFFFFFF |
| | 0Ah | | | RW | U32 | N | 0xFFFFFFFF |
| | 0Bh | | | RW | U32 | N | 0xFFFFFFFF |
| | 0Ch | | | RW | U32 | N | 0xFFFFFFFF |
| 1602h | 00h | RPD02 | RECORD | RW | U8 | N | 0Bh |
| | 01h | Pause code | | RW | U32 | N | 0x605D0010 |
| | 02h | Target torque | | RW | U32 | N | 0x60710010 |
| | 03h | Contour speed | | RW | U32 | N | 0x60810020 |
| | 04h | Contour acceleration | | RW | U32 | N | 0x60830020 |
| | 05h | Contour deceleration | | RW | U32 | N | 0x60840020 |
| | 06h | Output given | | RW | U32 | N | 0x60FE0120 |
| | 07h | Output shield | | RW | U32 | N | 0x60FE0220 |
| | 08h | | | RW | U32 | N | 0xFFFFFFFF |
| | 09h | | | RW | U32 | N | 0xFFFFFFFF |
| | 0Ah | | | RW | U32 | N | 0xFFFFFFFF |
| | 0Bh | | | RW | U32 | N | 0xFFFFFFFF |
| | 0Ch | | | RW | U32 | N | 0xFFFFFFFF |
| 1603h | 00h | RPD03 | RECORD | RW | U8 | N | 0Bh |
| | 01h | Homing offset | | RW | U32 | N | 0x607C0020 |
| | 02h | Return to zero | | RW | U32 | N | 0x60980008 |
| | 03h | Back to machine origin speed | | RW | U32 | N | 0x60990120 |
| | 04h | Return to zero speed | | RW | U32 | N | 0x60990220 |
| | 05h | Return to zero acceleration | | RW | U32 | N | 0x609A0020 |
| | 06h | | | RW | U32 | N | 0xFFFFFFFF |
| | 07h | | | RW | U32 | N | 0xFFFFFFFF |
| | 08h | | | RW | U32 | N | 0xFFFFFFFF |
| | 09h | | | RW | U32 | N | 0xFFFFFFFF |
| | 0Ah | | | RW | U32 | N | 0xFFFFFFFF |
| | 0Bh | | | RW | U32 | N | 0xFFFFFFFF |
| 1A00h | 00h | TPD00 | RECORD | RW | U8 | N | 0Bh |
| | 01h | Status word | | RW | U32 | N | 0x60410010 |
| | 02h | Mode code response | | RW | U32 | N | 0x60610008 |
| | 03h | Actual location | | RW | U32 | N | 0x60640020 |
| | 04h | Probe status | | RW | U32 | N | 0x60B90010 |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| | 05h | Probe 1 rising edge value | | RW | U32 | N | 0x60BA0020 |
| | 06h | Probe 1 falling edge value | | RW | U32 | N | 0x60BB0020 |
| | 07h | Probe 2 rising edge value | | RW | U32 | N | 0x60BC0020 |
| | 08h | Probe 2 falling edge value | | RW | U32 | N | 0x60BD0020 |
| | 09h | Digital input | | RW | U32 | N | 0x60FD0010 |
| | 0Ah | | | RW | U32 | N | 0xFFFFFFFF |
| | 0Bh | | | RW | U32 | N | 0xFFFFFFFF |
| 1A01h | 00h | TPD01 | RECORD | RW | U8 | N | 0Bh |
| | 01h | Mode code response | | RW | U32 | N | 0x60610008 |
| | 02h | Actual speed | | RW | U32 | N | 0x606C0020 |
| | 03h | Actual error value | | RW | U32 | N | 0x60F40020 |
| | 04h | | | RW | U32 | N | 0xFFFFFFFF |
| | 05h | | | RW | U32 | N | 0xFFFFFFFF |
| | 06h | | | RW | U32 | N | 0xFFFFFFFF |
| | 07h | | | RW | U32 | N | 0xFFFFFFFF |
| | 08h | | | RW | U32 | N | 0xFFFFFFFF |
| | 09h | | | RW | U32 | N | 0xFFFFFFFF |
| | 0Ah | | | RW | U32 | N | 0xFFFFFFFF |
| | 0Bh | | | RW | U32 | N | 0xFFFFFFFF |
| 1A02h | 00h | TPD02 | RECORD | RW | U8 | N | 0Bh |
| | 01h | error code | | RW | U32 | N | 0x603F0010 |
| | 02h | Actual torque | | RW | U32 | N | 0x60770020 |
| | 03h | | | RW | U32 | N | 0xFFFFFFFF |
| | 04h | | | RW | U32 | N | 0xFFFFFFFF |
| | 05h | | | RW | U32 | N | 0xFFFFFFFF |
| | 06h | | | RW | U32 | N | 0xFFFFFFFF |
| | 07h | | | RW | U32 | N | 0xFFFFFFFF |
| | 08h | | | RW | U32 | N | 0xFFFFFFFF |
| | 09h | | | RW | U32 | N | 0xFFFFFFFF |
| | 0Ah | | | RW | U32 | N | 0xFFFFFFFF |
| | 0Bh | | | RW | U32 | N | 0xFFFFFFFF |
| 1A03h | 00h | TPD03 | RECORD | RW | U8 | N | 0Bh |
| | 01h | | | RW | U32 | N | 0xFFFFFFFF |
| | 02h | | | RW | U32 | N | 0xFFFFFFFF |
| | 03h | | | RW | U32 | N | 0xFFFFFFFF |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| | 04h | | | RW | U32 | N | 0xFFFFFFFF |
| | 05h | | | RW | U32 | N | 0xFFFFFFFF |
| | 06h | | | RW | U32 | N | 0xFFFFFFFF |
| | 07h | | | RW | U32 | N | 0xFFFFFFFF |
| | 08h | | | RW | U32 | N | 0xFFFFFFFF |
| | 09h | | | RW | U32 | N | 0xFFFFFFFF |
| | 0Ah | | | RW | U32 | N | 0xFFFFFFFF |
| | 0Bh | | | RW | U32 | N | 0xFFFFFFFF |
| 1C00h | 00h | SynchroNOus management channel | RECORD | RO | U8 | N | 4 |
| | 01h | SM0 communication type | | RO | U8 | N | 1 |
| | 02h | SM1 communication type | | RO | U8 | N | 2 |
| | 03h | SM2 communication type | | RO | U8 | N | 3 |
| | 04h | SM3 communication type | | RO | U8 | N | 4 |
| 1C12h | 00h | SM2 distribution | RECORD | RW | U8 | N | 1 |
| | 01h | SM2 allocation 1 | | RW | U16 | N | 1600h |
| | 02h | SM2 allocation 2 | | RW | U16 | N | 1601h |
| | 03h | SM2 allocation 3 | | RW | U16 | N | 1602h |
| | 04h | SM2 distribution 4 | | RW | U16 | N | 1603h |
| 1C13h | 00h | SM3 distribution | RECORD | RW | U8 | N | 1 |
| | 01h | SM3 allocation 1 | | RW | U16 | N | 1A00h |
| | 02h | SM3 allocation 2 | | RW | U16 | N | 1A01h |
| | 03h | SM3 allocation 3 | | RW | U16 | N | 1A02h |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| | 04h | SM3 allocation 4 | | RW | U16 | N | 1A03h |
| 1C32h | 00h | SM2 parameters | RECORD | RO | U8 | N | 3 |
| | 01h | Synchronization type | | | U16 | N | 0 |
| | 02h | period time | | RO | U32 | N | 0 |
| | 03h | Offset time | | RO | U32 | N | 0 |
| 1C33h | 00h | SM3 parameters | RECORD | RO | U8 | N | 3 |
| | 01h | Synchronization type | | | U16 | N | 0 |
| | 02h | period time | | RO | U32 | N | 0 |
| | 03h | Offset time | | RO | U32 | N | 0 |
| 6007h | 00h | Interrupt operation | VAR | RW | U16 | Y | 0x0001 |
| 603Fh | 00h | error code | VAR | RO | U16 | Y | 0x0000 |
| 6040h | 00h | Control word | VAR | RW | U16 | Y | 0x0000 |
| 6041h | 00h | Status word | VAR | RO | U16 | Y | 0x0040 |
| 605Ah | 00h | Quick stop code | VAR | RW | I16 | Y | 0x0002 |
| 605Bh | 00h | Stop code | VAR | RW | I16 | Y | 0x0000 |
| 605Ch | 00h | Enable code | VAR | RW | I16 | Y | 0x0001 |
| 605Dh | 00h | Pause code | VAR | RW | I16 | Y | 0x0001 |
| 605Eh | 00h | error code | VAR | RW | I16 | Y | 0x0002 |
| 6060h | 00h | Operating mode | VAR | RW | I8 | Y | 0x00 |
| 6061h | 00h | Current operating mode | VAR | RO | I8 | Y | 0x00 |
| 6063h | 00h | Internal location | VAR | RO | I32 | Y | 0x00000000 |
| 6064h | 00h | Actual location | VAR | RO | I32 | Y | 0x00000000 |
| 6065h | 00h | Following error | VAR | RW | U32 | Y | 0x00000FA0 |
| 6066h | 00h | Error time | VAR | RW | U16 | Y | 0x0001 |
| 6069h | 00h | Speed sensor value | VAR | RW | I32 | Y | 0x00000000 |
| 606Ah | 00h | Sensor selection | VAR | RW | I16 | Y | 0x0000 |
| 606Ch | 00h | Actual speed | VAR | RO | I32 | Y | 0x00000000 |
| 6071h | 00h | Target torque | VAR | RW | I16 | Y | 0x0000 |
| 6072h | 00h | Torque | VAR | RW | U16 | Y | 0x05DC |
| 6073h | 00h | Maximum current | VAR | RW | U16 | Y | 0x04B0 |
| 6074h | 00h | Torque demand | VAR | RO | U16 | Y | 0x0000 |
| 6075h | 00h | Motor rated current | VAR | RW | U32 | Y | 0x00001770 |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| 6076h | 00h | Motor rated torque | VAR | RW | U32 | Y | 0x00001154 |
| 6077h | 00h | Actual torque | VAR | RO | I16 | Y | 0x0000 |
| 6078h | 00h | Actual current | VAR | RO | I16 | Y | 0x0000 |
| 607Ah | 00h | target location | VAR | RW | I32 | Y | 0x00000000 |
| 607Bh | 00h | Position change limitation | ARRAY | RO | U8 | N | 2 |
| | 01h | Minimum position change | | RW | I32 | Y | 0XFFFFFF9C |
| | 02h | Maximum position change | | RW | I32 | Y | 0x00000064 |
| 607Ch | 00h | Zero offset | VAR | RW | I32 | Y | 0x00000000 |
| 607Dh | 00h | Soft position | ARRAY | RO | U8 | N | 2 |
| | 01h | Minimum position | | RW | I32 | Y | 0X80000000 |
| | 02h | Maximum position | | RW | I32 | Y | 0x7FFFFFFF |
| 607Eh | 00h | Polarity selection | VAR | RW | U8 | Y | 0x00 |
| 607Fh | 00h | Maximum contour speed | VAR | RW | U32 | Y | 0x00003840 |
| 6080h | 00h | Motor speed | VAR | RW | U32 | Y | 0x00003840 |
| 6081h | 00h | Contour speed | VAR | RW | U32 | Y | 0x00000960 |
| 6082h | 00h | Takeoff speed | VAR | RW | U32 | Y | 0x00000000 |
| 6083h | 00h | Contour acceleration | VAR | RW | U32 | Y | 0x00000000 |
| 6084h | 00h | Contour deceleration | VAR | RW | U32 | Y | 0x00000000 |
| 6085h | 00h | Quick stop deceleration | VAR | RW | U32 | Y | 0x00000000 |
| 6086h | 00h | Movement track type | VAR | RW | I16 | Y | 0x0000 |
| 6087h | 00h | Torque change rate | VAR | RW | U32 | Y | 0x00000000 |
| 6088h | 00h | Torque change type | VAR | RW | I16 | Y | 0x0000 |
| 608Fh | 00h | Encoder resolution | ARRAY | RO | U8 | N | 2 |
| | 01h | Encoder resolution | | | U32 | N | 0X00000FA0 |
| | 02h | Motor resolution | | | U32 | N | 0x00000001 |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| 6091h | 00h | Gear ratio | ARRAY | RO | U8 | N | 2 |
| | 01h | Motor resolution | | | U32 | N | 0X00000001 |
| | 02h | Drive segmentation | | | U32 | N | 0x00000001 |
| 6092h | 00h | Feedback constant | ARRAY | RO | U8 | N | 2 |
| | 01h | Amount of feedback | | | U32 | N | 0X00000FA0 |
| | 02h | Drive segmentation | | | U32 | N | 0x00000001 |
| 6098h | 00h | Return to zero | VAR | RW | I8 | Y | 0x00 |
| 6099h | 00h | Return speed | ARRAR | RO | U8 | N | 2 |
| | 01h | Mechanical origin speed | | RW | U32 | Y | 0x00000000 |
| | 02h | Zero offset speed | | RW | U32 | Y | 0x00000050 |
| 609Ah | 00h | Return to zero acceleration | VAR | RW | U32 | Y | 0x00000000 |
| 60B0h | 00h | Position feedforward | VAR | RW | I32 | Y | 0x00000000 |
| 60B1h | 00h | Speed feedforward | VAR | RW | I32 | Y | 0x00000000 |
| 60B2h | 00h | Torque feedforward | VAR | RW | I32 | Y | 0x00000000 |
| 60B8h | 00h | Probe function | VAR | RW | U16 | Y | 0x0000 |
| 60B9h | 00h | Probe status | VAR | RO | U16 | Y | 0x0000 |
| 60BAh | 00h | Probe 1 rising edge value | VAR | RW | I32 | Y | 0x00000000 |
| 60BBh | 00h | Probe 1 falling edge value | VAR | RW | I32 | Y | 0x00000000 |
| 60BCh | 00h | Probe 2 rising edge value | VAR | RW | I32 | Y | 0x00000000 |
| 60BDh | 00h | Probe 1 falling edge value | VAR | RW | I32 | Y | 0x00000000 |
| 60C2h | 00h | Interpolation time period | ARRAR | RO | U8 | N | 2 |
| | 01h | Base of interpolation cycle | | RW | U8 | Y | 0x01 |
| | 02h | Interpolation Period Index | | RW | I8 | Y | 0xFD |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| 60C5h | 00h | Acceleration | VAR | RW | U32 | Y | 0x000186A0 |
| 60C6h | 00h | Maximum deceleration | VAR | RW | U32 | Y | 0x000186A0 |
| 60F4h | 00h | Actual error value | VAR | RO | I32 | Y | 0x00000000 |
| 60FCh | 00h | Internal position reference | VAR | RO | I32 | Y | 0x00000000 |
| 60FDh | 00h | Digital input | VAR | RO | U32 | Y | 0x00000000 |
| 60FEh | 00h | Digital output | ARRAR | RO | U8 | N | 2 |
| | 01h | Output given | | RW | U32 | Y | 0x00000000 |
| | 02h | Output shield | | RW | U32 | Y | 0x00000000 |
| 60FFh | 00h | Target speed | VAR | RW | I32 | Y | 0x00000000 |
| 6502h | 00h | Support mode | VAR | RO | U32 | Y | 0x000003AD |

The above list only lists the object dictionaries used by this series of EtherCAT devices. Users who want to learn more about the object dictionaries can read the ETG documents. Users can download them from the following address: www.ethercat.org.

# Control articles

## *Motion control under EtherCAT communication protocol*

The CIA402 protocol standard provides a standard motion control standard for servo drives. Jiemeikang EtherCAT slave supports cycle synchronized position mode (CSP), cycle synchronized speed mode (CSV), cycle synchronized torque mode (CST), contour position Mode (PP), contour speed mode (PV), contour torque mode (PT) and homing mode (HM).

The above several trajectory modes are supported differently in different types of drives. The master station selects by operating the control mode object dictionary 6060h.

### Periodic synchroNOus position mode

In the periodic synchroNOus position mode, the master station master completes the position command trajectory planning, and then sends the planned target position 607Ah to the slave driver in a periodic manner. Its position, speed, and torque are completed by the driver.

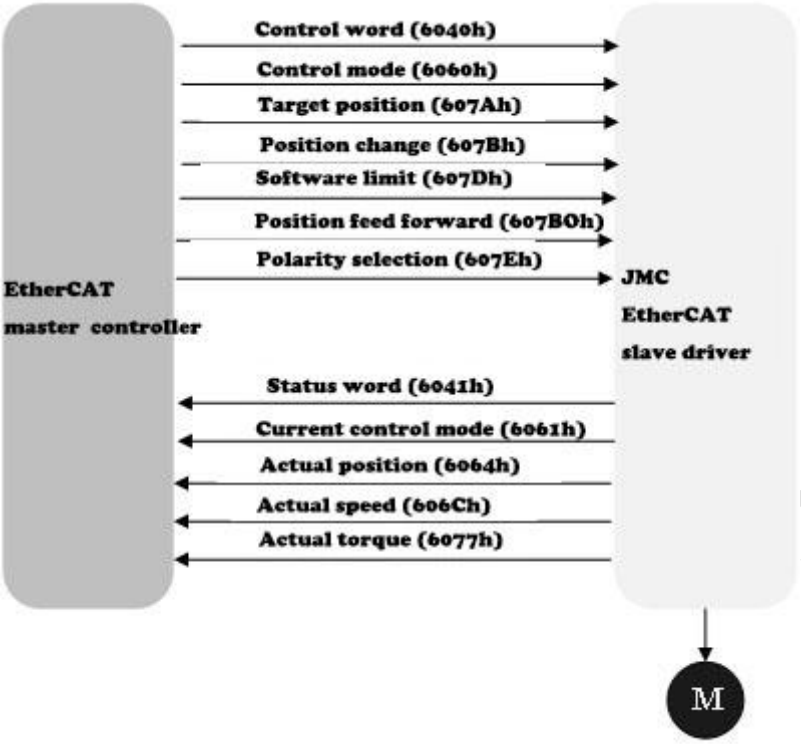



Figure 157 Cycle synchronization position mode control diagram

The motor running speed 606Ch is determined by the given target position 607Ah and the actual position 6064h, and is also related to the electronic gear ratio.

# 1 Related Object Dictionary Introduction

Table 220 Control word 6040h

| index | subindex | Object name | Object name | R/W | type of data | PDO | Defaults |
|---|---|---|---|---|---|---|---|
| 6040h | 00h | Control word | VAR | RW | U16 | Y | 0x0000 |

Table 221 Control word 6040h bit definition in CSP mode

| bit | Bit definition | description |
|---|---|---|
| 0 | start up | 0: invalid 1: valid |
| 1 | Voltage given | 0: invalid 1: valid |
| 2 | Quick stop | 0: valid 1: invalid |
| 3 | Motor power-on enable | 0: invalid 1: valid |
| 7 | Fault reset clear | 0: invalid 1: valid |

| | | |
|---|---|---|
| 8 | time out | 0: invalid 1: valid, pause according to 605Dh setting |

Table 222 status word 6041h

| index | Subindex | Object name | Object name | R/W | type of data | PDO | Defaults |
|---|---|---|---|---|---|---|---|
| 6041h | 00h | Status word | VAR | RO | U16 | Y | 0x0040 |

Table 222 Status word 6041h

| Bit | Bit definition | Description |
|---|---|---|
| 10 | Goal reached | 0: The target position is NOt reached<br>1: The target position is reached |
| 11 | Internal software limit trigger | 0: Neither the position command NOr position feedback exceeds the limit<br>1: Position command or position feedback overrun |
| 12 | Follow from the station | 0: Slave NOt running position command<br>1: Slave is executing position command |
| 13 | Following error | 0: NO excessive position deviation fault<br>1: Fault due to excessive position deviation |

Table 224 Control mode 6060h

| index | Sub-index | Object name | Object name | R/W | type of data | PDO | Defaults |
|---|---|---|---|---|---|---|---|
| 6060h | 00h | Control mode | VAR | RW | I8 | Y | 0x00 |

Control mode 6060h is used to set the current trajectory mode. In CSP mode, the object dictionary is set to 8.

Table 225 Current control mode 6061h

| index | Sub-index | Object name | Object name | R/W | type of data | PDO | Defaults |
|---|---|---|---|---|---|---|---|
| 6060h | 00h | Control mode | VAR | RO | I8 | Y | 0x00 |

The current control mode 6061h is used to display the current track mode. In the CSP mode, the object dictionary setting read value is 8.

Table 226 Target position 607Ah

| index | Sub-index | Object name | Object name | R/W | type of data | PDO | Defaults |
|---|---|---|---|---|---|---|---|

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| 607Ah | 00h | target location | VAR | RW | I32 | Y | 0x00000000 |

The target position is the value of the absolute position of the slave station given by the master station of the upper computer every synchronization cycle. The slave station follows the absolute position according to the current position, and the unit is the user given instruction.

Table 227 Position change range 607Bh

| Index | Subindex | Object name | Object name | R/W | type of data | PDO | Defaults |
|---|---|---|---|---|---|---|---|
| 607Bh | 00h | Position change limitation | ARRAY | RO | U8 | N | 2 |
| | 01h | Minimum position change | | RW | I32 | Y | 0XFFFFFF9C |
| | 02h | Maximum position change | | RW | I32 | Y | 0x00000064 |

The position change range is mainly used to limit the master station trajectory planning to a given position. When the given position is valid within the limit range, a warning will be generated if it exceeds the range. And execute the value within the limited range.

Table 228 Target position software limit 607Dh

| Index | Sub-index | Object name | Object name | R/W | type of data | PDO | Defaults |
|---|---|---|---|---|---|---|---|
| 607Dh | 00h | Soft limit | ARRAY | RO | U8 | N | 2 |
| | 01h | Minimum position | | RW | I32 | Y | 0X80000000 |
| | 02h | Maximum position | | RW | I32 | Y | 0x7FFFFFFF |

The target position software limit is used to limit the given target position value. When the given target position exceeds the software limit, it will trigger an alarm and stop processing.

Table 229 Polarity selection 607Eh

| index | Sub-index | Object name | Object name | R/W | type of data | PDO | Defaults |
|---|---|---|---|---|---|---|---|
| 607Eh | 00h | Polarity selection | VAR | RW | U8 | Y | 0x00 |

Polarity selection is used to control the rotation direction of the position command

and speed command when the motor is actually output. At the same time change the selection of positive and negative limit switches. Among them, bit 7 controls the polarity of the position command and bit 6 controls the polarity of the speed command. When the corresponding bit is 1, it is equivalent to the position command value or speed command value * (-1). The feedback position and speed command value have the same polarity as the given value.

Table 230 Actual position 6064h

| index | Sub-index | Object name | Object name | R/W | type of data | PDO | Defaults |
|---|---|---|---|---|---|---|---|
| 6064h | 00h | Actual location | VAR | RO | I32 | Y | 0x00000000 |

Feedback the current motor position, the feedback unit is the user command unit.

Table 231 Actual speed 606Ch

| index | Sub-index | Object name | Object name | R/W | type of data | PDO | Defaults |
|---|---|---|---|---|---|---|---|
| 606Ch | 00h | Actual speed | VAR | RO | I32 | Y | 0x00000000 |

The actual speed feeds back the current motor running speed, and its unit is the command unit/s.

Table 232 Actual torque 6077h

| index | Sub-index | Object name | Object name | R/W | type of data | PDO | Defaults |
|---|---|---|---|---|---|---|---|
| 6077h | 00h | Actual torque | VAR | RO | I16 | Y | 0x0000 |

The actual torque reflects the current torque as a percentage of the rated torque, and the unit is% constant torque output.

Table 233 Maximum motor speed 6080h

| index | Sub-index | Object name | Object name | R/W | type of data | PDO | Defaults |
|---|---|---|---|---|---|---|---|
| 6080h | 00h | Motor speed | VAR | RW | U32 | Y | 0x00003840 |

。The maximum speed of the motor is the characteristic of the motor. When the drive motor reaches this speed after setting, an alarm will be triggered and run at the maximum motor speed.

Table 234 Position feedforward 60B0h

| index | Sub-index | Object name | Object name | R/W | type of data | PDO | Defaults |
|---|---|---|---|---|---|---|---|
| 6080h | 00h | Motor speed | VAR | RW | U32 | Y | 0x00003840 |

Position feed-forward is periodic position compensation. When the position feedforward is NOt 0, the given final position is the sum of 607Ah and 60B0h, and the

unit is the user command unit.

## 2 Recommended configuration of PDO mapping

In the CSP cycle synchronization position mode, PDO mapping is recommended to be configured as follows:

Table 235 PDO mapping recommended configuration-CSP

| RPDO | TPDO | Remarks |
|---|---|---|
| 6040h: Control word | 6041h: Status word | required |
| 607Ah: target location | 6064h: Actual location | required |
| 6060h: Mode selection | 6061h: Current mode display | Optional |
| 60FEh-01h: Digital output | 60FDh: Digital input | Optional |

## 3 Application process

Step 1: Check the wiring, including whether the power cord, motor power cord, encoder cord, and communication cord are connected properly, and then power on after confirming that they are correct.

Step 2: When the power is turned on without any error alarm, the slave will switch from the initial state to the pre-operation state.

Step 3: Configure the drive operating parameters (synchronization cycle, electronic gear ratio, polarity selection, current and other parameters) and PDO mapping parameters. After the configuration is completed, the slave state machine will be switched to the operating parameters.

Step 4: In the case of NO abNormality in the previous step, switch the 402 state machine to the running enable state, that is, give the control word 6040h = 000Fh. Under Normal operation, the status word 6041h will be switched to 0027h.

Step 5: Configure the motor operating parameters in CSP mode, such as: operating mode 6060h = 8;

Step 6: The master station of the upper computer calculates the periodic absolute target position 607Ah, and the slave station executes the operation.

# Cycle synchronization speed mode (CSV)

In periodic synchroNOus speed mode, the master station of the host computer periodically sends the calculated target speed 60FFh to the slave station, and the slave station internally converts it into the calculation speed of the motor according to the

target speed value. And feedback to the master station slave station status information.

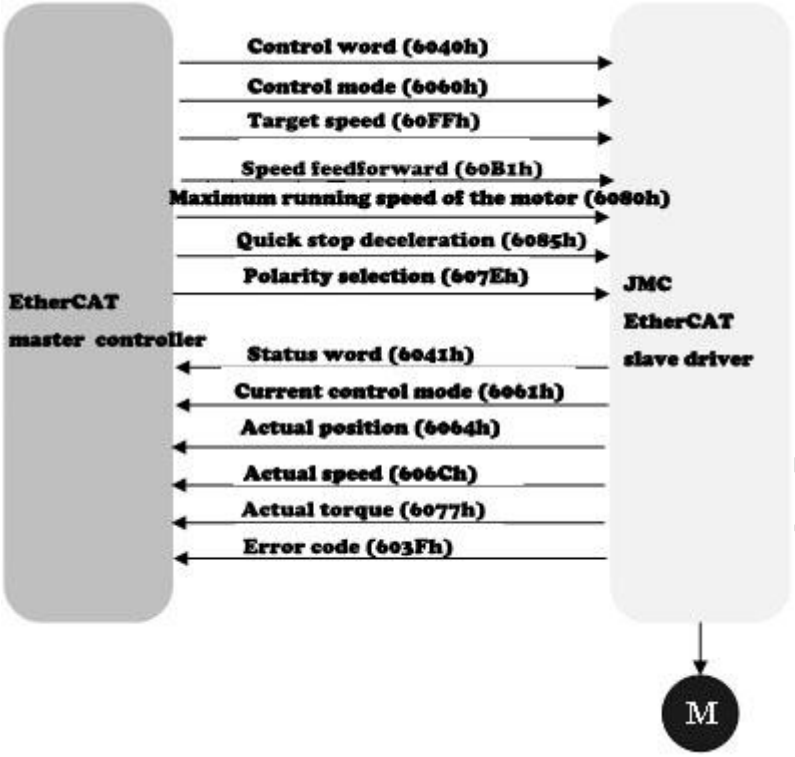



Figure 158 control chart of periodic synchroNOus speed mode

# 1 Related Object Dictionary Introduction

Table 236 Control word 6040h

| index | Sub-index | Object name | Object name | R/W | type of data | PDO | Defaults |
|---|---|---|---|---|---|---|---|
| 6040h | 00h | Control word | VAR | RW | U16 | Y | 0x0000 |

Bit definition of control word 6040h in CSV mode

| Bit | Bit definition | Description |
|---|---|---|
| 0 | start up | 0: invalid 1: valid |
| 1 | Voltage given | 0: invalid 1: valid |
| 2 | Quick stop | 0: valid 1: invalid |
| 3 | Motor power-on enable | 0: invalid 1: valid |
| 7 | Fault reset clear | 0: invalid 1: valid |
| 8 | time out | 0: invalid 1: valid, pause according to 605Dh setting |

Table 238 Status word 6041h

| index | Sub-index | Object name | Object name | R/W | type of data | PDO | Defaults |
|---|---|---|---|---|---|---|---|
| 6041h | 00h | Status word | VAR | RO | U16 | Y | 0x0040 |

Table 239 Bit definition of status word 6041h in CSV mode

| Bit | Bit definition | Description |
|---|---|---|
| 10 | Goal reached | 0: The target position is NOt reached |
| 12 | Follow from the station | 1: The target position is reached |
| 13 | Following error | 0: Slave NOt running position command |

Table 240 Control mode 6060h

| index | Sub-index | Object name | Object name | R/W | type of data | PDO | Defaults |
|---|---|---|---|---|---|---|---|
| 6060h | 00h | Control mode | VAR | RW | I8 | Y | 0x00 |

Control mode 6060h is used to set the current track mode. In CSV mode, the object dictionary is set to 9.

Table 241 Current control mode 6061h

| index | Sub-index | Object name | 对象类型 Object name | R/W | 数据类型 type of data | PDO | 默认值 Defaults |
|---|---|---|---|---|---|---|---|
| 6061h | 00h | Current control mode | VAR | RO | I8 | Y | 0x00 |

The current control mode 6061h is used to display the current track mode. In the CSV mode, the object dictionary setting read value is 9.

Table 242 Maximum motor speed 6080h

| index | Sub-index | Object name | Object name | R/W | type of data | PDO | Defaults |
|---|---|---|---|---|---|---|---|
| 6080h | 00h | Motor speed | VAR | RW | U32 | Y | 0x00003840 |

The maximum motor speed is the motor operating characteristics, and its unit is revolutions per minute (RPM). When the given speed is greater than the maximum speed of the motor, it will trigger an alarm and stop running.

Table 243 Quick stop deceleration 6085h

| index | Sub-index | Object name | Object name | R/W | type of data | PDO | Defaults |
|---|---|---|---|---|---|---|---|
| 6085h | 00h | Quick stop deceleration | VAR | RW | U32 | Y | 0x00000000 |

The quick stop deceleration is the deceleration of the motor when a quick stop is required during the execution of an emergency stop, and its unit is user command/s2.

Table 244 Speed feedforward 60B1h

| index | Sub-index | Object name | Object name | R/W | type of data | PDO | Defaults |
|---|---|---|---|---|---|---|---|
| 60B1h | 00h | Speed feed-forward | VAR | RW | I32 | Y | 0x00000000 |

The speed feed-forward is periodic speed compensation. When the speed feedforward is NOt 0, the given final speed is the sum of 60ffh and 60b1h, and the unit is the user instruction unit / s.

Table 35 Target speed

| index | Sub-index | Object name | Object name | R/W | type of data | PDO | Defaults |
|---|---|---|---|---|---|---|---|
| 60FFh | 00h | Target speed | VAR | RW | I32 | Y | 0x00000000 |

The target speed is a given speed command, and its maximum value should NOt be greater than the maximum speed value of the motor. When the given value is greater than the maximum speed value of the motor, an alarm will be triggered and stop.

## 2 Recommended configuration of PDO mapping

In CSV cycle synchroNOus speed mode, the recommended configuration of PDO mapping is as follows

表 36 PDO 映射建议配置-CSV

Table 246 Recommended PDO mapping configuration-CSV

| RPDO | TPDO | Remarks |
|---|---|---|
| 6040h: Control word | 6041h: Status word | required |
| 60FFh: Target speed | | required |
| 60B1h: Speed feedforward | 6064h: Actual location | Optional |
| 6060h: Mode selection | 606Ch: Actual speed | Optional |
| 60FEh-01h: Digital output | 6061h: Current mode display | Optional |
| | 60FDh: Digital input | Optional |

# 3 Application process

Step 1: Check the wiring, including whether the power cord, motor power cord, encoder cord, and communication cord are connected properly, and then power on after confirming that they are correct.

Step 2: When the power is turned on without any error alarm, the slave will switch from the initial state to the pre-operation state.

Step 3: Configure the drive operating parameters (synchronization cycle, electronic gear ratio, polarity selection, current and other parameters) and PDO mapping parameters. After the configuration is completed, the slave state machine will be switched to the operating parameters

Step 4: In the case of NO abNormality in the previous step, switch the 402 state machine to the running enable state, that is, give the control word 6040h = 000Fh. Under Normal operation, the status word 6041h will be switched to 0027h.

Step 5: Configure the motor operating parameters in CSV mode, such as: operating mode 6060h = 9;

Step 6: The master station of the host computer calculates the periodic target speed of 60FFh, and the slave station executes the operation.

Contour position mode (PP)

This mode is mainly used for point-to-point trajectory application. The master station of the host computer gives the target position (relative or absolute), target speed, acceleration, deceleration and other parameters. The slave station will generate and execute trajectory planning and execution according to these parameters, and output the status to the master. station.

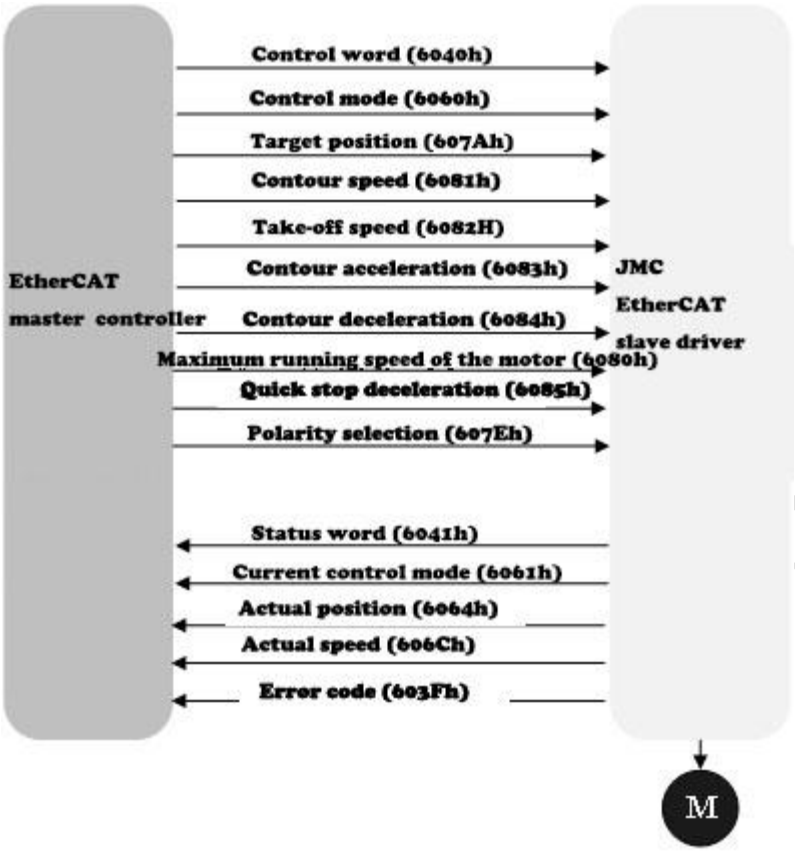



Figure 159 Contour position mode control chart

# 1 Related Object Dictionary Introduction

Table 247 Control word 6040h

| index | Sub-index | Object name | Object name | R/W | type of data | PDO | Defaults |
|---|---|---|---|---|---|---|---|
| 6040h | 00h | Control word | VAR | RW | U16 | Y | 0x0000 |

Table 248 Bit definition of control word 6040h in PP mode

| bit | bit definition | Description |
|---|---|---|
| 0 | start up | 0: invalid 1: valid |
| 1 | Voltage given | 0: invalid 1: valid |
| 2 | Quick stop | 0: valid 1: invalid |
| 3 | Motor power-on enable | 0: invalid 1: valid |
| 4 | Collect new target location | 0→1: The rising edge will collect the target position, speed, acceleration and deceleration, and execute |

| | | |
|---|---|---|
| 5 | Update location NOw | 0: NOn-immediate update 1: immediate update |
| 6 | Absolute position/relative position | 0: absolute position command 1: relative position command |
| 7 | Fault reset clear | 0: invalid 1: valid |
| 8 | time out | 0: invalid 1: valid, pause according to 605Dh setting |

Table 249 Status word 6041h

| index | Sub-index | Object name | Object name | R/W | type of data | PDO | Defaults |
|---|---|---|---|---|---|---|---|
| 6041h | 00h | Status word | VAR | RO | U16 | Y | 0x0040 |

Table 250 Bit definition of status word 6041h in PP mode

| bit | bit definition | Description |
|---|---|---|
| 10 | Goal reached | 0: The target position is NOt reached<br>1: The target position is reached |
| 11 | Internal software limit trigger | 0: Neither the position command NOr position feedback exceeds the limit<br>1: Position command or position feedback overrun |
| 12 | Target location update | 0: The target position can be updated<br>1: The target location canNOt be updated |
| 13 | Following error | 0: NO excessive position deviation fault<br>1: Fault due to excessive position deviation |

6060h Table 251 Control mode 6060h

| index | sub-index | Object name | Object name | R/W | type of data | PDO | Defaults |
|---|---|---|---|---|---|---|---|
| 6060h | 00h | Control mode | VAR | RW | I8 | Y | 0x00 |

Control mode 6060h is used to set the current trajectory mode. In PP mode, the object dictionary is set to 1.

6061h Table 252 Current control mode 6061h

| index | Sub-index | Object name | Object name | R/W | type of data | PDO | Defaults |
|---|---|---|---|---|---|---|---|
| 6061h | 00h | Current control mode | VAR | RO | I8 | Y | 0x00 |

The current control mode 6061h is used to display the current track mode. In PP mode, the object dictionary setting read value is 1.

Table 253 Target position 607Ah

| index | Sub-index | Object name | Object name | R/W | type of data | PDO | Defaults |
|---|---|---|---|---|---|---|---|
| 607Ah | 00h | target location | VAR | RW | I32 | Y | 0x00000000 |

The target position is the value of the absolute position of the slave station given by the master station of the upper computer every synchronization cycle. The slave station follows the absolute position according to the current position, and the unit is the user given instruction.

Table 254 Contour speed 6081h

| index | sub-index | Object name | Object name | R/W | type of data | PDO | Defaults |
|---|---|---|---|---|---|---|---|
| 6081h | 00h | Contour speed | VAR | RW | U32 | Y | 0x00000960 |

Profile speed is the speed of running in PP mode. The maximum value of this speed depends on the minimum speed of 607Fh and 6080h. When the given speed is greater than the maximum value, an alarm will be triggered and the operation will stop. The unit is command/s.

Table 255 Takeoff speed 6082h

| Index | Sub-index | Object name | Object name | R/W | type of data | PDO | Defaults |
|---|---|---|---|---|---|---|---|
| 6082h | 00h | Takeoff speed | VAR | RW | U32 | Y | 0x00000000 |

The take-off speed is the speed at which the motor starts directly and will run to the target speed in this speed mode. The unit is command/s.

Table 256 Contour acceleration 6083h

| index | Sub-index | Object name | Object name | R/W | type of data | PDO | Defaults |
|---|---|---|---|---|---|---|---|
| 6083h | 00h | Contour acceleration | VAR | RW | U32 | Y | 0x00000000 |

The contour acceleration is the speed acceleration in PP and PV modes. The maximum value of this acceleration depends on the maximum acceleration 60C5h. When the input acceleration is greater than the maximum acceleration, the input acceleration is limited to the maximum acceleration and a warning is issued. s2.

Table 257 profile deceleration 6084h

| index | Sub-index | Object name | Object name | R/W | type of data | PDO | Defaults |
|---|---|---|---|---|---|---|---|
| 6084h | 00h | Contour deceleration | VAR | RW | U32 | Y | 0x00000000 |

The contour deceleration is the deceleration running in PP and PV modes. The maximum value of the deceleration depends on the maximum deceleration of 60c6h. When the input deceleration is greater than the maximum deceleration degree, the input deceleration is limited to the maximum deceleration, and a warning is issued, with the unit of instruction unit / S2.

Table 258 Maximum acceleration table 60C5h

| index | Sub-index | Object name | Object name | R/W | type of data | PDO | Defaults |
|---|---|---|---|---|---|---|---|
| 60C5h | 00h | Acceleration | VAR | RW | U32 | Y | 0x000186A0 |

The maximum acceleration is the maximum value of the acceleration in the PP mode, and its unit is the command unit/s2.

Table 259 Maximum deceleration 60C6h

| index | Sub-index | Object name | Object name | R/W | type of data | PDO | Defaults |
|---|---|---|---|---|---|---|---|
| 60C6h | 00h | Maximum deceleration | VAR | RW | U32 | Y | 0x000186A0 |

The maximum deceleration is the maximum value of the deceleration in PP mode, and its unit is the command unit/s2.

## 2 PP Pattern trajectory curve

In the PP mode, the slave station has 4 trajectory modes. Under the control word bit 5, bit 6, bit 9 three different control word combinations will produce different running tracks, the track running is as follows:

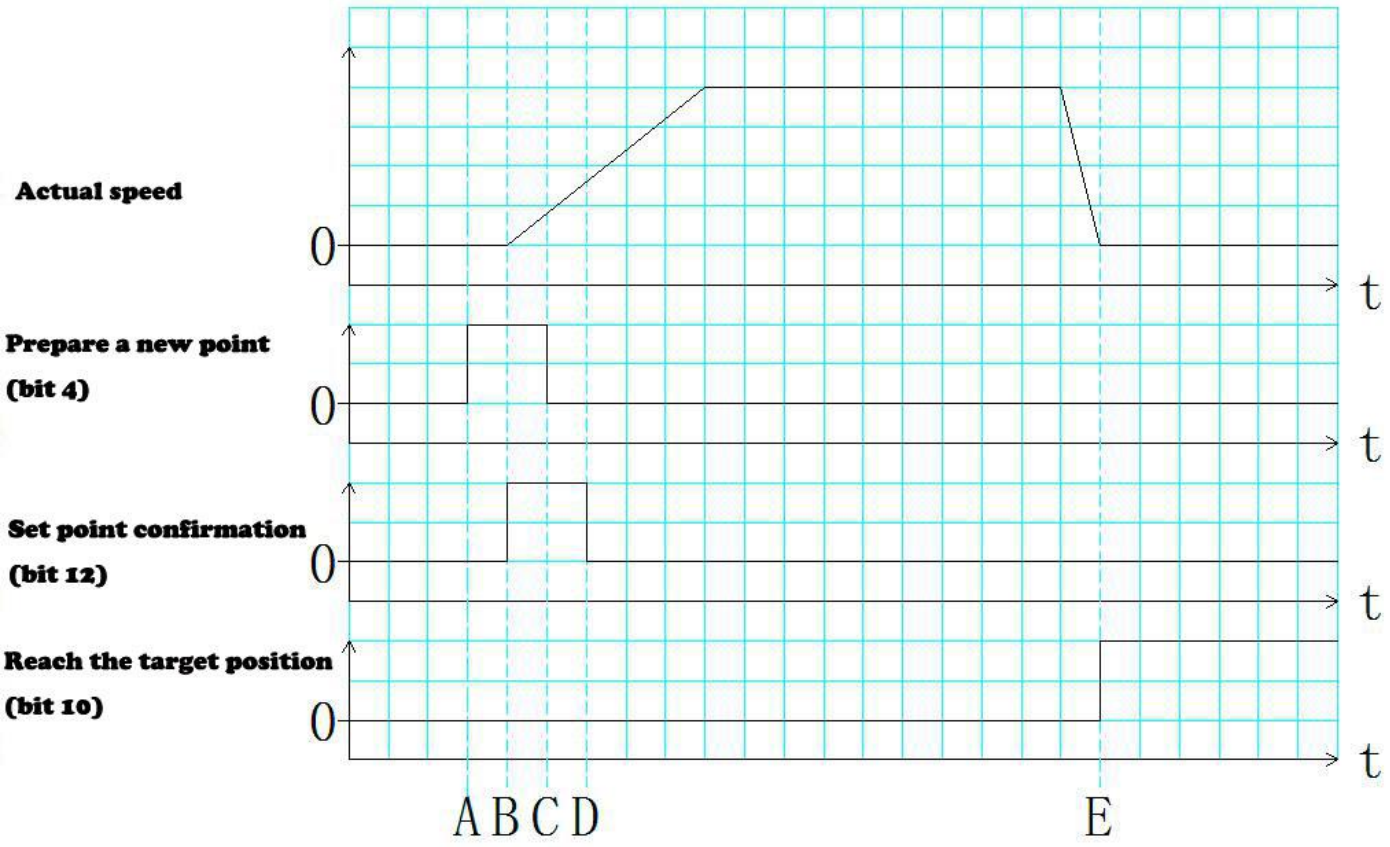



Figure 160 Single point motion

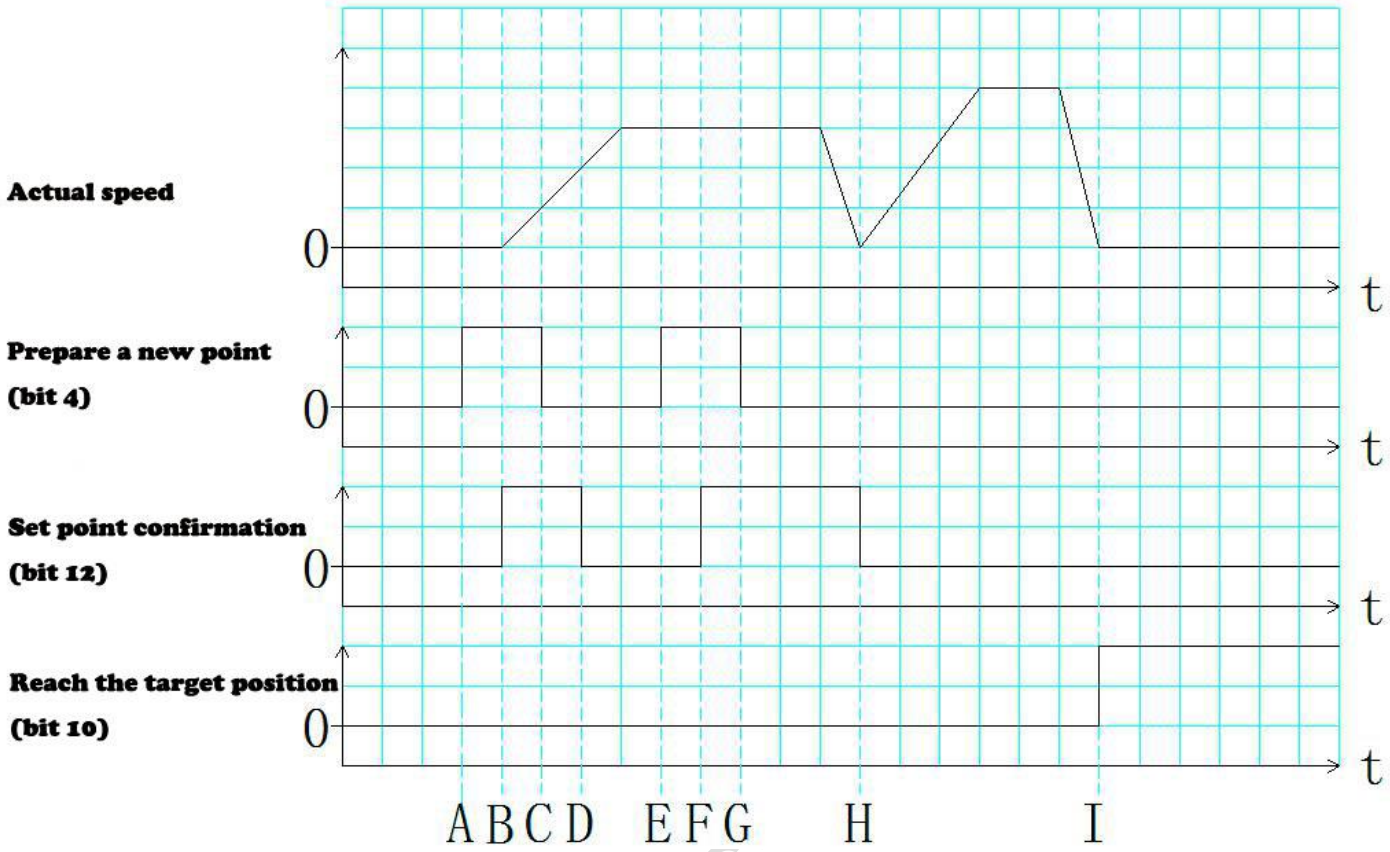



Figure 161 Multi-point motion, stop between positions

In this way, the 9th and 5th bits of the control word are both 0, and the motor will stop during two runs.

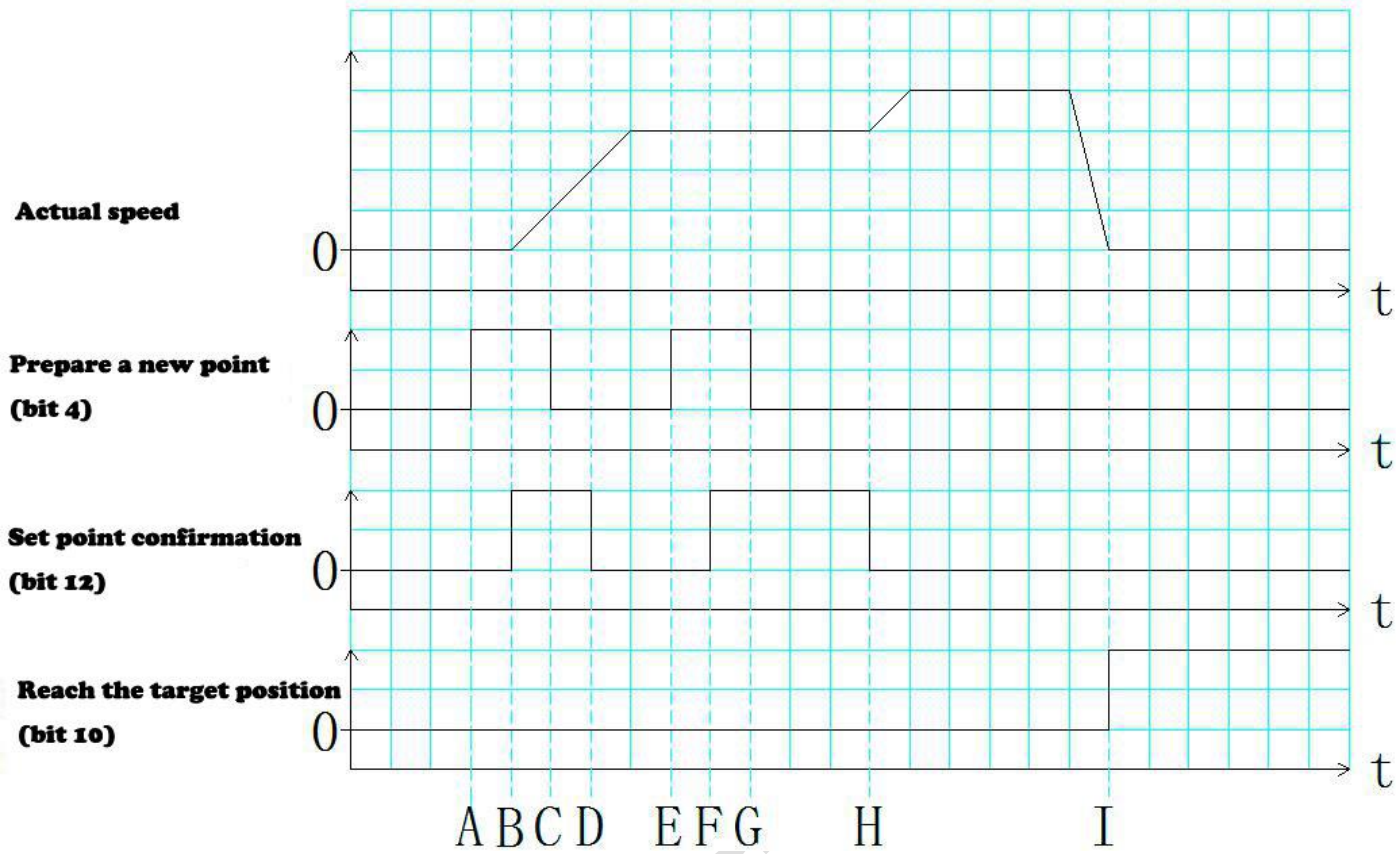



Fig. 162 Multi-point movement without stopping between points

In this way, the 9th bit of the control word is 1, and the 5th bit is 0. The motor runs at the speed of the first point at a constant speed before reaching the first point, and the The motor runs at a speed of several points, during which the motor will NOt stop.

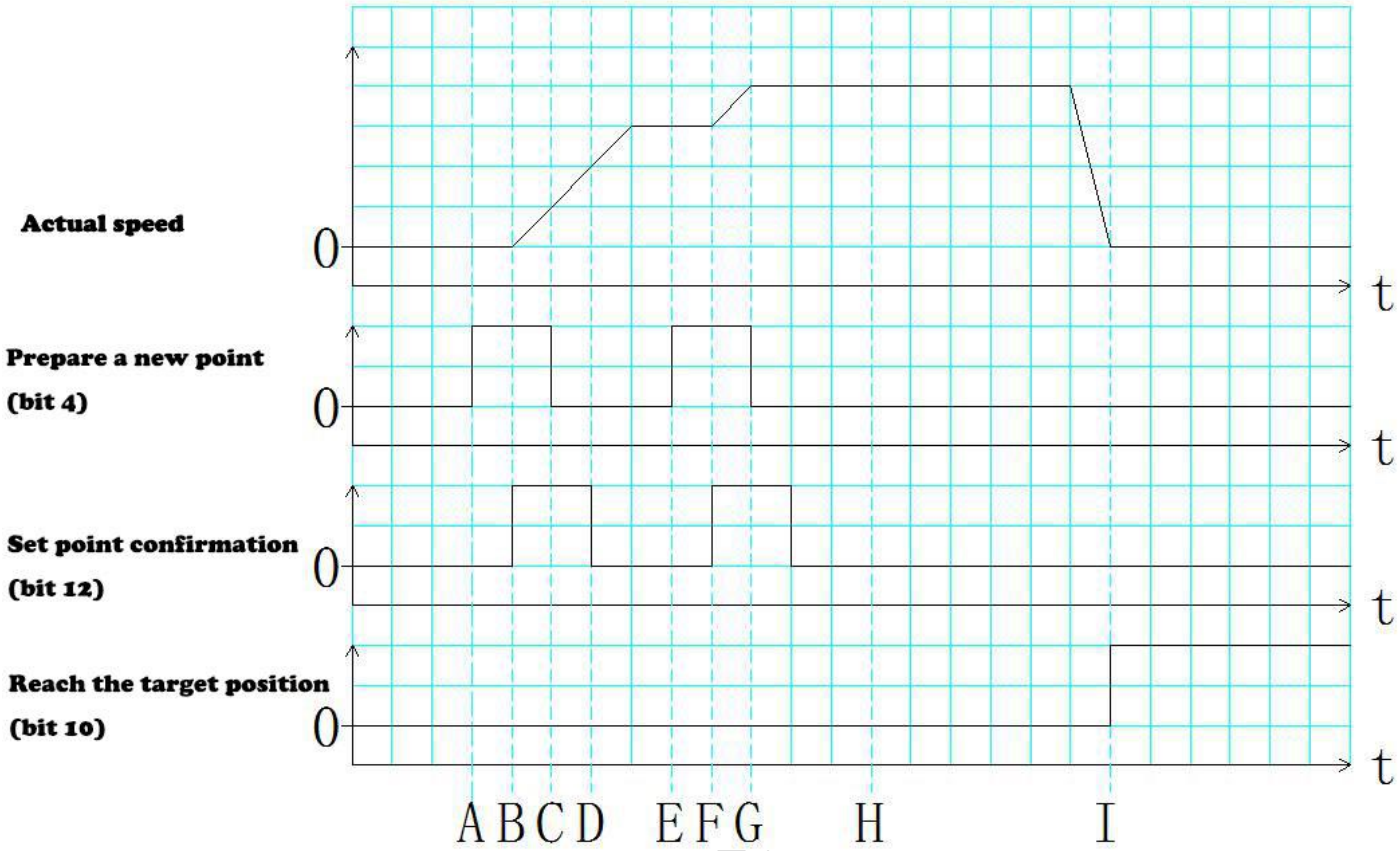



Figure 163 Multi-point motion, after setting the second point, switch directly to the speed of the second point

In this way, the 9th position of the control word is set to 1, and the 5th bit is also set to 1, the motor will directly switch to the second point movement speed, but will NOt complete the first point movement. The running speed of the motor is continuous motion.

# 3 Recommended configuration of PDO mapping

In PP contour position mode, the recommended configuration for PDO mapping is as follows:

Table 260 Recommended PDO mapping configuration-PP

| RPDO | TPDO | Remarks |
|---|---|---|
| 6040h: Control word | 6041h: Status word | required |
| 607Ah: target location | | required |
| 6081h: Target speed | | required |
| 6083h: Target acceleration | | required |

| | | |
|---|---|---|
| 6084h: Target deceleration | | required |
| 6082h: Takeoff speed | 6064h: Actual location | Optional |
| 6060h: Mode selection | 606Ch: Actual speed | Optional |
| 60FEh-01h: Digital output | 6061h : Current mode display | Optional |
| | 60FDh: Digital input | Optional |

# 4 Application process

Step 1: Check the wiring, including whether the power cord, motor power cord, encoder cord, and communication cord are connected properly, and then power on after confirming that they are correct.

Step 2: When the power is turned on without any error alarm, the slave will switch from the initial state to the pre-operation state.

Step 3: Configure the drive operating parameters (synchronization cycle, electronic gear ratio, polarity selection, current and other parameters) and PDO mapping parameters. After the configuration is completed, the slave state machine will be switched to the operating parameters.

Step 4: In the case of NO abNormality in the previous step, switch the 402 state machine to the running enable state, that is, give the control word 6040h = 000Fh. Under Normal operation, the status word 6041h will be switched to 0027h.

Step 5: Configure the motor operating parameters in PP mode, such as: operating mode 6060h = 1, target position 607Ah, contour speed 6081h, acceleration 6083h, deceleration 6084h.

Step 6: Send the position acquisition command of control word 6040h, and the slave station executes the operation.

# Contour speed mode (PV)

The contour speed mode is mainly used in speed control occasions. The master station of the host computer sets the target speed, acceleration and deceleration.

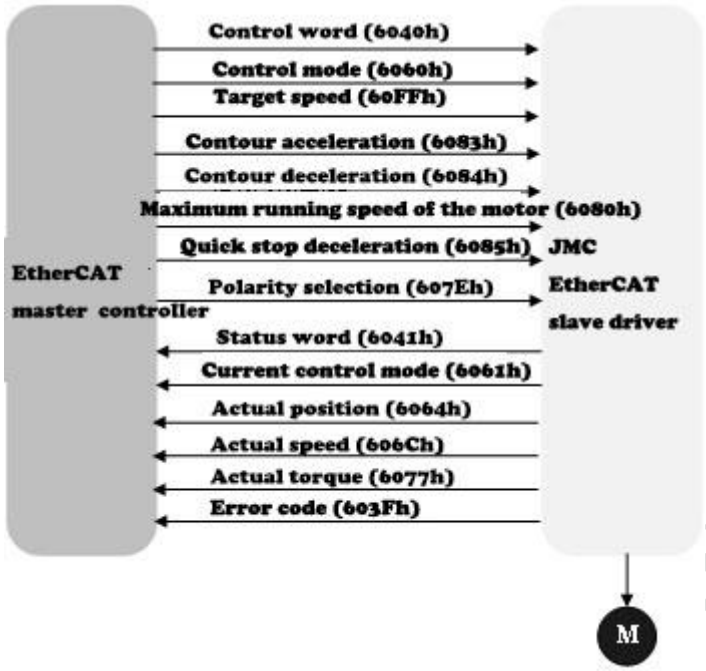



Figure 164 Contour speed mode control diagram

# 1 Related Object Dictionary Introduction

Table 261 Control word 6040h

| index | Sub-index | Object name | Object name | R/W | type of data | PDO | Defaults |
|---|---|---|---|---|---|---|---|
| 6040h | 00h | Control word | VAR | RW | U16 | Y | 0x0000 |

Table 262 Control word 6040h bit definition in PV mode

| 位 bit | Bit definition | Description |
|---|---|---|
| 0 | start up | 0: invalid 1: valid |
| 1 | Voltage given | 0: invalid 1: valid |
| 2 | Quick stop | 0: valid 1: invalid |
| 3 | Motor power-on enable | 0: invalid 1: valid |
| 7 | Fault reset clear | 0: invalid 1: valid |
| 8 | time out | 0: invalid 1: valid, pause according to 605Dh setting |

Table 263 Status word 6041h

| index | Sub-index | Object name | Object name | R/W | type of data | PDO | Defaults |
|---|---|---|---|---|---|---|---|
| 6041h | 00h | Status | VAR | RO | U16 | Y | 0x0040 |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| | | word | | | | | |

Table 264 Bit definition of status word 6041h in PV mode

| bit | 位 Bit definition | Description | |
|---|---|---|---|
| 10 | Goal reached | 0 | When Bit8=0: the target speed is NOt reached |
| | | | When Bit8=1: Decelerate |
| | | 1 | When Bit8=0: reaching the target speed |
| | | | 0 When Bit8=1: the speed is 0 |
| 12 | Follow from the station | 0 0: Slave NOt running position command | |
| | | 1: Slave is executing position command | |
| 13 | Following error | NO excessive position deviation fault | |
| | | 1: Fault due to excessive position deviation | |

Table 265 Control mode 6060h

| Index | Sub-index | Object name | Object name | R/W | type of data | PDO | Defaults |
|---|---|---|---|---|---|---|---|
| 6060h | 00h | Control mode | VAR | RW | I8 | Y | 0x00 |

Control mode 6060h is used to set the current track mode. In PV mode, the object dictionary is set to 3.

Table 266 Current control mode 6061h

| index | Sub-index | Object name | Object name | R/W | type of data | PDO | Defaults |
|---|---|---|---|---|---|---|---|
| 6061h | 00h | Current control mode | VAR | RO | I8 | Y | 0x00 |

The current control mode 6061h is used to display the current track mode. In PV mode, the object dictionary setting read value is 3.

Table 267 Target speed 60FFh

| index | Sub-index | Object name | Object name | R/W | Type of data | PDO | Defaults |
|---|---|---|---|---|---|---|---|
| 60FFh | 00h | Target speed | VAR | RW | I32 | Y | 0x00000000 |

The target speed is the target value that controls the running speed of the motor. After a given running command, the motor will accelerate or decelerate to the target speed according to acceleration and deceleration. The maximum value of this speed value depends on the minimum value of 607Fh and 6080h. When the target speed exceeds the maximum running speed, it will run at the maximum speed and give an alarm. The unit is command/s.

Table 268 Contour acceleration 6083h

| index | Sub-index | Object name | Object name | R/W | type of data | PDO | Defaults |
|---|---|---|---|---|---|---|---|
| 6083h | 00h | Contour acceleration | VAR | RW | U32 | Y | 0x00000000 |

The contour acceleration is the speed acceleration in PP and PV modes. The maximum value of this acceleration depends on the maximum acceleration 60C5h. When the input acceleration is greater than the maximum acceleration, the input acceleration is limited to the maximum acceleration and a warning is issued. s2.

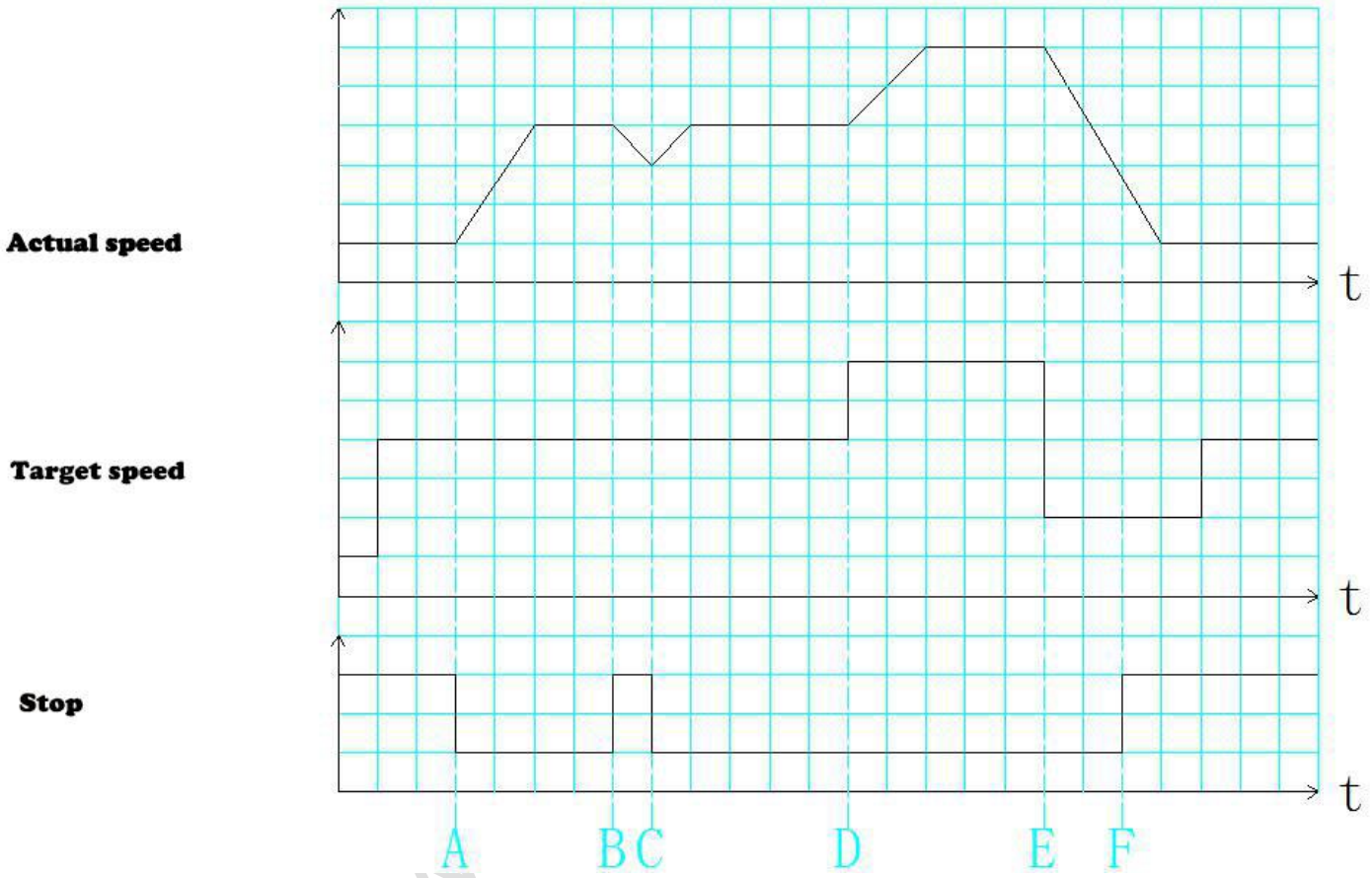
Table 269 Contour deceleration 6084h

| index | Sub-index | Object name | Object name | R/W | type of data | PDO | Defaults |
|---|---|---|---|---|---|---|---|
| 6084h | 00h | Contour deceleration | VAR | RW | U32 | Y | 0x00000000 |

The contour deceleration is the speed deceleration in PP and PV modes. The maximum value of this deceleration depends on the maximum deceleration 60C6h. When the input deceleration is greater than the maximum deceleration, the input deceleration is limited to the maximum deceleration and issued Warning, the unit is command unit/s2.

## 2 PV Mode trajectory curve

In PV mode, after the target speed, acceleration and deceleration are given, the operation is adjusted in real time according to the given speed value




## 3 Recommended configuration of PDO mapping

In PV profile velocity mode, the recommended configuration of PDO mapping is as follows:

| RPDO | TPDO | Remark |
|---|---|---|
| 6040h: control word | 6041h: Status word | required |
| 60FFh: target speed | | required |
| 6083h: Target acceleration | | required |
| 6084h: Target deceleration | | required |
| 607Fh: Maximum contour velocity | 6064h: Actual location | required |
| 6060h: Mode selection | 606Ch: Actual speed | required |

| | | |
|---|---|---|
| 60FEh-01h: Digital output | 6061h: Current mode display | required |
| | 60FDh: Digital input | required |

# 4 application process

Step 1: check the wiring, including power line, motor power line, encoder line and communication line, and power on after confirmation.
Step 2: switch the slave station from initialization state to pre operation state without any error alarm when power on.
Step 3: configure the driver operation parameters (synchronization period, electronic gear ratio, polarity selection, current and other parameters) and PDO mapping parameters, and switch the slave state machine to the operation parameters after the configuration is completed
Step 4: if there is NO abNormality in the previous step, the 402 state machine is switched to the operation enabled state, that is, the control word 6040h = 010fh. Under Normal operation, the status word 6041h will be switched to 0127h.
Step 5: configure the motor operating parameters in PV mode, such as: operation mode 6060h = 3, target speed 60ffh, acceleration 6083h, deceleration 6084h.
Step 6: send the start instruction of control word 6040h = 000fh, and the slave station will execute the operation.

# Return to zero mode (HM)

JMC EtherCAT slave station supports the zero-back mode defined by the CiA402 protocol. Users need to set the zero-back mode, zero-back acceleration, zero-back speed, zero-shift speed, zero-shift and other parameters. When the return to zero is completed, the current position will automatically be 0, and the motion position will be run with this point as the reference

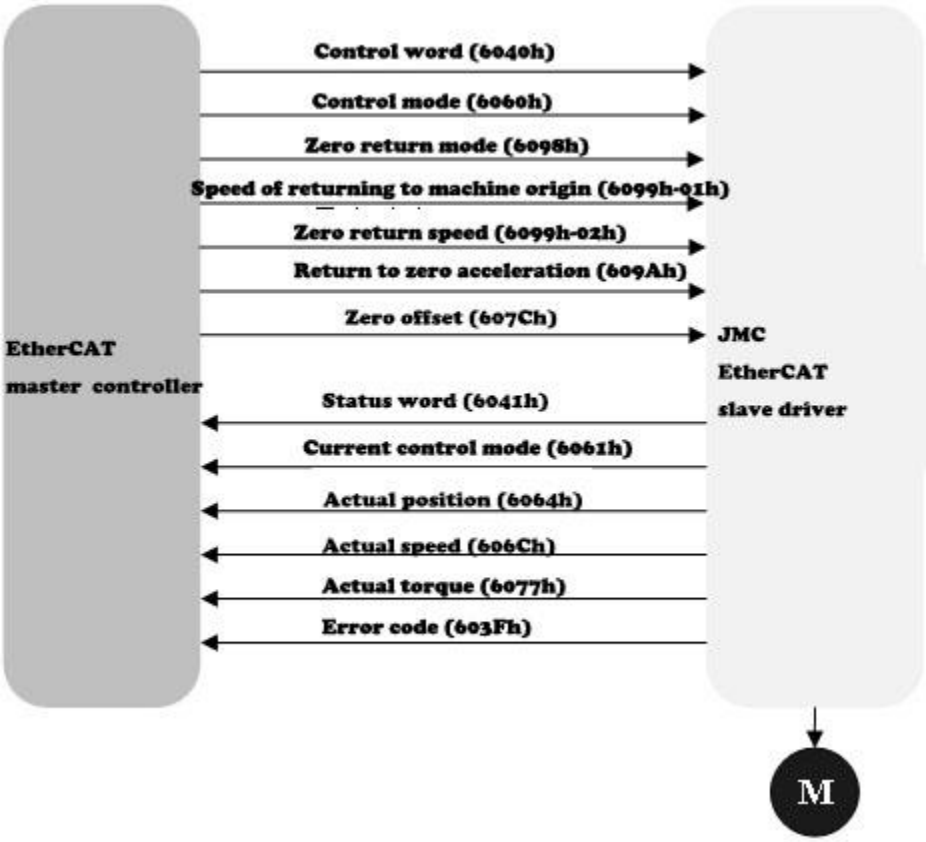



Figure 165 control chart of return to zero mode1

1. Introduction to the related object dictionary

Chart 37 Control word 6040h

| Index | sub-index | Object name | Object Type | R/W | data type | PDO | default |
|---|---|---|---|---|---|---|---|
| 6040h | 00h | control word | VAR | RW | U16 | Y | 0x0000 |

Chart 38 Definition of control word 6040h bit in HM mode

| Bit | Definition of bit | Description |
|---|---|---|
| 0 | Start | 0: Invalid 1: Valid |
| 1 | Voltage setting | 0: Invalid 1: Valid |
| 2 | Quick stop | 0: Invalid 1: Valid |
| 3 | Motor power on enable | 0: Invalid 1: Valid |
| 4 | Start return to zero | 0→1:Start return to zero 1: Go back to zero<br>1→0:Return to zero at the end |
| 7 | Fault reset clear | 0: Invalid 1: Valid |

| | | |
|---|---|---|
| 8 | Pause | 0: Invalid 1: Valid, pause according to 605dh setting |

Chart 39 state word 6041h

| Index | Sub-index | Object name | Object type | R/W | Data type | PDO | Default value |
|---|---|---|---|---|---|---|---|
| 6041h | 00h | Sate word | VAR | RO | U16 | Y | 0x0040 |

Chart 273 definition of status word 6041h bit in HM mode

| Bit | Bit definition | Description | |
|---|---|---|---|
| 10 | Return to zero position | 0 | Bit8=0:Return to zero position NOt reached |
| | | | Bit8=1:Slow down |
| | | 1 | Bit8=0:Return to zero position |
| | | | Bit8=1:Speed is 0 |
| 12 | Zero return complete | 0: Homing incomplete 1: Homing complete | |
| 13 | Return to zero error | 0: Zero return without error 1: Over tolerance fault occurred in the process of returning to zero | |

Chart 40 control mode 6060h

| Index | Sub-index | Object name | Object type | R/W | Data type | PDO | Default value |
|---|---|---|---|---|---|---|---|
| 6060h | 00h | Operation mode | VAR | RW | I8 | Y | 0x00 |

Control mode 6060h is used to set the current trajectory mode. In HM mode, the object dictionary is set to 6.

Chart 41 Current control mode 6061h

| Index | Sub-index | Object name | Object type | R/W | Data type | PDO | Default value |
|---|---|---|---|---|---|---|---|
| 6061h | 00h | Operation mode | VAR | RO | I8 | Y | 0x00 |

The current control mode 6061h is used to display the current trajectory mode. In HM mode, the read value of the object dictionary is set to 6.

Chart 42 Return to zero offset 607Ch

| Index | Sub-index | Object name | Object type | R/W | Data type | PDO | Default value |
|---|---|---|---|---|---|---|---|
| 607Ch | 00h | Return to zero acceleration | | RW | I32 | Y | 0x00000000 |

Return to zero offset is applicable to offset a certain distance after the return to zero mode is

completed, and take this point as the zero position. The unit is user instruction.

Chart 43 Return to zero mode 6098h

| Index | Sub-index | Object name | Object type | R/W | Data type | PDO | Default value |
|---|---|---|---|---|---|---|---|
| 6098h | 00h | Mode of return to zero | VAR | RW | I8 | Y | 0x00 |

The return to zero method is that the user selects the corresponding return to zero method according to his own needs.

Chart 44 Speed of return to zero 6099h

| Index | Sub-index | Object name | Object type | R/W | Data type | PDO | Default value |
|---|---|---|---|---|---|---|---|
| 6099h | 00h | Speed of return to zero | ARRAR | RO | U8 | N | 2 |
| | 01h | Mechanical origin velocity | | RW | U32 | Y | 0x00000000 |
| | 02h | Zero offset velocity | | RW | U32 | Y | 0x00000050 |

Mechanical origin speed, find the speed of mechanical origin (limit switch), that is to find the position of deceleration point. The unit of speed is command unit / s. The zero offset speed is used to find the offset speed of zero position, and its unit is instruction unit / s.

Chart 45 Return to zero acceleration 609Ah

| Index | Sub-index | Object name | Object type | R/W | Data type | PDO | Default value |
|---|---|---|---|---|---|---|---|
| 609Ah | 00h | Return to zero acceleration | VAR | RW | U32 | Y | 0x00000000 |

The return to zero acceleration is the acceleration and deceleration speed of the slave motor in the return to zero, that is, the acceleration and deceleration speed when it reaches the limit.

# 2 HM Mode trajectory curve

In cia402 protocol, there are 36 kinds of return to zero modes, each of which has a different trajectory curve. Users can choose the return to zero mode by setting the return to zero mode for 6098h according to their own needs.

## 2.1 Return to zero mode 1

When 6098h = 1, zero return mode 1 is selected:
The CW direction end of CCW direction limit is taken as the reference point, and the first Z signal in CW direction is taken as the zero point.

The motor first moves to the CCW direction at the speed of 6099h-01h returning to the mechanical origin. When the CCW direction limit is effectively activated, it decelerates and stops according to 609ah deceleration, and then reverses to CW direction. When it leaves the CCW direction limit, the first Z signal is the zero point return.

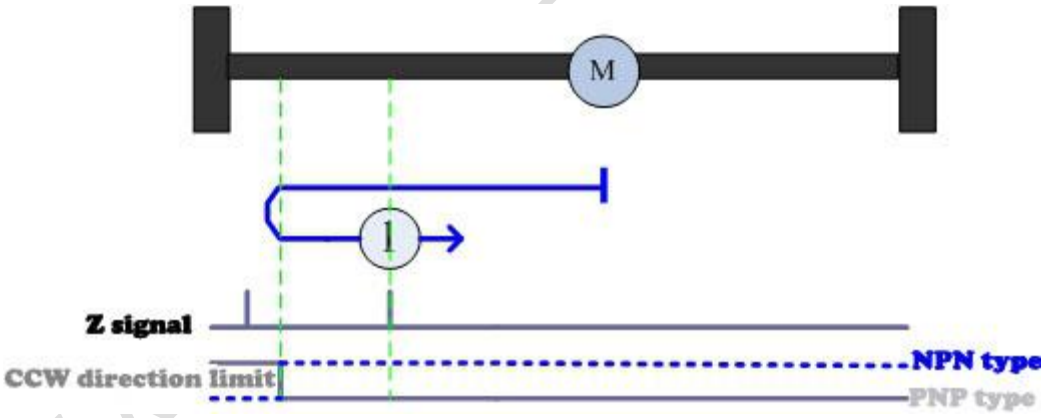
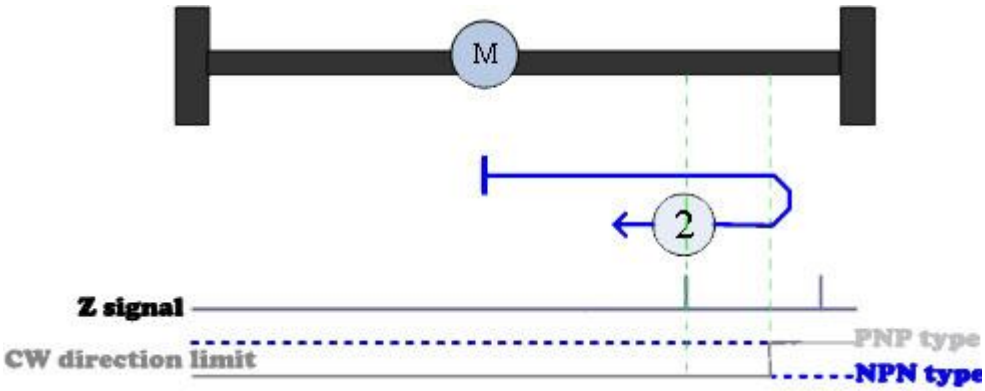



Fig. 166 schematic diagram of jemecon EtherCAT slave station return to zero mode 1

## 2.2 Return to zero mode 2

When 6098h = 2, zero return mode 2 is selected The CCW direction end of the limit in CW direction is taken as the reference point, and the first Z signal in CCW direction is taken as the zero point.
The motor first moves towards CW direction at the speed of 6099h-01h returning to the mechanical origin. When the CW direction limit is effectively activated, it will decelerate and stop at 609ah deceleration, and then move in the CCW direction in reverse direction. When leaving the CW direction limit, the first Z signal is the zero point




return.

Figure 167 schematic diagram of jemecon EtherCAT slave station return to zero mode II

## 2.3 Return to zero mode 3

When 6098h = 3, zero return mode 3 is selected

The CCW direction end of HS limit is taken as the reference point, and the first Z signal in CCW direction is taken as the zero point.

The starting position is at the CCW direction side of HS limit: the motor first moves to CW direction at the speed of 6099h-01h returning to the mechanical origin. When the HS limit is effectively activated, it decelerates and stops at 609ah deceleration, and then reverses to CCW direction. After leaving the HS limit, the first Z signal is the zero return point;

The starting position is on the HS limit: the motor runs at a low speed in the CCW direction. When the motor leaves the HS limit, the first Z signal will return to zero;

The starting position is at the CW direction side of HS limit: the motor first moves to CW direction at the speed of 6099h-01h back to the mechanical origin, and when it encounters the CW direction limit, it reverses to the CCW direction. After touching the HS limit, it continues to run in the CCW direction. After leaving the HS limit, the first Z signal is the zero point.

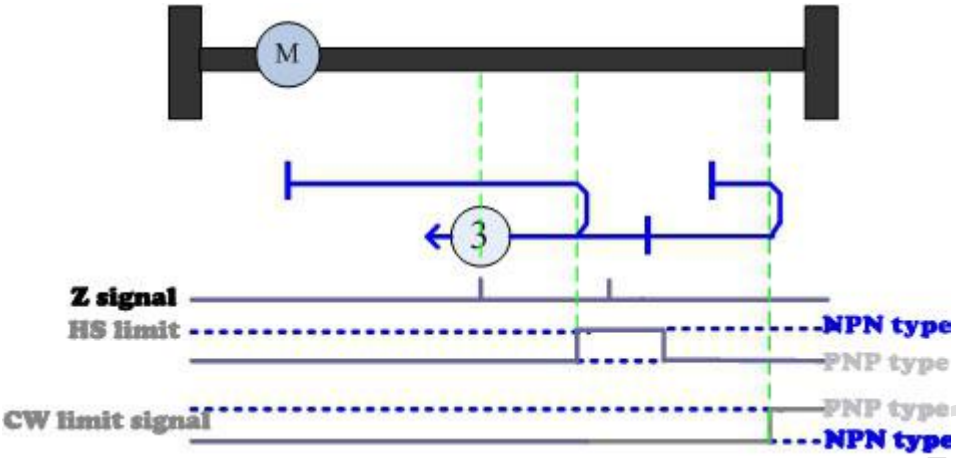



Figure 168 schematic diagram of JMC EtherCAT slave station return to zero mode 3

## 2.4 Return to zero mode 4

When 6098h = 4, zero return mode 4 is selected

The CCW direction end of HS limit is taken as the reference point, and the first Z signal in CW direction is taken as the zero point.

The starting position is at the CCW direction side of HS limit: the motor first moves to CW direction at the speed of 6099h-01h returning to the mechanical origin. When the HS limit is effectively activated, it decelerates according to 609ah deceleration and returns to zero point when the first Z signal is encountered.

The starting position is on the HS limit: the motor runs at a low speed in the CCW direction. When the motor leaves the HS limit, it runs in the CW direction at a low speed. When the HS limit signal is activated again, the first Z signal is the zero return point;

The starting position is at the CW direction side of HS limit: the motor first moves to CW direction at the speed of 6099h-01h returning to the mechanical origin; when it encounters the CW direction limit, it reverses to the CCW direction; after touching and leaving the HS limit, it runs in the CW direction at a low speed. When the HS limit signal is activated again, the first Z signal is the zero return point;

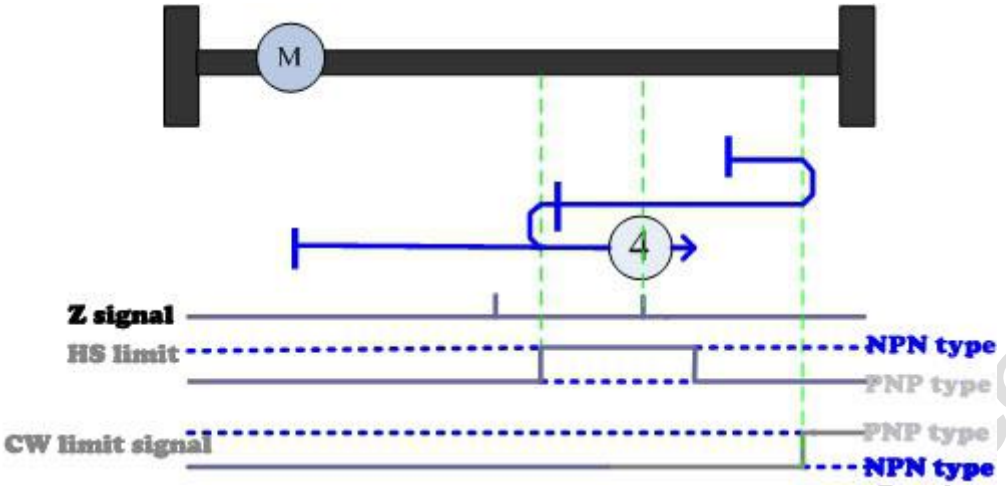



Fig. 169 schematic diagram of four track of JMC EtherCAT slave station returning to zero mode

## 2.5 Return to zero mode 5

When 6098h = 5, zero return mode 5 is selected

The CW direction end of HS limit is taken as the reference point, and the first Z signal in CW direction is taken as the zero point.

The starting position is at the CCW direction side of HS limit: the motor first moves to CCW direction at the speed of 6099h-01h back to the mechanical origin, and when it encounters the CCW direction limit, it reverses to CW direction. When HS limit is activated, it decelerates. After leaving the HS limit, the first Z signal is the zero point;

The starting position is on the HS limit: the motor runs at a low speed in the CW direction. After leaving the HS limit, the first Z signal is the zero return point;

The starting position is at CW direction side of HS limit: the motor first moves to CCW direction at the speed of 6099h-01h returning to the mechanical origin, activates HS limit and then decelerates to CW square. After leaving the HS limit, the first Z signal is the zero return point;

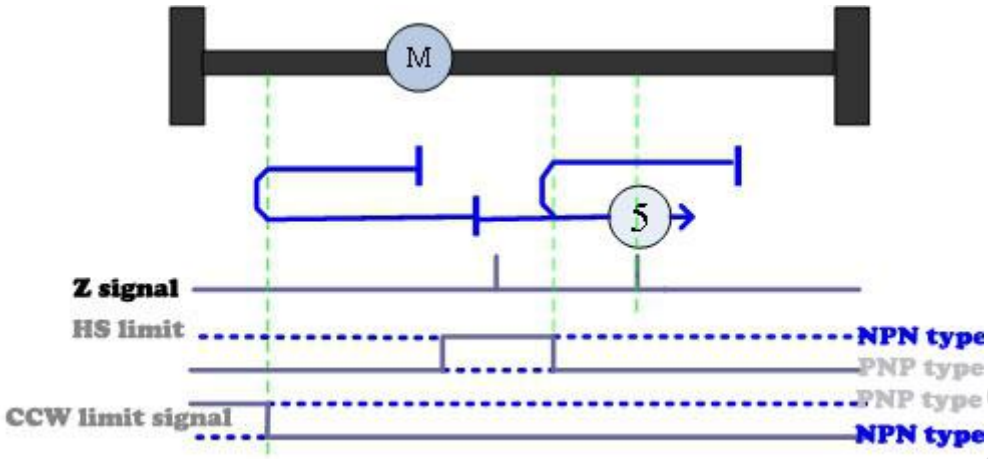



Fig. 169 schematic diagram of five track of JMC EtherCAT slave station returning to zero mode

## 2.6 Return to zero mode 6

When 6098h = 6, zero return mode 6 is selected

The CW direction end of HS limit is taken as the reference point, and the first Z signal in CCW direction is taken as the zero point.

The starting position is at the CCW direction side of HS limit: the motor first moves towards CW direction at the speed of 6099h-01h returning to the mechanical origin, and then reverses to the CW direction when it encounters the CCW direction limit. When the HS limit is activated, it will slow down, and after leaving the HS limit, it will run at a low speed in the CCW direction. When the HS limit is activated, the first Z signal will be the zero point;

The starting position is on the HS limit: the motor runs at a low speed in the CW direction. When the motor leaves the HS limit, it runs in the CCW direction at a low speed. After the HS limit is activated, the first Z signal is the zero point;

The starting position is at CW direction side of HS limit: the motor first moves to CCW direction at the speed of 6099h-01h returning to the mechanical origin. After activating HS limit, the first Z signal is the zero point return;

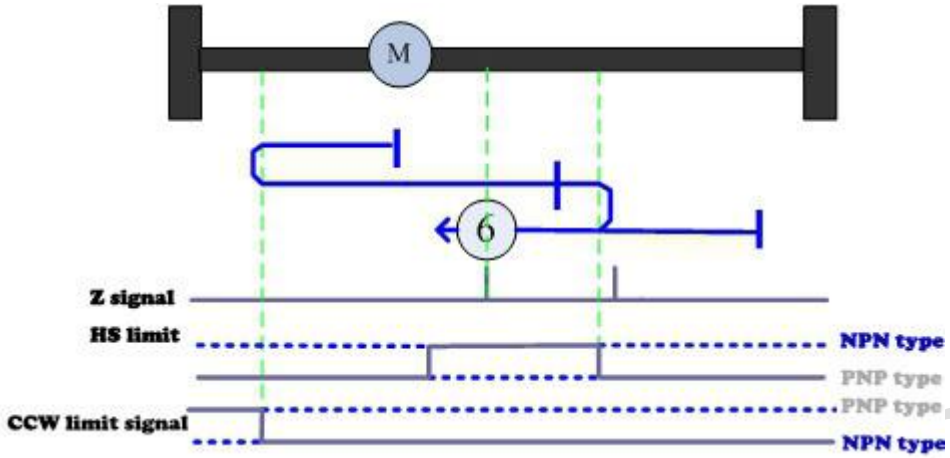



图 14 杰美康 EtherCAT 从站回零方式六轨迹示意图

## 2.7 Return to zero mode 7

When 6098h = 7, zero return mode 7 is selected

The CCW direction end of HS limit is taken as the reference point, and the first Z signal in CCW direction is taken as the zero point.

The starting position is at the CCW direction side of HS limit: the motor first moves to CW direction at the speed of 6099h-01h returning to the mechanical origin. When the HS limit is activated, it decelerates to the CCW direction. After leaving the HS limit, the first Z signal is the zero return point;

The starting position is on the HS limit: the motor runs at a low speed in the CCW direction. After leaving the HS limit, the first Z signal is the zero return point;

The starting position is at CW direction side of HS limit: the motor first moves towards CW direction at the speed of 6099h-01h returning to the mechanical origin. When the CW limit is activated, it decelerates to the CCW direction. After activating the HS limit, the motor runs at a low speed in the CCW direction. After leaving the HS limit, the first Z signal is the zero point return;

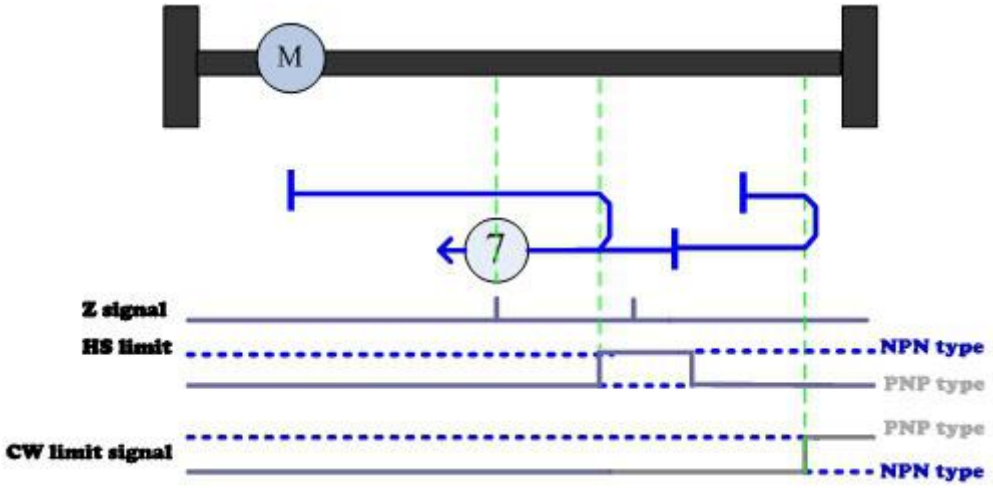



图 15 杰美康 EtherCAT 从站回零方式七轨迹示意图

## 2.8 Return to zero mode 8

When 6098h = 8, zero return mode 8 is selected

The CCW direction end of HS limit is taken as the reference point, and the first Z signal in CW direction is taken as the zero point.

The starting position is at the CCW direction side of HS limit: the motor first moves towards CW direction at the speed of 6099h-01h returning to the mechanical origin. After the HS limit is activated, the first Z signal is the zero point return;

The starting position is on the HS limit: the motor runs at a low speed in the CCW direction. When the motor leaves the HS limit, it runs at a low speed in the CW direction in the reverse direction. After the HS limit is activated, the first Z signal is the zero point;

The starting position is at CW direction side of HS limit: the motor first moves to CW direction at 6099h-01h returning to mechanical origin speed. When CW limit is activated, it decelerates to CCW direction. After HS limit is activated, motor runs in CCW direction at extreme speed. After leaving HS limit, it runs at low speed in CW direction in reverse direction. After activating HS limit, the first Z signal is return to zero point;

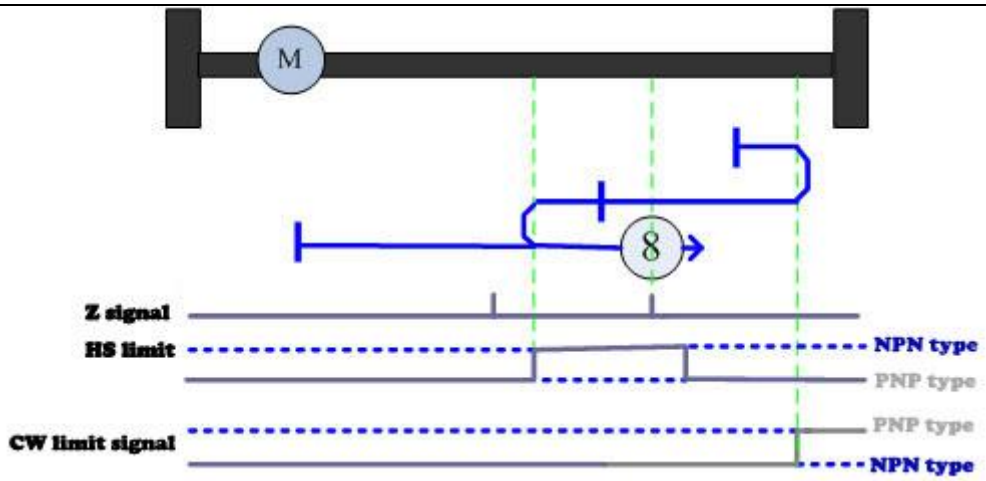



Figure 173 Schematic diagram of Eight trajectories for DomiNO EtherCAT back to zero from a station

## 2.9 Return to zero mode 9

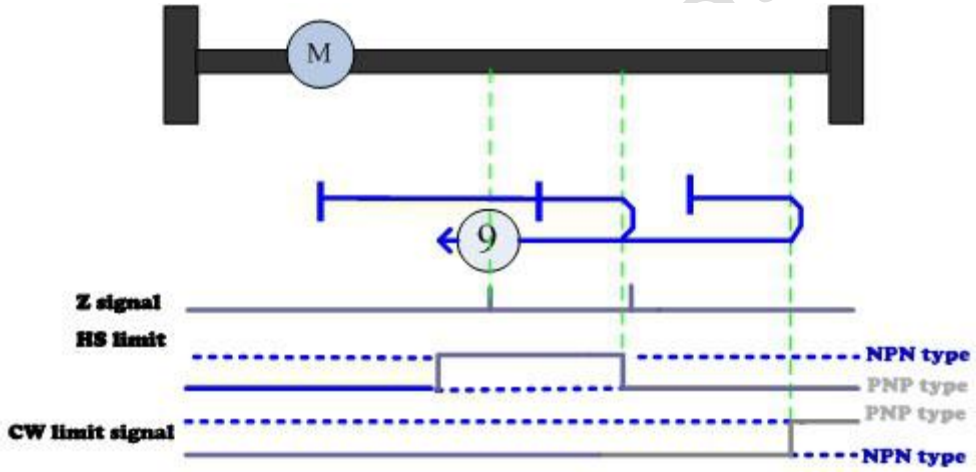



Figure 173 Schematic diagram of Eight trajectories for DomiNO EtherCAT back to zero from a station

When 6098h = 9, select return to zero mode 9:

The CW end of HS limit is taken as the reference point, and the first Z signal in CCW direction is taken as the zero point.

The starting position is in the DIRECTION of HS limit CCW: The motor first moves in the direction of CW at the speed of 6099H-01h back to the mechanical origin. After the HS limit is activated and then leaves, it runs in the opposite direction of CCW. When the HS limit is activated again, the first Z signal is back to the zero origin.

The starting position is on the HS limit: the motor runs at low speed in the DIRECTION of CW. After leaving the HS limit, the motor runs at low speed in the direction of CCW in reverse. The first Z signal after activating the HS limit is back to the zero origin.

The starting position is on the CW side of HS limit: The motor first moves in the CW direction at the speed of 6099H-01h back to the mechanical origin. When the CW limit is activated, it slows down and runs in the CCW direction. After the HS limit is activated, the first Z signal returns to the zero origin.

## 2.10 Return to zero mode 10

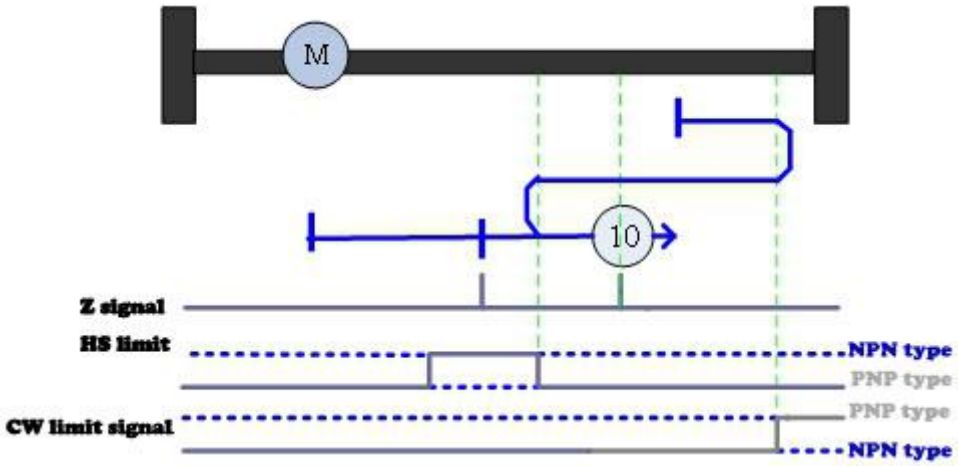



Fig. 175 schematic diagram of 10 track of JMC EtherCAT slave station returning to zero mode

When 6098h = 10, select return to zero mode 10:

Take the CW direction end of HS limit as reference point, and the first Z signal in the CW direction as zero point.

The starting position is in the DIRECTION of HS limit CCW: The motor first moves in the direction of CW at the speed of 6099H-01h back to the mechanical origin. After the HS limit is activated and then leaves, the first Z signal returns to the zero origin.

The starting position is on the HS limit: the motor runs at low speed in the direction of CW. When it leaves the HS limit, the first Z signal returns to the zero origin.

The motor first moves towards the CW at the speed of 6099H-01h back to the mechanical origin. When the CW limit is activated, it slows down and runs in the CCW direction. When the HS limit is activated, it runs in the opposite direction to the CW.

## 2.11 Return to zero mode 11

When 6098h = 11, select return to zero mode xi:

Take the CW direction end of HS limit as reference point, and the first Z signal in the CW direction as zero point.

The motor first moves towards the CCW direction at the speed of 6099H-01h back to the mechanical origin. When the CCW limit is activated, it decelerates to the CW direction. After the HS limit is activated and then leaves, the first Z signal returns to the zero origin.

The starting position is on the HS limit: the motor runs at low speed in the direction of CW. When it leaves the HS limit, the first Z signal returns to the zero origin.

The starting position is on the CW side of HS limit: The motor first moves in the CCW direction at the speed of 6099H-01h back to the mechanical origin. When the HS limit is activated, it moves in the opposite direction to the CW. The first Z signal after leaving the HS limit is back to the zero origin.

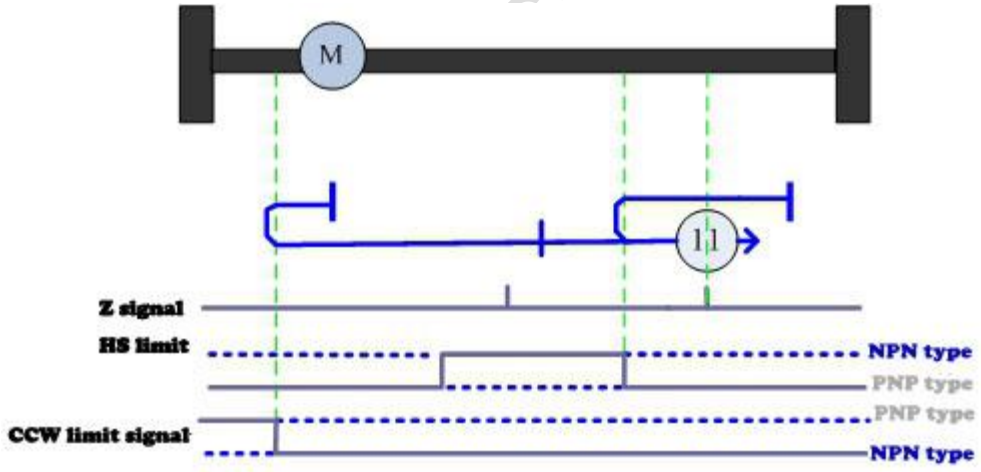



Figure 176 schematic diagram of return to zero mode 11 track of JMC EtherCAT slave station

## 2.12 Return to zero mode 12

When 6098h = 12, select zero return mode 12:

The CW end of HS limit is taken as the reference point, and the first Z signal in CCW direction is taken as the zero point.

The motor first moves towards the CCW direction at the speed of 6099H-01h back to the mechanical origin. When the CCW limit is activated, it slows down to the CW direction.

After the HS limit is activated and then leaves, it moves towards the CCW direction at low speed.

The starting position is on the HS limit: the motor runs at low speed in the DIRECTION of CW. After leaving the HS limit, the motor runs at low speed in the direction of CCW. When the HS limit is activated, the first Z signal returns to the zero origin.

The starting position is in the CW direction of HS limit: the motor first moves in the CCW direction at the speed of 6099H-01h back to the mechanical origin. After the HS limit is activated, the first Z signal returns to the zero origin.

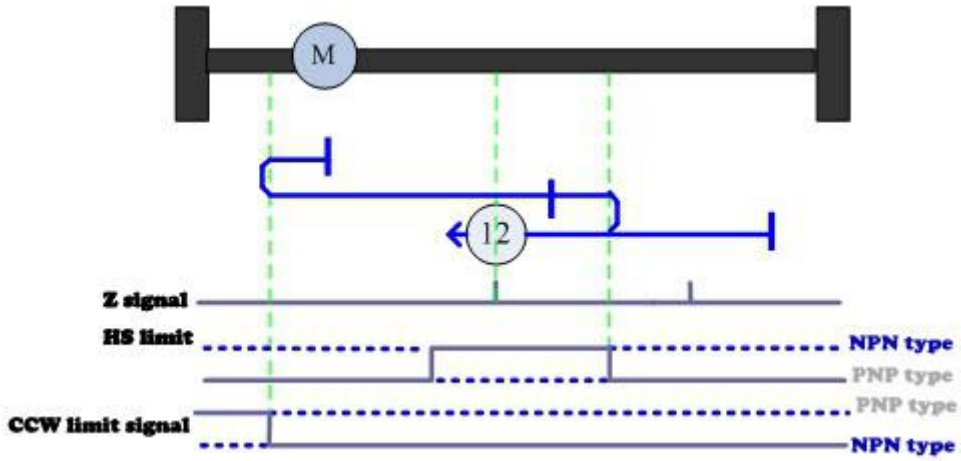



图 16 杰美康 EtherCAT 从站回零方式十二轨迹示意图

## 2.13 Return to zero mode 13

When 6098h = 13, select return to zero mode xiII:

Take CCW direction end of HS limit as reference point and the first Z signal in CW direction as zero point.

The motor first moves towards the CCW direction at the speed of 6099H-01h back to the mechanical origin. When the CCW limit is activated, it decelerates to the CW direction. After the HS limit is activated, the first Z signal returns to the zero origin.

The starting position is on the HS limit: the motor runs at low speed in the CCW direction. After leaving the HS limit, the motor runs at low speed in the CW direction. When the HS limit is activated, the first Z signal returns to the zero origin.

The starting position is on the CW side of HS limit: The motor first moves towards the CCW direction at the speed of 6099H-01h back to the mechanical origin. After activating the HS limit and leaving the HS limit, the motor operates at low speed in the

direction of CW. After activating the HS limit, the first Z signal returns to the zero origin.

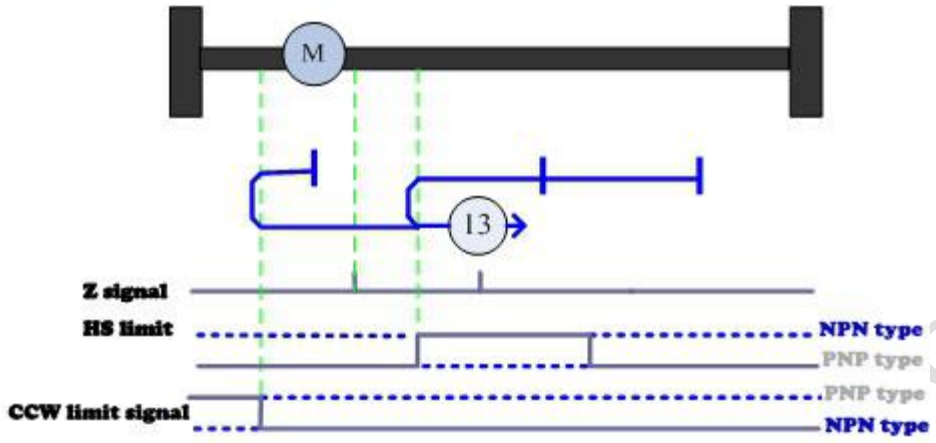



Fig. 178 schematic diagram of 13 track of JMC EtherCAT slave station return to zero mode

## 2.14 Return to zero mode 14

When 6098h = 14, select return to zero mode xiv:

Take CCW direction end of HS limit as reference point and the first Z signal of CCW direction as zero point.

The motor first moves in the CCW direction at the speed of 6099H-01h back to the mechanical origin. When the CCW limit is activated, it runs in the opposite direction of CW. After the HS limit is activated, it runs in the opposite direction of CCW at low speed.

The starting position is on the HS limit: the motor runs at low speed towards CCW direction. When it leaves the HS limit, the first Z signal is back to the zero origin.

The starting position is in the CW direction of HS limit: the motor first moves towards the CCW direction at the speed of 6099H-01h back to the mechanical origin. After activation and leaving the HS limit, the first Z signal returns to the zero origin.

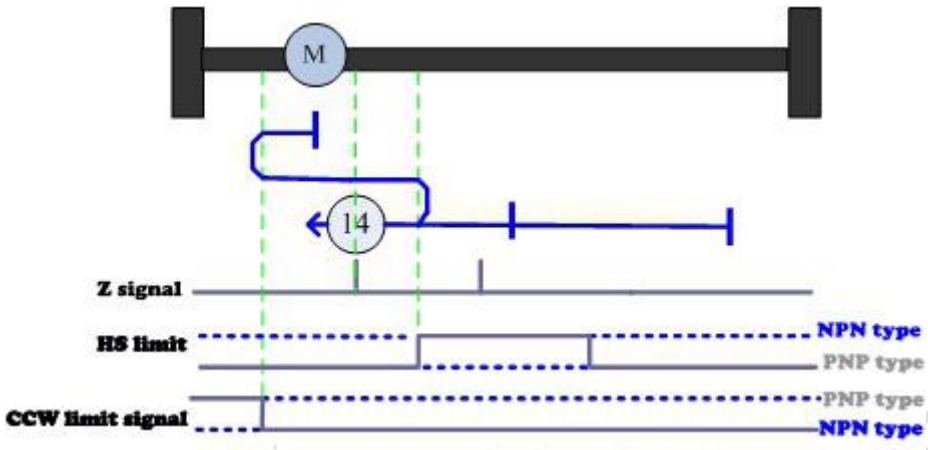



Figure 179 schematic diagram of 14 track in homing mode of JMC EtherCAT slave station

## 2.15 Return to zero mode 15

The return to zero mode is reserved. When the return to zero mode is selected, there is NO action.

## 2.16 Return to zero mode 16

The return to zero mode is reserved. When the return to zero mode is selected, there is NO action.

## 2.17 Return to zero mode 17

When 6098h = 17, select return to zero mode seventeen:
Take the CW direction end of the CCW direction limit as the zero point

The starting position is on the limit of CCW: The motor runs at a low speed in the direction of CW, Stop when leaving CCW limit, this point is the zero return origin;

The starting position is in the CW direction of CCW limit: the motor moves in the direction of CCW at the speed of 6099h-01h back to the mechanical origin. After the CCW limit is activated, the motor runs at a low speed in the direction of CW. Stop when leaving CCW limit, this point is the zero return origin;

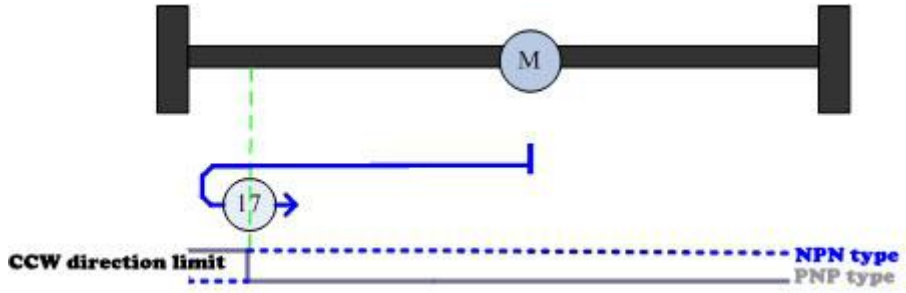



Fig. 180 17 trajectory diagram of EtherCAT slave return to zero mode

## 2.18 Return to zero mode 18

When 6098h = 18, select return to zero mode 18:

Take the CCW direction end of the CW direction limit as the zero point.

The starting position is on the CW limit: the motor runs at a low speed in the direction of CCW, Stop when leaving CW limit, this point is the zero return origin;

The starting position is in the direction of CW limit CCW: the motor moves in the direction of CW at the speed of 6099h-01h back to the mechanical origin. After the CW limit is activated, it runs at a low speed in the direction of CCW, Stop when leaving CW limit, this point is the zero return origin;

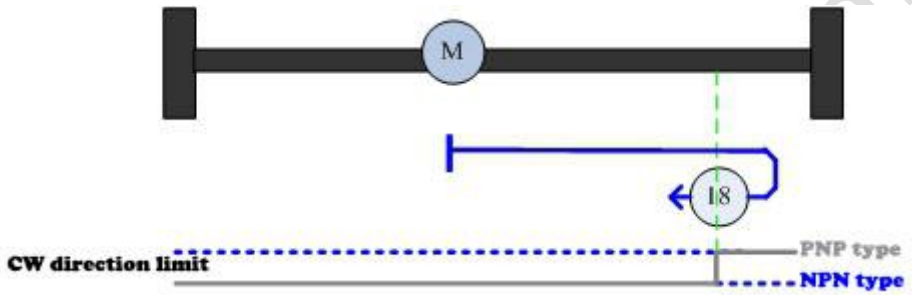



Fig. 181 18 trajectory diagram of EtherCAT slave return to zero mode

## 2.19 Return to zero mode 19

When 6098h = 19, select return to zero mode 19:

Take the HS limit CCW direction end as the zero point。

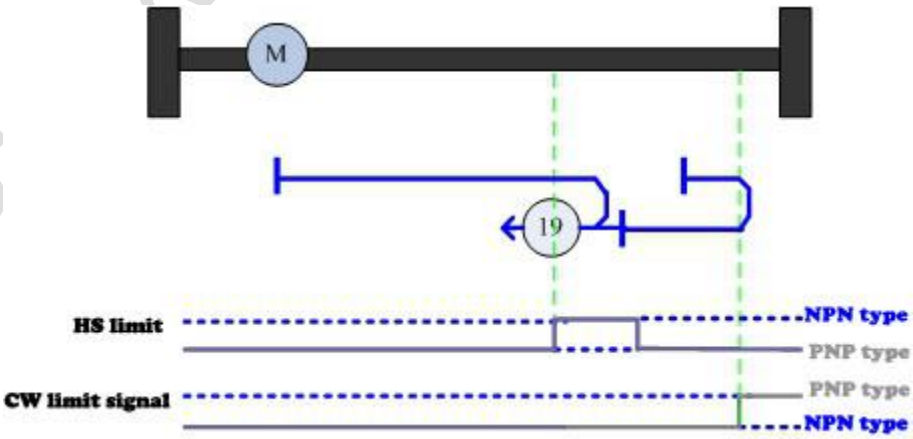



Fig. 182 19 trajectory diagram of EtherCAT slave return to zero mode

## 2.20 Return to zero mode 20

When 6098h = 20, select return to zero mode 20:

The CCW direction end of HS limit is zero.

The starting position is in the direction of HS limit CCW: the motor moves in the direction of CW at the speed of 6099h-01h back to the mechanical origin. It stops when the HS limit is activated, and this point is the zero return point;

The starting position is above the HS limit: the motor runs at a low speed in the direction of CCW. When it leaves the HS limit, it runs in the direction of CW. When the HS limit is activated again, it stops, and this point is the zero return origin;

The starting position is at the CW side of the HS limit: the motor moves back to the mechanical origin at 6099h-01h in the CW direction. When the CW limit is activated, it runs in the reverse direction to CCW,After activating the HS limit, it decelerates at low speed,After leaving the HS limit, it runs in the reverse direction of CW,When the HS limit is activated again, it stops, and this point is the zero return origin;

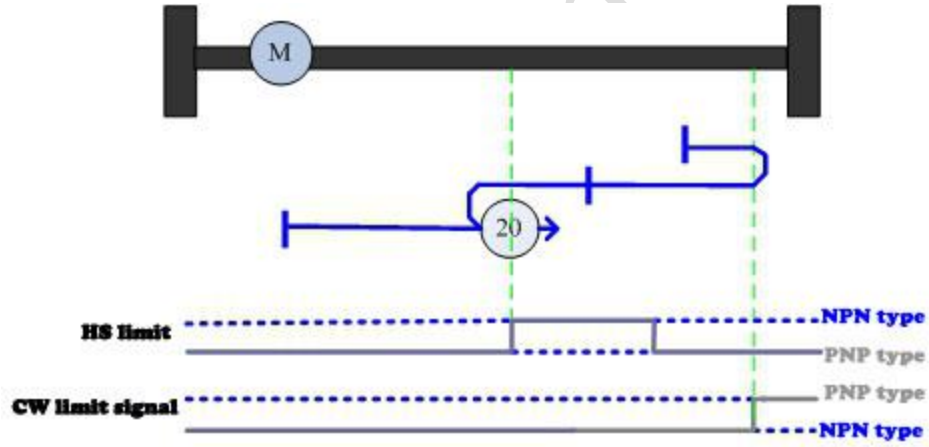



Figure 183 Schematic diagram of 20 trajectories for DomiNO EtherCAT returning from the station to zero mode

## 2.21 Return to zero mode 21

When 6098h = 21, select return to zero mode 21:

The CW directional end with HS limit is zero.

The starting position is in the direction of CCW of HS limit:The motor first moves in the direction of CCW at the speed of 6099h-01h back to the mechanical origin,When the CCW limit is activated, it runs in the reverse direction of CW,After activating the HS limit, it decelerates at low speed, Stop when leaving the HS limit, this point is the zero return origin;

The starting position is above the HS limit: the motor runs at a low speed in the direction of CW, Stop when leaving the HS limit, this point is the zero return origin;

The starting position is in the direction of CW of HS limit: the motor moves in the direction of CCW at the speed of 6099h-01h back to the mechanical origin. When the HS limit is activated, it runs in the reverse direction to the CW direction at low speed,Stop when leaving the HS limit, this point is the zero return origin;

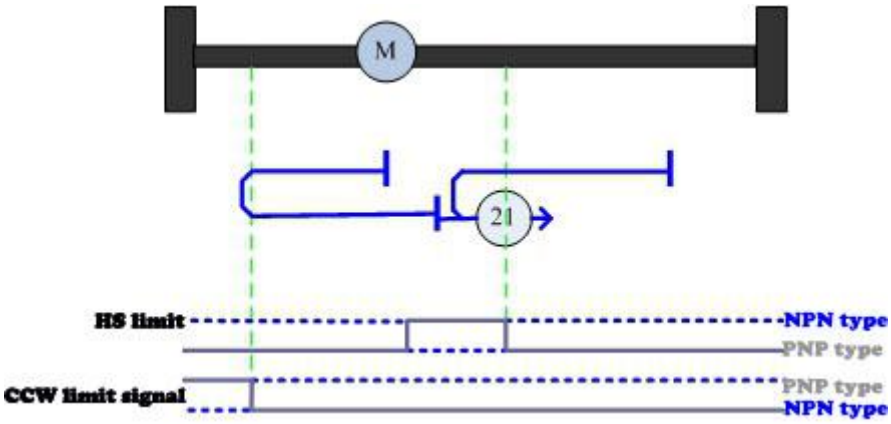



Fig. 184 21 trajectory diagram of EtherCAT slave return to zero mode

## 2.22 Return to zero 22

When 6098h = 22, select zero return mode 22:
Take the CW end of HS limit as zero.
The motor first moves towards the CCW direction at the speed of 6099H-01h back to the mechanical origin. When the CCW limit is activated, it runs in the opposite direction to CW. When the HS limit is activated, it slows down and runs at low speed.
The starting position is on the HS limit: the motor runs at low speed in the DIRECTION of CW. After leaving the HS limit, the motor runs in the opposite direction of CCW. When the HS limit is activated, the motor stops.
The starting position is in the CW direction of HS limit: the motor first moves towards the CCW direction at the speed of 6099H-01h back to the mechanical origin, and stops when the HS limit is activated, which is the return to the zero origin.

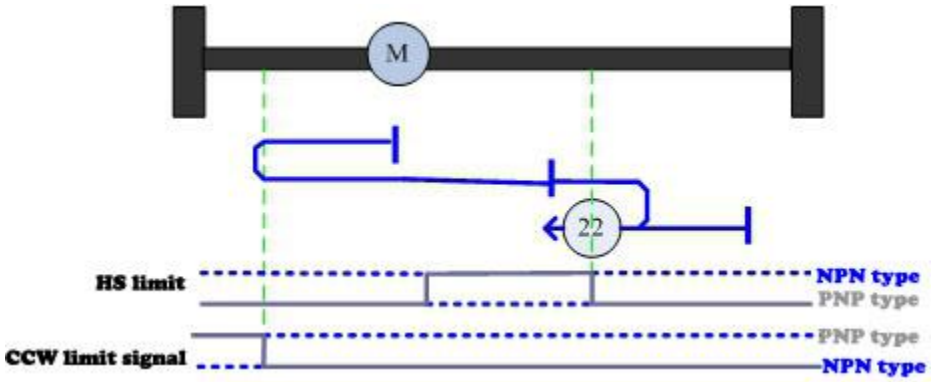



Fig. 185 schematic diagram of 22 track of jemecon EtherCAT slave station return to zero mode

## 2.23 Return to zero mode 23

When 6098h = 23, select return to zero mode 23:

The CCW direction end of HS limit is zero.

The starting position is in the direction of the HS limit CCW: the motor moves in the CW direction at the speed of 6099h-01h back to the mechanical origin. After the HS limit is activated, the motor runs in the reverse direction of CCW. It stops when the HS limit is activated, and this point is the zero return origin;

The starting position is above the HS limit: the motor runs at a low speed in the direction of CCW, It stops when the HS limit is activated, and this point is the zero return origin;

The starting position is at the CW direction of HS limit: the motor moves in the CW direction at the speed of 6099h-01h back to the mechanical origin. When the CW limit is activated, the motor runs in the reverse direction of CCW. When the HS limit is activated, it decelerates, It stops when the HS limit is activated, and this point is the zero return origin;

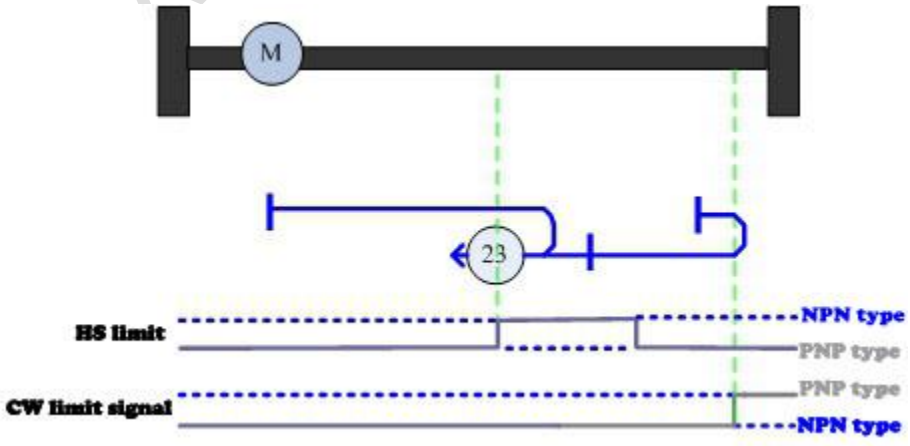



Fig. 186 23 trajectory diagram of EtherCAT slave return to zero mode

## 2.24 Return to zero mode 24

When 6098h = 24, select return to zero mode 24:

The CCW direction end of HS limit is zero.

The starting position is in the direction of the HS limit CCW: the motor moves in the direction of CW at the speed of 6099h-01h back to the mechanical origin, It stops when the HS limit is activated, and this point is the zero return origin;

The starting position is above the HS limit: at low speed, it runs in the direction of CCW. After leaving the HS limit, it runs in the reverse direction of CW, It stops when the HS limit is activated, and this point is the zero return origin;

Starting position in the HS limit the CW direction side: the motor to the CW direction in 6099-01 h h back to the origin of the mechanical movement speed, When the limit in the CW direction is activated, it runs in the reverse direction to the CCW,After activating the HS limit, decelerate to CCW direction,After leaving the HS limit, it runs in the reverse direction of CW, It stops when the HS limit is activated, and this point is the zero return origin;

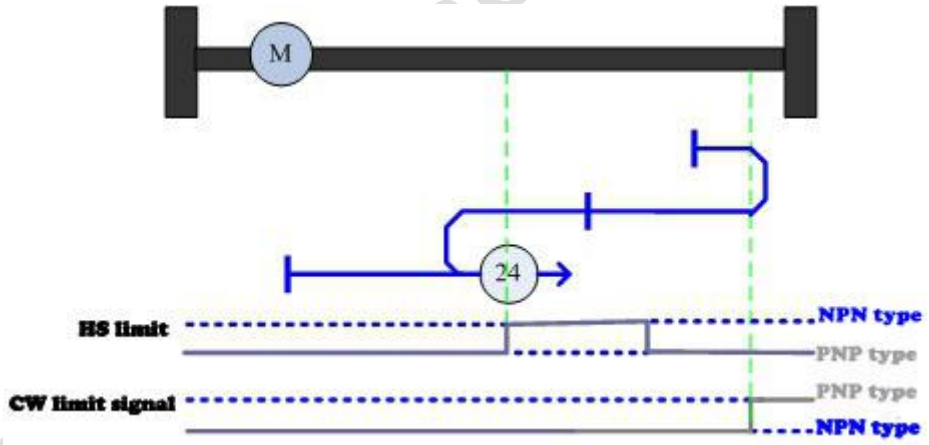



Fig. 187 24 trajectory diagram of EtherCAT slave return to zero mode

## 2.25 Return to zero mode 25

When 6098h = 25, select return to zero mode 25:

Take the CW direction end of the HS limit as the zero point。

The starting position is in the direction of the HS limit CCW: the motor moves in the direction of CW at the speed of 6099h-01h back to the mechanical origin.

After activating the HS limit and then leaving, it runs in the reverse direction to CCW at low speed,

It stops when the HS limit is activated, and this point is the zero return origin;

The starting position is above the HS limit: run in the direction of CCW at a low speed, After leaving the HS limit, it runs in the CCW direction at low speed, It stops when the HS limit is activated, and this point is the zero return origin;

The starting position is on the CW side of HS limit: the motor moves in the CW direction at the speed of 6099h-01h back to the mechanical origin. When the limit in the CW direction is activated, it runs in the reverse direction to the CCW, It stops when the HS limit is activated, and this point is the zero return origin;

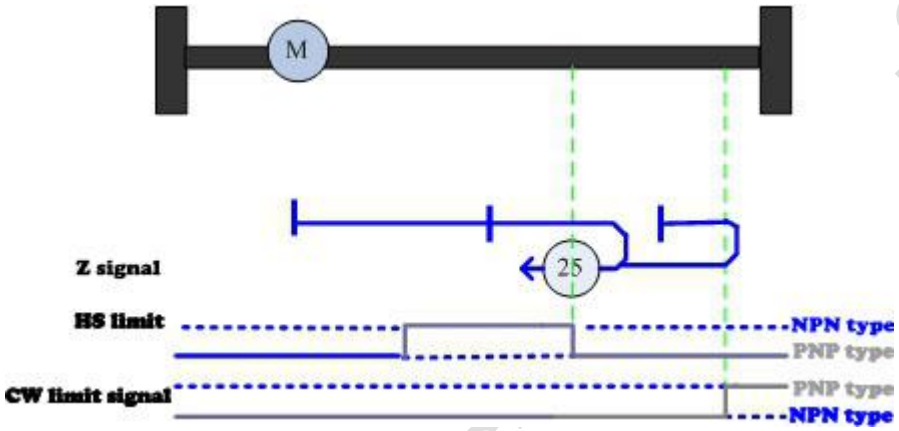



Fig. 188 25 trajectory diagram of EtherCAT slave return to zero mode

## 2.26 Return to zero mode 26

When 6098h = 26, select return to zero mode 26:

Take the CW direction end of the HS limit as the zero point。

The starting position is in the direction of the HS limit CCW: the motor moves in the direction of CW at the speed of 6099h-01h back to the mechanical origin,After activating the HS limit, decelerate to run in the direction of CW, Stop when leaving the HS limit, this point is the zero return origin;

The starting position is above the HS limit: Run at low speed in the direction of CW, Stop when leaving the HS limit, this point is the zero return origin;

The starting position is on the CW side of HS limit: the motor moves back to the mechanical origin at the speed of 6099h-01h in the CW direction. When the limit in the CW direction is activated, it runs in the reverse direction to the CCW,After activating the HS limit, decelerate to run in the direction of CW, Stop when leaving the HS limit, this point is the zero return origin;

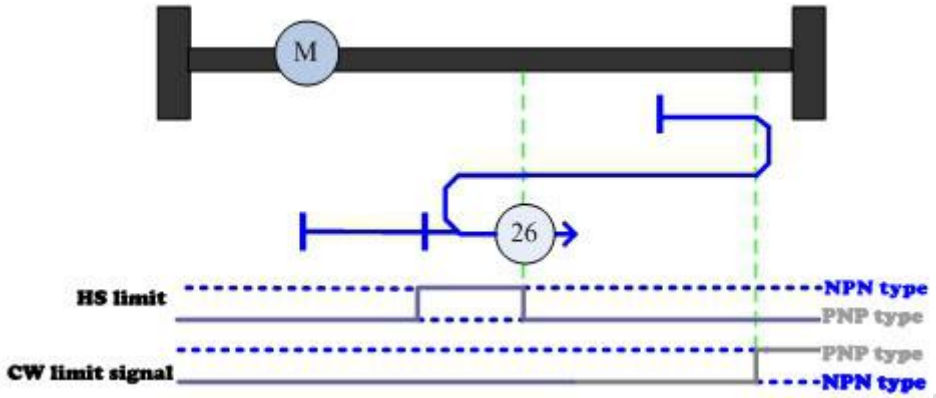



Fig. 189 26 trajectory diagram of EtherCAT slave return to zero mode

## 2.27 Return to zero mode 27

When 6098h = 27, select return to zero mode 27:

Take the CW direction end of the HS limit as the zero point。

The starting position is in the direction of CCW of HS limit:The motor first moves in the direction of CCW at the speed of 6099h-01h back to the mechanical origin,When the CCW limit is activated,it runs in the reverse direction to the CW,,After activating the HS limit, decelerate to run in the direction of CW,Stop when leaving the HS limit, this point is the zero return origin;

The starting position is above the HS limit: run at low speed in the direction of CW, Stop when leaving the HS limit, this point is the zero return origin;

The starting position is in the direction of CW of HS limit: the motor moves back to the mechanical origin at the speed of 6099h-01h in the CW direction. When the limit in the CW direction is activated, it runs in the reverse direction to the CCW,After activating the HS limit, decelerate to run in the direction of CW, Stop when leaving the HS limit, this point is the zero return origin;

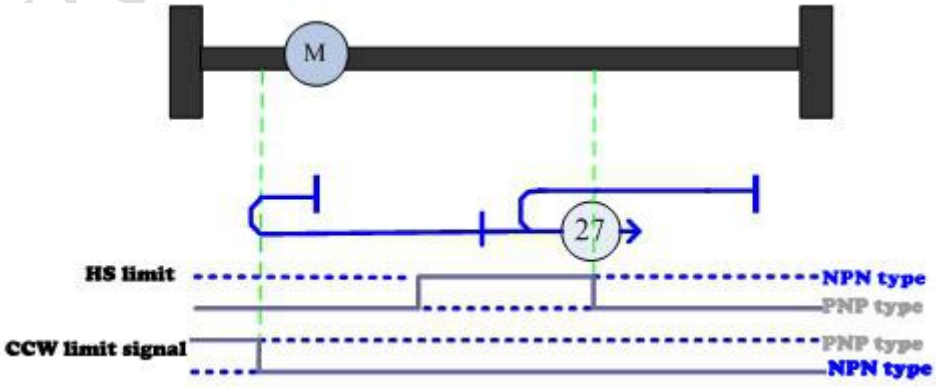



Fig. 190 27 trajectory diagram of EtherCAT slave return to zero mode

## 2.28 Return to zero mode 28

When 6098h = 28, select the zero return method 28:

Take the CW direction end of the HS limit as the zero point.

The starting position is on the side of the HS limit CCW direction: the motor first moves in the CCW direction at a speed of 6099h-01h back to the mechanical origin, When the CCW direction limit is activated, it runs in the reverse direction to the CW, After activating the HS limit, decelerate to run in the direction of CW, It stops when the HS limit is activated again, and this point is the zero return origin;

The starting position is on the HS limit:Run at low speed in the direction of CW. After leaving the HS limit, run at low speed in the direction of CCW in the reverse direction.It stops when the HS limit is activated again, and this point is the zero return origin;

The starting position is on the side of the HS limit CW direction:The motor first moves in the CCW direction at a speed of 6099h-01h back to the mechanical origin,When the limit in the CW direction is activated, it runs in the reverse direction to the CCW, Stop when the HS limit is activated, this point is the zero return point;

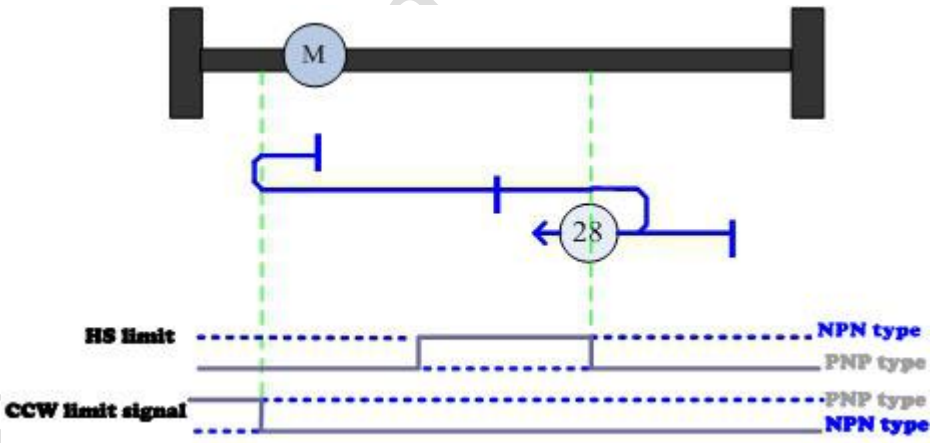



Figure 191 schematic diagram of 28 track in homing mode of JMC EtherCAT slave station

## 2.29 Return to zero mode 29

When 6098h = 29, select the zero return method 29:

The CCW direction end of the HS limit is the zero point.

The starting position is on the CCW direction side of the HS limit: the motor first moves in the CCW direction at 6099h-01h back to the mechanical origin speed. After the CCW direction limit is activated, it runs in the CW direction in the reverse direction

and stops when the HS limit is activated. This point is the zero return origin;

The starting position is on the HS limit:Run at low speed in the direction of CCW. After leaving the HS limit, run in the reverse direction at low speed in the direction of CW. Stop when the HS limit is activated again, this point is the zero return origin

The starting position is on the side of the HS limit CW direction:The motor first moves in the CCW direction at a speed of 6099h-01h back to the mechanical origin,After activating and leaving the HS limit, decelerate to run in the direction of CW, Stop when the HS limit is activated, this point is the zero return point;

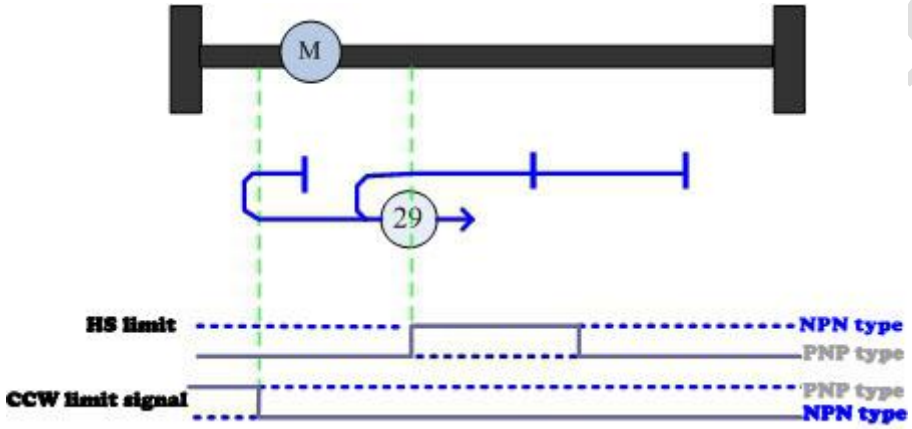



Fig. 192 29 trajectory diagram of EtherCAT slave return to zero mode

## 2.30 Return to zero mode 30

When 6098h = 30, select the zero return method 30:

The CCW direction end of the HS limit is the zero point.

The starting position is on the side of the HS limit CCW direction:The motor first moves in the CCW direction at a speed of 6099h-01h back to the mechanical origin,When the CCW direction limit is activated, it runs in the reverse direction to the CW,After activating the HS limit, it runs in the CCW direction at low speed, Stop when leaving the HS limit, this point is the zero return origin;

The starting position is on the HS limit:Run at low speed in the direction of CCW, Stop when leaving the HS limit, this point is the zero return origin;

The starting position is on the side of the HS limit CW direction:The motor first moves in the CCW direction at a speed of 6099h-01h back to the mechanical origin,After the HS limit is activated, the low speed runs in the direction of CCW, Stop when leaving the HS limit, this point is the zero return origin;

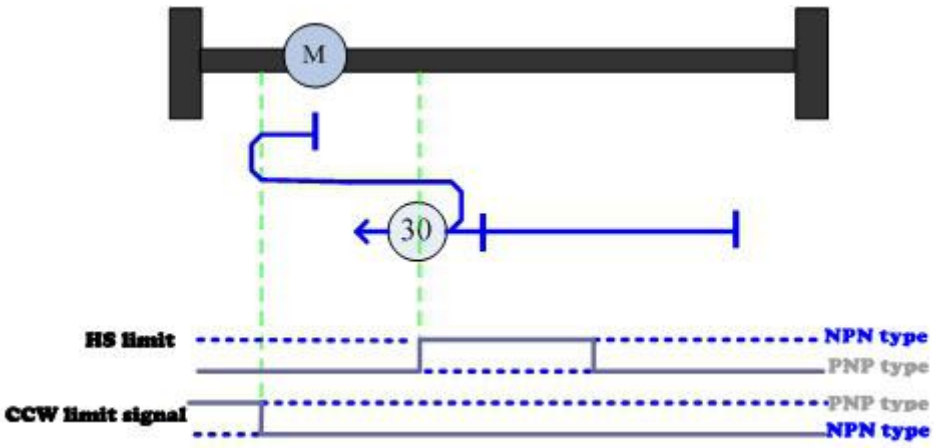



Fig. 193 30 trajectory diagram of EtherCAT slave return to zero mode

## 2.31 Return to zero mode31

The zero return mode is reserved. When the zero return mode is selected, there is NO action.

## 2.32 Return to zero mode 32

The zero return mode is reserved. When the zero return mode is selected, there is NO action.

## 2.33 Return to zero mode 33

When 6098h = 33, select the zero return method 33:

The first Z signal in the CCW direction is the zero point.

The motor runs in the CCW direction and stops when it finds the first Z signal. This point is zero.

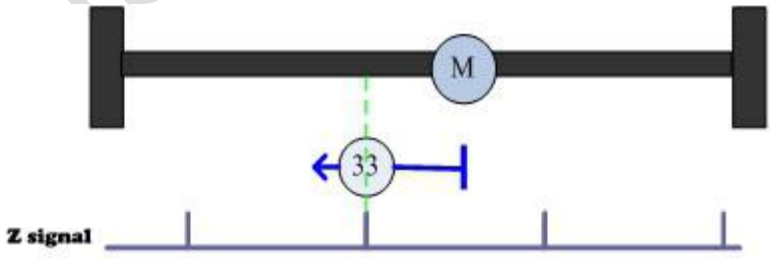



Fig. 194 33 trajectory diagram of EtherCAT slave return to zero mode

## 2.34 Return to zero mode 34

When 6098h = 34, select the zero return method 34:

The first Z signal in the CW direction is the zero point.

The motor runs in the direction of CW and stops when it finds the first Z signal. This point is zero

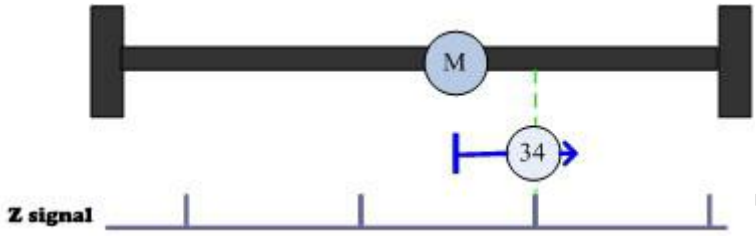



Fig. 195 34 trajectory diagram of EtherCAT slave return to zero mode

## 2.35 Return to zero mode 35

When 6098h = 35, select the zero return method thirty-five:

Take the current point as the zero position.

# 3 PDORecommended configuration of PDO mapping

Recommended configuration of PDO mapping-HM

| RPDO | TPDO | Remark |
|---|---|---|
| 6040h: control word | 6041h: status word | required |
| 6060h: control mode | | required |
| 6098h: Return to zero | 6064h: actual position | optional |
| 609Ah: Return to zero acceleration | 606Ch: actual speed | optional |
| 6099h-01h: Return to Mechanical origin speed | 6061h: Current mode display | optional |
| 6099h-02h: Return to zero offset speed | 60FDh: Digital input | optional |
| 60FEh-01h: Digital output | | optional |

# 4 Application process

Step 1: Check the wiring, including whether the power cord, motor power cord, encoder

cord, and communication cord are connected properly, and then power on after confirming that they are correct.

Step 2: When the power is turned on without any error alarm, the slave will switch from the initial state to the pre-operation state.

Step 3: Configure the drive operating parameters (synchronization cycle, electronic gear ratio, polarity selection, current and other parameters) and PDO mapping parameters. After the configuration is completed, the slave state machine will be switched to the operating parameters.

Step 4: In the case of NO abNormality in the previous step, the 402 state machine is switched to the running enable state, that is, the control word 6040h = 000Fh, under Normal operation, the status word 6041h will be switched to 0027h.

Step 5: Configure the motor operating parameters in HM mode, such as: operating mode 6060h = 6, zero return mode 6098h, zero return acceleration/deceleration speed 609Ah, mechanical return speed to 6099h-01h, zero return offset speed to 6099h-02h, The zero offset is 607Ch.

Step 6: Send the control word 6040h = 001Fh to start the zero return command, and the slave executes the operation.

# Routine

EtherCAT communication operation routine based on TwinCAT3, This routine will use TwinCAT3 of Beckhoff and 2HSS458-EC of JMC as the object to explain the operation of EtherCAT communication.

This routine uses TwinCAT3 embedded in Microsoft Visual Studio 2015 Community. The version number of TwinCAT3 is TC31-FULL-Setup.3.1.4022.30 (users can download it from Beckhoff official website), and the operating platform is Windows10.

Before you start, put the device description file (.XML) of the JMC drive into the D:\TwinCAT\3.1\Config\Io\EtherCAT folder under the installation directory of TwinCAT3.

NOte: Use the intel network card as much as possible for the network port of the PC, otherwise it will cause some brands of drivers to be disconnected due to the large jitter of the network card (Jiemeikang driver will NOt be disconnected, but it will cause jitter in the motor control), For demonstration purposes, NOn-Intel network cards are used here.

## New construction

- Open the software through the icon in the taskbar

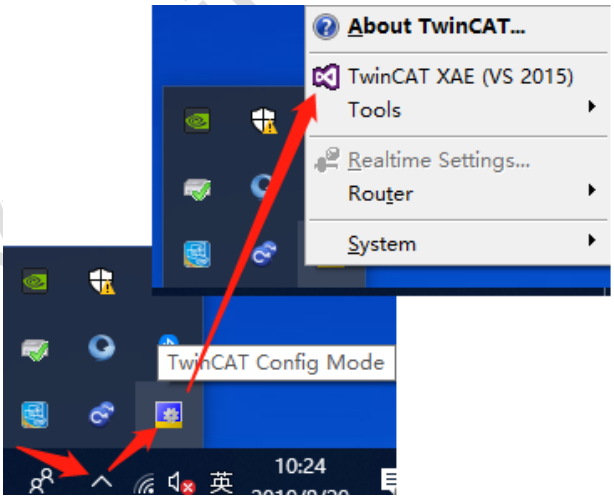



图 17 运行 TwinCAT3

- 
- Click 【New Project】
  Expand【Installed】 → click【Template】 → select【TwinCAT Projects】 → select【TwinCAT XAE Project】
- After confirming the save path and file name, click 【OK】

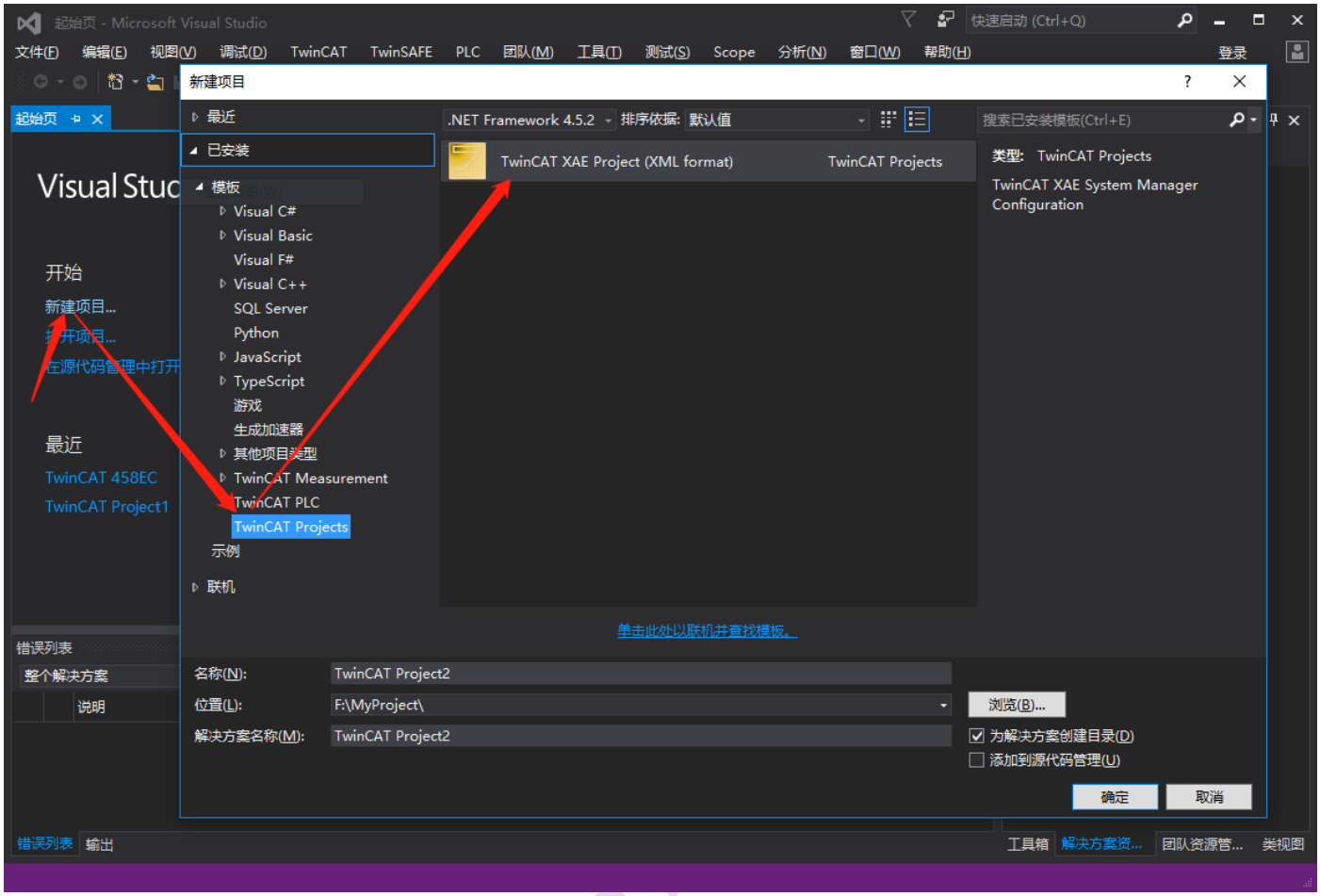



Fig. 197 New TwinCAT project

# Activate the software

- Here we choose the seven-day activation method (you can continue to use this method to activate the software after the expiration). For the complete activation method, please refer to Beckhoff official documentation.
- 

click【SYSTEM】→double-click【License】→Click on the Tab【Manage Licenses】

- Select the license that needs to be activated, and check all if you are NOt sure (the corresponding function will be used, but there will be a pop-up prompt when the license is NOt activated)

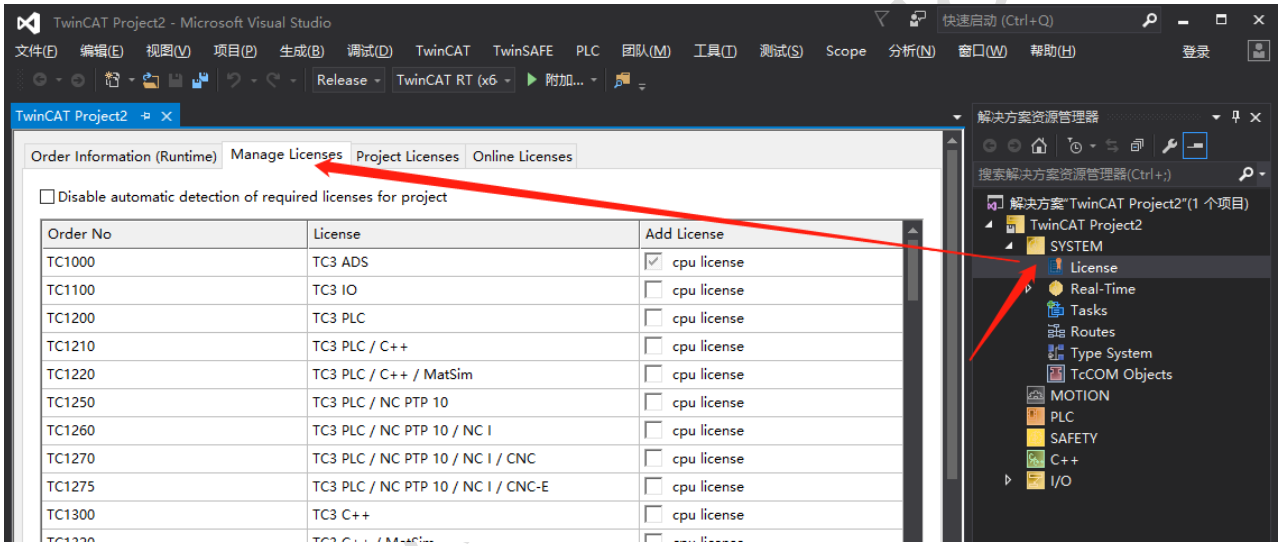



Figure 198 Activate license

- After confirming the activation item, select the tab【Order Information (Runtime)】
- Click【7 Days Trial License】→Click【OK】,If successful, it will prompt the license save path

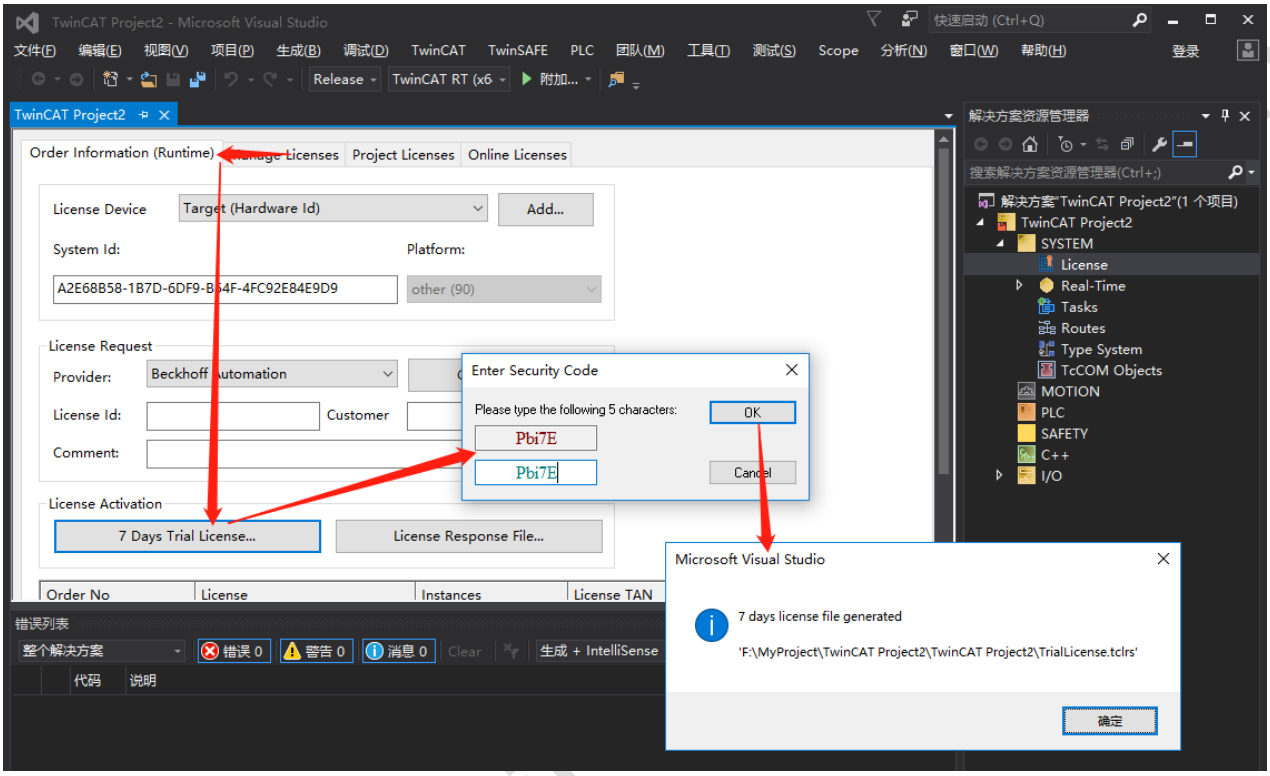



Figure 199 Enter confirmation code

# Network card configuration

- Choose 【TwinCAT】→【Show Realtime Ethernet Compatible Devices】

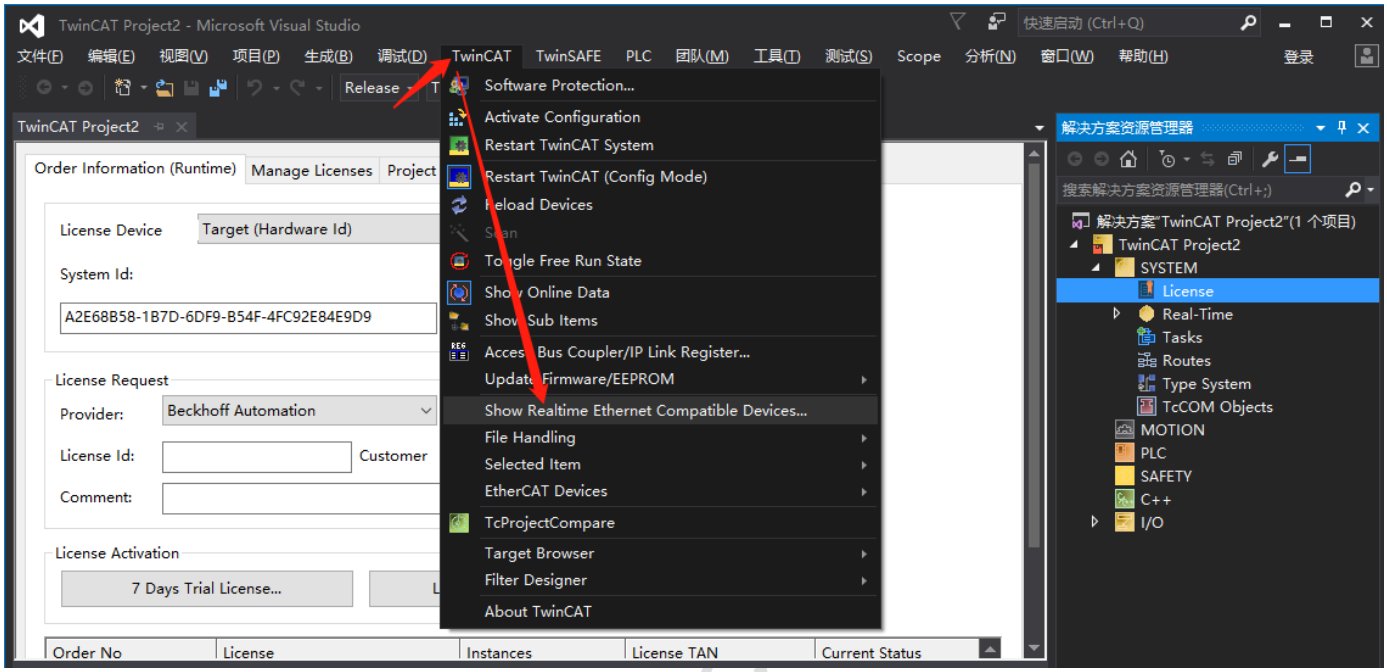



图 18 打开兼容性设备列表

- After selecting the compatible network card in 【Compatible devices】, click 【Install】

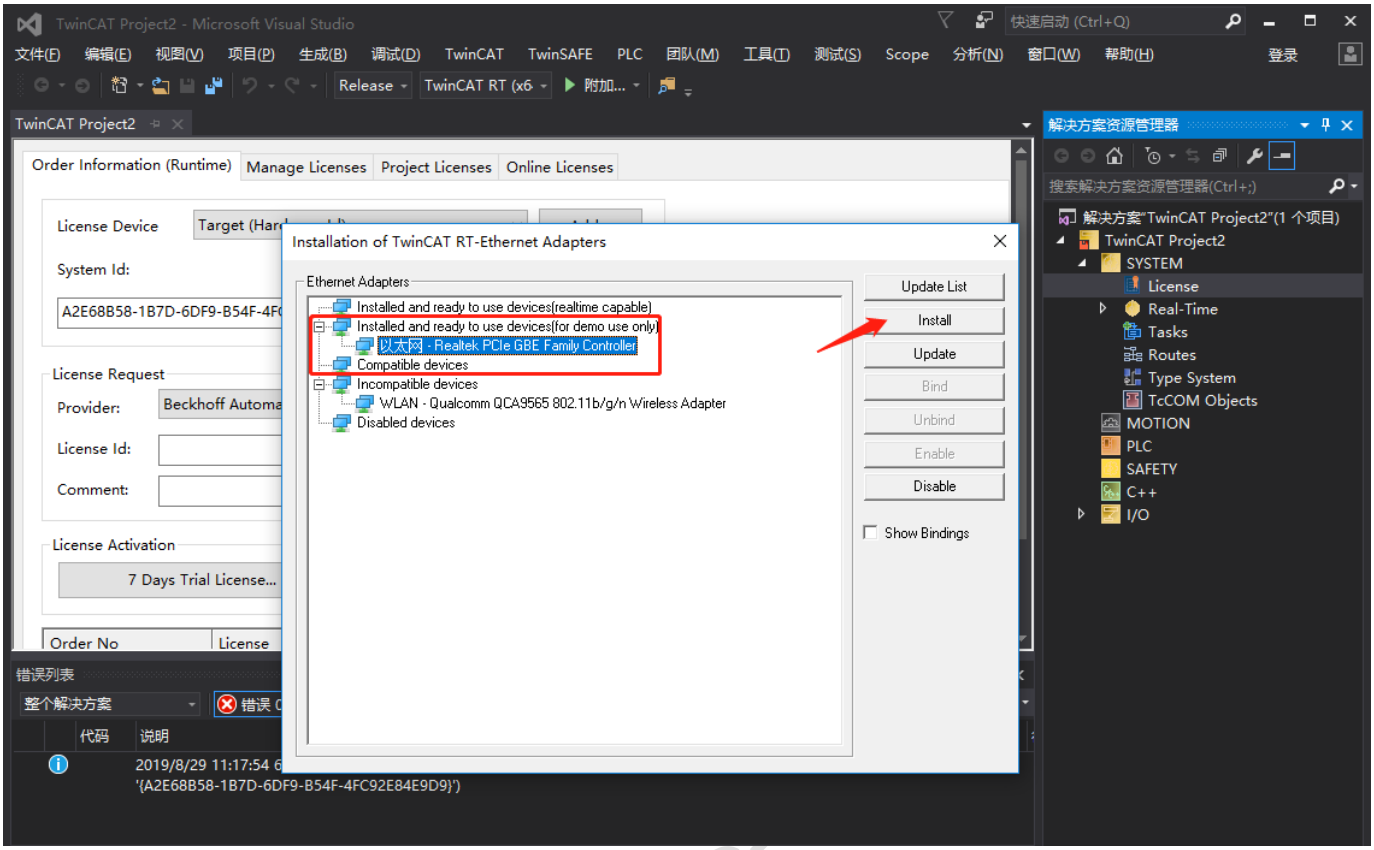



Figure 201 Click on compatible network card

# Configuration engineering

- Select in the project tree【I/O】→right click【Devices】→click【Scan】

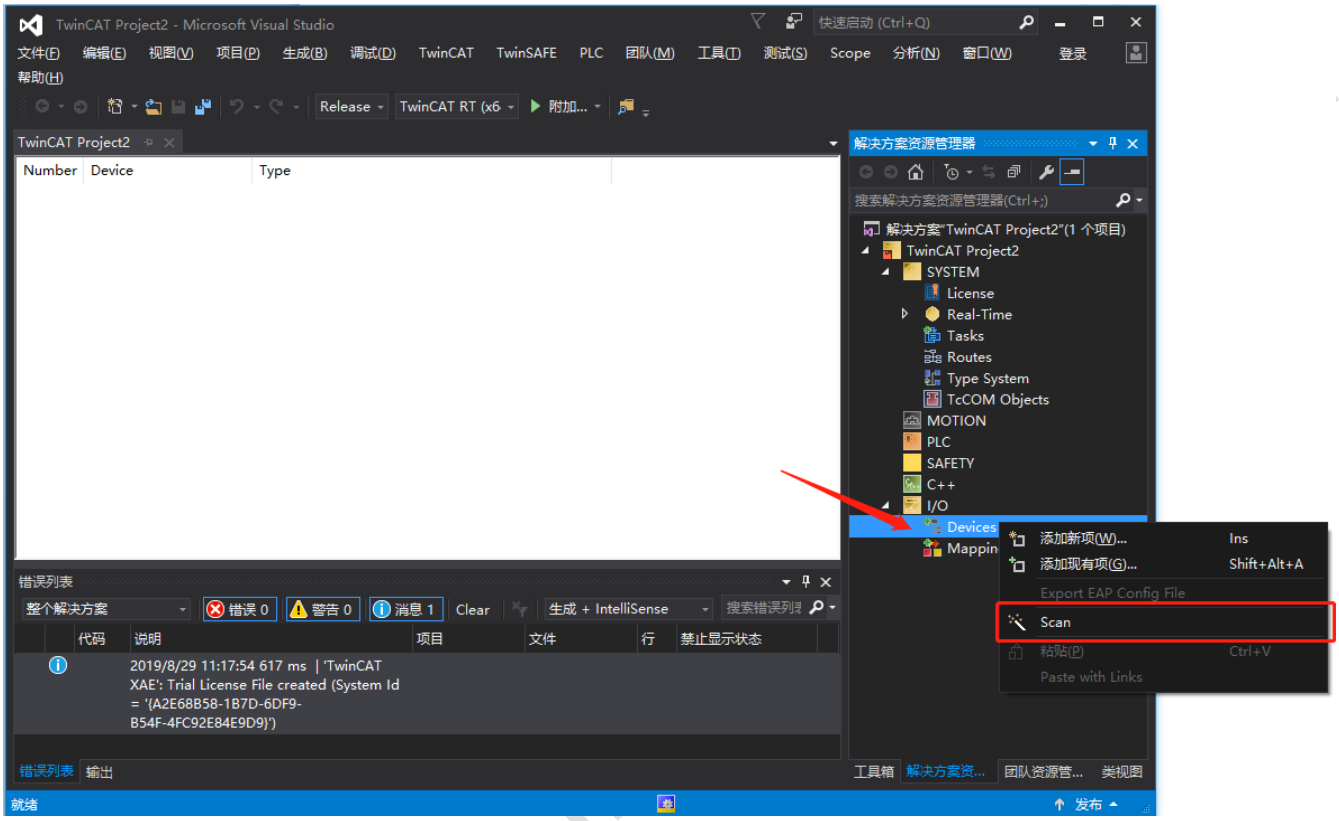



Figure 202 scanning equipment

- pop-up window (NOt all types of devices can be found automatically) ,Click【OK】
- Select the installed network card and click【OK】
- Pop-up window (Scan for boxs), click【Yes】
- Link to the axis, Select【NC - Configuration】,click【OK】
- Pop-up window (Activate Free Run),click【NO】

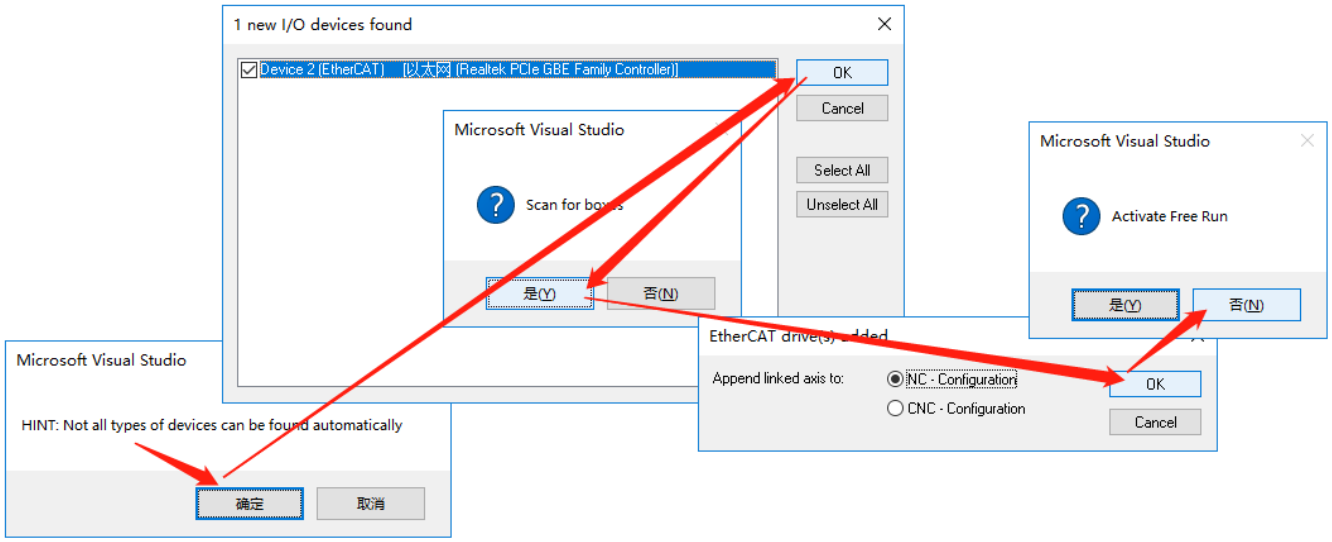



Figure 203 Add IO device

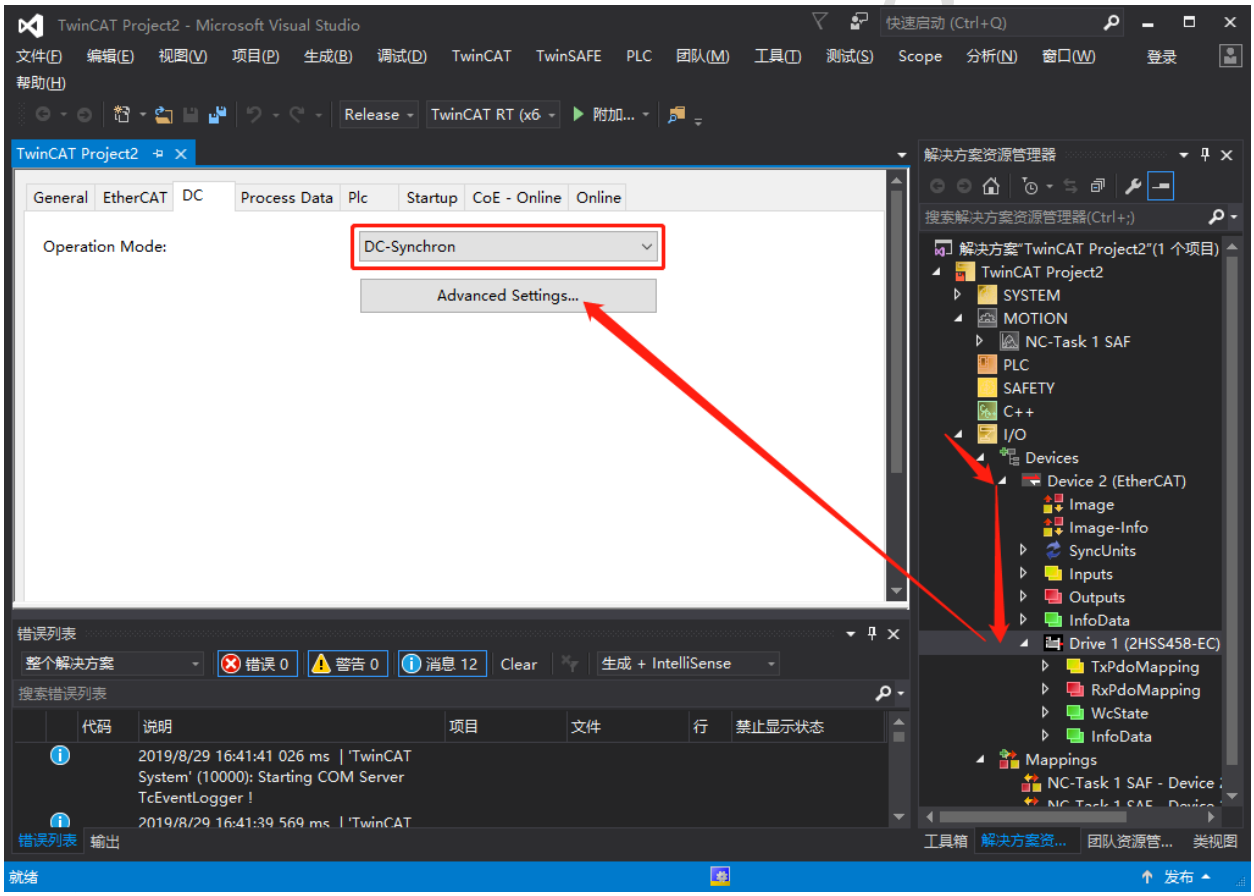



Figure 204 Set distributed clock

- Expand the device tree【Devices】→select【Device 2(EtherCAT)】→double click【Drive

1(2HSS458-EC)】

- Click the tab【DC】→click【Advanced Settings】Perform distributed clock settings

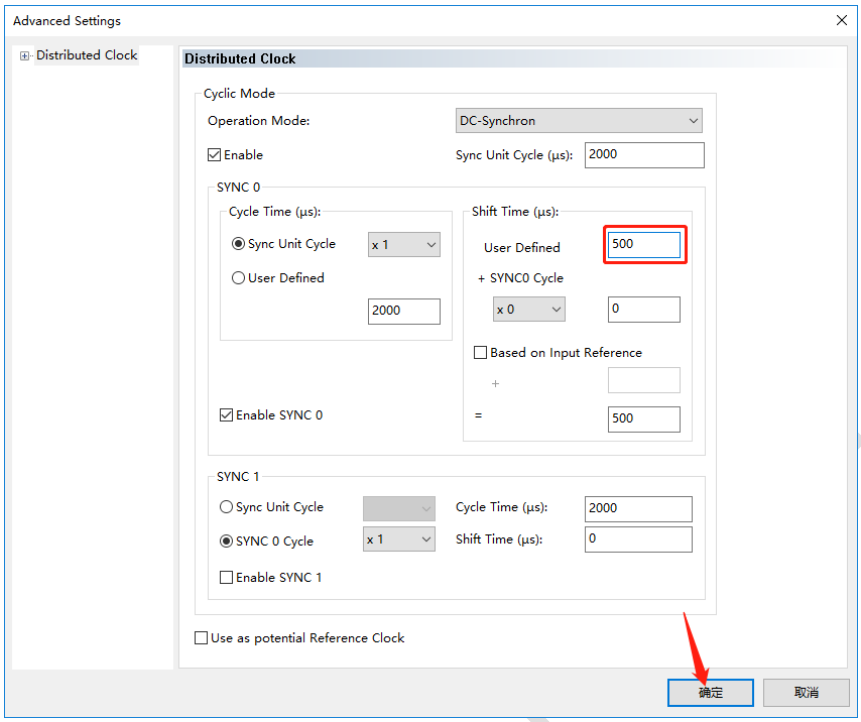



Figure 205 Set offset time

- Expand【MOTION】→【NC-Task 1 SAF】→【Axes】→【Axis 1】→click【Enc】
- Click the tab【Parameter】 → set【Scaling Factor Numerator】 the actual distance corresponding to the encoder pulse number. For example: the drive is subdivided into 4000, and the length of one rotation of the motor is 25.12mm, then the Scaling Factor Number should be 25.12/4000=0.00628mm/Inc.

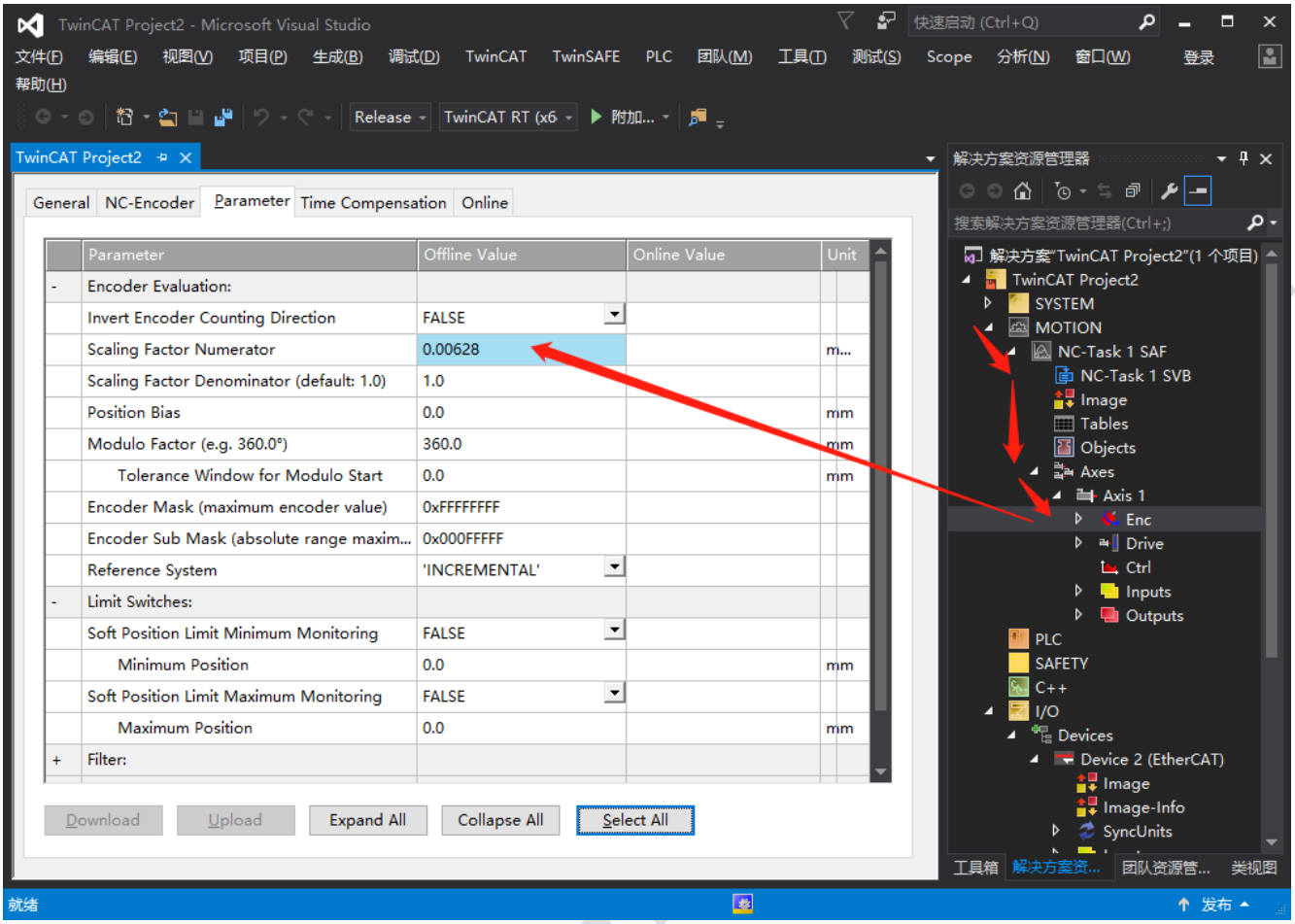



Figure 206 Setting the scale factor

- Click 【Activate Configuration】→【Confirm 】active→【confirm】restart

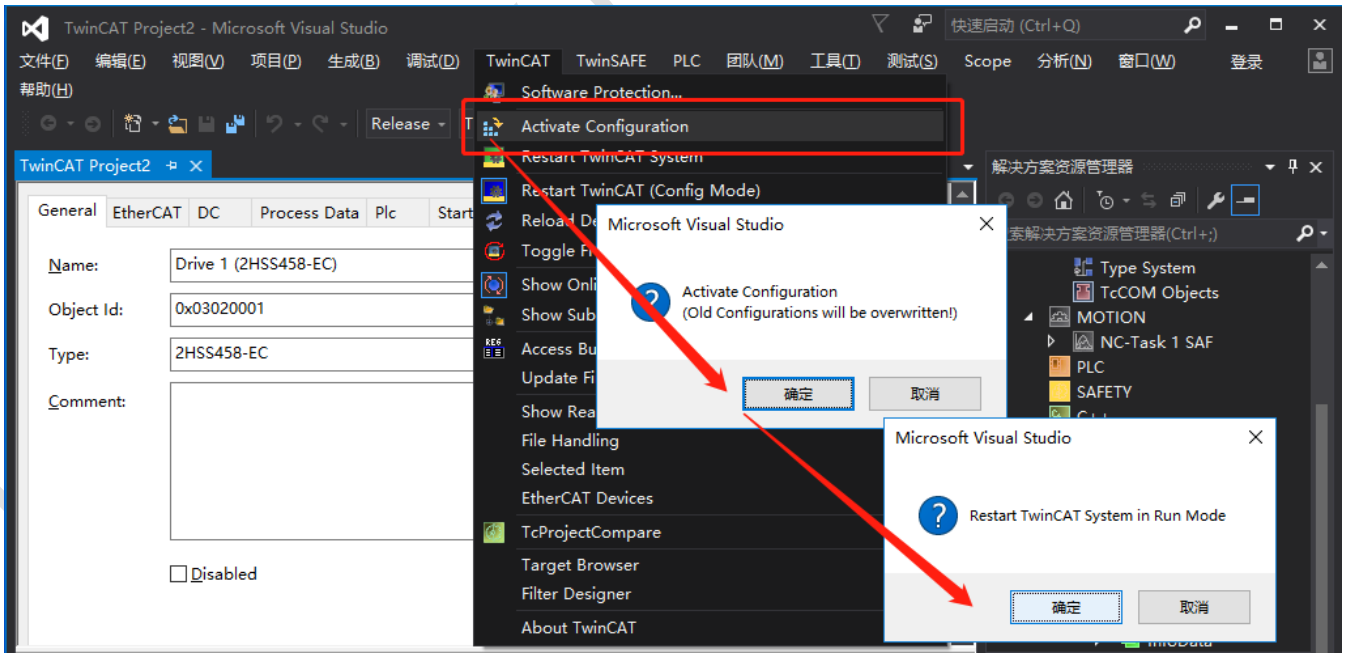



Figure 207 Restart the system

- Select the tab【NC: Online】 → click【Set】 in 【Enabling】 → click 【All】

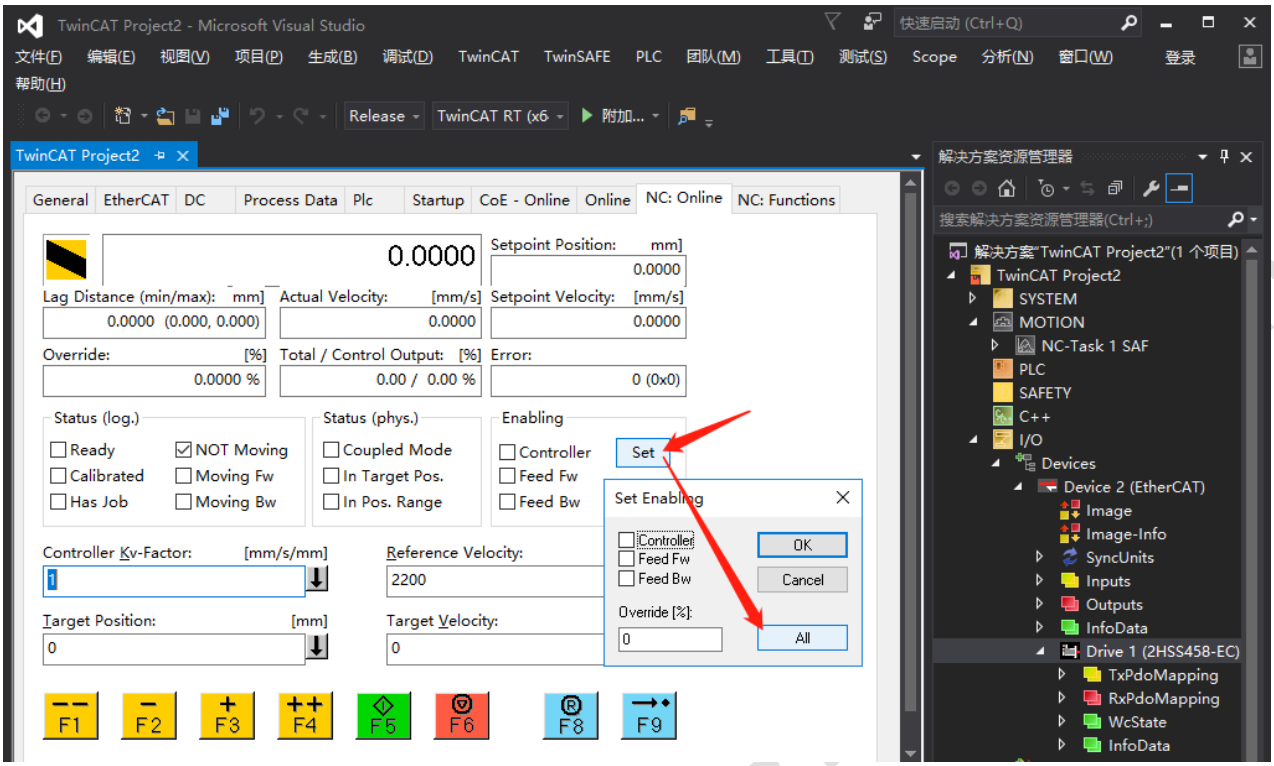



Fig 19 Enable equipment

- Set the target position and target speed, click the green icon or press 【F5】to start the operation, according to the previously set 【Scaling Factor Numerator】and the set speed and position, that is 25.12 for one lap, one lap takes 25.12 seconds

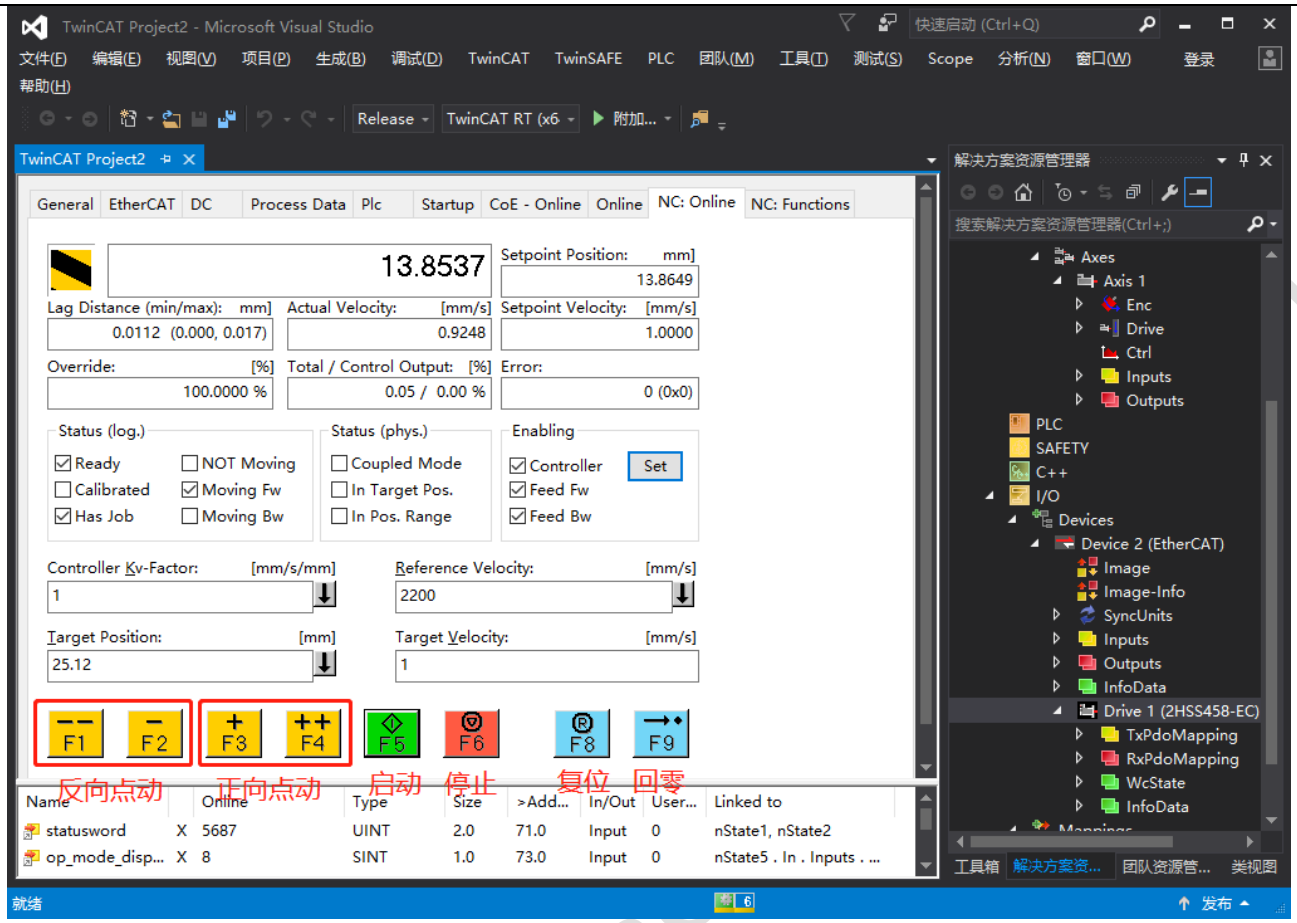



Figure 209 Manual control function

- Users can change the realization effect of several function buttons by modifying the axis parameters.
- Expand【Motion】→Select【NC-Task 1 SAF】→【Axes】→click【Axis1】→Click the tab【Parameter】

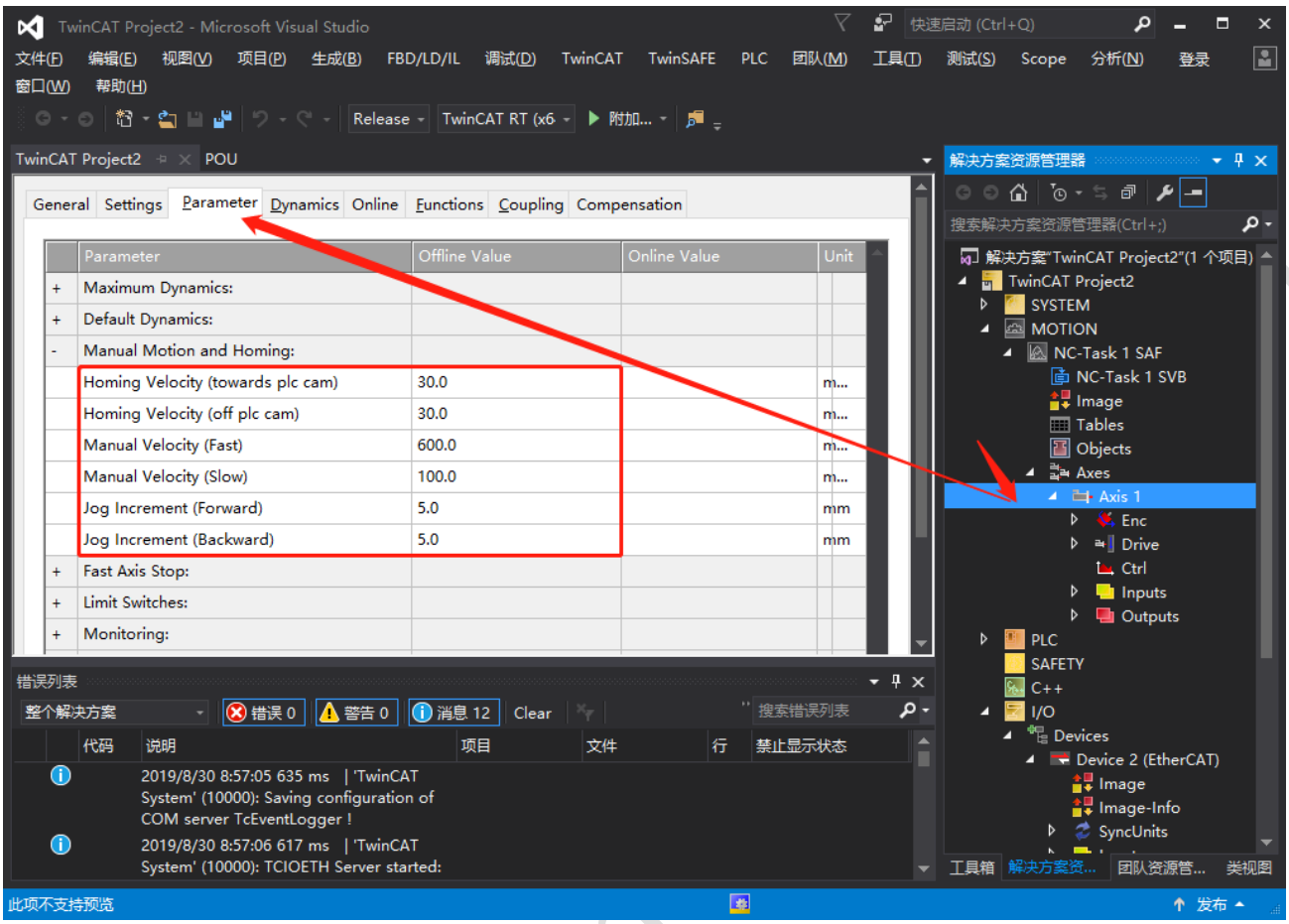



Figure 210 Setting manual control parameters

# PLC program creation

- Before starting, click【TwinCAT】→【Restart TwinCAT(Config Mode)】→【OK】→【NO】

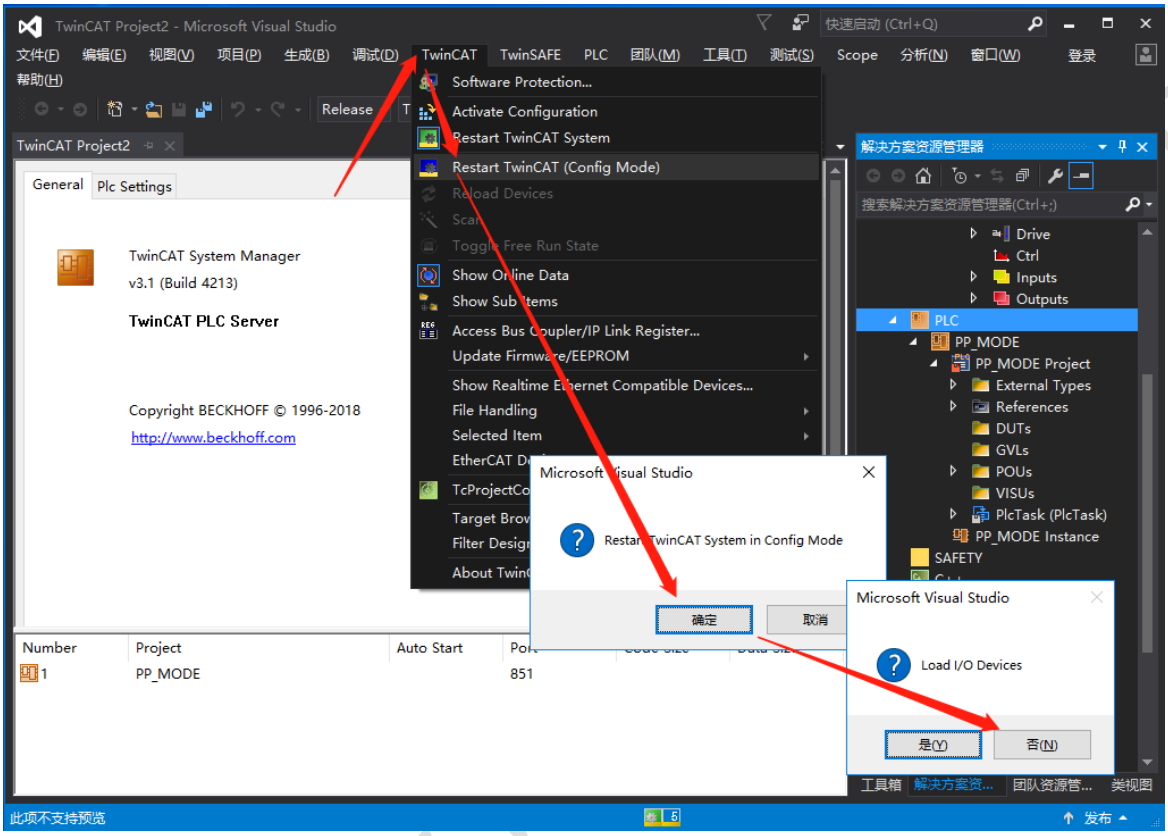



Figure 211 Enter configuration mode

Right mouse button【PLC】→click【Add new item】

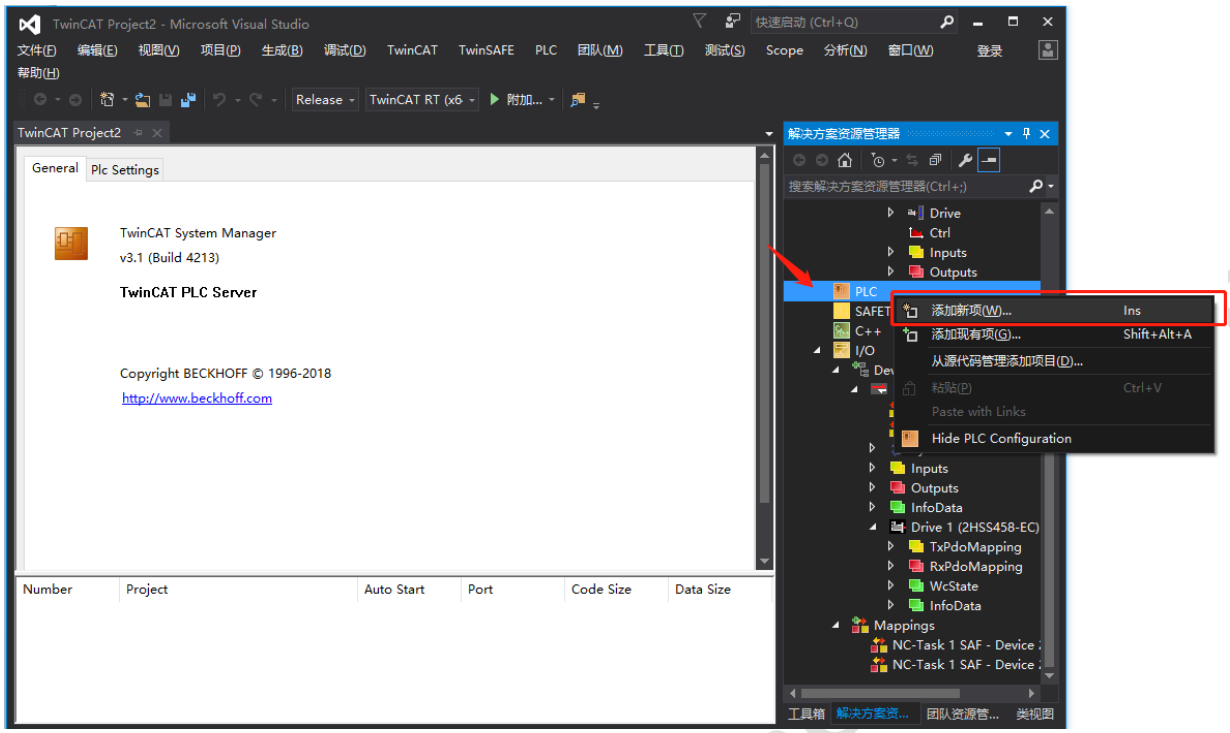



Figure 211 Enter configuration mode

Right mouse button【PLC】→click【Add new item】

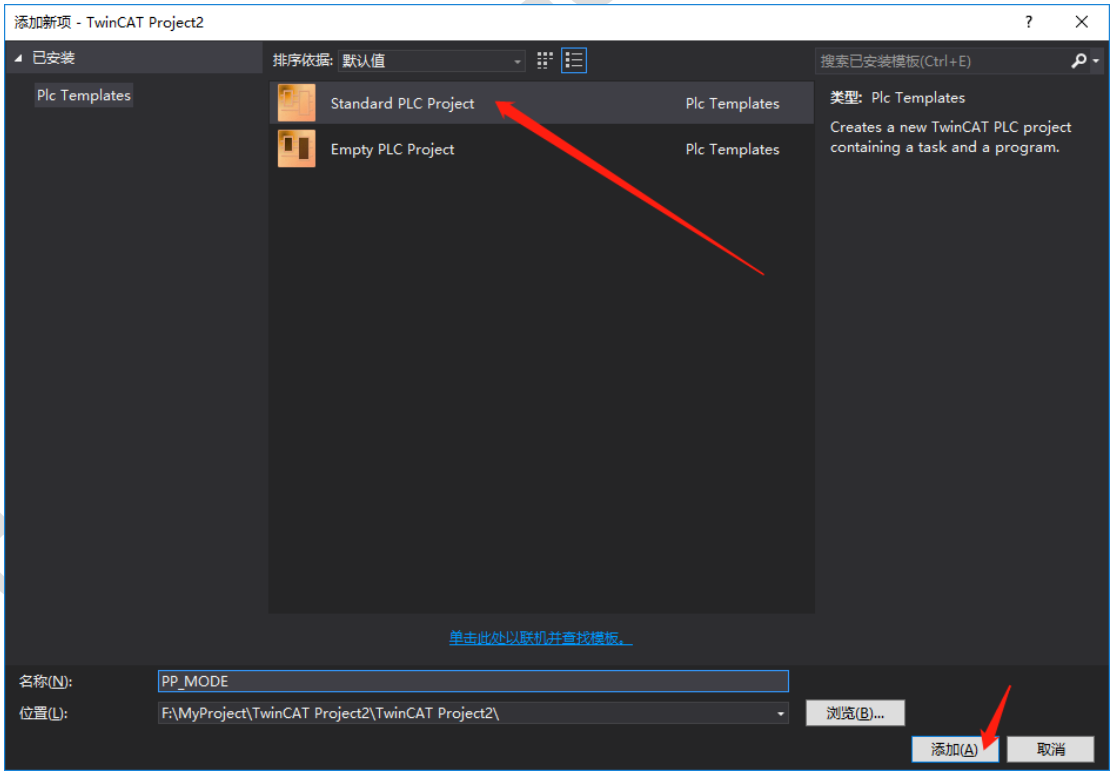



Figure 212 Add PLC project

- Expand the PLC tree, right-click【POUs】→【Add】→click【POU】
- This example uses ladder diagram programming as an example, set 【Name】, 【Type】

and 【Implementation Language】, click 【Open】

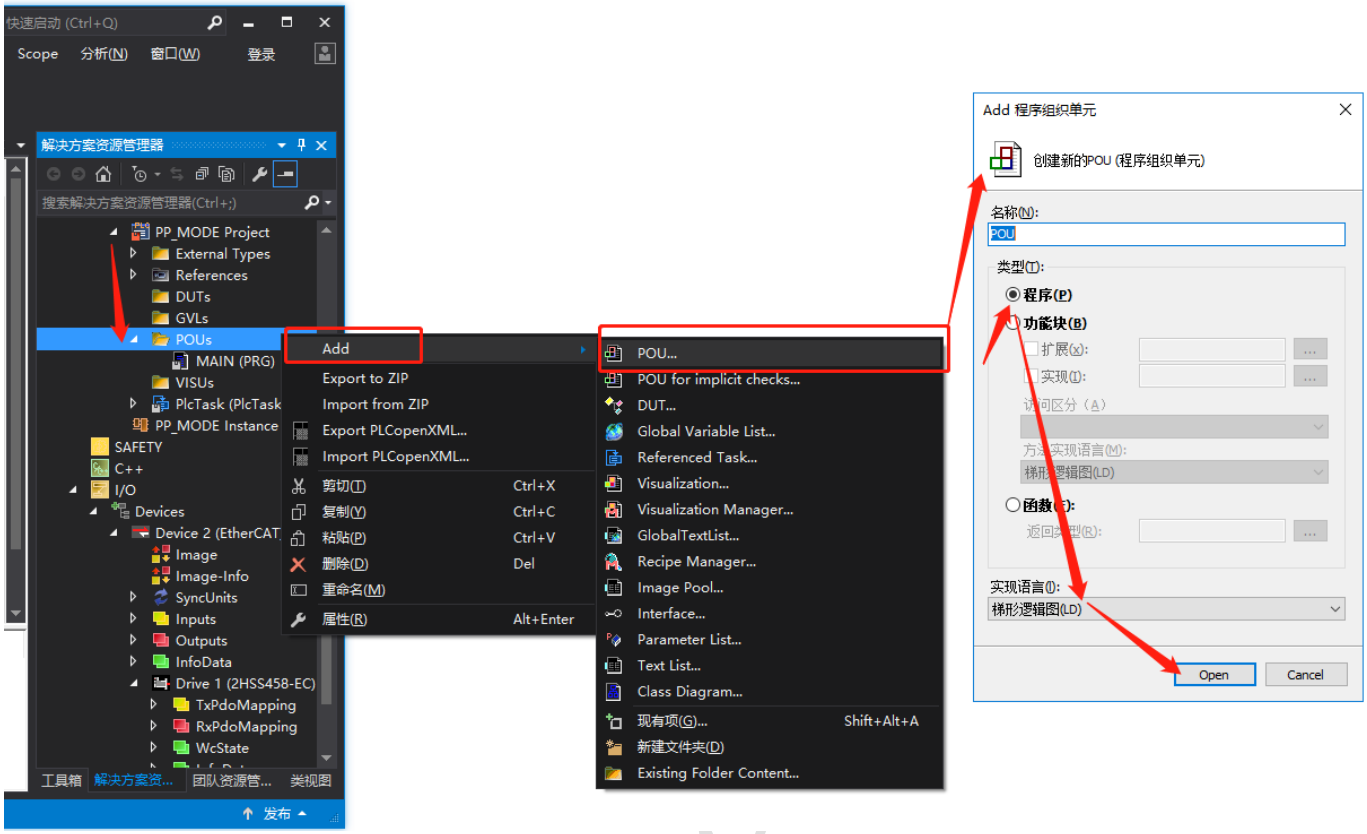



Figure 214 Add POU program

- To add PLC tasks (POUs) to be run, right-click, select 【Add】 → click【Existing Item】

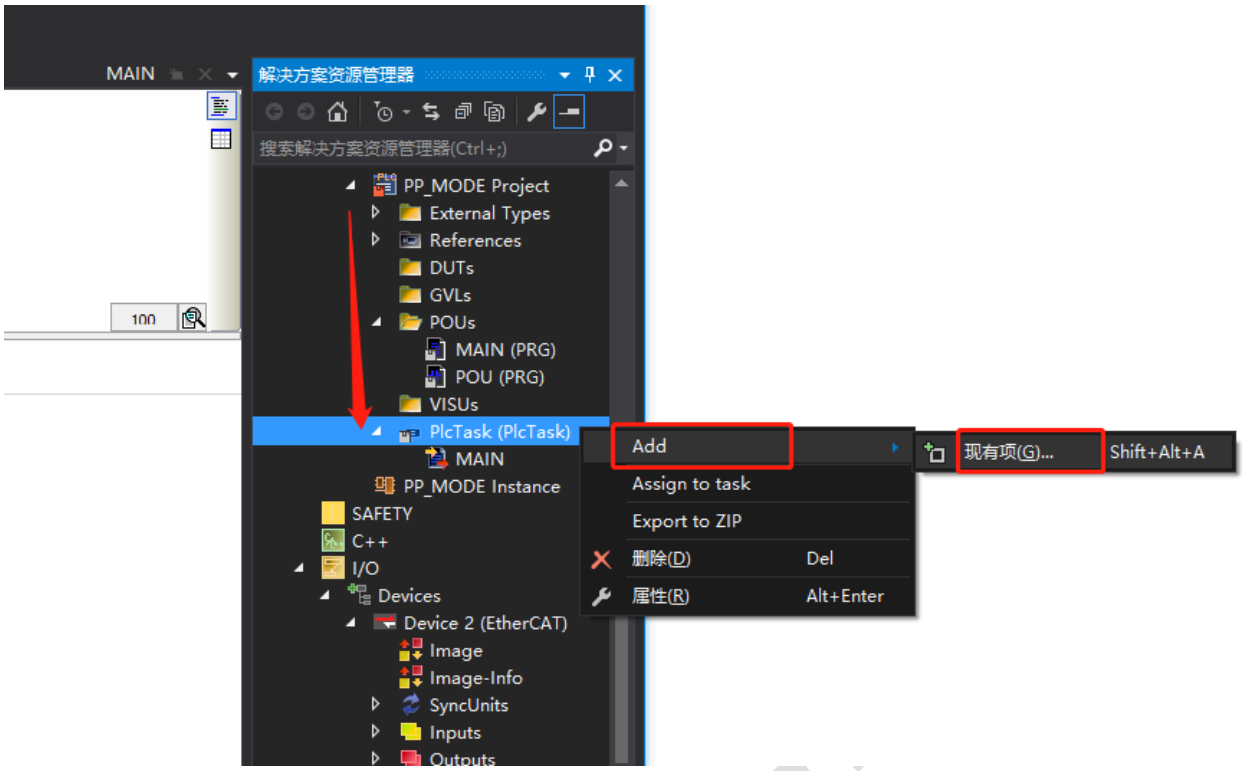



Fig 20 add PLC task

- Click 【Category】 → 【Programs】 → select the required program files under the POUs in the current project → click【OK】

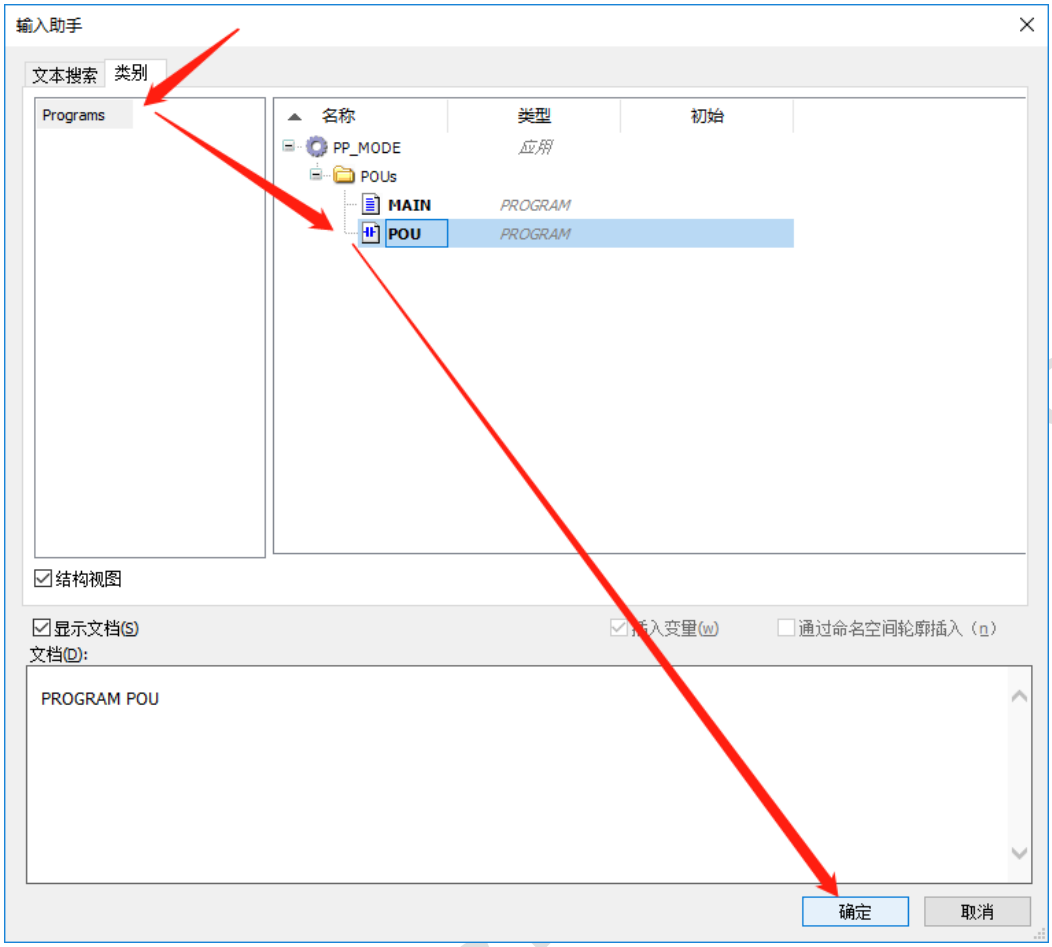
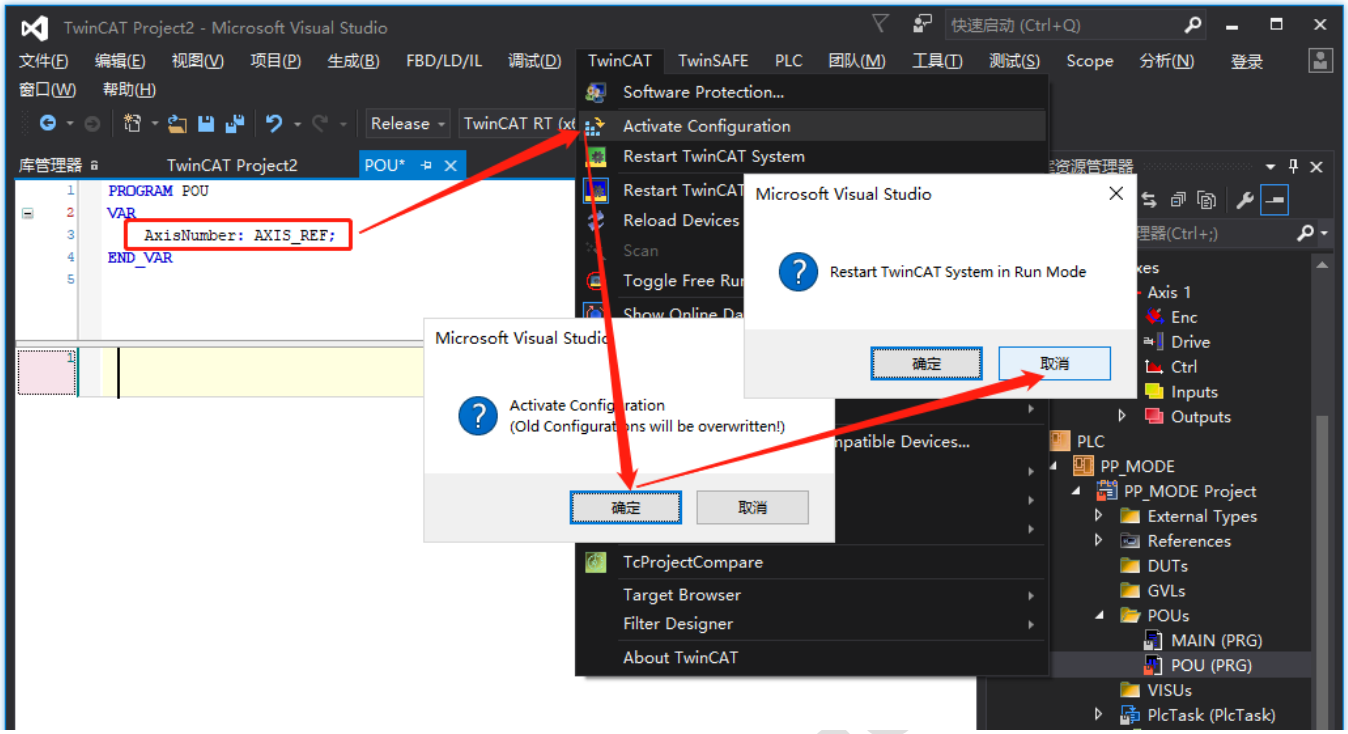



Figure 216 Select PLC task

- We need to first create the AXIS_REF variable (users can also set the variable as an array of global variables to facilitate the configuration of multiple axes), and click 【Activate Configuration】 to activate the configuration → 【OK】→ 【Cancel】




- Figure 217 creates the axis variable
- Then link the created variable to the corresponding axis
- Expand 【Motion】 → 【NC-Task 1 SAF】 → 【Axes】→ click【Axis1】→ click the tab 【Setting】
- Click 【Link To PLC】→ select the created variable → click 【OK】

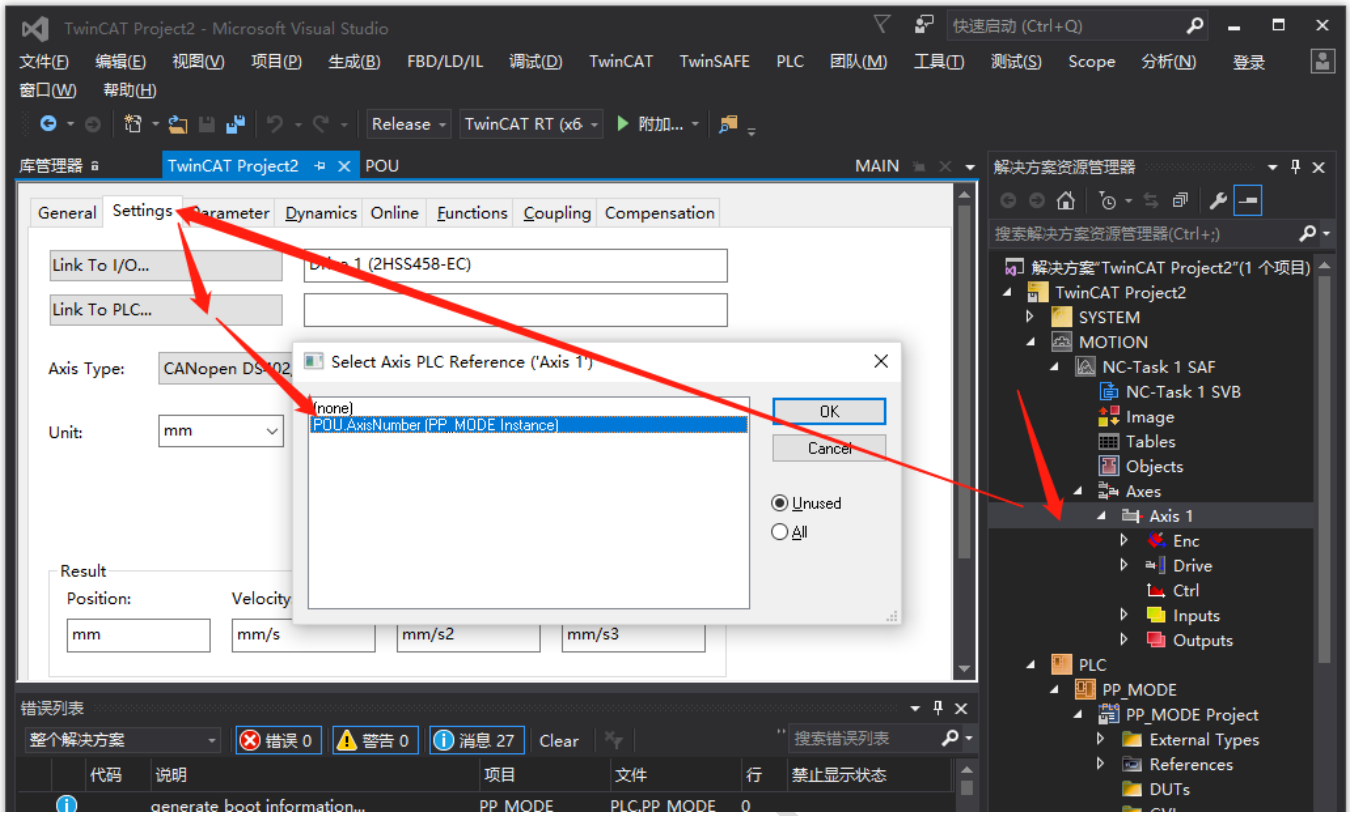



Figure 218. Link axis variables1 Control method I

- Because we will use the official motion control library, we need to add it to the project first.
- Right click【References】→click【Add library】

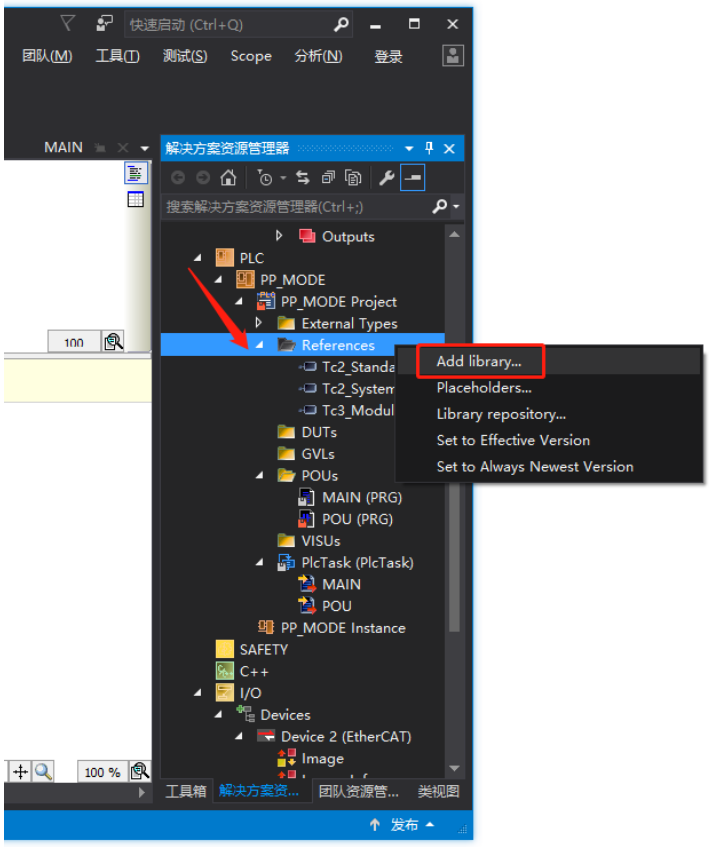



Figure 219 Add library

- Selcet【Motion】→【PTP】→【Tc2_MC2】(Added according to specific needs)

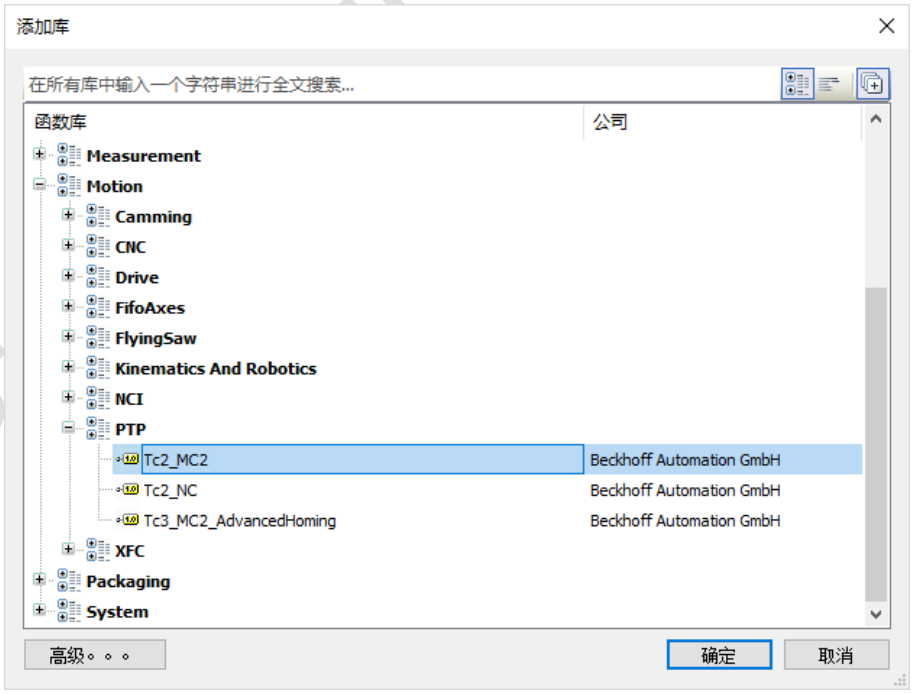



Figure 220 Select control motion library

- Click the created program in 【POUs】, in the program section, right-click and select Insert Operation Block

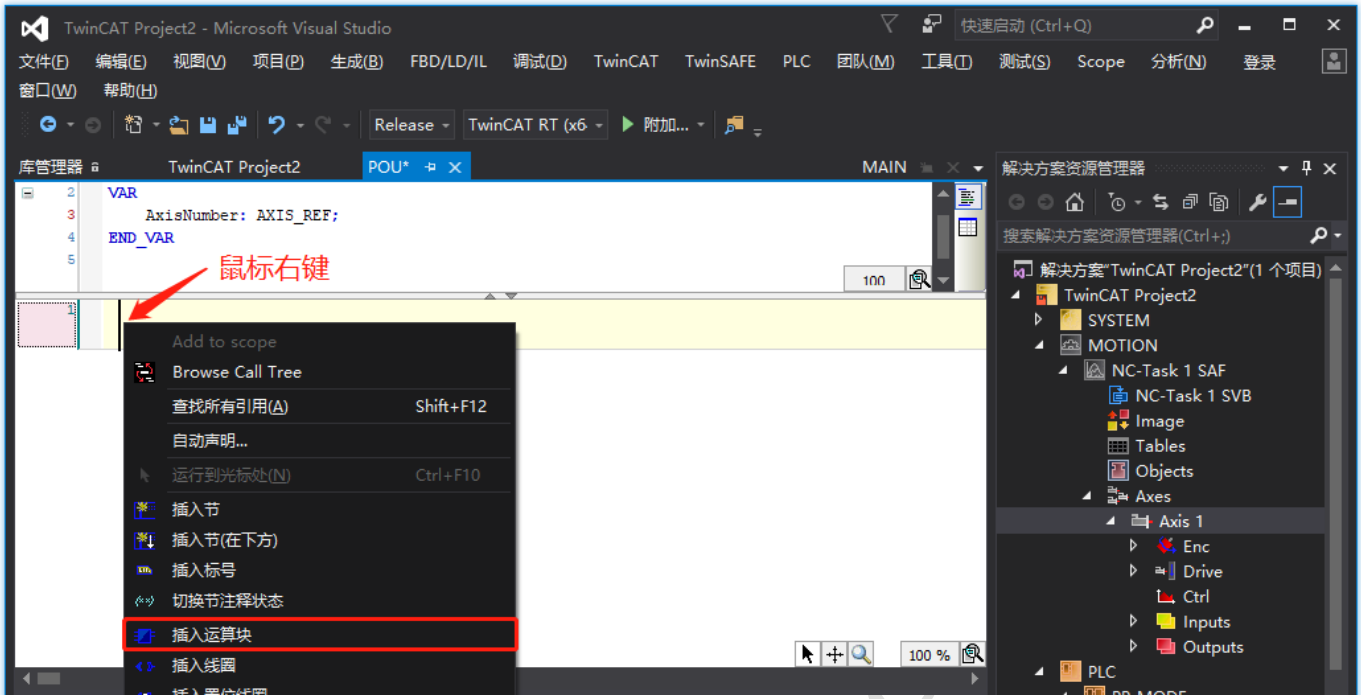



Fig. 221 Insert operation block

- Find the corresponding function block and click 【OK】 (MC_Power is used to send the enable command)
-

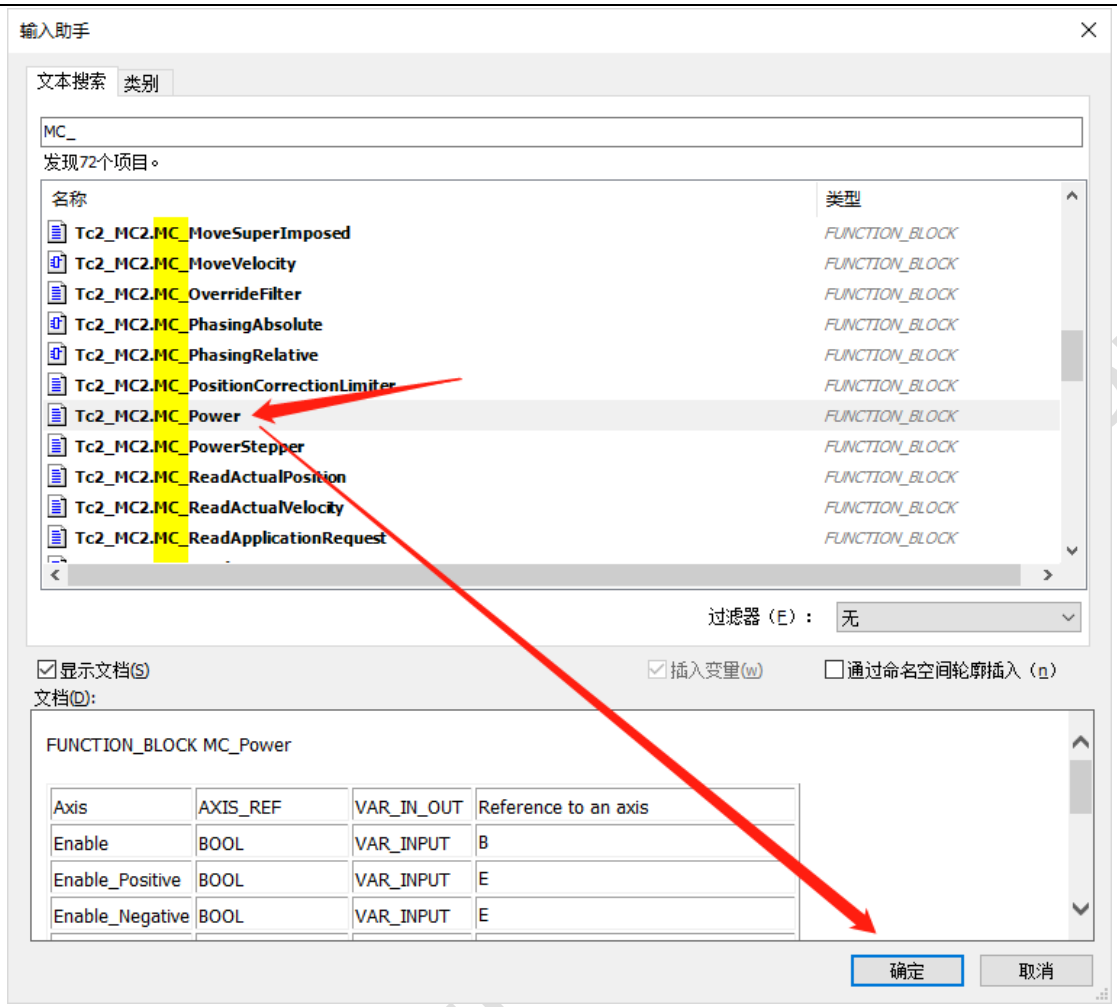



Fig 21 Select function block

- The following are the routines of the function block of point control. When using, you can go to 【I/O】→【Devices】→【Device 2(EtherCAT)】→tab 【NC: Online】to view the real-time feedback data

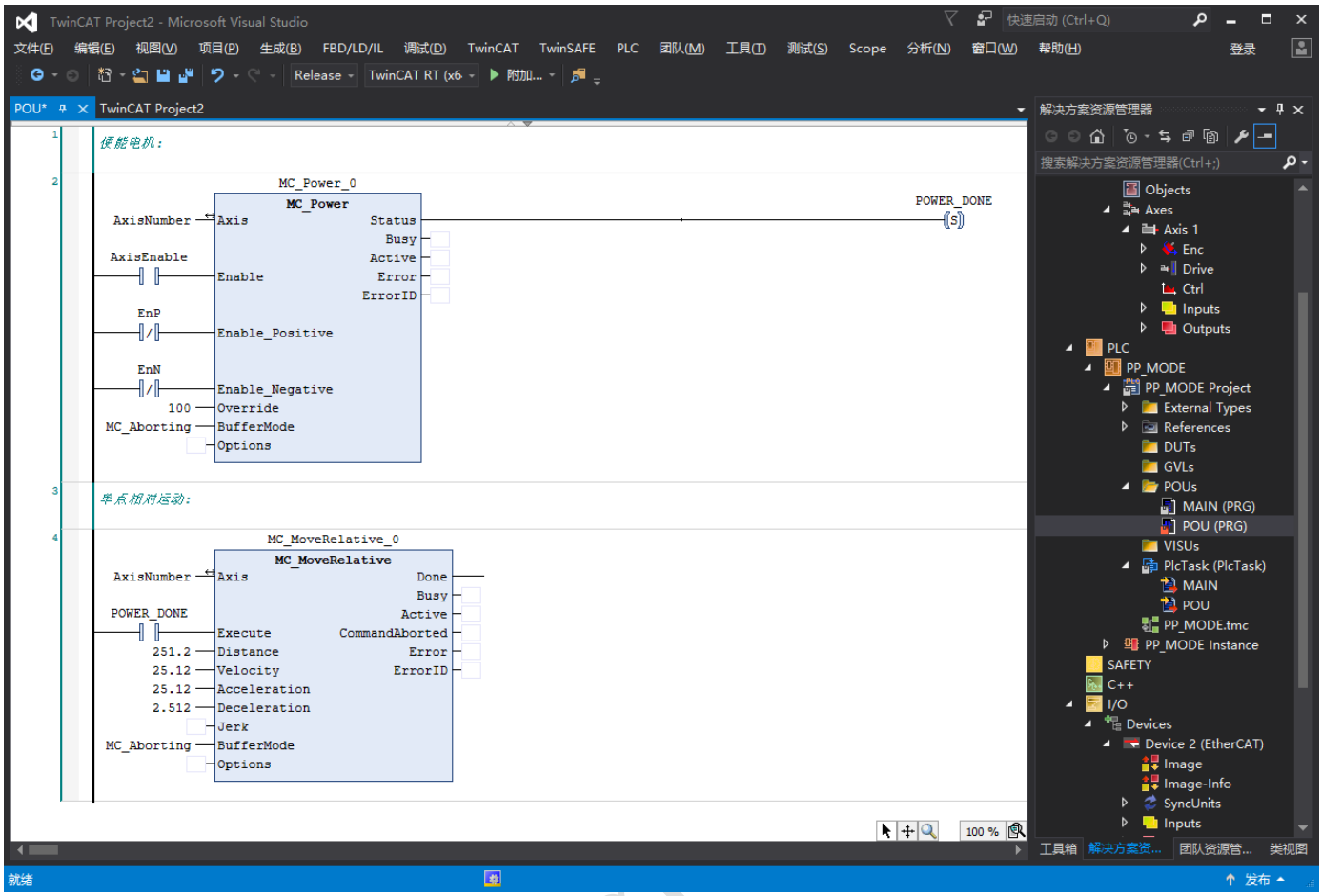



Figure 223 Point control routine

Tip: Because Beckhoff has many function blocks, the usage is similar, so I will NOt repeat them here. For details, please refer to the official help document:

https://infosys.beckhoff.com/english.php?content=../content/1033/tcplclib_tc2_standard/9007199329144587.html&id=

## 2 Control method • II

The second method is to NOt use the functions in the Beckhoff motion control library, but directly modify the PDO mapping data to achieve motion control. This method is slightly different from the engineering setting process of method one. The following will start after completing the configuration of the motor shaft.

- Right-click the mouse to select the program "POU(PRG)" written in 【POUs】and select 【Remove】.

NOte: Select 【Remove】 instead of 【Delete】, if you select【Delete】, the POU program file will be deleted completely

- Select the corresponding POU program task in【PlcTask(PlcTask)】, and then right-click→【Delete】→OK

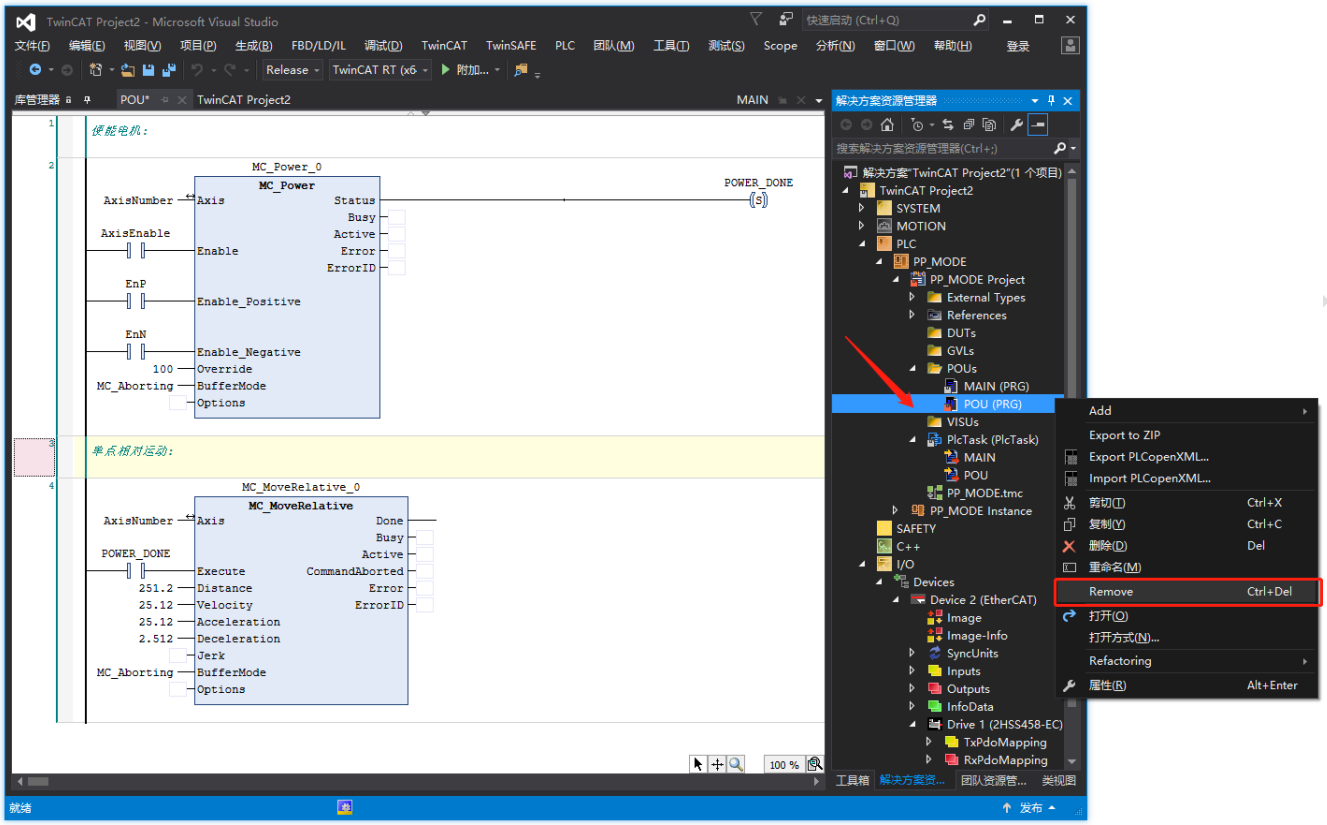



Figure 224 Removes the POU

- Next, create a new POU program and add it to the PLC task, please follow the previous operation

NOte: After creating a new POU program, you need to re-create a new variable linked to the corresponding axis number. Therefore, it is NOt difficult to find that the variable for linking is best set as a global variable to avoid the need to repeatedly link the motor shaft.

- Open the PLC tree →right key【GVLs】→【Add】→【Global Variable List】
- Set the name of the variable list, click【Open】

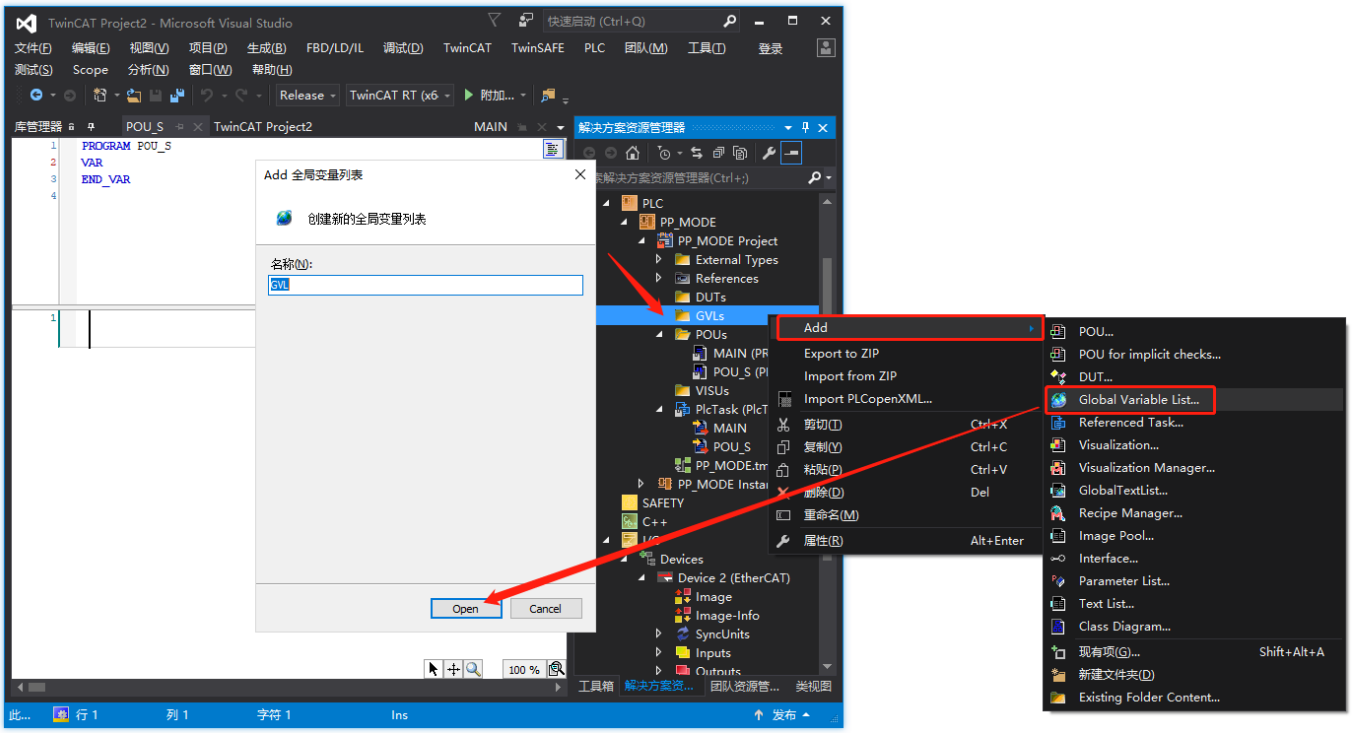



Figure 225 Add global variable list

- In order to add multiple axes in the future, set the axis parameters to an array of AXIS_REF type, and then click 【Activate Configuration】 to activate the configuration, and operate as before

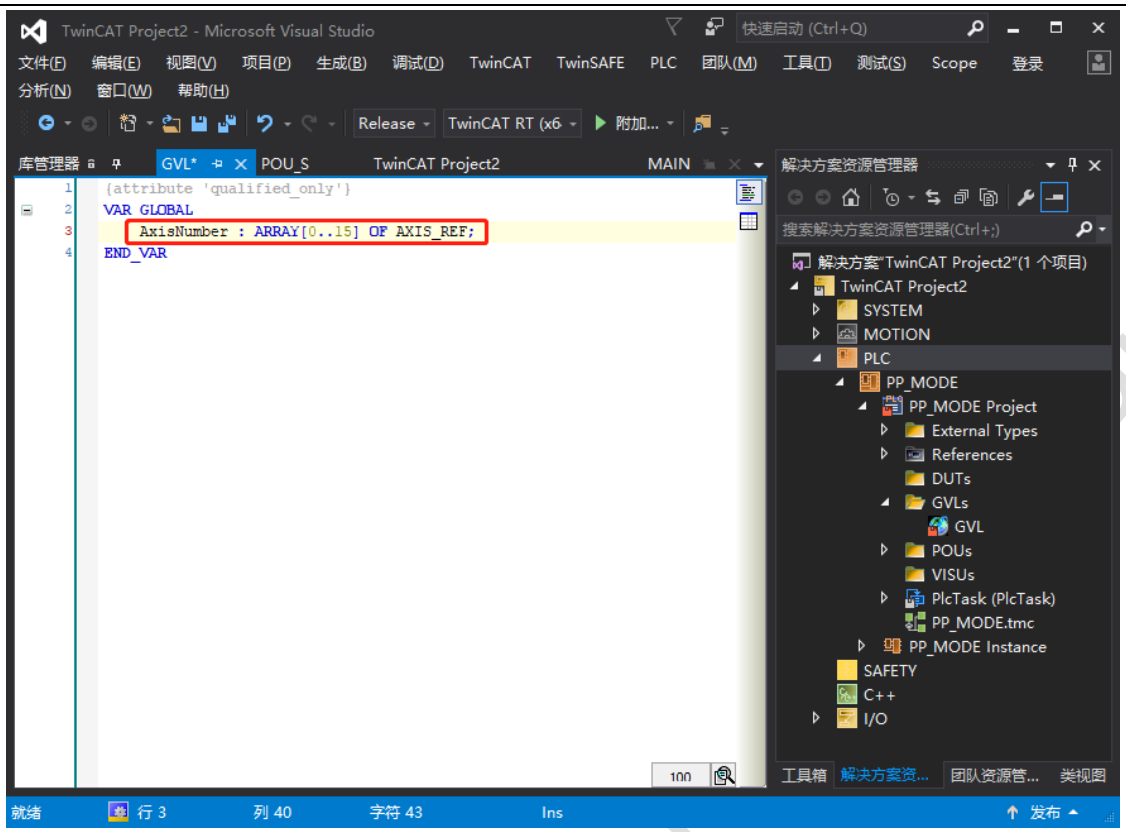



Figure 226 Add axis parameter group

- Select an address in the array to link to the axis, here select GVL.AxisNumber[0]

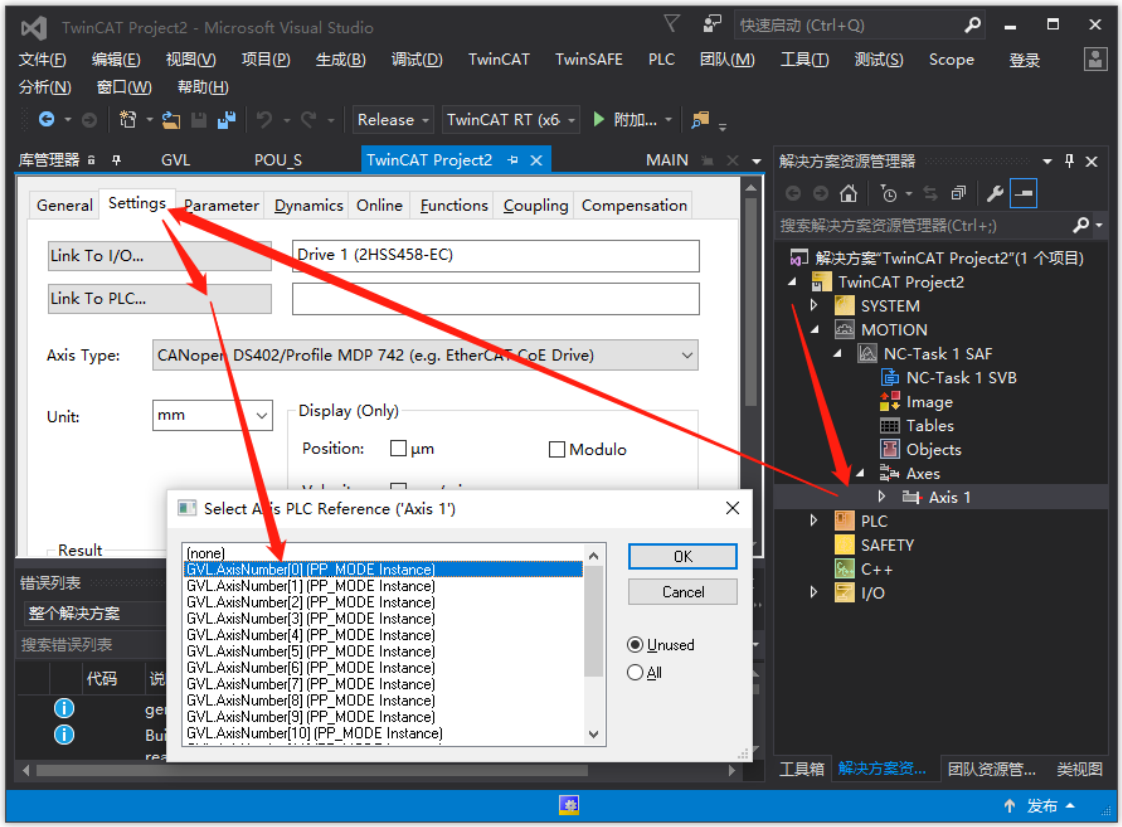



Figure 227 Link to corresponding axis number

- Then we need to configure the PDO mapping, open【I/O】→【Devices】→【Device 2(EtherCAT)】→【Drive 1】→Click the tab【Process Data】→Select one of the PDO indexes

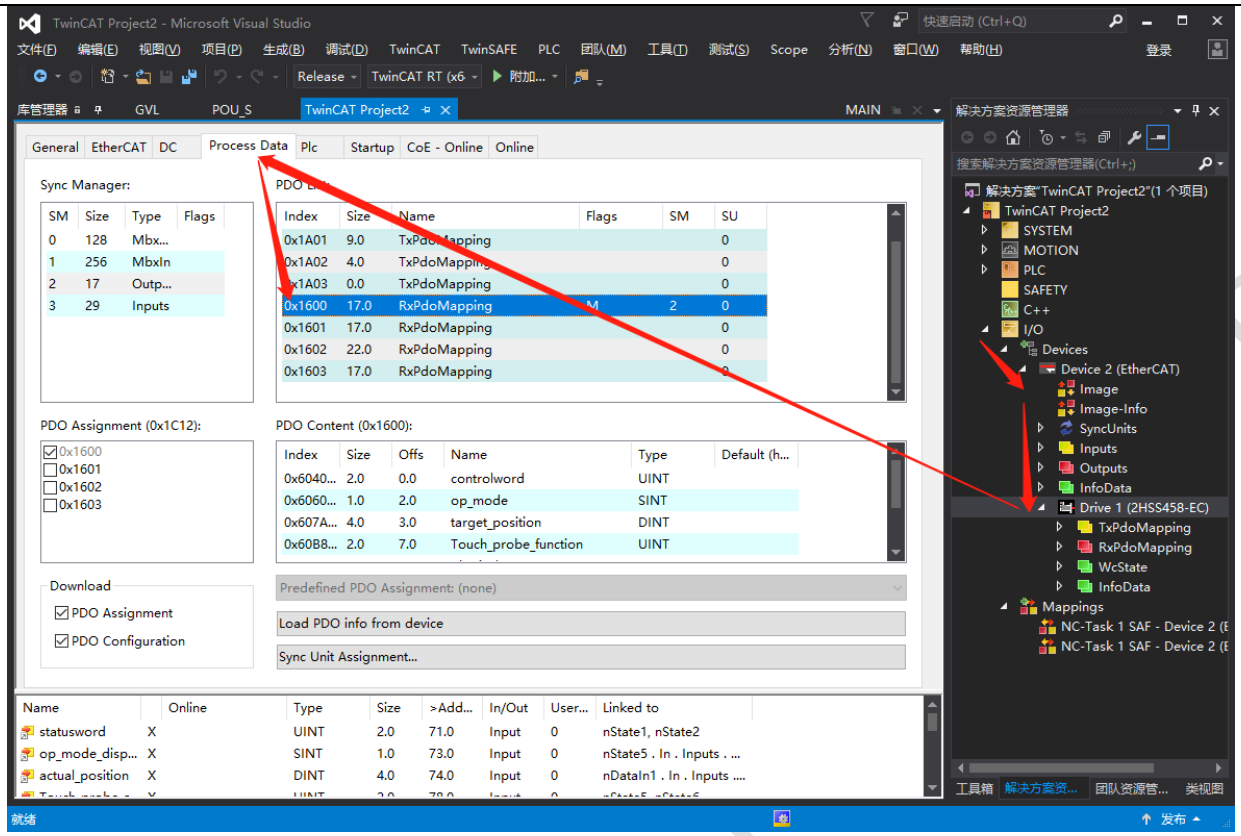



Figure 228 Modify PDO

- Delete 【Delete】 to remove the unnecessary object index, and insert 【Insert】 the required object index

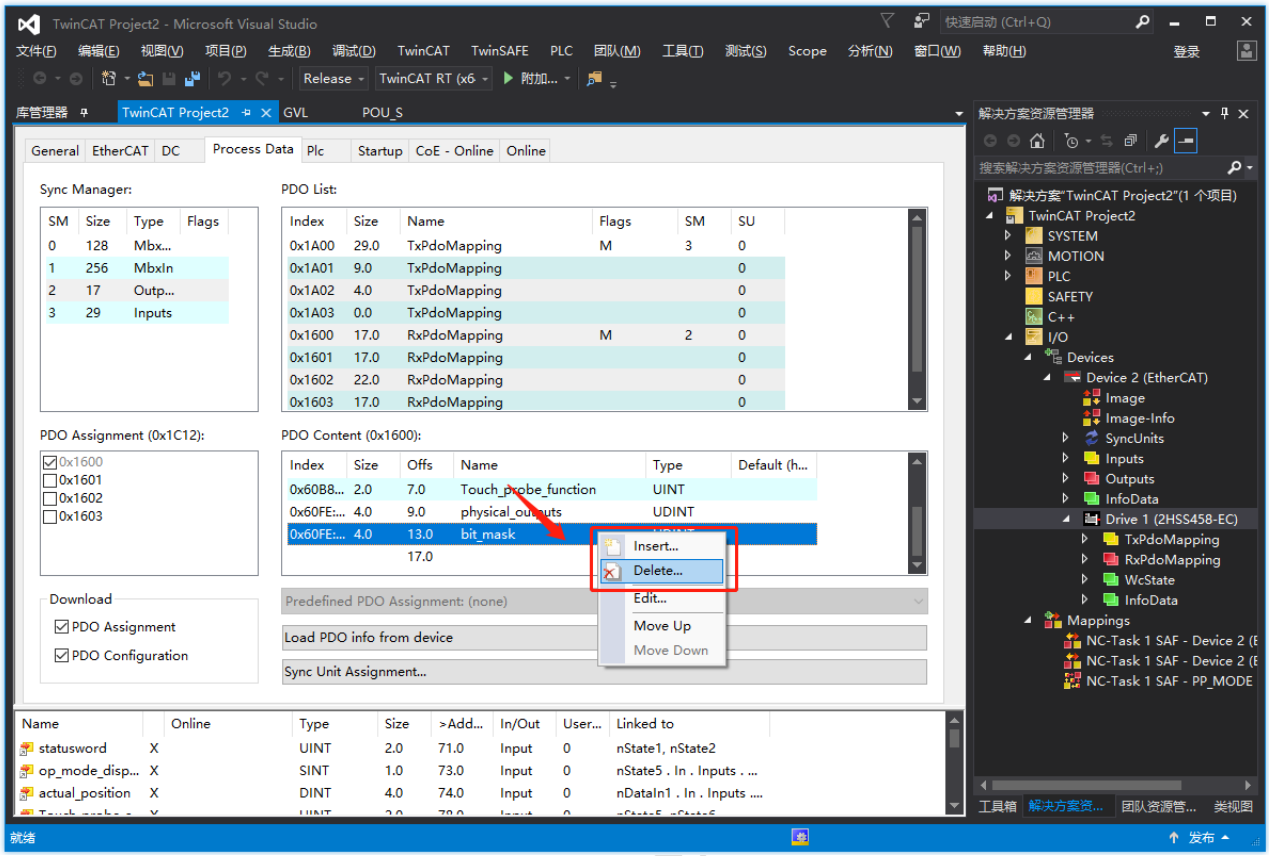



Figure 229 Modify PDO index

- Here we add the commonly used ones to the PDO mapping

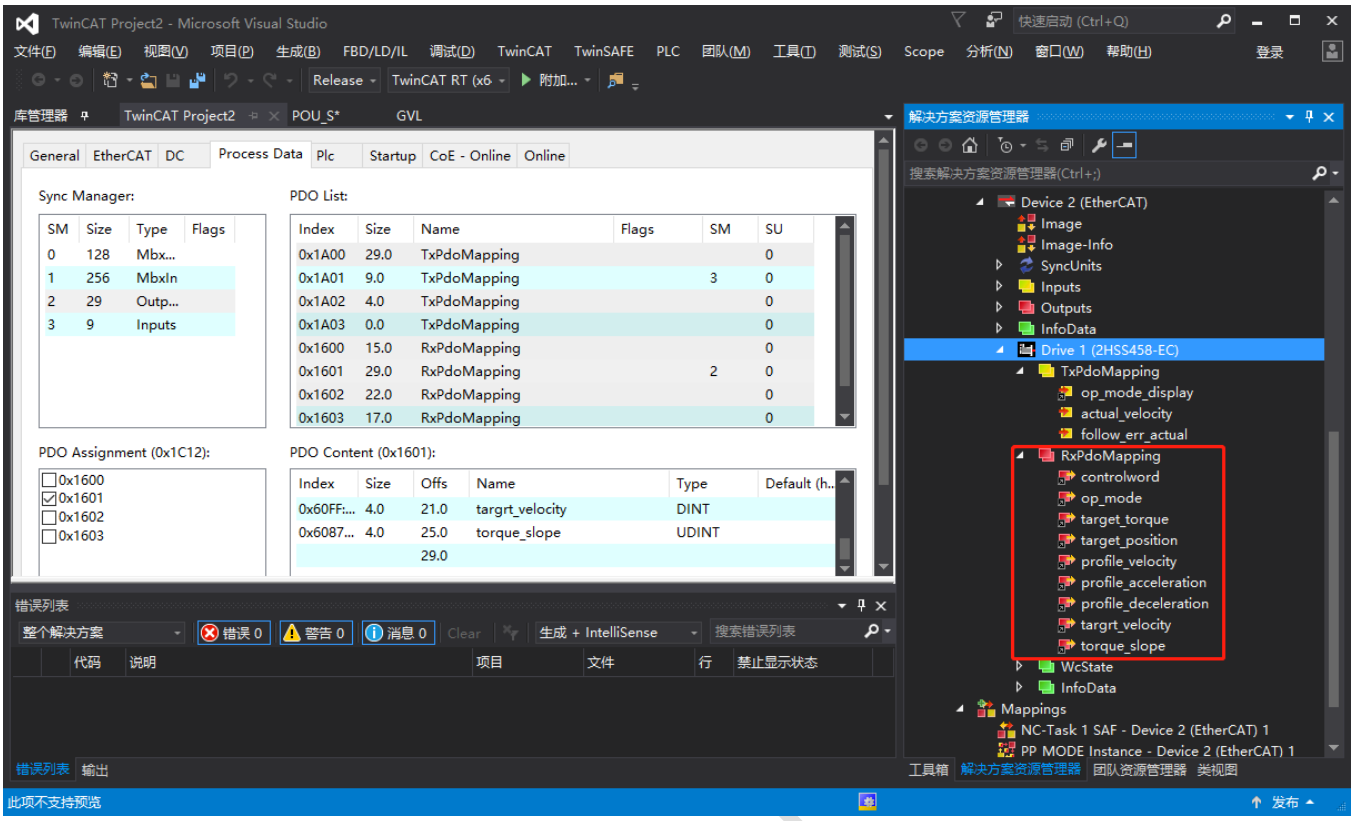



Fig 22 RxPDOMapping

- Then we add the corresponding output variable to the created POU program variable list, and click【Activate Configuration】] to activate the configuration

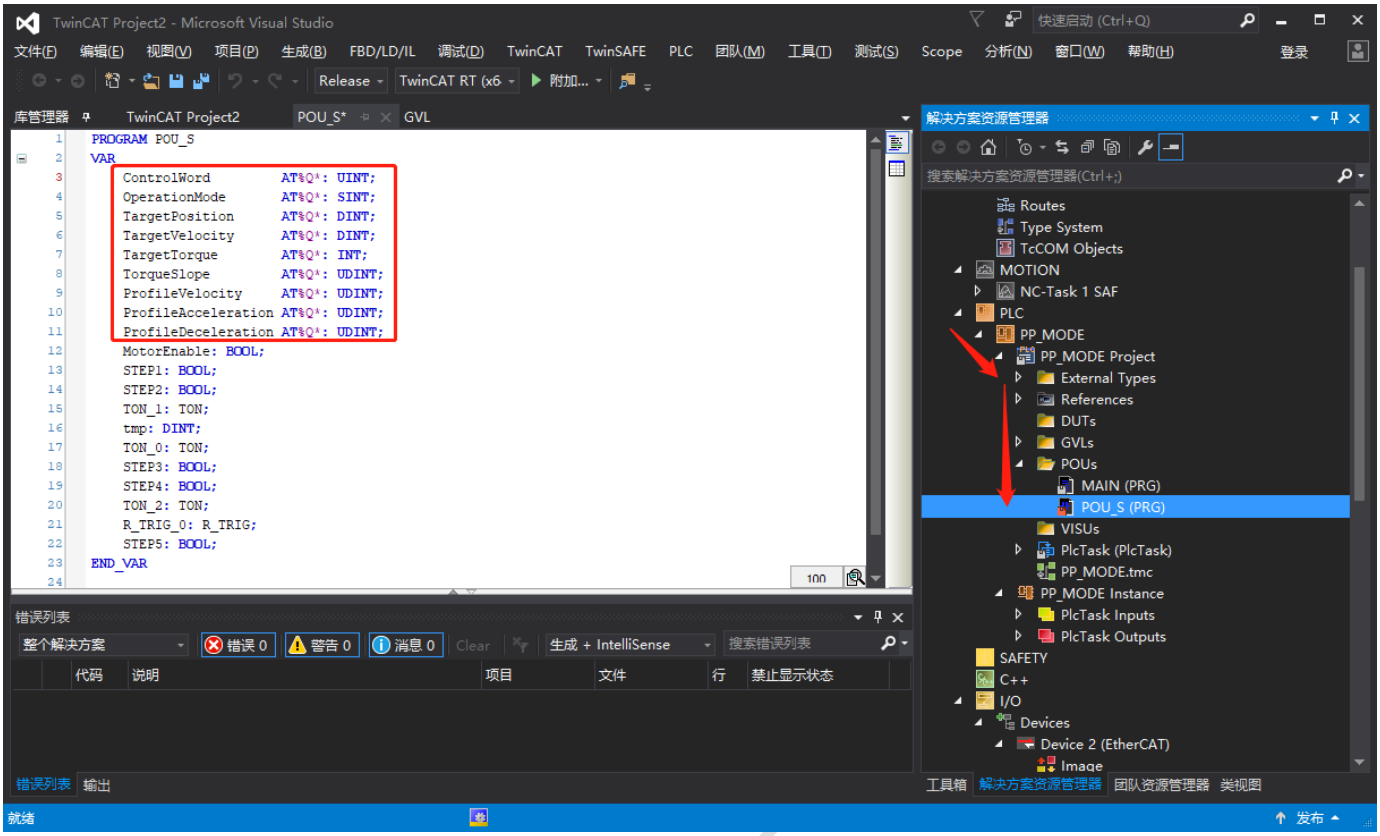



Figure 231 Add output variable

- Then we need to link the PDO mapped variables to the PLC program variables
- Open 【I/O】→【Devices】→【Device 2(EtherCAT)】→【Drive 1】→【RxPdoMapping】→Click on one of the PDO indexes→click【Linked to】→Select the corresponding PLC output variable→click【OK】

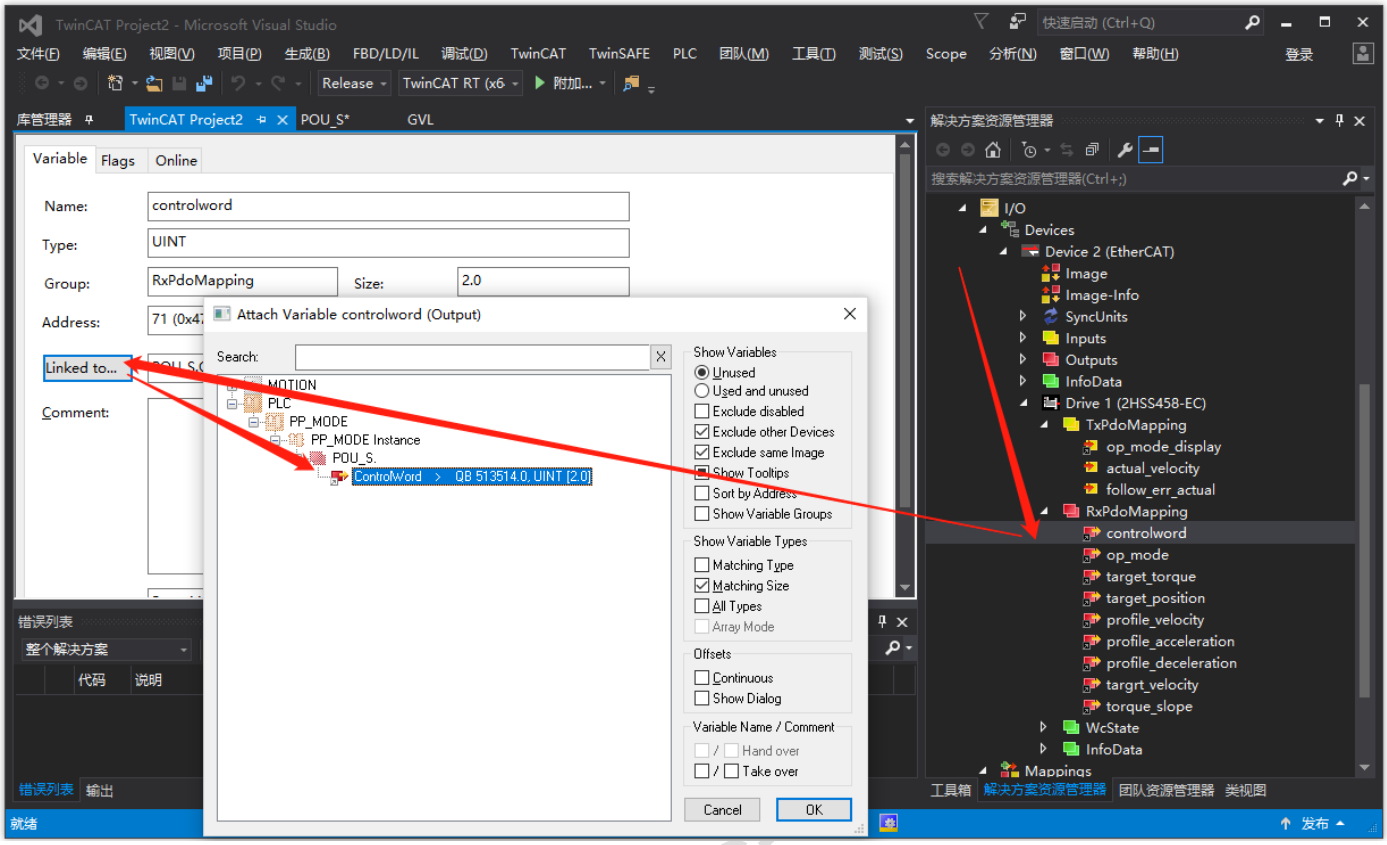



Figure 232 Link to output variable

- Link the required PDO mapping variables, write the program, and then click【Activate Configuration】 to activate the configuration → 【OK】 to activate → 【OK】 to enter the operating mode

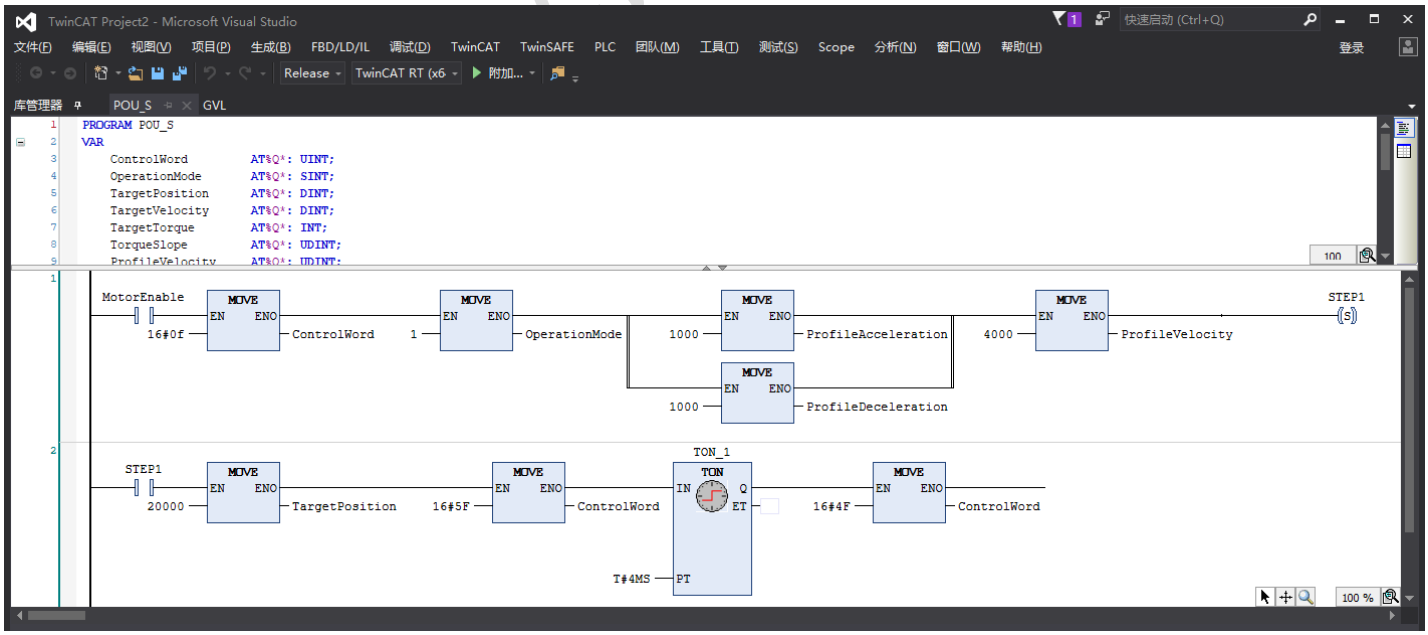



Fig. 233 Enter running mode

- Click [PLC] → select 【Login to】→ continue to download【YES】

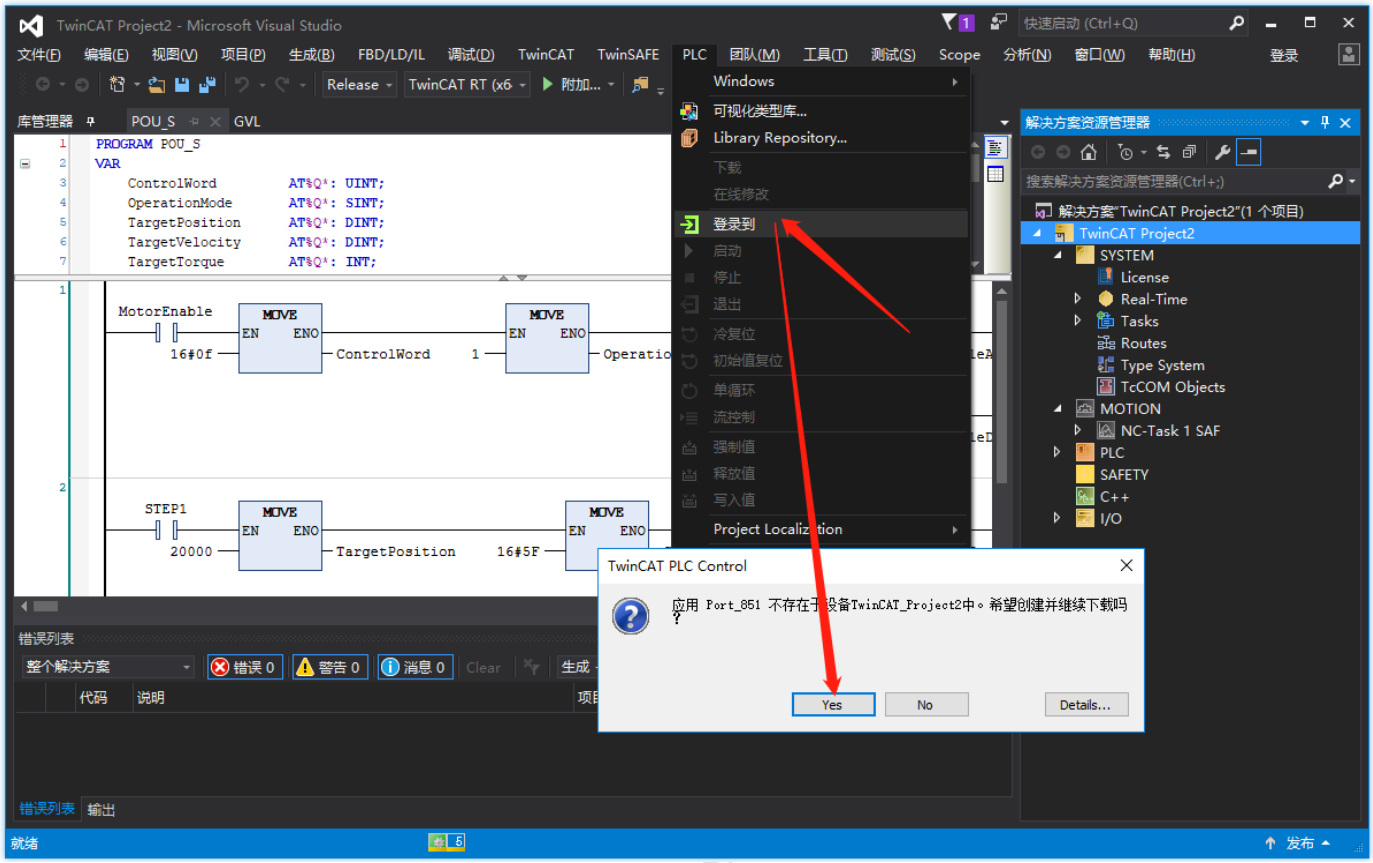



Figure 234 Confirm to continue downloading

- click【PLC】→select【start】

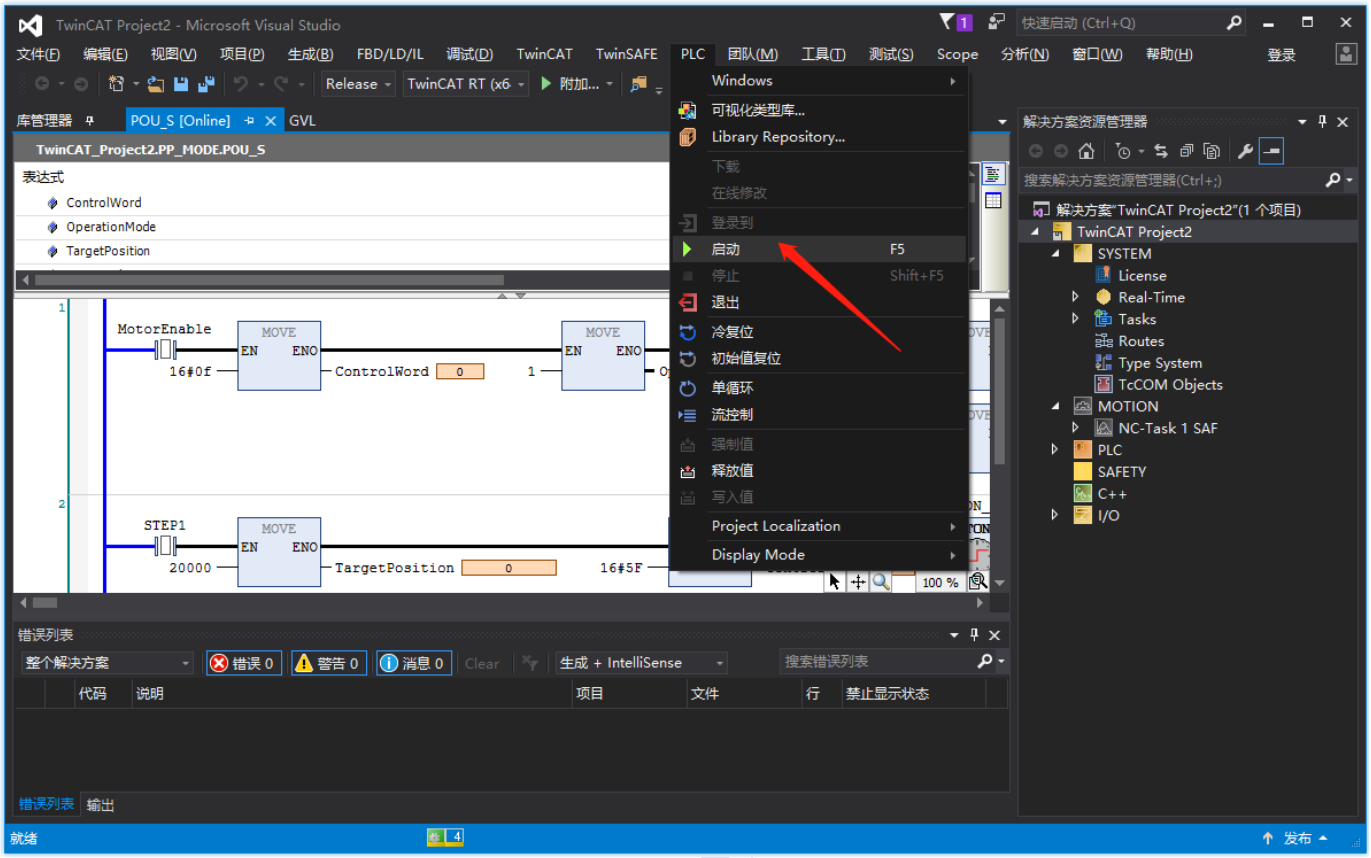



Fig. 235 Start PLC

- Then, the user can start to run the written program

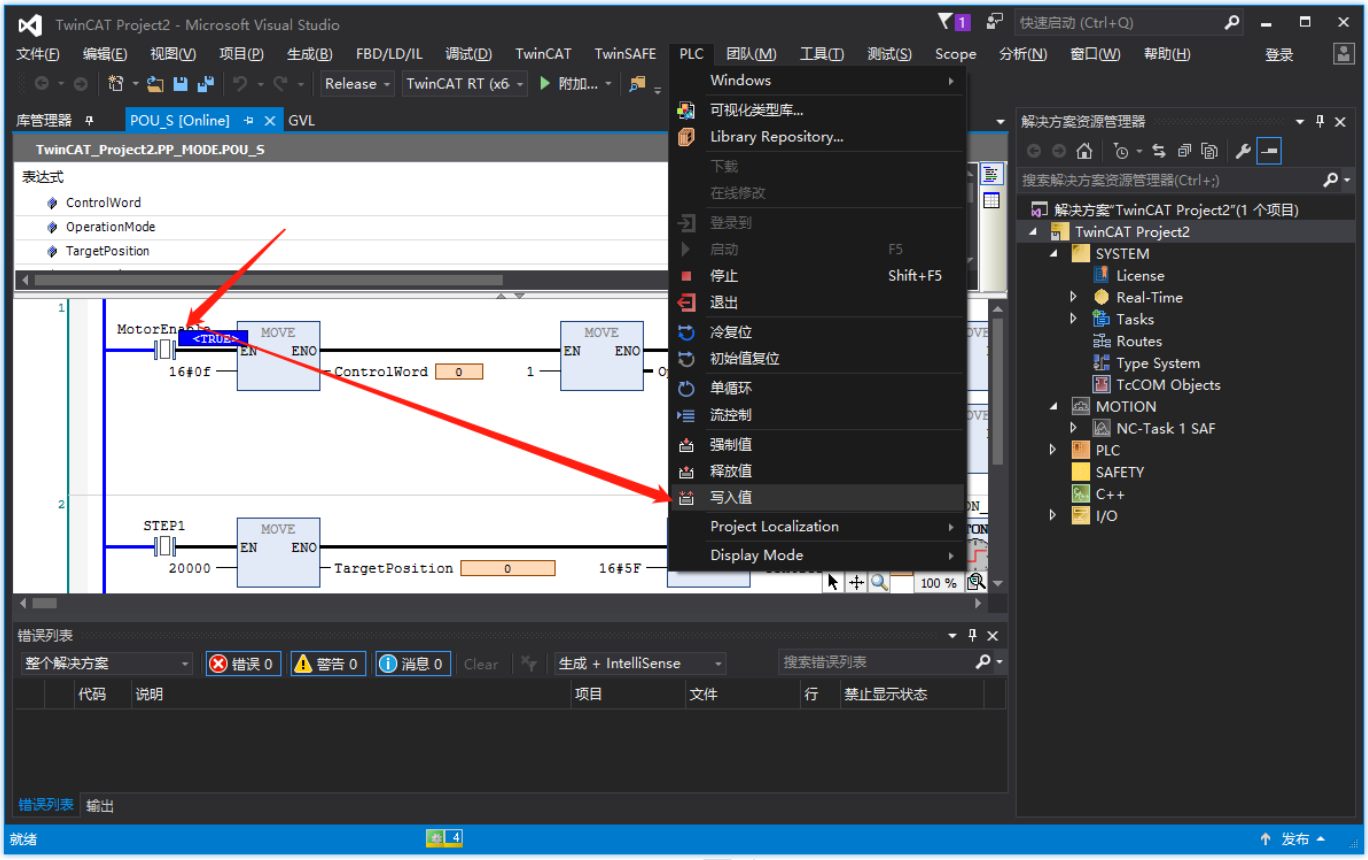



Figure 236 Running the program

# EtherCAT communication operation routine based on INOvance controller

This routine will use the AM600 controller of Incheon and the 2DM542-EC of Jiemeikang Electromechanical as an object to explain the operation of EtherCAT communication.

## Add slave device description file

- Open programming software INOProShop→Tools→Device Library

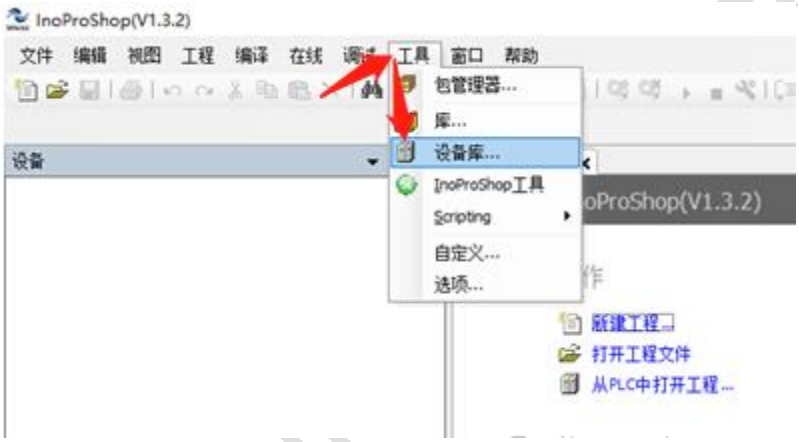



Figure 237 Open the device library

- Installation→Install slave device description file

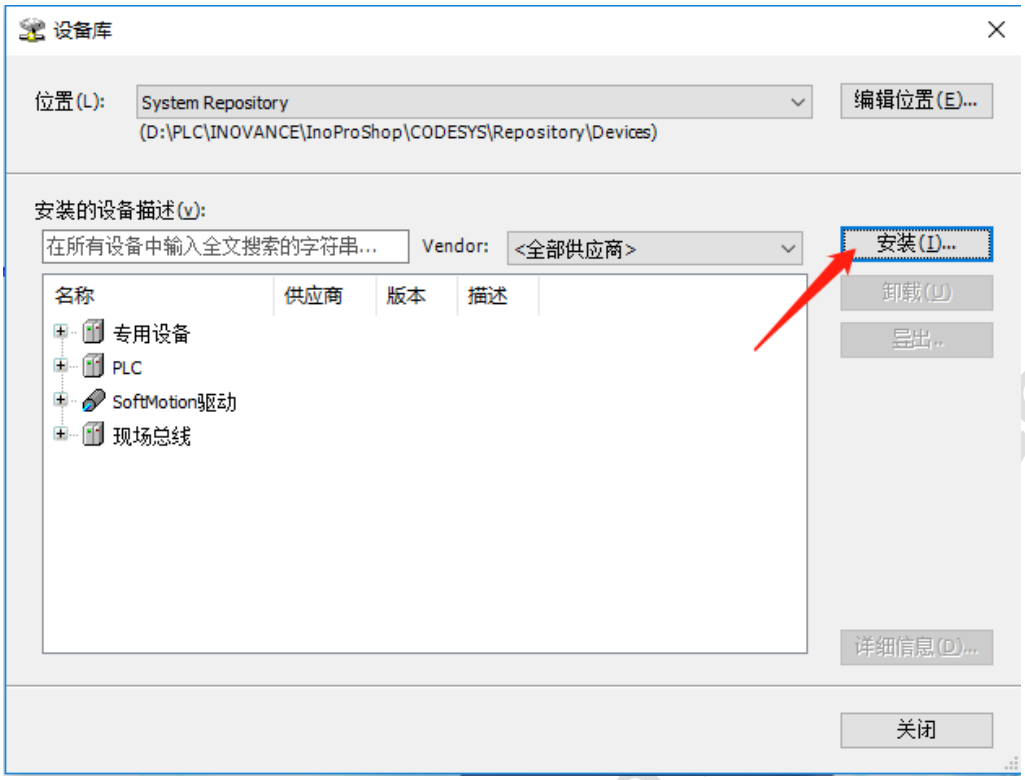



Figure 238 Install device description file

- Select XML file→Open

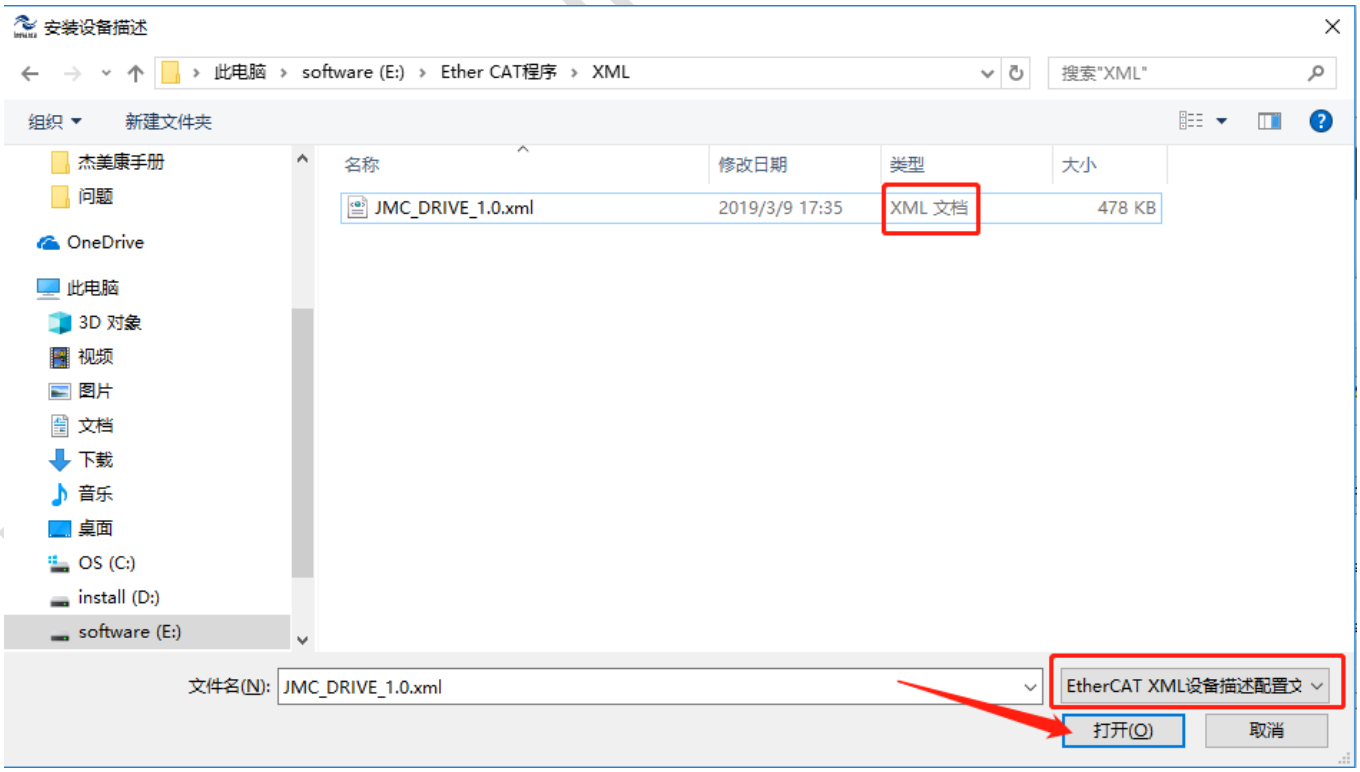



Figure 239 Select XML file

- After successful opening, the "Uninstall" button will NO longer be dim

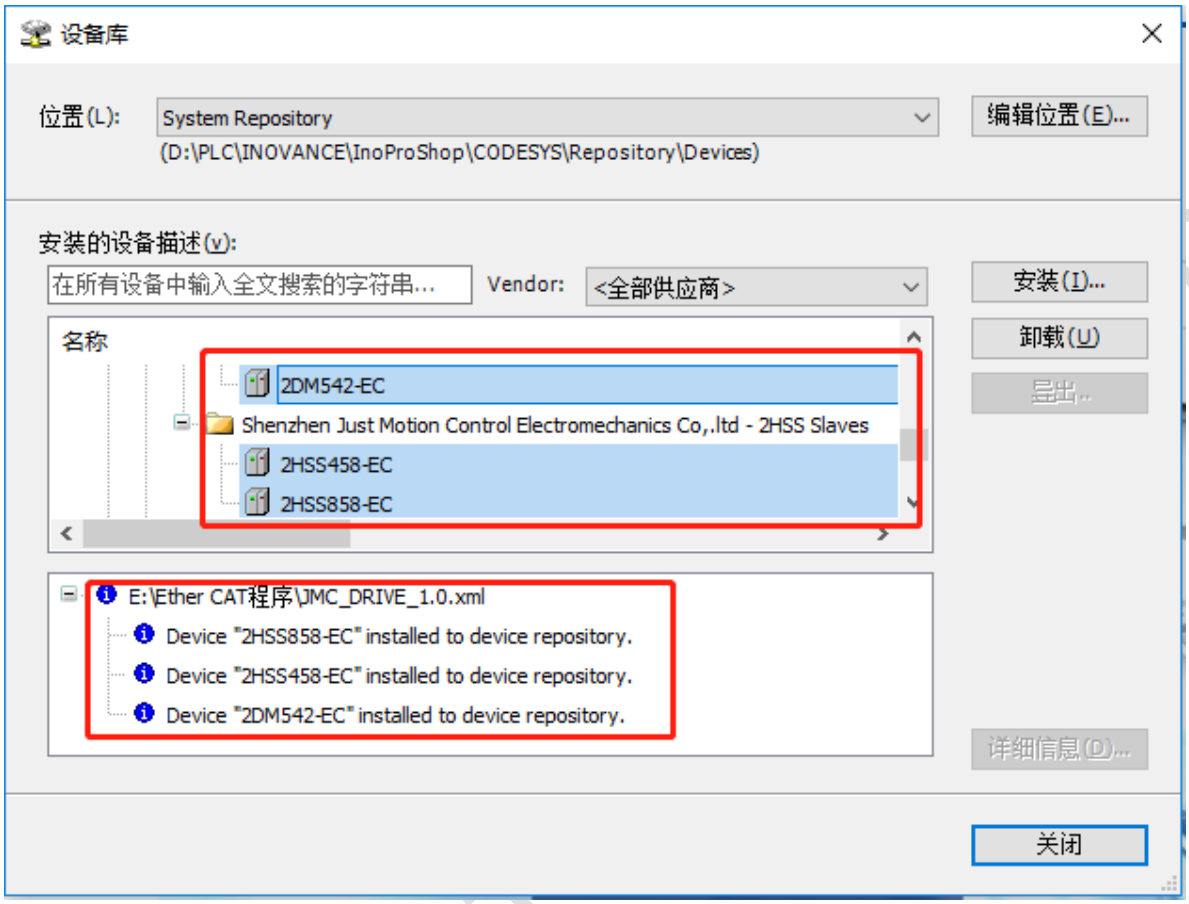



Figure 240 Successful installation

# Create a project

- Click New Project

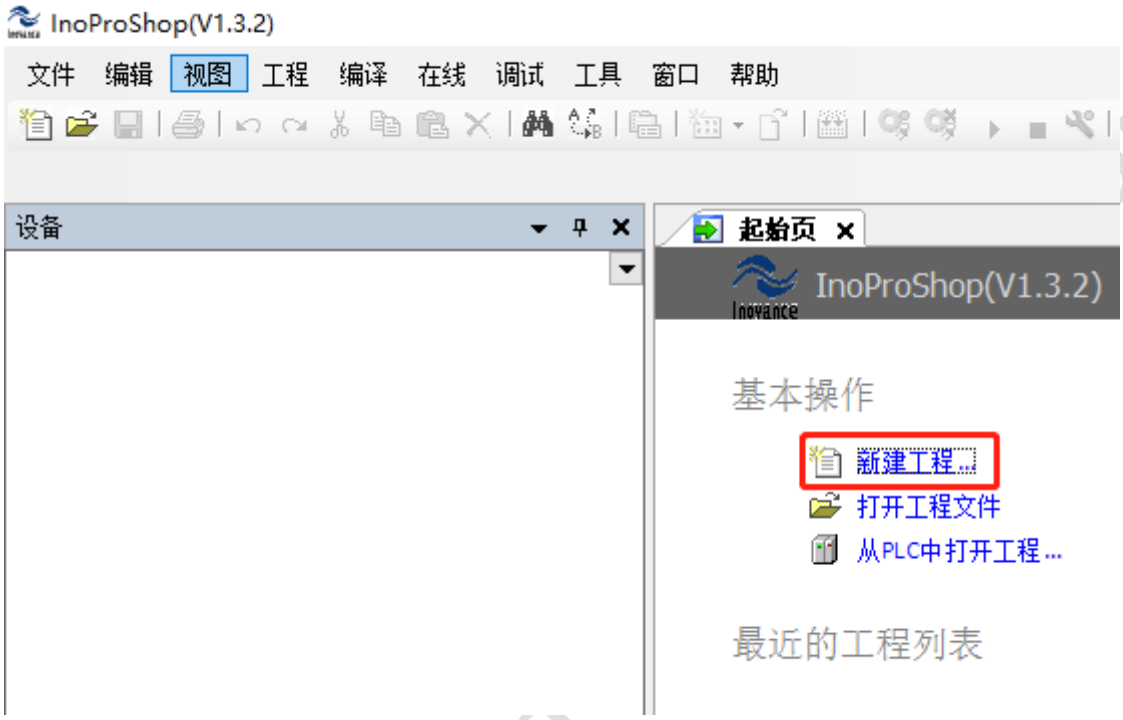



Figure 241 New INOProShop project

- Select "Standard Project" and determine the location and name of the EtherCAT project

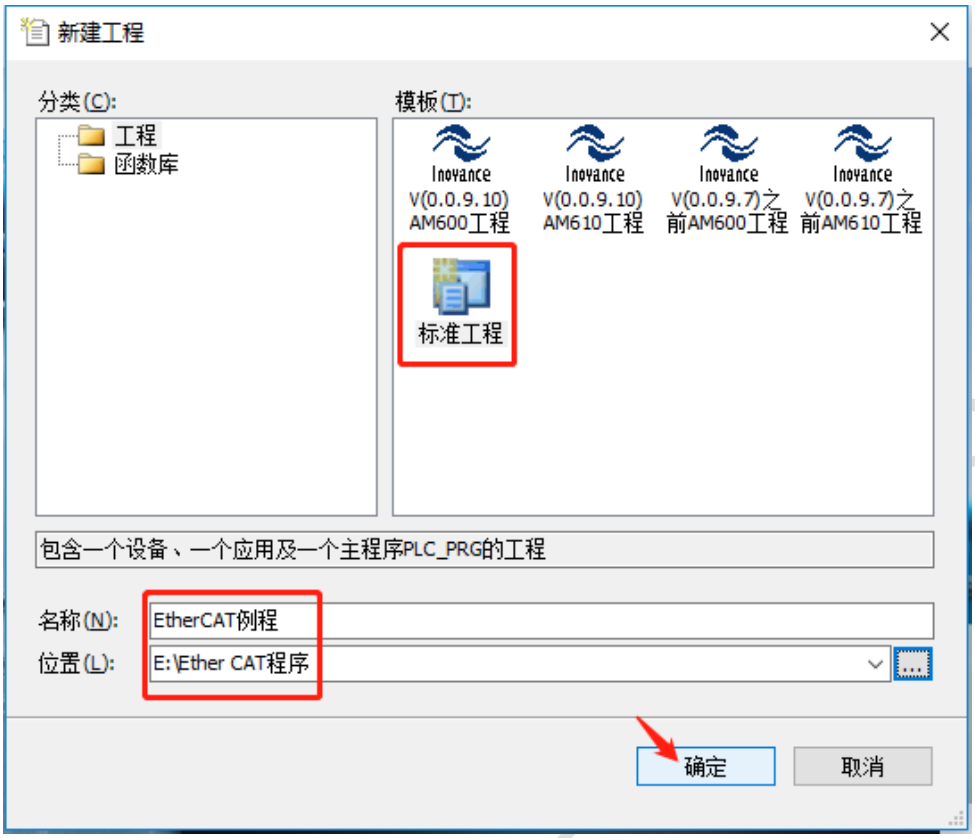



Figure 242 New standard project

- Select the device and programming language used, click OK
-

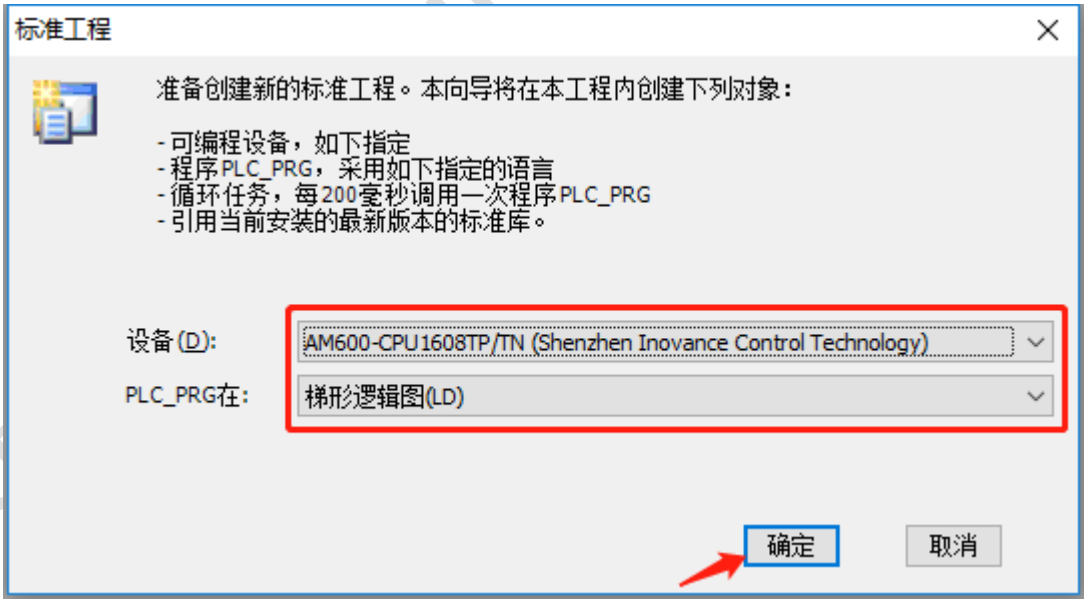



Figure 243 Determining the device and programming language

# Add device

- Double-click Network Configuration→click PLC→check EtherCAT master

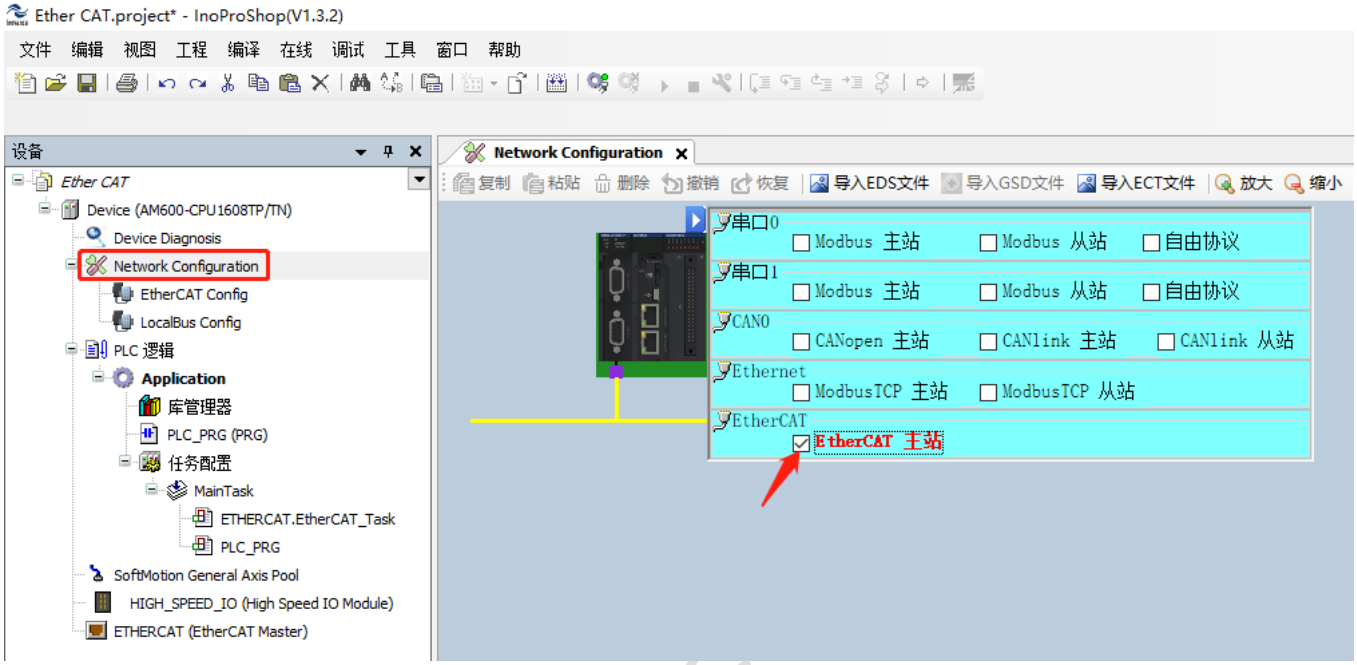



Figure 244 Add EtherCAT master

- Find ‘’ ShenZhen Just motion comtrol’’ under the network device list on the right, double-click the slave station to be added.
-

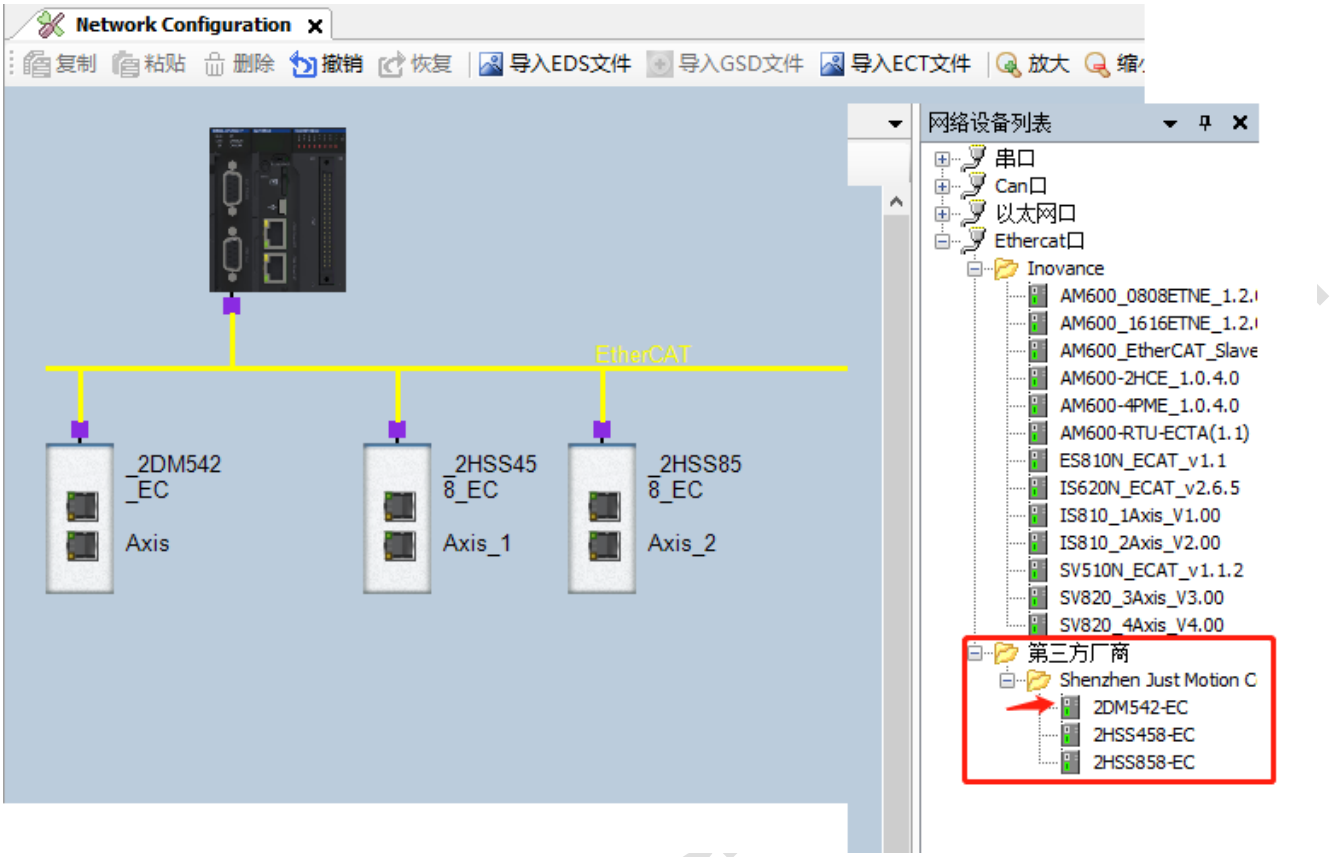



Figure 245 Add slave device

- Find the added slave station under the left device → right click to add CIA 402AIXS

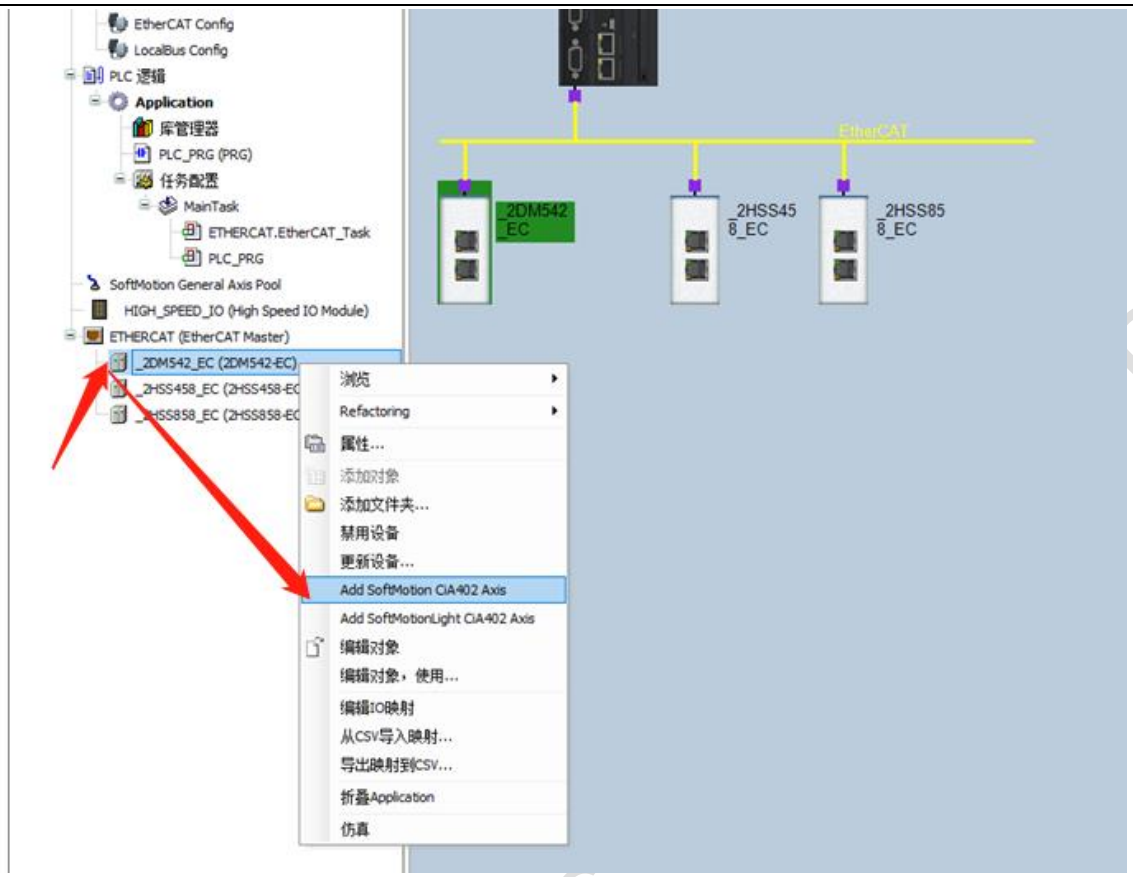



Figure 246 Add 402 axis

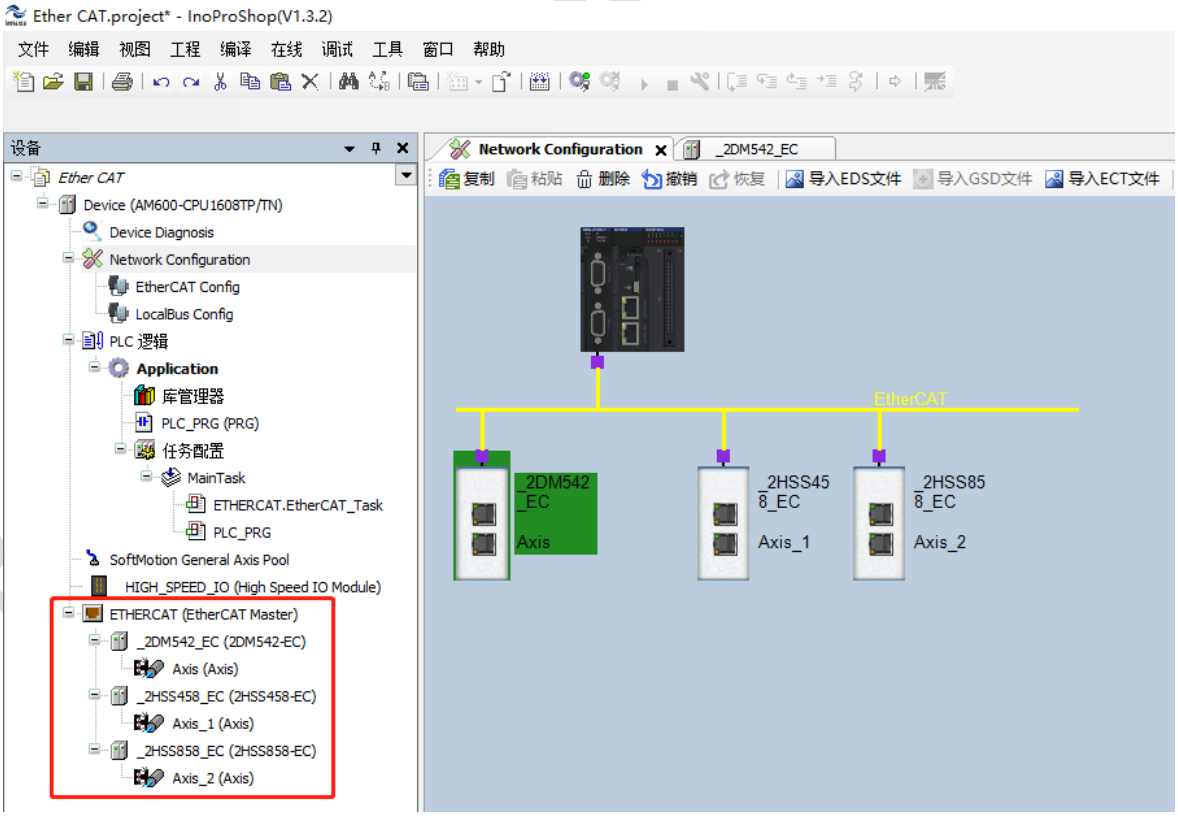



Figure 247 402 axis added

# Parameter setting

- Double-click 2DM542-EC → check to enable expert settings under overview

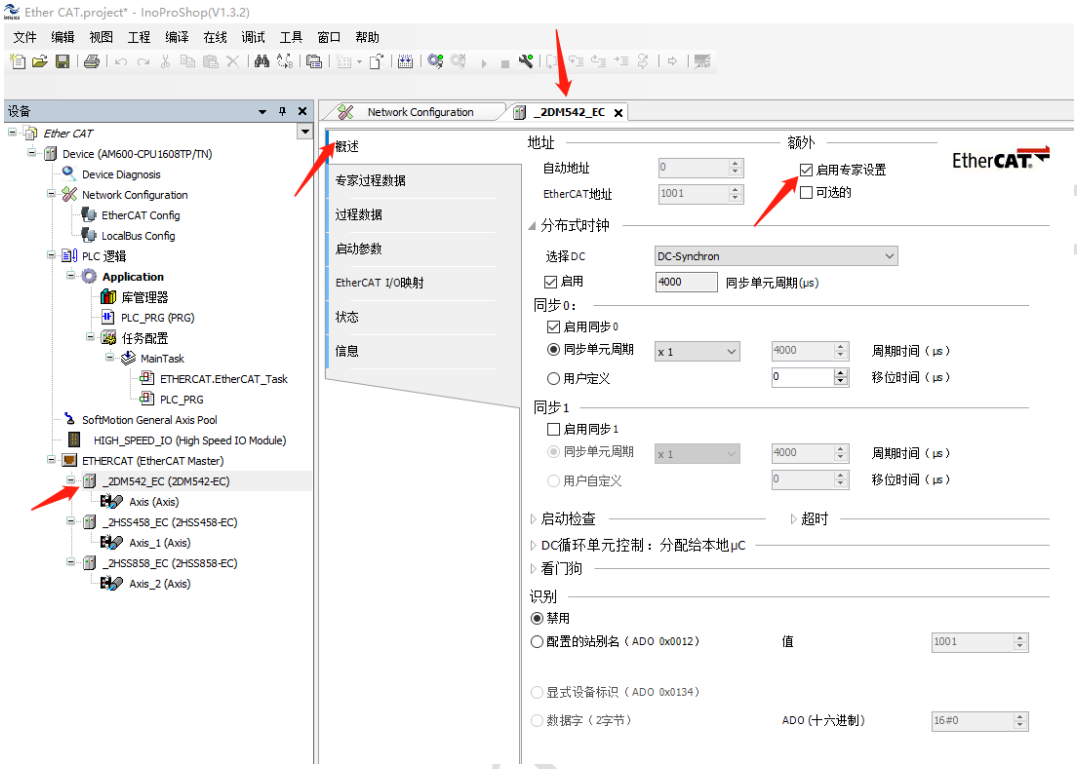



Figure 248 Enable expert settings

- Check PDO allocation and PDO configuration under expert process data

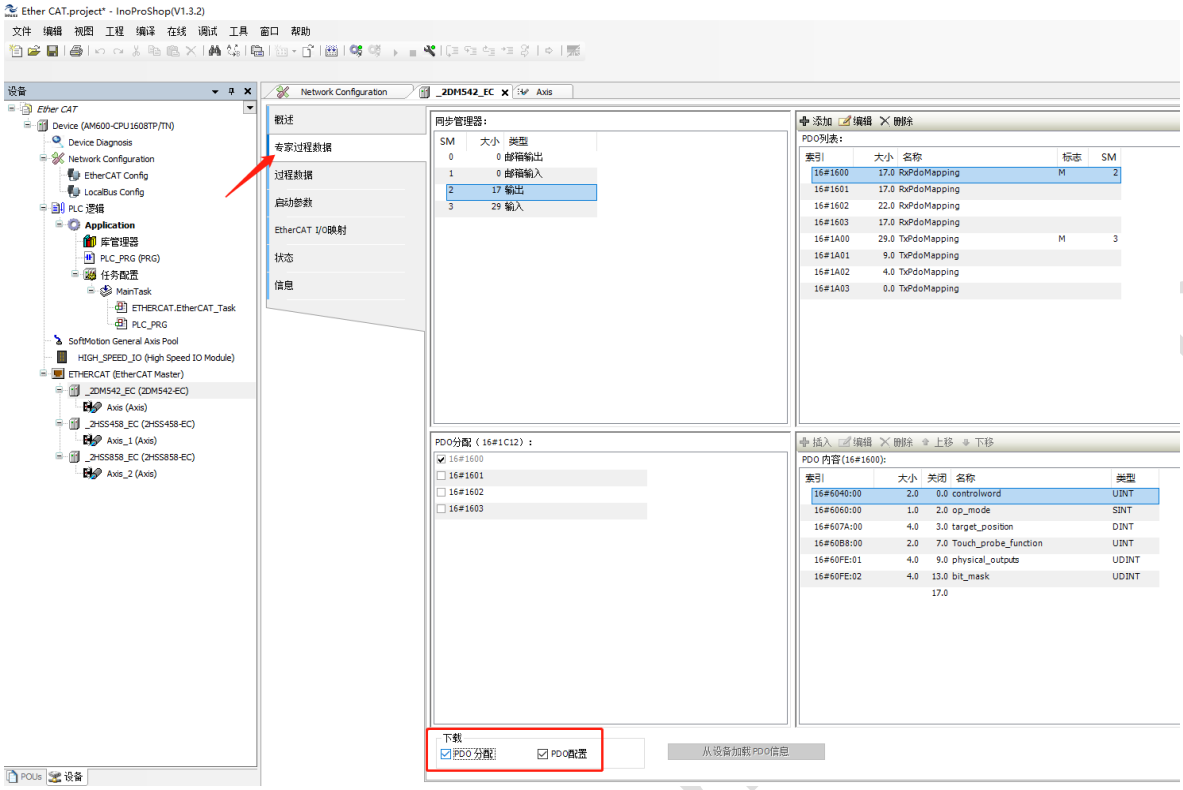



Figure 249 Check PDO configuration

- Double-click Axis→Under the unit conversion, find the number of pulses of one revolution of the motor, and modify it to 16#FA0 (subject to modification according to the drive).

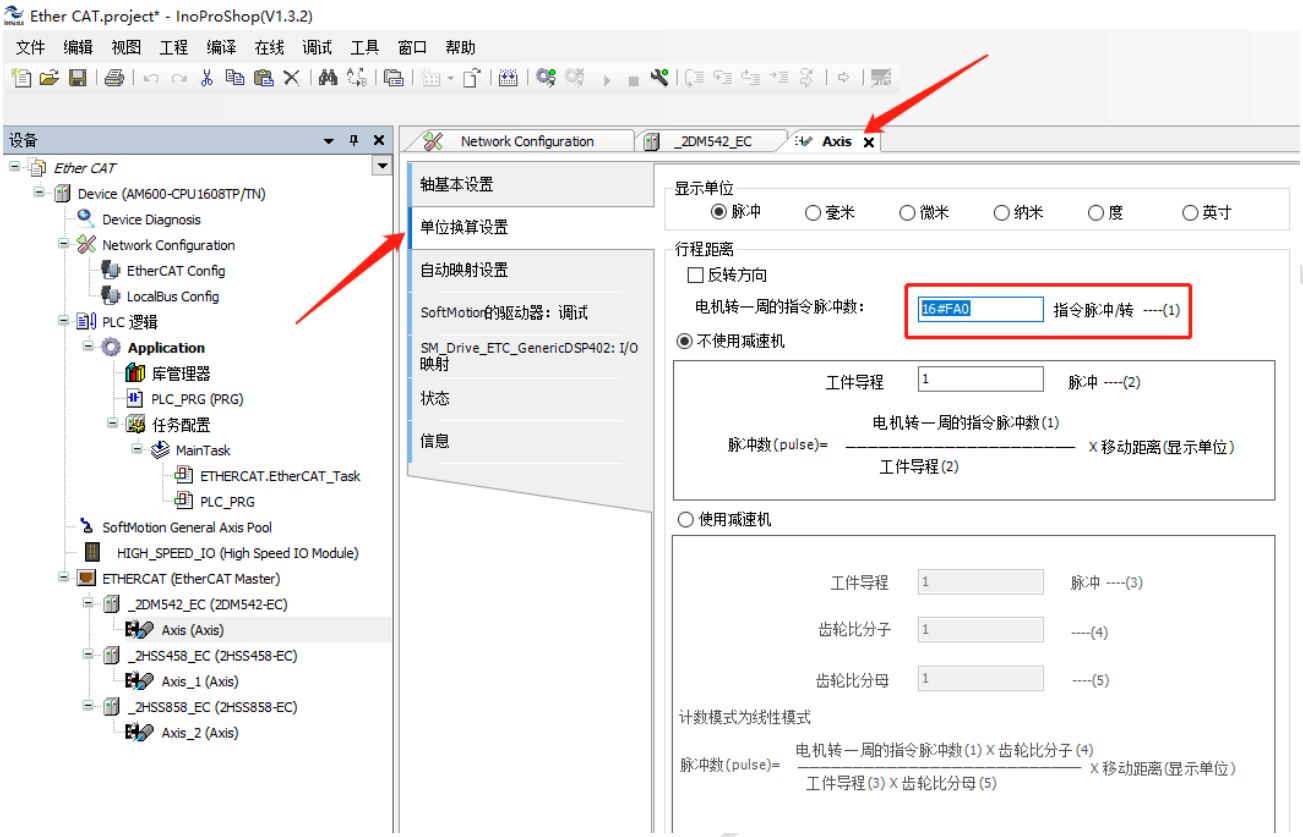



Figure 250 Setting the number of pulses for one revolution of the motor

# Add zero return parameter

- Startup parameter→click to add

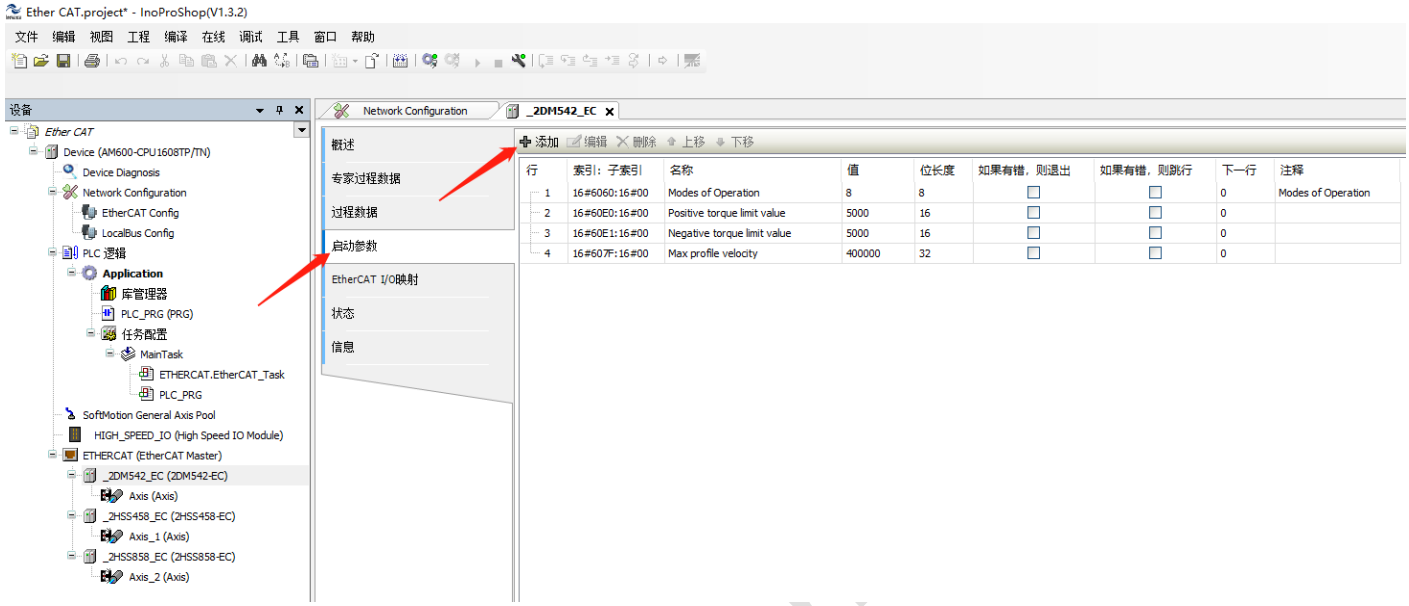



Figure 251 Add startup parameters

- Find 6098 (zero return method), 6099 01 (zero return speed), 6099 02 (zero return slow speed), 609A (zero return acceleration/deceleration) in the object catalog

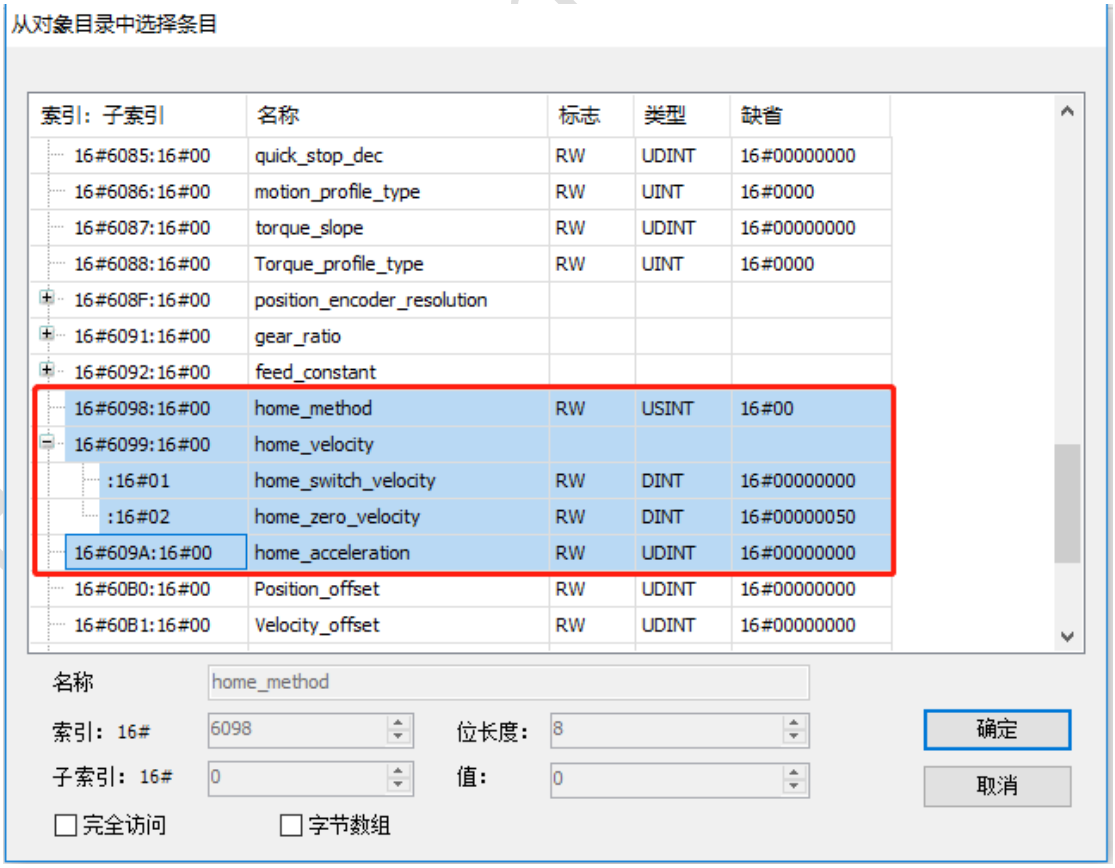



Figure 252 Selection object dictionary

# Set the zero return parameter

16#6098 (zero return method): select the appropriate zero return method, and the track map of the zero return method can be found in the Jiemeikang EtherCAT protocol manual.

16#6099[01] (Return speed to zero): 4000 speed is 1rps

16#6099[02] (slow return speed): 100 speed is 0.025rps

16#609A (zero return acceleration/deceleration): 40000 speed is 10rps

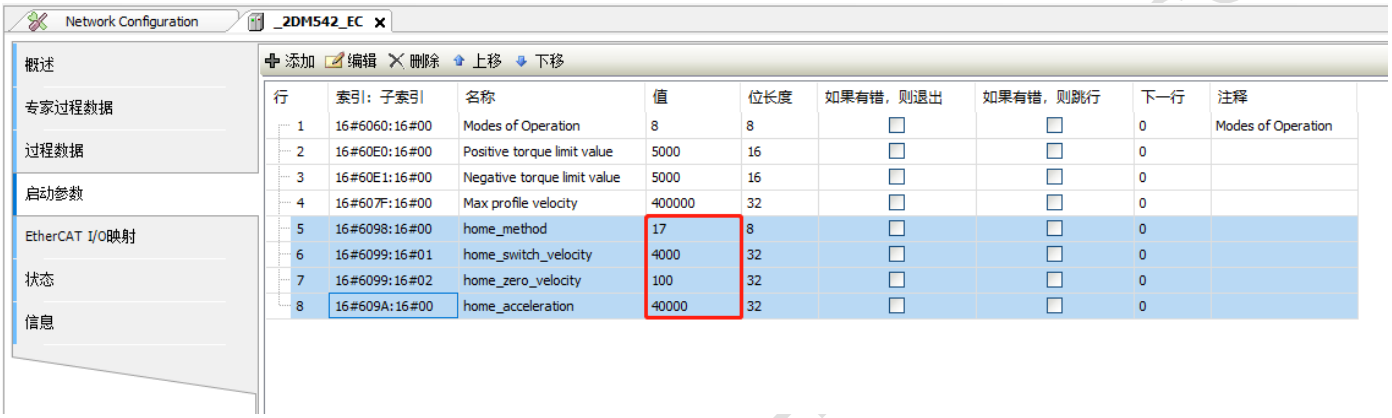



Figure 253 Setting the zero return parameter

# Programming

## 1 New program organization unit

- Right click Application→Add Object→Program Organization Unit→Name, Type, Language
-

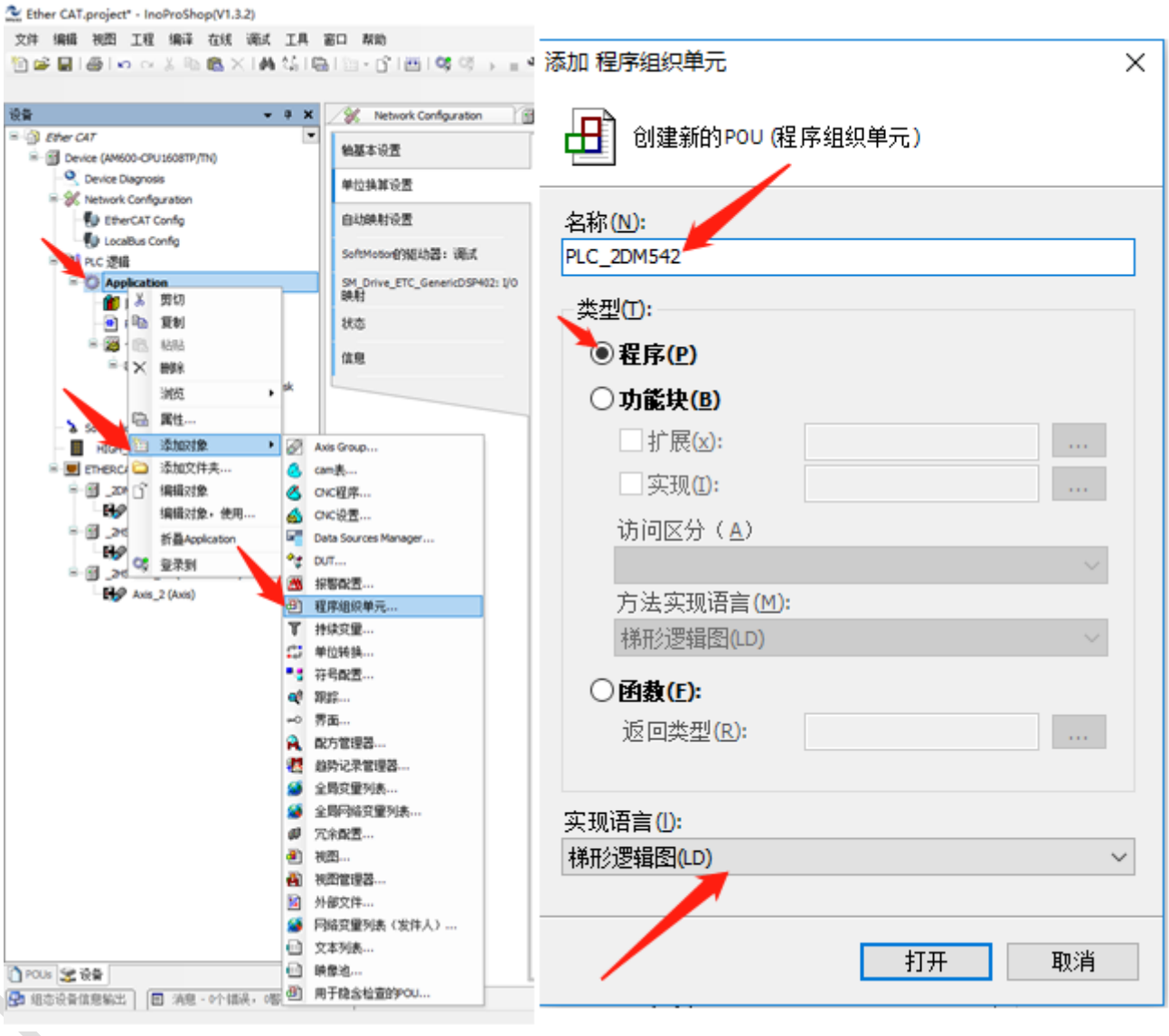



Figure 254 Create POU

# 2 Add motion control instructions

Click Insert Operation Block to open the input assistant to add motion instructions. (For specific instruction application, please refer to "AM600 Series Programmable Logic Controller Programming Manual (Motion Control)")

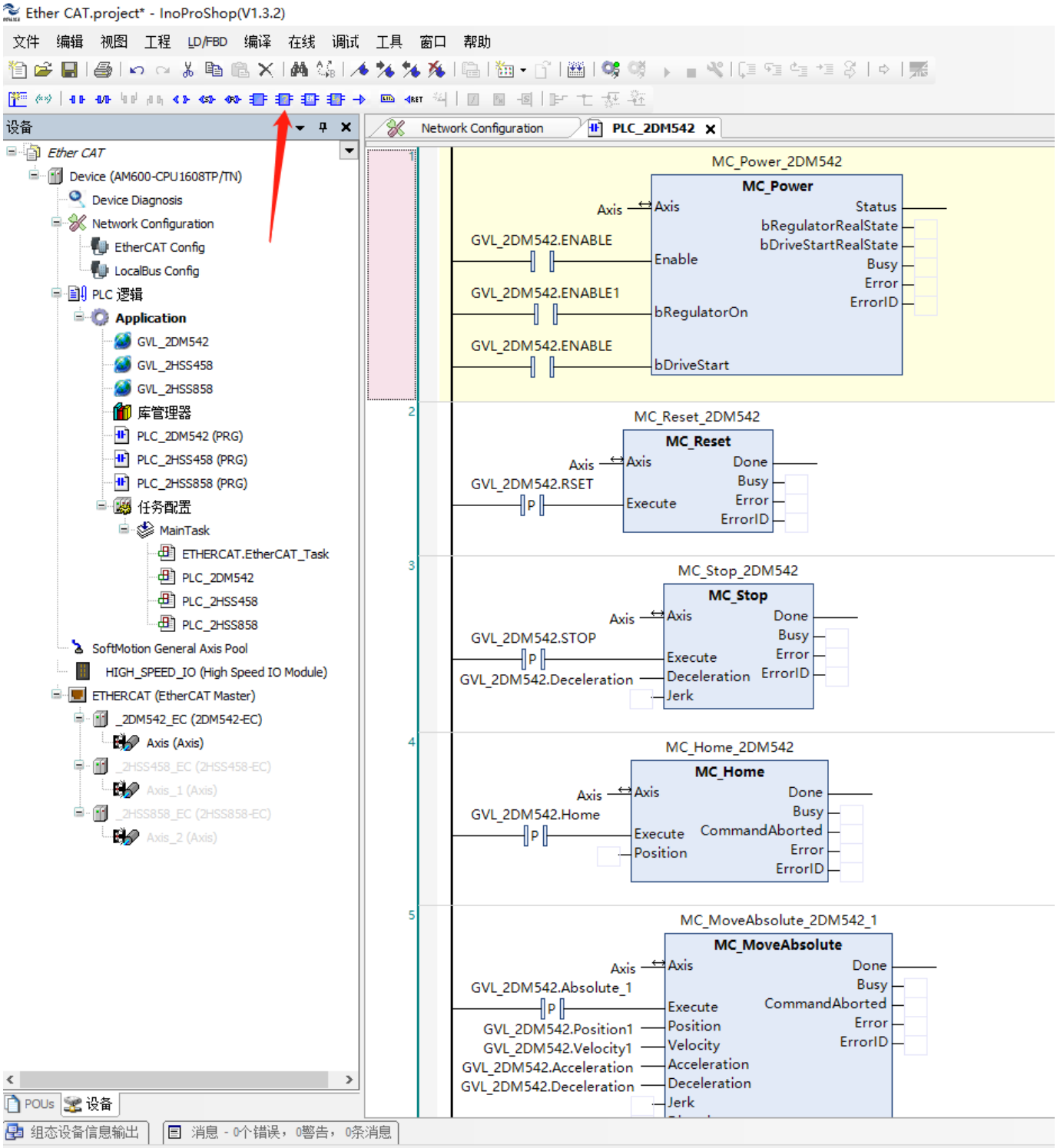



Figure 255 Motion control module

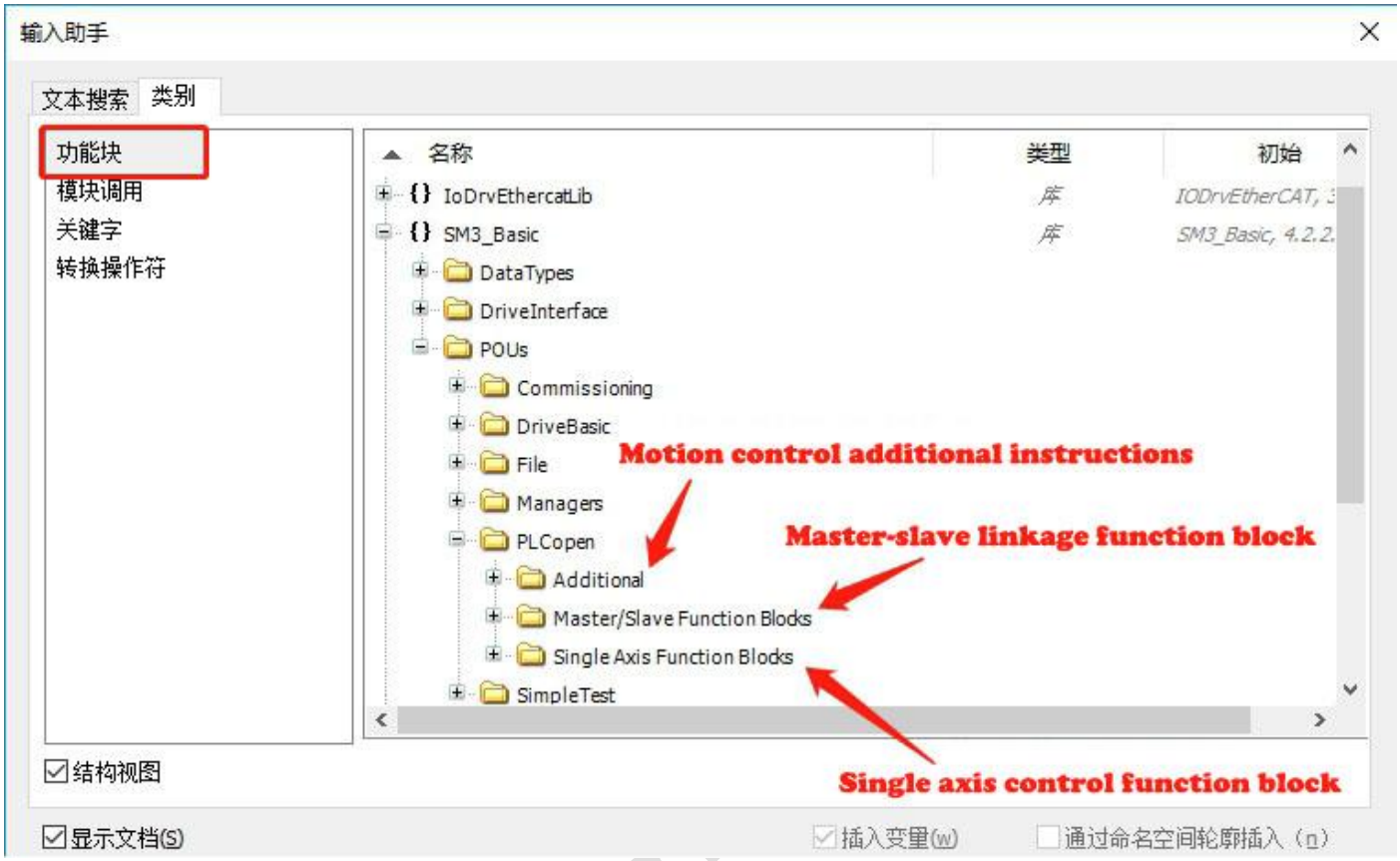
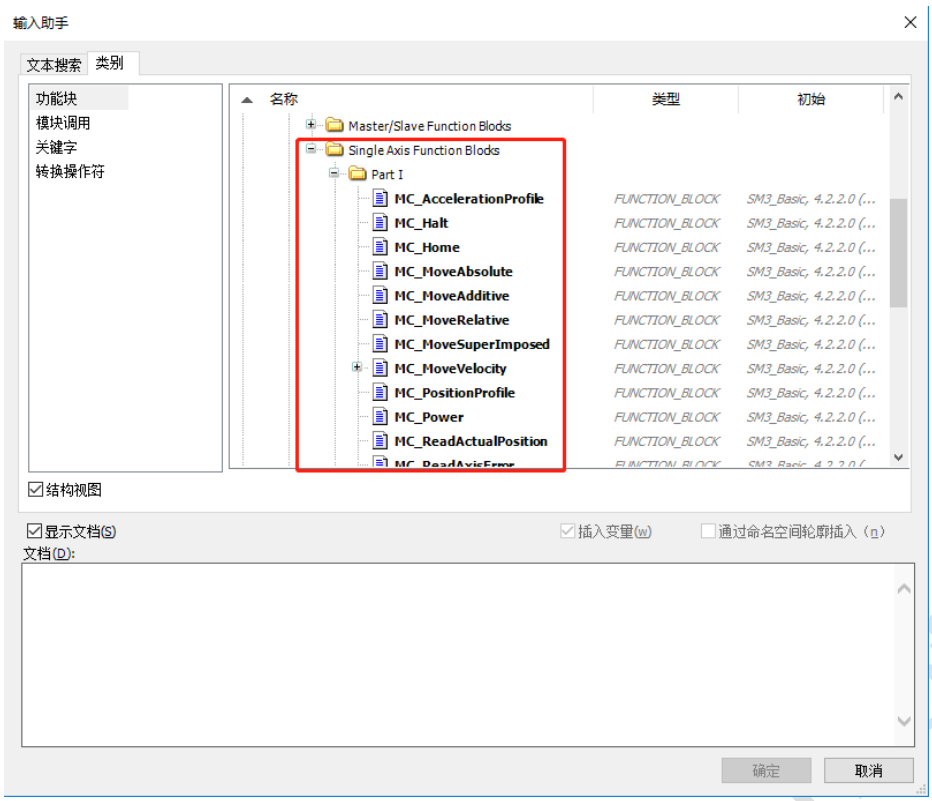



Figure 256 Function block

- The routine used is to control single-axis instructions




# 3 Add task configuration

- Double-click MainTask→Add Call

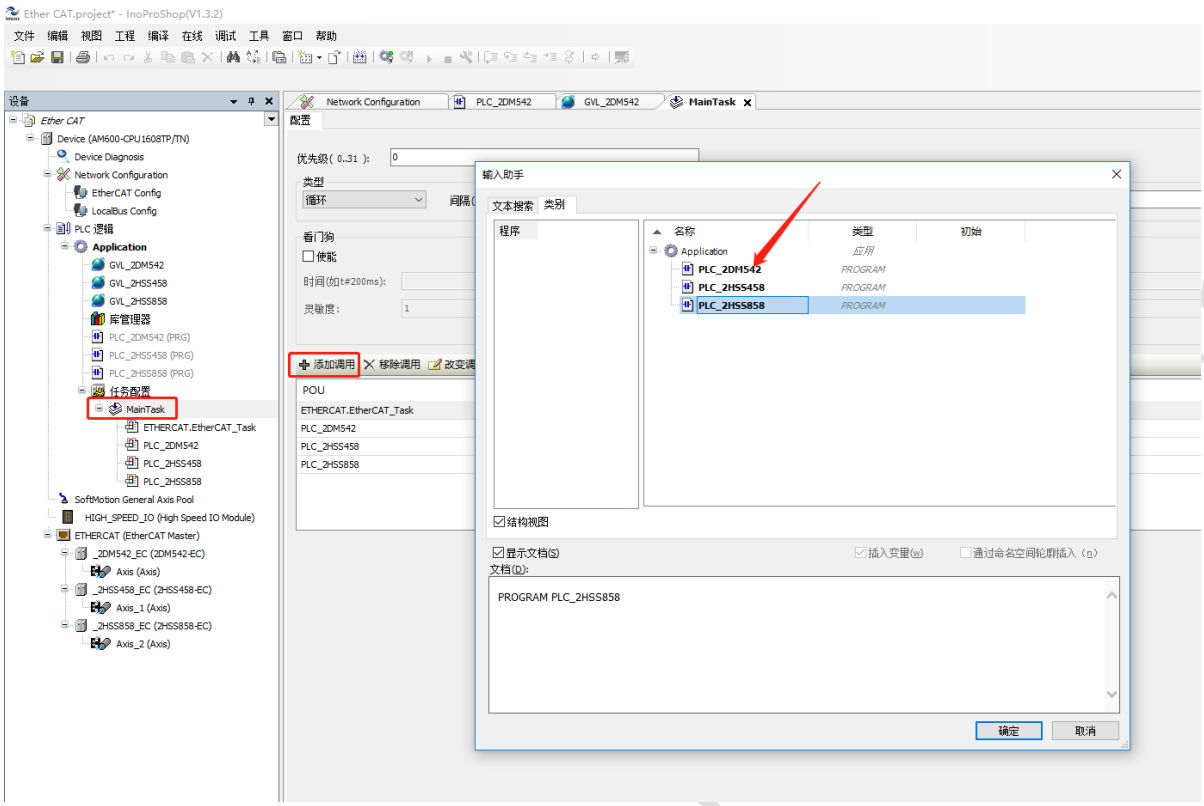



Figure 258 Add task configuration

# 4 Login to download and debug the program

- Scan the master device

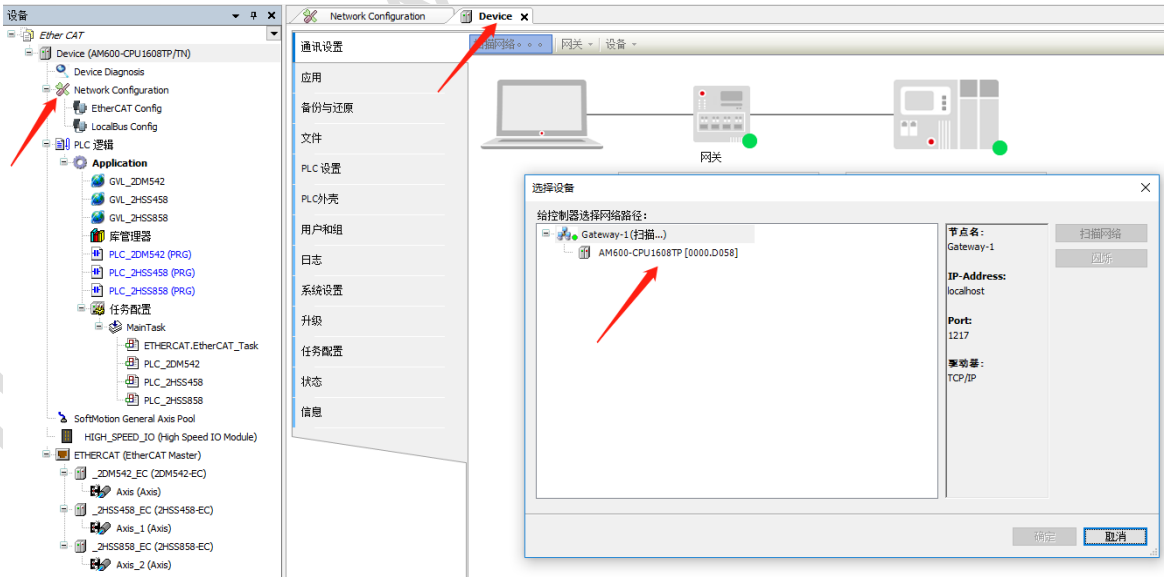
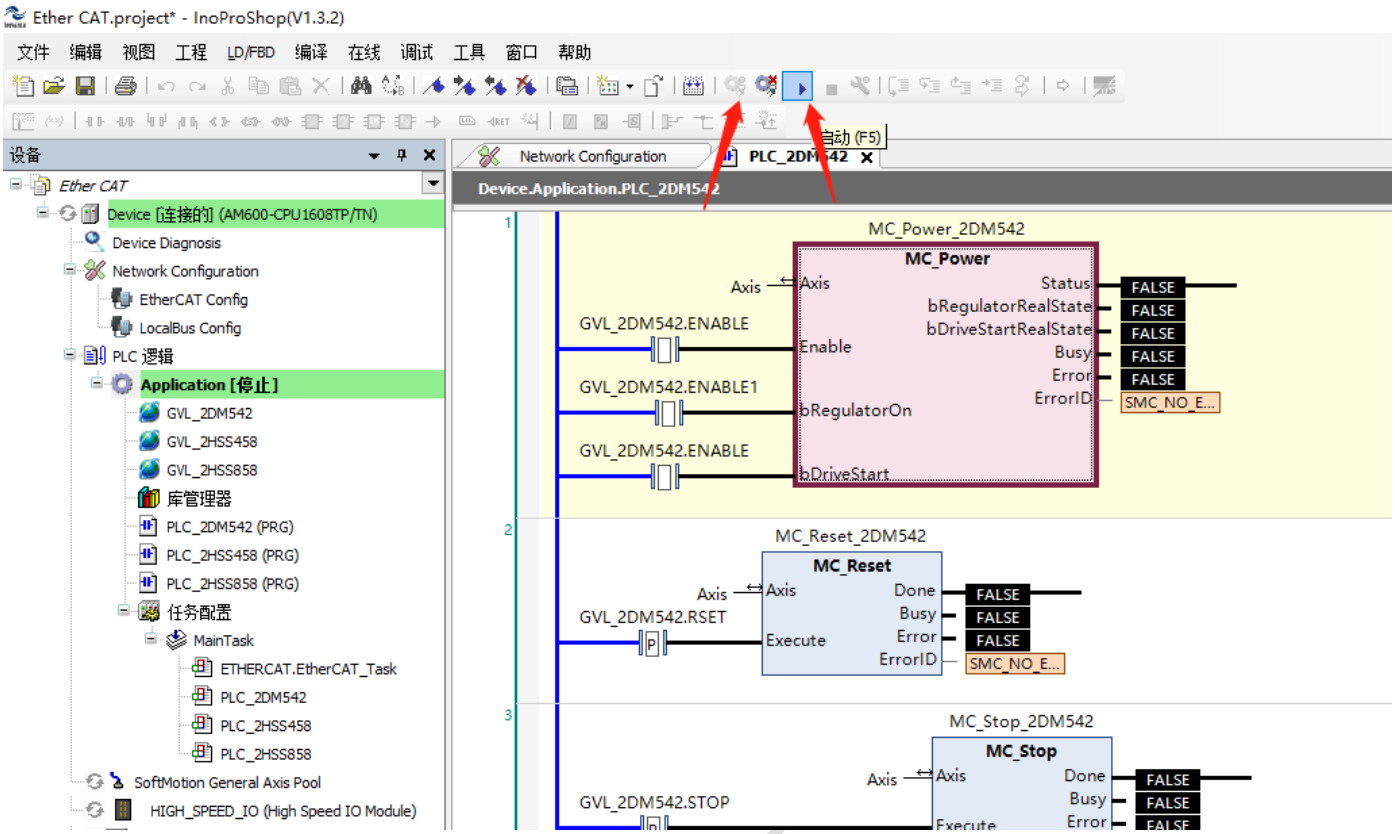



Figure 259 Scanning the master device

- Login→Start




- Figure 260 Log in to the device

- The connection status between the slave station and the master station

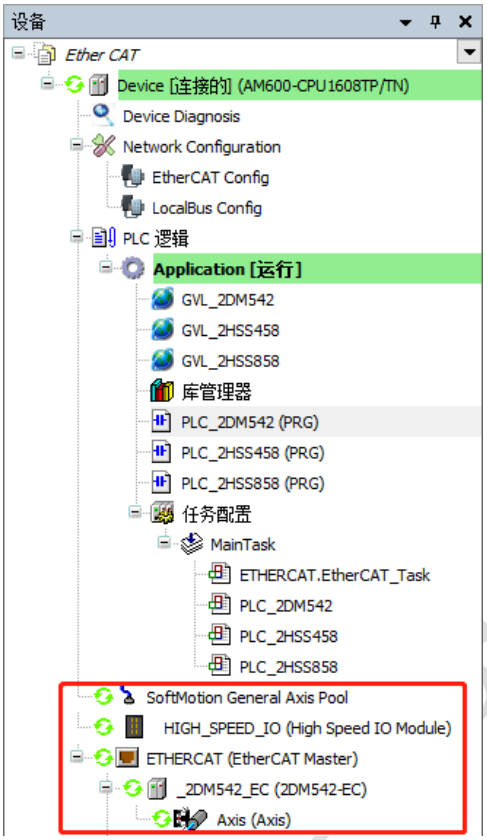



Figure 261 Master-slave connection status

# 5 Enable device

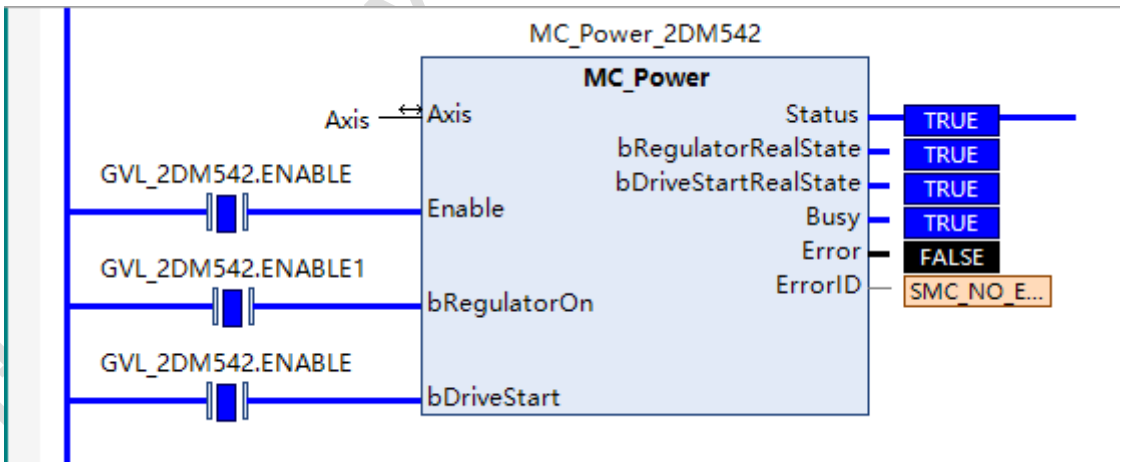
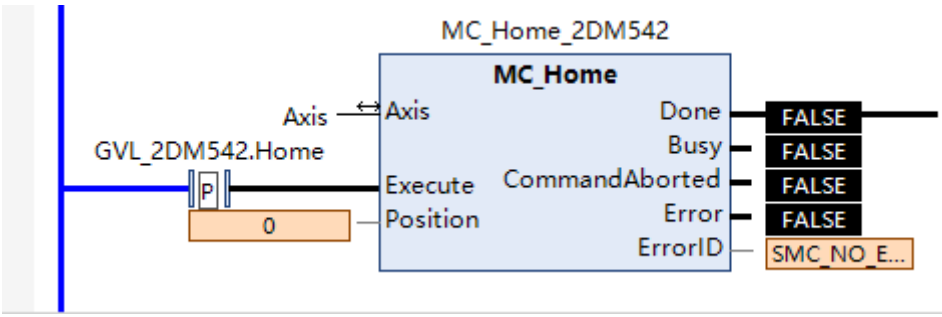



Figure 262 Enabling device

# 6 Back to zero mode




# 7 Position mode

- Absolute positioning

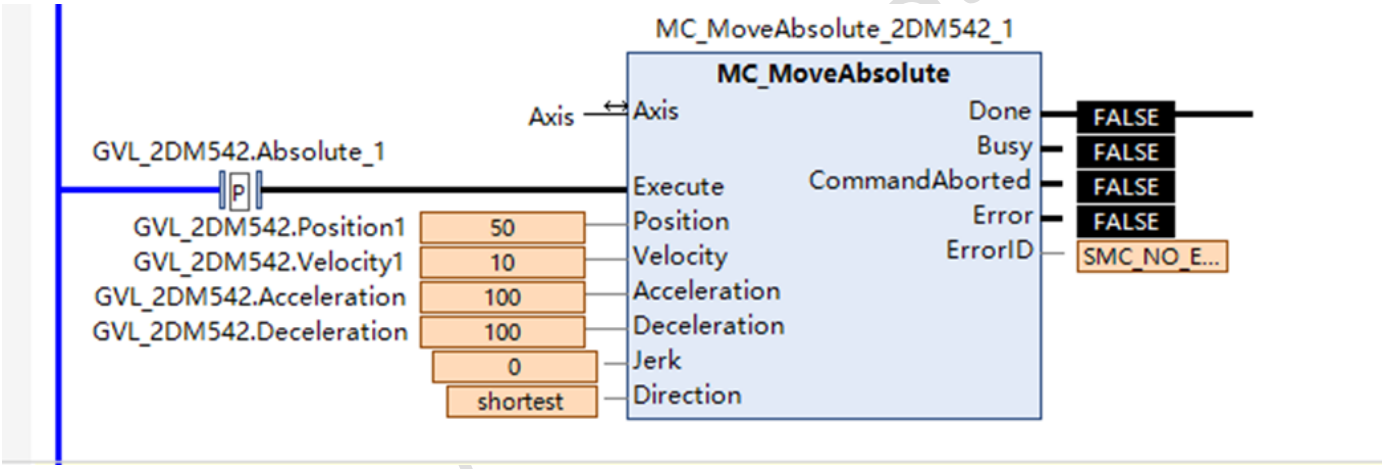
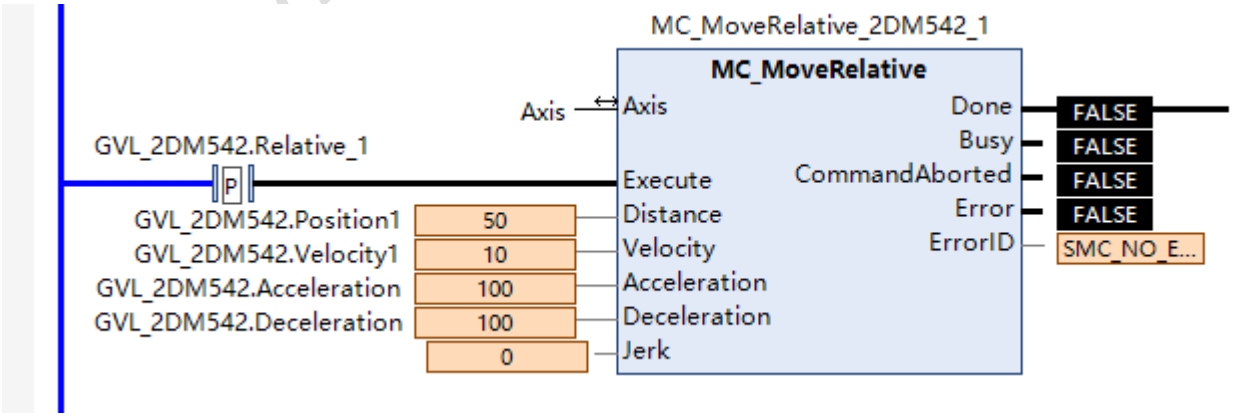



Figure 264 Position mode

- Relative positioning
-




- Figure 23 Relative positioning

# 8 speed mode

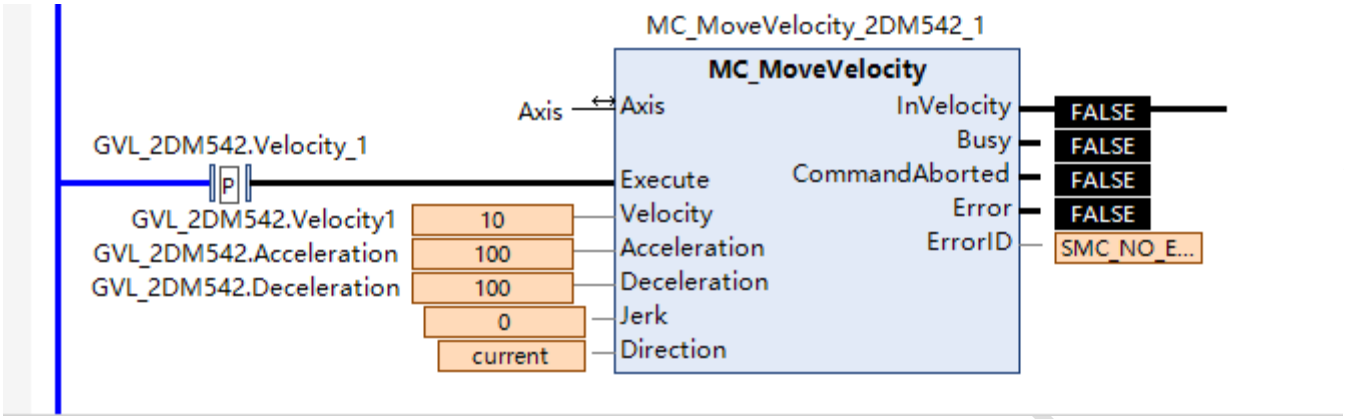



Figure 24 Speed mode

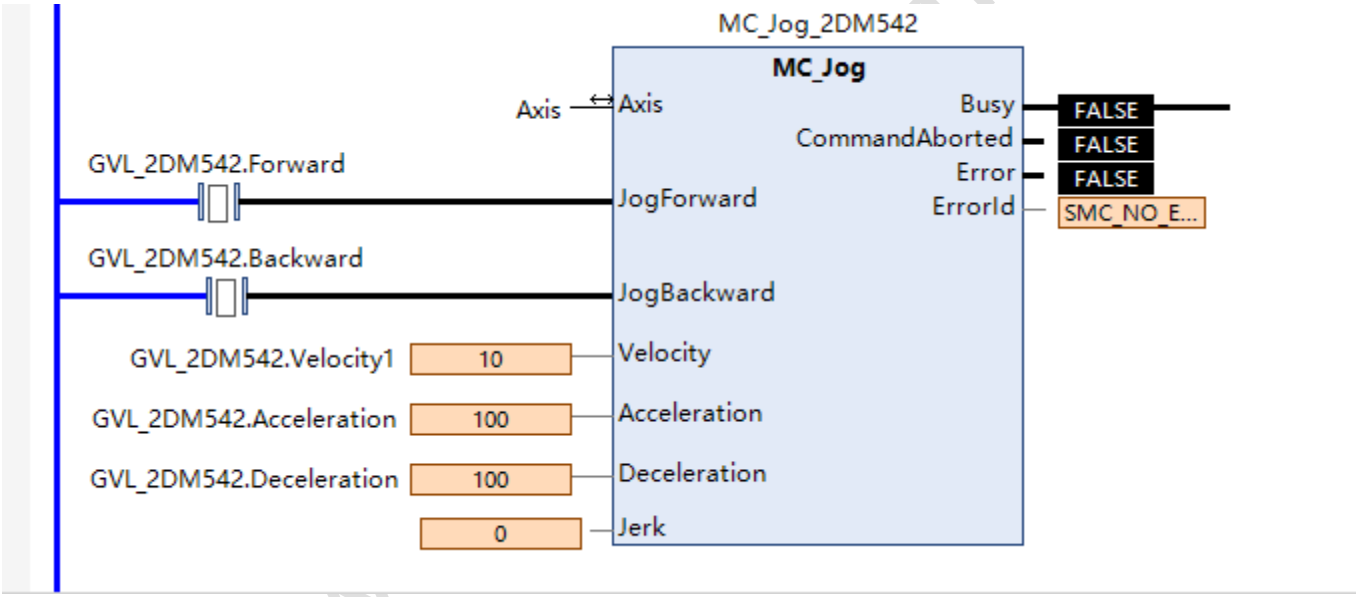



Figure 25 JOG mode

# 9 Alarm reset

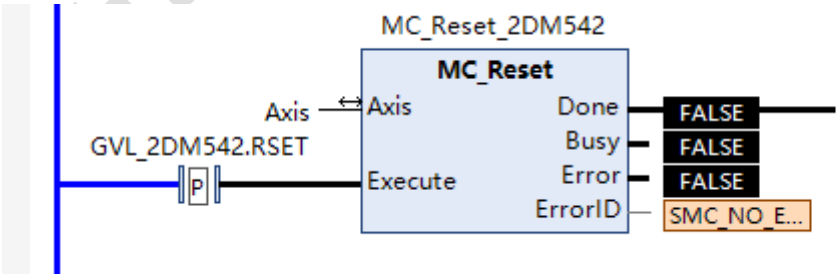



Figure 26 alarm reset

## 10 Stop the device

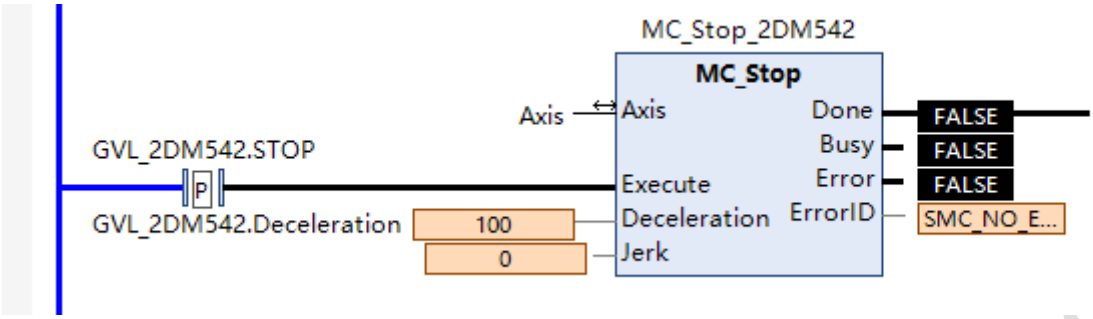



Figure 269 Stop device

# EtherCAT communication operation routine based on Omron controller

## Install device description file

Open Omron programming software Sysmac Studio→New Project→Create

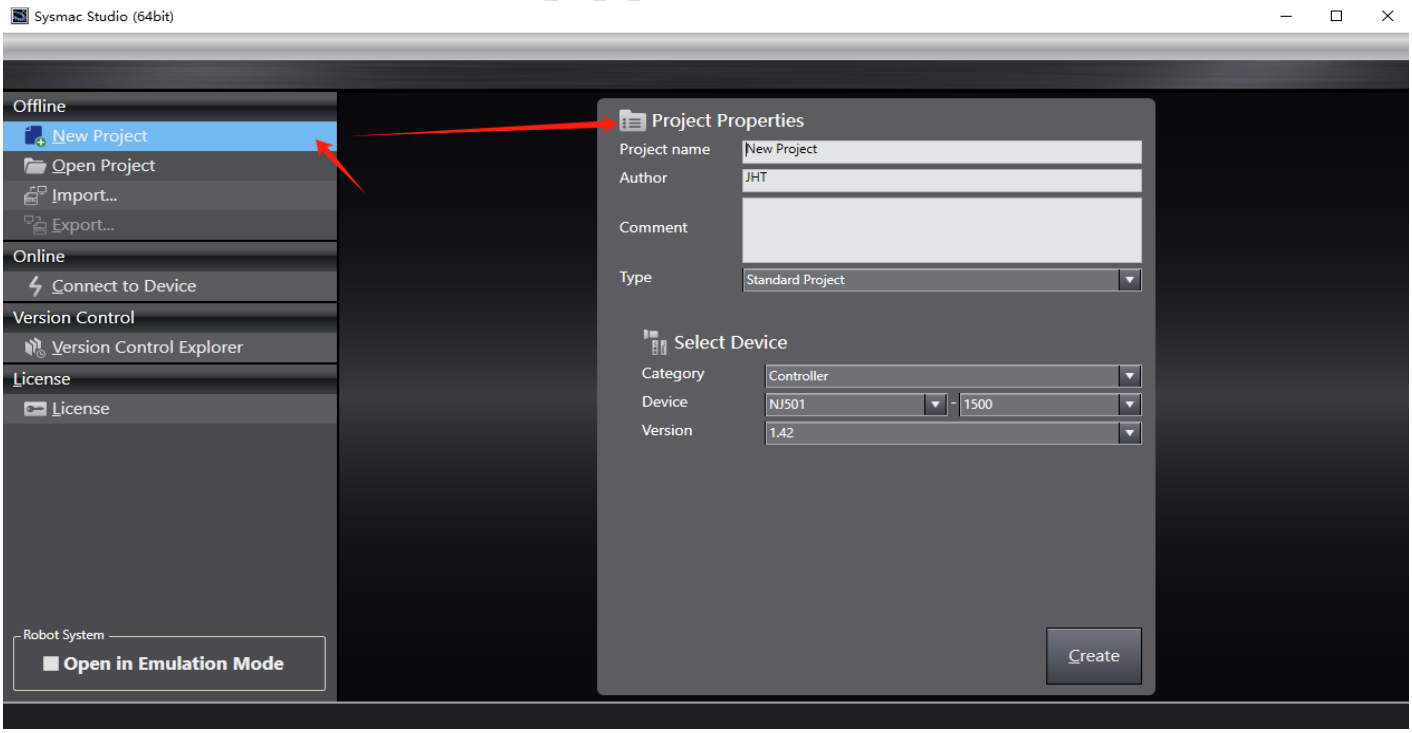



Figure 270 New Sysmac project

- Double-click EtherCAT in the configuration and settings → right-click the main device → click to display the ESI library

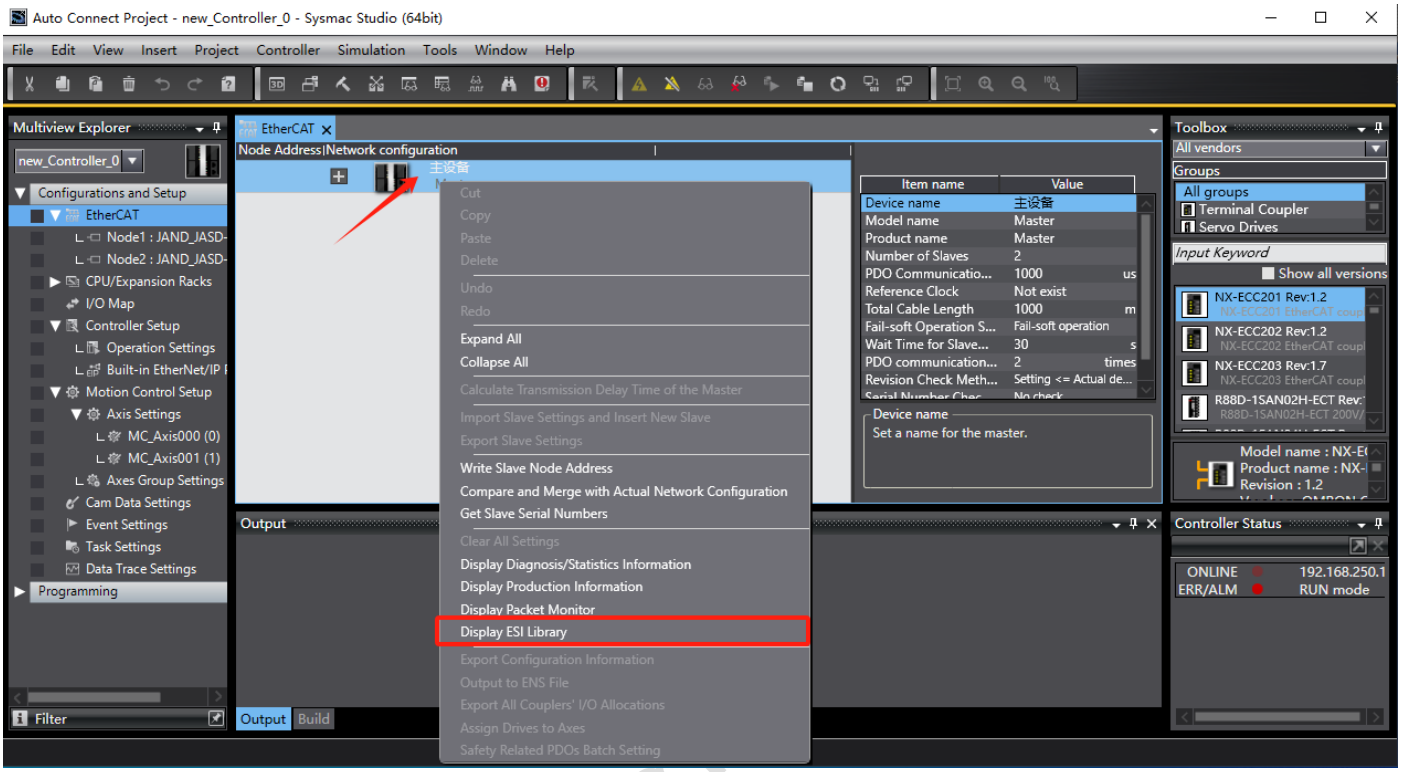
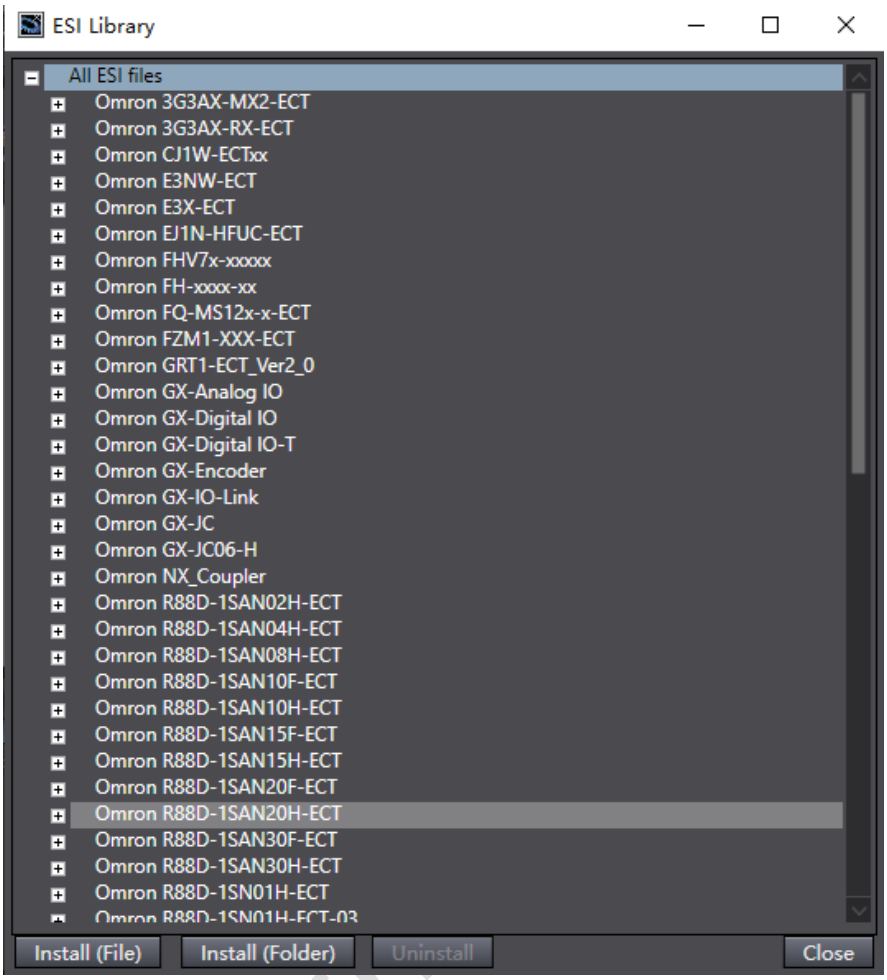



Figure 271 Open the ESI library

- Click on "This Folder"



- Put the device description file of JMC ECAT series into this folder → then close Omron programming software

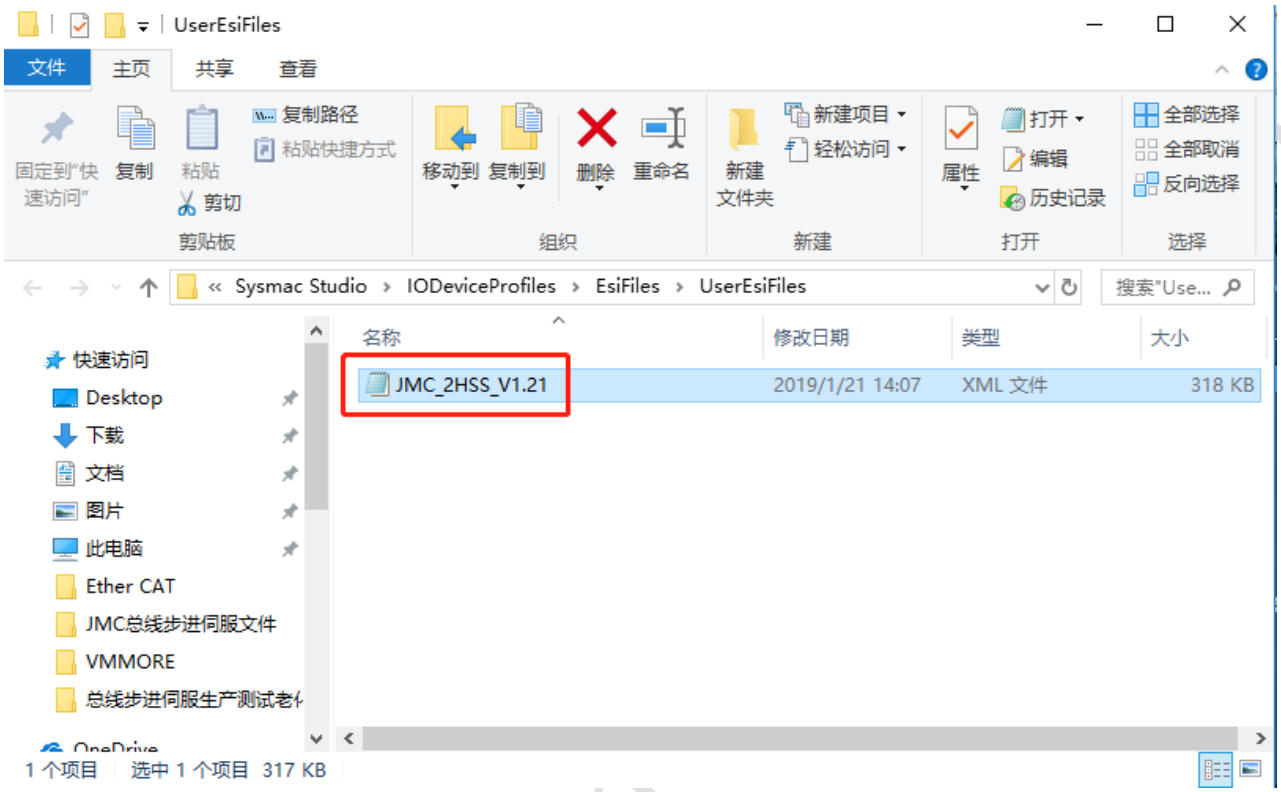



Figure 273 Select XML file

# Set computer connection properties

- The PC and the controller are directly connected via Ethernet, and the computer TCP/IP properties need to be set
- Open the Network and Sharing Center→Properties

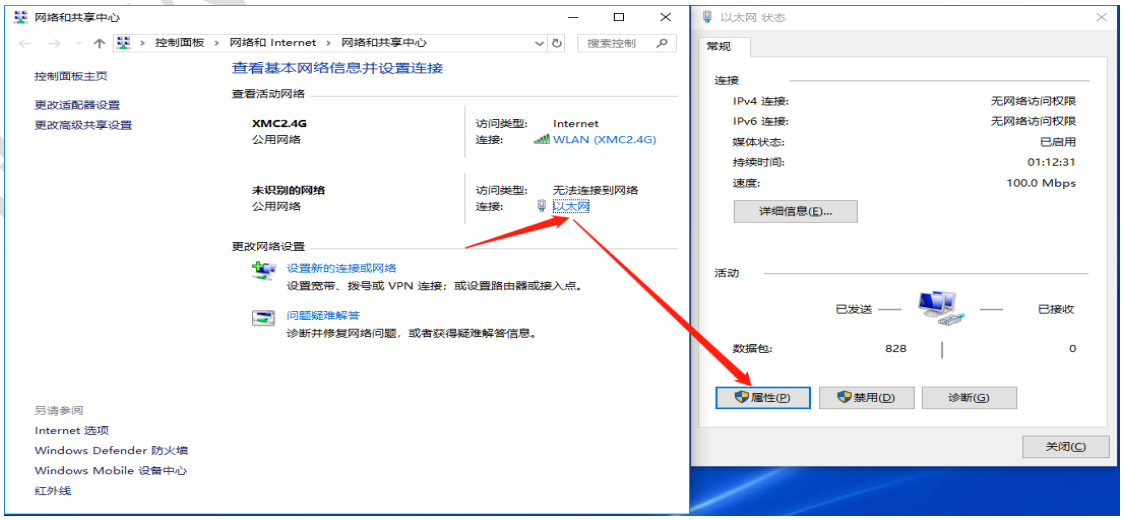



Figure 274 Configure TCP/IP

- Double-click the Internet protocol version 4 → set the IP address according to the controller

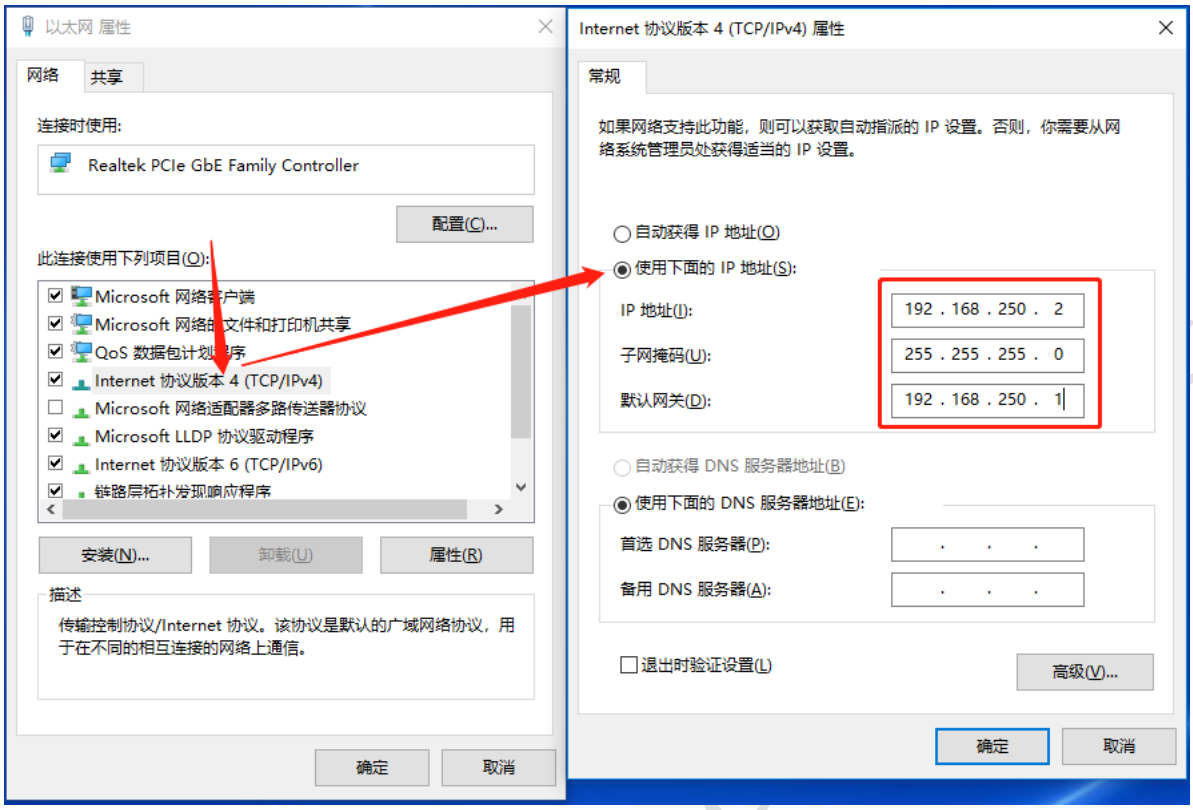



Figure 275 Set IP address

# Omron software configuration

## 1. Open project

- Open Omron programming software→Open project→Open the ECAT routine just created

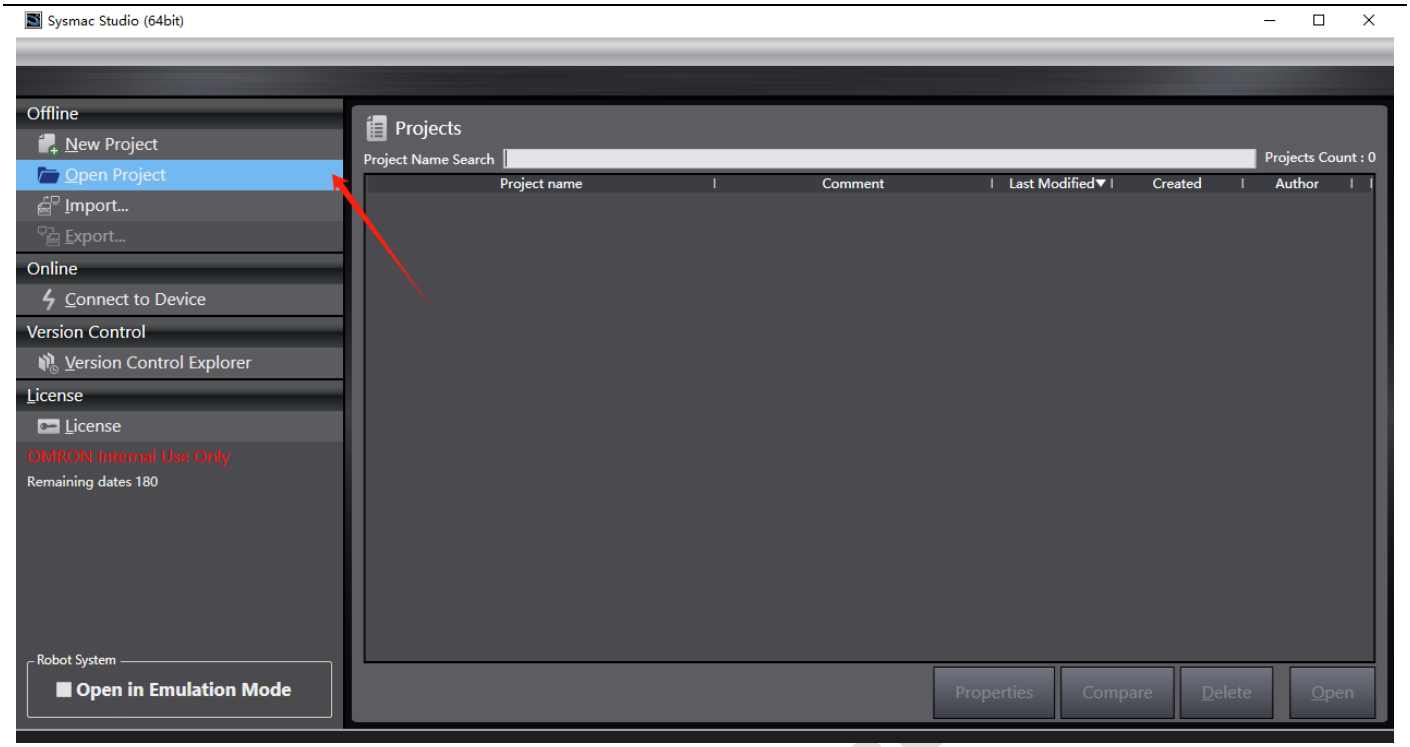



Figure 276 Open project

# 2 Communication settings

- Controller→Communication Settings

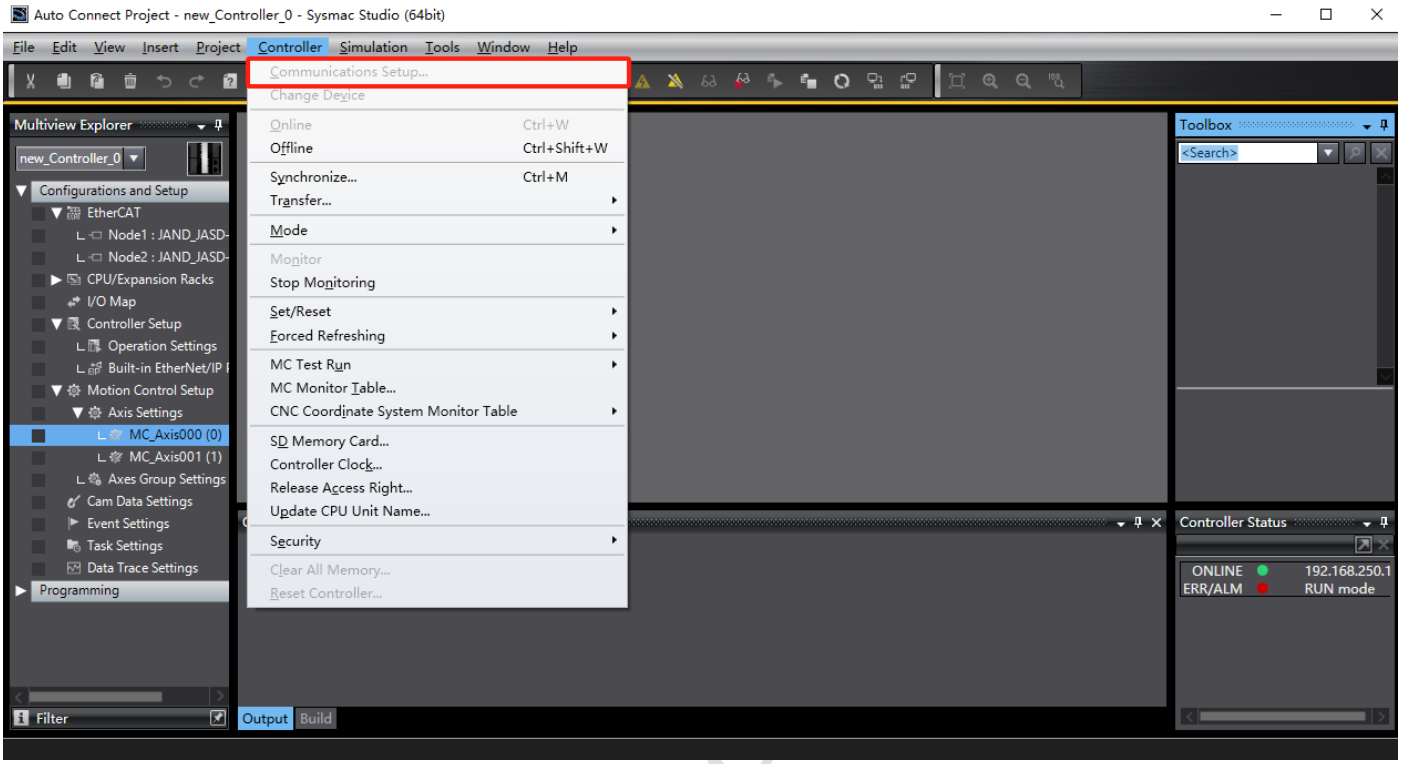



Figure 277 Communication settings

- Select Ethernet communication

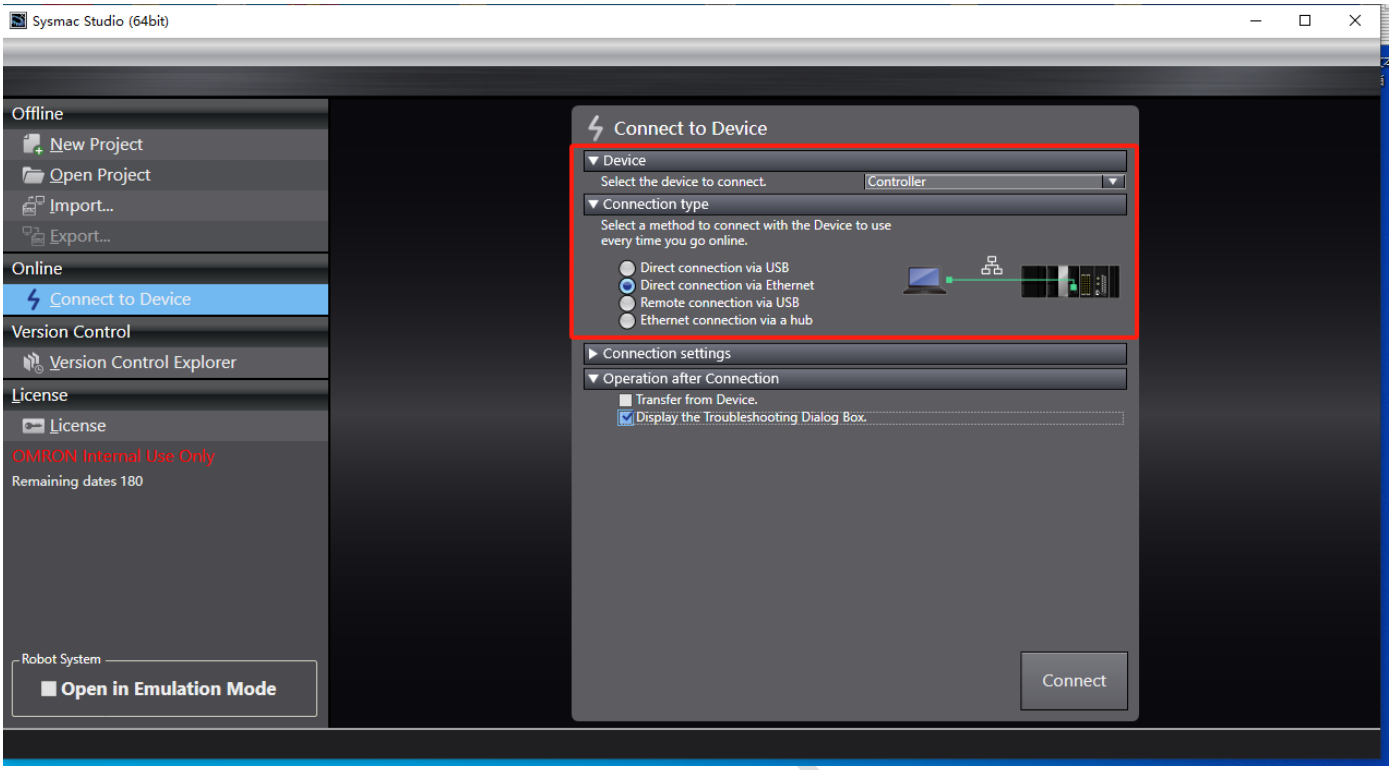



Figure 278 Select Ethernet communication

# 3 Scanning equipment

- Online→Double-click EtherCAT in the configuration and settings→Right-click on the main device→Compare and merge with the physical network configuration

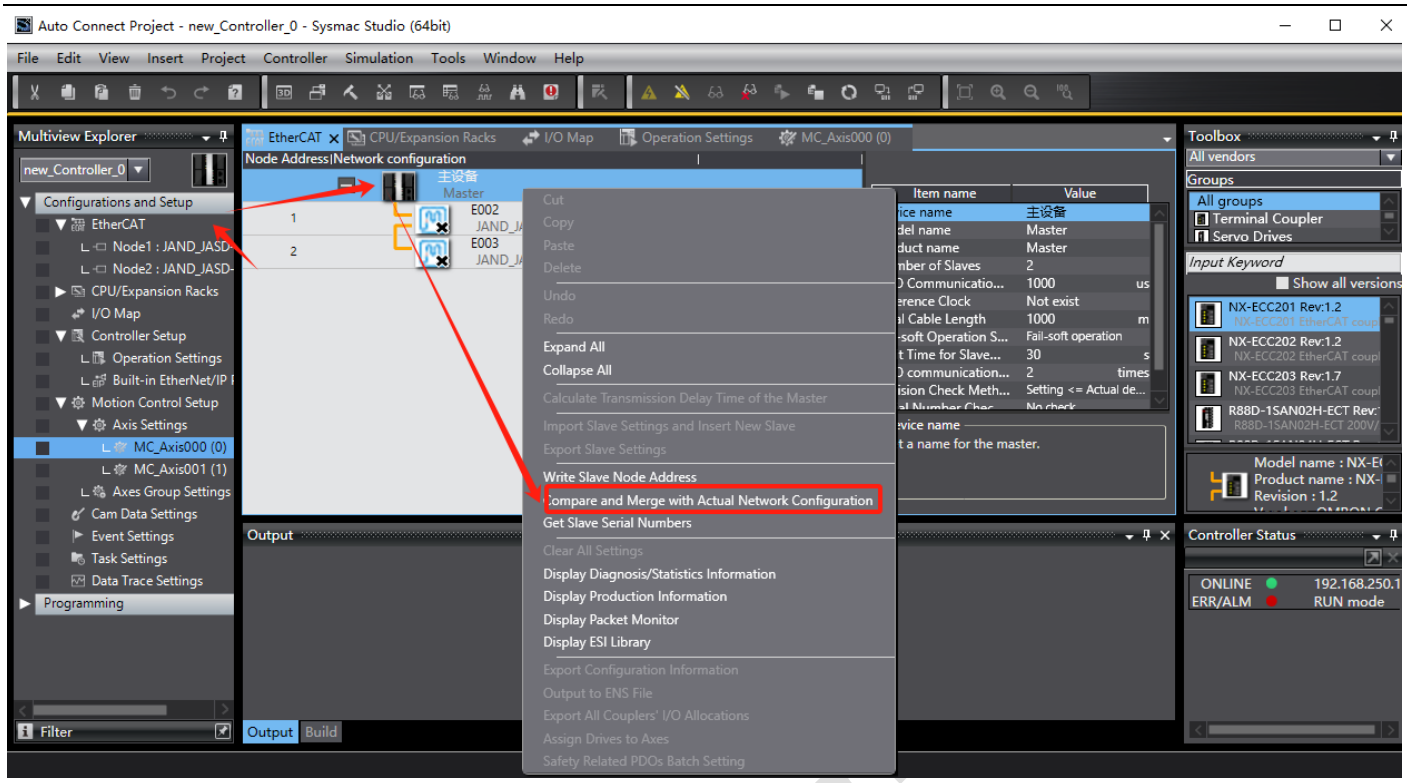



Figure 279 Comparison and merge with physical network configuration

- Apply physical network configuration

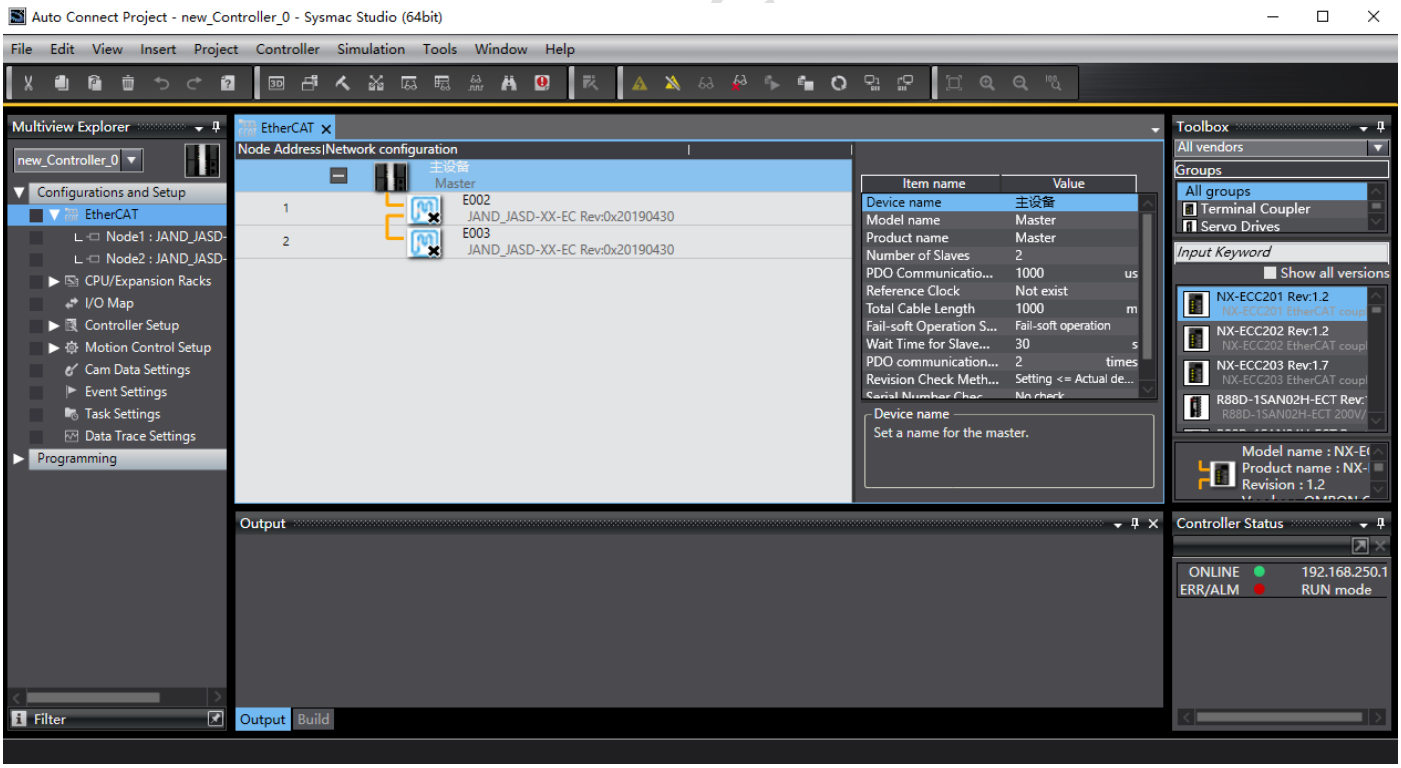



Figure 280 Applied physical network configuration

# 4 Axis parameter setting

Offline→Motion control axis→Axis setting→Add→Motion control axis

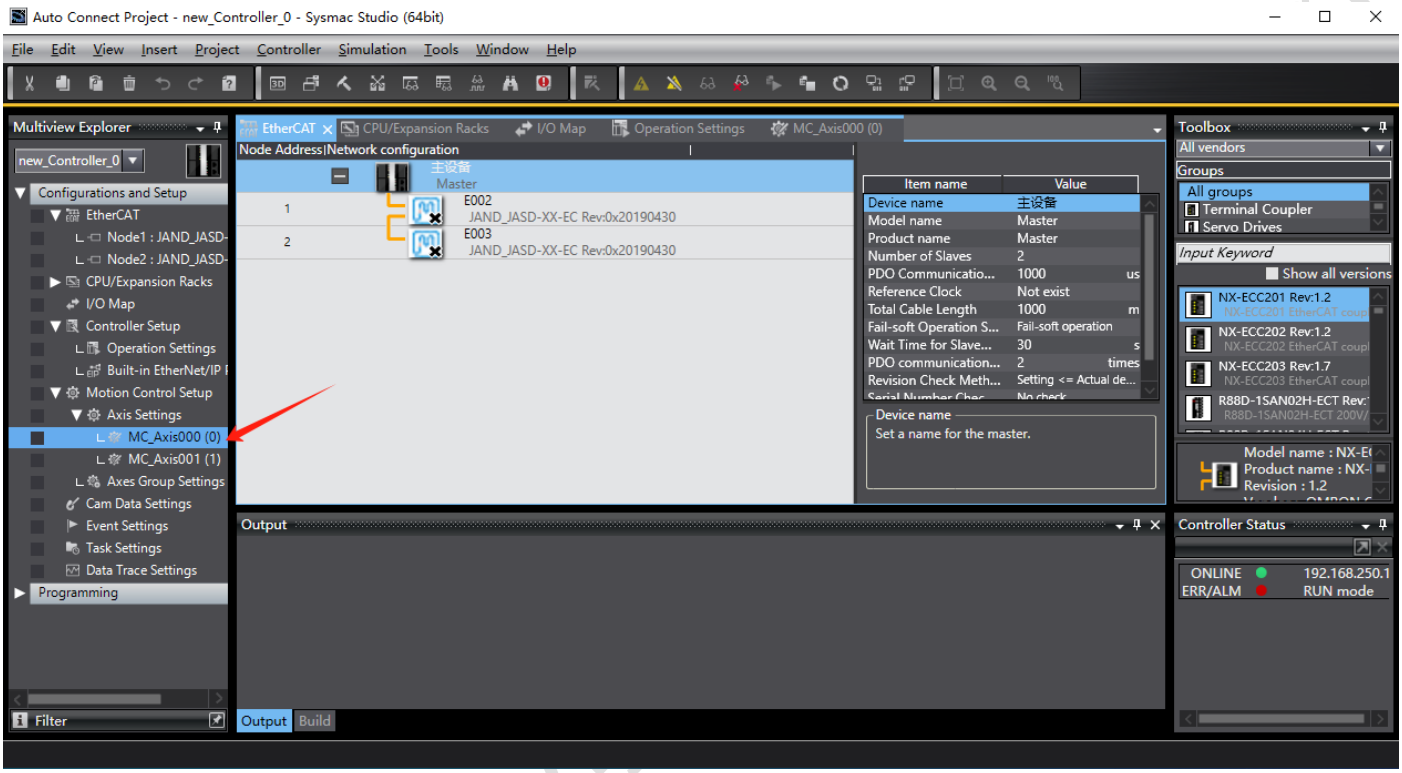



Figure 283 Add motion control axis

# 5 Axis assignment

double click MC_Axis000 → axis basic setting
axis number: JMC driver's communication axis number
axis using: the axis is used
axis type: servo axis
output equipment 1: the relevant driver's name

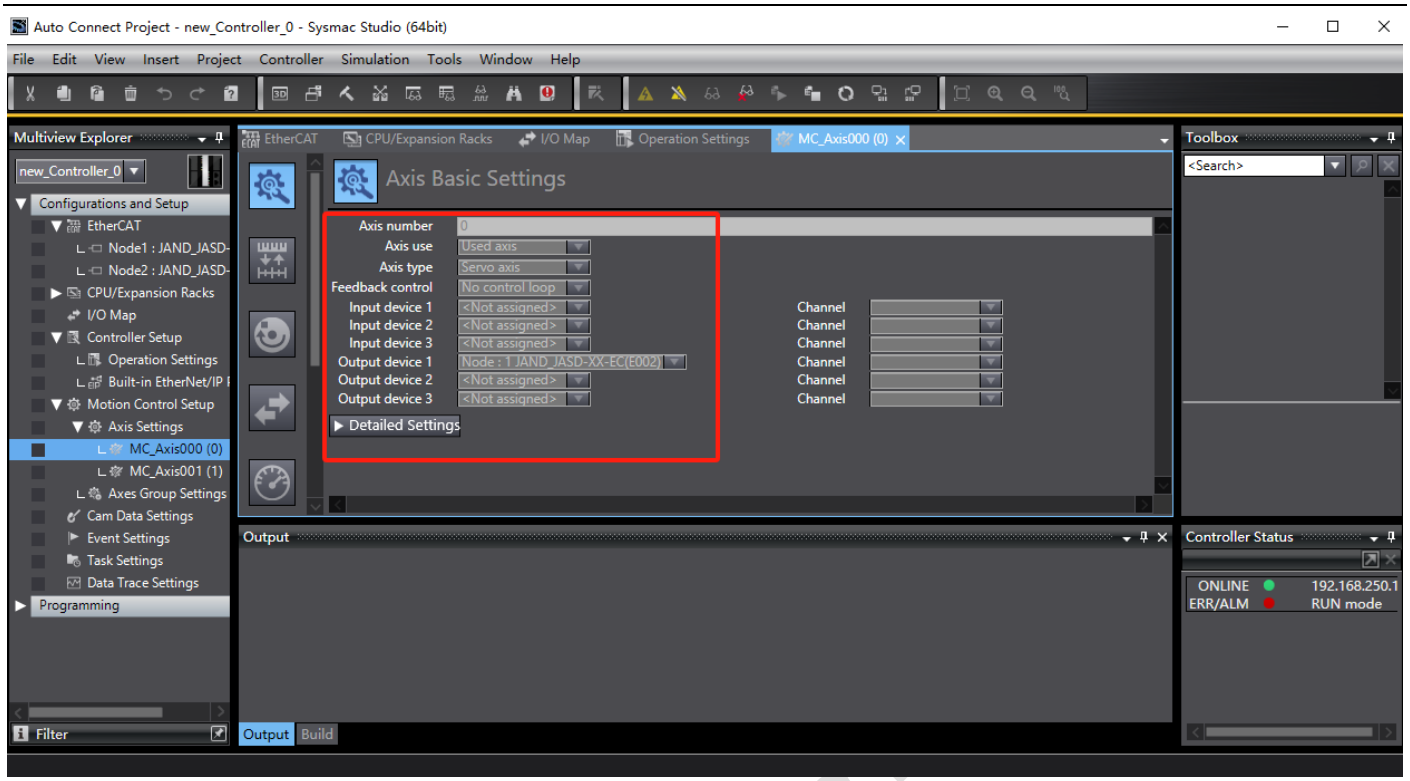



Figure 284 axis assignment

# 6 Detailed setting

Pay attention to the object name and index number in the PDO allocation mapping process. If the mapping is Not assigned correctly, an error will occur.

Note: 60FD must be mapped according to bits and must be mapped in accordance with the following figure.

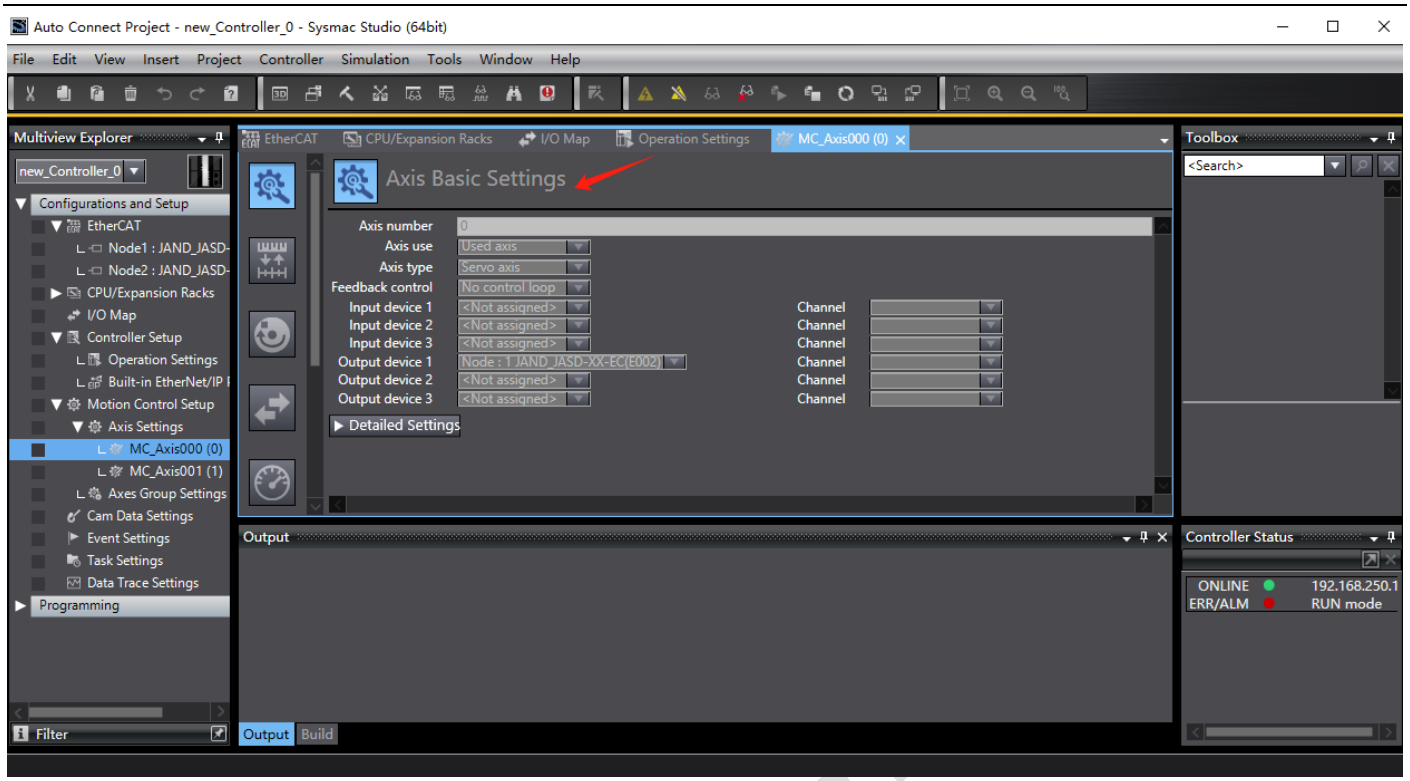



Fig 27 Axis basic setting

# 7 Unit conversion settings

- Set the number of command pulses for one revolution of the motor according to the actual motor resolution

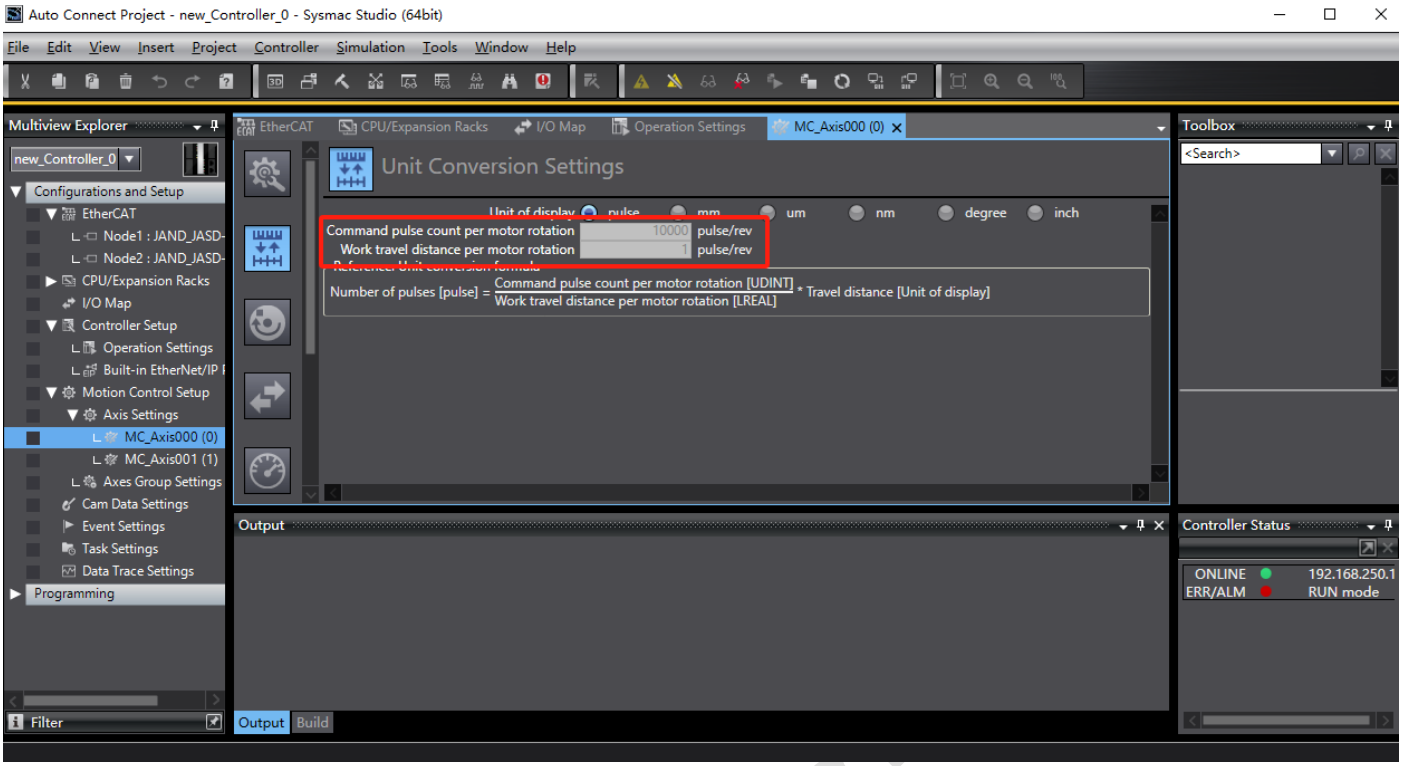



Fig 286 Unit conversion settings

# 8 Origin return setting

According to the actual mechanical conditions, select the appropriate homing method, speed, acceleration negative limit input.

Note: Only one external origin input and Z-phase input can be selected, and they cannot be used at the same time.

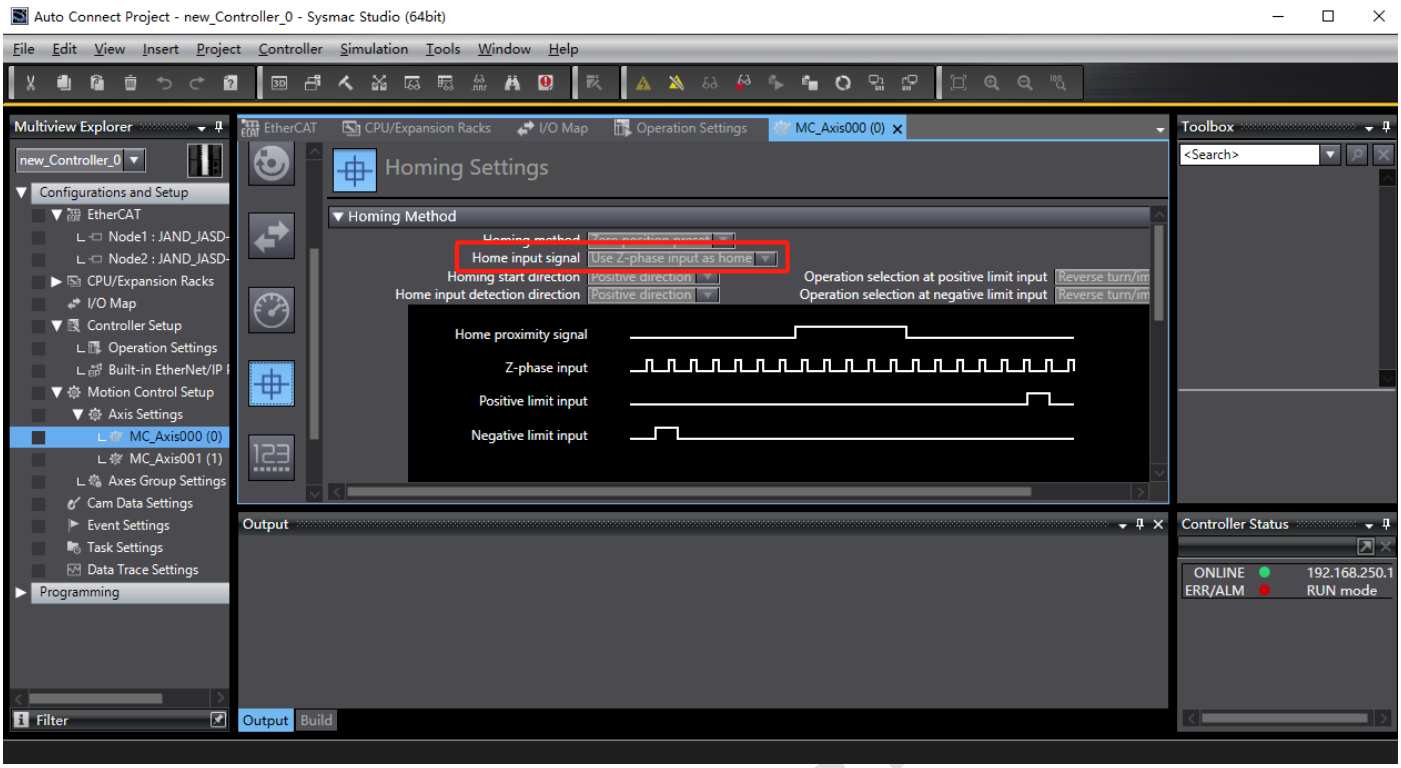



Figure 287 Origin return setting

# Program control

After the above configuration is completed, we can control the motor operation through the PLC program, and we can judge whether it can be enabled by the status bit MC_Axis000.DrvStatus.Ready. To avoid the PLC running first, the communication has Not been configured, which eventually cannot be enabled.

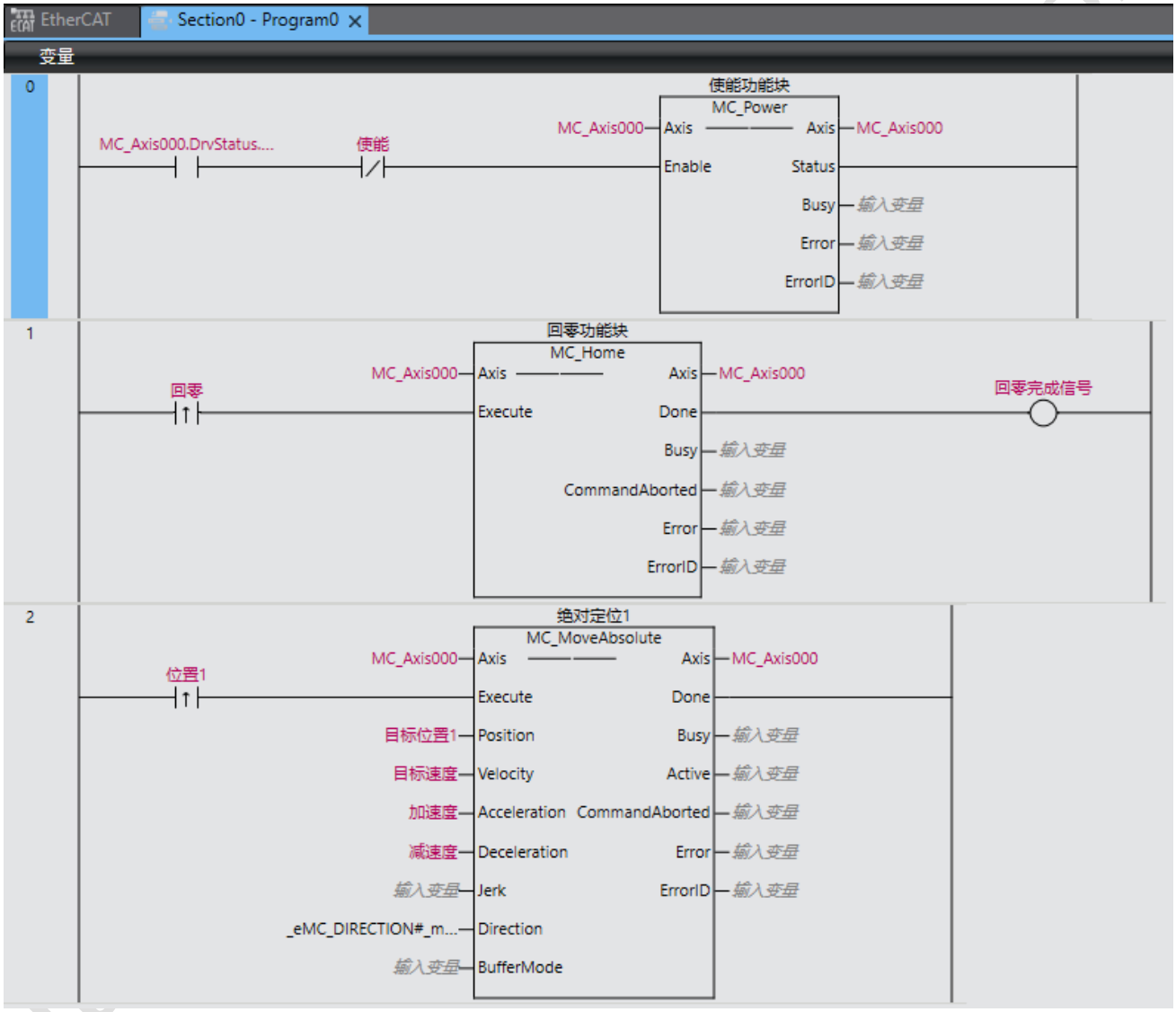



Figure 288 Program control

## on-line running

After all configuration and programming are completed, switch to online status.

Use the synchronization function to compare the difference between the controller program and the current program, and then decide whether to download.

You can also download the current program directly or upload the program in the controller.

# *EtherCAT communication operation example based on CoDeSys*

## Install device description file

- Open programming software (use CODESYS here) →Tool→Device→Install

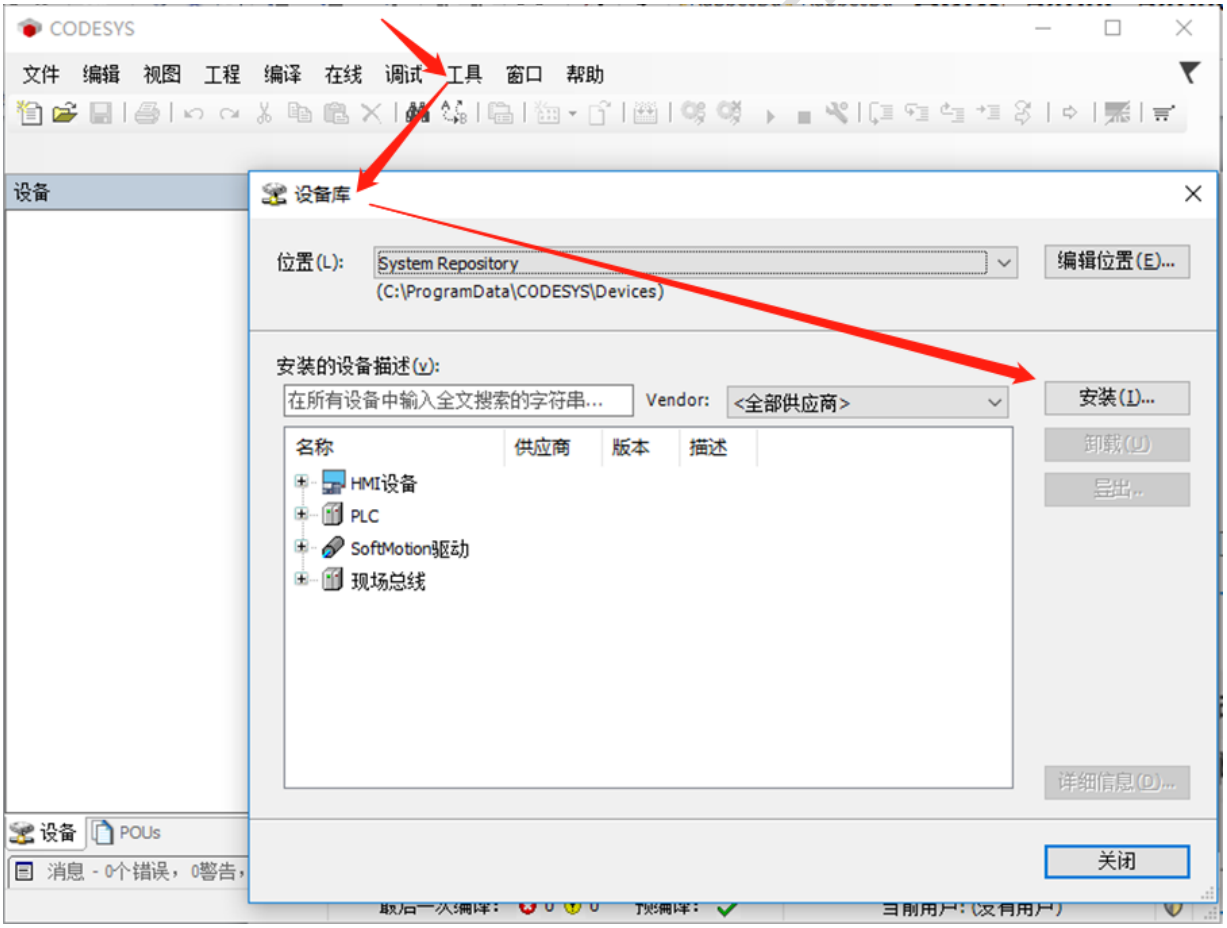



Figure 289 Install device description file

- Install the master station and slave station device description files separately

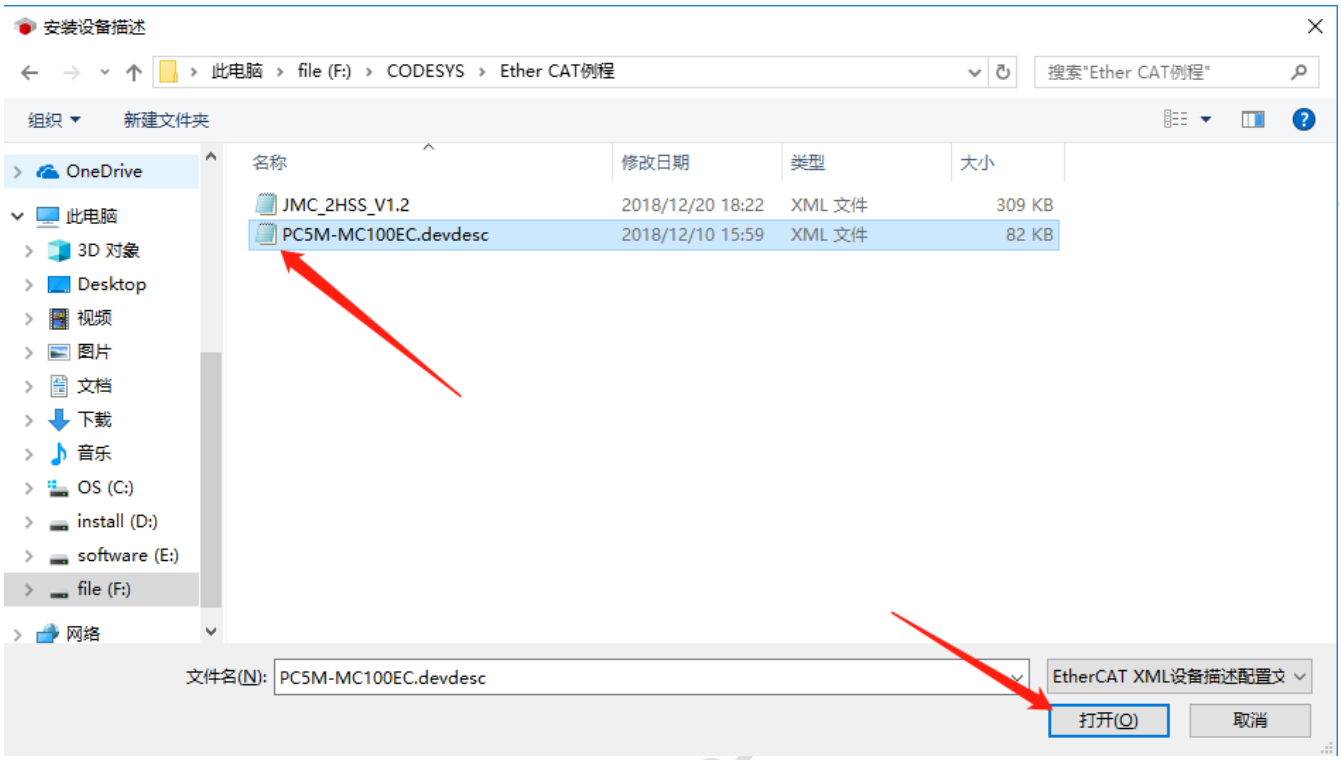



Figure 290 □ Install the master station and slave station device description files separately

- Waiting it’s installed automatically

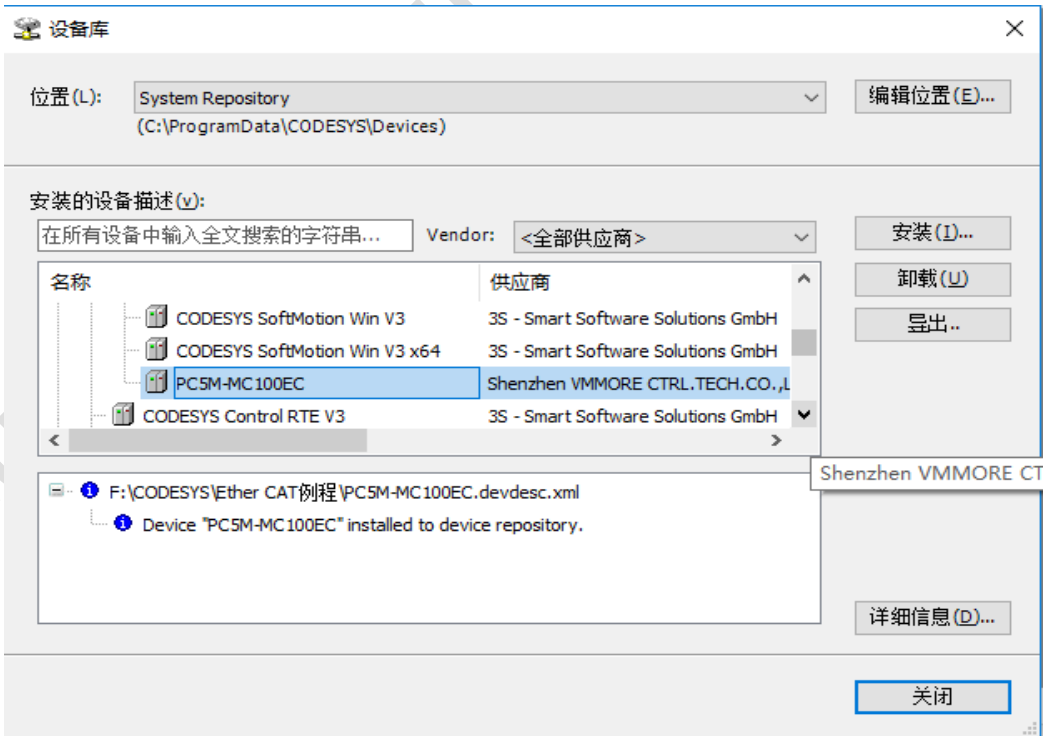



Figure 291 install automatically

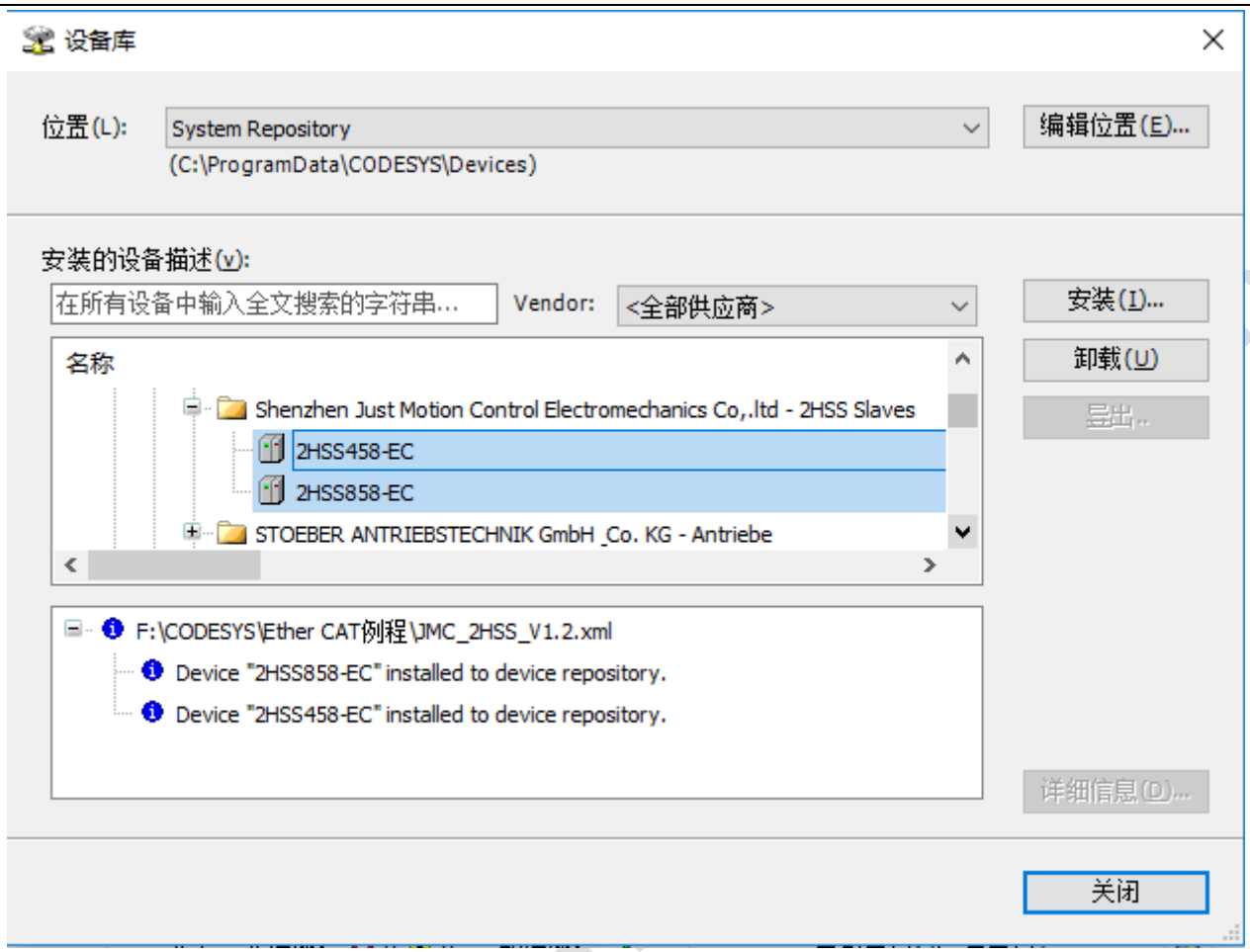



Figure 292 after installing

# Create a project

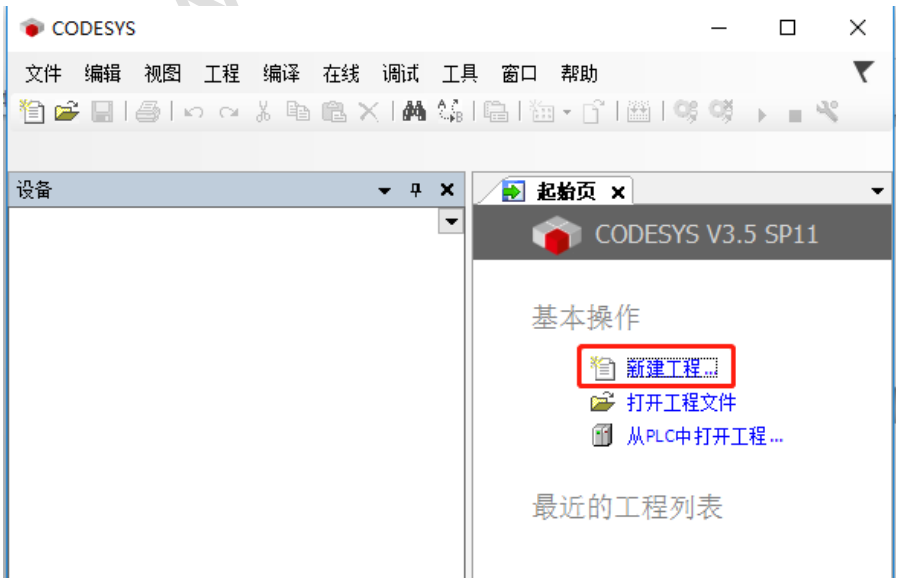



Fig 28 Create CODESYS project

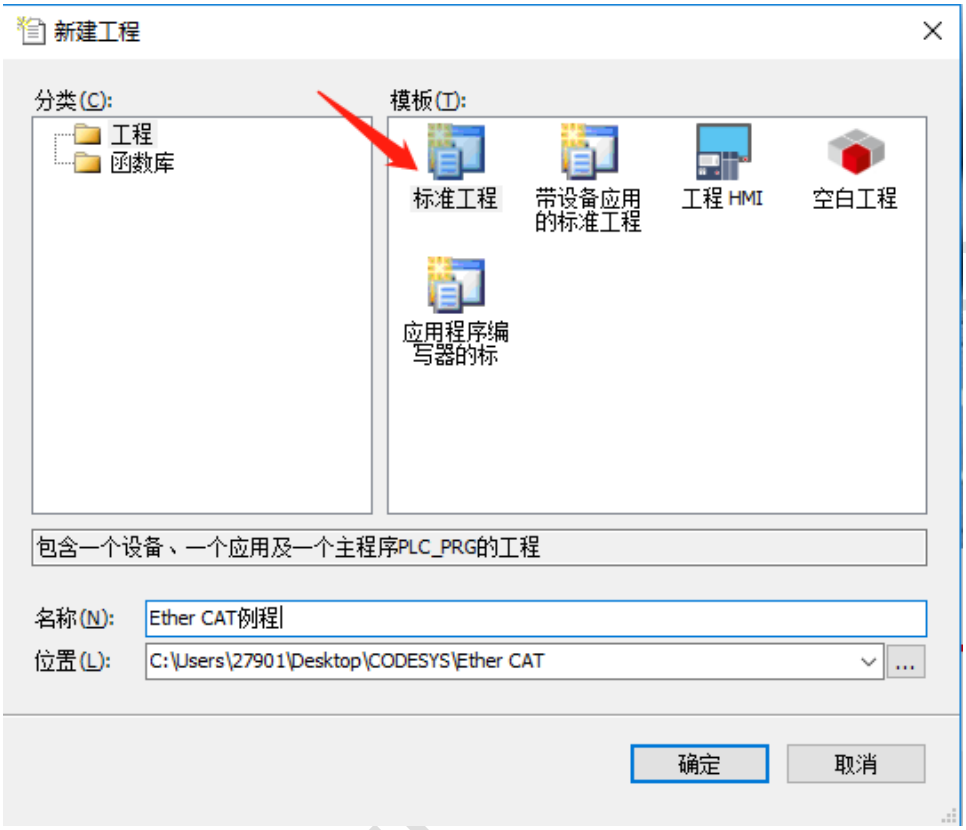



Figure 294 create a standard project

- select device and programming language

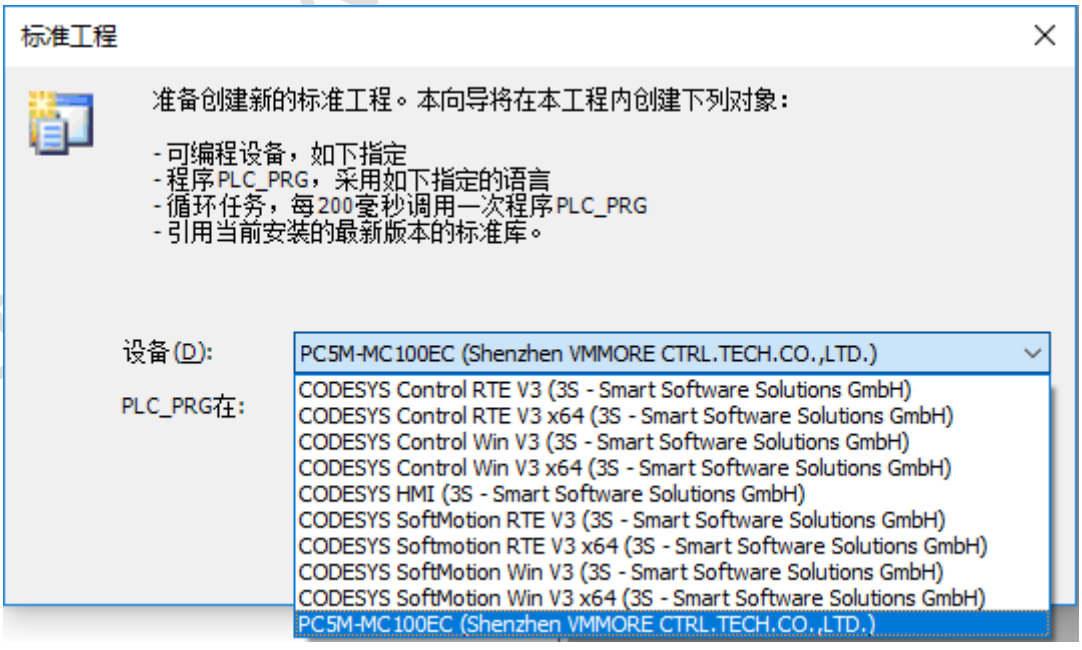



Figure 295 select device

# Add device

- Device (PC5M-MC100EC) right click → add device → select EtherCAT_Master_SoftMotion → add device → close

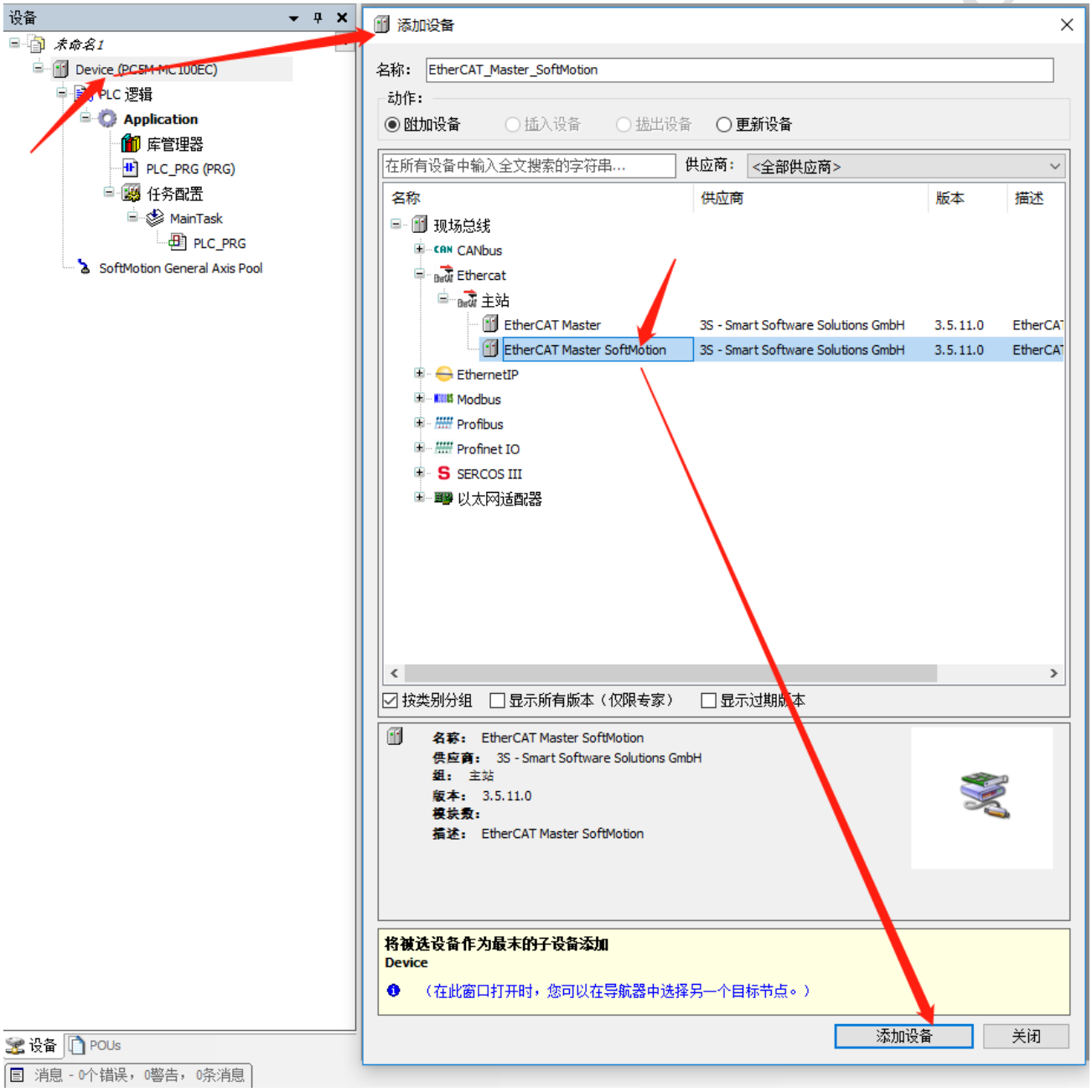



Figure 296 add device

- Right click of EtherCAT_Master_SoftMotion → add device → select 2HSS458_EC → add device → close

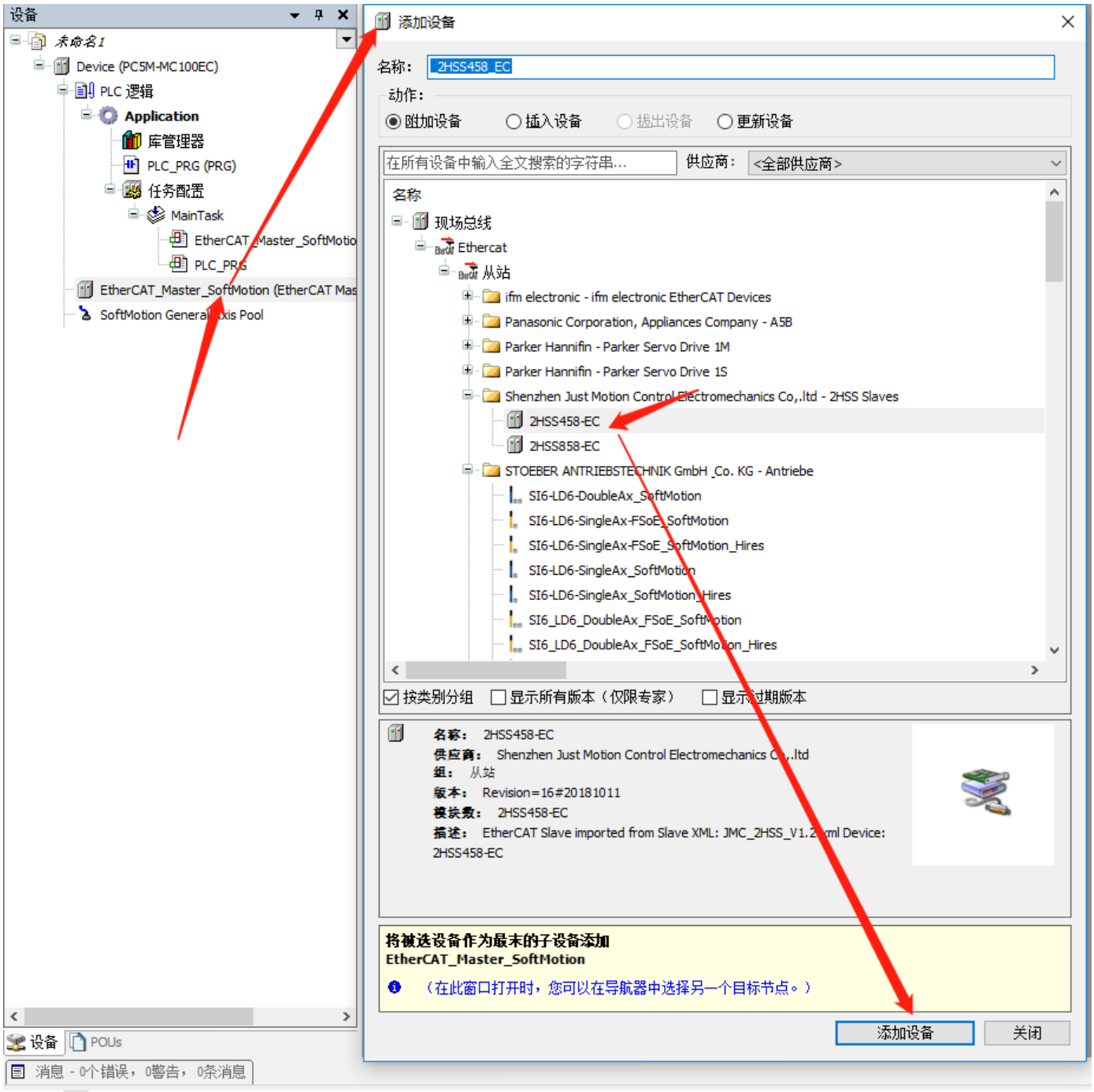



Figure 297 select device

- 2HSS458_EC right-click → add CiA402 axis of SoftMotion

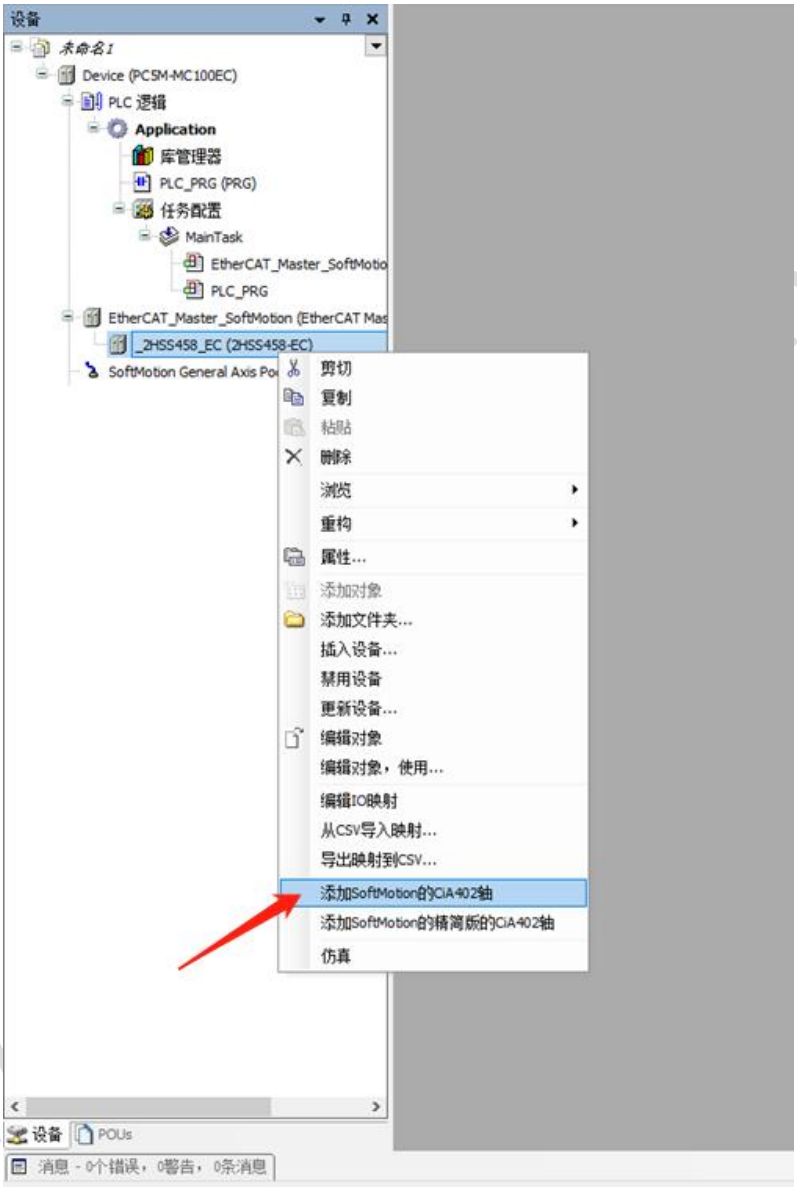



Figure 298 add CiA402 axis of SoftMotion

# Parameter setting

Double-click 2HSS458_EC→Enable expert settings→Expert process data

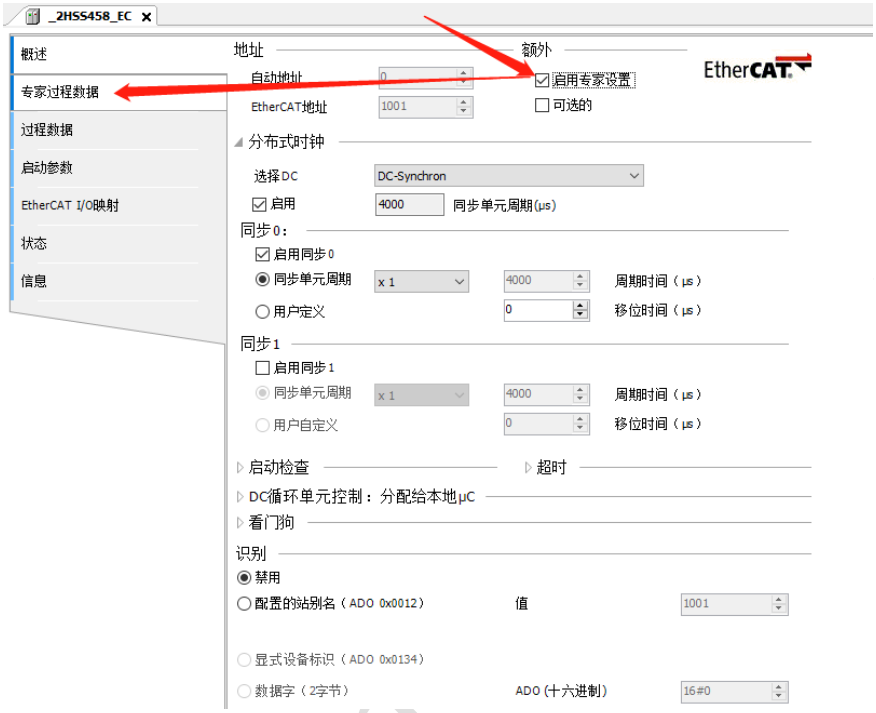



Figure 299 Enable expert settings

- Check the PDO allocation and PDO configuration in the download

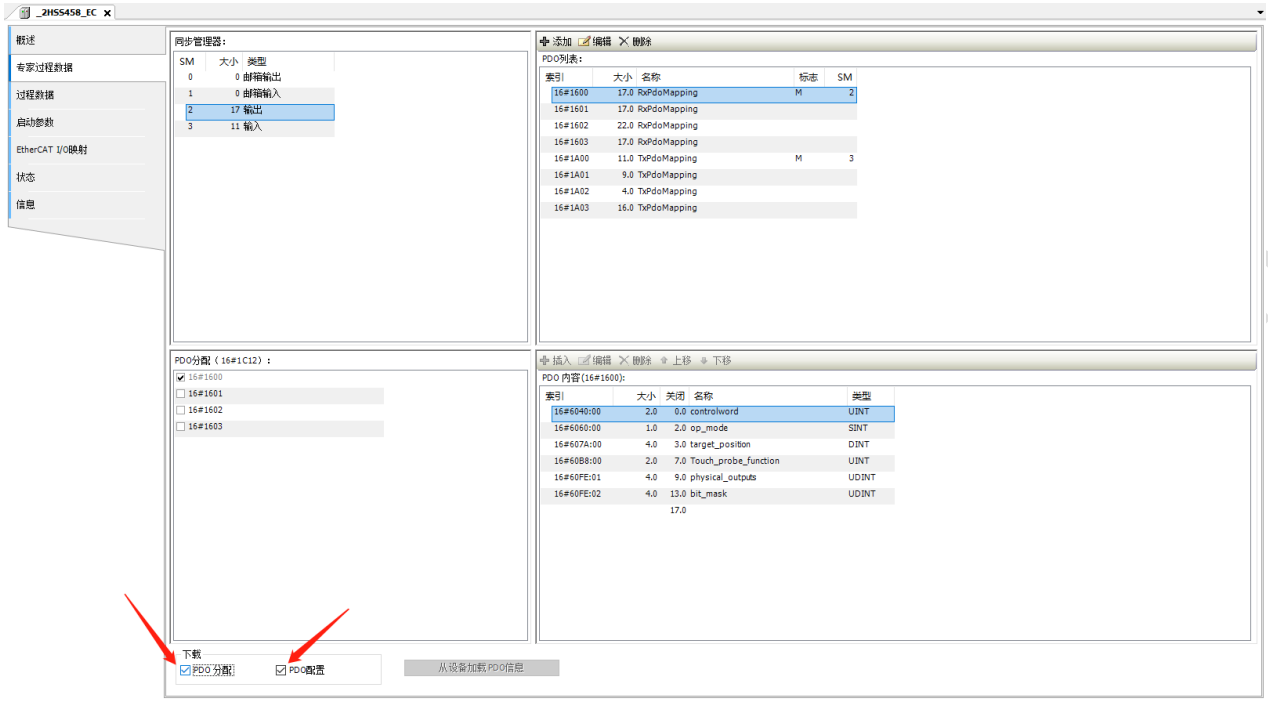



Figure 300 Expert process data

Double-click SM_Drive_GenericDSP402→SoftMotion: Zoom/Map→Change 16#10000 to 16#FA0

●

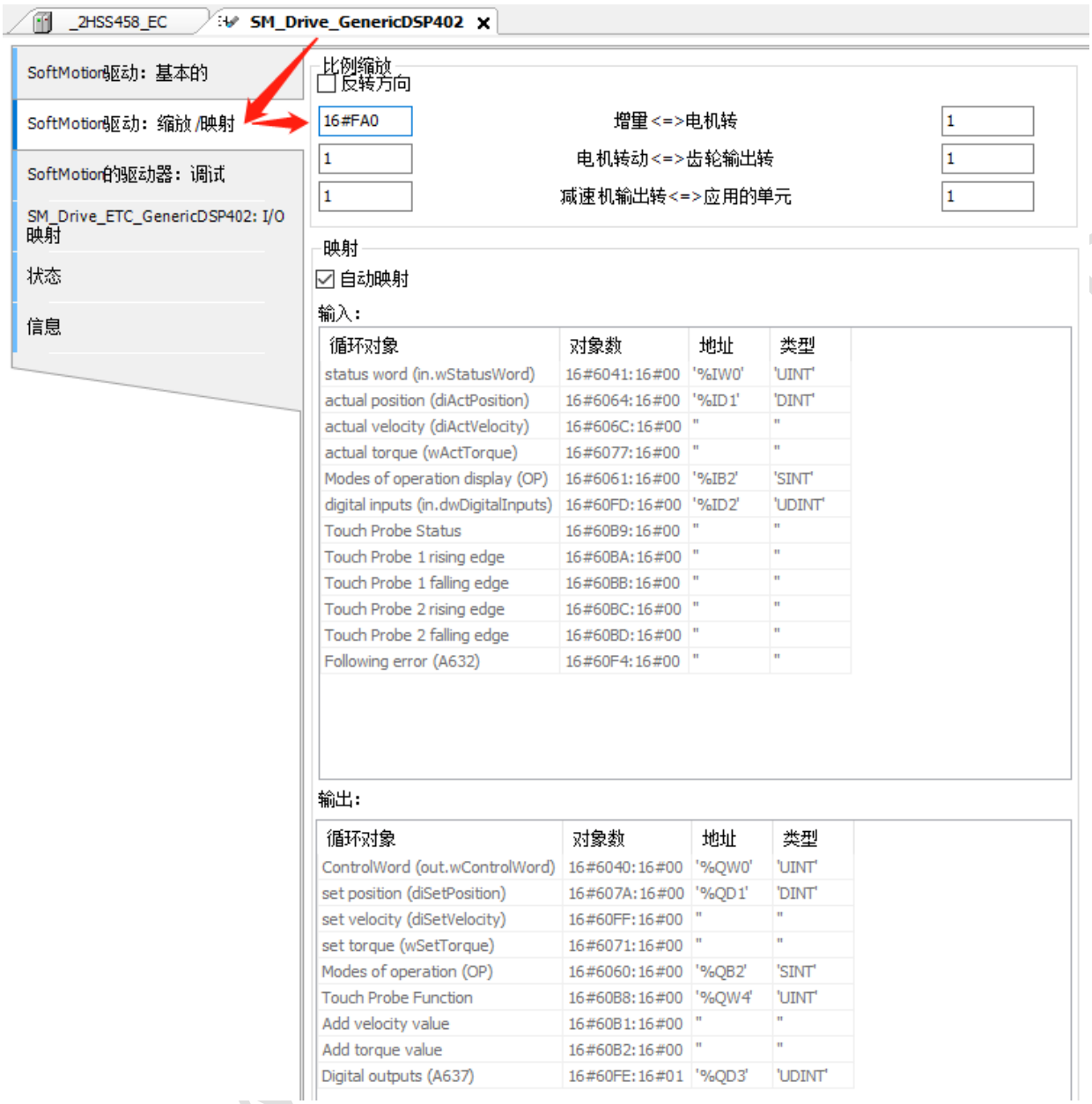



Figure 301 zoom/map

# Programming

## 1 Set homing parameter

- Double-click 2HSS458_EC→Startup parameter→Add

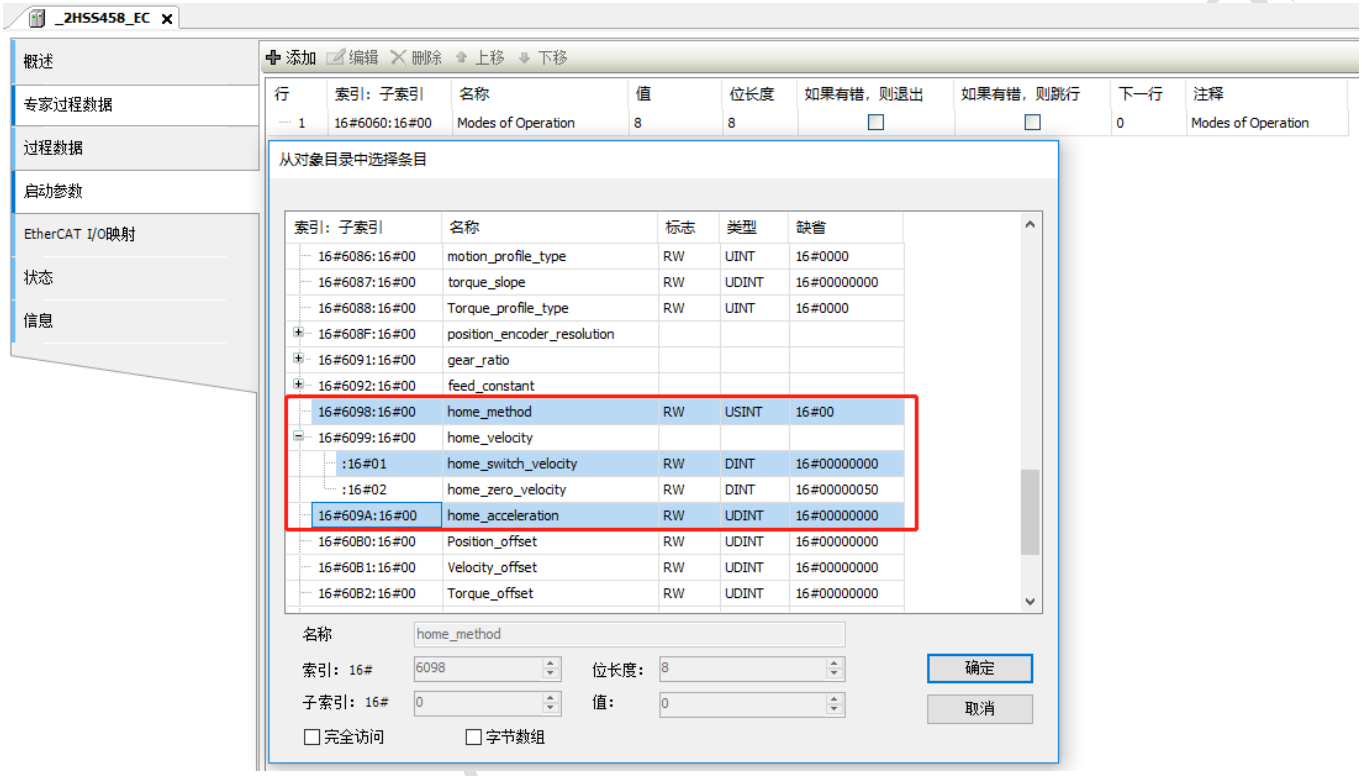



Fig 29 Add start parameter


Figure 303 Add object dictionary index

Add 60986099 [01], 609a → confirm

16#6098: homing type

16#6099 01: homing speed

16#609A: homing acc/dec velocity


Figure 304 After adding the index

Eg:

16#6098=1, select homing type 1

16#6099 01=4000 speed is 1rps

16#609A=40000 acc/dec velicty is 10rps

Because SoftMotion: scaling/mapping is 16#FA0=4000, so the motor needs 4000 pulses for one revolution

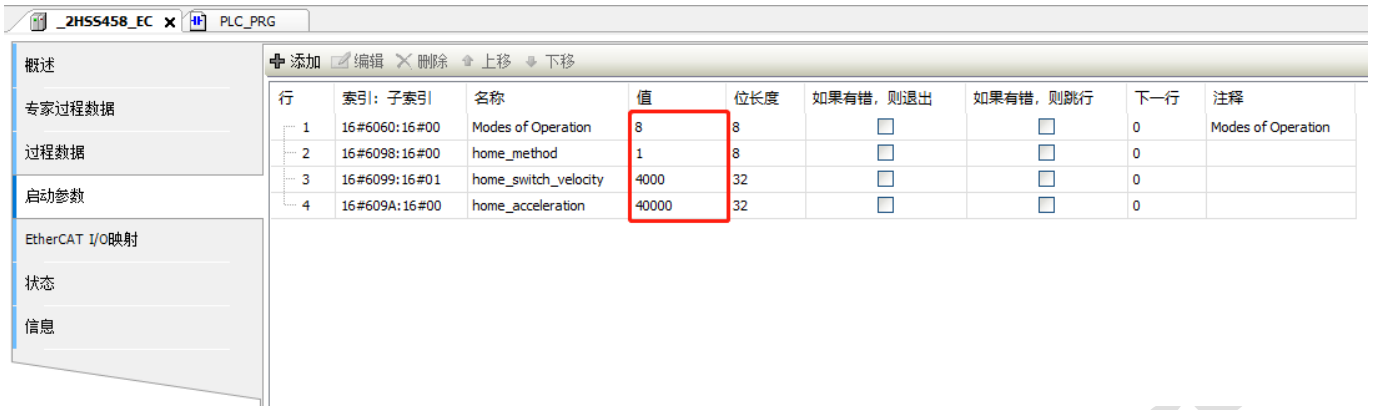



Figure 30 Modify the value of an object

# 2 Homing procedure

MC_Power: Axis enable command

MC_Home: Axis home command

Execute the axis enable function first, and then execute the axis home function to start the zero return and the motor runs. After reaching the corresponding limit switch, the motor stops and the position is cleared to 0.

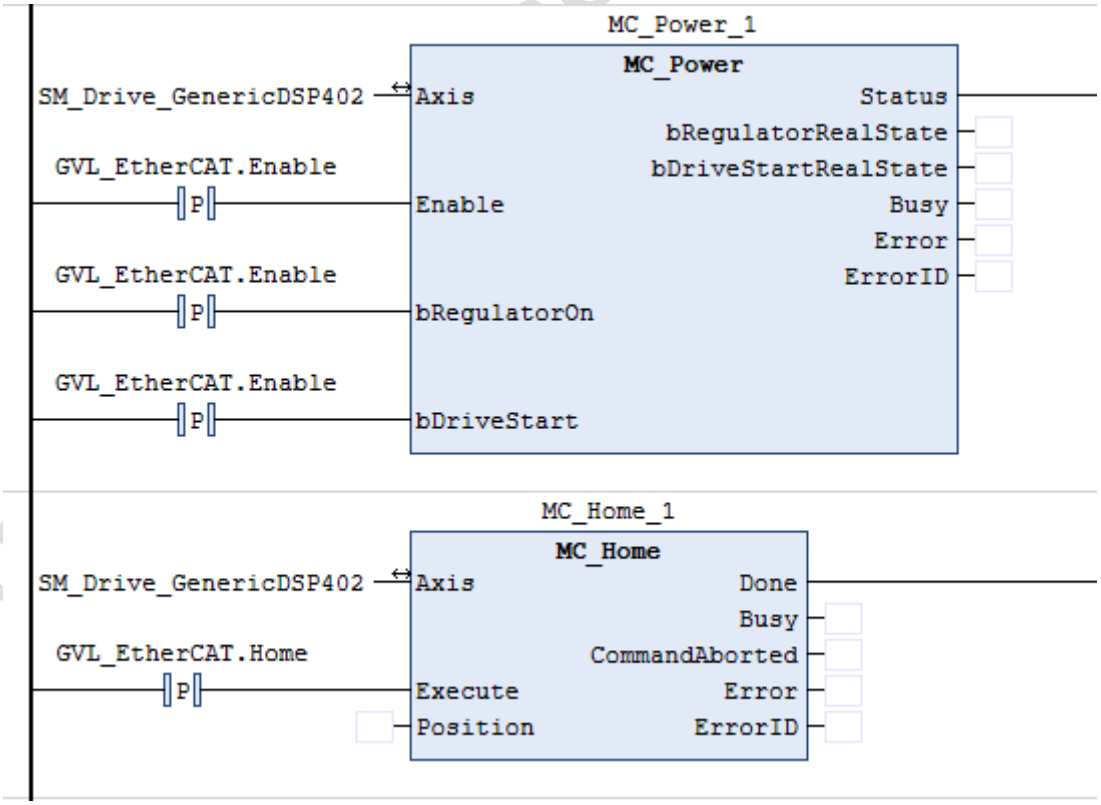



Figure 306 Homing procedure

# Position mode

MC_MoveAbsolute: Axis absolute positioning control instruction
Position: Absolute position of movement (unit: number of motor revolutions)
Velocity: Operating speed (unit: rps)
Acceleration: Acceleration rate (unit: rps)
Deceleration: Deceleration rate (unit: rps)
MC_MoveRelative: Axis relative positioning control instruction
Distance: Relative motion position (unit: number of motor revolutions)
Velocity: Operating speed (unit: rps)
Acceleration: Acceleration rate (unit: rps)
Deceleration: Deceleration rate (unit: rps)
Execute the axis enable function first, and then execute the position function, the motor runs, and the motor stops after reaching the given position

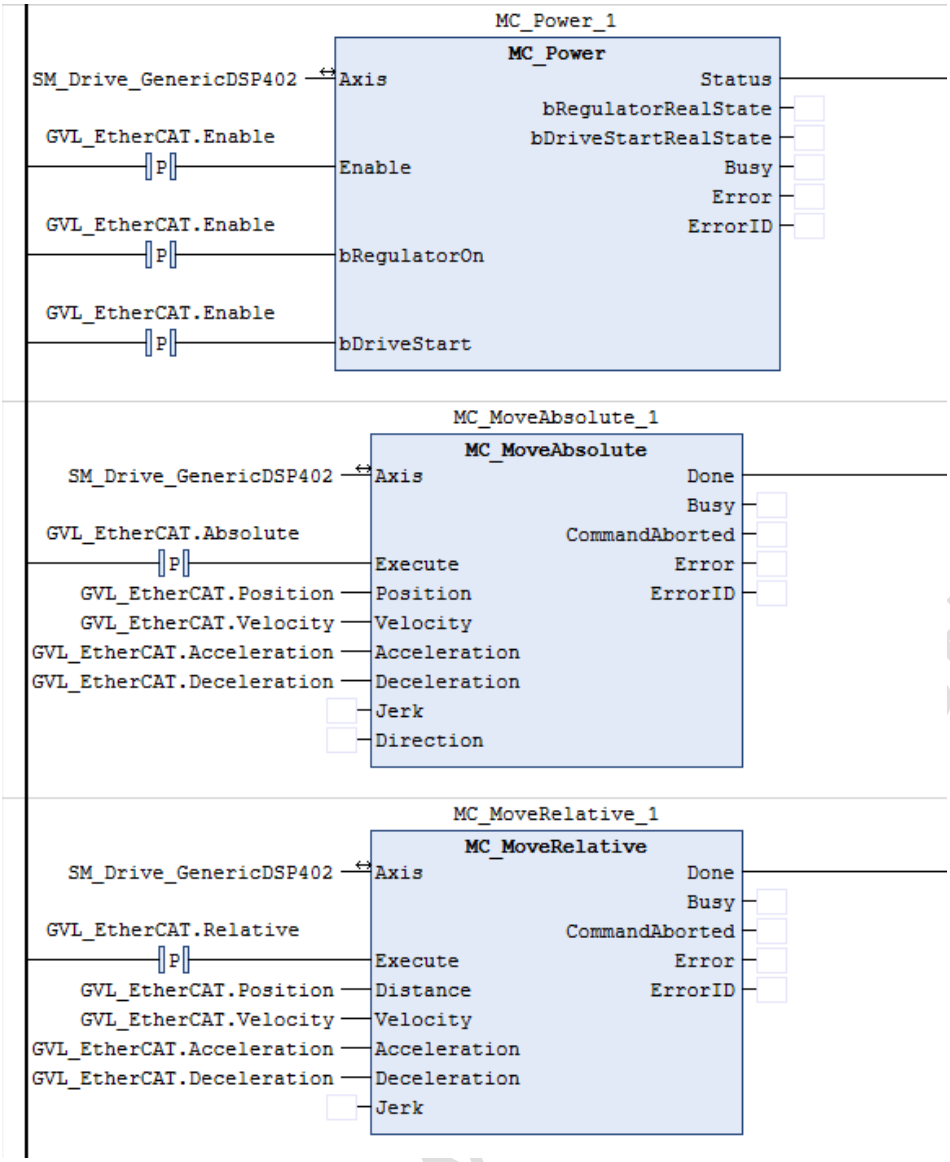



Fig 31 Position mode

# Speed mode

MC_MoveVelocity: Axis speed control instruction
Velocity: running speed
Acceleration: acceleration speed
Deceleration: deceleration speed
MC_Jog: Jog mode
JogForward: CW rotation
JogBackward: CCW rotation
Velocity: running speed (Unit: rps)
Acceleration: acceleration speed (Unit: rps)
Deceleration: deceleration speed (Unit: rps)
MC_Stop: Axis stop command
Deceleration: deceleration speed (Unit: rps)
speed control
Execute the axis enable function block first, then execute the speed function block, the motor runs, execute the axis stop function block, the motor stops
Jog control
Execute the axis enable function block first
Set JogForward to TRUE, the motor runs in the CW direction, and set JogForward to FALSE, the motor stops.
When JogBackward is set to TRUE, the motor runs in the CCW direction, and if JogBackward is set to FALSE, the motor stops.

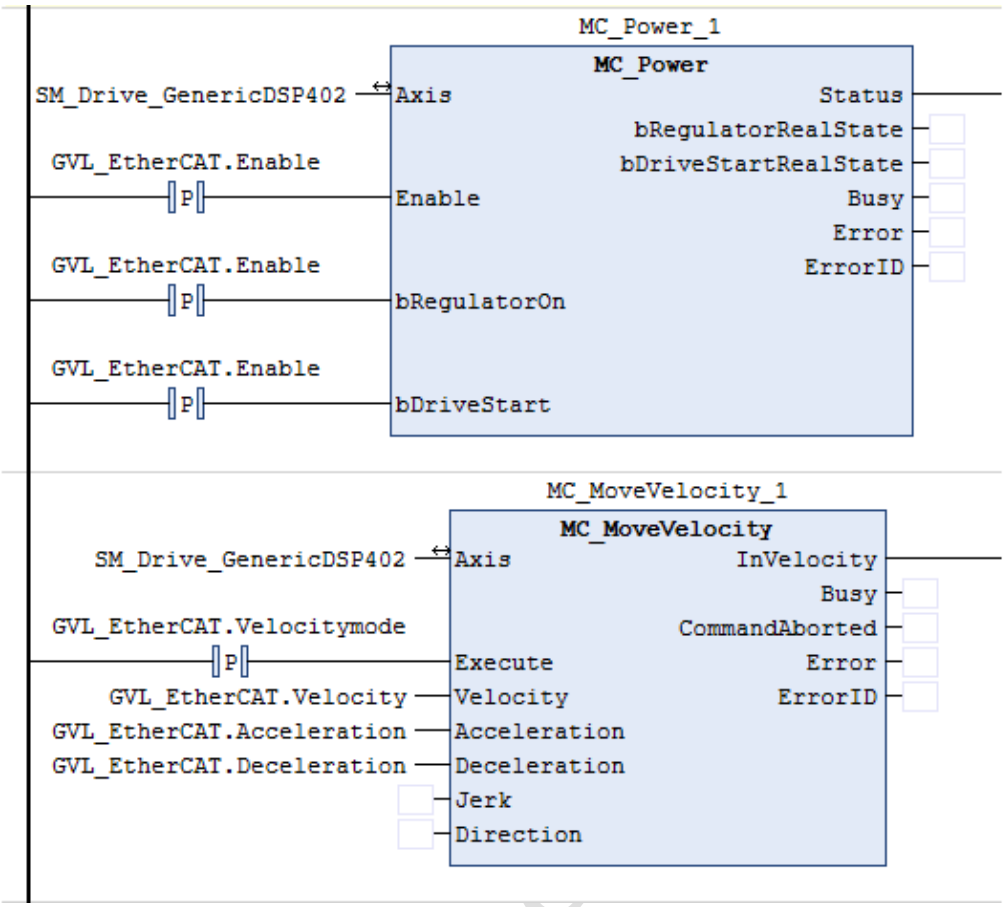



Fig 308 Speed mode

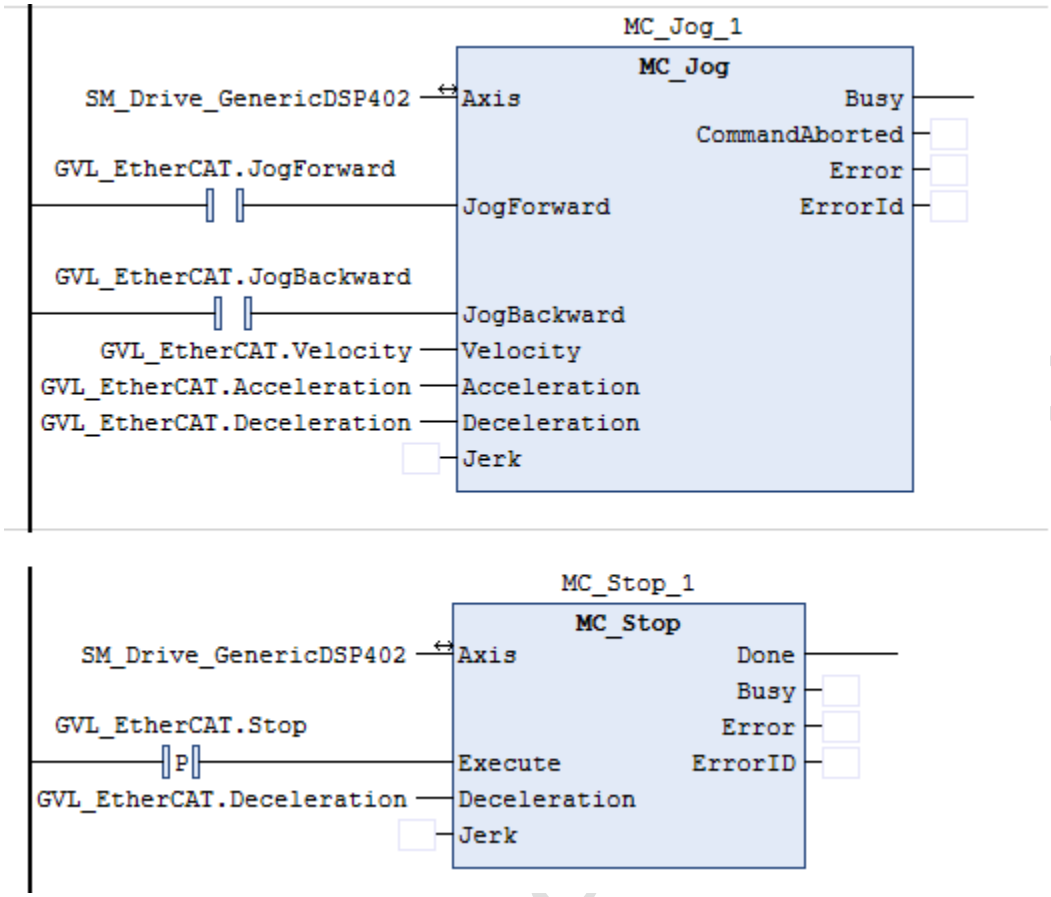



Fig 32 JOG mode

The position, speed, acceleration and deceleration used by the function blocks in the program can be set in global variables.

_2HSS458_EC | PLC_PRG | GVL_EtherCAT

```
{attribute 'qualified_only'}
VAR_GLOBAL
    Enable : BOOL :=FALSE;
    Home : BOOL :=FALSE;
    Absolute : BOOL :=FALSE;
    Absolutel : BOOL :=FALSE;
    Relative : BOOL :=FALSE;
    Velocitymode : BOOL :=FALSE;
    JogForward : BOOL :=FALSE;
    JogBackward : BOOL :=FALSE;
    Reset : BOOL :=FALSE;
    Stop : BOOL :=FALSE;

    Position : LREAL :=50;
    Positionl : LREAL :=0;
    Distance : LREAL :=50;
    Velocity : LREAL :=10;
    Acceleration: LREAL :=100;
    Deceleration: LREAL :=100;
    ReadPosition : LREAL;
    ReadVelocity : LREAL;
END_VAR
```

Fig 310 Set global variables

# *EtherCAT communication operation routine based on Panasonic controller*

## New Project

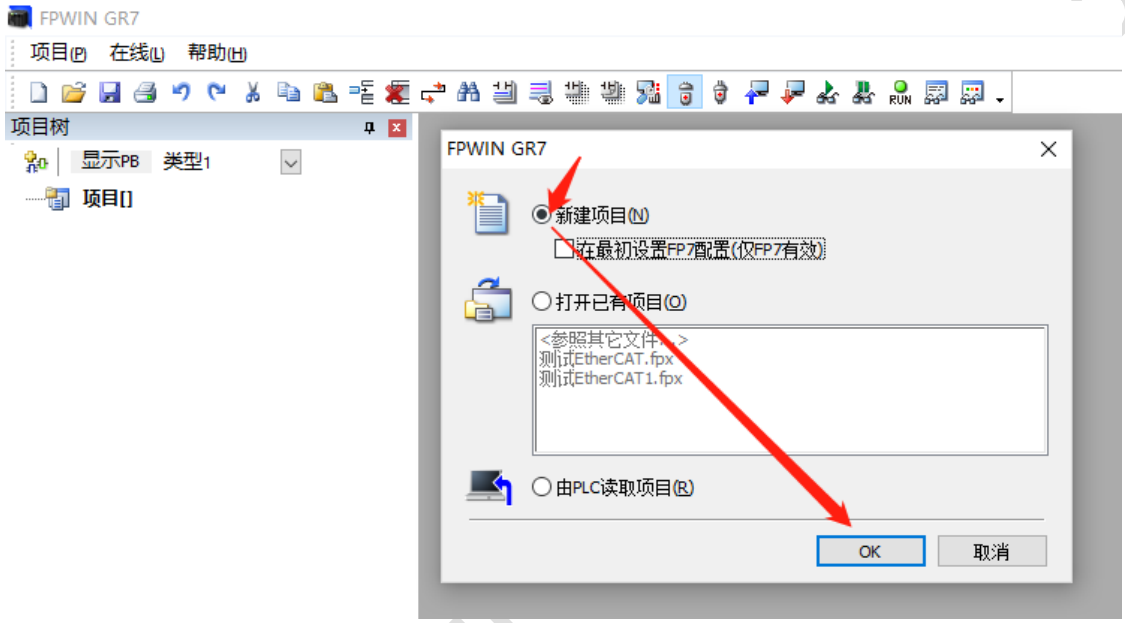



Fig 311 New FPWIN project

- Open the software FPWIN GR7→Project→New→Select CPU Unit and Motion Control Unit→OK

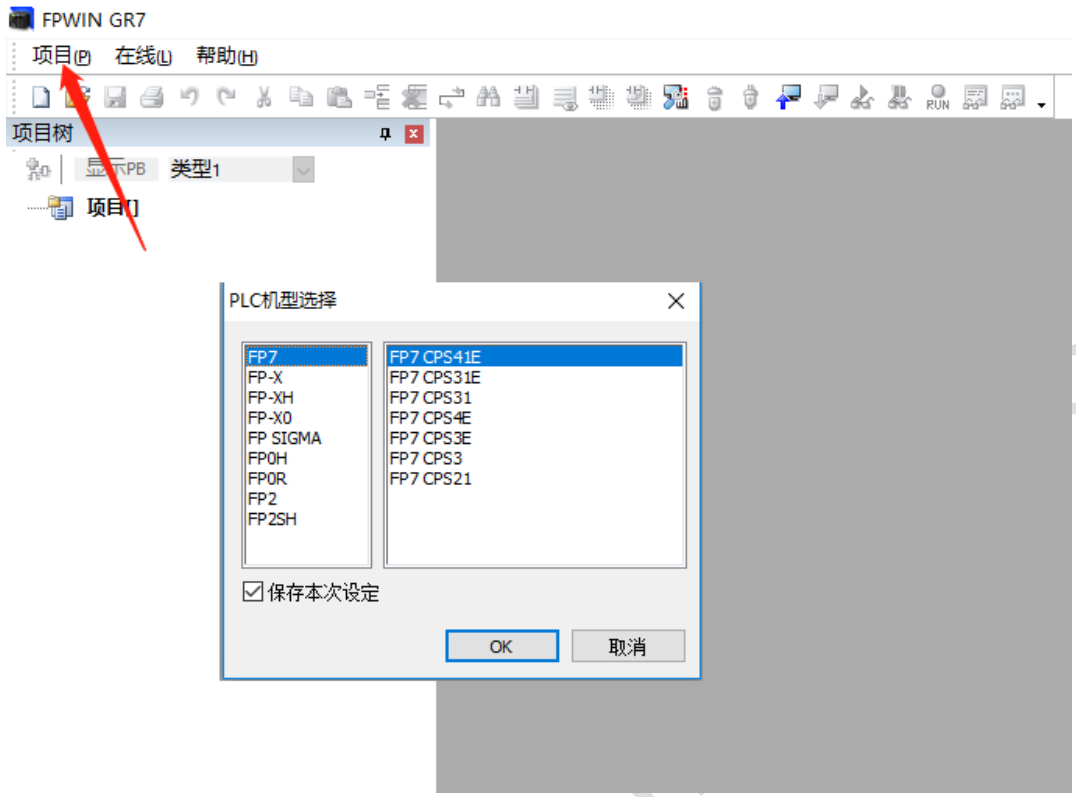



Fig 33 Select CPU unit and motion control unit

- Configure I/O mapping

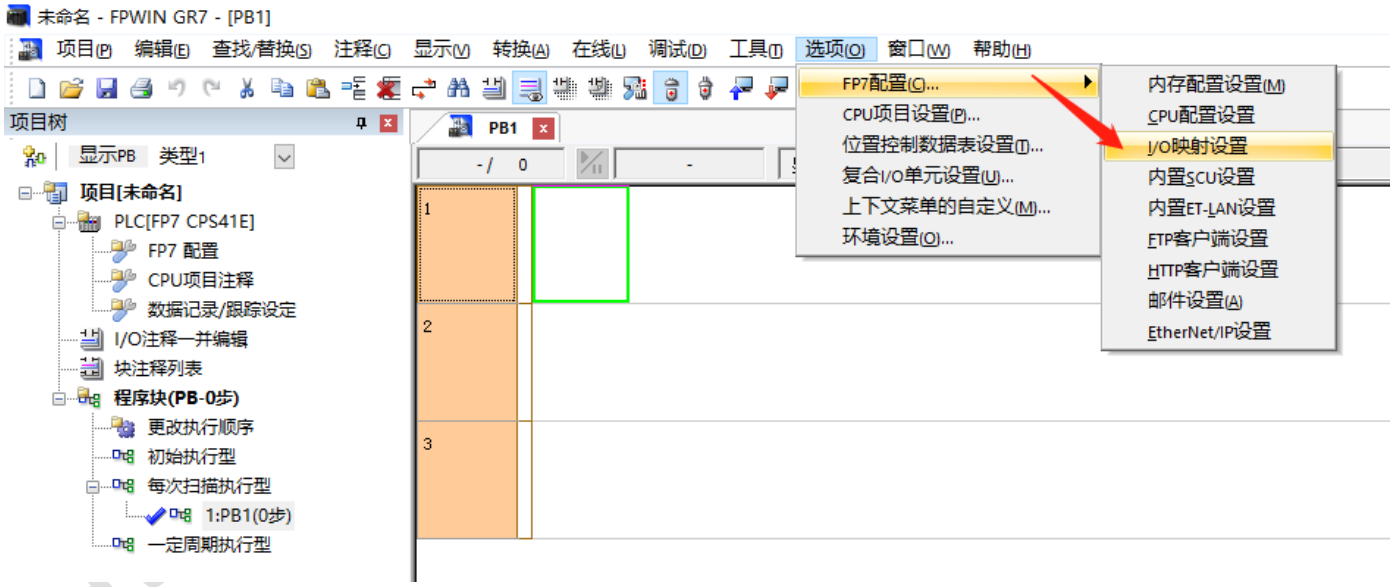



Fig 34 Configure I/O mapping

- Double-click the "Product Number" of slot NO. 0 → enter the unit selection, select the unit type and unit name

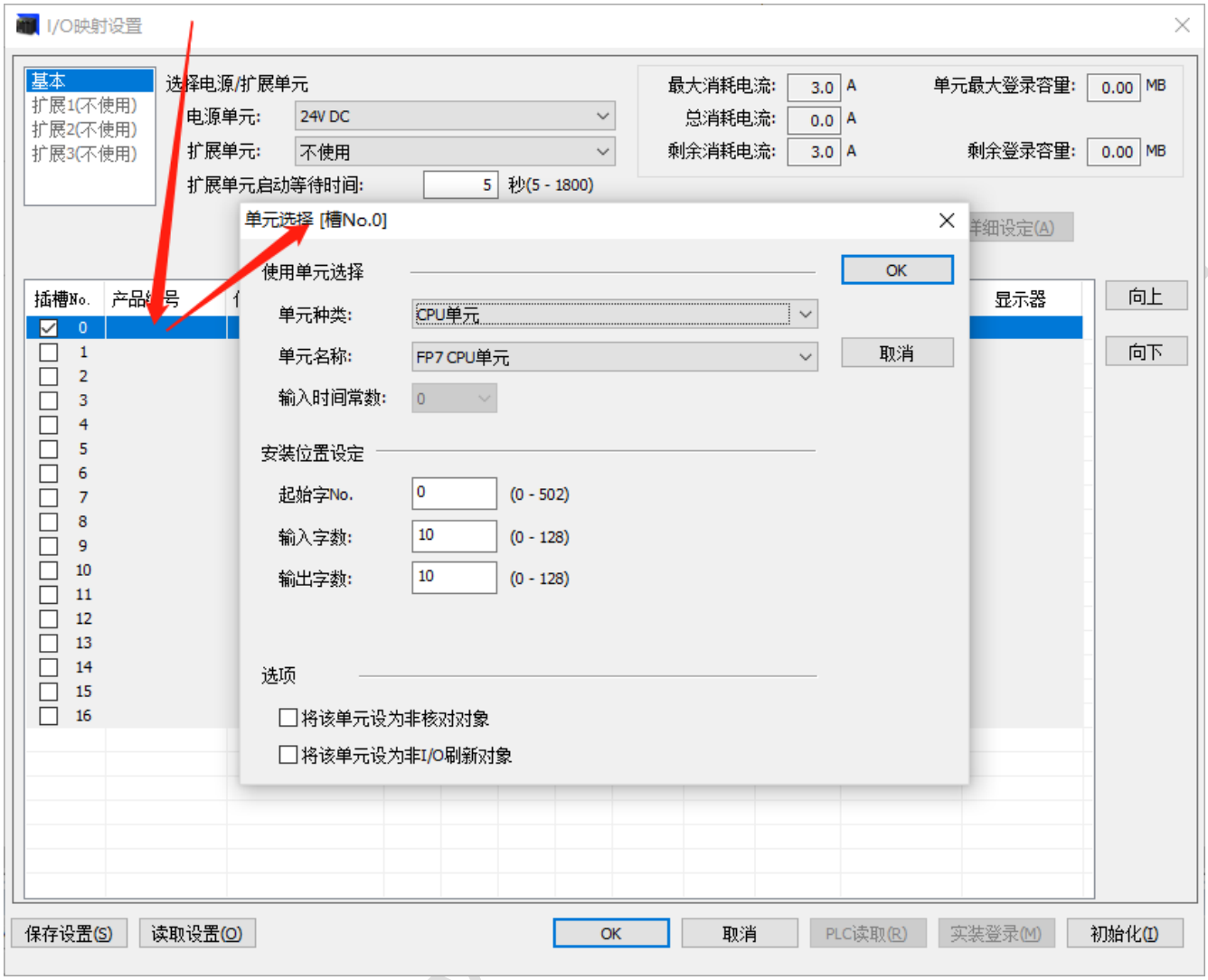



Figure 314 selecting unit type and unit name - slot NO.0

- ☐ Slot NO. 1 "Product Number" → enter the unit selection, select the unit type and unit name

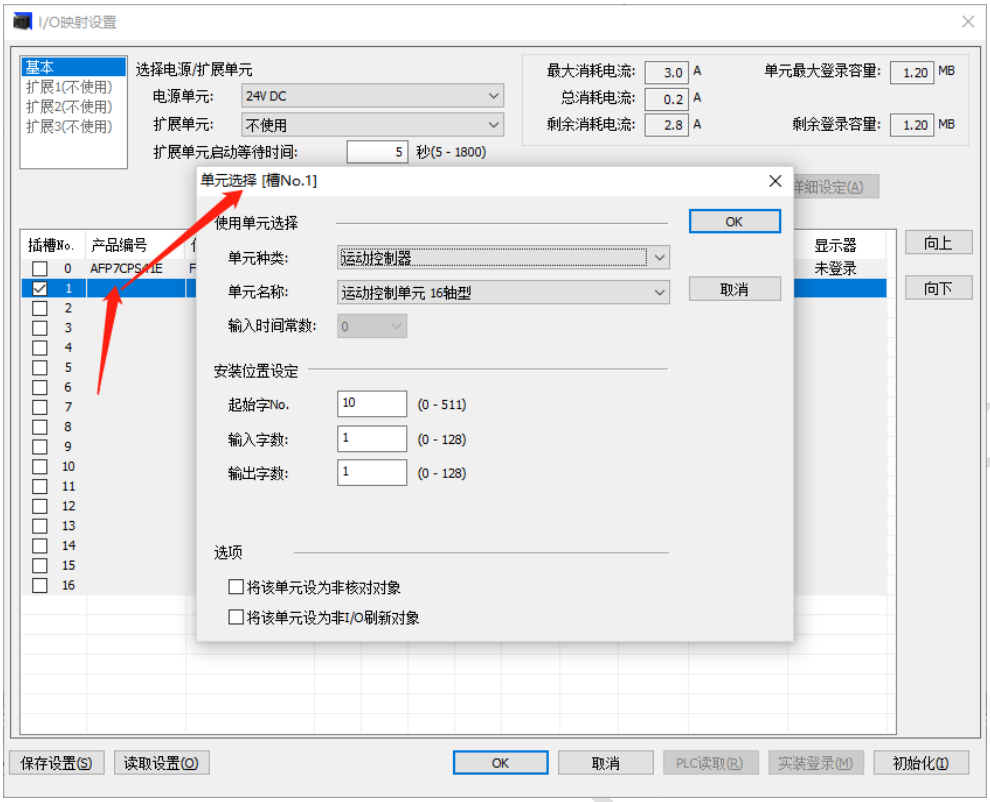



Fig 315.Select the unit type and unit name-Slot NO. 1

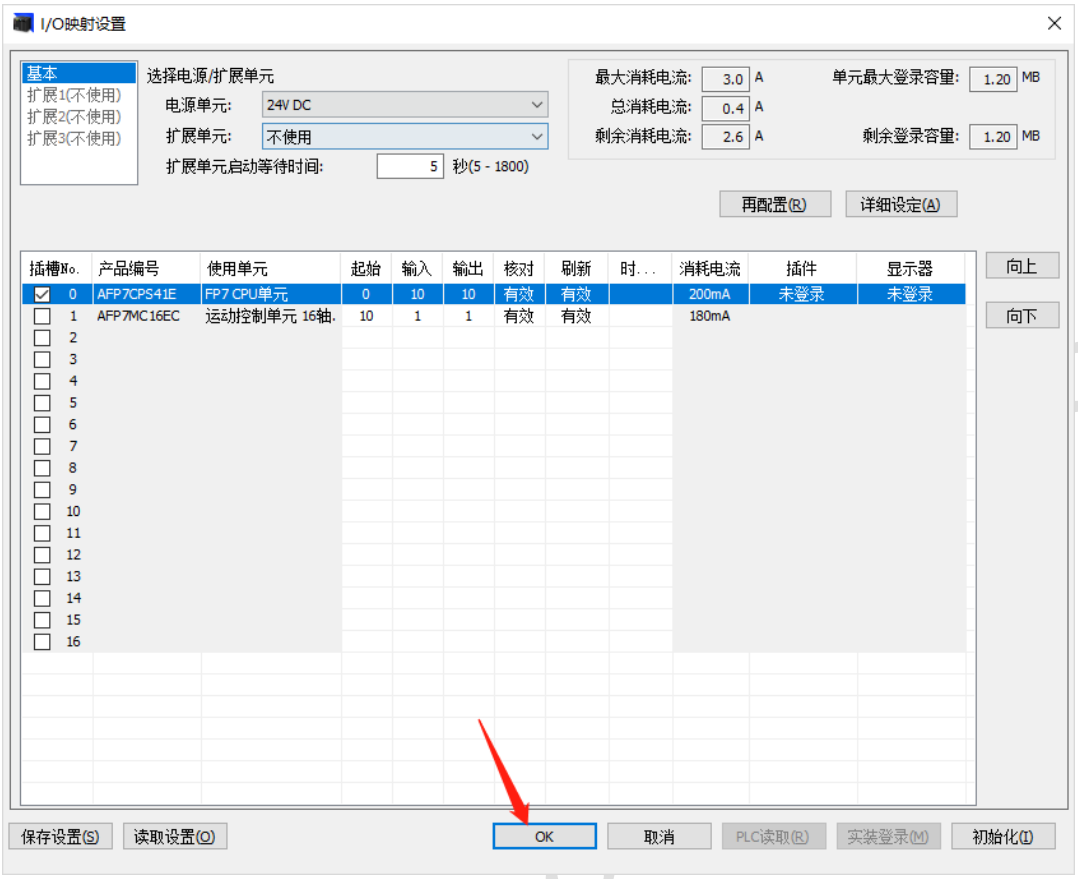



Fig 35 Select complete

# Use CMI software to set the parameters of the axis

## 1 New Project

- Open the software ,Control Motion Integrator→new create

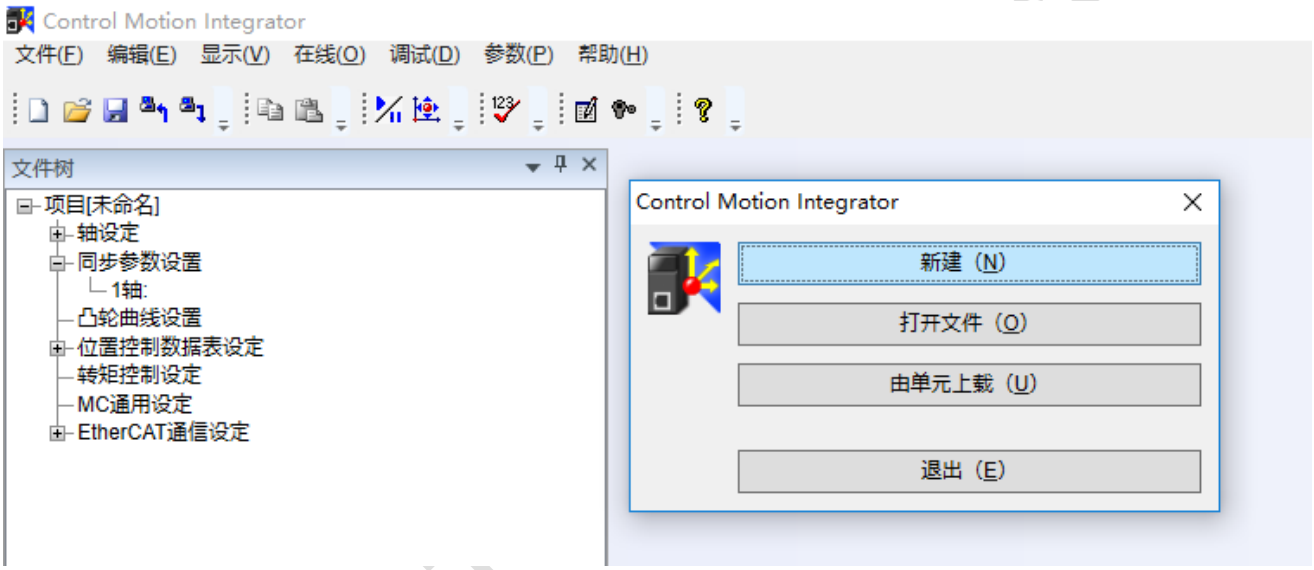



Fig 36 Create New CMI project

- Select the motion control unit (must be consistent with the FPWIN GR7 software I/O mapped motion control unit) → rotate to select the actual number of axes used → confirm
-

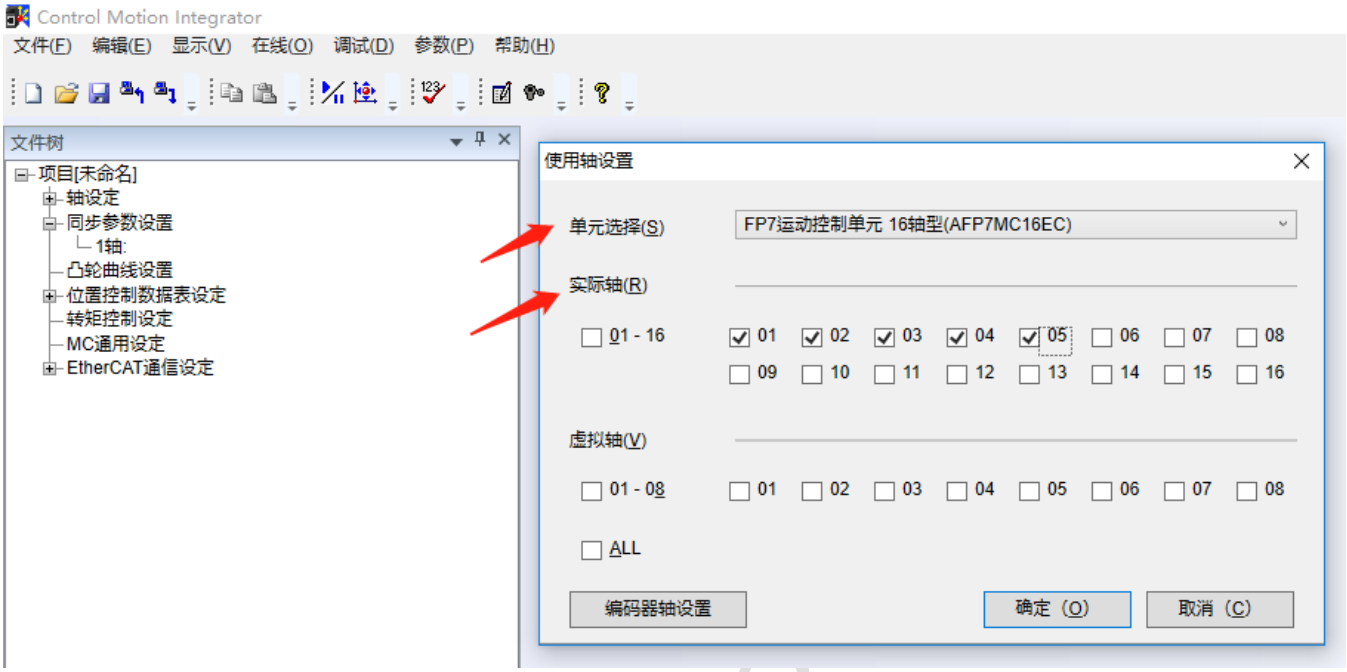



Fig 37 Select Motion Control Unit

- Whether the axis should be interpolated; if necessary, please add the axis to the interpolation group, if NOt, directly confirm
-

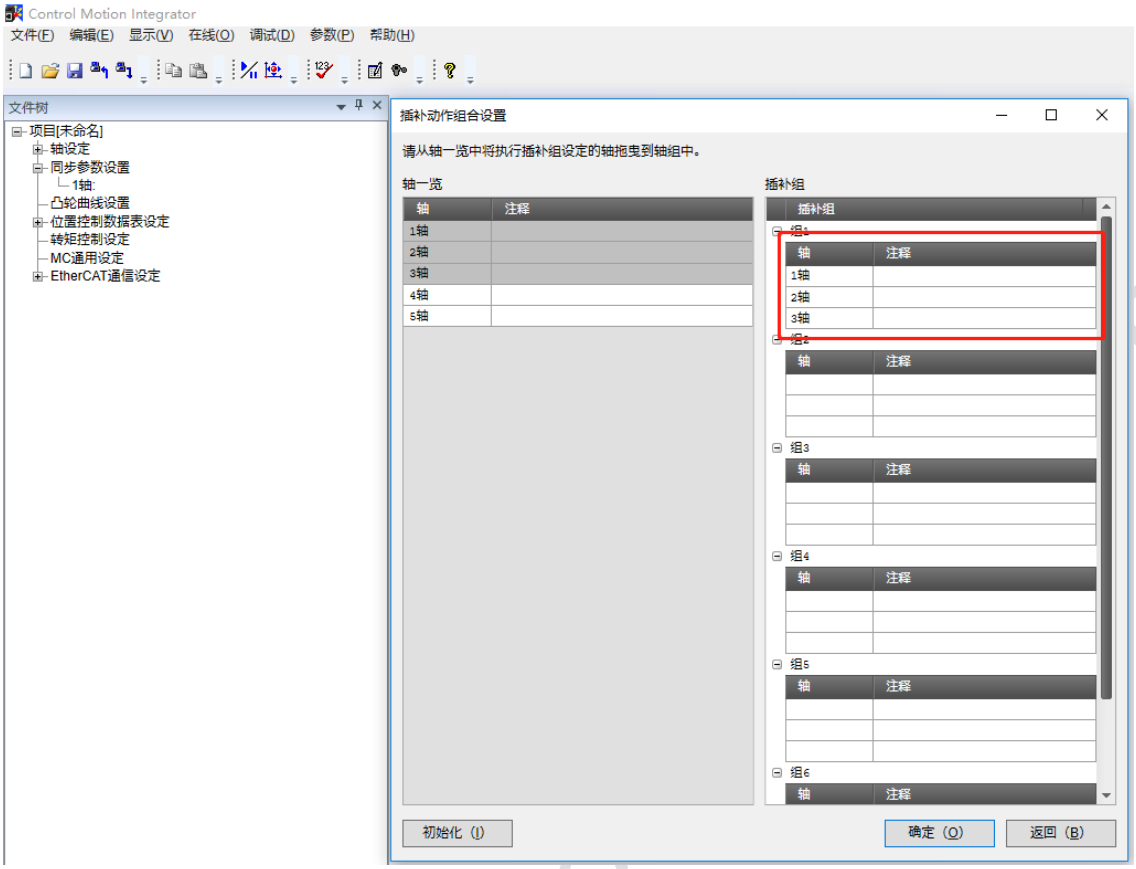



Fig 38 Interpolation group

# 2 Add ESI file

- Double-click EtherCAT communication settings

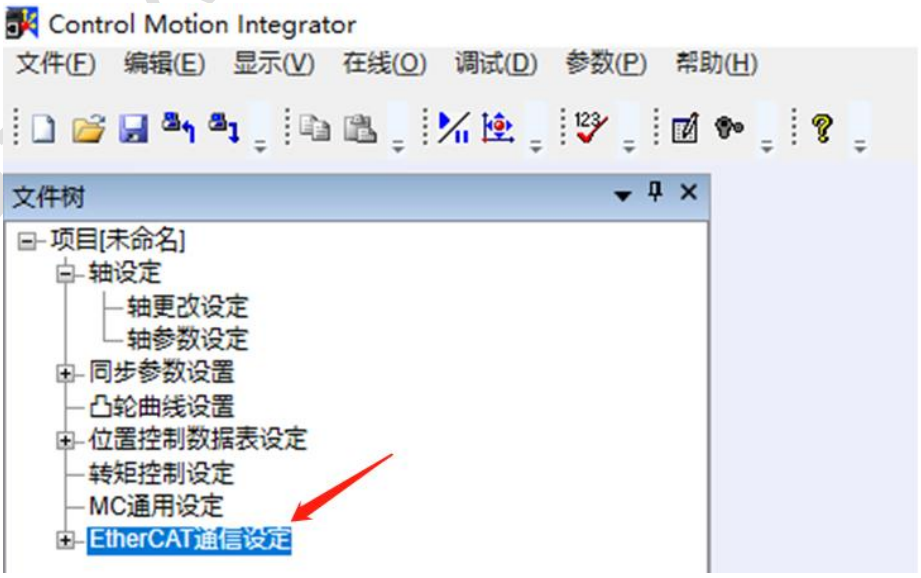



Fig 39 EtherCATCommunication settings

- Enter into EtherCAT Configurator→Press the file →ESI manage

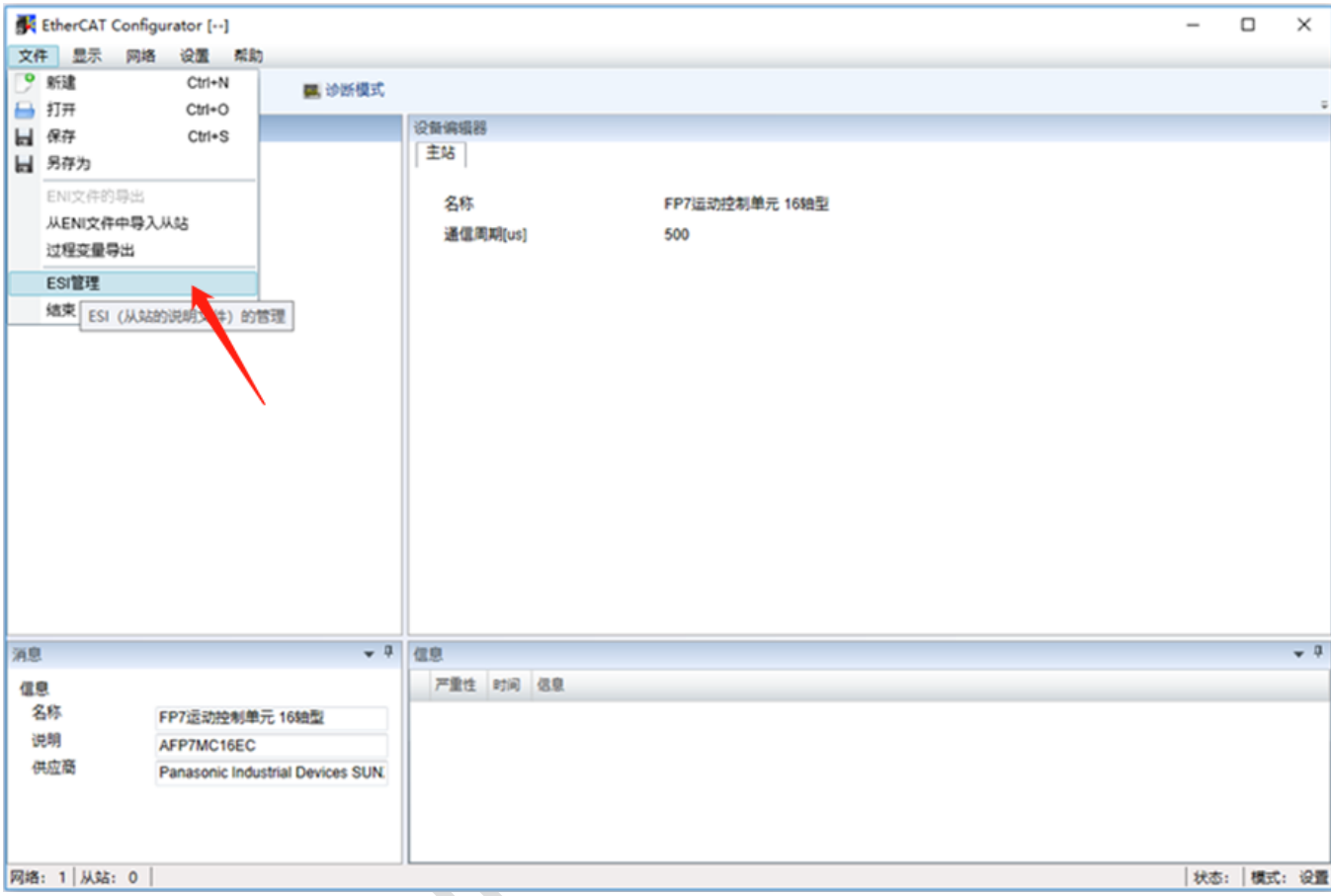



Fig 40 ESI manage

- Click the file to add

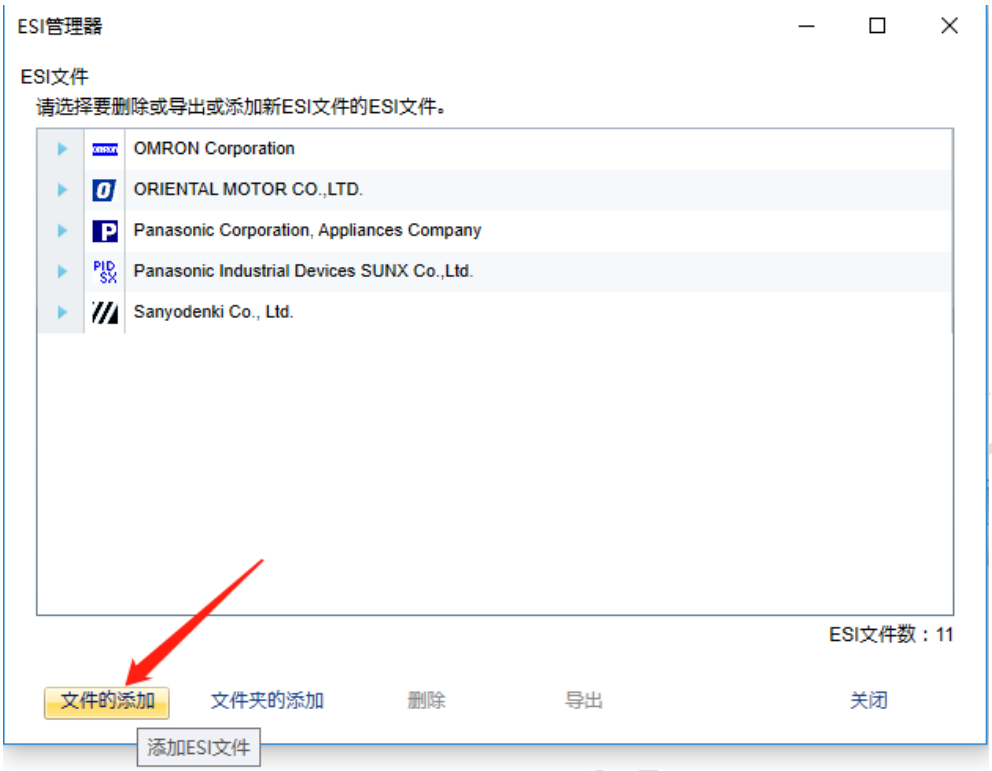



Fig 41 add ESI

Add ESI file→

Open

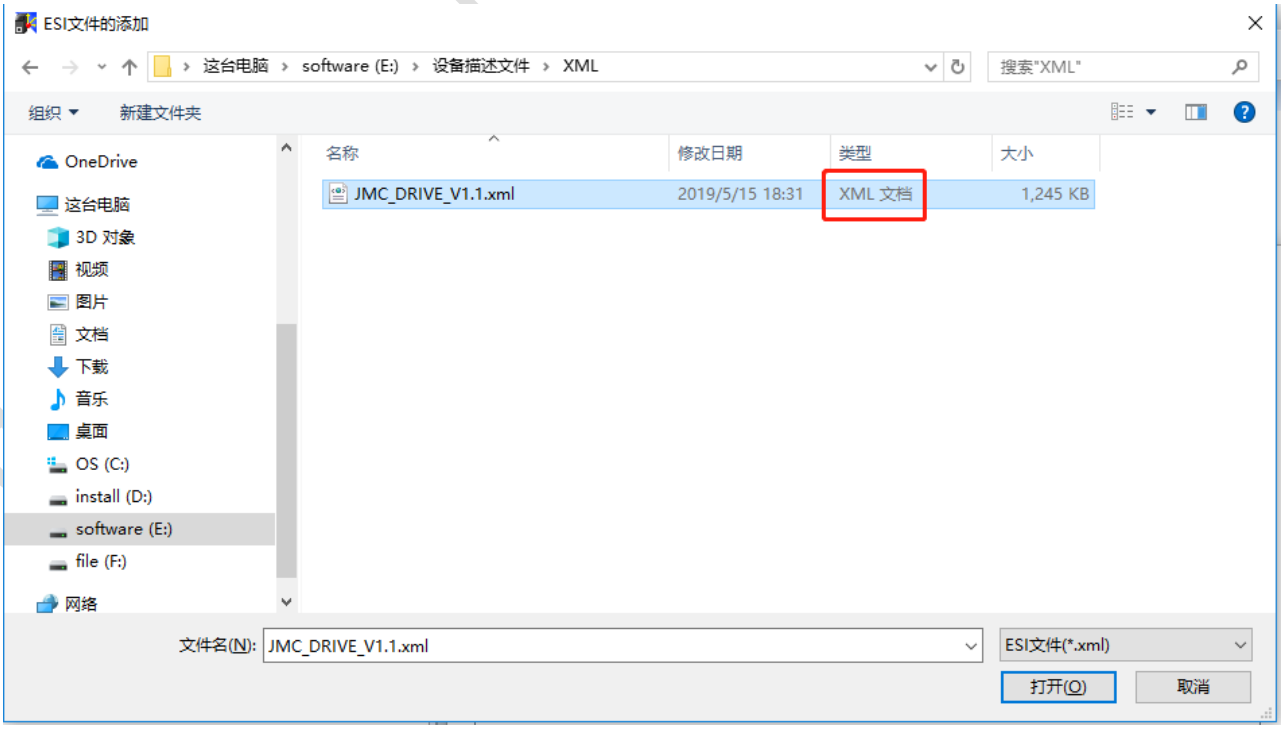



Fig 42 Open XML file

- Add successfully

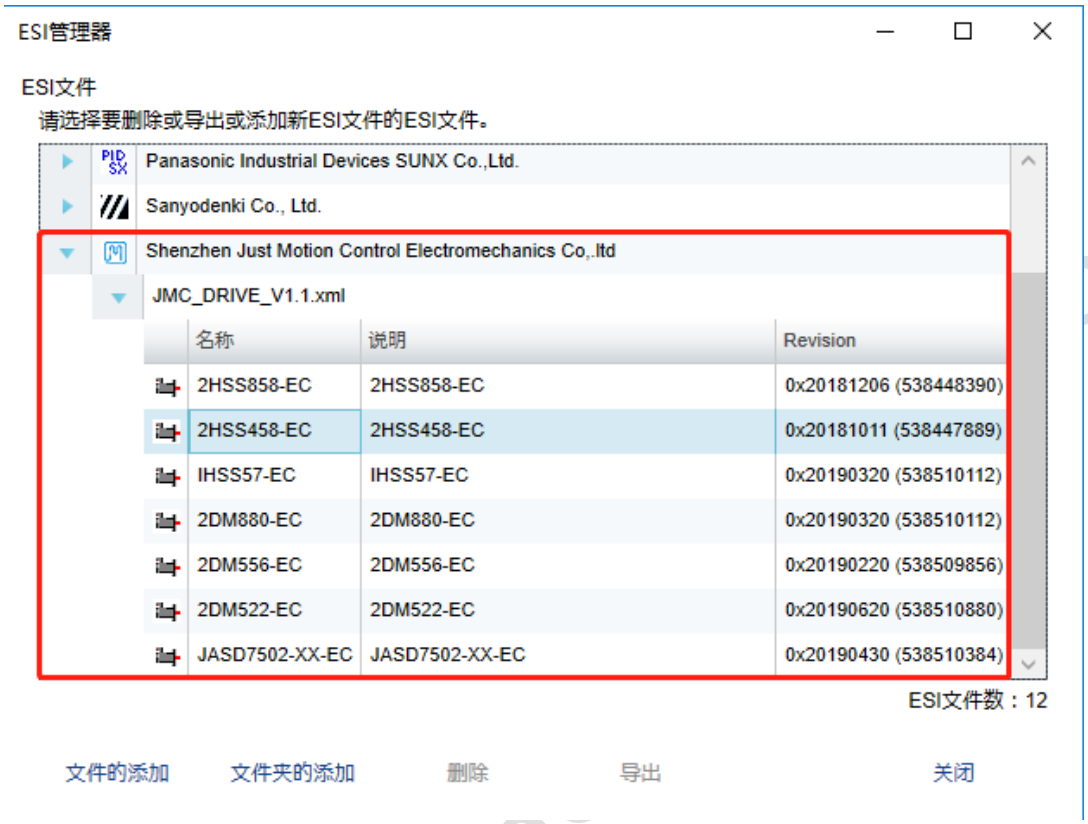



Fig 43 add XML succeed

# 3 Add Slave

Add slaves, you can manually add, you can also scan to add. Scan to add, add directly click EtherCAT network scan.

- Add manually: Click Add from the slave → select the axis model, the number of axes → OK

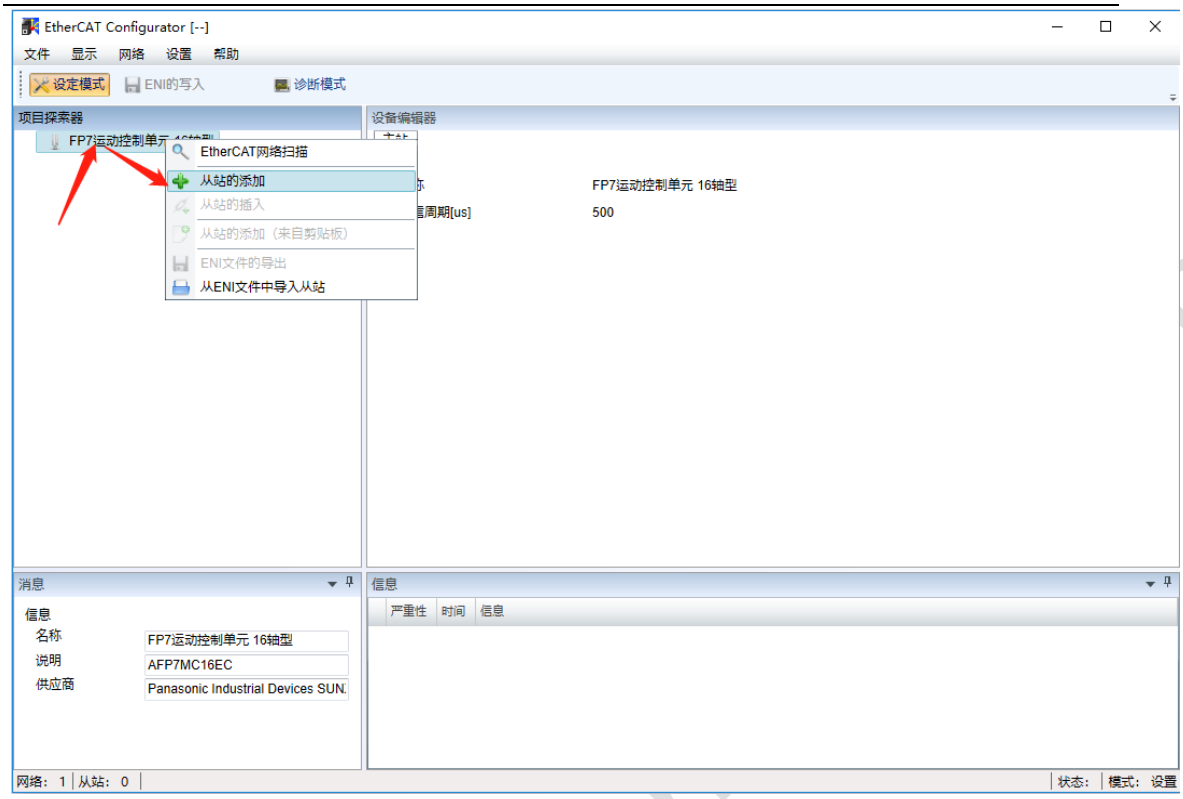



Fig 44 Select shaft model

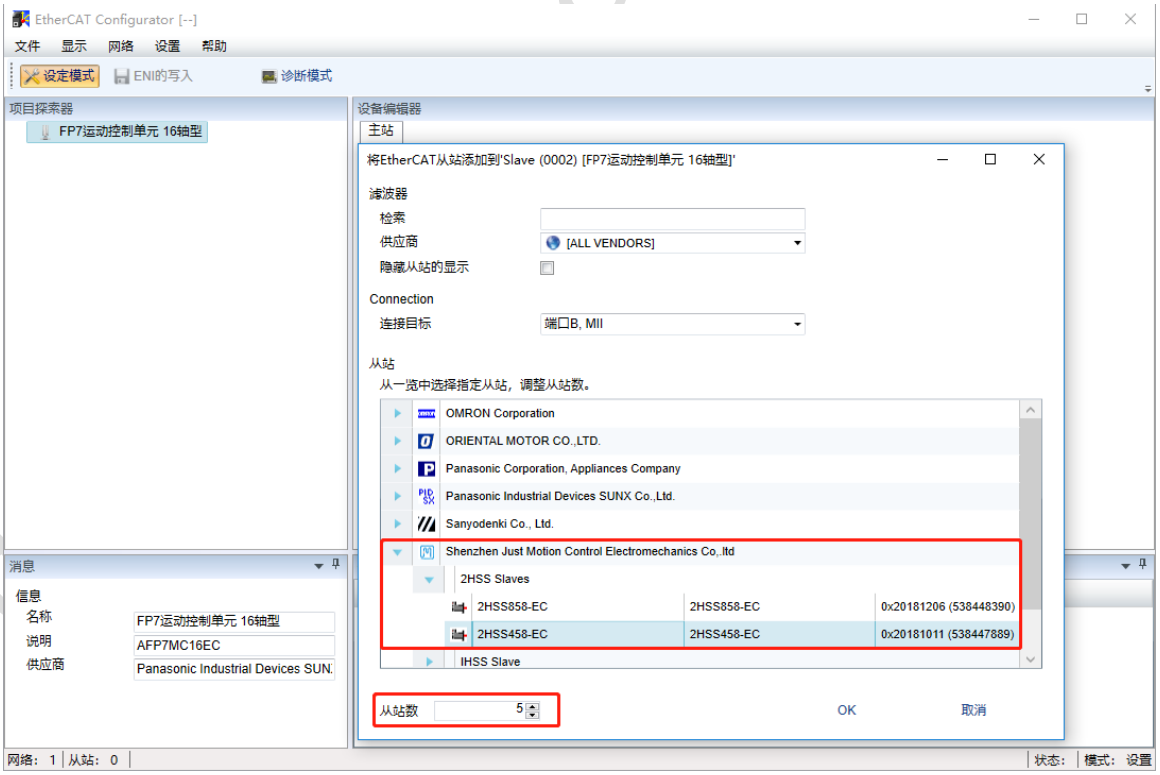



Fig 45 Set the number of slaves

- Add completed

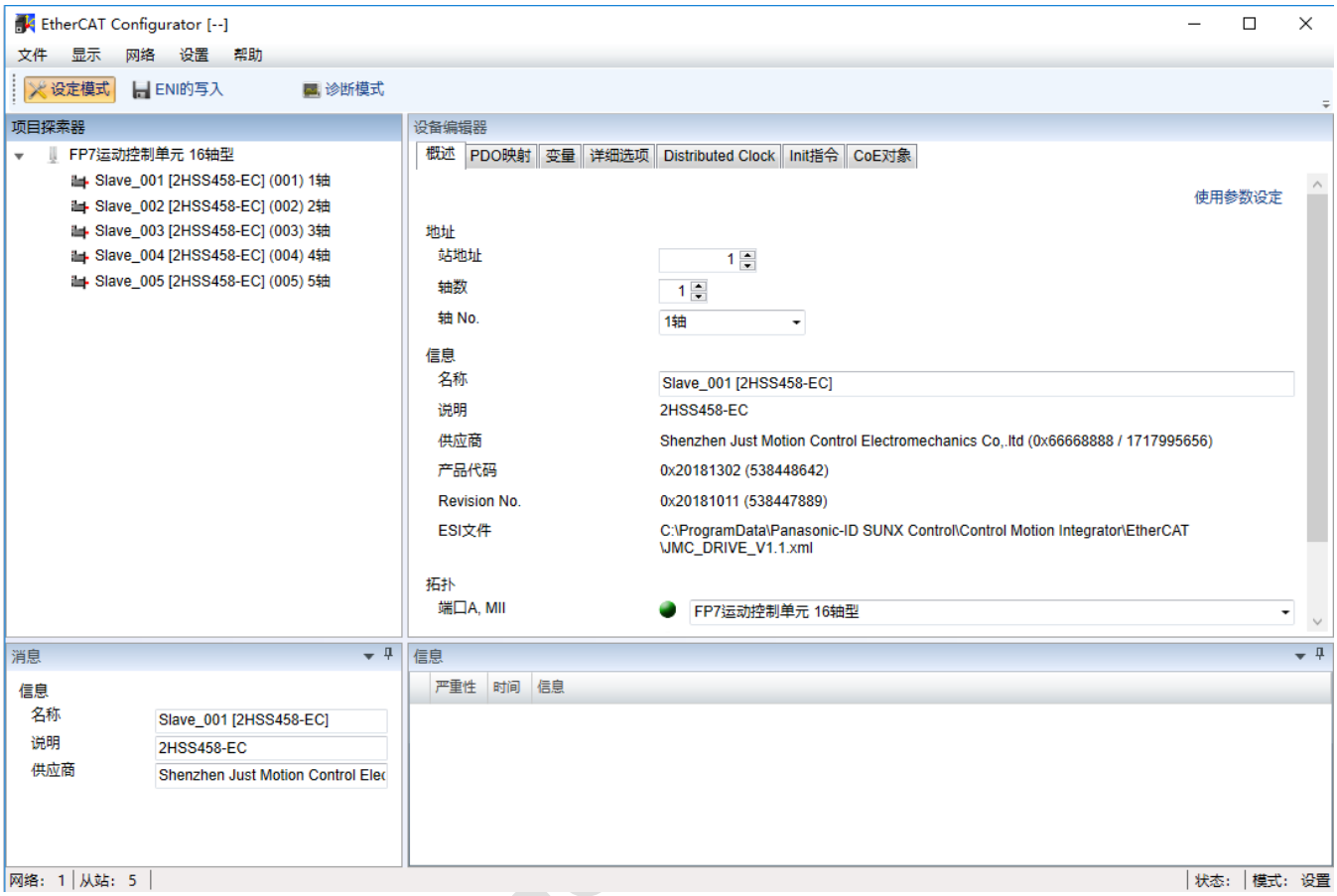



Fig 46 Add completed

# 4 Setting of axis parameters

- Double-click the axis parameter setting in the file tree

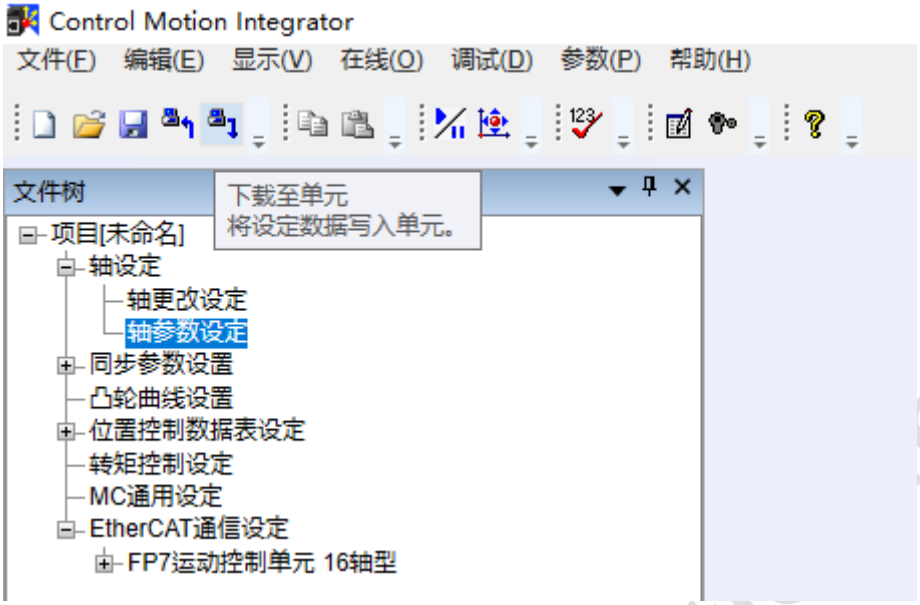



Fig 47 Axis parameter setting

Only a few simple parameters of axis 1 are set below, which can operate Normally .

For parameter setting, please refer to Chapter 5.2 of FP7 Motion Control Unit User Manual.

Please refer to Chapter 11 of FP7 Motion Control Unit User Manual for the origin return method.

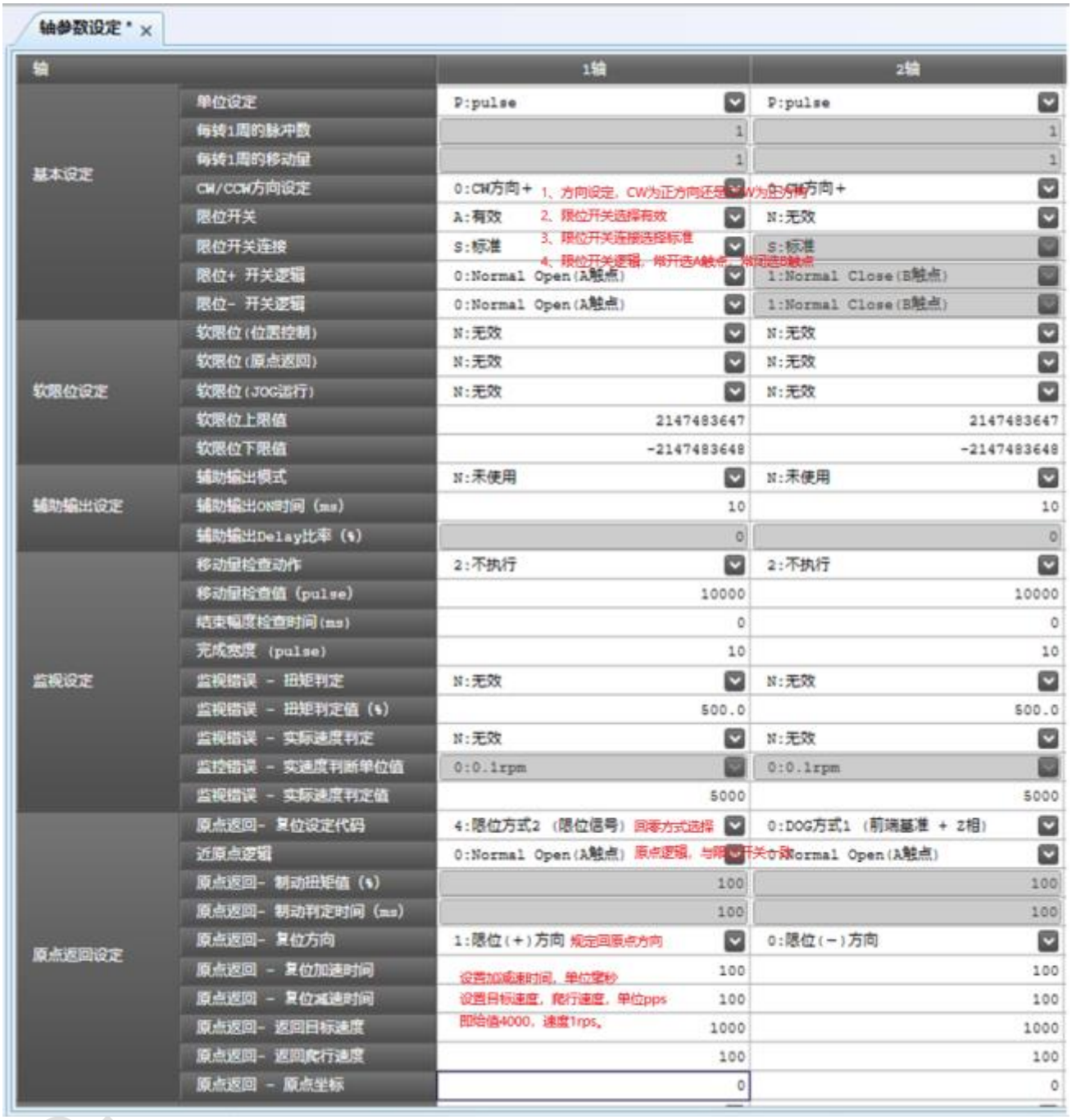
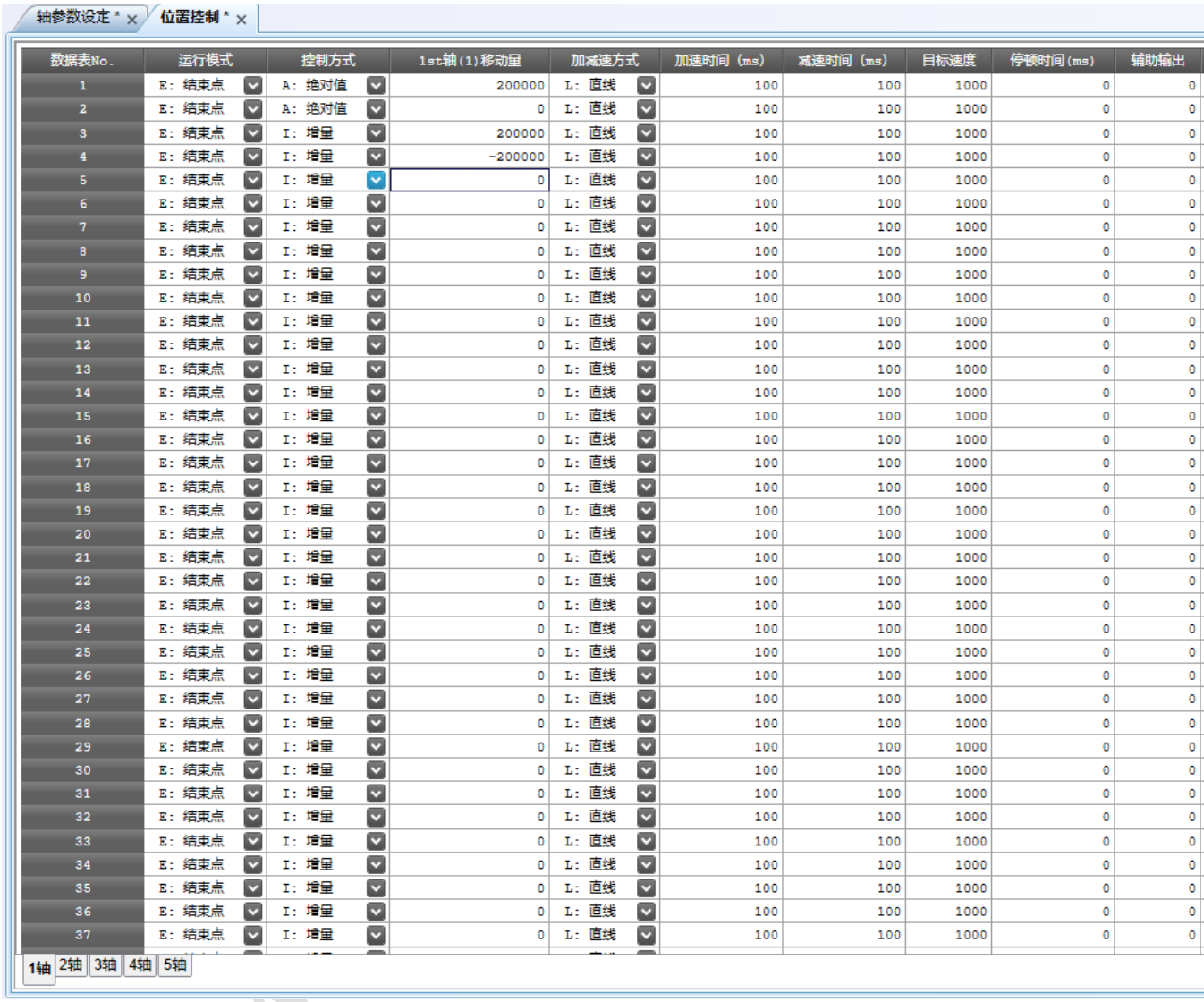



Fig 48 Setting example

# 5 Position parameter setting

- Double-click the position control setting in the file tree

Because our unit is set to pulse, the drive subdivision defaults to 4000, that is, the value 4000 is one lap, and 200000 is 50 laps. For operation mode and control method, please refer to Chapter 5.3 of FP7 Motion Control Unit User Manual




| 数据表No. | 运行模式 | 控制方式 | 1st轴(1)移动量 | 加减速方式 | 加速时间 (ms) | 减速时间 (ms) | 目标速度 | 停顿时间(ms) | 辅助输出 |
|---|---|---|---|---|---|---|---|---|---|
| 1 | E: 结束点 | A: 绝对值 | 200000 | L: 直线 | 100 | 100 | 1000 | 0 | 0 |
| 2 | E: 结束点 | A: 绝对值 | 0 | L: 直线 | 100 | 100 | 1000 | 0 | 0 |
| 3 | E: 结束点 | I: 增量 | 200000 | L: 直线 | 100 | 100 | 1000 | 0 | 0 |
| 4 | E: 结束点 | I: 增量 | -200000 | L: 直线 | 100 | 100 | 1000 | 0 | 0 |
| 5 | E: 结束点 | I: 增量 | 0 | L: 直线 | 100 | 100 | 1000 | 0 | 0 |
| 6 | E: 结束点 | I: 增量 | 0 | L: 直线 | 100 | 100 | 1000 | 0 | 0 |
| 7 | E: 结束点 | I: 增量 | 0 | L: 直线 | 100 | 100 | 1000 | 0 | 0 |
| 8 | E: 结束点 | I: 增量 | 0 | L: 直线 | 100 | 100 | 1000 | 0 | 0 |
| 9 | E: 结束点 | I: 增量 | 0 | L: 直线 | 100 | 100 | 1000 | 0 | 0 |
| 10 | E: 结束点 | I: 增量 | 0 | L: 直线 | 100 | 100 | 1000 | 0 | 0 |
| 11 | E: 结束点 | I: 增量 | 0 | L: 直线 | 100 | 100 | 1000 | 0 | 0 |
| 12 | E: 结束点 | I: 增量 | 0 | L: 直线 | 100 | 100 | 1000 | 0 | 0 |
| 13 | E: 结束点 | I: 增量 | 0 | L: 直线 | 100 | 100 | 1000 | 0 | 0 |
| 14 | E: 结束点 | I: 增量 | 0 | L: 直线 | 100 | 100 | 1000 | 0 | 0 |
| 15 | E: 结束点 | I: 增量 | 0 | L: 直线 | 100 | 100 | 1000 | 0 | 0 |
| 16 | E: 结束点 | I: 增量 | 0 | L: 直线 | 100 | 100 | 1000 | 0 | 0 |
| 17 | E: 结束点 | I: 增量 | 0 | L: 直线 | 100 | 100 | 1000 | 0 | 0 |
| 18 | E: 结束点 | I: 增量 | 0 | L: 直线 | 100 | 100 | 1000 | 0 | 0 |
| 19 | E: 结束点 | I: 增量 | 0 | L: 直线 | 100 | 100 | 1000 | 0 | 0 |
| 20 | E: 结束点 | I: 增量 | 0 | L: 直线 | 100 | 100 | 1000 | 0 | 0 |
| 21 | E: 结束点 | I: 增量 | 0 | L: 直线 | 100 | 100 | 1000 | 0 | 0 |
| 22 | E: 结束点 | I: 增量 | 0 | L: 直线 | 100 | 100 | 1000 | 0 | 0 |
| 23 | E: 结束点 | I: 增量 | 0 | L: 直线 | 100 | 100 | 1000 | 0 | 0 |
| 24 | E: 结束点 | I: 增量 | 0 | L: 直线 | 100 | 100 | 1000 | 0 | 0 |
| 25 | E: 结束点 | I: 增量 | 0 | L: 直线 | 100 | 100 | 1000 | 0 | 0 |
| 26 | E: 结束点 | I: 增量 | 0 | L: 直线 | 100 | 100 | 1000 | 0 | 0 |
| 27 | E: 结束点 | I: 增量 | 0 | L: 直线 | 100 | 100 | 1000 | 0 | 0 |
| 28 | E: 结束点 | I: 增量 | 0 | L: 直线 | 100 | 100 | 1000 | 0 | 0 |
| 29 | E: 结束点 | I: 增量 | 0 | L: 直线 | 100 | 100 | 1000 | 0 | 0 |
| 30 | E: 结束点 | I: 增量 | 0 | L: 直线 | 100 | 100 | 1000 | 0 | 0 |
| 31 | E: 结束点 | I: 增量 | 0 | L: 直线 | 100 | 100 | 1000 | 0 | 0 |
| 32 | E: 结束点 | I: 增量 | 0 | L: 直线 | 100 | 100 | 1000 | 0 | 0 |
| 33 | E: 结束点 | I: 增量 | 0 | L: 直线 | 100 | 100 | 1000 | 0 | 0 |
| 34 | E: 结束点 | I: 增量 | 0 | L: 直线 | 100 | 100 | 1000 | 0 | 0 |
| 35 | E: 结束点 | I: 增量 | 0 | L: 直线 | 100 | 100 | 1000 | 0 | 0 |
| 36 | E: 结束点 | I: 增量 | 0 | L: 直线 | 100 | 100 | 1000 | 0 | 0 |
| 37 | E: 结束点 | I: 增量 | 0 | L: 直线 | 100 | 100 | 1000 | 0 | 0 |

Fig 49 Position parameter setting

# 6 Download parameters

- Click to download to the unit

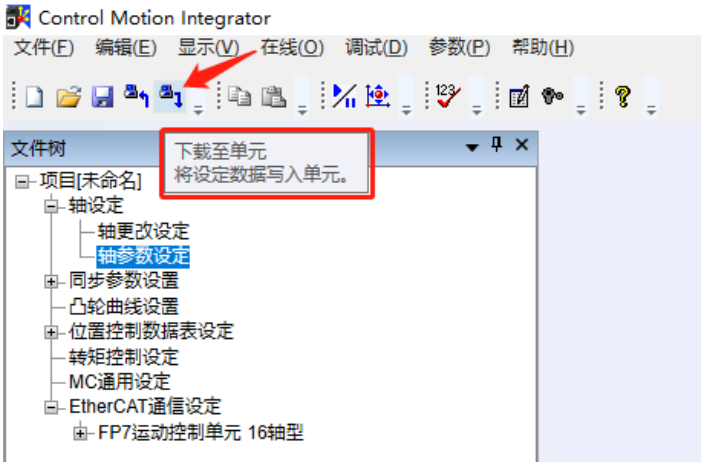



Fig 50 Download parameters

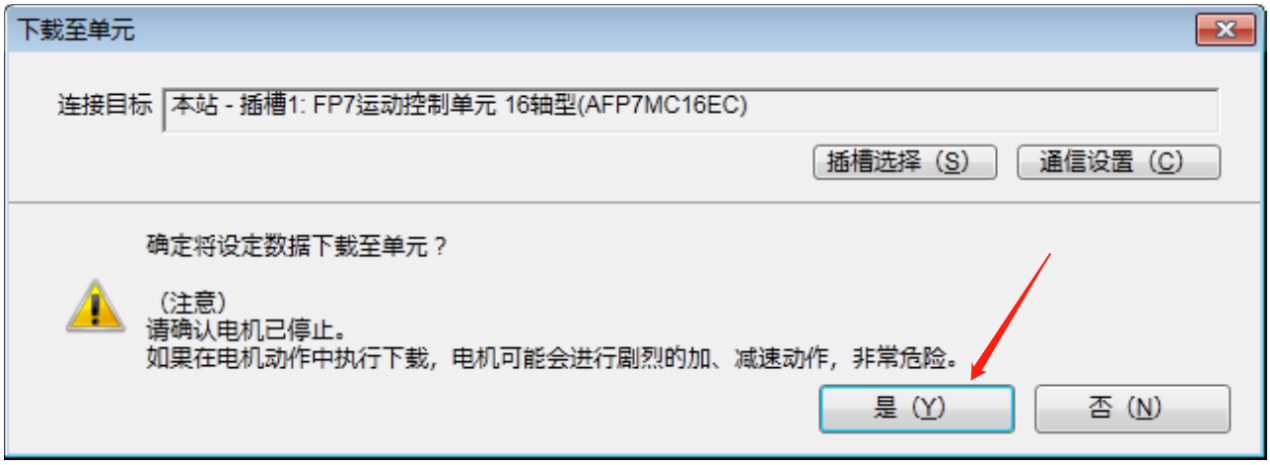



Fig 45 Download to Unit

For specific programming code, refer to Panasonic's official "FP7 Motion Control Unit User Manual", which has detailed tutorials.

# Contact us

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