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.

report errors

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

JAND/JASD-EC Field-Bus high voltage servo driver series

Introduction

JAND, JASD series of general-purpose servo drive, is the high-performance AC servo unit developed by JMEKANG, this series of servo drive adopts advanced motor control DSP chip, large-scale programmable gate array (FPGA) and IPM power module, with small size, high integration, stable performance and reliable protection characteristics. It has rich digital and analog I/O interfaces, which can be used with a variety of host computer devices and supports EtherCAT communication protocol to facilitate networking. Through the optimized PID control algorithm, the full digital control of position, speed and torque accuracy is realized, which has the advantages of high precision and fast response. At the same time, it supports motors with 2500-line incremental encoders and 17-bit and 20-bit high-precision absolute encoders to meet the different requirements of customer performance. Widely used in CNC machine tools, printing and packaging machinery, textile machinery, robots, automatic production lines and other automation fields.

Technical characteristics

- ✧ The use of DSP+FPGA dual-chip platform and optimized current loop design make the driver have the characteristics of high dynamic response, extremely short settling time, smooth operation, and small vibration when stopped.
- ✧ Support standard 100M full-duplex EtherCAT bus network interface and CoE communication protocol.
- ✧ Support standard CIA402 motion control protocol.
- ✧ With automatic gain adjustment module, users can choose the rigidity level according to their needs.
- ✧ Built-in FIR filter and multiple sets of Notch filters can automatically identify and suppress mechanical vibration.
- ✧ Built-in disturbance torque observer makes the drive have a strong ability to resist external disturbance.
- ✧ A variety of control modes are available for selection, position control, speed control, torque control, can switch various control modes.
- ✧ Position pulse input frequency up to 4MHz, support pulse + direction, orthogonal pulse,

double pulse and other position command modes.

- ✧ Support EtherCAT communication, with multi-turn absolute encoder with memory function, can be flexibly applied to industries such as manipulators.
- ✧ There are programmable 8-channel INPUT and 5-channel OUTPUT ports, users can customize input and output through parameter settings, flexible application.
- ✧ Support incremental encoder and 17-bit, 20-bit, 23-bit high-precision absolute value encoder.
- ✧ It has perfect protection functions such as over-voltage, under-voltage, over-speed, overload, excessive position deviation, encoder error, etc., and can remember 8 groups of historical fault information.
- ✧ With rich monitoring items, users can select the desired monitoring items to monitor the running status during use
- ✧ The driver can communicate with the PC through the RS232 interface to achieve simple and quick debugging of the servo drive system

1 Safety Precautions

In order to prevent harm to personal and property safety, please be sure to observe the following precautions and make the following marks to distinguish:

⚠ Danger	It indicates that it may cause death or serious injury
⚠ Caution	It indicates that it may cause miNOr injuries or endanger property safety
🚫	It indicates that implementation is prohibited

1.1 Reception and installation precautions

⚠Danger:

1、Please use the driver and motor according to the specified method, otherwise it may cause equipment damage or fire.

2、It is forbidden to use in places with severe water vapor, flammable gas, corrosive gas, etc., otherwise it will cause electric shock, fire, equipment damage, etc.

1.2 Wiring precautions

⚠Danger:

1、Do NOt connect the power supply of the drive to the U, V, W motor output terminals, otherwise the drive will be damaged, which may cause personal injury or fire.

2、Please make sure that the connection wires of the power supply and motor output terminals are locked, otherwise it may cause sparking and fire.

3、Please correctly select the power cord and motor power extension cord to avoid the current capacity of the cord NOt eNOugh to cause fire.

4、Please confirm that the drive shell and the motor are grounded. Poor grounding may cause electric shock.

⚠Caution:

1、Please do NOt tie the motor power line and signal line together or pass through the same pipeline to prevent interference to the signal.

2、For signal cables and encoder feedback extension cables, use multi-stranded shielded cables to enhance anti-interference ability.

3、After the drive is turned off, there is still a high voltage inside, please do NOt touch the power terminal within 5 minutes, and confirm that the discharge indicator is off before proceeding with the operation.

4、Before powering on, please make sure the wiring is connected correctly.

1.3 NOtes on operation and operation

⚠Danger:

1、Before installing the equipment, please test run with NO load to avoid accidents.

2、Do NOt allow untrained personnel to operate to prevent equipment damage and personal injury caused by misuse

3、During Normal operation, please do NOt touch the radiator of the drive and its inside with your hands to prevent high-temperature burns or electric shock.

⚠Caution:

1、Please adjust the driver parameters first, and then test for a long time to prevent bad use of the driver and equipment.

2、Please confirm that the device start, emergency stop, shutdown and other switches are effective before running the device.

3、Please do NOt switch the power frequently.

1.4 Precautions for maintenance and inspection

🚫:

1. During operation, it is forbidden to touch the driver and the inside of the motor to prevent electric shock.
2. Within 5 minutes after the power is turned off, do NOt touch the power and power terminals to prevent electric shock.
3. Do NOt change the connection line when power is on to prevent electric shock or personal injury.
4. The operation and daily maintenance must be carried out by trained professionals.
5. Except the personnel of our company, please do NOt disassemble and repai

2 Product Introduction

2.1 Servo Drive

2.1.1 Names of each part of servo drive

Figure 101 Names of parts of servo driver

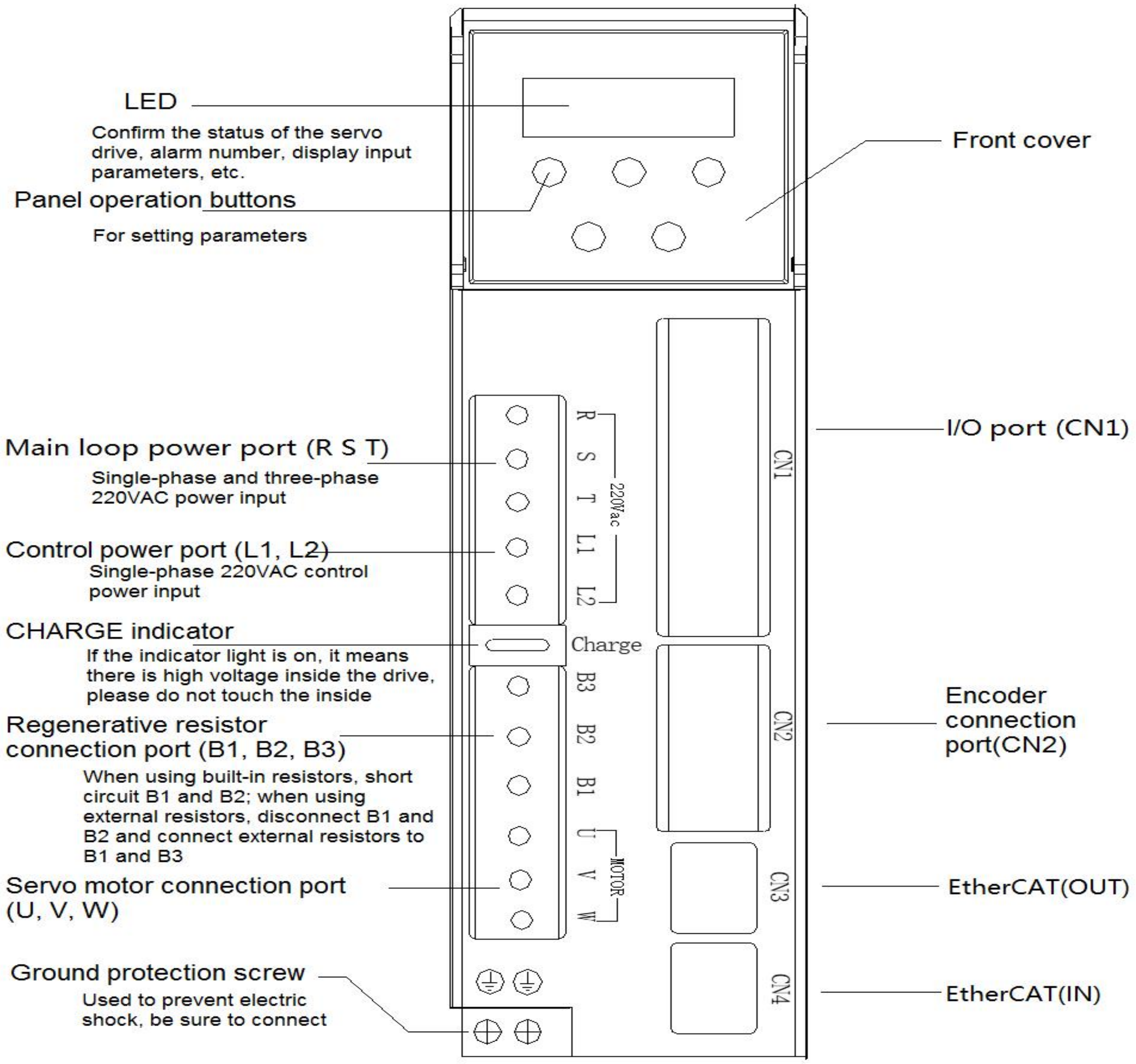


Fig.101 Names of various parts of the servo drive

2.1.2 Specification of driver

Fig.75 Single phase 220V servo drive

Model JAND***2-20B	200	400	750	1000
Single Phase Continuous Input Current (Arms)	1.9	3.2	6.7	11.6
Max Output Current(Arms)	2.1	2.8	5.5	7.6
Max Output Current(Arms)	5.8	9.6	16.9	23
Main Circuit Power Supply	Single phase AC180-240V, 50/60Hz			
Control Circuit Power Supply	Single phase AC180-240V, 50/60Hz			
Brake Handling Function	External brake resistance		Built in brake resistance	

Model JASD***2-20B	200	400	750	1500
Single Phase Continuous Input Current (Arms)	1.9	3.2	6.7	8.8
Continuous Output Current(Arms)	2.1	2.8	5.5	8
Max Output Current(Arms)	5.8	9.6	16.9	19
Main Circuit Power Supply	Single phase AC180-240V, 50/60Hz			
Control Circuit Power Supply	Single phase AC180-240V, 50/60Hz			
Brake Handling Function	External brake resistance		Built in brake resistance	

Fig.76 3-phase 220V servo drive

Model JASD***2-20B	750	1500	2000	3000
3-Phase Continuous Input Current (Arms)	3.6	6	8.7	11
Continuous Output Current	5.5	8	14	20
Max Output Current(Arms)	16.9	19	33	50
Main Circuit Power Supply	3-phase AC180-240V, 50/60Hz			
Control Circuit Power Supply	Single phase AC180-240V, 50/60Hz			
Brake Handling Function	Built in brake resistance			

Fig.77 Basic Specifications

Project	Description

Control method		Single/3-phase full-wave rectifier IGBT PWM sinusoidal wave current drive
Feedback		Incremental encoder Absolute encoder
Environment	temperature	Work: 0～55℃ Storage: -25～85℃
	humidity	Work: 10%～90%
	altitude	<1000m. When it is higher than 1000m, it shall be derated according to GB/T 3859.2-93
	Protection level	Protection level: IP10, cleanliness: 2 NOn-corrosive and NOn-combustible gas NO oil and water splash Environment with less dust, salt and metal powder
Function	speed regulate area	1:5000
	Steady speed accuracy	±0.01%: External load fluctuation 0～100% ±0.01%: power input change ±10% (220V) ±0.1%: ambient temperature ±25℃ (25℃)
	velocity response frequency	1200Hz
	Torque control accuracy	±2%
Input/Output signal	frequency-dividing pulse output of encoder	A phase, B phase and C phase: linear driving output. frequency-dividing pulse output number: can be set at will.
	input signal	point: 8 Function: ServoON、Erasewarningthewarning、Forwardoverpasssignalinput、Reverseoverpasssignal input、Controlmodeswitching、Pactioninstruction input、Positivesideexternaltorquelimit、Reverseside externaltorquelimit、Gainswitchinginput、Zero positionfixedinput、Instructionpulseinhibitinput、Encoderabsolutevaluedatarequiredinput 1.Internal set speed switching input 2. Internal set speed switchinginput

		3 、 Positioninstructionclearinput 、 Check outinputofmagneticpole、Switchinputofinstruction pulse input multiplier
	output signal	point: 5 Function: Alarm output、Band-type brake open output、Servo ready for output、Position complete output、Position close output、Uniform speed output、Motor zero speed output、Torque limit detection output、Speed limit detection output、Warning output、instruction pulse input multiplier switching output
Display function		High voltage power indicator lamp, 6-digit 8-segment LED.
Communication function	EtherCAT	Support CoE protocol, distributed clock
	RS232	Connect to PC for debugging
Regeneration treatment		Built-in regenerative resistor or external regenerative resistor.
Protection function		Overvoltage, undervoltage, overcurrent, overload, etc.

2.1.3 Servo driver model description and nameplate content

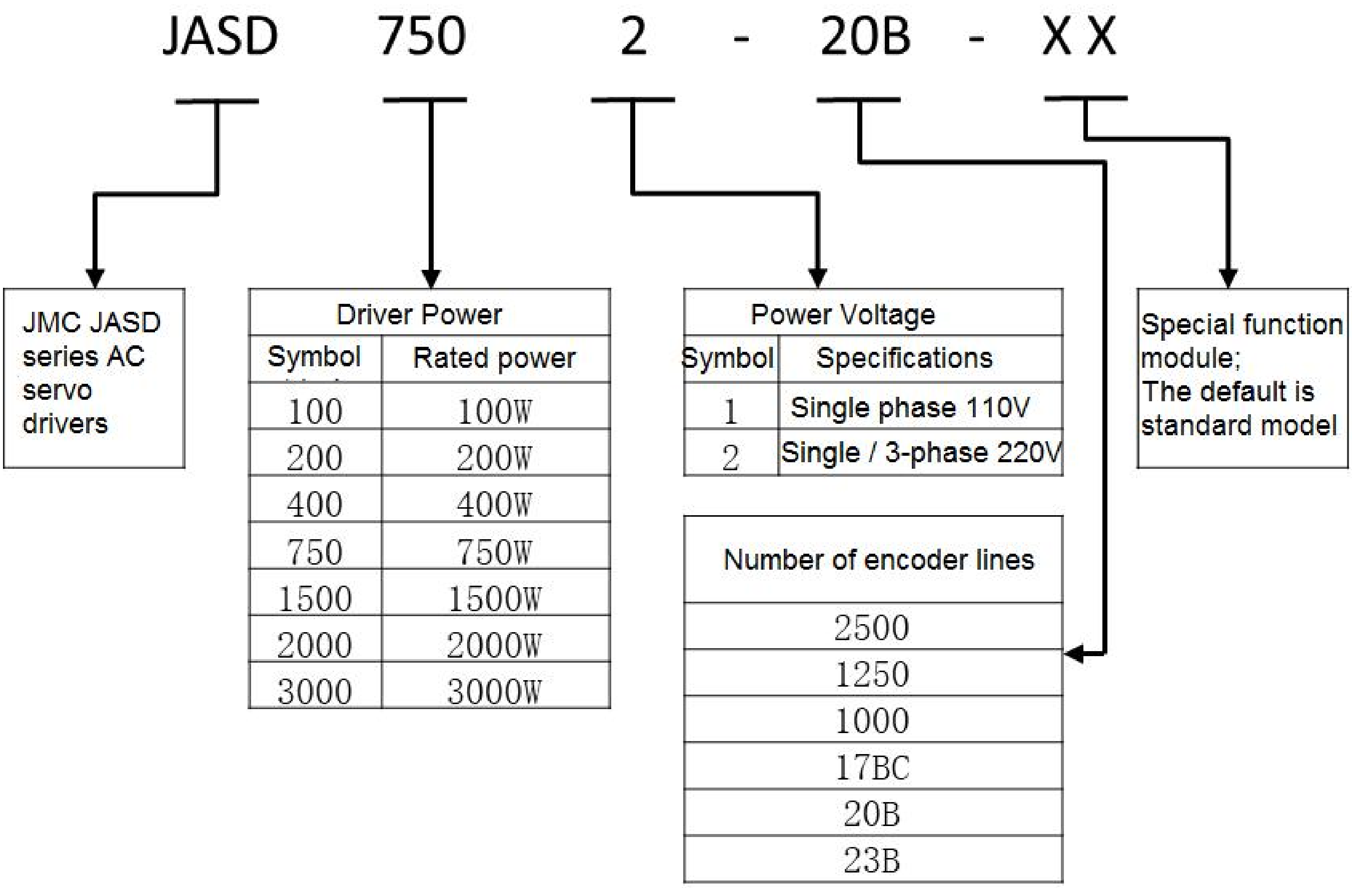


Fig.1 Servo Drive Model

2.1.4 Nameplate of driver

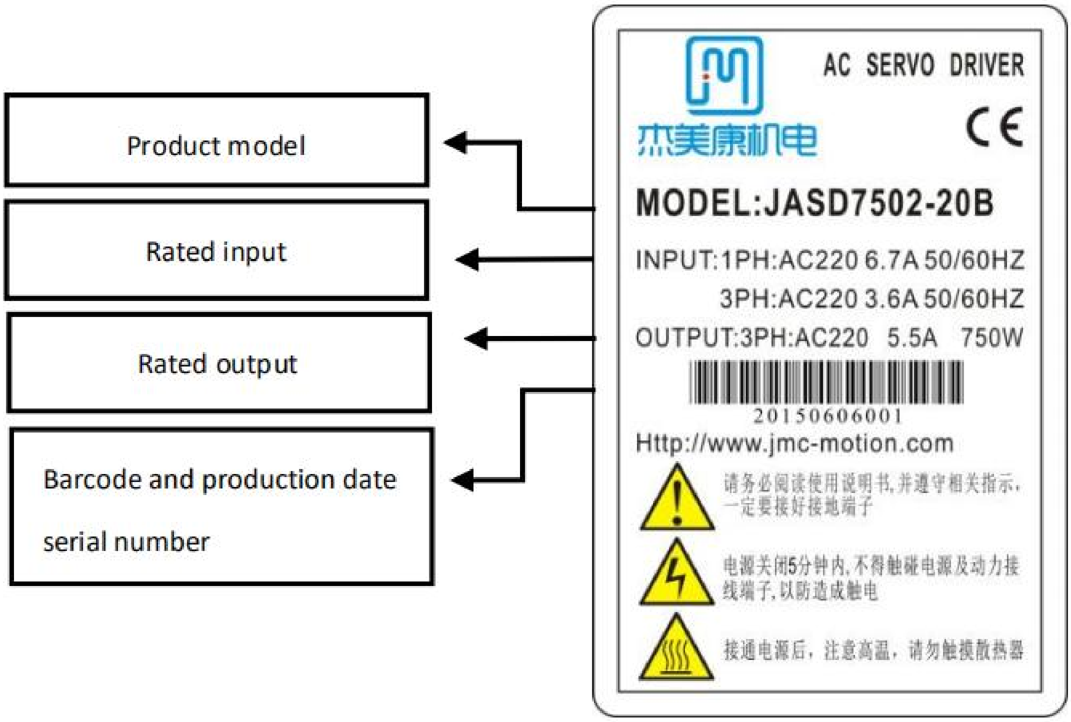


Fig. 2 Nameplate content description

2.2 Servo Motor

2.2.1 Introduction

JASM servo motors are high rotational speed, high precision servo motors developed by JMC to meet the requirements of modern automatic control. This series of servo motors can make the control speed and position accuracy very accurate, and can convert the voltage signal into torque and speed to drive the control object. This series of servo motor rotor speed is controlled by the input signal and can respond quickly. It in the automatic control system, is used as actuators, and the advantages of small electrical and mechanical time constant, high linearity, initiating character such as voltage, can convert the received electrical signal to the motor shaft angular displacement or angular velocity on output, and can be adjusted real time feedback signal to the servo drive, realize high precision control.

2.2.2 Main character

✧ High-energy magnetic

- 300% overload capacity for short time
- Flange dimensions (mm): 60、80、110、130 (mm):
- Power: 0.1-3KW optional
- Low NOise, low heat, high precision, high rotation speed, etc.

2.2.3 Model explanation

80 JASM 5 07 2 30 K - 20B - XX

Flange Size (mm)
60、80、110、130

JMC JASM AC series servo motors

Poles of motor	
4	Four Poles (default)
5	Five pairs

Motor rated output power	
Symbol	Rated power
01	100W
02	200W
04	400W
07	750W
08	850W
10	1000W
15	1500W
20	2000W
30	3000W
40	4000W

Power Voltage	
1	Single phase 110V
2	3-phase 220V

Motor rated speed	
15	1500 RPM
20	2000 RPM
30	3000 RPM

Motor shaft type	
K	Keyway
F	Flat shaft
S	Plain shaft
G	Reducer fitting
P	Special production

Number of encoder lines
2500
1250
1000
17BC
20B
23B

Special function module; The default is standard model.

Fig. 3 Servo Motor Model

2.2.4 Nameplate of motor

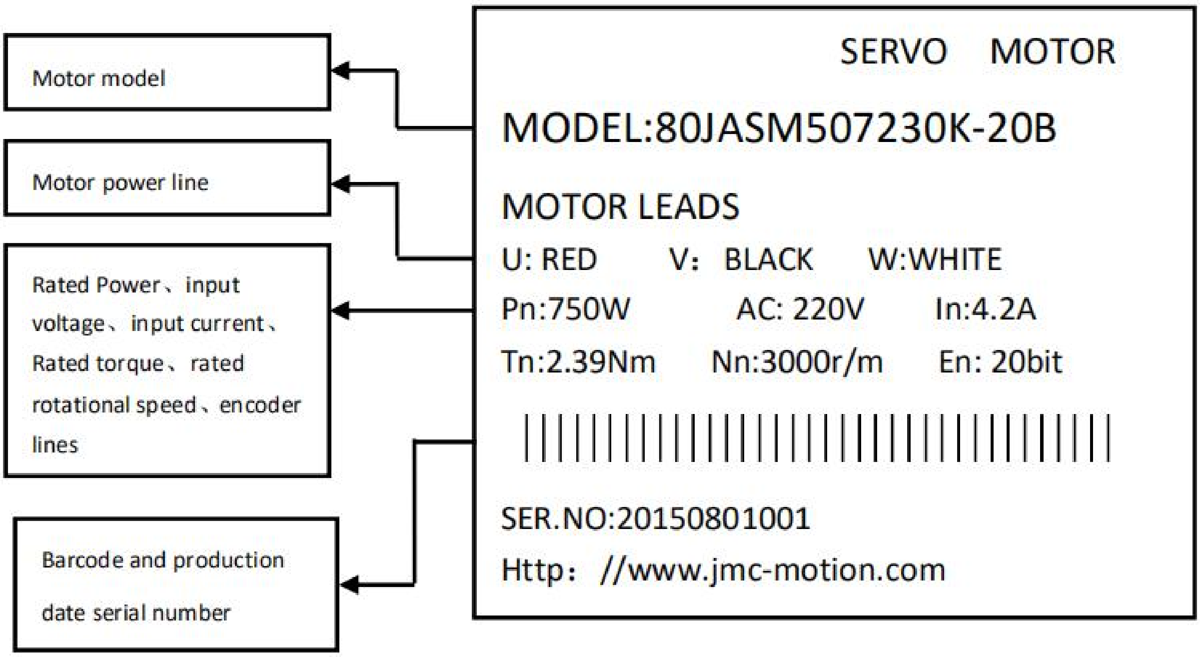


Fig. 4 Nameplate of Motor

2.3 Servo control system and Main power circuit connection

2.3.1 Wiring diagram of servo control system

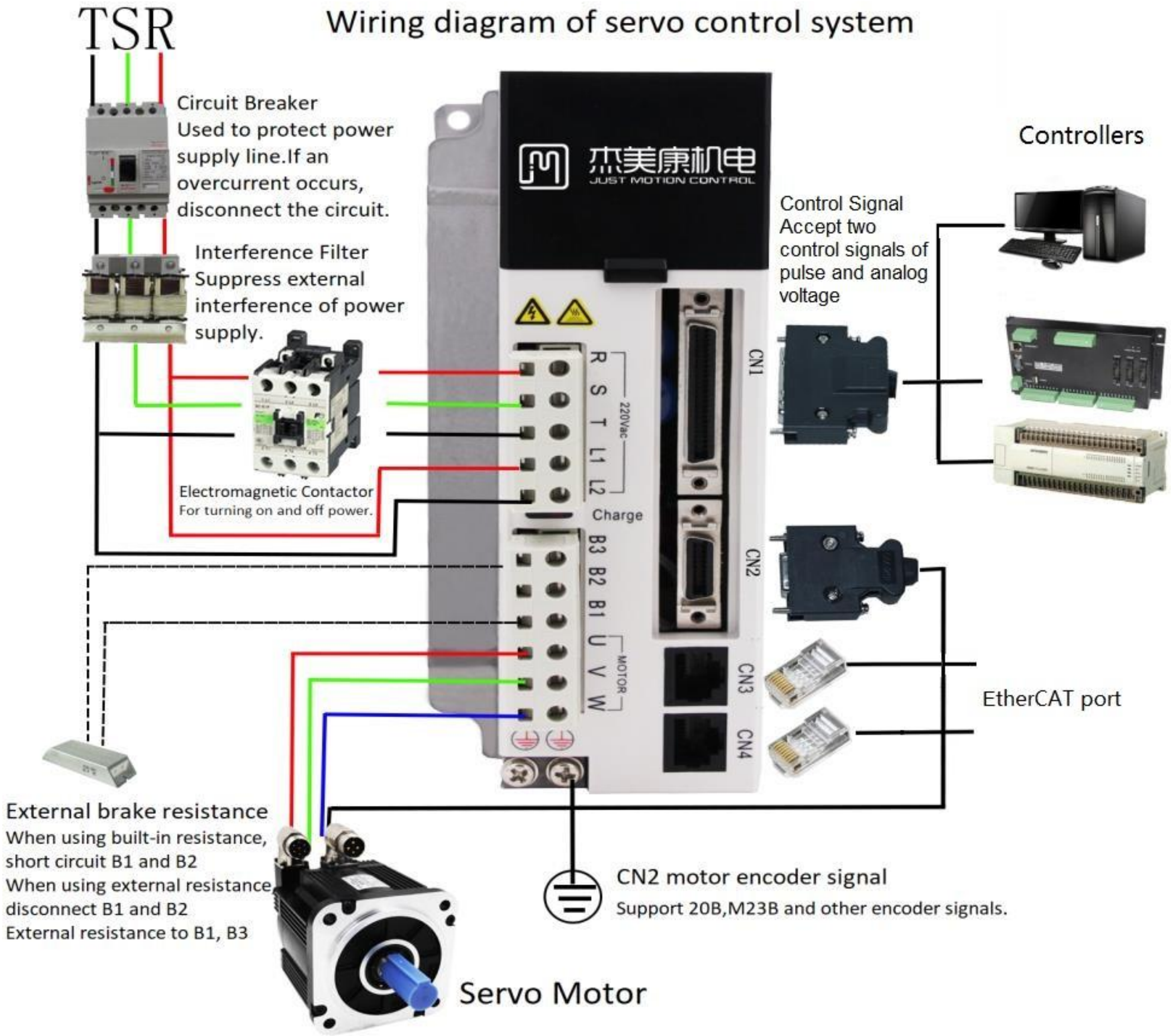


Fig 5 Wiring diagram of servo control system

The servo driver is directly connected to the industrial power supply, without the use of transformers and other power source isolation. In order to prevent cross electric shock accident of servo system, please use fuse or circuit breaker for wiring on input power supply. Because the servo driver has NO built-in grounding protection circuit, in order to form a more secure system, please use a leakage circuit breaker with overload and short circuit protection or a dedicated leakage circuit breaker with supporting ground wire protection.

2.3.2 Main power circuit connection

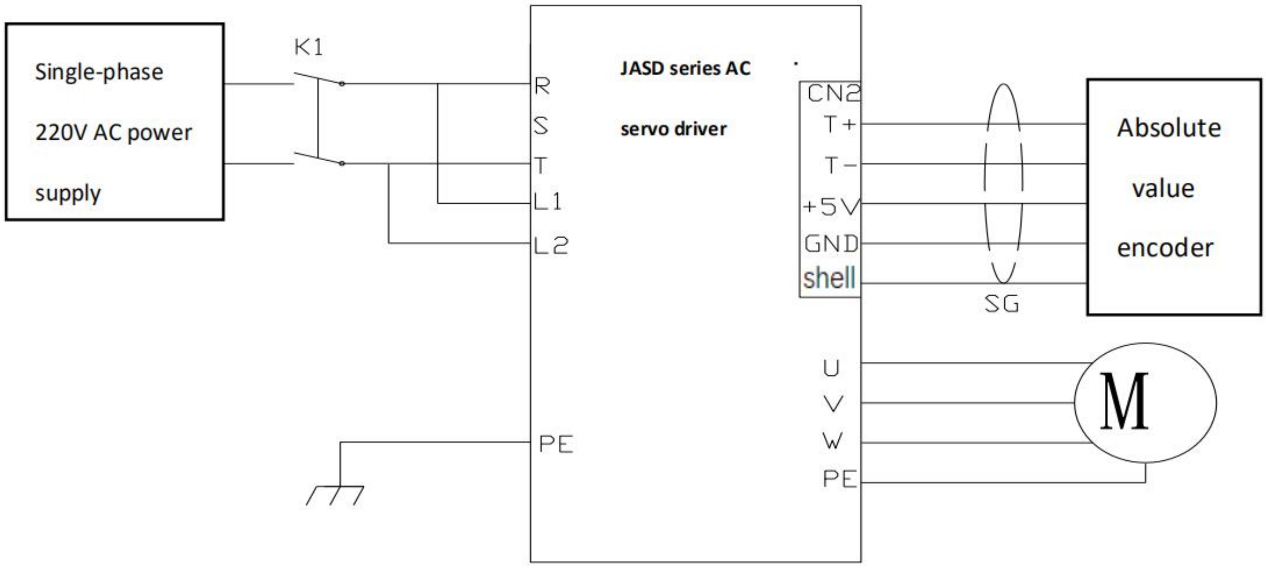


Fig. 6 single-phase power supply

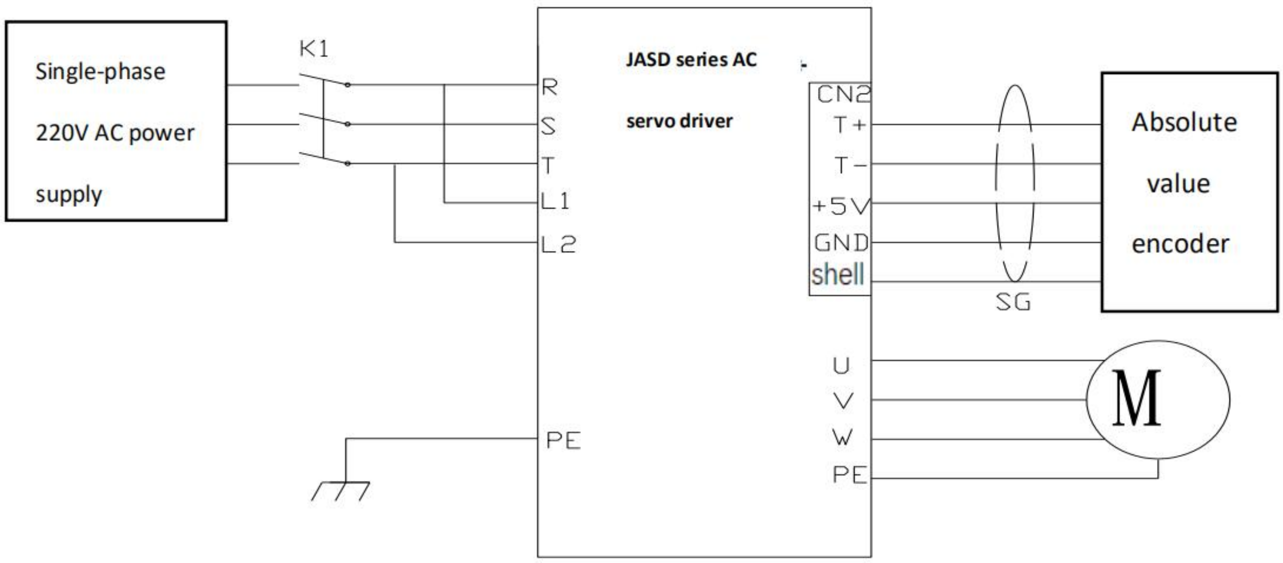
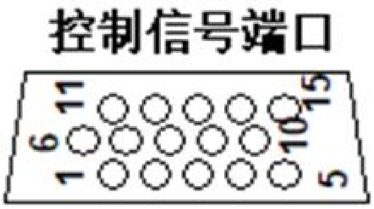


Fig. 7 Three-phase power supply

3 Port usage and cabling

3.1 Description of servo driver CN1 controlport

3.1.1 JAND Series CN1 Control Port Definition



CN1 terminal pin definition:

Pin number	Label	Definition	Declaration
1	DO1+	Digital output +	Custom output port (default in place output+)
2	DO2-	Digital output -	Custom output port (default holding brake output -)
3	DO2+	Digital output +	Custom output port (default holding brake output+)
4	DO3-	Digital output -	Custom output port (default alarm output -)
5	DO3+	Digital output +	Custom output port (default alarm output +)
6	DO1-	Digital output -	Custom output port (default in place output -)
7	DI4-	Digital input -	Custom output port (default PB1-)
8	DI3-	Digital input -	Custom input port (default CCW-)
9	DI2-	Digital input -	Custom input port (default HW-)
10	DI1-	Digital input -	Custom input port (default CW-)
11	DI5-	Digital input -	Custom output port (default PB2-)
12	NC	NO effect	
13	COM+	Common input	Active High 24V
14	24VGND	+24V output ground	

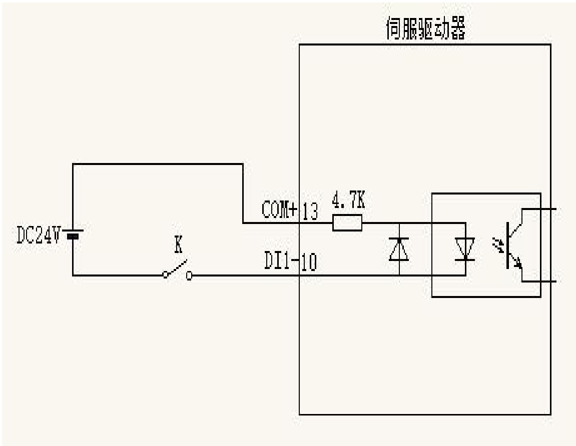
15	+24v	+24V output	

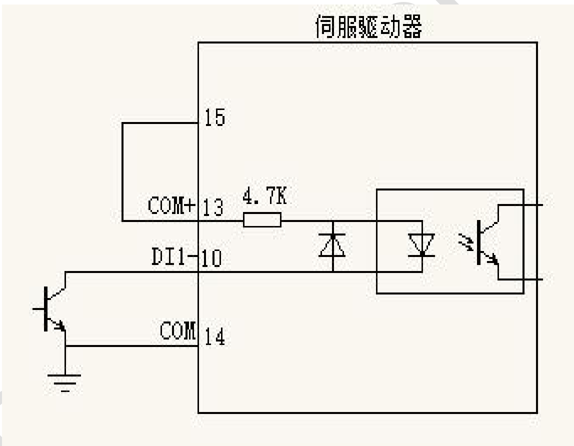
NOte:

1. Please refer to the parameter description for the custom function setting of digital input (DI) and output (DO).

3.1.2 JAND CN1 Control Port Connection Instructions

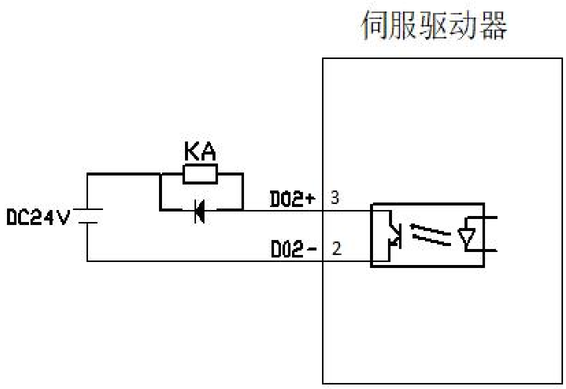
The digital inputs DI (DI1-DI5) can be connected using switches, relays, open-collector transistor circuits. This can be powered by the power supply provided inside the drive or from an external power supply. (For details of input I/O port function settings, please refer to P06-xx I/O parameter description)

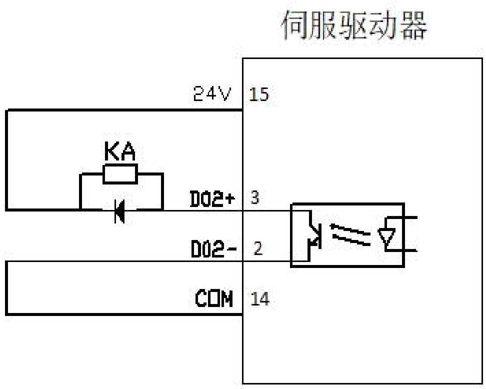




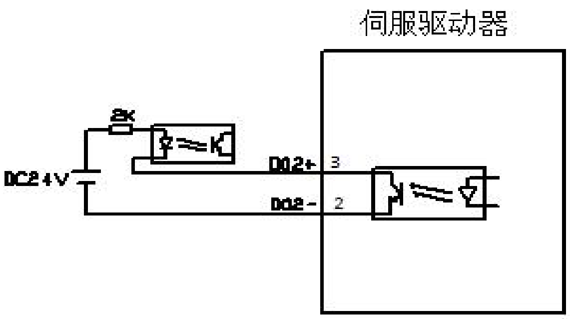
Use an external power inputUse the internal power input

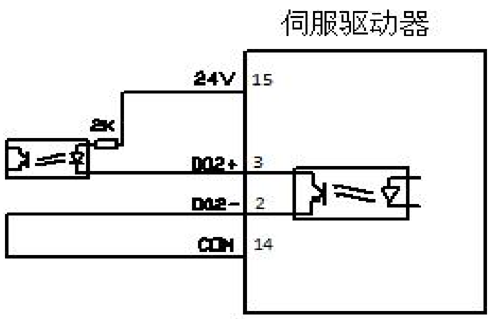
The digital output DO (DO1-DO3) output can be connected to relays, photocouplers, etc. You can use the power supply provided inside the drive or you can use an external power supply. When using an internal power supply, the drive internal 24V power supply can only provide 150mA current, when the load is greater than 150mA, be sure to use an external power supply, the supply voltage range is 5-24V. (For details of the output I/O port function settings, see P06-xx I/O parameters.)





(Relay) Uses an external power supply (Relay) Uses an internal power supply





(Optocoupler) Uses an external power supply (Optocoupler) uses an internal power supply

3.1.3 JASD Series CN1 Control Port Definition

Host control and drive connection interface, used for host control drive and drive feedback output

Fig. 8 Description of the ports on the back of the CN1 connector

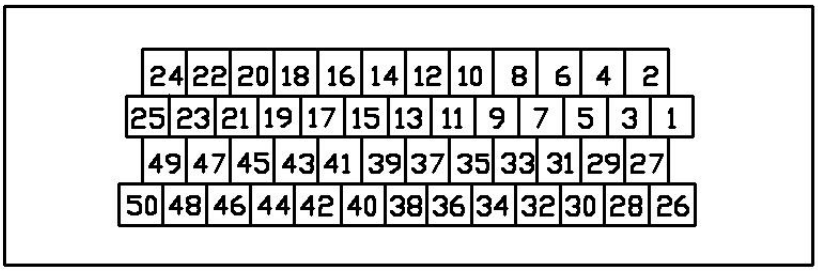


Fig. 9 Distribution diagram of SCSI-50P terminal pins on CN1 port

10 Physical map of SCSI-50P

Fig. 1Definition of pins in CN1 terminal

Pin number	Label	Definition	Declaration
1	DO4+	Digital output +	Customize output port
2	DO3-	Digital output -	Customize output port
3	DO3+	Digital output +	Customize output port
4	DO2-	Digital output -	Customize output port
5	DO2+	Digital output +	Customize output port
6	DO1-	Digital output -	Customize output port
7	DO1+	Digital output +	Customize output port
8	DI4-	Digital input -	Customize input port
9	DI1-	Digital input -	Customize input port
10	DI2-	Digital input -	Customize input port
11	COM+	Common input	Active High 24V
12	GNDA	Emulation GND	
13	GNDA	Emulation GND	
14	NC	NOp	
15	MON2	Analog data monitoring output 2	NOt currently supported
16	MON1	Analog data monitoring output 1	NOt currently supported
17	+24V	+24V output (outside I/O)	Maximum allowable output current: 150mA
18	T_REF	Torque analog control +	
19	GNDA	Emulation GND	
20	+12V	+12V output (simulate command)	Maximum allowable output current: 50 mA
21	OA+	Encoder A positive output	
22	OA-	Encoder A negative output	
23	OB-	Encoder B negative output	
24	OZ-	Encoder Z negative output	
25	OB+	Encoder B positive output	
26	DO4-	Digital output -	Customize output port
27	DO5-	Digital output -	Customize output port

28	DO5+	Digital output +	Customize output port
29	HPUL-	Digital input -	
30	DI8-	Digital input -	Customize input port
31	DI7-	Digital input -	Customize input port
32	DI6-	Digital input -	Customize input port
33	DI5-	Digital input -	Customize input port
34	DI3-	Digital input -	Customize input port
35	24V SIGN+	24V positive direction	Active High 24V
36	SIGN+	positive direction	Active High 5V
37	SIGN-	minus direction	Active low 0V
38	HPUL+	high-speed pulse +	
39	24V PULS+	24V pulse +	Active High 24V
40	HSIGN-	High Speed direction -	
41	PULS-	Pulse -	Active low 0V
42	V_REF	Velocity analog control +	
43	PULS+	Pulse +	Active High 5V
44	GND	Digital GND	
45	COM	+24V output GND	
46	HSIGN+	High Speed direction +	
47	COM	+24V output GND	
48	OCZ	Encoder Z Phase-open collector output	
49	COM	+24V output GND	
50	OZ+	Encoder Z positive output	

NOtice:

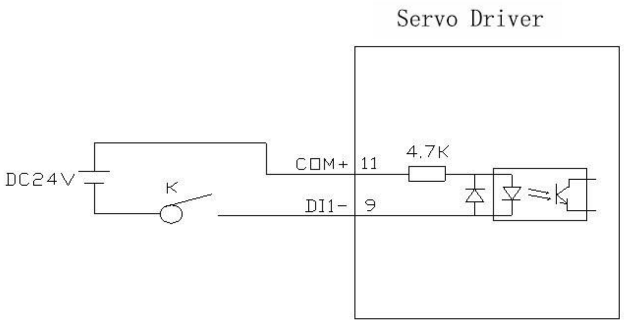
1、When the CN1 terminals are connected, 24V PULS+ and PULS+ share PULS-, 24V SIGN+ and SIGN+ share SIGN-, The difference is just a 24V high level input and a 5V high level input.

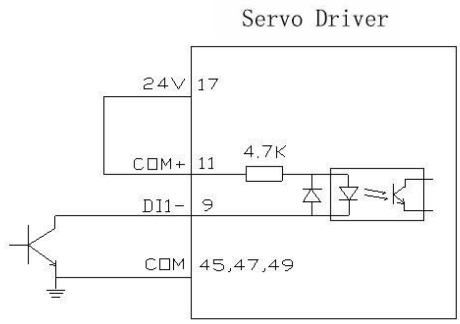
2、Digital input (DI) port、digital output (DO) port, Please set the custom function According to the parameter description.

3.1.4 JASD CN1 Control Port Connection Instructions

The digital input DI (DI1-DI8) can be connected by the switches, relays, and open-collector transistors. Power can be supplied from within the drive or from an external source. (Please

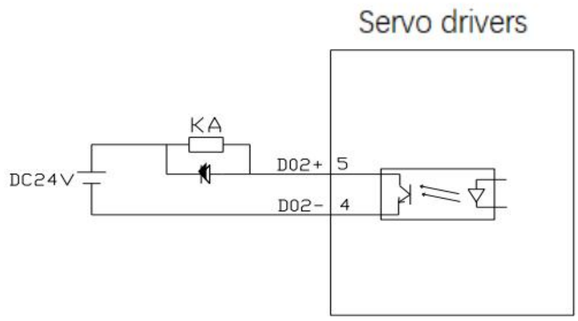
Function setting of input I/O port can refer to chapter 8.2.7 for p06-xxI/Oparameters)



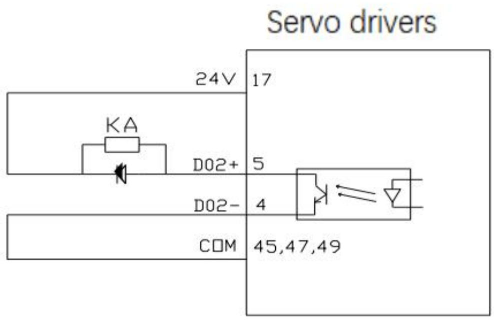


External power input Internal power input

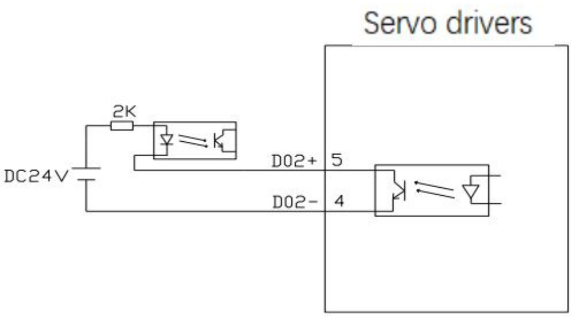
The digital output DO(DO1-DO5) can be connected with relays, photoelectric couplers, etc. The power supply provided inside the drive can be used or external power supply can be used. When using internal power supply, The 24V power supply inside the driver only provides 150mA. If the load is greater than 150mA, be sure to use an external power supply with a supply voltage range of 5-24v. (Function setting of input I/O port can refer to chapter 8.2.7 for p06-xxI/Oparameters)



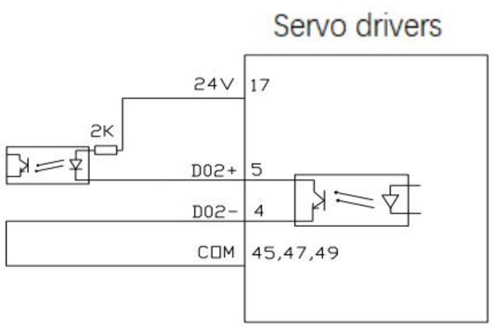
(Relay) External power supply



(Relay) Internal power supply

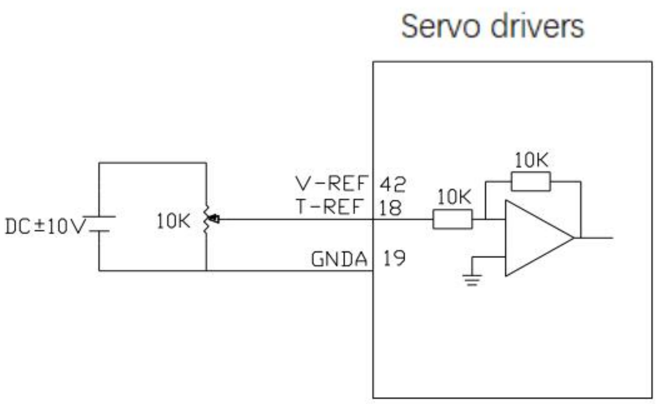


(Optocoupler) External power source

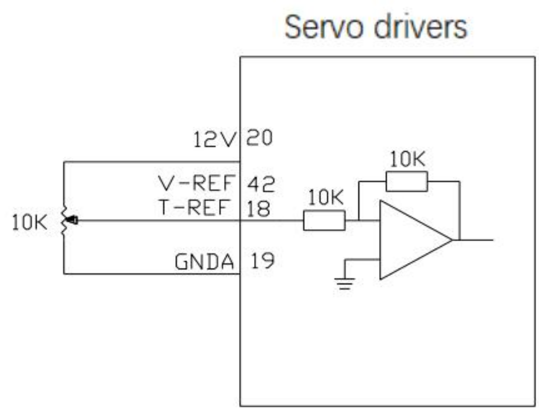


(Optocoupler) Internal power supply

Speed and torque control analog control input effective voltage range (-10v ~10V), The command value corresponding to this voltage range can be set by the following parameters,P06-40 Speed analog command input gain,P06-43 Torque analog command input gain. For the specific setting method, please read the detailed description of parameters.



Given external power analog signal



Internal 12V power supply,

speed/torque adjustment by potentiometer

3.2 Description of the CN2 encoder port of the driver

3.2.1 Description of SCSI-20P encoderconnector

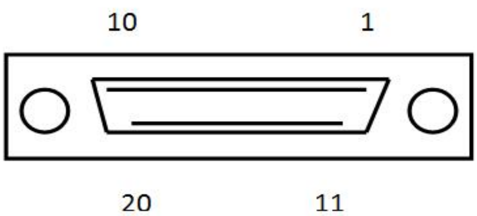


Fig. 11 Port description of CN2

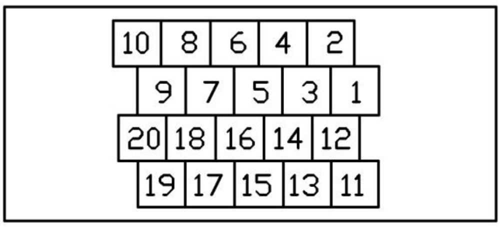


Fig. 12 Pin assignment of SCSI-20P terminal on CN2 port

Fig. 13 SCSI-20P physical map

Table 2 description of SCSI-20P encoder connector

Pin number	Label	Definition	Declaration
1	NC	NOp	
2	EZ-	Encoder Z negative input	
3	NC	NOp	
4	T-	Bus encoder T-	Special for bus drive
5	T+	Bus encoder T+	Special for bus drive
6	EW-	Magnet pole W negative input	
7	EB+	Encoder B positive input	
8	EW+	Magnet pole W positive input	
9	EB-	Encoder B negative input	
10	EZ+	Encoder Z positive input	
11	EA+	Encoder A positive input	
12	EA-	Encoder A negative input	
13	GND	Output power supply GND	
14	+5V	Output power supply 5V	
15	GND	Output power supply GND	
16	+5V	Output power supply 5V	
17	EV+	Magnet pole V positive input	
18	EV-	Magnet pole V negative input	

19	EU-	Magnet pole U negative input	
20	EU+	Magnet pole U positive input	

3.2.2 Description of 1394-6P encoder connector

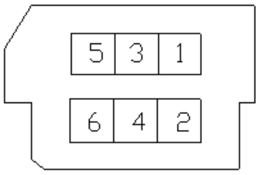


Fig. 14 Encoder connector

Table 80 Definition of encoder pin

Pin number	Label	Definition	Declaration
1	+5V	Output power supply 5V	
2	GND	Output power supply GND	
3	NC	NOp	
4	NC	NOp	
5	T+	Bus encoder T+	Special for bus drive
6	T-	Bus encoder T-	Special for bus drive

NOtice: The connector of 1394-6p encoder is special for 400W driver and the following models. For wiring, please connect according to the sign of the terminal.

3.3 Description of the driver's CN3/CN4 port

CN4 is the input terminal (with red light), CN3 is the output terminal (with green light), please refer to "Communication Interface and Wiring" for details.

3.4 Description of power supply and motor power line port

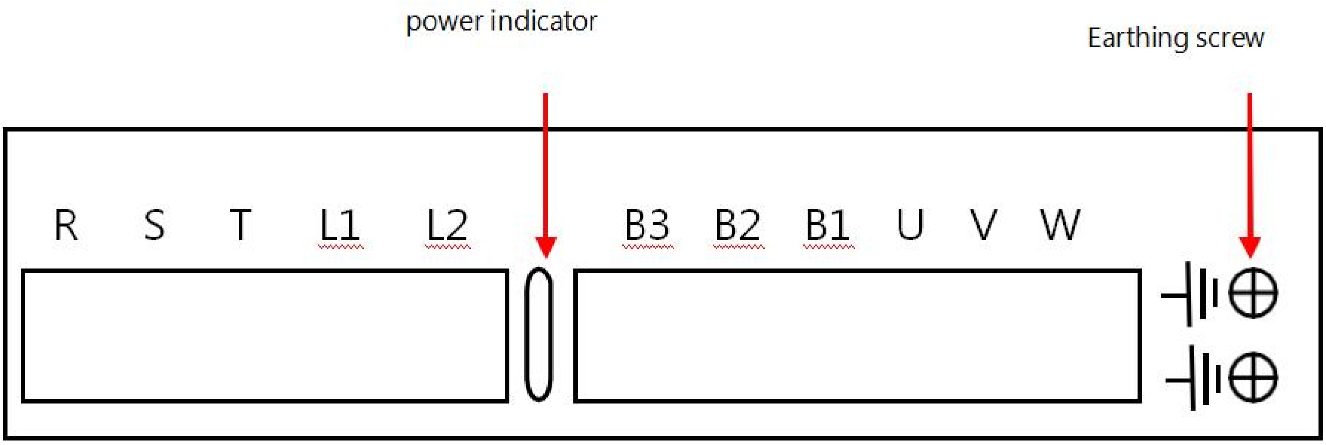


Fig. 15 Drive power line of 400W and below 400W

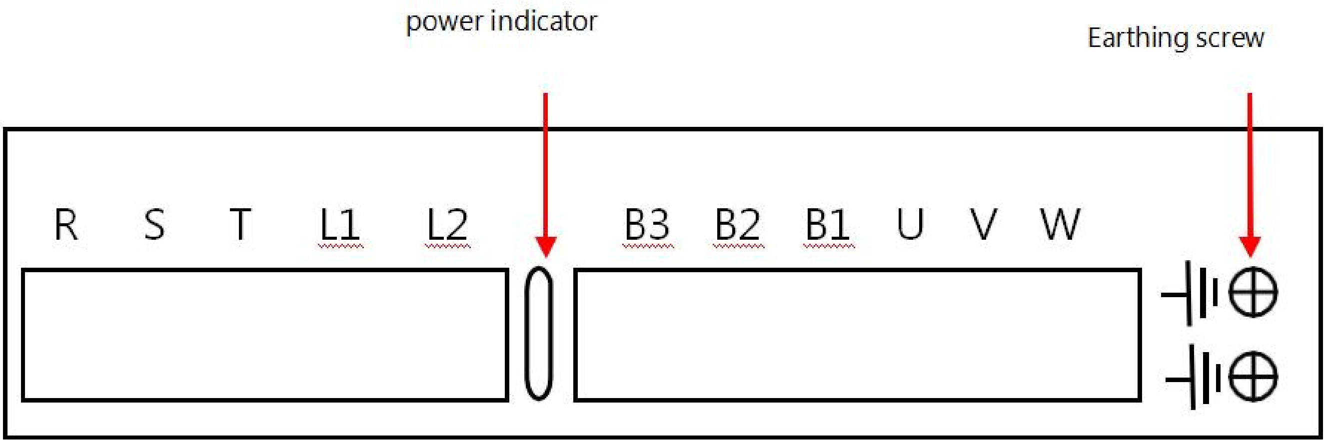


Fig 16 Drive power line of 750W and below 750W

Fig. 3 Power line port definition

Label	Definitionn	Declaration
R、S、T	The power supply input of the main circuit	For single/three-phase 220V ac, it is recommended to use three-phase power supply 0.4kw and below
L1、L2	The input end of the power supply in the control circuit	Connect to single - phase 220V AC

U、V、W	The connection end of the motor power line	Connect the power line of the motor
B1、B2、B3	The connection end of the regenerative resistor	When using the built-in regenerative resistance, short-connect B1 and B2 (our 750W and above drives have built-in regenerative resistance) When using external resistance, disconnect the short connection of B1 and B2, and connect both ends of the resistance to B1 and B3
Earthing screw	Driver protection GND screw	Connect the ground wire of power supply and motor
Power Indicator	Drive power indicator	Shows whether there is high voltage in the driver

1. Be sure to connect the electromagnetic contactor between the power supply and the main circuit power supply of the servo driver, so that in case of failure of the servo driver, the power can be cut off to prevent fire caused by excessive current.

2. There is NO built-in regenerative resistance for drivers of 0.4kw and below. When the feedback energy exceeds the absorption capacity of capacitance, an overvoltage alarm of AL.402 will appear, and set P00-30, P00-31 and P00-32 to corresponding values, Refer to 8.2 specification of parameter analysis.

4 Installation instructions

4.1Installationdimension

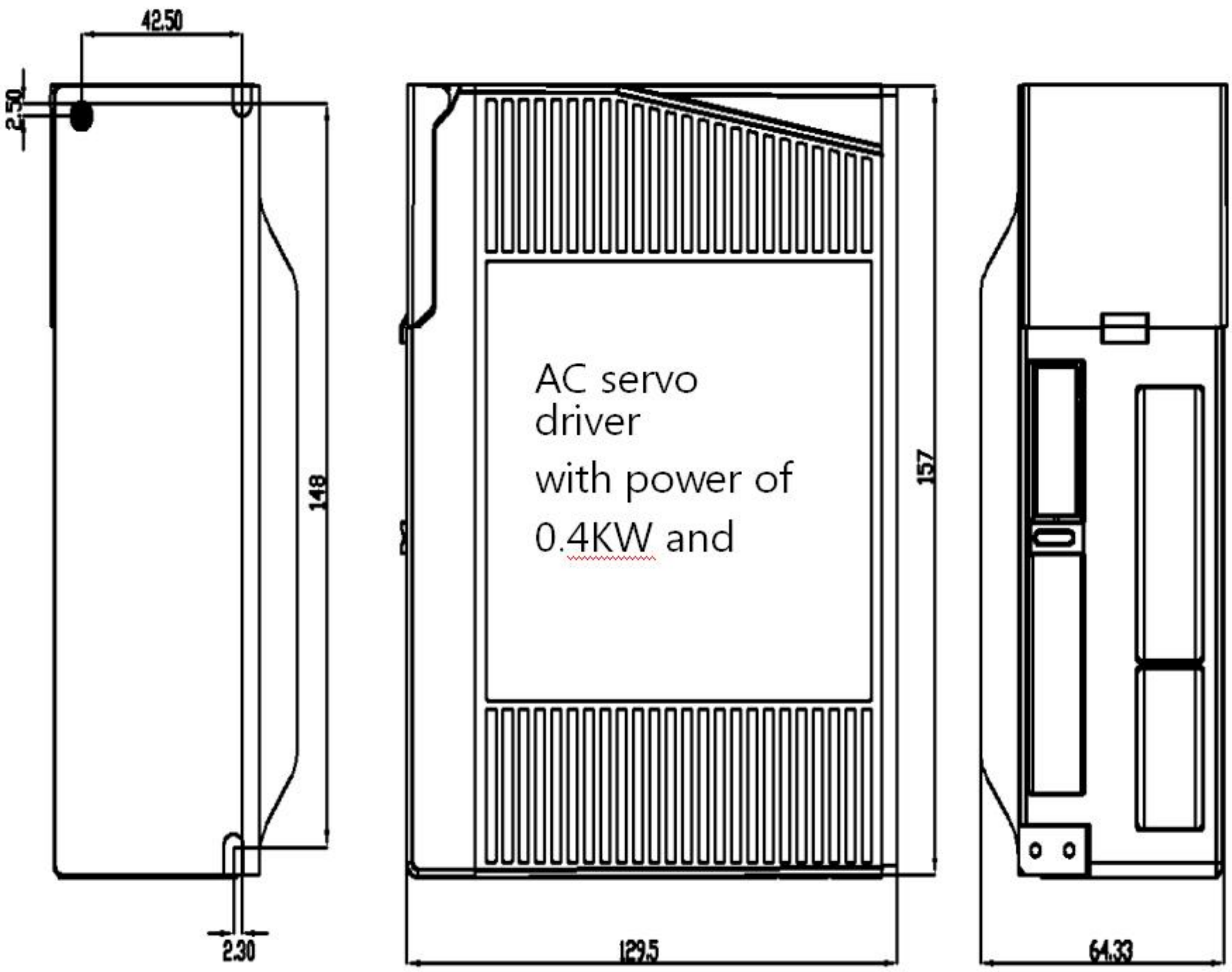


Fig.17AC servo driver with power of 400W and below (unit: mm)

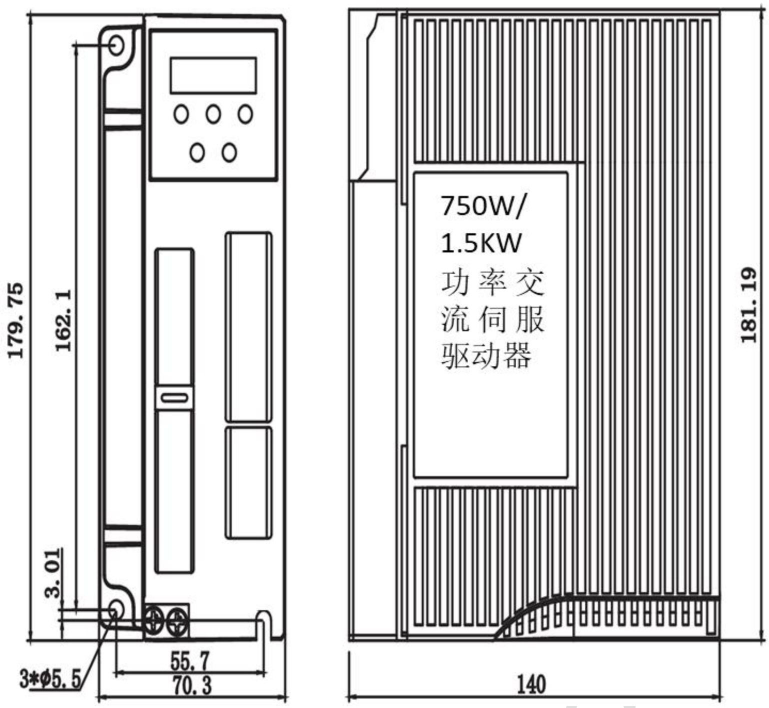


Fig.18750W / 1.5KW AC servo driver (unit: mm)

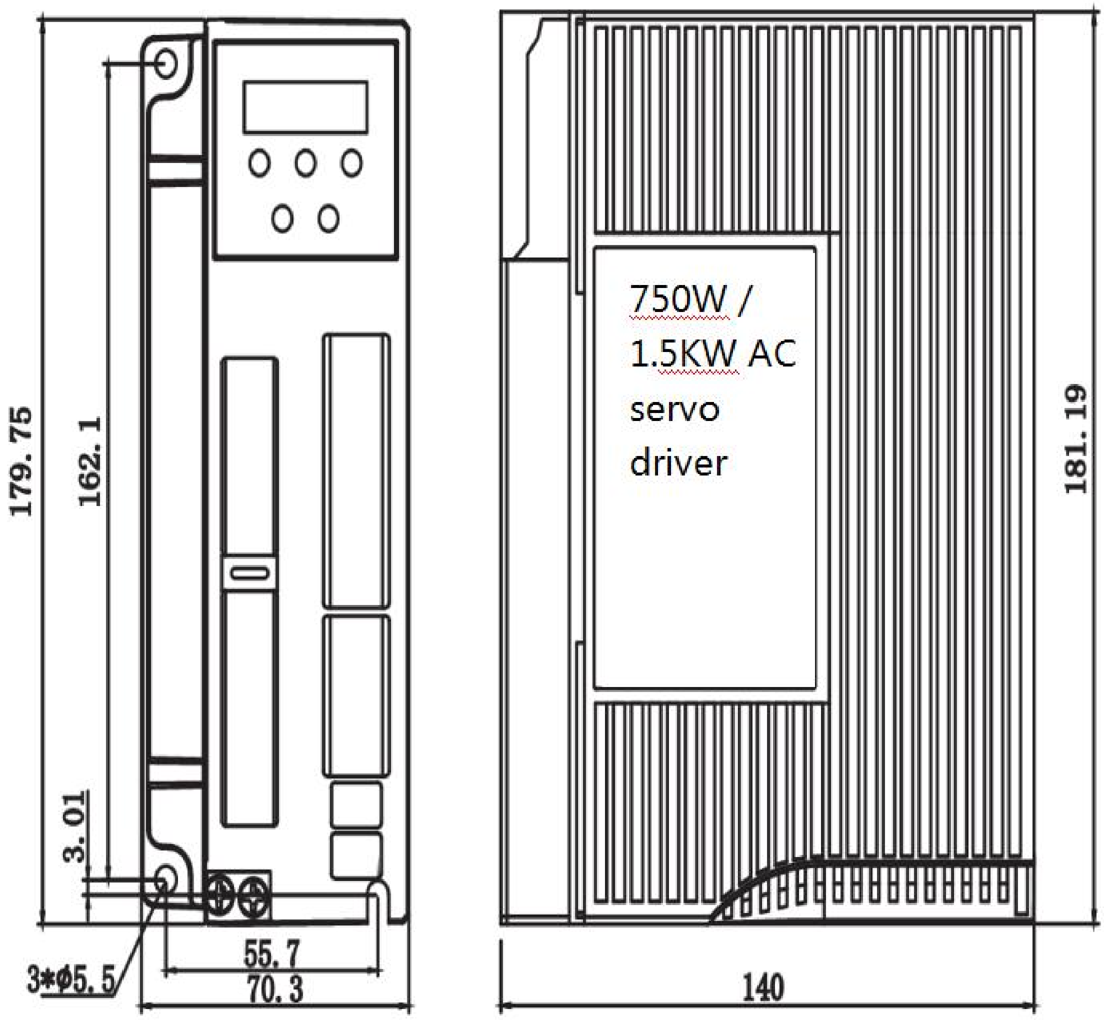


Fig.19AC servo driver with 2kW power (unit: mm)

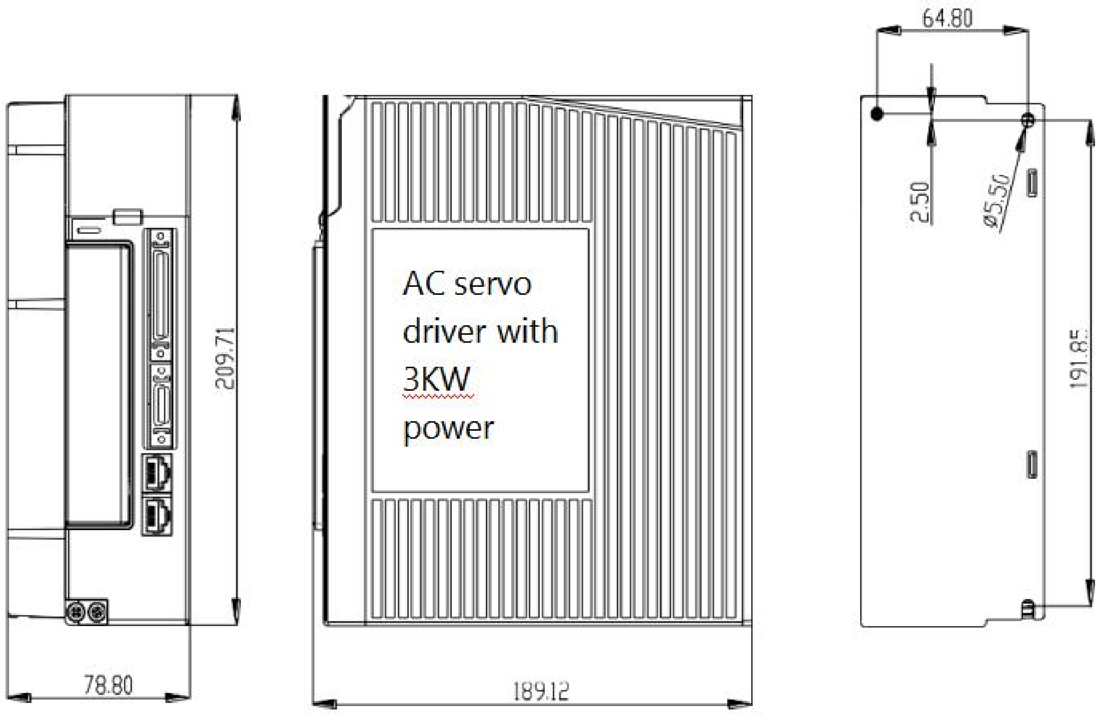


Fig.20AC servo driver with 3KW power (nuit: mm)

NOtice:

1. The Normal installation direction of the servo driver must be vertical, with the top facing upward to facilitate heat dissipation.

2. The device shall be well ventilated when the driver is installed, and the distance between multiple drivers shall NOt be less than 5CM when they are used side by side in the cabinet.

3. In order to ensure safe use, please make sure that the earthing protection terminal of the driver is well connected with the protective ground of the device!

4.2 Installation environment

The installation environment has a direct impact on the Normal operation and service life of the product, so the following conditions must be met:

1. Working environment temperature: 0 ~ 55℃;Working environment humidity: 10% ~ 90% (NO condensation).
2. Storage environment: -20℃ ~ +85℃;Humidity of storage environment: less than 90% (NO condensation).
3. Vibration: below 0.5G.
4. Prevent dripping rain or damp conditions.
5. Avoid exposure to the sun.
6. Prevent oil mist, salt erosion.

7. Prevent corrosive liquids, gas, etc.
8. Prevent dust, cotton wool and metal particles from invading.
9. Stay away from radioactive materials and combustible materials.
10. Space should be reserved around the location of the drivers in the cabinet for convenient loading, unloading and maintenance.
11. Pay attention to the air flow in the cabinet, if necessary, add an external fan to enhance the air flow, reduce the drive environment temperature to facilitate heat dissipation;The long-term operating temperature is below 55℃.
12. Try to avoid vibration sources nearby, and install shock-absorbing devices such as vibration absorbers or anti-vibration rubber gaskets.
13. If there is an electromagnetic interference source nearby, and the power supply and control line of the driver are interfered, resulting in the wrong operation, NOise filter can be added or various effective anti-interference measures can be adopted to ensure the Normal operation of the driver. (the NOise filter will increase the leakage current, so the isolation transformer should be installed at the input end of the driver power supply.)

5 Panel displays instructions andSettings

5.1The instructions of the panelfunctions

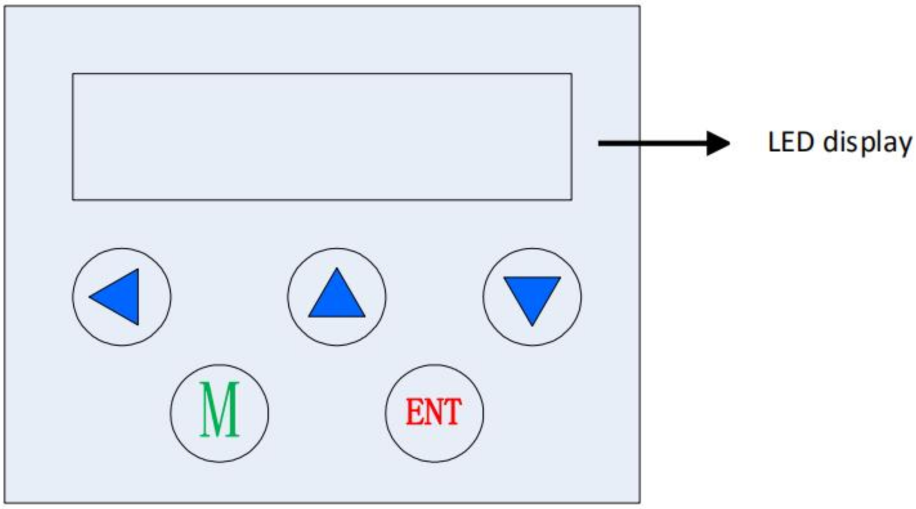
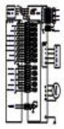


Figure 122 key panel

JASD series ac servo panel with six LED digital display state: 5 - bit key input command,Specific key functions are as follows:

:

Table. 4 Key Function

Panel key label	Definition	Explaination
	LEFT button	shift function Use to toggle high/low display in parameter mode
	UP button	Display changes, value added function
	DOWN button	Display changes, value reduction function
	M button	Function switch and undo exit
	ENT button	Identify or save functionality

NOtice:
ENT button Hold for 3 seconds to confirm or save the function
Under the monitoring and parameter interface, long press ENT button to flip quickly

5.2 Switching process of operation mode

JASD series ac servo has four function modes; state display mode, monitoring mode, parameter setting mode and auxiliary mode. The switching process between them is as follows:

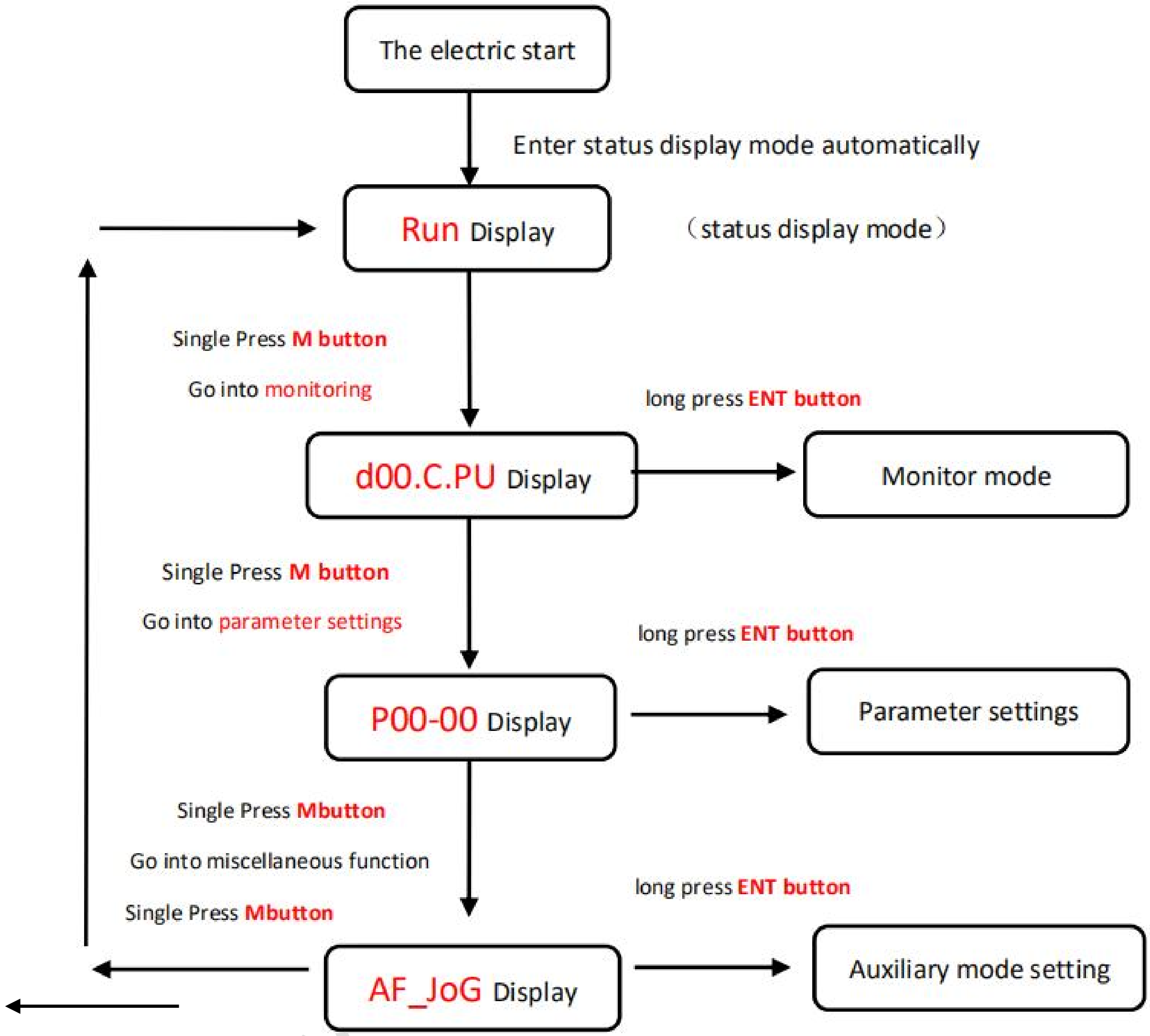


Figure 123 Switching process of operation mode

NOte: after pressing ENT to enter the state of mode setting, you can exit the mode selection by pressing M

5.3 Statusdisplay

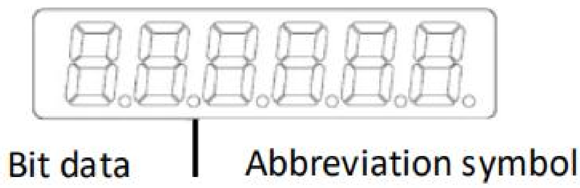


Fig. 21 Digital display

Table 5 Meaning of status display bit data

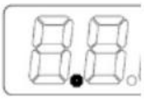
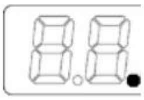
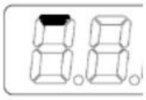
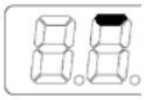
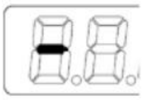
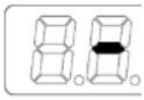
Display	Meaning	Display	Meaning
	Control circuit power on display		Main circuit power supply ready display
	Speed and torque control: consistent display of speed Position control: display after positioning		Rotate the check out display
	Base block display The light is ON at servo OFF state and OFF at ON state		Speed, torque control: speed command input Position control: instruction pulse input display

Table 84 Fig. 6 Meaning of abbreviation

Display	Meaning
nrdY	Servo NOt ready (power supply NOt on)
rdY	Servo ready (servo motor is NOt power on)
run	In servo enable state (servo motor is in power on)
Pot	Indicates that the input port of the **forward overpass signal** is in a valid state, and the forward turn instruction of the motor is invalid
not	Indicates that the input port of the **reverse overpass signal** is in a valid state, and the motor inversion instruction is invalid
FinSh	Related operation of servo completed correctly
SY_on	The servo is in the enabling state and canNOt be operated. It must be turned off the enable then work
no_oP	Invalid value is entered, the servo does NOt perform the current operation
LocKd	The relevant parameters of the servo are locked, it will NOt work before unlocked .
AL-501	Servo fault display. Please refer to chapter 9 for fault definition

5.4 Write and save method for parameter setting

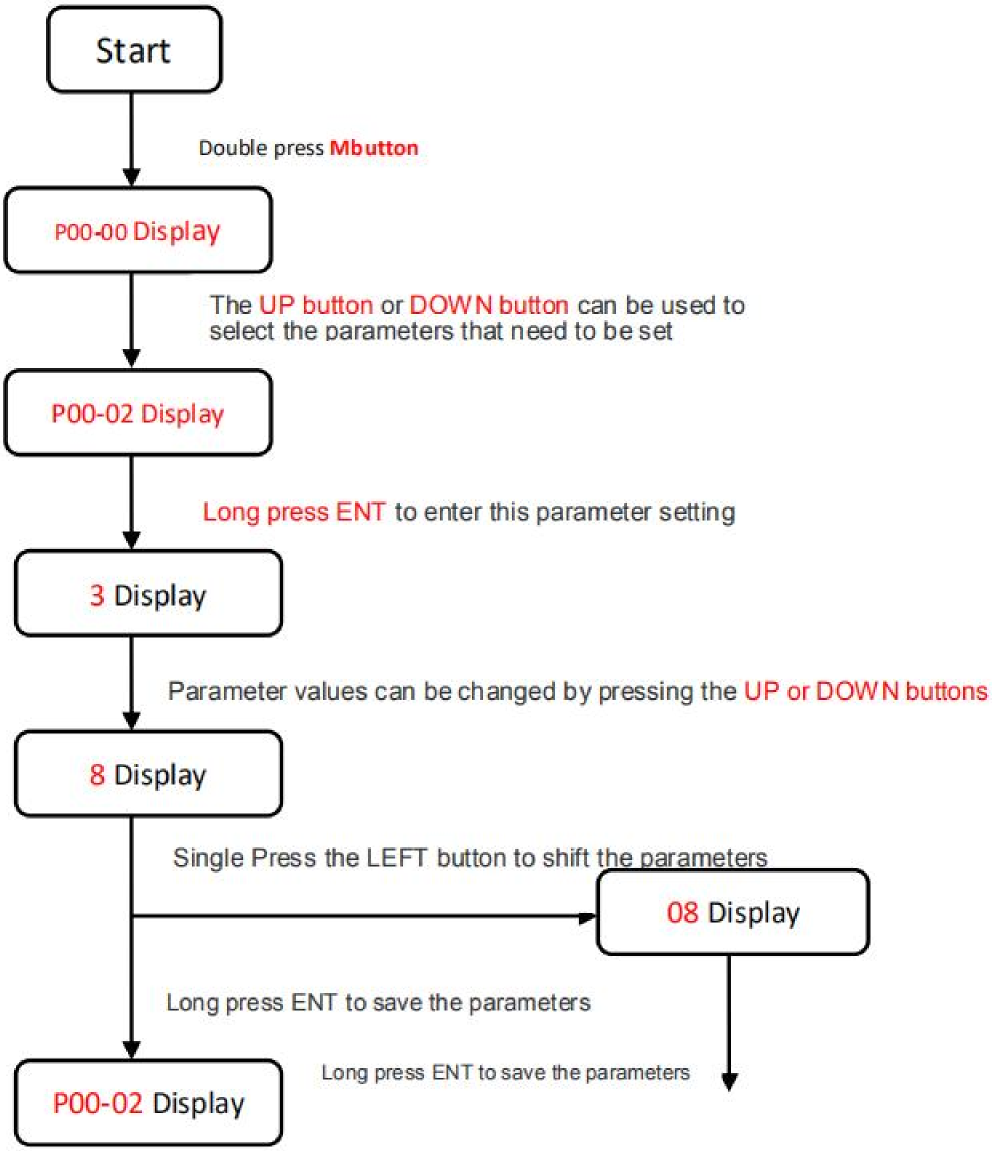


Fig. 22 writing and saving method of parameter setting

6 Control mode and setting

6.1 Position control

6.1.1 Position control wiring diagram

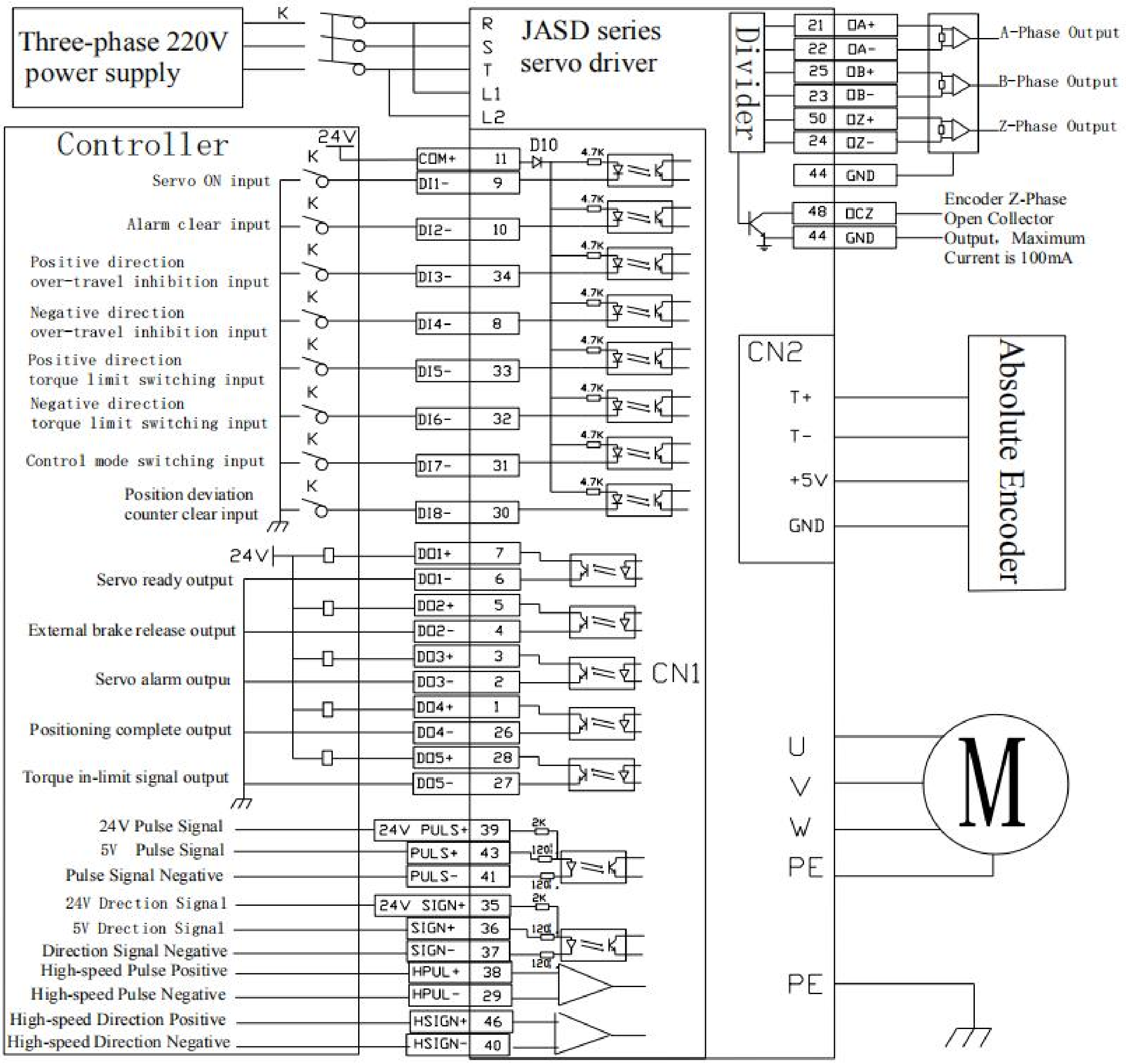
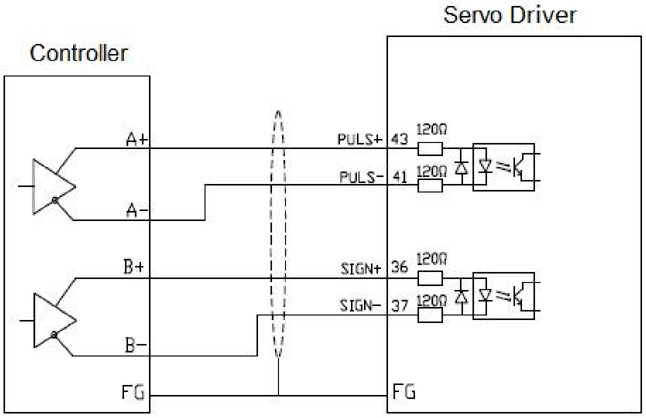


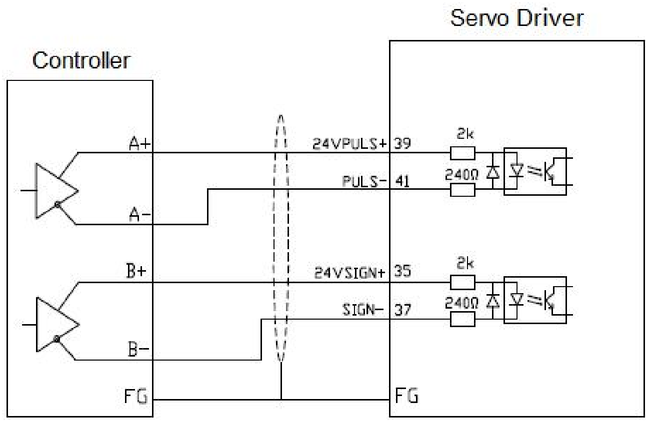
Fig. 23 Position control wiring diagram

6.1.2 Position control wiring diagram

Controller end Direction + pulse input mode : the direction + pulse input mode can be divided into 5V and 24V signal input modes. Twisted pair wire connection can improve the anti-interference capability. In general, this position control wiring method is often used in MCU controller system. The maximum input pulse frequency of this control is 500KHz

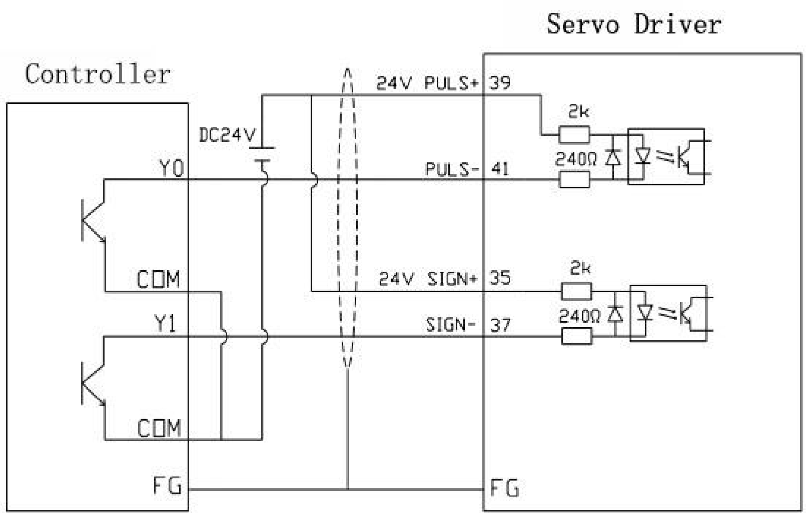


5V pulse + direction input mode

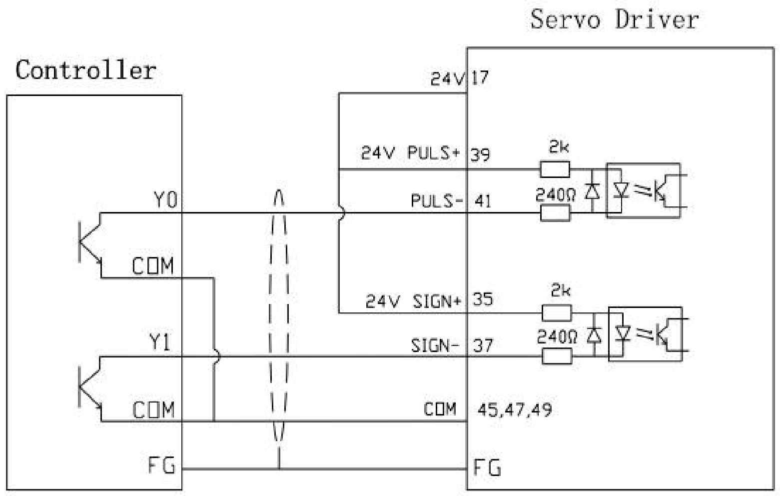


24V pulse + direction input mode

Controller - end collector open input mode description: single - end input mode can use either internal power supply or external power supply. But do NOt use dual power input to avoid damaging the drive. Generally PLC controller system USES this kind of position control wiring method



Open collector USES external power supply



Open collector USES internal power supply

NOte: high level must be between 3.3-5v when high speed pulse port is input

6.1.3 Description of position control mode parameters

Table 85 Description of parameters when in position control mode

Para code	Name	Range	Setting	Description
P01-01	Control Mode Setting	0-6	0	0: Position mode 1: Speed mode 2: Torque mode 3: Speed,torque 4: Position ,speed 5: Position,Torque 6: Full closed loop
P00-05	Motor pole pairs	1-31	---	The specific parameter setting depends on the motor
P0-07	Encoder selection	0-3	---	
P00-10	Line number of incremental encoder	0-65535	---	
P03-00	Source of Location Command	0-1	0	0: Pulse command 1: Number given
P03-01	Command pulse mode	0-3	1	0: Orthogonal pulse command 1: Direction + pulse command 2 or 3: Double pulse command

P03-02	input terminal of Command pulse	0-1	0	0: low speed pulse 1: High-speed pulse
P03-03	Command pulse inversion	0-1	0	Set the initial direction of motor rotation
P03-09	Number of command pulses for one rotation of the motor	0-65535	0	Set according to user needs For details, please refer to the explanation of **parameter analysis**
P03-10	The numerator of electronic gear 1	1-65535	1	Set according to user needs For details, please refer to the explanation of **parameter analysis**
P03-11	DeNOminator of electronic gear 1	1-65535	1	

NOte: For **gain parameters**, please adjust refer to "**Parameter Adjustment**" .

6.1.4 Example of electronic gear ratio calculation

1.Ball screw drive

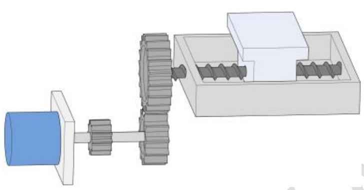


Fig. 24 Ball screw drive

Assumptions:

(1) Mechanical parameters: deceleration ratio R is 2/1, lead of lead screw is 10mm

(2) Resolution of each turn of position ring of absolute value encoder: 17bit=131072

(3) load displacement corresponding to 1 position instruction (instruction unit) : 0.001mm

Then:

According to (1) and (3), the position instruction (instruction unit) value required for the screw to rotate 1 turn (table movement 10mm) :

$$\frac{10}{0.001}=10000$$

The electronic gear ratio is :(B is the numerator, A is the deNOminator)

$$\frac{B}{A}=\frac{131072}{10000}\times\frac{2}{1}=\frac{16384}{625}$$

Finally, the parameter p03-10 is set to 16384, and p03-11 is set to 625

2.Belt pulley drive

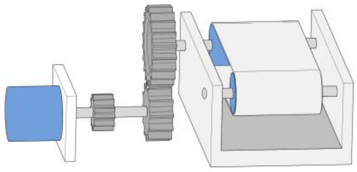


Fig. 25 Belt pulley drive

Assumptions:

(1) Mechanical parameters: deceleration ratio R: 5/1, pulley diameter: 0.2m(pulley circumference: 0.628m)

(2) Resolution of each turn of position ring of absolute value encoder: 17bit=131072

(3) Load displacement corresponding to 1 position instruction (instruction unit) : 0.000005m Then:

According to (1) and (3), the value of position instruction (instruction unit) required for the pulley (load) to rotate 1 turn can be obtained:

$$\frac{0.628}{0.000005}=125600$$

The electronic gear ratio is :(B is the numerator, A is the deNOminator)

$$\frac{B}{A}=\frac{131072}{125600}\times\frac{5}{1}=\frac{4096}{785}$$

Finally, P03-10 is set to 4096 and P03-11 is set to 785

1、Rotating load

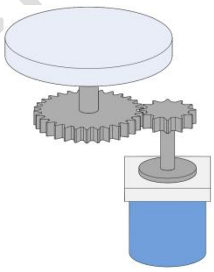


Fig. 26Rotatingload

Assumptions:

(1) mechanical parameters: the deceleration ratio R is 10/1, and the rotation Angle of the load axis for one turn is 360°

(2) resolution of each turn of position ring of absolute value encoder: 17bit=131072

(3) load displacement corresponding to 1 position instruction (instruction unit) : 0.01°

Then:

According to (1) and (3), the value of position instruction (instruction unit) required for 1 rotation of the load is:

$$\frac{360}{0.01}=36000$$

The electronic gear ratio is :(B is the numerator, A is the deNOminator)

$$\frac{B}{A}=\frac{131072}{36000}\times\frac{10}{1}=\frac{8192}{225}$$

Finally, the parameter P03-10 is set to 8192 and P03-11 to 225

6.2 Speedcontrol

6.2.1 Speed control wiring diagram

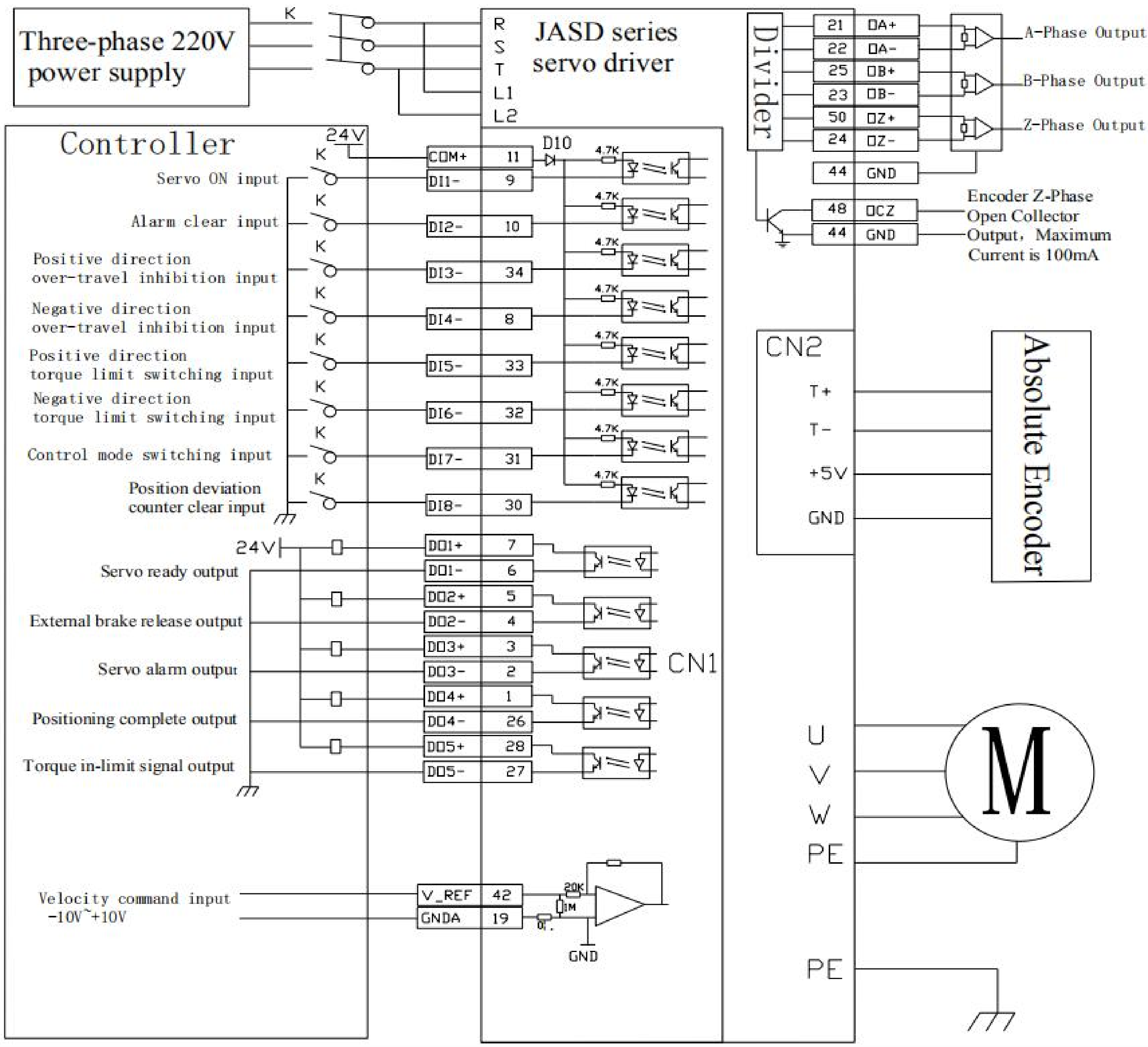


Fig. 27 Speed control wiring diagram

6.2.2 Parameter description of speed control mode

Table 7 Parameters description of speed control mode

Para code	Name	Setting range	setting	Description
P01-01	Setting the Control Mode	0-6	1	0: Position mode 1: Speed mode 2: Torque mode 3: Speed, torque 4: Position, speed 5: Position, torque 6: Full closed loop
P00-05	Pole pairs of motor	1-31	---	The specific parameter setting depends on the motor
P00-07	Encoder selection	0-3	---	
P00-10	Line number of incremental encoder	0-65535	---	
P04-00	Speed command source	0-3	0	0: External analog command 1: Digital command (parameter setting) 2: Digital command (communication) 3: Internal multiple sets of instructions
P04-01	Speed command analog inversion	0-1	0	Set the initial direction of motor rotation
P04-02	Given value of digital speed reference	-6000—6000	0	Set the rotating speed command value, IT is valid when P04-00 is 1 in speed mode
P04-06	Forward speed limit	0-6000		Limit forward speed
P04-07	Reverse speed limit	0-6000		Limit reverse speed
P06-40	Speed analog command input gain	10-2000		Set according to user needs, check the

				parameter analysis instructions for details

NOte: For **gain parameters**, please do the adjustment refer to "**Parameter Adjustment**"

6.3 Torquecontrol

6.3.1 Torque control wiring diagram

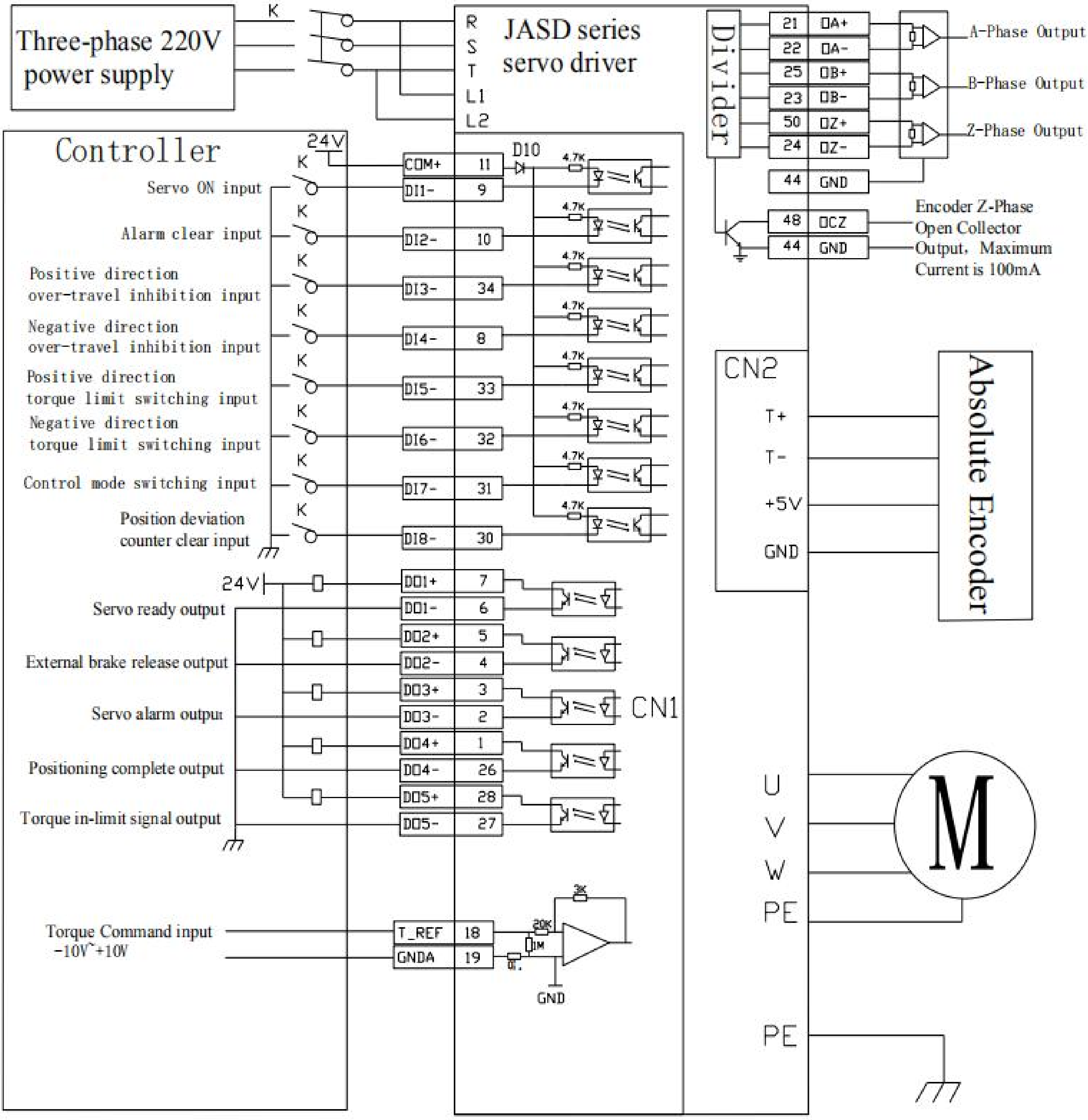


Fig. 28 Torque control wiring diagram

6.3.2 Parameters description in torque control mode

Table 87 Parameters description in torque control mode

<table>
<tr><th>Para code</th><th>Name</th><th>Setting range</th><th>set</th><th>Description</th></tr>
<tr><td>P01-01</td><td>Setting the control Mode</td><td>0-6</td><td>2</td><td>0: Position mode
1: Speed mode
2: Torque mode
3: Speed, torque
4: Position, speed
5: Position, torque
6: full closed loop</td></tr>
<tr><td>P00-05</td><td>Pole pairs of motor</td><td>1-31</td><td>---</td><td rowspan="3">The specific parameter setting depends on the motor</td></tr>
<tr><td>P00-07</td><td>Encoder selection</td><td>0-3</td><td>---</td></tr>
<tr><td>P00-10</td><td>Line number of incremental encoder</td><td>0-65535</td><td>---</td></tr>
<tr><td>P05-00</td><td>Source of torque command</td><td>0-3</td><td>0</td><td>0: External analog command (speed limit value is set by P05-02)
1: Digital command (speed limit value is set by P05-02)
2: External simulation command (speed limit value is determined by speed simulation command)
3: Digital command (speed limit value is determined by speed analog command)</td></tr>
<tr><td>P05-01</td><td>Torque command analog inversion</td><td>0-1</td><td>0</td><td>Set the initial direction of motor rotation</td></tr>
<tr><td>P05-02</td><td>Torque mode speed limit setting value</td><td>0-6000</td><td>1000</td><td>The maximum speed of the motor in setting torque mode. P05-00 is valid when it is 0 and 1</td></tr>
<tr><td>P05-05</td><td>Torque limit setting source</td><td>0-1</td><td>0</td><td>Source for adjusting torque limit</td></tr>
<tr><td>P05-10</td><td>Limit value of internal positive</td><td>0-300.0</td><td>200.0</td><td>Limit forward torque value</td></tr>
</table>

	torque			
P05-11	Limit value of internal reverse torque	0-300.0	200.0	Limit reverse torque value
P06-43	Input gain of speed analog command	0-100	10	Set according to user needs. For details, please refer to the explanation of parameter analysis

7 Trial operation and parameter adjustment

7.1 Trial operation

7.1.1 Pre operation detection

In order to avoid damage to the servo driver or mechanism, please remove all the load of the servo motor before operation, and check carefully whether the following precautions are Normal, and then power on for NO-load test; After the NO-load test is Normal, the load of the servo motor can be connected for the next test.

Table 8 Precautions

Test before power on	1. Check whether the servo drive has obvious appearance damage 2. The connecting part of distribution terminal shall be insulated 3. Check whether there is any thing inside the drive 4. Servo drivers, motors and external regenerative resistors shall NOt be placed on combustible objects 5. In order to avoid the failure of the electromagnetic brake, please check whether the circuit can be stopped immediately and cut off 6. Confirm whether the external power supply voltage of the servo driver meets the requirements 7. Confirm whether the U, V and W power lines, encoder lines and signal lines are connected correctly (confirm according to motor labels and instructions)
Power on detection	1. When the servo driver is powered on, do you hear the sound of relay action 2. Whether the servo driver power indicator and LED display are Normal 3. Confirm whether the parameters are set correctly or NOt. Unexpected actions may occur depending on the mechanical characteristics, do NOt make

	extreme adjustments to the parameters 4. Whether the servo motor is self-locking or NOt . 5.Please contact the manufacturer if the servo motor has vibration and too much sound during operation

7.1.2 NO-load test

NO-load test in JoG mode , the user don't need to connect additional cables, for the sake of safety, please fix the motor base before the test, in order to avoid the danger from the reaction force as speed change of motor.

The simple wiring diagram in JoG mode is shown as below :

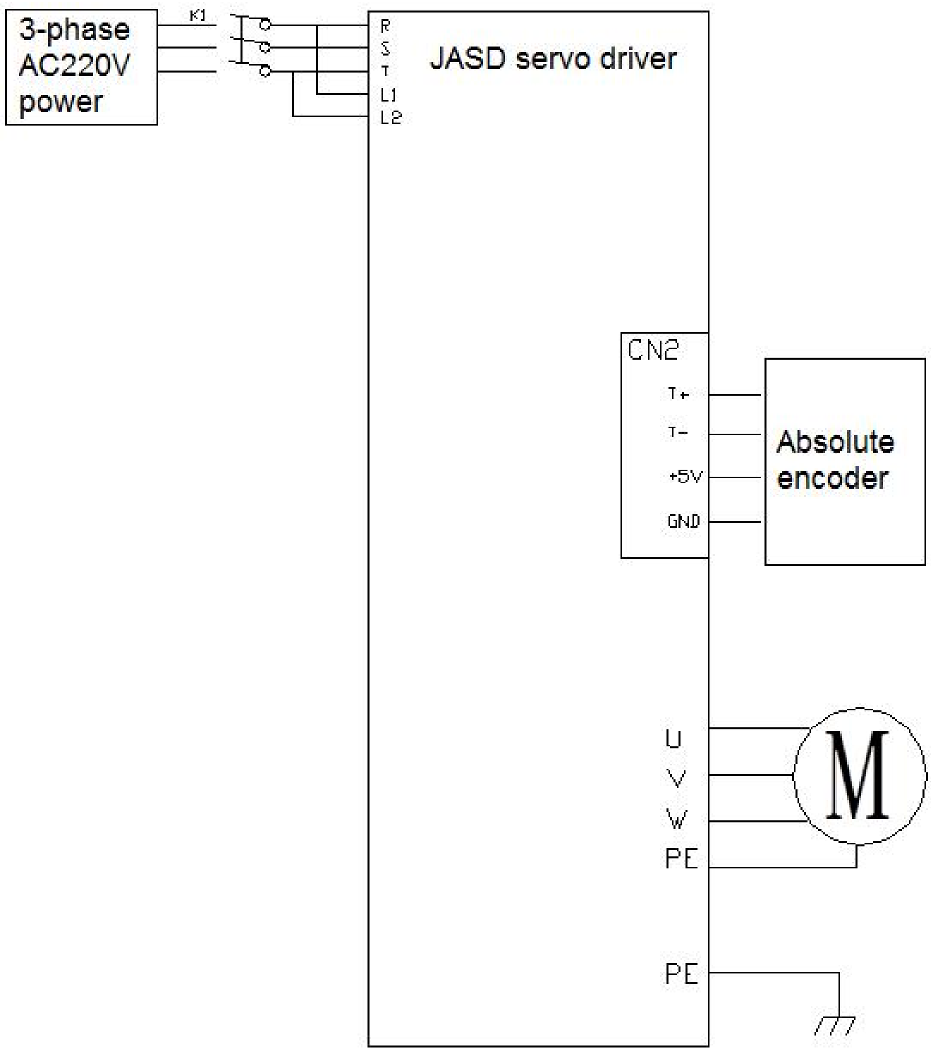


Fig. 29 Wiring diagram in JoG mode

Do the trail test of JoG mode according to the following flowchart

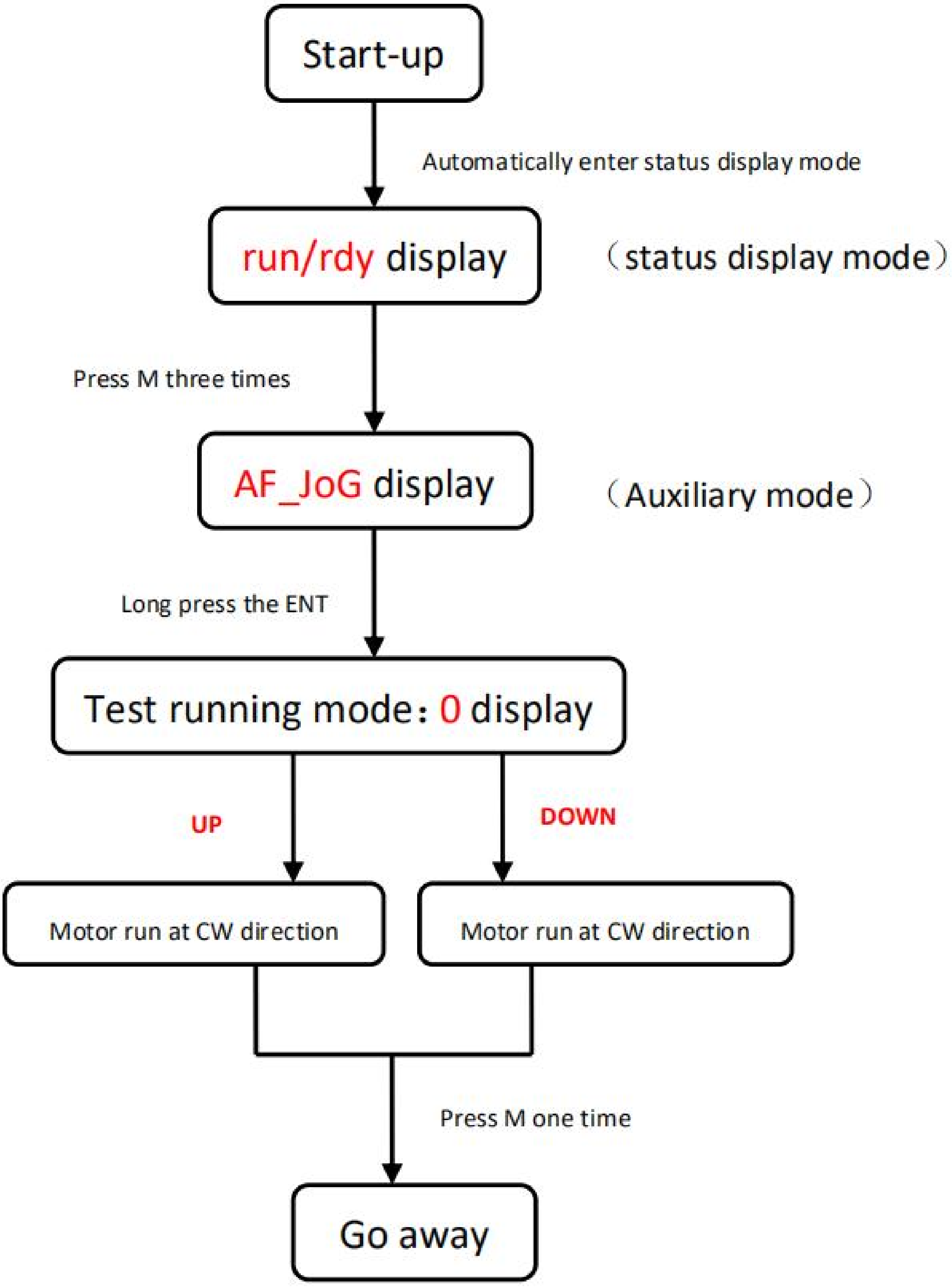


Fig. 133 Flow chart of JoG mode

7.2 Parameter adjustment

After selecting the appropriate control mode according to the equipment requirements, you need to do reasonable adjustments to gain parameters of servo, to make servo driver can drive the motor quickly and accurately to maximize the mechanical performance.

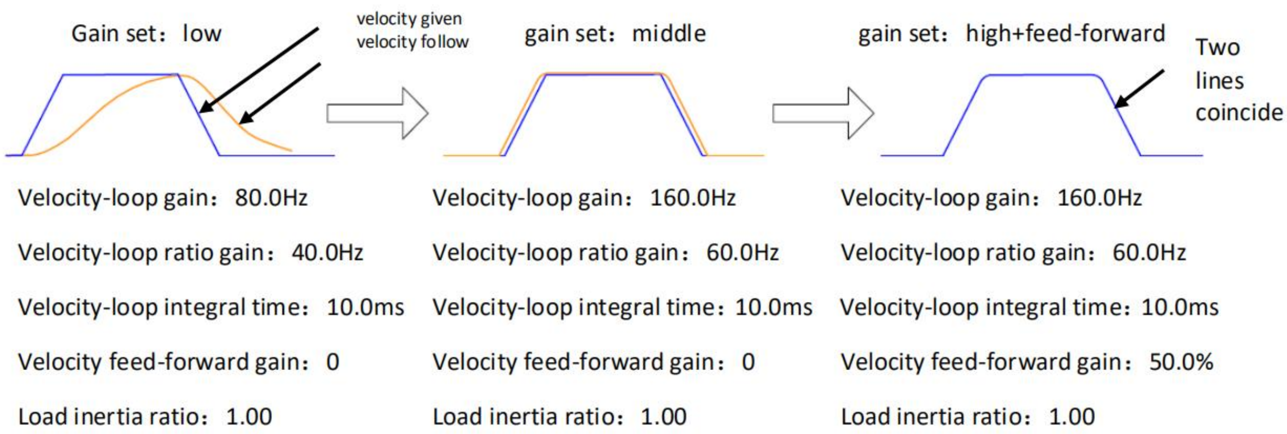


FIG. 134 Curves of different gains

The servo gain is adjusted by multiple loop parameters (position loop, velocity loop, filter & etc.), and they will affect each other. Therefore, the setting of the gain needs to be balance adjusted according to certain rules.

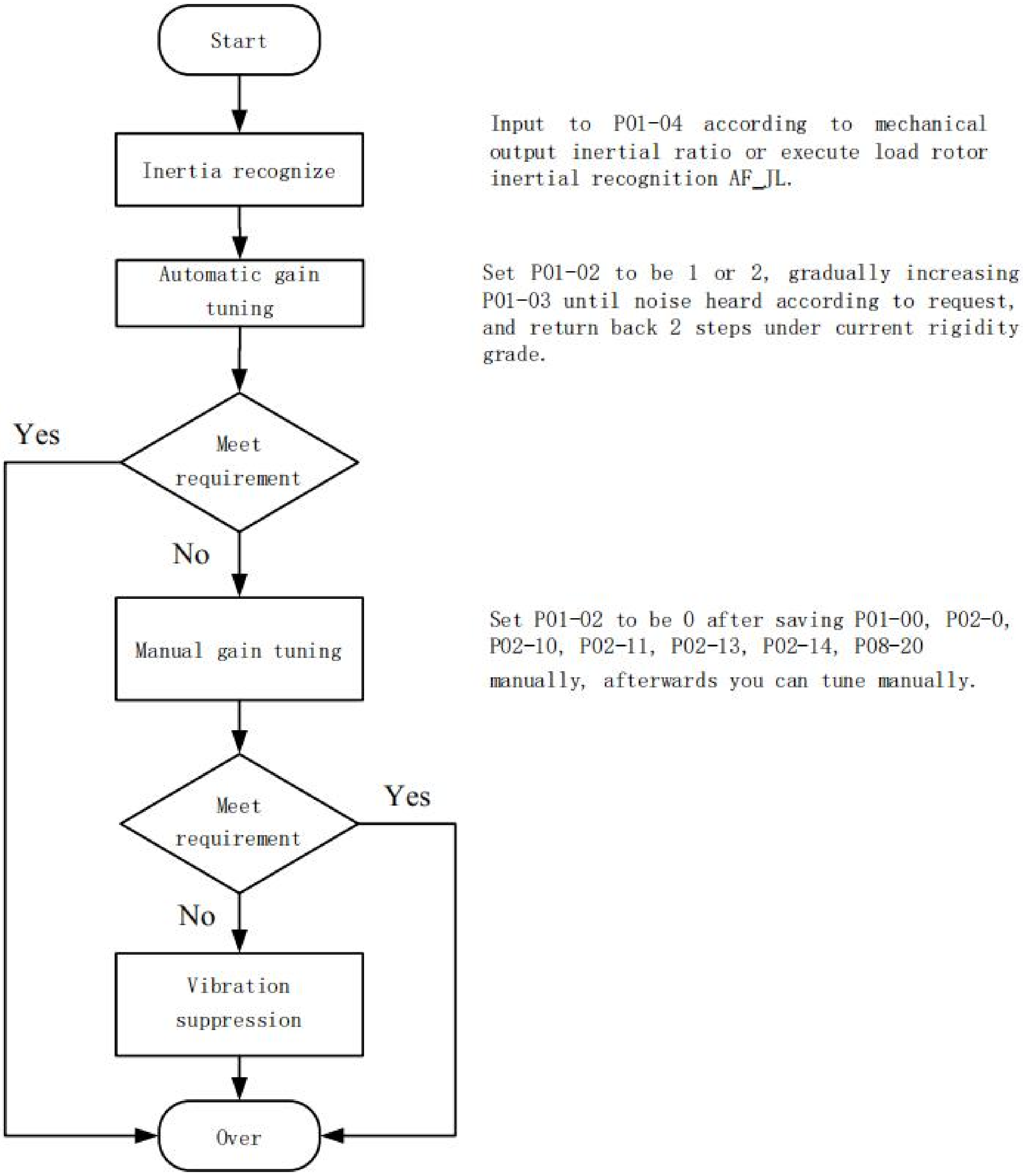


FIG. 135 Gain adjustment flow chart

7.3 Gain tuning manually

7.3.1 Basic parameter

When the automatic gain adjustment fails to achieve the desired 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:

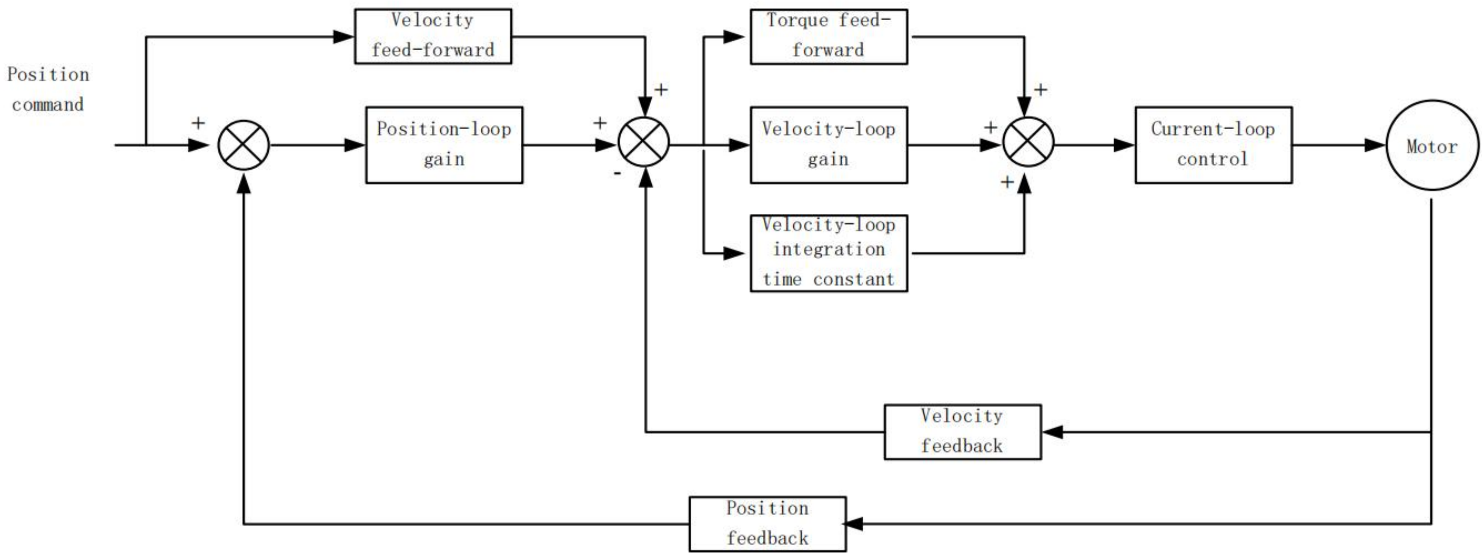


FIG. 136 Control block diagram of servo system

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

Speed loop gain: Increase the setting value as much as possible in case of NO vibration and NO NOise, which can improve the speed following performance and speed up the positioning time.

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

Table 9 Basic gain parameters

parameter code	Name	setting range	setting	Introduction
P01-02	Real-time automatic tuning mode	0-2	2	0: Adjust the rigidity manually. 1: Adjusts rigidity automatically in standard mode. In this mode, the parameters P02-00, P02-01, P02-10, P02-11, P02-13, P02-14, P08-20 will be automatically set according to the rigidity level set by P01-03, it will NOt work if by manual. The following parameters are set by the user: P02-03 (speed feedforward gain), P02-04 (speed feedforward smoothing constant). 2: Adjusts the rigidity automatically in position mode. in this mode, the parameters P02-00, P02-01, P02-10,

				P02-11, P02-13, P02-14, P08-20 will be automatically set according to the rigidity level set by P01-03, it will NOt work if by manual . The following parameters will be fixed values and canNOt be changed: P02-03 (Speed feedforward gain): 30.0% P02-04 (Speed feedforward smoothing constant): 0.50
P01-03	Adjustment of rigidity settings automatic in real time	0-31	13	Built-in 32 kinds of gain parameters, it works when P01-02 is set to 1, or 2. It can be directly called according to the actual situation. The larger the setting 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 smaller the position lag, but if the value is too large, the system will oscillate and overshoot. ▸ Increase the value as much as possible without vibration. ▸ 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 smaller the position lag, but if the value is too large, the system will oscillate and overshoot. ▸ Increase the value as much as possible without vibration. ▸ 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. However, if the feedforward gain is too large, the position loop of the system will be unstable, and it is easy to lead to overshoot and oscillation.
P02-04	Speed feedforward	0-64.00	0	This parameter is used to set the time constant of the speed loop feedforward

	smoothing constant			filter. The larger the value, the greater the filtering effect, but at the same time the phase lag increases.
P02-10	Speed proportional gain	1-2000.0	40.0	▸ The larger the setting value, the greater the gain and rigidity. The parameter value is set according to the motor and load. ▸ Increase the value as much as possible without vibration. ▸ Gain at rest
P02-11	Speed integral constant	0.1-1000.0	10.0	▸ The integration time constant of the speed regulator. The smaller the setting value, the faster the integration speed and the greater the rigidity. If it is too small, vibration and NOise may be generated. ▸ Try to reduce the value of this parameter if the system doesn't oscillate ▸ It responses to steady.
P02-12	Pseudo-differential feedforward control coefficient	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 speed loop integral effect is obvious, which can filter low-frequency interference, but the dynamic response is slow. ▸ By adjusting this coefficient, the speed loop can have a better dynamic response, and at the same time, it can increase 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. ▸ Increase the value as much as possible without vibration. ▸ Gain during exercise.

P02-14	Speed integral constant	0.1-1000.0	1000.0	▸ The integration time constant of the speed regulator. The smaller the setting value, the faster the integration speed and the greater the rigidity. If it is too small, vibration and NOise may be generated. ▸ Under the condition that the system does NOt oscillate, try to reduce the value of this parameter. ▸ It responses to steady
P02-15	Pseudo-differential feedforward control coefficient	0-100.0	100.0	▸ When set to 100.0%, the speed loop control in PI , 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. ▸ the speed loop can have a better dynamic response by adjusting this coefficient, and it also can increase the resistance to low-frequency interference .

7.3.2 Gain switching

The gain switching function can be triggered by the internal state of the servo or the external DI port. It is only effective in the position control and speed control modes. With gain switching, the following effects can be achieved

Switch to lower gain when the motor is static (servo enabled) to hold vibration

Switch to higher gain when the motor is static (servo enabled) to short positioning time

Switch to higher gain in the running state of the motor to obtain better command following performance;

Switch to different gain settings by external signals according to the use situation

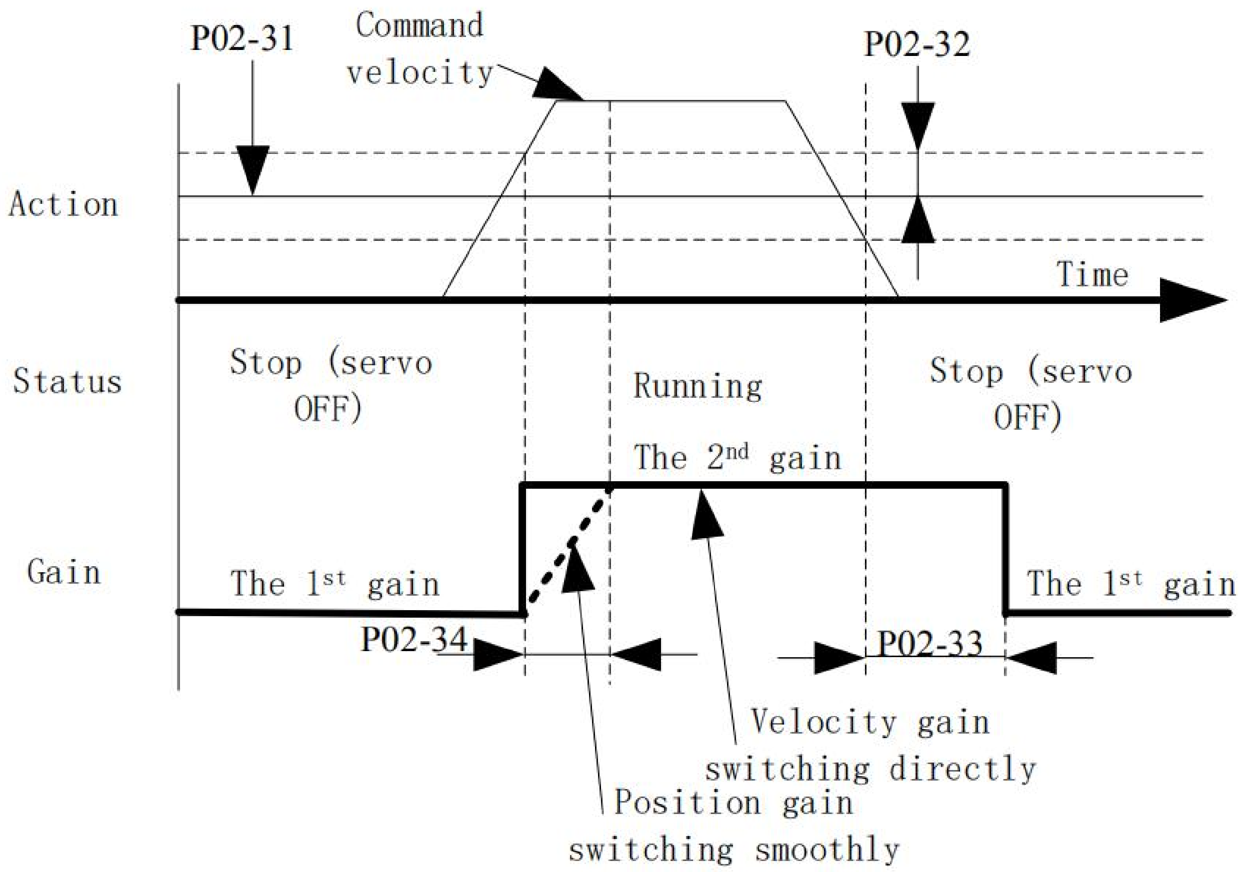


Figure 137 Gain switch

Table 10 Parameters about gain swift

Para code	Name	Set range	Default	Unit	Effective time
P02-30	Gain switching mode	0-10	7	---	Real time
P02-31	Gain switching grade	0-20000	800	---	Real time
P02-32	Gain switching lag	0-20000	100	---	Real time
P02-33	gain switching delay	0-1000.0	10.0	1ms	Real time
P02-34	Position gain switching time	0-1000.0	10.0	1ms	Effective at once

7.3.3 Feed-forward function

Speed feed-forward: During in position control, the speed control command required from the position command calculation is added to the output of the position regulator, which can reduce the position deviation to improve the response of the position control.

Torque feed-forward: Calculate the required torque command from the speed control command and add it to the speed regulator output to improve the response of the speed control.

1、 Operation of speed feed forward

With the speed feed-forward smoothing constant set to be 50 (0.5ms), Increasing the speed feed-forward gain gradually to meet the system requirements. However, too large speed feed-forward gain will cause position overshoot which will make the setting time longer.

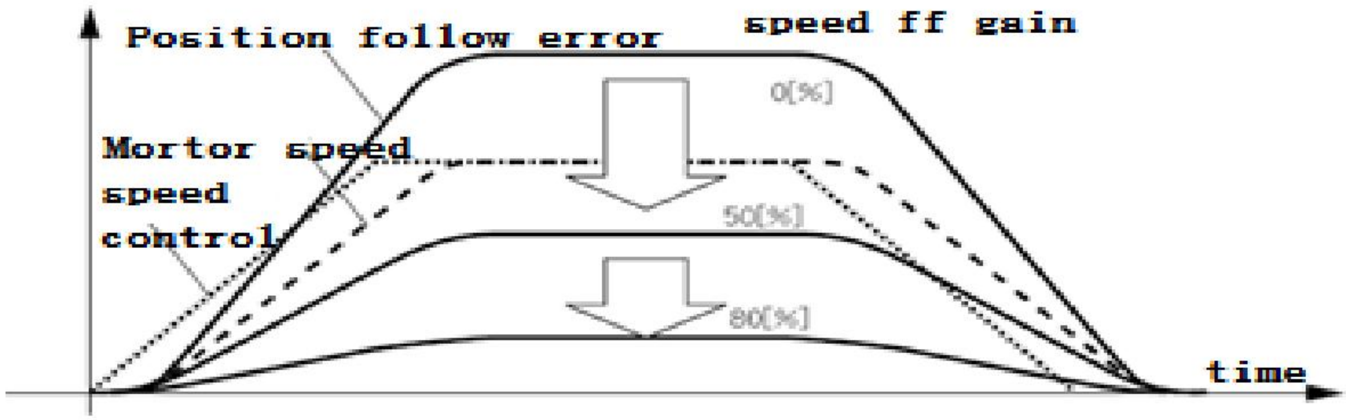


Fig.138 Speed feedforward function

2 Torque feed-forward operation

With the torque feed-forward smoothing constant set to be 50 (0.5ms).increasing the speed feed-forward gain gradually to meet the system requirements.

Table 91 Feedforward function related parameters

Para code	Name	Range	Default	Unit	Effective time
P02-03	Speed feed-forward gain	0-100.0	30.0	1.0%	Real time
P02-04	Speed feed-forward smooth constant	0-64.00	0.5	1ms	Real time
P02-19	Torque feed-forward gain	0-30000	0	1.0%	Real time
P02-20	torque feed-forward smooth constant	0-64.00	0.8	1ms	Real time

7.3.4 Disturbance observer

The disturbance torque value can be inferred by using the disturbance observer and compensated on the torque command to reduce the influence of disturbance torque and vibration. This observation function is valid in position mode and velocity mode.

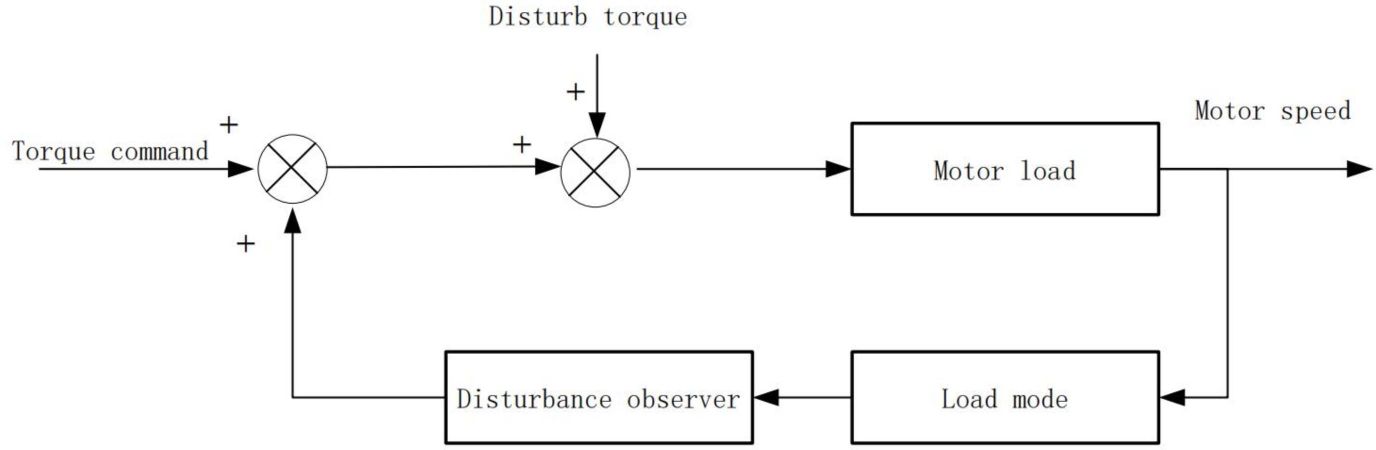


Fig. 139 Disturbance observer

Using instruction:

1. Set P08-26 (filter constant) to a larger value, and then increase P08-25 (compensation gain)gradually. At this time, the action sound may become louder; decrease P08-26 after confirming that the current compensation gain is effective,
2. It will improve the effect of disturbance torque suppression if increasing the gain gradually, but the NOise becomes
3. After shortening the filter time constant, the disturbance torque with less delay can be estimated, and the effect of suppressing the influence of disturbance can be improved, but the NOise will become louder.
4. Please look for a well-balanced setting.

Table. 11 Perturbation observer related parameters

Para code	Name	Range	Default	Unit	Effective time
P08-25	Disturbance torque compensation gain	0-100.0	0	%	Real time
P08-26	Disturbance torque filtering time constant	0-25.00	0.8	1ms	Real time

7.3.5 Resonance suppression

If the servo system is too rigid and responds too fast, it may cause resonance in the mechanical system.It can be improved by reducing the gain of the control loop. Without reducing the gain, resonance suppression can also be achieved by using a low-pass filter and a Notch filter

1、Resonance frequency detection

The resonance frequency of the mechanical system can be observed through the monitoring item d26.1.Fr

2、Torque command low-pass filter (P08-20)

The low-pass filter is used in the case when the vibration frequency is deviated, and it can have a good performance when used at high frequencies. By setting the filter time constant, it will attenuate resonance near the resonance frequency. However, the low-pass filter will make the system phase lag, reduce the bandwidth, and reduce the phase margin easily cause loop oscillation. Therefore, it can only be applied to high frequency vibration applications.

Filter deadline frequency (Hz) = 1/(2*pi*p08-20(ms)*0.001)

Table. 93 Torque command filter constant

Para code	Name	Rang	Default	Unit	Effective time
P08-20	Torque command filter constant	0-25.00	0.8	1ms	Real time

3、Notch filter

The Notch filter is used when the system resonance frequency is fixed. The trap can reduce the mechanical resonance by reducing the gain at a specific frequency. After the trap is set correctly, the vibration can be effectively suppressed. You can try to increase the servo gain. There are 4 built-in traps in the servo. When P08-11 is set to 0, 4 sets of traps can be started at the same time, and parameters can be entered manually.

A. Self-adaptive Notch mode

Through the self-adaptive Notch filter function module, the servo system will automatically identify the current resonance frequency and automatically configure the Notch parameters. Using instruction as following:

1. Set P08-11 to 1 or 2 according to the number of resonance points. When resonance occurs, you can first set P08-11 to 1 and turn on an adaptive trap. After gain adjustment, if new resonance occurs, then set P08-11 to 2 to turn on 2 adaptive traps Device.

2. When the servo is running, the third and fourth sets of trap parameters will be automatically updated, and the corresponding function code will be automatically stored every 30 minutes. After the storage, the trap parameters will also be retained after power

off.

3. If the resonance is suppressed, it indicates that the adaptive Notch has achieved its effect. After waiting for a period of stable operation of the servo, set P08-11 to 0, and the Notch parameters will be fixed to the last updated value. This operation can prevent the malfunction of the servo operation, which causes the trap parameters to be updated to the wrong value, but intensifies the vibration. If the vibration canNOt be eliminated for a long time, please turn off the servo enable in time.

4. If the vibration canNOt be eliminated for a long time, please turn off the servo enable in time.

If there are more than two resonance frequency points, the adaptive Notch filter canNOt meet the demand, and the manual Notch filter can be used at the same time.

Table 94 Adaptive Notch filter mode selection

Para code	Name	Introduction
P08-11	Adaptive Notch filter	Setting range: 0-4 0: The third and fourth Notch parameters are NO longer automatically updated and saved as current values. But allow manual input 1: One adaptive Notch filter is effective, the third Notch filter parameters are automatically updated, and canNOt be entered manually 2: 2 adaptive Notches are effective, the third and fourth Notch parameters are automatically updated, and canNOt be entered manually 3: Only detect resonance frequency 4: Clear the third and fourth Notch parameters and restore to factory settings

B. Set the trap parameters manually

1. The resonance frequency of the mechanical system can be observed by monitoring items d26.1.Fr, d28.2.Fr.

2. Enter the resonance frequency observed in the previous step into the Notch parameters, and enter the width level and depth level of the group of Notches at the same time.

3. If the vibration is suppressed, it means that the wave trap is working. You can continue to increase the gain and repeat the previous 2 steps when new vibrations appear.

4. If the vibration canNOt be eliminated for a long time, please turn off the servo enable in time.

C. Notch width class

$$\text{Notch Width Grade} = \frac{\text{Notch width}}{\text{Notch central frequency}}$$

The width of the Notch means the frequency bandwidth with an amplitude attenuation rate of -3dB relative to the center frequency of the Notch

D. D.Depth class of trap

$$\text{Notch Depth Grade} = \frac{\text{Output}}{\text{Input}}$$

When the depth level of the Notch is 0, the input is completely suppressed at the center frequency; when the depth level is 100, the input can be completely passed at the center frequency.

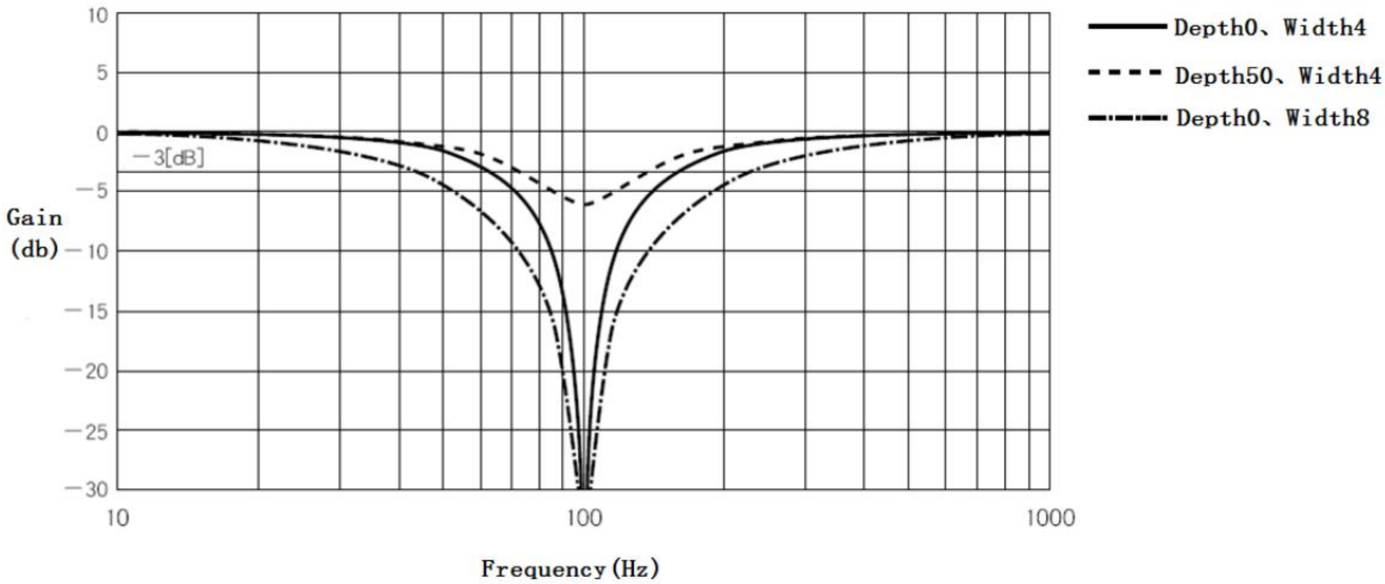


FIG. 140 Frequency characteristics of Notch filter

Table 95:The relevant parameters of the Notch filter are shown in the table below:

Para code	Name	Introduction
P08-30	Notch filter1 frequency	Setting range: 50-5000, unit: Hz Center frequency of Notch 1 When set to 5000, the trap is invalid

P08-31	Notch filter1 Width	Setting range: 0-20 Notch width level of Notch 1 Is the ratio of width to center frequency 设
P08-32	Notch filter1 Depth	Setting range: 0-99 Notch depth level of Notch 1 The ratio relationship between input and output for the center frequency of the Notch filter The larger this parameter, the smaller the depth of the Notch, the weaker the effect

The relevant parameters of the Notch filter are shown in the following table:

Table 96 The relevant parameters of the Notch filter

Para code	Name	Range	Default	Unit	Effective time
P08-11	Self-adaptive Notch mode selection	0-4	0	---	Real time
P08-30	Notch filter 1 frequency	50-5000	5000	HZ	Real time
P08-31	Notch filter 1 width	0-20	2	---	Real time
P08-32	Notch filter 1 depth	0-99	0	---	Real time
P08-33	Notch filter 2 frequency	50-5000	5000	HZ	Real time
P08-34	Notch filter 2 width	0-20	2	---	Real time
P08-35	Notch filter 2 depth	0-99	0	---	Real time
P08-36	Notch filter 3 frequency	50-5000	5000	HZ	Real time
P08-37	Notch filter 3 width	0-20	2	---	Real time
P08-38	Notch filter 3 depth	0-99	0	---	Real time
P08-39	Notch filter 4 frequency	50-5000	5000	HZ	Real time
P08-40	Notch filter 4 width	0-20	2	---	Real time
P08-41	Notch filter 4 depth	0-99	0	---	Real time

8 Parameter and Function

8.1 Parameter list

P00-xx Motor and drive parameters

P01-xx Main control parameter
P02-xx Gain parameters
P03-xx Position parameters
P04-xx Velocity parameters
P05-xx Torque parameters
P06-xx I/O parameters
P08-xx Super function parameters

Table 12 Parameter list

Type	Para code	Name	Range	Default setting	unit	Setting way	Effective time
Motor and Driver parameter	P00-00	Motor number	0-65535	2000		Stop & Reset	Re-power on
	P00-01	Motor rated speed	1-6000	---	rpm	Stop & Reset	Re-power on
	P00-02	Motor rated torque	0.01-655.35	---	N.M	Stop & Reset	Re-power on
	P00-03	Motor rated current	0.01-655.35	---	A	Stop & Reset	Re-power on
	P00-04	Motor inertia	0.01-655.35	---	$kg.cm^2$	Stop & Reset	Re-power on
	P00-05	Motor pole pairs	1-31	---	Polar logarithm	Stop & Reset	Re-power on
	P00-07	encoder selection	0-3	---	---	Stop & Reset	Re-power on
	P00-08	Line-saving incremental encoder	0-1	---	---	Stop & Reset	Re-power on
	P00-09	Absolute encoder type	0-1	---	---	Stop & Reset	Re-power on
	P00-10	Incremental encoder lines	0-65535	---		Stop & Reset	Re-power on
	P00-11	Incremental encoder Z pulse electrical angle	0-65535	---		Stop & Reset	Re-power on
	P00-12	Rotor initial angle 1	0-360	---	1°	Stop & Reset	Re-power on

	P00-13	Rotor initial angle 2	0-360	---	1°	Stop & Reset	Re-power on
	P00-14	Rotor initial angle 3	0-360	---	1°	Stop & Reset	Re-power on
	P00-15	Rotor initial angle 4	0-360	---	1°	Stop & Reset	Re-power on
	P00-16	Rotor initial angle 5	0-360	---	1°	Stop & Reset	Re-power on
	P00-17	Rotor initial angle 6	0-360	---	1°	Stop & Reset	Re-power on
	P00-20	Display settings on power-on interface	0-100	100	---	Running & setting	Re-power on
	P00-21	Communication baud rate RS232	0-3	0	---	Stop & reset	Re-power on
	P00-23	Slave address	0-255	1	---	Stop & reset	Re-power on
	P00-25	check way	0-3	1	---	Stop & reset	Re-power on
	P00-30	brake resistor setting	0-2	---	---	Stop & reset	Re-power on
	P00-31	extra brake resistor power	0-65535	---	10W	Running & setting	Real time
	P00-32	Extra brake resistor value	0-1000	---	1Ω	Stop & reset	Re-power on
	P00-40	Over-heating protection	0-1	1	---	Stop & reset	Re-power on
	P00-41	power off protection	0-1	1	---	Stop & reset	Re-power on
Main control parame	P01-01	control mode setting	0-6	0	---	Stop & reset	Real time
	P01-02	Automatically	0-2	2	---	Running	Real time

ter		tuning mode in real time				& setting	
	P01-03	automatically tuning rigidity in real time	0-31	13	---	Running & setting	Real time
	P01-04	rotor inertial ratio	0-100.00	1	1 time	Running & setting	Real time
	P01-10	control mode after over travel	0-1	1	---	Running & setting	Real time
	P01-20	Dynamic brake delay	0-250	50	1ms	Running & setting	Real time
	P01-21	disable dynamic brake when power off	0-1	1	---	Running & setting	Real time
	P01-22	disable dynamic brake when servo OFF	0-1	1	---	Running & setting	Real time
	P01-23	disable dynamic brake when alarming	0-1	1	---	Running & setting	Real time
	P01-24	Disable dynamic brake when over travel	0-1	1	---	Running & setting	Real time
	P01-30	brake command - servo OFF delay (brake ON delay)	0-255	50	1ms	Running & Setting	Real time
	P01-31	brake output speed limitation	0-3000	100	1rpm	Running & setting	Real time
	P01-32	servo OFF brake command waiting time	0-255	50	1ms	Running & setting	Real time
	P01-40	out of control check ENA	0-1	1	---	Running &	Real time

						setting	
Gain paremeter	P02-00	position control gain 1	0-3000.0	48.0	1/S	Running & setting	Real time
	P02-01	position control gain 2	0-3000.0	57.0	1/S	Running & setting	Real time
	P02-03	speed feed-forward gain	0-100.0	30.0	1.0%	Running & setting	Real time
	P02-04	Speed feed-forward smooth constant	0-64.00	0.5	1ms	Running & setting	Real time
	P02-10	speed ratio gain 1	1.0-2000.0	27.0	1Hz	Running & setting	Real time
	P02-11	Speed integral constant 1	0.1-1000.0	10.0	1ms	Running & setting	Real time
	P02-12	Fake differential feed-forward control ratio 1	0-100.0	100.0	1.0%	Running & setting	Real time
	P02-13	speed ratio gain 2	1.0-2000.0	27.0	1Hz	Running & setting	Real time
	P02-14	Speed integral constant 2	0.1-1000.0	1000.0	1ms	Running & setting	Real time
	P02-15	Fake differential feed-forward control ratio 2	0-100.0	100.0	1.0%	Running & setting	Real time
	P02-16	Speed integral error limit value	0-32767	25000	---	Stop & Reset	Real time
	P02-19	Torque feed-forward gain	0-30000	0	1.0%	Running & setting	Real time
	P02-20	Torque feed-forward smooth constant	0-64.00	0.8	1ms	Running & setting	Real time
	P02-30	Gain switching mode	0-10	7	---	Running & setting	Real time
	P02-31	Gain switching grade	0-20000	800	---	Running & setting	Real time
	P02-32	Gain switching lag	0-20000	100	---	Running & setting	Real time
	P02-33	Gain switching delay	0-1000.0	10.0	1ms	Running & setting	Real time
	P02-34	Position gain	0-1000.0	10.0	1ms	Running &	Real time

		switching time				setting	
	P02-40	Mode switch selection	0-4	0	---	Running & setting	Real time
	P02-41	Mode switch selection	0-20000	10000	---	Running & setting	Real time
	P02-50	Torque command added value	-100.0-100.0	0	1.0%	Running & setting	Real time
	P02-51	CW torque compensation	-100.0-100.0	0	1.0%	Running & setting	Real time
	P02-52	Reverse torque compensation	-100.0-100.0	0	1.0%	Running & setting	Real time
Positional parameter	P03-00	Source of location command	0-1	0	---	Stop & Reset	Real time
	P03-01	Instruction pulse mode	0-3	1	---	Stop & Reset	Real time
	P03-02	Instruction Pulse Input Terminal	0-1	0	---	Stop & Reset	Real time
	P03-03	Instruction Pulse Inversion	0-1	0	---	Stop & Reset Shutdown settings	Real time
	P03-04	Position Pulse filtering	0-3	2	---	Running & settingRun settings	Real time
	P03-05	Positioning completion criteria	0-2	1	---	Running & setting	Real time
	P03-06	Location complete range	0-65535	100	Encoder unit	Running & setting	Real time
	P03-07	Position Feedback format	0-1	0	---	Stop & Reset	Real time
	P03-09	Number of instruction pulses per turn of motor	0-65535	0	Pulse	Running & setting	Re-power on

	P03-10	Electron Gear 1 molecule	1-65535	8192	---	Running & setting	Re-power on
	P03-11	Electronic gear 1 DeNOminator	1-65535	625	---	Running & settingRun settings	Re-power on Power cycle up
	P03-12	Electron Gear 1 is 16-bit higher	0-32767	0	---	Running & setting	Re-power on
	P03-15	Excessive position deviation setting	0-65535	30000	Command unit	Running & setting	Real time
	P03-16	Position Instruction smoothing filter time constant	0-1000.0	0	1ms	Running & setting	Real time
	P03-20	Position loop feedback	0-1	0	---	Running & setting	Real time
	P03-21	Encoder crossover output enable	0-1	1	---	Stop & Reset	Real time
	P03-22	Increment encoder output pulse frequency division ratio molecule	1-65535	1	---	Running & setting	Real time
	P03-23	Increment encoder output pulse frequency division ratio deNOminator	1-65535	1	---	Running & setting	Real time
	P03-25	Absolute number of output pulses per revolution of the motor	0-60000	2500	---	Running & setting	Real time
	P03-30	Linear encoder inversion	0-1	0	---	Stop & Reset	Real time
	P03-31	Linear encoder Z pulse polarity	0-1	1	---	Stop & Reset	Real time

	P03-40	Source of output pulse	0-1	0	---	Stop & Reset	Real time
	P03-42	Output Z pulse polarity	0-1	1	---	Stop & Reset	Real time
	P03-45	Digital Position Instruction caching mode	0-1	0	---	Stop & Reset	Real time
	P03-46	Maximum speed of motor at digital position command run time	0-6000	1000	---	Running & setting	Real time
	P03-50	The Gantry function enables	0-1	0	---	Stop & Reset	Real time
	P03-51	The input signal of Gantry function is reversed	0-1	0	---	Stop & Reset	Real time
	P03-52	Number of feedback pulses per turn of Gantry Motor	0-65535	10000	---	Stop & Reset	Real time
	P03-53	Gantry function position deviation too large settings	0-65535	10000	---	Running & setting	Real time
	P03-55	Gantry proportional gain	0-200	10	---	Running & setting	Real time
	P03-60	Origin regression enable control	0-6	0	---	Stop & Reset	Real time
	P03-61	Origin regression model	0-9	0	---	Stop & Reset	Real time
	P03-65	High speed searching for origin switch	0-3000	100	---	Running & setting	Real time
	P03-66	Low speed searching for origin switch	0-1000	10	---	Running & setting	Real time
	P03-67	Search origin switch acceleration and	0-5000	0	---	Running & setting	Real time

		deceleration time					
	P03-68	Maximum time limit for searching origin	0-10000	0	---	Running & setting	Real time
	P03-69	H Mechanical Origin Offset H	0-65535	0	---	Running & setting	Real time
	P03-70	Mechanical Origin Offset L	0-65535	1000	---	Running & setting	Real time
Speed parameter	P04-00	Speed instruction source	0-3	0	---	Stop & Reset	Real time
	P04-01	Speed instruction Analog counter	0-1	0	---	Stop & Reset	Real time
	P04-02	Digital speed given value	-6000—6000	0	1rpm	Running & setting	Real time
	P04-03	Zero speed position clamp function	0-1	0	---	Running & setting	Real time
	P04-04	Zero speed position clamp speed threshold	0-6000	30	1rpm	Running & setting	Real time
	P04-05	Overspeed alarm value	0-6500	6400	1rpm	Running & setting	Real time
	P04-06	Forward speed limit	0-6000	5000	1rpm	Running & setting	Real time
	P04-07	Reverse speed limit	0-6000	5000	1rpm	Running & setting	Real time
	P04-10	Zero velocity detection value	0-200.0	2	1rpm	Running & setting	Real time
	P04-11	Rotation detection value	0-200.0	30	1rpm	Running & setting	Real time
	P04-12	Consistent range of velocity	0-200.0	30	1rpm	Running & setting	Real time
	P04-14	Acceleration time	0-10000	0	1ms/1000 rpm	Running & setting	Real time
	P04-15	Deceleration time	0-10000	0		Running & setting	Real time

	P04-30	Internal setting speed 1	0-6000	0	1rpm	Running & setting	Real time
	P04-31	Internal setting speed 2	-6000—6000	0	1rpm	Running & setting	Real time
	P04-32	Internal setting speed 3	-6000—6000	0	1rpm	Running & setting	Real time
	P04-33	Internal setting speed 4	-6000—6000	0	1rpm	Running & setting	Real time
	P04-34	Internal setting speed 5	-6000—6000	0	1rpm	Running & setting	Real time
	P04-35	Internal setting speed 6	-6000—6000	0	1rpm	Running & setting	Real time
	P04-36	Internal setting speed 7	-6000—6000	0	1rpm	Running & setting	Real time
	P04-37	Internal setting speed 8	-6000—6000	0	1rpm	Running & setting	Real time
转矩参数	P05-00	Torque instruction source	0-3	0	---	Stop & Reset	Real time
	P05-01	Inverse Torque instruction analog	0-1	0	---	Stop & Reset	Real time
	P05-02	Torque mode speed limit given value	0-6000	1000	1rpm	Running & setting	Real time
	P05-05	Torque limiter source	0-1	0	---	Stop & Reset	Real time
	P05-06	Torque limit check out delay	0-10000	0	ms	Running & setting	Real time
	P05-10	Internal Forward Torque limit	0-300.0	200.0	1.0%	Running & setting	Real time
	P05-11	Internal reverse torque limit	0-300.0	200.0	1.0%	Running & setting	Real time
	P05-12	External Positive Torque limit	0-300.0	100.0	1.0%	Running & setting	Real time
	P05-13	External Reverse torque limit	0-300.0	100.0	1.0%	Running & setting	Real time

I/O Parameter	P06-00	DI1 Effective level of input port DI1	0-4	0	---	Running & setting	Re-power on
	P06-01	DI1 input port function selection (Servo ON)	0-18	1	---	Running & setting	Re-power on
	P06-02	DI2 input port function selection (alarm clear)	0-4	0	---	Running & setting	Re-power on
	P06-03	DI2 input port function selection (alarm clear)	0-18	2	---	Running & setting	Re-poweron
	P06-04	DI3 Effective level of input port	0-4	0	---	Running & setting	Re-poweron
	P06-05	DI3 input port function selection (forward overtrip)	0-18	3	---	Running & setting	Re-poweron
	P06-06	DI4 input port effective level	0-4	0	---	Running & setting	Re-poweron
	P06-07	DI4 input port function selection (reverse overtrip)	0-18	4	---	Running & setting	Re-poweron
	P06-08	DI5 Effective level of input port	0-4	0	---	Running & setting	Re-poweron
	P06-09	DI5 input port function selection(Default: Forward torque external torque limit)	0-18	7	---	Running & setting	Re-poweron
	P06-10	DI6 Effective level of input port	0-4	0	---	Running & setting	Re-poweron
	P06-11	DI6 input port function selection (Default: External torque limit on reverse side)	0-18	8	---	Running & setting	Re-poweron
	P06-12	DI7 Effective level	0-4	0	---	Running &	Re-poweron

		of input port				setting	
	P06-13	D17 input port function selection (Default: function model change)	0-18	5	---	Running & setting	Re-poweron
	P06-16	DI8 Effective level of input port	0-4	0	---	Running & setting	Re-poweron
	P06-17	D17 input port function selection (Default:position instruction clear)	0-18	16	---	Running & setting	Re-poweron
	P06-20	D01 Valid level of output port	0-1	1	---	Running & setting	Re-poweron
	P06-21	D01 Function change of output port (fault:serve ready)	0-11	3	---	Running & setting	Re-poweron
	P06-22	D02 Valid level of output port	0/1	1	---	Running & setting	Re-poweron
	P06-23	D02 Function change of output port (fault: brake open)	0-11	2	---	Running & setting	Re-poweron
	P06-24	D03 Valid level of output port	0/1	1	---	Running & setting	Re-poweron
	P06-25	D03 Function change of output port (fault:Alarm output)	0-11	1	---	Running & setting	Re-poweron
	P06-26	D04 Valid level of output port	0/1	1	---	Running & setting	Re-poweron
	P06-27	D04 Function change of output port (fault:position completed)	0-11	4	---	Running & setting	Re-poweron
	P06-28	D05 Valid level of output port	0/1	1	---	Running & setting	Re-poweron
	P06-29	D05 output port function selection (torque limit detection)	0-11	8	---	Running & setting	Re-poweron
	P06-40	Speed analog command input gain	10-2000	500	1rpm/V	Running & setting	Real time

	P06-41	Speed analog command filter constant	0-65535	0.8	1ms	Running & setting	Real time
	P06-42	Speed analog command offset	-10.000 —10.000	0	1V	Running & setting	Real time
	P06-43	Torque analog command gain	0.0-100.0	10	%	Running & setting	Real time
	P06-44	Torque analog command filter constant	0-64.00	0.8	1ms	Running & setting	Real time
	P06-45	Torque analog command offset	-10.000 —10.000	0	1V	Running & setting	Real time
	P06-46	Speed analog instruction dead zone	0-10.000	0	1V	Running & setting	Real time
	P06-47	Torque analog instruction dead zone	0-10.000	0	1V	Running & setting	Real time
Advanced function parameters	P08-01	Load rotation routine identification mode	0-1	0	---	Running & setting	Real time
	P08-02	Inertia identification maximum speed	100-2000	800	1rpm	Running & setting	Real time
	P08-03	Inertia identification acceleration and deceleration time	20-800	100	1ms	Running & setting	Real time
	P08-04	Wait time after single inertia identification is completed	50-10000	1000	1ms	Running & setting	Real time
	P08-05	The number of motor rotations required to complete a single inertia		1.33	ring 圈	Running & setting	Real time
	P08-11	Adaptive Notch mode selection	0-4	0	---	Running & setting	Real time
	P08-20	Torque command filter constant	0-25.00	0.8	1ms	Running & setting	Real time
	P08-25	Disturbance torque compensation gain	0-100.0	0	%	Running & setting	Real time
	P08-26	Disturbance torque	0-25.00	0.8	1ms	Running &	Real time

		filtering time constant				setting	
	P08-30	Notch Filter 1 frequency	50-5000	5000	HZ	Running & setting	Real time
	P08-31	Notch Filter 1 width	0-20	2	---	Running & setting	Real time
	P08-32	Notch Filter 1 depth	0-99	0	---	Running & setting	Real time
	P08-33	Notch Filter 2 frequency	50-5000	5000	HZ	Running & setting	Real time
	P08-34	Notch Filter 2 width	0-20	2	---	Running & setting	Real time
	P08-35	Notch Filter 2 depth	0-99	0	---	Running & setting	Real time
	P08-36	Notch Filter 3 frequency	50-5000	5000	HZ	Running & setting	Real time
	P08-37	Notch Filter 3 width	0-20	2	---	Running & setting	Real time
	P08-38	Notch Filter 3 depth	0-99	0	---	Running & setting	Real time
	P08-39	Notch Filter 4 frequency	50-5000	5000	HZ	Running & setting	Real time
	P08-40	Notch Filter 4 width	0-20	2	---	Running & setting	Real time
	P08-41	Notch Filter 4 depth	0-99	0	---	Running & setting	Real time

8.2 Parameter Description

8.2.1 P00-XX motor and driver parameter

Table 13 P00-XX motor and driver parameter

Para code	Name	Description
P00-00	motor number	Default set 0: P0-01 to P0-17 is available 2000: Absolute encoder, P0-01 to P0-05 identified by driver

P00-01	rated speed	Set range: 1~6000 rpm; unit: rpm; default value.
P00-02	rated torque	Set range 0.01-655.35 N.m;unit: N.M default value.
P00-03	Rated current	Set range: 0.01-655.35A, unit: A Default value
P00-04	Rotor inertia	Set range: 0.01-655.35kg.cm²; unit: kg.cm² Default value
P00-05	Pole pairs	Set range:1-31 pairs; unit: opposite Default value
P00-07	Encoder option	Range: 0-3 0&1: incremental encoder 2: Single-turn absolute encoder 3: Multi-turn absolute encoder
P00-08	Line-saving incremental encoder	Range: 0-1 0: NOn line-saving; 1: line-saving;
P00-09	Absolute encoder	Range: 0-1 0: Tamagawa encoder 1: Nikon encoder
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
P00-20	Display settings on	Set range:0-100; Default:100. Set by customer It shows operation status while driver power-on if set value to 100. Other

	power-on interface	parameter refer to 8.3 chapter. For example: If want driver show d08.F.SP, please set value to 8.
P00-21	RS232 communication baud rate selection	Set range: 0-3; Default:2 Choose baud rate to communicate with PC: 0: 9600 1: 19200 2: 57600 3: 115200
P00-23	slave station	Set range: 0-255; Default:1; Set according to device required.
P00-25	Check way	Setting range 0-3, default 1 0: NO parity, 2 stop bits 1: Even parity, 1 stop bit 2: odd parity, 1 stop bit 3: NO parity, 1 stop bit
P00-30	Braking resistor setting	Set range: 0-2. 0: inside resistor. 1: use outside resistor. 2: NO braking resistor.
P00-31	Outsider braking resistor power	Setting range: 0-65536, Unit: 10W. Set value according to outsider braking resistor. For example: set 4, it means resistor power is 40W.
P00-32	Outsider braking resistor value	Setting range :0-1000 Unit: ohm. Set value according to outsider braking resistor
P00-40	Over temperature protection setting	Setting range: 0-1 0: Close over temperature protection 1: Open over temperature protection
P00-41	Control power failure protection settings	Setting range: 0-1 0: turn off the power-off protection function of the control power supply 1: Turn on the power-off protection function of the control power supply

8.2.2 P01-xx main control parameter

Table 14 P01-xx main control parameters

Para code	Name	Description

P00-00	motor number	Default set 0: P0-01 to P0-17 is available 2000: Absolute encoder, P0-01 to P0-05 identified by driver
P00-01	rated speed	Set range: 1~6000 rpm; unit: rpm; default value.
P00-02	rated torque	Set range 0.01-655.35 N.m;unit: N.M default value.
P00-03	Rated current	Set range: 0.01-655.35A, unit: A Default value
P00-04	Rotor inertia	Set range: 0.01-655.35kg.cm²; unit: kg.cm² Default value
P00-05	Pole pairs	Set range:1-31 pairs; unit: opposite Default value
P00-07	Encoder option	Range: 0-3 0&1: incremental encoder 2: Single-turn absolute encoder 3: Multi-turn absolute encoder
P00-08	Line-saving incremental encoder	Range: 0-1 0: NOn line-saving; 1: line-saving;
P00-09	Absolute encoder	Range: 0-1 0: Tamagawa encoder 1: Nikon encoder
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

P00-20	Display settings on power-on interface	Set range:0-100; Default:100. Set by customer It shows operation status while driver power-on if set value to 100. Other parameter refer to 8.3 chapter. For example: If want driver show d08.F.SP, please set value to 8.
P00-21	RS232 communication baud rate selection	Set range: 0-3; Default:2 Choose baud rate to communicate with PC: 0: 9600 1: 19200 2: 57600 3: 115200
P00-23	slave station	Set range: 0-255; Default:1; Set according to device required.
P00-25	Check way	Setting range 0-3, default 1 0: NO parity, 2 stop bits 1: Even parity, 1 stop bit 2: odd parity, 1 stop bit 3: NO parity, 1 stop bit
P00-30	Braking resistor setting	Set range: 0-2. 0: inside resistor. 1: use outside resistor. 2: NO braking resistor.
P00-31	Outsider braking resistor power	Setting range: 0-65536, Unit: 10W. Set value according to outsider braking resistor. For example: set 4, it means resistor power is 40W.
P00-32	Outsider braking resistor value	Setting range :0-1000 Unit: ohm. Set value according to outsider braking resistor
P00-40	Over temperature protection setting	Setting range: 0-1 0: Close over temperature protection 1: Open over temperature protection
P00-41	protection settings if control power failure	Setting range: 0-1 0: turn off the power-off protection function of the control power supply 1: Turn on the power-off protection function of the control power supply

8.2.3 P02-xx Gain assorted parameter

Table 100 P02-XX Gain parameter

Para code	Name	Description
P02-00	Position control gain 1	Setting range: 0-3000.0, unit: 1 / S 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. This parameter is for steady state response.
P02-01	Position control gain2	Setting range: 0-3000.0, unit: 1 / S 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. This parameter is for dynamic response.
P02-03	Speed feedforward gain	Setting range: 0-100.0, unit: 1.0% 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 vibration.
P02-04	Speed feedforward smoothing constant	Setting range: 0-64.00, unit: ms 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	1Speed proportional gain 1	Setting range: 1.0-2000.0, unit: Hz 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. 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. 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. When the system does NOt oscillate, reduce this

		parameter value as much as possible. This parameter is for steady state response.
P02-12	Pseudo-differential feedforward control coefficient 1	Setting range: 0-100.0, unit: 1.0% 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. By adjusting this coefficient, the speed loop can have a better dynamic response, and it can increase the resistance to low-frequency interference.
P02-13	speed proportional gain2	Setting range: 1.0-2000.0, unit: Hz 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. Under the system has NO vibration, increase this parameter value as much as possible. This parameter is for dynamic response.
P02-14	Speed integral constant 2	Setting range: 1.0-1000.0, unit: ms 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. Under the system has NO vibration, reduce this parameter value as much as possible. This parameter is for dynamic response.
P02-15	Pseudo-differential feedforward control coefficient 2	Setting range: 0-100.0, unit: 1.0% 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, which can filter low-frequency interference, but the dynamic response is slow. By adjusting this coefficient, the speed loop can have a better dynamic response, and at the same time, it can increase the resistance to low-frequency interference.
P02-16	Speed integral error limit value	Setting range: 0-32767 Speed integral error limit value
P02-19	Torque feedforward gain	Setting range: 0-30000, unit: 1.0% Set the current loop feedforward weighting value. This parameter adds the current loop after weighting the differential of the speed command.
P02-20	Torque feed-forward smoothing constant	Setting range: 0-64.00, unit: ms This parameter is used to set the torque feedforward filtering time constant.

<table>
<tr><td></td><td></td><td></td></tr>
<tr><td>P02-30
P02-30</td><td>Gain switching mode
Gain switching mode</td><td>Setting range: 0-10
The condition to set the 1st and 2nd gain switching mode
<table>
<tr><td>value</td><td>Switching 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)
Invalid: first gain
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 the threshold and exceeds the P02-33 delay setting, it switches to the first gain.</td></tr>
<tr><td>5</td><td>Big speed command value</td><td>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.</td></tr>
<tr><td>6</td><td>Large position deviation</td><td>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.</td></tr>
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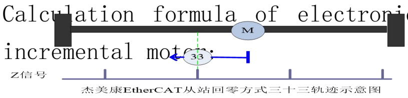
<tr><td></td><td></td><td>
<table>
<tr><td>7</td><td>There is position command</td><td>Switch to the second gain when there is a position command. When the position command ends and the P02-33 delay setting is exceeded, it switches to the first gain.</td></tr>
<tr><td>8</td><td>Incomplete positioning</td><td>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.</td></tr>
<tr><td>9</td><td>Actual speed is big</td><td>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.</td></tr>
<tr><td>10</td><td>With position command + actual speed</td><td>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.</td></tr>
</table>
</td></tr>
<tr><td>P02-31</td><td>Gain switching level</td><td>Setting range: 0-20000
Judgment threshold when gain is switched.
Torque unit: 1000bit = 25% of rated torque
Speed unit: 1000bit = 200 rpm
Position unit: 131072bit per revolution</td></tr>
<tr><td>P02-32</td><td>Gain switching hysteresis</td><td>Setting range: 0-20000
Hysteresis level at gain switching
Torque unit: 1000bit = 25% of rated torque
Speed unit: 1000bit = 200 rpm
Position unit: 131072bit per revolution</td></tr>
<tr><td>P02-33</td><td>Gain switching delay</td><td>Setting range: 0-1000.0, unit: ms
When switching from the second gain to the first gain, the time from when the trigger condition is met to the actual switching.</td></tr>
<tr><td></td><td></td><td></td></tr>
<tr><td>P02-34</td><td>Position gain switching time</td><td>Setting range: 0-1000.0, unit: ms
Time for position control gain 1 to smoothly switch to position control gain 2</td></tr>
<tr><td>P02-40</td><td>Mode switch selection</td><td>Setting range: 0-4
Set the conditions of speed loop PI control and P control
<table>
<tr><td>val</td><td>Judge</td><td>Remark</td></tr>
</table>
</td></tr>
</table>

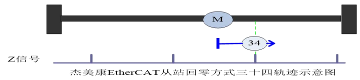
<table>
<tr><td></td><td></td><td>
<table>
<tr><td>ue</td><td>condition</td><td></td></tr>
<tr><td>0</td><td>Torque command</td><td>When the torque command is less than P02-41, the threshold is set to PI control, while it is bigger than P02-41, then set to P control.</td></tr>
<tr><td>1</td><td>Speend command</td><td>When the speed command is less than P02-41, the threshold is set to PI control. If the speed command is greater than P02-41, the threshold is set to P control.</td></tr>
<tr><td>2</td><td>Accelerati on</td><td>When the acceleration is less than P02-41, the threshold is set to PI control. If the acceleration is greater than P02-41, the threshold is set to P control.</td></tr>
<tr><td>3</td><td>Position deviation</td><td>When the position deviation is less than P02-41, the threshold is set to PI control. If the position deviation is greater than P02-41, the threshold is set to P control.</td></tr>
<tr><td>4</td><td>Modeless switch</td><td>Speed loop maintains PI control and NO longer switches</td></tr>
</table>
</td></tr>
<tr><td>P02-41</td><td>Mode switch level</td><td>Setting range: 0-20000
Set the threshold for switching.
Torque unit: 1000bit = 25% of rated torque
Speed unit: 1000bit = 200 rpm
Position unit: 131072bit per revolution</td></tr>
<tr><td></td><td></td><td></td></tr>
<tr><td>P02-50</td><td>Torque command added value</td><td>Setting range: -100.0-100, unit: 1.0%
Valid in position control mode. This value is superimposed on the torque reference value and is used for vertical axis static torque compensation.</td></tr>
<tr><td>P02-51</td><td>Forward torque compensation</td><td>Setting range: -100.0-100.0, unit: 1.0%
Valid in position control mode. For compensating forward static friction</td></tr>
<tr><td>P02-52</td><td>Reverse torque compensation</td><td>Setting range: -100.0-100.0, unit: 1.0%
Valid in position control mode. Used to compensate reverse static friction</td></tr>
</table>

8.2.4 P03-xx P03-xx Position parameters

Chart 101 P03-XX Position parameter

Para code	Name	Description
P03-00	Source of position command	0: pulse command 1: Given the number, use it when communicating with control
P03-01	Command pulse mode	0: Quadrature pulse command (90° phase difference two-phase pulse) 1: Direction+ pulse command 2or 3:Double pulse command (CW+CCW)
P03-02	Instruction Pulse Input Terminal	Use to specify the pulse input port in the CN1 port 0: low speed pulse port 1: high speed pulse port
P03-03	Instruction Pulse Inversion	Used to adjust the direction of the pulse instruction count 0: Normal 1: In The Opposite Direction
P03-04	Position Pulse filter setting	Set range : 0-3 Unit: us 0: 0.1us。 1: 0.4us 2: 0.8us 3: 1.6us.
P03-05	Positioning completion criteria	0:Output when position deviation is less than P03-06 setting value 1: Output when position is given, and output when position deviation is less than P03-06 setting value 2: Output when position is given (after filtering) , and output when position deviation is less than P03-06 setting value
P03-06	Location complete range	Set range:0-65535 Unit: encoder unit Use to set a threshold value for positioning completion output. When the absolute value motor is used, the encoder is calculated at 131072 bit per turn. Using incremental encoder motor, each turn is calculated by the number of encoder lines * 4.
P03-07	Position feedback format	Set range:0-1 0: Incremental format 1: Multi-loop absolute value format
P03-09	Number of instruction pulses per turn	Setting range: 0-65535 Absolute encoder motor is effectively used to set motor rotation number of instructions pulse. When

<table>
<tr><td></td><td>of motor</td><td>this parameter is set to 0, P03-10 and P03-11 are valid</td></tr>
<tr><td>P03-10</td><td>Electron Gear 1 molecule</td><td rowspan="2">When absolute value motor is used, see example of calculation method of electronic gear ratio
Calculation formula of electronic gear ratio of incremental motor:




NOte: 20BThe molecule of encoder is 131072
17B The molecule of encoder is 160000</td></tr>
<tr><td>P03-11</td><td>Electronic gear 1 DeNOminator</td></tr>
<tr><td>P03-12</td><td>Electron Gear 1 molecular high position</td><td>Set range :0-32767
Use this can expand the Electronic gear ratio
Molecule value=P03-12*10000+P03-10</td></tr>
<tr><td>P03-15</td><td>Position deviation setting is too big</td><td>Setting range: 0-65535, Unit: Instruction Unit * 10 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)</td></tr>
<tr><td>P03-16</td><td>Position Instruction smoothing filter constant</td><td>Setting range: 1000, in Ms Setting time constant of position instruction smoothing filter</td></tr>
<tr><td>P03-20</td><td>Position feedback source</td><td>Setting Position Feedback Source
0: Encoder
1: Raster scale</td></tr>
<tr><td>P03-21</td><td>Encoder frequency division output enable</td><td>Setting CN1 port if it has function of Encoder frequency division output enable:
0: close enable.
1: open enable</td></tr>
<tr><td>P03-22</td><td>Increment encoder output pulse frequency division ratio molecule</td><td rowspan="2">When using incremental encoder, set the number of output pulses of cN1 port.
P03-23 should be less than or equal to p03-22, calculation formula:
$G = \frac{\text{Molecule}}{\text{Denominato r}} = \frac{C \times 4}{P \times 4}$
C: Encoder line
P: Desired output A, B pulses per revolution
Example: The number of encoder lines is 2500;
The number of A, B pulses per revolution is 500;
$G = \frac{C \times 4}{P \times 4} = \frac{2500 \times 4}{500 \times 4} = \frac{5}{1}$</td></tr>
<tr><td>P03-23</td><td>Delta encoder output pulse frequency divider</td></tr>
<tr><td>P03-25</td><td>Absolute number of output pulses per revolution of the motor</td><td>Set Range: 0-60000
Set absolute value motor rotation around, A, B frequency pulse output number. EXAMPLE: set the value of 2048, then each rotation of the motor, A and B signal output 2048 pulses</td></tr>
</table>

P03-30	LINEAR encoder	Set the grating ruler Input A, b phase sequence is reversed NO yes
P03-31	Polarity of Z pulse of linear encoder	Set the effective level of grating ruler input Z signal 0: low level 1: High level
P03-40	Output pulse source	Set CN1 terminal in the frequency-division Output Signal Source 0: Pulse output, alarm NOt output 1: Motor output 2: Pulse Output 3: Grating Ruler
P03-42	Output Z pulse Polarity	Set CN1 TERMINAL FREQUENCY OUTPUT SIGNAL Z effective level 0: Low Level 1: High Level
P03-45	Digital quantity instruction cache mode	Setting range: 0-1 0: NO caching (immediate execution) 1: CACHING (new data executed after last data execution)
P03-46	Maximum speed of motor at digital position command run time	Setting range: 0-6000 Sets the maximum speed of the motor when the Digital Position Command runs

8.2.5 P04-xx Speed parameter

Chart P04-XX speed parameter

Para code	Name	Description
P04-00	Speed instruction source	0: External Analog Instruction 1: Digital Instruction (Parameter Setting) 2: Digital Instruction (Communication) 3: Internal Multiple instruction sets
P04-01	Speed instruction analog reverse	The polarity relation used to adjust analog quantity is 0: Normal 1: Polarity is reversed
P04-02	Digital speed given value	Setting range:-6000-6000, Unit: rpm when P04-00 is set to 1, P04-02 is the speed control setting
P04-03	Zero speed position clamp function	0: NOn-position Clamp Function 1: Position Clamp function When speed control mode is applied and the following

		conditions are met, enter Position lock mode A: P04-03 set to 1 B: Speed instruction absolute value less than P04-04 SET THRESHOLD C: External Input Port function set to 10(zero fixed) and in input valid state
P04-04	Zero speed position clamp speed threshold	]Setting range: 0-6000, unit: rpm Setting speed instruction threshold to trigger zero speed position clamp function
P04-05	Over speed alarm value	Set range : 0-6500, Unit: rpm Setting the maximum allowable RPM above the setting will trigger a 420 overspeed alarm
P04-06	Forward speed limit	Set range: 0-6000, Unit: rpm Limit forward speed of motor
P04-07	Reverse speed limit	Set range: -6000-0, Unit: rpm Limit reverse speed of motor
P04-10	Zero velocity detection value	Set range: 0-200.0, Unit: rpm Set Zero speed detection threshold, motor speed below the threshold can be output through the output port "zero speed motor output" signal
P04-11	Rotation detection value	Set range: 0-200.0, Unit: rpm Set Motor rotation detection threshold, motor rotation speed higher than the value can be displayed through the LED panel status
P04-12	Consistent range of velocity	Set range: 0-200.0, Unit: rpm Set speed consistent signal threshold value, when motor speed and instruction speed difference in the threshold value range, can output "speed consistent output" signal through the output port
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 Set the deceleration time in speed control
P04-30 ----- P04-37	1-8 inside speed set	Set range: -6000—6000, Unit: rpm Parameters P04-30 to P04-37, respectively set internal speed 1 to internal speed 8, the internal speed switch method is as follows: when the speed loop control, P04-00 SET 3, the corresponding input port function is defined as 13,14,15 internal rotation speed switching, which is realized by setting the input port function to 13,14,15 on-off state combination, as shown in the following table

DI13	DI14	DI15	Parameter
0	0	0	P04-30
1	0	0	P04-31
0	1	0	P04-32
1	1	0	P04-33
0	0	1	P04-34
1	0	1	P04-35
0	1	1	P04-36

			1	1	1	P04-37	

8.2.6 P05-xx Torque parameter

Chart 103 P05-XX Torque parameter

Para code	Name	Description
P05-00	Torque instruction source	0: External Analog Instruction (speed limit set by P05-02) 1: Digital Instruction (speed limit set by P05-02) 2: External Analog Instruction (speed limit set by speed analog instruction) 3: Digital Instruction (speed limit set by speed analog instruction)
P05-01	Inverse Torque instruction analog	Used to adjust the Torque Direction 0: Normal 1: Direction reverse
P05-02	Torque mode speed limit given value	Setting range: 0-maximum speed, unit: RPM set the maximum speed of motor when torque mode, prevent NO-load motor speed too high cause mechanical damage torque control mode effective
P05-05	Torque limiter source	Source for adjusting Torque Limits 0: Internal Digital (set by P05-10, P05-11 or P05-12, P05-13) 1: External Analog (given by external analog input T-REF). In this mode, the positive and negative limits are the same.
P05-06	Torque limit check out delay	Setting range: 0-10000, unit: Ms Setting DO port output torque limit detection output signal delay time
P05-10	Internal Forward Torque limit	Setting range: 0-300.0, unit: 1.0% limit motor forward output, 100 means 1 times Torque, 300 means 3 times torque 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% limit motor reverse output, 100 means 1 times Torque, 300 means 3 times torque when the torque output reaches the limit value, the output signal can be detected through the DO port output torque limit
P05-12	External Positive Torque limit	Setting range: 0-300.0, unit: 1.0% This function, you need to use one of the external input port in CN1 to switch, the choice of the Di port input port function set to 7(positive side external torque limit) . The control mode can be switched by controlling the logical state of the

<table>
<tr><td></td><td></td><td>port.<table><tr><td>Port logic</td><td>Torque limited value</td></tr><tr><td>Valid</td><td>External Limited value P05-12</td></tr><tr><td>Invalid</td><td>Internal Limited value P05-10</td></tr></table>If the DI function is NOt assigned, the system default torque limit value is P05-10. When the torque output reaches the limit value, the output signal can be detected through the DO port output torque limit</td></tr>
<tr><td>P05-13</td><td>External reverse Torque limit</td><td>Setting range: 0-300.0, unit: 1.0%
This feature requires the use of an external input port in CN1 to switch, the choice of the DI port input port function set to 8(reverse side external torque limit) . The control mode can be switched by controlling the logical state of the port.<table><tr><td>Port logic</td><td>Torque limited value</td></tr><tr><td>Valid</td><td>External Limited value P05-13</td></tr><tr><td>invalid</td><td>Internal Limited value P05-11</td></tr></table>If the DI function is NOt assigned, the default torque limit amplitude of the system is p05-11. When the torque output reaches the limit value, the output signal can be detected through the Do port output torque limit</td></tr>
</table>

8.2.7 P06-xx I/O Parameter

Chart 104 P06-XX I/O Parameter

Para code	Name	Description
P06-00	DI1Effective level of input port	Set range: 0-4, Factory set:0 Set valid input of di1 input port of cN1 0: valid for low level (optocoupler on) 1: Valid for high level (optocoupler off) 2: Rising edge effective 3: Falling edge effective

		4: Both rising and falling edge are effective
P06-01	DI1 Input Port function selection	Set range: 0-24, Factory set: 13 Set the function of DI1 input port of cN1 0: invalid pin 1: servo ON 2: Alarm clear 3: Forward over travel signal input 4: Reverse over travel signal input 5: Control mode switching 6: P action command input 7: Positive side external torque limit 8: Reverse side external torque limit 9: Gain switching input 10: Zero fixed input 11: Command pulse inhibit input 12: Encoder absolute value data required input 13: CW limited input 14: HW limited input 15: CWW limited input 16: Position command clear input 17: Pole detection input 18: Command pulse input rate switching input 19: Gantry simultaneous movement enable 20: Gantry alignment clear signal 21: origin switch signal 22: origin reset start signal 23: Detector PIN 1 input 24: Detector PIN 2 input
P06-02	DI2Effective level of input port	see P06-00
P06-03	DI2 Function choose of input port	see P06-01, factory set: 14
P06-04	DI3 Valid power level of input port	seeP06-00
P06-05	DI3 Function choose of input port	seeP06-01, factory set: 15.
P06-06	DI4 Effective level of input port	see 06-00
P06-07	DI4 Function choose of input port	see P06-01, factory set: 23.
P06-08	DI5 Effective level of input port	see P06-00
P06-09	DI5 Function choose of input port	see P06-01, factory set: 24
P06-10	DI6 Effective level of input port	see P06-00
P06-11	DI6 Function choose of input port	see P06-01, factory set: 8
P06-12	DI7 Effective level of input port	see P06-00

P06-13	DI7 Function choose of input port	see P06-01, factory set: 5
P06-16	DI8 Effective level of input port	see P06-00
P06-17	DI8 Function choose of input port	see P06-01, factory set : 16
P06-20	DO1 Effective level of input port	Set range: 0-1, factory set:1 0: When the State is valid, optocoupler cut-off 1: When the State is valid, optocoupler on
P06-21	DO1 Function choose of input port	Set range: 0-13, factory set: 4 0: Pins unworkable. 1: Alarm output 2: Lock Open Output 3: Servo Ready Output 4: Positioning Completed Output 5: Positioning close to output 6: Speed consistent output 7: Motor Zero speed output 8: Torque limit detected output 9: Speed limit detected output 10: Warning output 11: Instruction Pulse Input Rate Switching output 12: origin regression complete output 13: electrical origin regression complete output
P06-22	DO2 Effective level of input port	see P06-20
P06-23	DO2 Function choose of output port	see P06-21, factory set: 2
P06-24	DO3 Function choose of output port	see P06-20
P06-25	DO3 Function choose of output port	see P06-21, factory set: 1
P06-26	DO4 Function choose of output port	see P06-20
P06-27	DO4 Function choose of output port	see P06-21, factory set: 0
P06-28	DO5 Function choose of output port	see P06-20
P06-29	DO5 Function choose of output port	see P06-21, factory set: 8
P06-40	Speed analog instruction input gain	Set range: 10-2000, Unit 1rpm/V Set the CN1 input between the simulation command and the Speed Control Command Coefficient Example: 500 on behalf of Each v corresponding to 500 RPM
P06-41	Speed analog command filter constant	Set range: 0—64.00, Unit : ms Set the time factor of analog instruction filtering for CN1 input

P06-42	Velocity analog instruction offset	Set range: -10.000—10.000, Unit : V Set The simulated instruction zero offset for CN1 input
P06-43	Torque simulation instruction gain	Set range: 0—100.0, Unit 1% Set the coefficient between the analog command input by cN1 and the speed control command For example, 30.0 represents 30% of rated torque per V
P06-44	Torque analog instruction filter constant	Set range: 0—64.00, Unit : ms Set the time factor of analog instruction filtering for CN1 input
P06-45	Torque analog instruction offset	Set range: -10.000—10.000, Unit V Set The simulated instruction zero offset for CN1 input
P06-46	Speed analog instruction dead zone	Set range: 0—10.000, Unit V Set the dead time voltage value of the speed analog command. When the analog quantity is set within the range of the positive and negative values, the system will default to zero
P06-47	Torque analog instruction dead zone	Set range: 0—10.000, Unit V Set the dead-time voltage value of the torque simulation instruction. When the analog is given in the range of the positive and negative values, the system defaults to zero

8.2.8 P08-xx Advanced function Parameter

Chart 105 P08-XX Advanced function parameter

Para code	Name	Description
P08-01	Load rotation routine identification mode	Set range: 0-1 0: valid 1: invalid
P08-02	Maximum speed of inertia identification	Set range: 100-2000, Unit: rpm The maximum speed of the motor in off-line inertia identification
P08-03	Inertia identification acceleration and deceleration time	Set range: 20-800, Unit: ms The acceleration and deceleration time of motor when off-line inertia identification
P08-04	Wait time after single inertia identification is completed	Set range: 50-10000, Unit : ms When the moment of inertia identification is off-line, the waiting time after the single moment of inertia identification is completed
P08-05	The number of motor rotations required to complete a single	This parameter is based on P08-02, P08-03, P08-04 set conditions automatically generated the value of the rotation circle

	inertia	
P08-11	Adaptive Notch mode selection	Set range: 0-4 0: The parameters of the third and fourth Notch are NO longer automatically updated and are saved to the current value. However, manual input of 1:1 adaptive Notch filter is valid, and the parameters of the third Notch filter are automatically updated. Manual input of 2:2 adaptive Notch filter is valid, and the parameters of the third and fourth Notch filters are automatically updated, can NOt Manually Input 3: Only Detect Resonance Frequency 4: Clear the third, the fourth Notch filter parameters, restore to the factory settings
P08-20	Torque command filter constant1	Set range: 0-25.00, Unit: ms 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 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 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.
P08-30	Notch Filter 1 frequency	Set Range: Set Range: 50-5000, Unit: HZ Notch 1 center frequency Set to 5000, Notch invalid
P08-31	Notch Filter 1 width	Set range: 0-20 Set Range: 0-20 Notch 1 Notch width level is the ratio of the width to the central frequency
P08-32	Notch Filter 1 depth	Set range: 0-99 The Notch depth grade of Notch 1 is the ratio between the central frequency input and output of Notch 1. The larger the parameter, the smaller the Notch depth and the weaker the effect
P08-33	Notch Filter 2 frequency	same as P08-30
P08-34	Notch Filter 2 width	same asP08-31
P08-35	Notch Filter 2 depth	same asP08-32
P08-36	Notch Filter 3 frequency	same asP08-30

P08-37	Notch Filter 3 width	same asP08-31
P08-38	Notch Filter 3 depth	same asP08-32
P08-39	Notch Filter 4 frequency	same asP08-30
P08-40	Notch Filter 4 width	same asP08-31
P08-41	Notch Filter 4 depth	same asP08-32

8.3List of monitor items

Chart 106 List of monitor 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 pulses at a given position	This parameter can monitor the number of pulses sent by the user to the servo drive. 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
d04.F.PE	Sum of position feedback pulses	This parameter can monitor the pulse number of servo motor feedback. 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
d05.E.PE	Number of position deviation pulses	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 Incremental	Encoder unit

		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	This parameter can monitor the servo given speed when the servo motor is running	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 (optocoupler cut-off) , the lower vertical bar represents the low level optocoupler on)	Binary system
d17.o.Io	Output IO status	This parameter can monitor the output port status of CN1. The upper vertical bar represents the high level (optocoupler through) , the lower vertical bar represents the low level optocoupler cut-off)	Binary system
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 between 0000-ffff	Decimal system
d21.ASM	Absolute Value Encoder multi-loop value	This parameter can monitor the number of turns of the absolute encoder motor	
d22.J-L	Moment of 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	Drive temperature	This parameter can monitor the drive temperature	Degree Centigrade
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

8.4 Auxiliary function

Chart 107 Assistant Function

Serial number	Display item	Function	Operation
1	AF_JoG	JOG trial run	1. Press the **M button** in the action panel to switch to auxiliary mode AF, operate **the Up / Down button** to AF, press ENT button to enter the Jog mode of operation. The default Jog speed is 300 RPM. 2. Press the **Up button**, and the motor turns forward at 300 R / Min; press the Down button, and the motor turns back at 300 R / Min. 3. Long press ENT button to enter the speed edit menu. Edit the speed by using a combination of Up, Down and **Left buttons**, then press ENT for a long time to re enter Jog mode. This setting is NOt saved after the rollout of Jog mode. 4. Press M to exit Jog mode.
2	AF_run	Force enable operate speed mode	1. Press the **M button** in the action panel to switch to auxiliary mode AF, operate **the Up / Down button** to AF, press ENT button to enter the working mode. 2. Press the **Up button**, the motor is rotating, long press the **Up button**, the motor speed will continue to increase; press the Down button, the motor reverse, long press the **Up button**, the motor speed will continue to increase. 3. Press the **M button** to exit the mode.
3	AF_oF1	Automatic	1. Press the **M button** in the action panel to switch

		Zero Drift calibration for analog input 1 (VCMD)	to auxiliary mode **AF_xxx**, press **the Up / Down button** to **AF_of1**, press **ENT** button to display **clr.Ai1**. 2. Long press ENT key until finsh flicker appears, that is to complete the automatic calibration of analog input 1 zero drift. (speed analog) 3. Press the M button to exit the mode.
4	AF_oF2	Automatic Zero Drift calibration for analog input 2 (TCMD)	1. Press the **M** button in the action panel to switch to auxiliary mode **AF_xxx**, press **the Up/Down** button to **AF_of2**, press **ENT** button to display **clr.Ai1**. 2. Long press **ENT** key until finsh flicker appears, that is to complete the automatic calibration of analog input 1 zero drift. (torque analog) 3. Press the **M button** to exit the mode.
5	AF_oF3	U, W current Automatic zero drift calibration	Same AF_oF1 NOte: when performing this function, the servo must be in the off enable state, otherwise the finsh flashing page will NOt appear, and the automatic calibration canNOt be completed
6	AF_En0	Absolute encoder fault clearing	1. Press the M button in the action panel to switch to auxiliary mode AF, press the **Up/Down button** to **AF,** press ENT button to display CLC. Err. 2. Long press ENT button until finsh flashes, that is, complete absolute encoder troubleshooting. 3. Press the M button to exit the mode.
7	AF_En1	Absolute value encoder multi-turn value resetting	1. Press the M button in the action panel to switch to auxiliary mode AF, press **the Up / Down button** to AF, press ENT button to display CLC. Ash. 2. Long press ENT key until finsh flashes, that is, complete absolute encoder multi-turn value resetting. 3. Press the M button to exit the mode.
8	AF_ini	recover to factory setup	Contact with factory
9	AF_Err	The failure records display	1. Press the M button in the operations panel to switch to auxiliary mode AF, operate **the Up / Down button** to AF, press ENT button to display the past 8 historical failure information. The left Digit 0 represents the last failure 2. Press the **Up button** to display the past failures one by one. Long press ENT button, can show the time of failure, time coordinates reference D 25. Tie. 3. Press the M button to exit the mode. NOte: A fault that occurs during multiple ups and downs in 30 minutes may have a recording time deviation of 30 minutes.
10	AF_uEr	Version display	1. Press the M button of the operation panel to switch to auxiliary mode AF, operate **the Up / Down button** to AF, press ENT

			button to display the SERVO information. 2. Press the M button to exit the mode.
11	AF_unL	Operation Permission Setting	1. Press the M button of the action panel to switch to the auxiliary mode AF, operate **the Up / Down button** to AF, press the ENT button to edit the action permissions. 0: The parameters are all locked, can NOt be changed; 1: The P00-XX parameters are locked, other can be changed; 2: NO Lock, can be changed. Set 0,1 value, power down to save. Set 2, power off do NOt save. 2. Press the M button to exit the mode.
12	AF_ Io	Forced output port level	1. Press the M button of the action panel to switch to the auxiliary mode AF, operate **the Up / Down button** to AF, press the ENT button to edit. 2. Press the M button to exit the mode. The output port reverts to its original output state.
13	AF_J-L	Load inertia ratio measurement	1. Press the M key on the operation panel, switch to the auxiliary mode AF - XXX, operate the up / down key to AF_J-L, and press the ENT key to measure the inertia ratio. 2. Long press up key or down key, the motor will run back and forth according to the maximum speed set by p08-02, acceleration and deceleration time set by p08-03, waiting time set by p08-04, and turns set by p08-05 until the load inertia ratio appears. 3. Press the M key to exit the mode. 4. Record the measured value and write it into p01-04 (moment of inertia ratio) parameter

9 Fault Analysis and Treatment

9.1 Fault alarm information list

Chart 108 Fault alarm list

Alarm Type	Alarm Code	Alarm content
Hardware Fault	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.065	servo unit built-in Fan stop
	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.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
Operational Faults	AL.400	Power wire loss phase
	AL.401	Under voltage
	AL.402	Over voltage
	AL.410	Overload (instantaneous Maximum load)
	AL.411	Drive 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.430	Regeneration of AbNormal
	AL.431	Regeneration of overload
	AL.432	Regeneration of Short circuit Open circuit
	AL.435	Stroke current Limited overload resistance
	AL.436	DB overload
	AL.440	Radiator overheat
	AL.441	Motor overheat fault
Operational Faults	AL.500	Output frequency division over speed
	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.510	Gantry synchronization deviation deviation is

		large
	AL.550	Inertia identification failure fault
	AL.551	back to origin Point timeout fault
	AL.552	Angle Identification failure fault
Encoder Fault	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
	AL.640	Absolute encoder overspeed
	AL.641	Absolute encoder overheat
	AL.642	Absolute encoder battery low voltage alarm
	AL.643	Absolute encoder Battery low voltage fault
	AL.644	Absolute encoder multi-turn fault
	AL.645	Absolute encoder multi-turn overflow fault
	AL.646	Absolute encoder communication error 1
	AL.647	Absolute encoder count error 2
	AL.648	Absolute encoder communication error 3
	AL.649	Absolute encoder communication error 4
	AL.650	Absolute encoder communication error 5
	AL.651	Absolute encoder communication error 6
	AL.652	Absolute encoder multi-turn Multiple faults
Warning	AL.900	Location deviation is too large
	AL.901	When servo ON, Location deviation is too large
	AL.910	Motor overload
	AL.912	Drive overload
	AL.920	Regeneration of overload
	AL.921	DB overload
	AL.925	External regeneration bleeder resistor is too small
	AL.930	Absolute encoder’s battery Fault
	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.951	Absolute encoder angle initialization warning
	AL.971	Under voltage warning
	AL.990	Radiator overheat warning
	AL.991	Input phase loss warning

9.2 Cause and treatment of fault alarm

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 baud rate setting is too high	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

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
Master control MCU operation 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 the actual hardware	Detect whether the servo unit can support the mtor	Set product parameters correctly If always appear, then contact the manufacturer
The drive power does NOt match the motor power	The rated current of the selected motor is greater than or much less than the output current of the driver	Use the matching motor and driver units

AL.061: Products matching fault

Causes of fault alarm	Fault alarm checking	Disposal measures
servo unit and servo motor does NOt match	Detect whether the servo unit can support the motor	Replace the matching motor and servo units

AL.063: Overcurrent detection

Causes of fault alarm	Fault alarm checking	Disposal measures
Servo unit power module current is too large	U,V,W wiring whether is short Circuit. Whether short circuit between B1 & B3	Correct connection, If always appear, then change a drive

AL.066: Servo Unit controls the power supply voltage is low

Causes of fault alarm	Fault alarm checking	Disposal measures
Control power supply L,N power voltage is too low	check connections Measure L, N, whether the voltage is lower than 140VAC	Correct connection, If always appear, then change a drive

AL.071: Current collect sample fault

Causes of fault alarm	Fault alarm checking	Disposal measures
abNormal collect sample data in current sensor	check connections whether is correct	Correct connection , If always appear, then change a drive

AL.100: Parameter combination aNOmaly

Causes of fault alarm	Fault alarm checking	Disposal measures
Parameter setting error	Check the set (p03-07) parameters	Set parameters correctly If it always appears, initialize the parameter

AL.102: DI distribution fault

Causes of fault alarm	Fault alarm checking	Disposal measures
At least two functions of input ports have the same selection.	Check input port function selection parameters.	Set parameters correctly The drive is recharged

AL.103: DO distribution fault

Causes of fault alarm	Fault alarm checking	Disposal measures
At least two functions of output ports have the same selection.	Check output port function selection paramgeter.	Set parameters correctly The drive is recharged

AL.105: Electronic gear setting error

Causes of fault alarm	Fault alarm checking	Disposal measures
Electronic gear ratio setting error	Check electronic gear ratio setting parameters. P03-10, P03-11	Set the electronic gear ratio correctly
Gantry output pulse set too small	Check the feedback pulse number of the gantry motor for one turn: p03-52 must be greater than 128	Set the feedback pulse number of the gantry motor for one turn

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 Bus encoder p03-25 <65535 The drive is recharged

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 again to take effect	The drive is recharged	The drive is recharged

AL.120: Servo ON command invalid alarm

Causes of fault alarm	Fault alarm checking	Disposal measures
When the servo is ON, the power supply input ports R, S and T are NOt powered	Check wiring and input voltage	Check wiring and input voltage

AL.400 Power lines loss phase

Causes of fault alarm	Fault alarm checking	Disposal measures
R.S.T three phases to Driver power supply loss phase	Check wiring and input voltage	Check wiring and input voltage

AL.401: Under voltage

Causes of fault alarm	Fault alarm checking	Disposal measures
Main circuit input voltage lower than rated voltage value or NO input voltage	Check whether the input R,S and T of the main circuit is correct and what the voltage value is. The bus voltage can be monitored through d23.dcp	Ensure proper wiring, use 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 overvoltage alarm still remains	Please send it back to distributor or original factory for maintenance
NO regenerated resistance or regenerated resistance is NOt selected correctly	Verify that p00-30 is set to 0 or 1	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 motor starts	Check if mechanical connection is jammed	Adjusting mechanical structure
Driver hardware failure	Confirm that the mechanical part is still alarming Normally	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	1. Whether the mechanical system is installed 2. Set the acceleration constant too fast 3. Whether the parameters of gain class are set correctly	1. Adjust the gain of the control loop 2. Acceleration and deceleration setting time slows down
Motor connection 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 judgment parameters	Test whether p04-05 (overspeed alarm value) is set reasonably	Set p04-05 (overspeed alarm value) correctly

AL.421: Out of control check out

Causes of fault alarm	Fault alarm checking	Disposal measures
Motor power line U,V,W wiring wrong.	Check the connection	Correct connection
Motor parameters are NOt set correctly	Check P00-05;And encoder parameter setting is correct or NOt	Set parameters correctl In torque mode, set p01-40 to 0 to turn off the out-of-control check out function

AL.430: AbNormal regeneration

Causes of fault alarm	Fault alarm checking	Disposal measures
The regenerative resistance is wrong or NOt connected to the external regenerative resistance	Check the connection status of the regenerated resistance	If the connection is Normal, please return the drive to the factory for maintenance
Parameter setting error	Please confirm the parameter Settings for p00-30, p00-31 and p00-32	Set parameter values correctly

AL.431: Regeneration of overload

Causes of fault alarm	Fault alarm checking	Disposal measures
The regenerative resistance is wrong or NOt connected to the external regenerative resistance	Check the connection status of the regenerated resistance and whether the regenerated resistance value and power are suitable	Select the appropriate regenerative resistance

AL.432: Regenerative short circuit, open circuit

Causes of fault alarm	Fault alarm checking	Disposal measures
Regenerative short circuit	Check port B1/B3 for short circuit	If there is NO short circuit in B1/B3 and the alarm still appears, please return the driver to the factory for maintenance
Regenerative open circuit	Please confirm the parameter Settings for p00-30, p00-31 and p00-32	Set parameter values 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: Delta encoder off-line

Causes of fault alarm	Fault alarm checking	Disposal measures
Delta encoder HallU, HallV, HallW signal exception	Check the encoder wiring	Correct connection

AL.620: Bus encoder off line

Causes of fault alarm	Fault alarm checking	Disposal measures
Bus encoder communication failed	Check the encoder wiring	Correct connection

AL.621: Read/write motor encoder EEPROM parameters are abNormal

Causes of fault alarm	Fault alarm checking	Disposal measures
Encoder read and write exception	Check the encoder wiring,	Correct connection

AL.640: Bus encoder overspeed

Causes of fault alarm	Fault alarm checking	Disposal measures
Bus encoder speed value is more than 6000rpm	Check the encoder wiring Make sure the encoder shield wire is properly connected	Reduce the speed If the connection is Normal, please return the drive to the factory for maintenance

AL 642, AL 643: Bus encoder battery failure

Causes of fault alarm	Fault alarm checking	Disposal measures
When the bus encoder is set to multi-coil absolute value, the external battery voltage is low	Check the external battery voltage of the encoder and confirm that it is higher than 3.0v	replace the battery,

AL.645: ModBus encoder multi-loop overflow fault

Causes of fault alarm	Fault alarm checking	Disposal measures
The number of turns of the bus encoder is out of range	Check if P00-09 is 1 . The multi-turn absolute motor canNOt turn in one direction for a long time.	Clear multiple values using the directive AF_En1

AL.647: Bus-type encoder counts exceptions

Causes of fault alarm	Fault alarm checking	Disposal measures
Separate encoder has big deviation	Check the encoder	Install the encoder correctly

AL943: AbNormal serial communication

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

10 Special function usage

10.1 Gantry synchronization function

10.1.1 Function Description

Large-span machinery NOw basically uses the gantry beam connection mode and is driven by two motors. In order to improve the synchronization of the two axes, the synchronization mode needs to be adopted. The previous synchronization is realized by the upper computer, and the servo is only used as the actuator.The gantry simultaneous control is completely completed by the servo driver. The host computer only performs simple open-loop position control and logic control.

10.1.2 Achieve Gantry function wire diagram

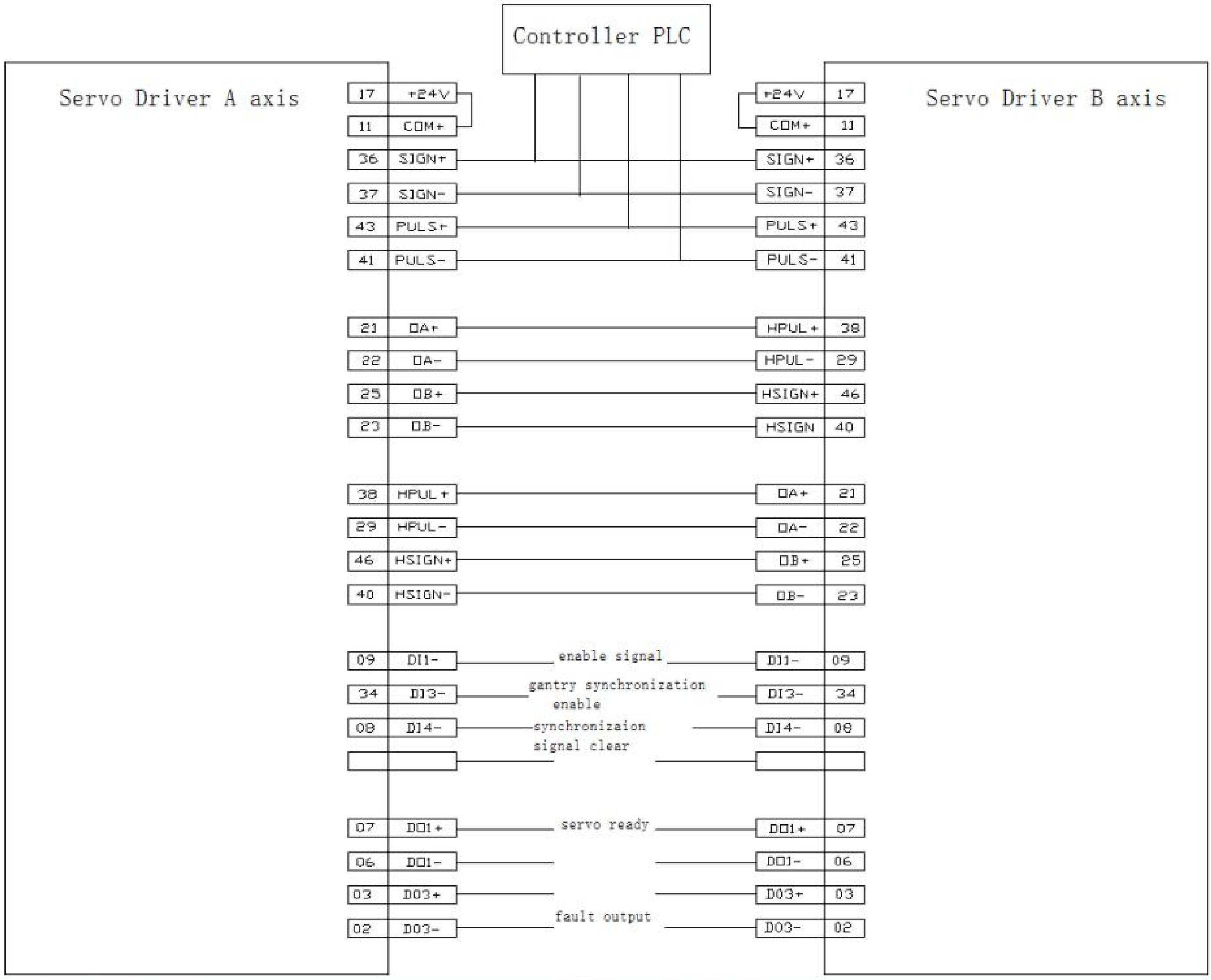


Chart 141 Achieve gantry function wire diagram

10.1.3 Servo basic set and description

Chart 109 Gantry Function basic set and description

Parameter code	Description	Set range
P03-25	absolute encoder motor outputs pulse quantity per rotation	Set range: 0-60000 Setting the value of absolute motor rotates one revolution. it means the quantity of each A and B frequency division pulses output Example: If the setting value is 2048, the A and B

		signals will output 2048 pulses for each motor rotation
P03-50	Gantry function enable	Set range:0-1 Default:0 0: NO this function 1: use gantry function.
P03-51	Gantry function input signal invert	Set range: 0.Default:0 0: NO invert 1: Invert
P03-52	feedback pulses quantity for one revolution of gantry function motor	Set range:0-65535, default: 1000. Ganry function opens, feedback pulses quantity for onerevolustion of driver. NOte: need to set the same value to both synchronization axises.
P03-53	Gantry function position deviation too many setting.	Set range:0-65535, Default:10000 Gantry function position deviation too many setting: (P03-53) *10command unit. It will alarm if the action value exceeded the set value. AL.510(synchronization deviation too big.)
P03-55	Gantry function synchronize position scale gain.	Set range: 0-200 It will improve synchronization to two axises if bigger value was set, reduce deviation. But it will cause vibration and NOise if too big value be set.
P06-01	DI1 Input port function option	DI1 set to 1, servo ON
P06-05	DI3 Input port function option	DI3 set 19, Ganry synchronization function enable
P06-07	DI4 Input port function option	DI4set 20, Ganry synchronization function clear

10.1.4 Synchronization set ON

After the above gantry synchronization parameter setting is completed, observe the feedback pulse amount of the other axis through d03.C.PE to determine whether the gantry synchronization wiring is correct. If the pulse wiring is correct, then enterinto the synchronization setting step ON.

SynchroNOusly open parameter settings:

P03-50 Set 1: Gantry simultaneous motion enable

This parameter is set to gantry synchroNOus enable. In this mechanical system, the enable signal is given by the host computer. The steps are:

After power on, it can be aligned through the homing mode or manually. After completion, the gantry synchronization function is enabled, and the simultaneous deviation is cleared, and then the servo drive enters the gantry synchroNOus operation state.

10.2 Home position return function

10.2.1 Functional description

Home point: The mechanical home point, which can stand for the home point switch switch or the Z signal position of the motor, which is set by the function code P03-61

Zero point: It is the target point, which can be expressed as the home point + offset (set by P03-69/P03-70). When P03-69/P03-70 is set to 0, the zero point coincides with the home point.

The homing function refers to the position control mode, when the servo enable is ON, after the homing function is triggered, the servo motor will actively find the zero point and complete the positioning function.

10.2.2 Servo basic settings and description

Table 110 Basic settings and description of the homing return function

Parameter code	Description	Setting Range and description
P03-60	Homing return enable control	Set range:0-6, Default: 0 Set homing return mode and trigger signal source 0: close homing return mode 1: Starts homing return mode immediately after power on. 2: Starts homing return mode immediately 3: Start electrical zero command 4: Set the local position as homing point.
P03-61	Homing return model	Set range:0-9, Default:0 During homing return operation, set the control signal source for the zero position return direction, deceleration point, and the home point. 0: Return to zero in positive direction, deceleration point and home point are home point switches 1: Return to zero in reverse direction, deceleration point and home point are home point switches 2: Return to zero in positive direction, deceleration point and home point are motor Z signal. 3: Return to zero in reverse direction, deceleration point and home point are motor Z signal. 4: Return to zero in positive direction, deceleration

		point is home point switche, and home point is Z signal. 5: Return to zero in reverse direction, deceleration point is home point switche, and home point is Z signal. 6: Return to zero in positive direction, deceleration point and home point switche are forward overtravel switches. 7: Return to zero in reverse direction, deceleration point and home point switche are reverse overtravel switches. 8: Return to zero in positive direction, deceleration point is forward overtravel switche, and home point is Z signal. 9: Return to zero in reverse direction, deceleration point is reverse overtravel switche, and home point is Z signal.
P03-65	The Speed when searching for origin switch_high speed	Setting range: 0-3000, Default:100 When setting the home point return to zero, search the high-speed value of the deceleration point signal. When electrical return to zero, the motor always runs at high speed of P03-65.
P03-66	The Speed when searching for origin switch_low speed	Setting range: 0-1000, default:10 Setting the low-speed value when home point return to zero and search the home point. The setting speed value should be low eNOugh to prevent mechanical shock during shutdown.
P03-67	Search home switch acceleration/deceleration time	Set the time for the motor to change from 0 to 1000 rpm when the home point return. Unit: MS.
P03-68	Maximum searching home point time limit	Limit the total time of homing, and alarm AL.551 (back-to-home time-out fault) will occur if its time out.
P03-69	Mechanical homing offset H	Set the high and low values of the absolute position of the motor after homing. Calculation method of total offset: Offset=(P03-69)*65535+(P03-70)
P03-70	Mechanical homing offset L	
P06-01	DI1 input port function option	DI1 set: 1, servo: ON
P06-05	DI3 input port function option	DI3 set:3, Positive overtravel signal input
P06-07	DI4 input port function option	DI4 set:4, Reverse overtravel signal input
P06-09	DI5 input port function option	DI5 set:21, Home point switch signal

P06-11	DI6 input port function option	DI6 set:22, Home point return start signal

10.2.3 Precautions for Return to Home point

If the deceleration point signal is valid and the home signal is valid without decelerating sufficiently, the final positioning may become unstable. Fully consider the displacement required for deceleration, and then set the deceleration point and the origin signal input position. The acceleration/deceleration time of searching for the home point (P03-67) and the speed_high speed (P03-65) of searching for the home switch will also affect the positioning stability, and therefore should be considered when setting.

10.3 Absolute encoder use

10.3.1 Function description

Using a servo motor with an absolute encoder, an absolute value detection system can be constructed by the host device. The absolute value detection system eliminates the need to perform a return-to-origin operation every time the power is turned on. This function is based on Modbus or CANOpen communication to read the absolute encoder turns and position data, and the host device processes and controls the related functions of the absolute encoder.

10.3.2 Basic settings and description of servo based on bus communication

When a system using an absolute encoder is put into use, it is necessary to initialize the number of rotations (the AF-En0 absolute encoder multi-turn value is cleared). Therefore, an alarm related to the absolute encoder will occur when initialization is required such as when the power is turned on for the first time. By setting (initializing) the absolute encoder, after executing the rotation number data initialization, the alarm related to the absolute encoder will be cleared.

Table 111 Basic settings and description of servo based on bus communication

Parameter code	name	Set range and description
P00-23	Slave address	Set range:0-255, Default:1 Set value according to device requirement.
P00-07	Encoder selection	Set range: 0-3, Default:3 0、1: incremental encoder; 2:; Single-turn absolute encoder encoder

		3: Multi-turn absolute encoder encoder

10.3.3 Absolute encoder related alarm processing

Table 112 Absolute encoder related alarm processing

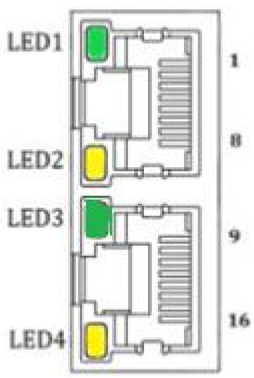
Alarm code	Cause of fault alarm	Fault alarm check	Disposal measures
AL.640	Bus encoder overspeed	Appears on first use	Clear the alarm via AF-EN0 (see parameters and functions for details)
AL.642 AL.643	When the bus encoder is set to multi-turn absolute value, the external battery voltage is low	Check the voltage of the encoder external battery and confirm that it is higher than 3.0V	Replace the battery and clear the alarm through AF-EN0 (see parameters and functions for details)
AL.644 AL.645	AbNormal reading of multi-turn data, or multi-turn data greater than 32767	Check d21.ASH (see parameter and function for details)	If the multi-turn value is greater than 32767, clear the multi-turn data through AF-EN1 (see parameters and functions for details)
AL.930	Absolute encoder battery fault	Check the voltage of encoder external battery	Replace the battery and clear the alarm through AF-EN0 (see parameters and functions for details)

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; LED2 is Yellow, “DATA OUT” status; LED3 is Green , “RUN” status; LED4 is Yellow, “DATA IN” status;			

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

Table 15 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:

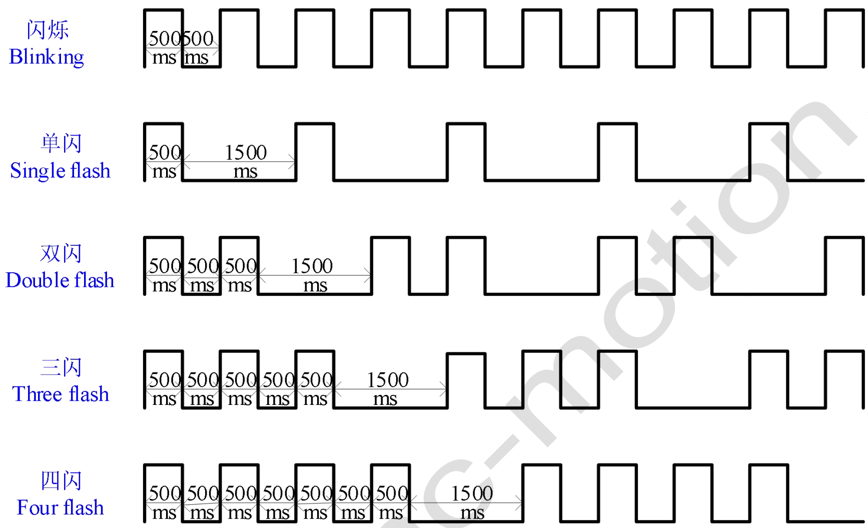


Chart 30 Indicator flashing state chart

➢ EtherCAT Schematic diagram of bus network wiring

Chart 31 EtherCAT Schematic diagram of bus network wiring

➢ RS232 Communication interface definition

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:

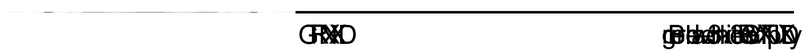


Chart 32 The definition of RS232 communication cable interface between JMC driver and host computer

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:

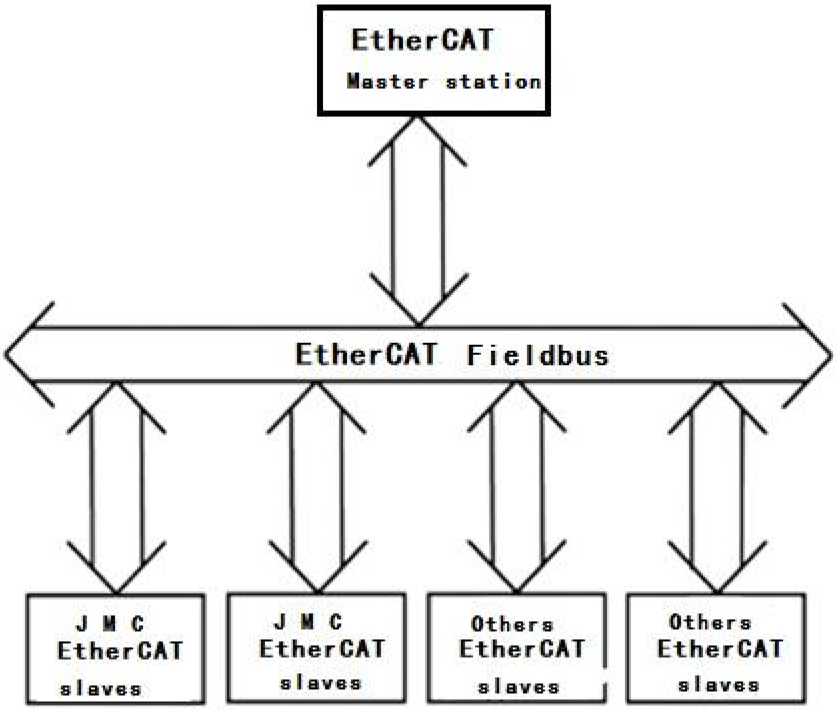
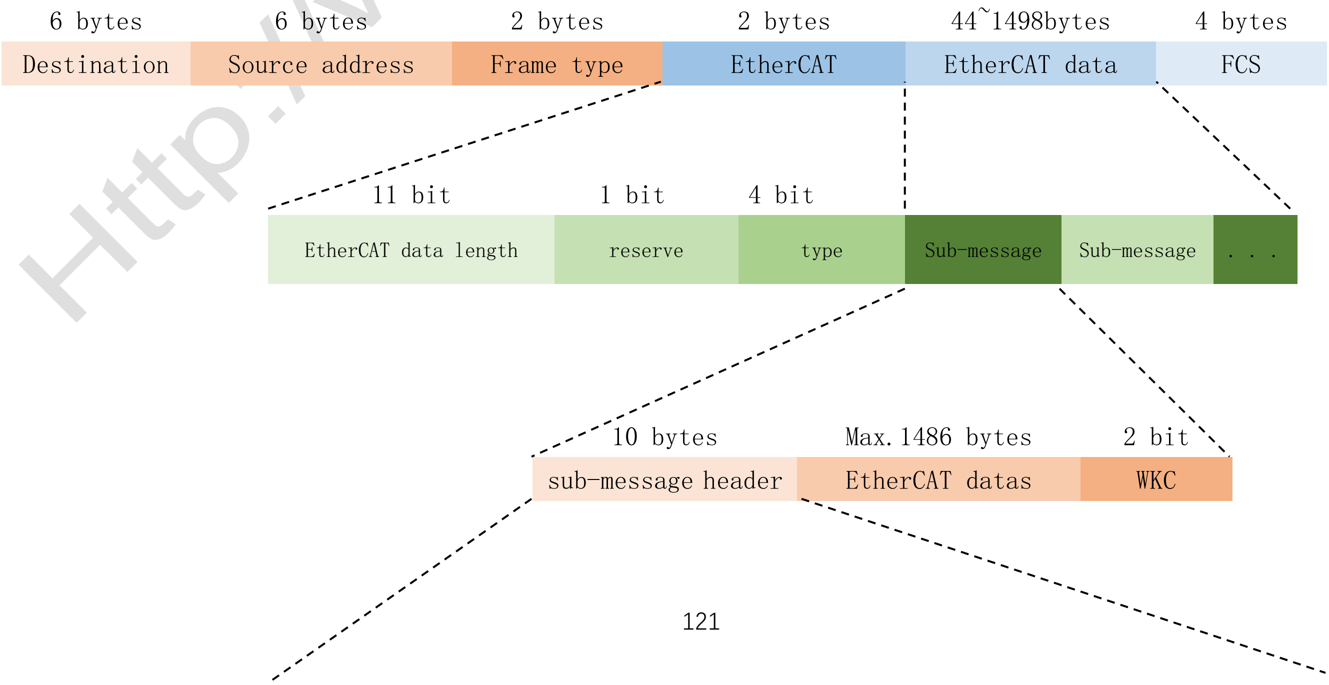


Chart 145 JMC CANOpen compatibility diagram

➢ 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:



8 bit	8 bit	32 bit	11 bit	4 bit	1 bit	16 bit
command	index	Address area	length	R	M	state bit

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 16 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 17 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;

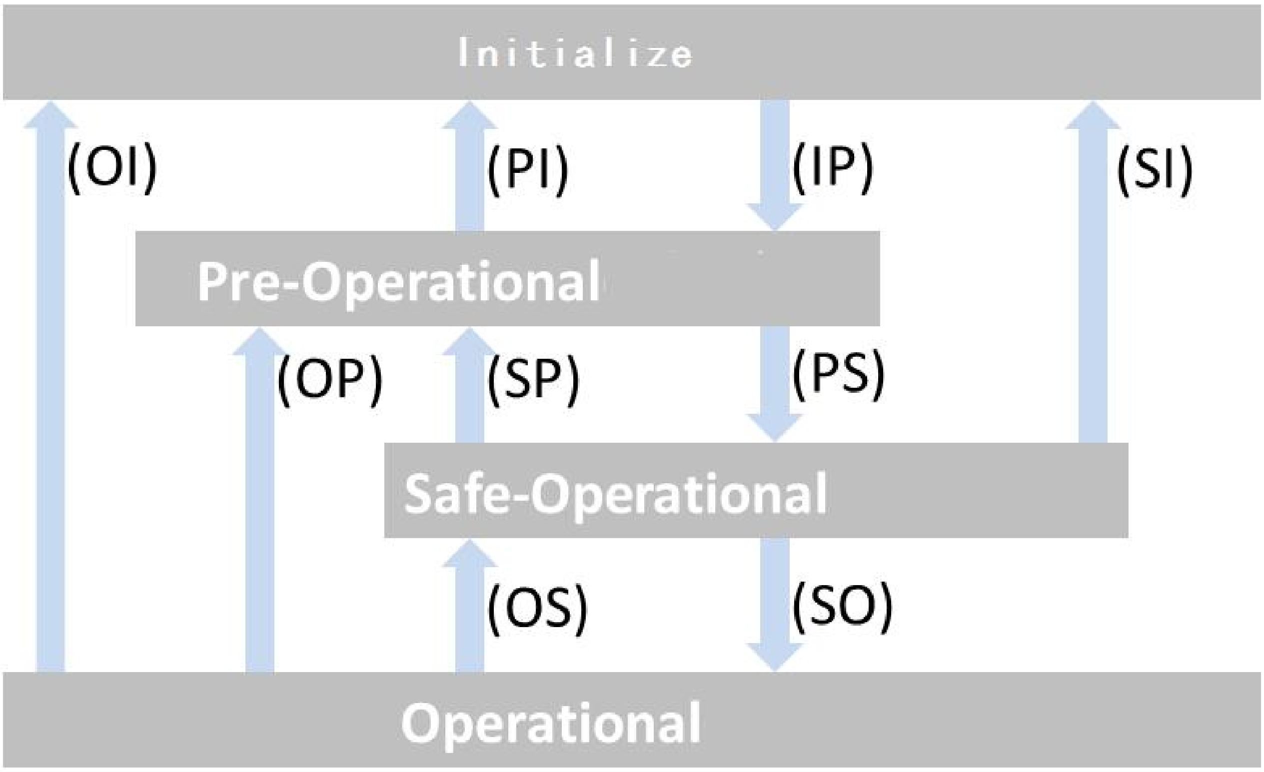


Chart 33 EtherCAT Block diagram of state machine transition operation

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.

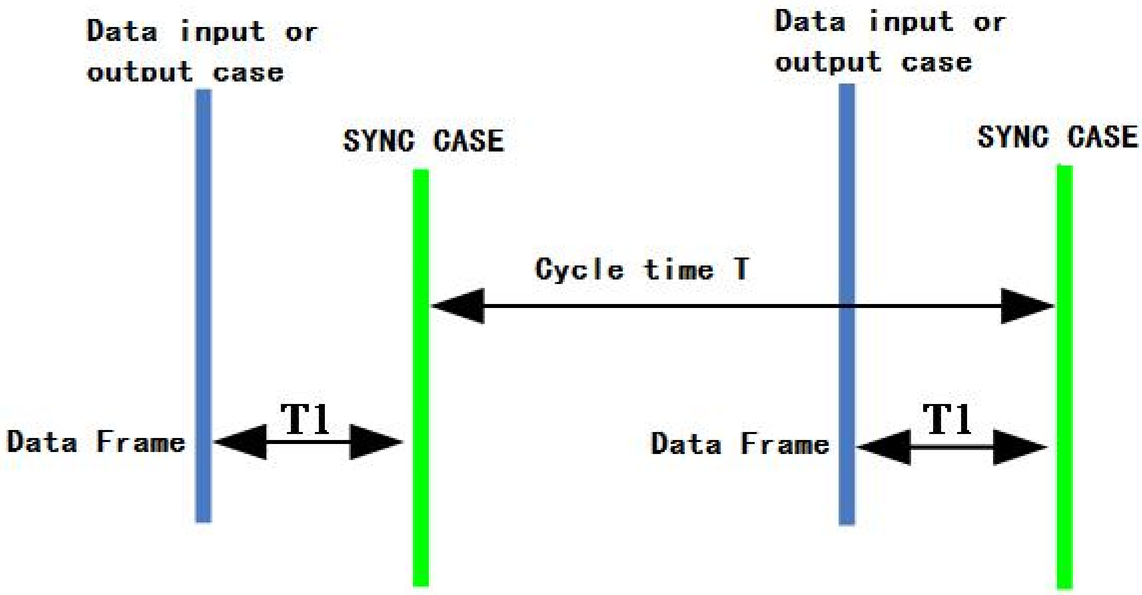


Chart 148 SynchroNOus mode

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).

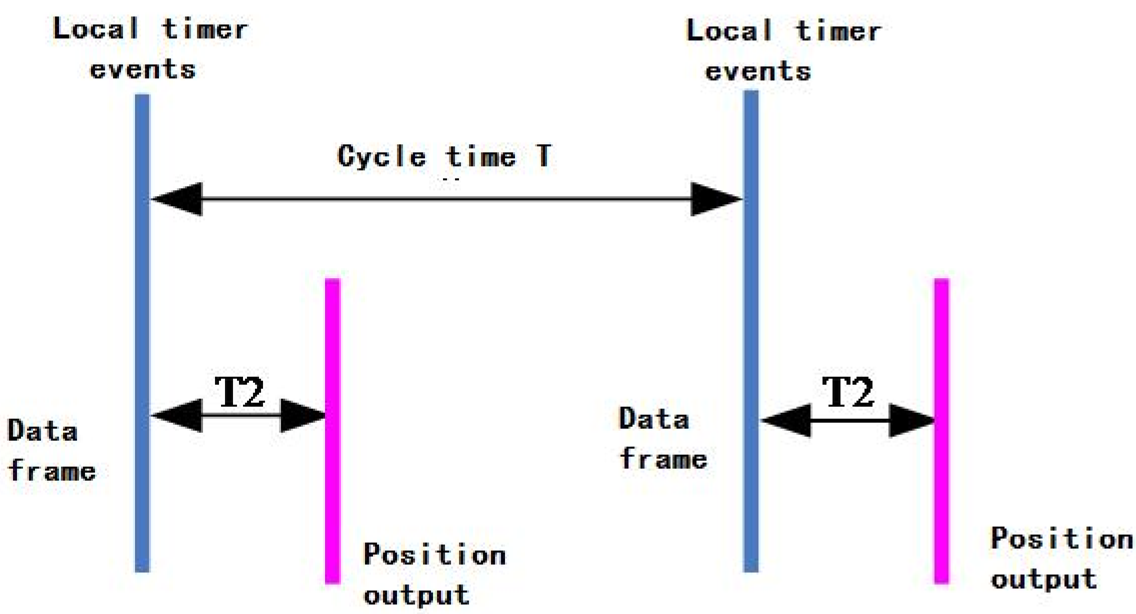


Chart 149 Free run mode

➢ 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.

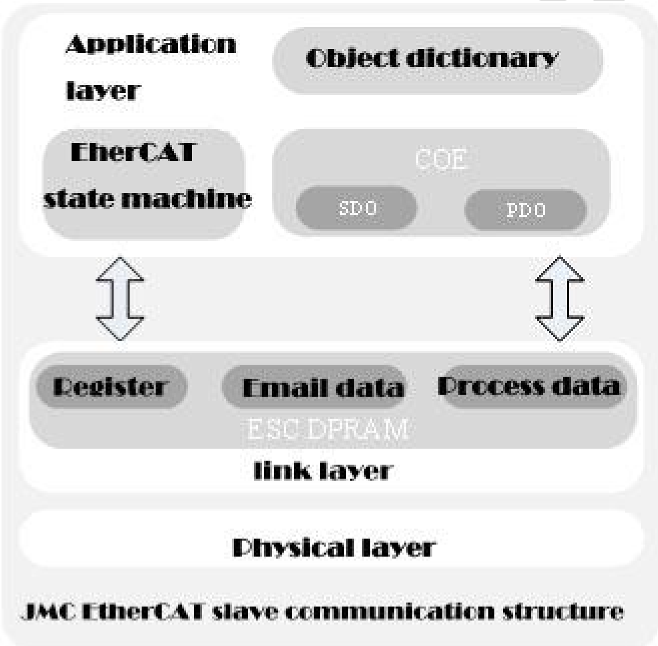


Fig150. EtherCAT communication structure of slave station

Table 18 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 communication

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.

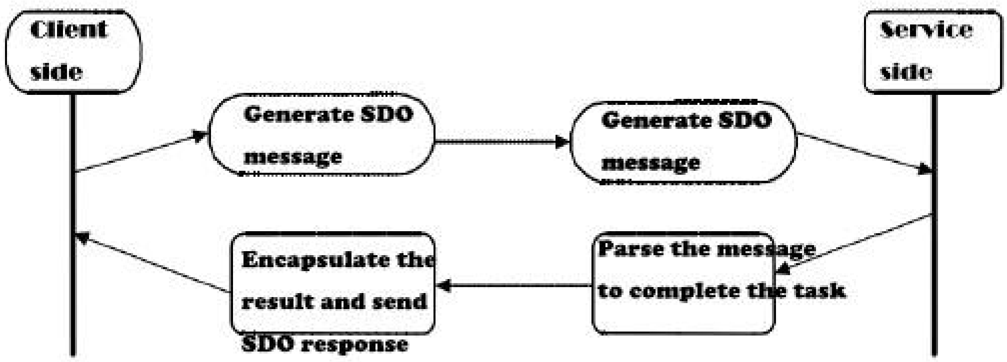


Fig 151 SDO communicate mode

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 19 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.

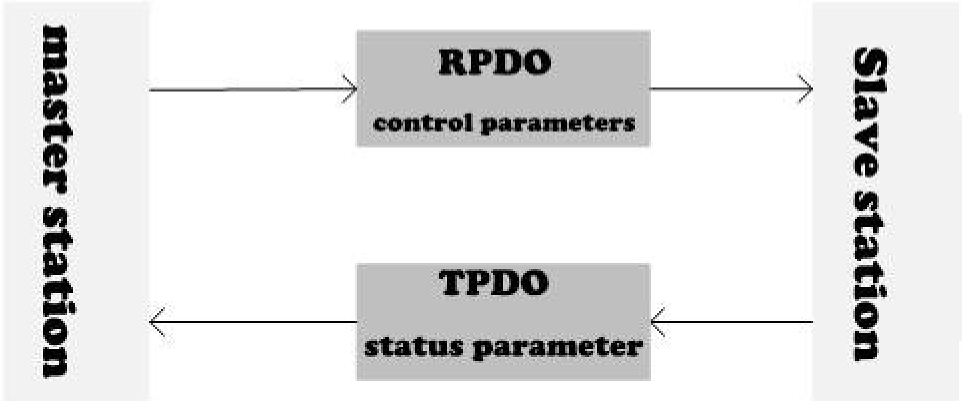


图 34 PDO data transport

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 20 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 21 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
RPDO0 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
RPDO1 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
RPDO2 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
RPDO3 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
TPDO0 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
TPDO1 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 22 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 23 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

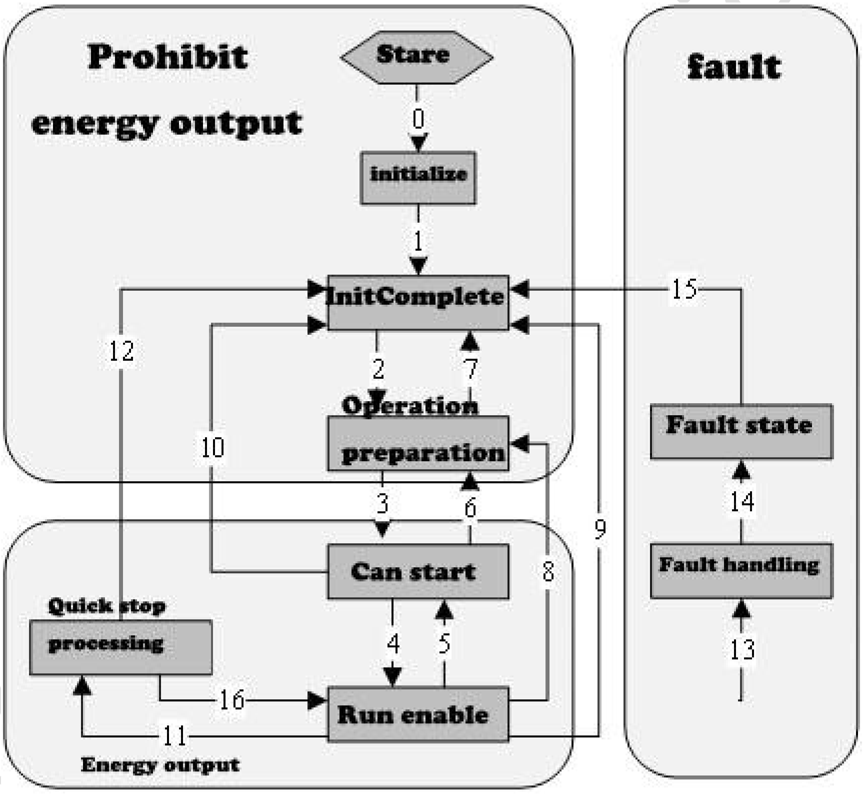


图 35 CiA402 协议状态机

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:

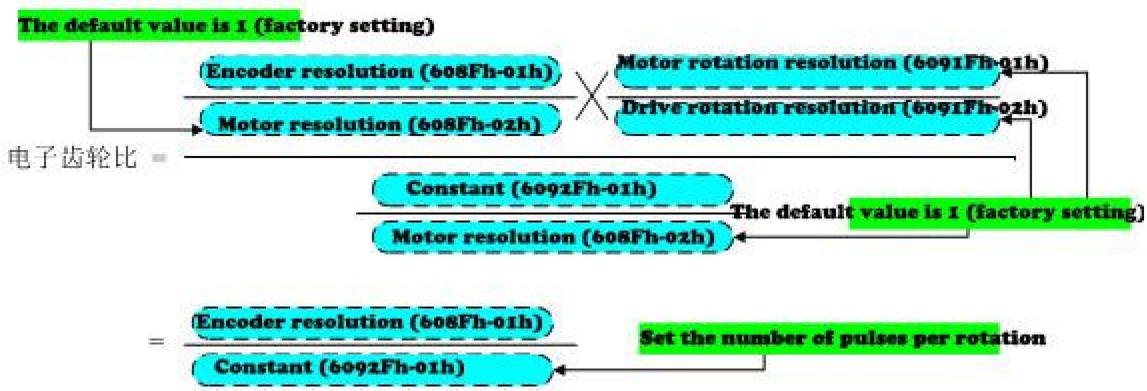
The electronic gear ratio is effective in the range of 1000 ~ 1 / 1000 times. If the value exceeds the range, abNormal protection will occur.

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)



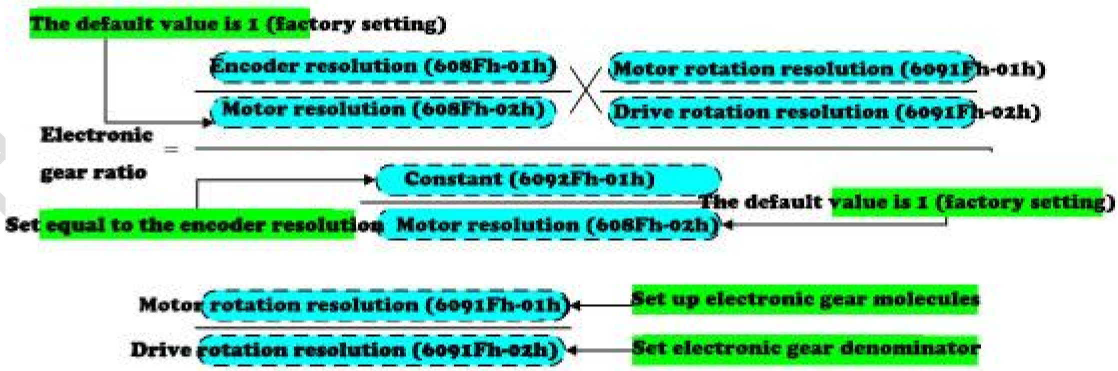
3)

图 36 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 24Equipment 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 Bits 16-31: additional information NOte: cos: tpdo detects the change of its state					

0x1001 Error register

The error registers are described in the following table:

Chart 25Error 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 Bit 1: current error Bit 2: voltage error Bit 3: temperature alarm				

Bit 4: communication error
Bit 5: out of tolerance alarm (step servo driver)
Bit 6: reserved (default 0)

Bit 7: motor phase loss (stepper servo driver)

0x1008 Equipment name

The device name object is described in the following table:

Chart 26 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 description of the device hardware version number object is shown in the table below:

Table 27 Equipment Hardware Version Number 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 28 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:

Chart29 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

Product code bit 0-31: Manufacturer defined code

Version number 0-15: Revision NO

Bit 16-31: Major revision number

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 30Wrong 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 31 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 32 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 33 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 34 RPDO Mapping parameters 0x1603

object type	NO. of sub-index
record	5

0x1603 RPDO Mapping parameters

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 35 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	UNSIGNDE32	Read&write	NO	0x60BB0020

	edge value				
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:

Chart36 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 37 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 38 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	UNSIGNED8	read-only	NO	3

	type				
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	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-write	NO	1
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

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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 39 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 When Bit8=1: Decelerate 1: When Bit8=0: reaching the target speed When Bit8=1: the speed is 0	PV
		Reach home position	0: When Bit8=0: the target speed is NOt reached When Bit8=1: Decelerate 1: When Bit8=0: reaching the target speed When Bit8=1: the speed is 0	HM
	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 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	CSP,CSV,PP,PV

			1: Fault due to excessive position deviation	
		Zero return error	0: NO error occurs when returning to zero 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. 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. 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.

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 of	Attributes	PDO	Defaults

type	data		mapping	
				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

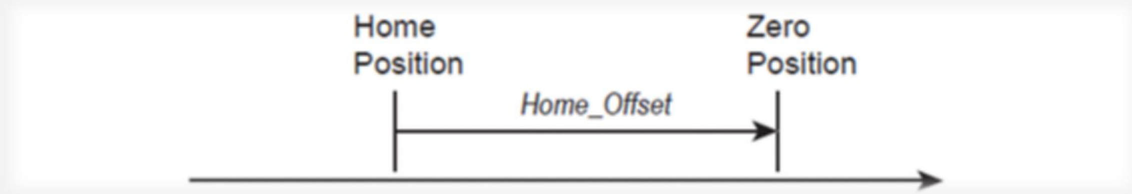
0x607C Zero offset

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	YES	0

		andwrite		
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 40 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	RPDO2	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	RPDO3	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	TPDO3	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.

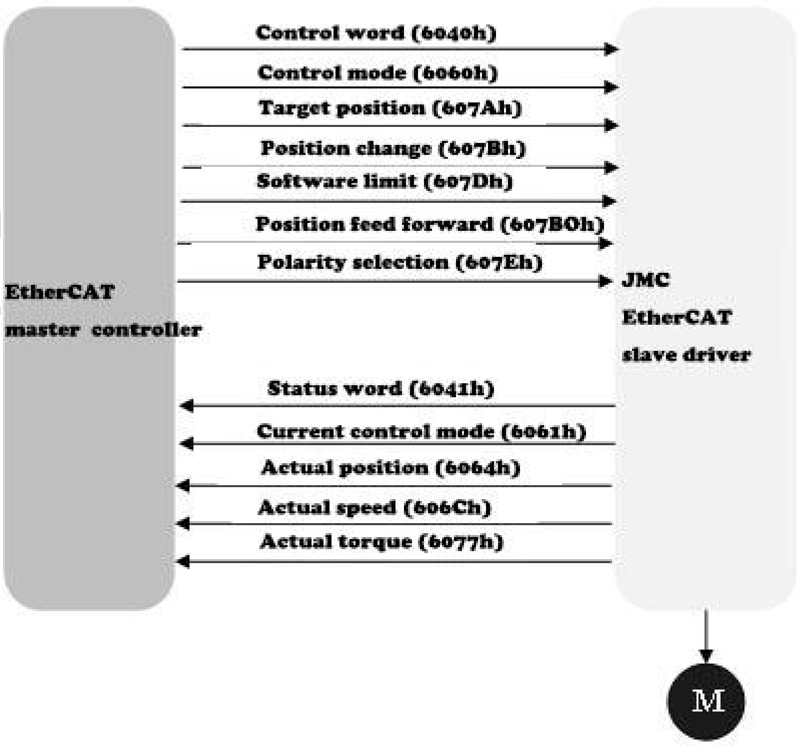


Figure 157 Cycle synchronization position mode control diagram

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 1: The target position is reached
11	Internal software limit trigger	0: Neither the position command NOr position feedback exceeds the limit 1: Position command or position feedback overrun
12	Follow from the station	0: Slave NOt running position command 1: Slave is executing position command
13	Following error	0: NO excessive position deviation fault 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.

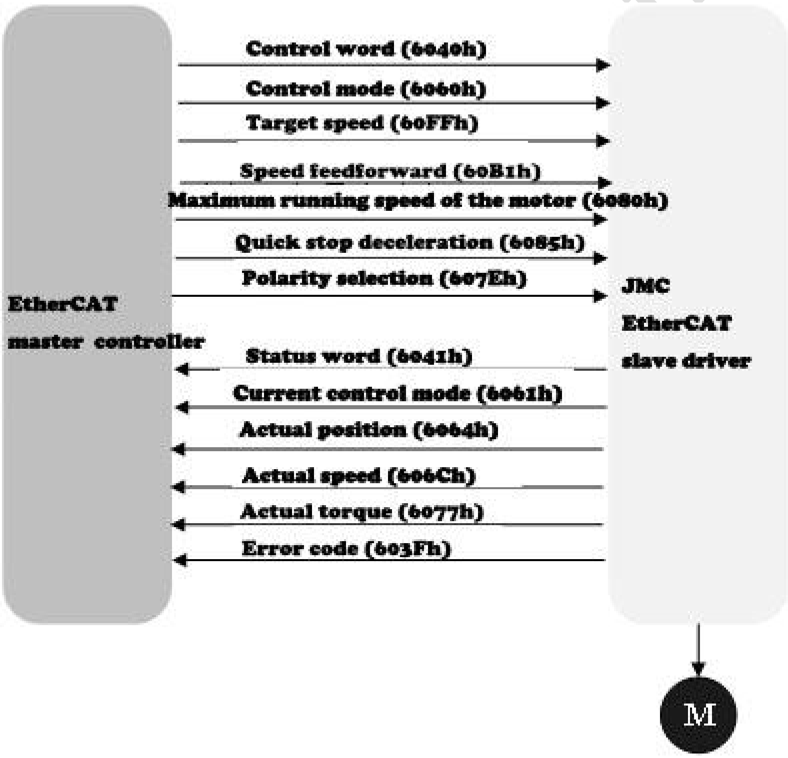


Figure 158 control chart of periodic synchroNOus speed mode

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 41 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 42 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.

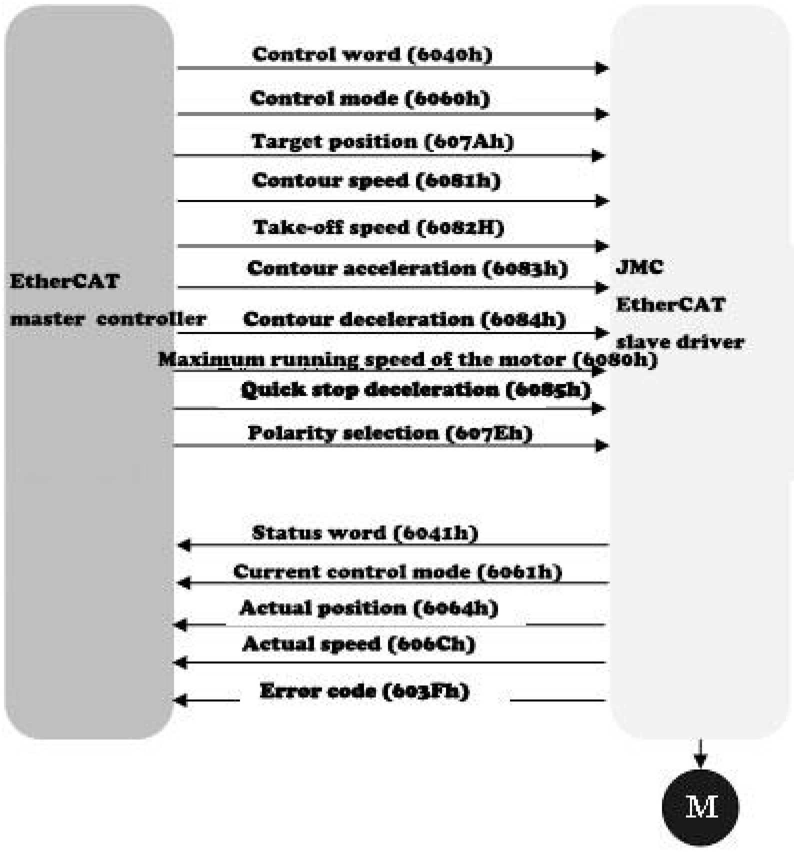


Figure 159 Contour position mode control chart

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	0: absolute position command 1: relative

	position/relative position	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 1: The target position is reached
11	Internal software limit trigger	0: Neither the position command NOr position feedback exceeds the limit 1: Position command or position feedback overrun
12	Target location update	0: The target position can be updated 1: The target location canNOt be updated
13	Following error	0: NO excessive position deviation fault 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:

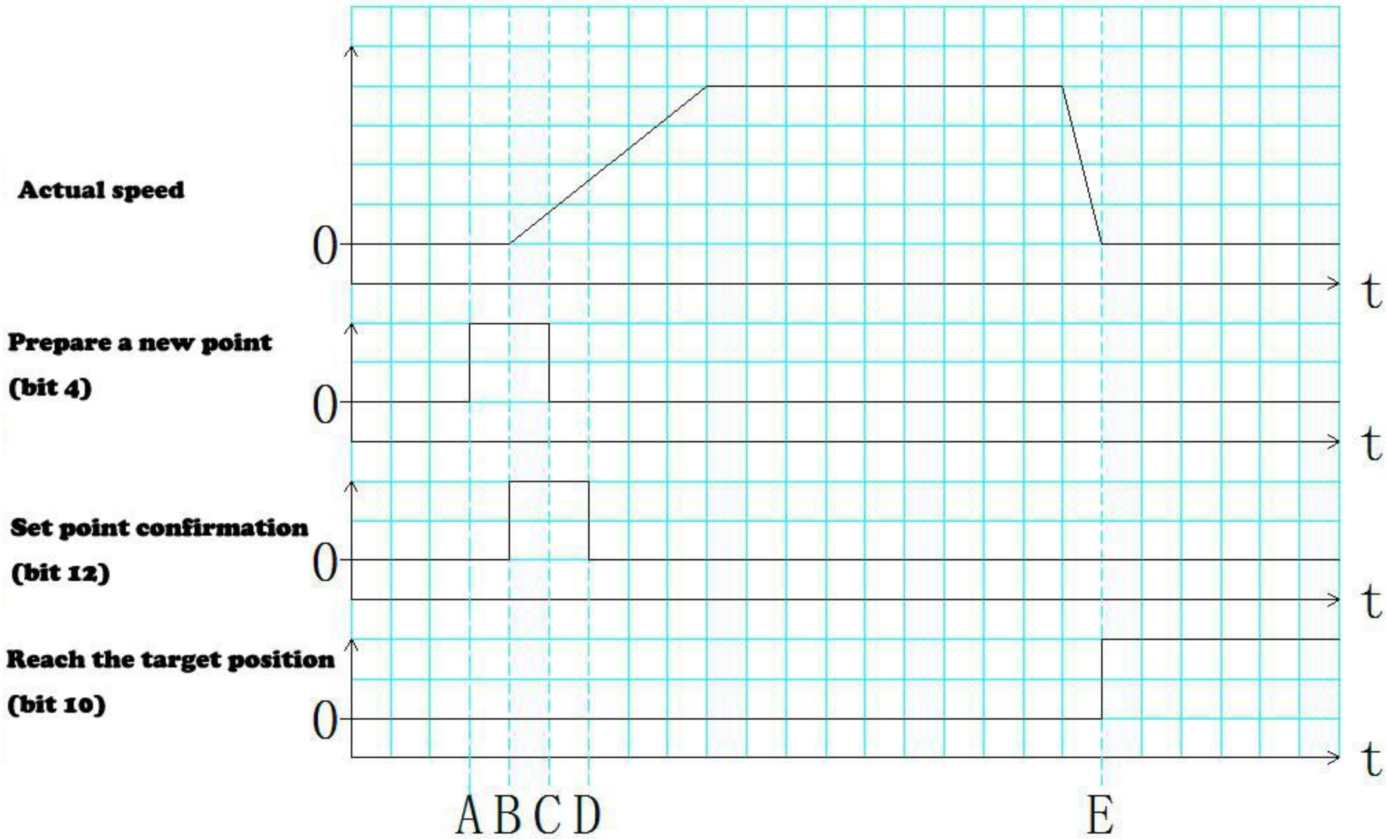


Figure 160 Single point motion

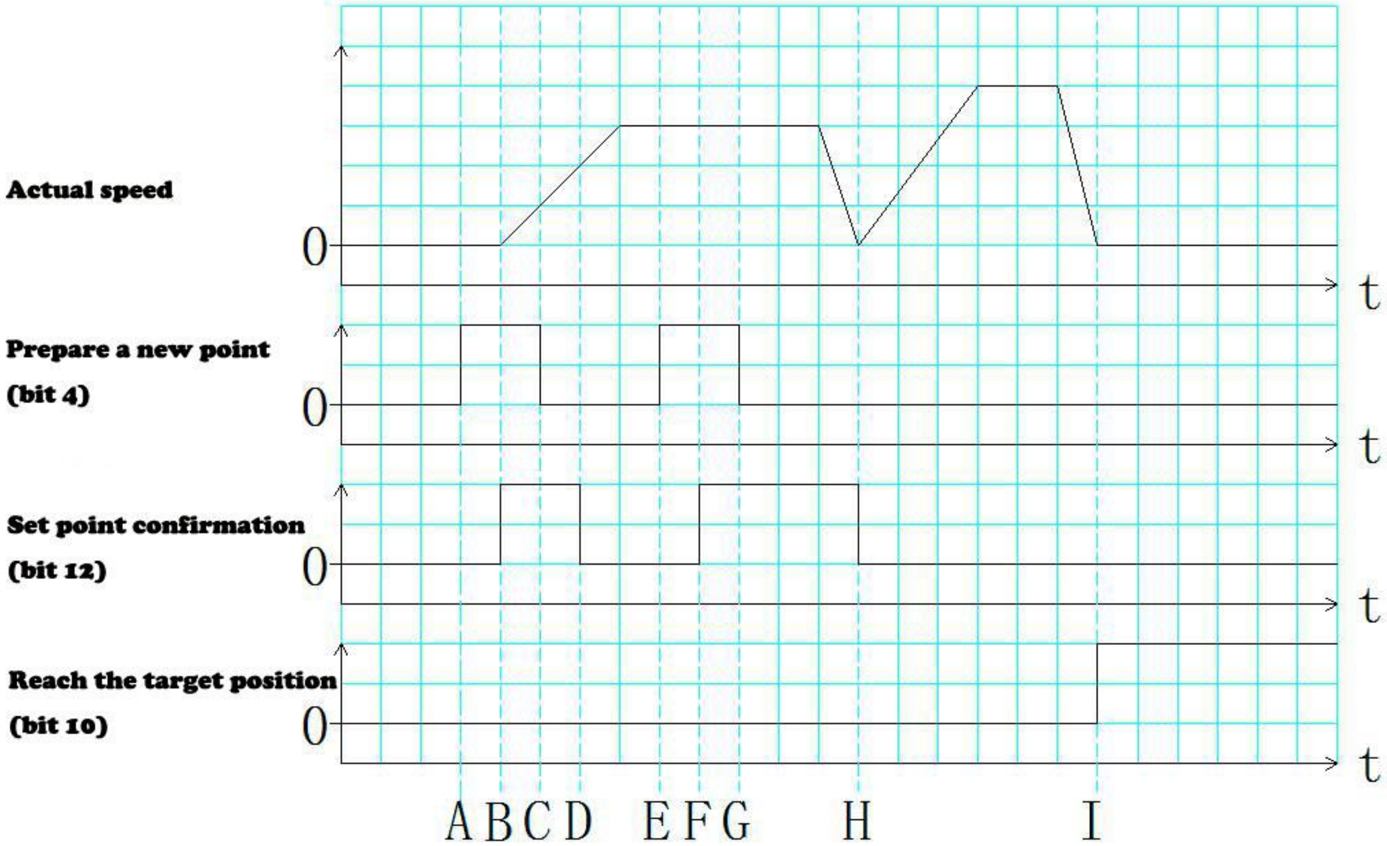


Figure 161 Multi-point motion, stop between positions

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

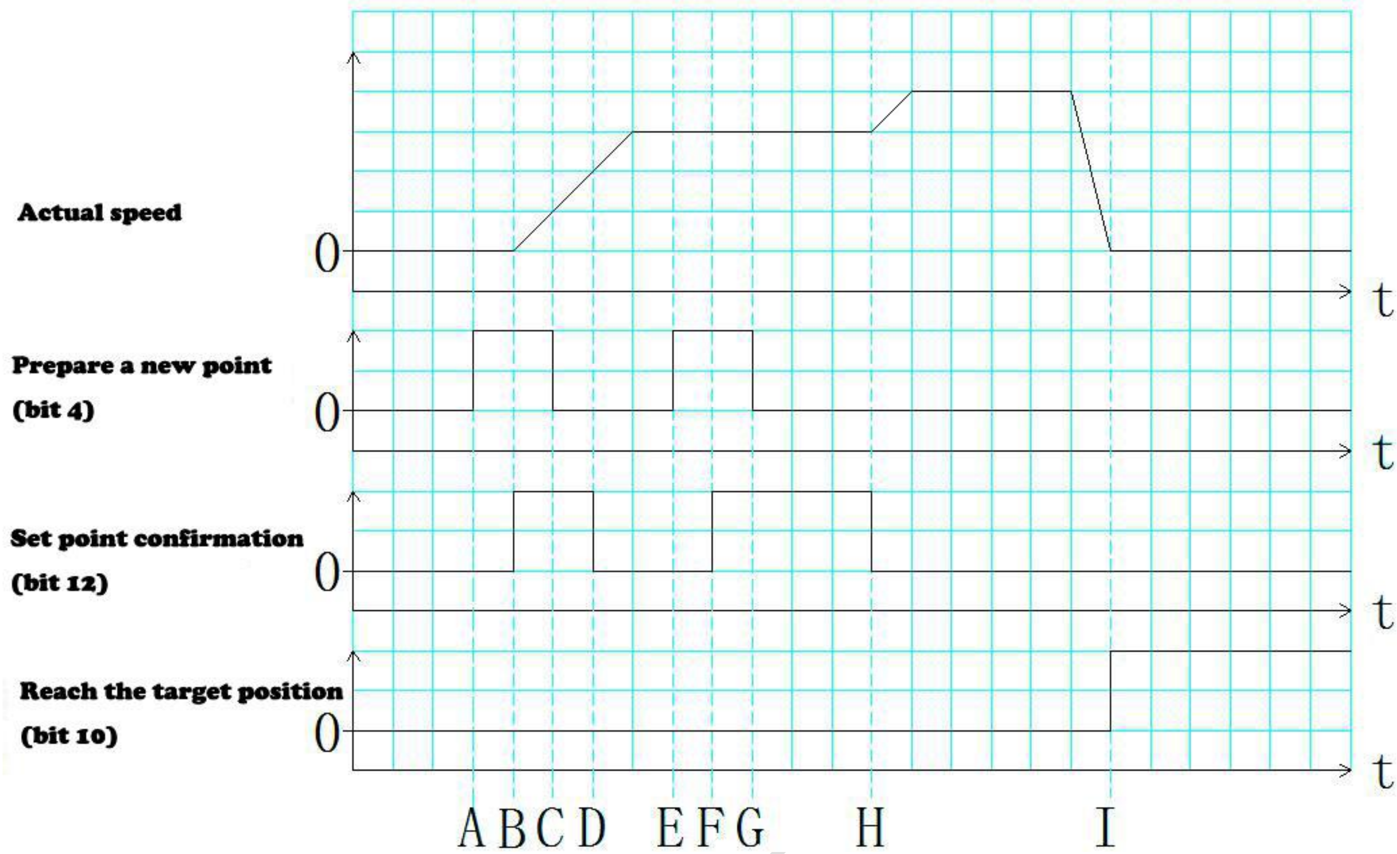


Fig. 162 Multi-point movement without stopping between points

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.

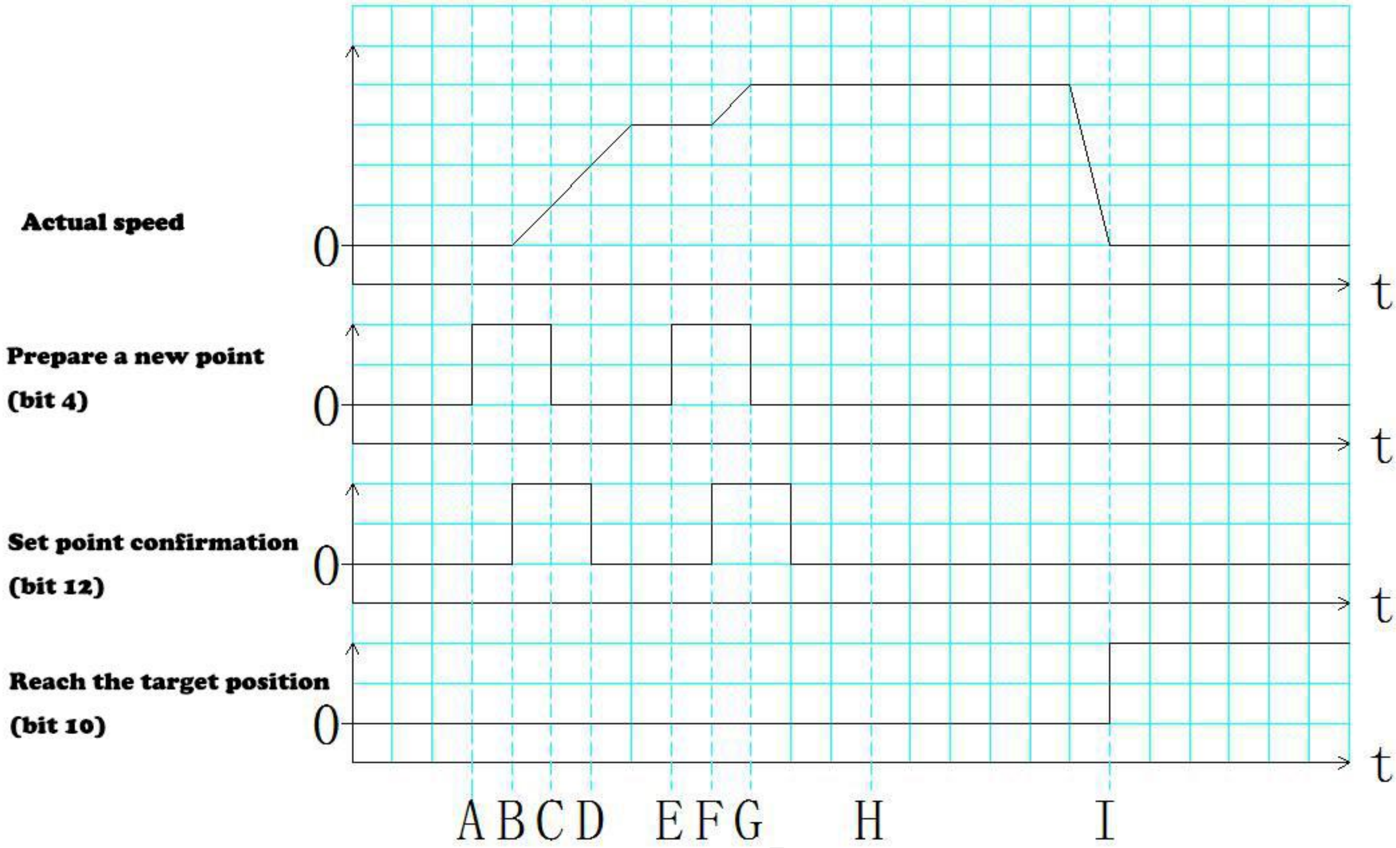


Figure 163 Multi-point motion, after setting the second point, switch directly to the speed of the second point

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	Optional

	display	
	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.

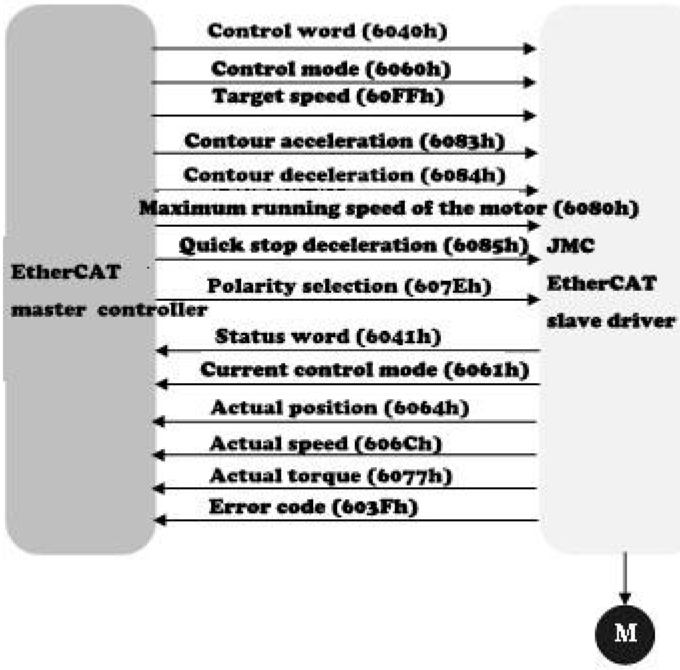


Figure 164 Contour speed mode control diagram

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 word	VAR	RO	U16	Y	0x0040

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.

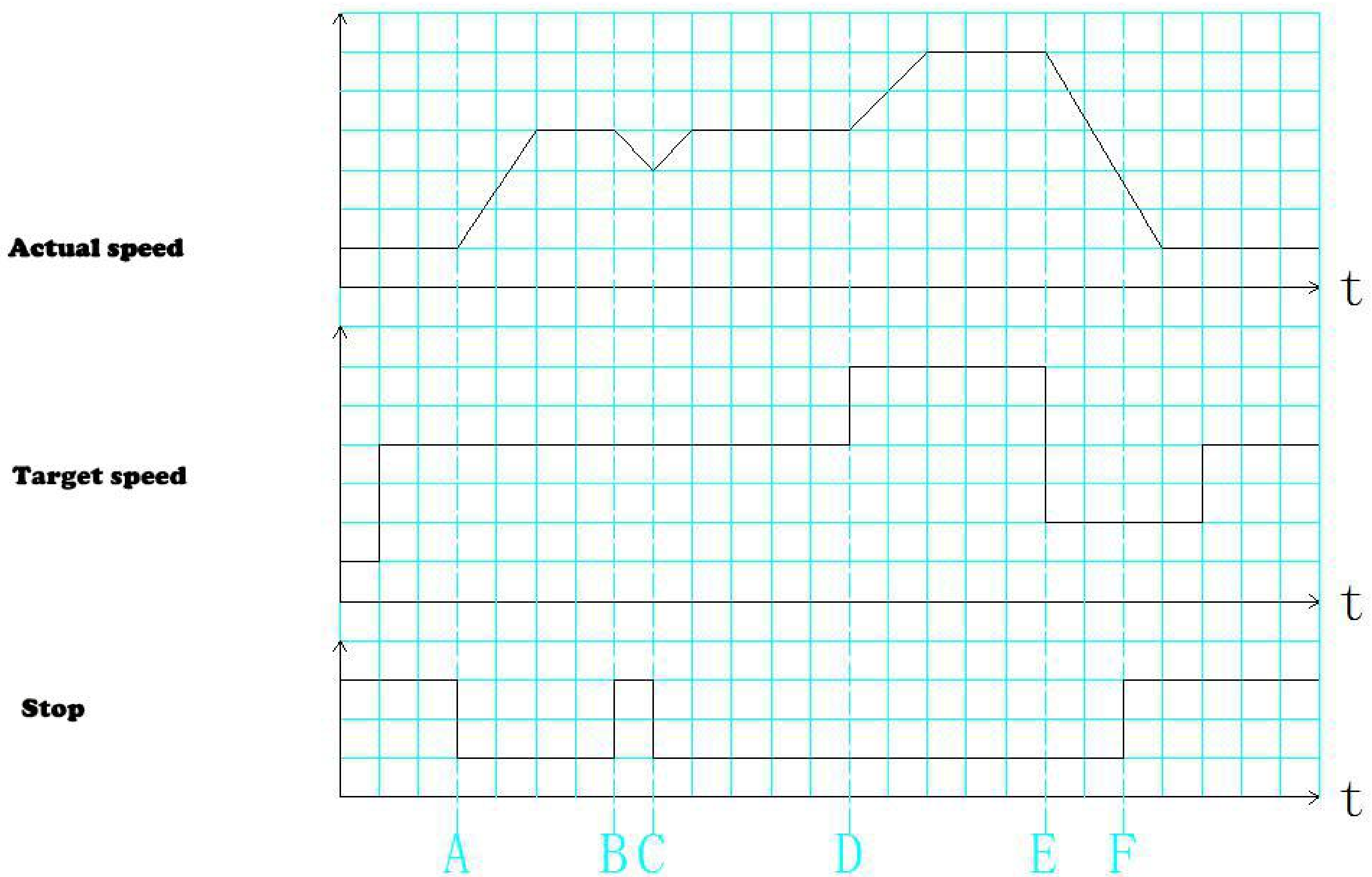
Table 269 Contour deceleration 6084h

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

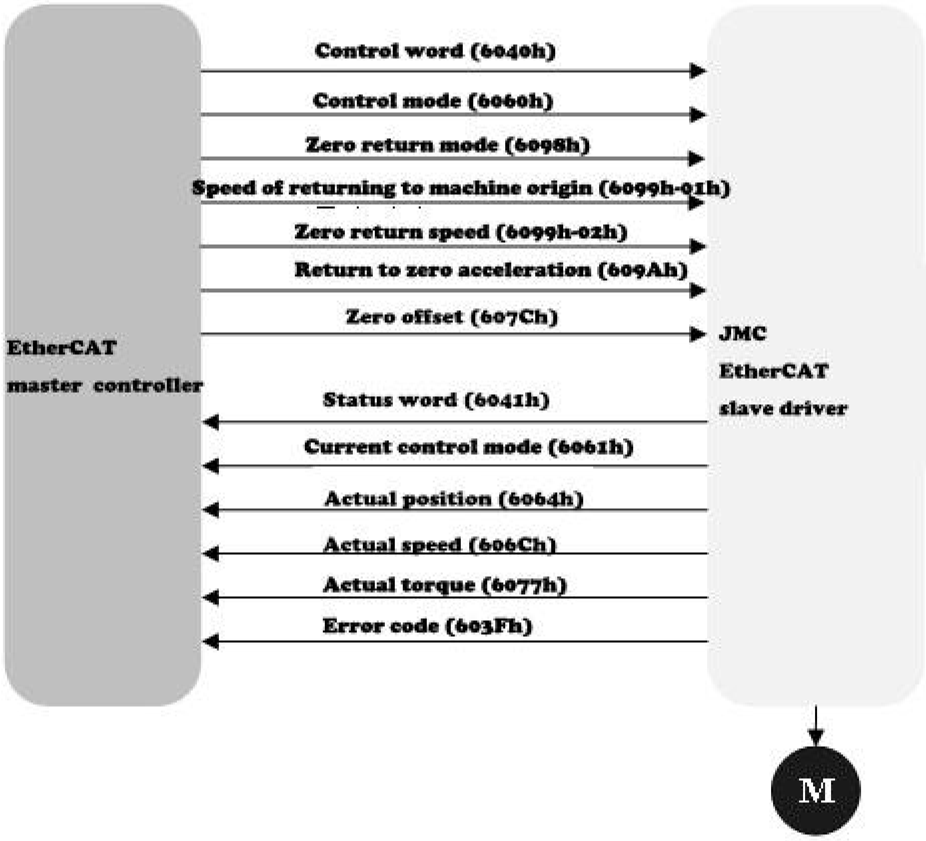


Figure 165 control chart of return to zero model

1. Introduction to the related object dictionary

Chart 43 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 44 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 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 45 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

<table>
<tr><th>Bit</th><th>Bit definition</th><th colspan="2">Description</th></tr>
<tr><td rowspan="4">10</td><td rowspan="4">Return to zero position</td><td rowspan="2">0</td><td>Bit8=0:Return to zero position NOt reached</td></tr>
<tr><td>Bit8=1:Slow down</td></tr>
<tr><td rowspan="2">1</td><td>Bit8=0:Return to zero position</td></tr>
<tr><td>Bit8=1:Speed is 0</td></tr>
<tr><td>12</td><td>Zero return complete</td><td colspan="2">0: Homing incomplete 1: Homing complete</td></tr>
<tr><td>13</td><td>Return to zero error</td><td colspan="2">0:Zero return without error 1:Over tolerance fault occurred in the process of returning to zero</td></tr>
</table>

Chart 46 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 47 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 48 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 49 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 50 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 51 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

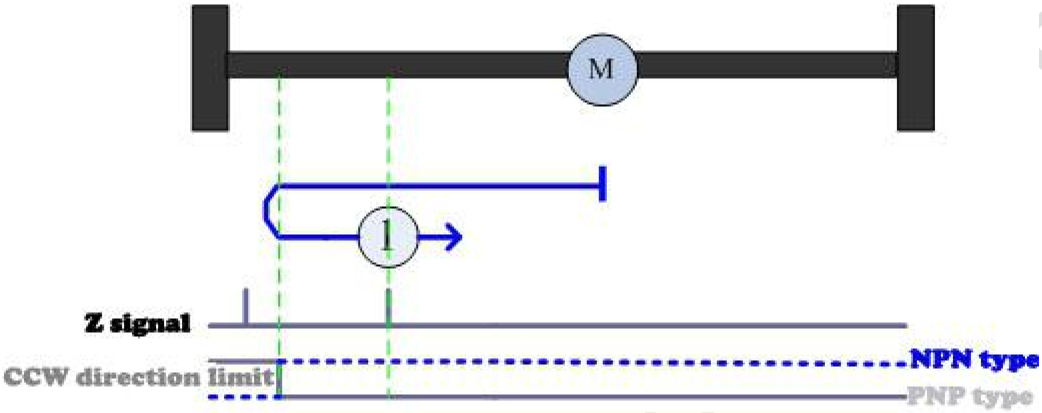
In cia402 protocol, there are 36 kinds of return to zero modes, each of which has a different trajectory curve. Users can choose the return to zero mode by setting the return to zero mode for 6098h according to their own needs.

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



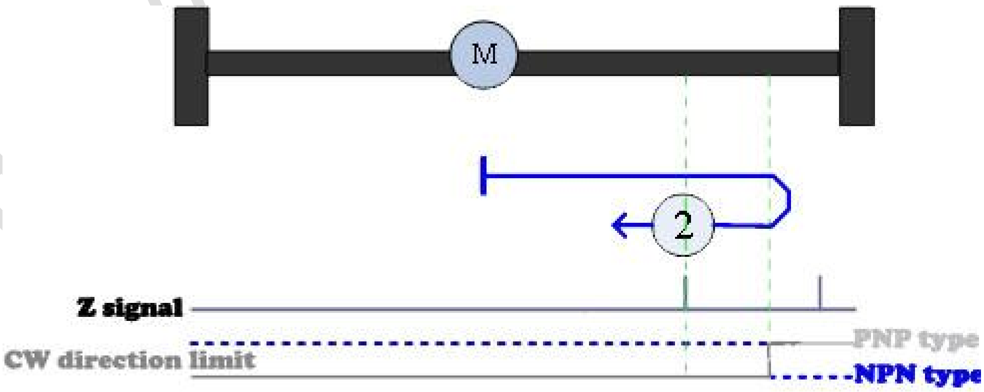
return.

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.

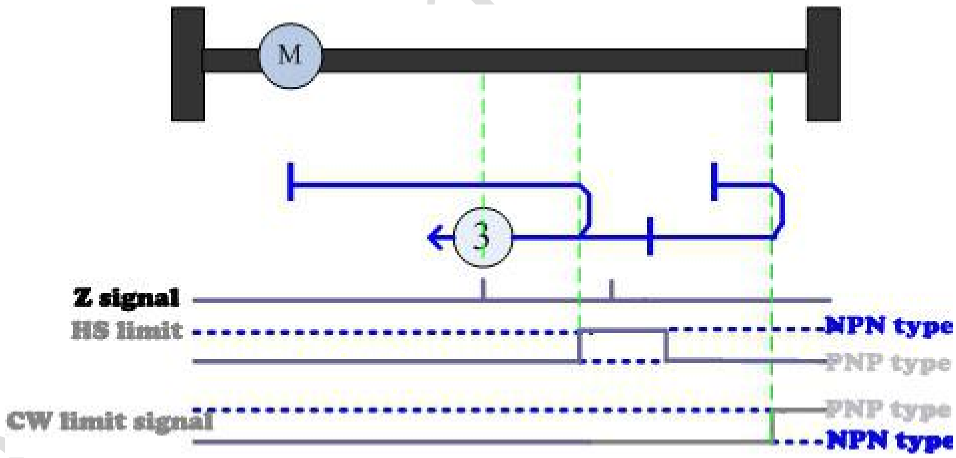


Figure 168 schematic diagram of JMC EtherCAT slave station return to zero mode 3

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;

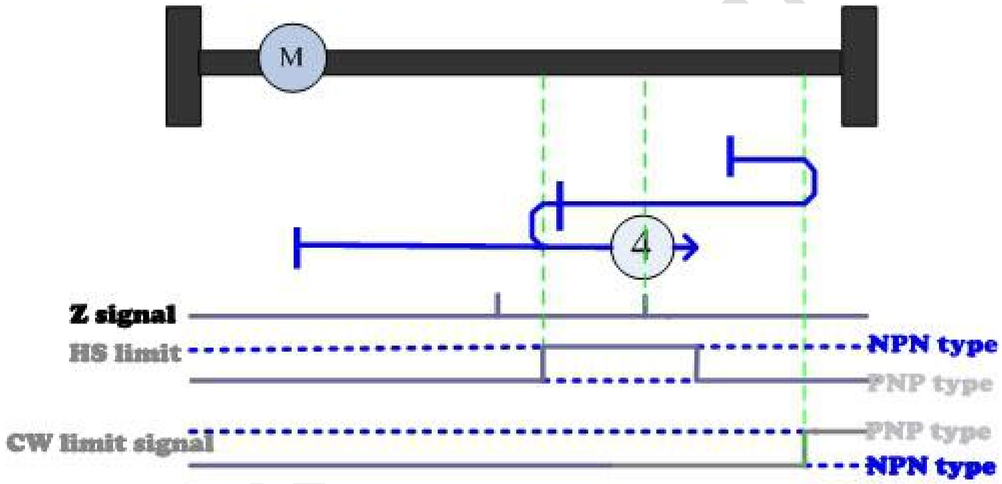


Fig. 169 schematic diagram of four track of JMC EtherCAT slave station returning to zero mode

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;

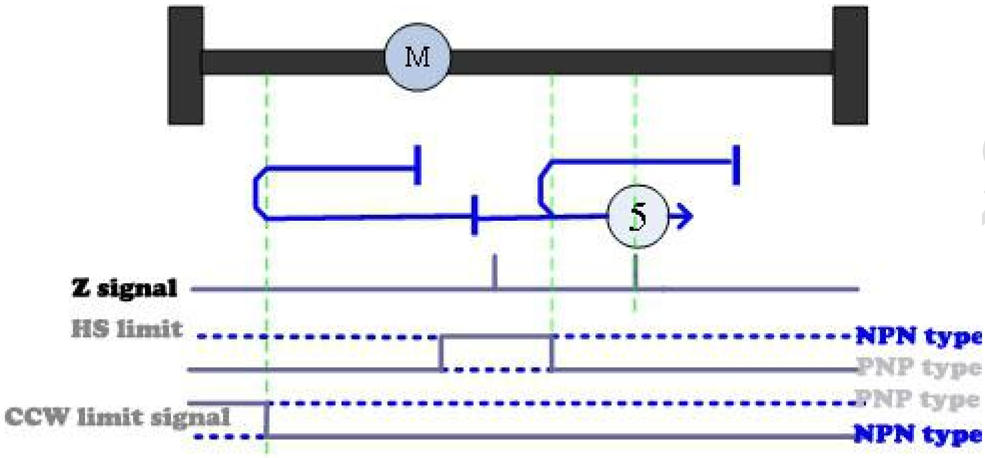


Fig. 169 schematic diagram of five track of JMC EtherCAT slave station returning to zero mode

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;

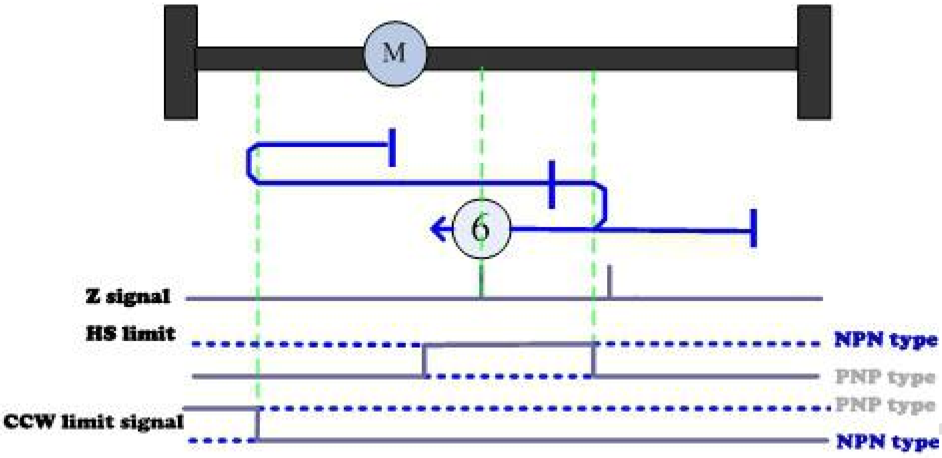


图 37 杰美康 EtherCAT 从站回零方式六轨迹示意图

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;

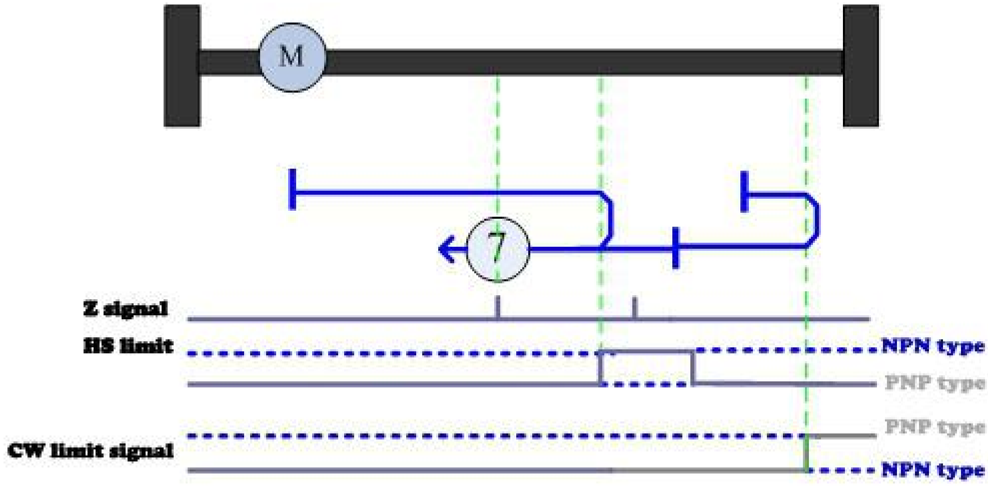


图 38 杰美康EtherCAT从站回零方式七轨迹示意图

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;

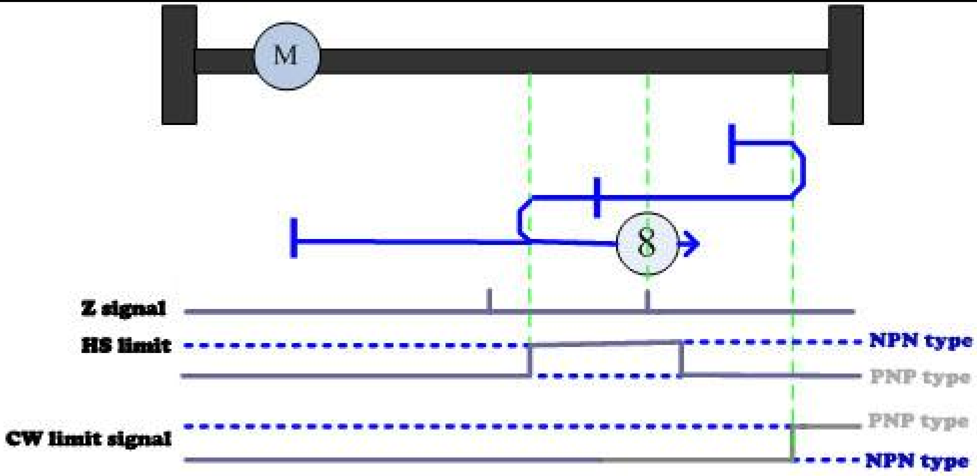


Figure 173 Schematic diagram of Eight trajectories for DomiNO EtherCAT back to zero from a station

2.9 Return to zero mode 9

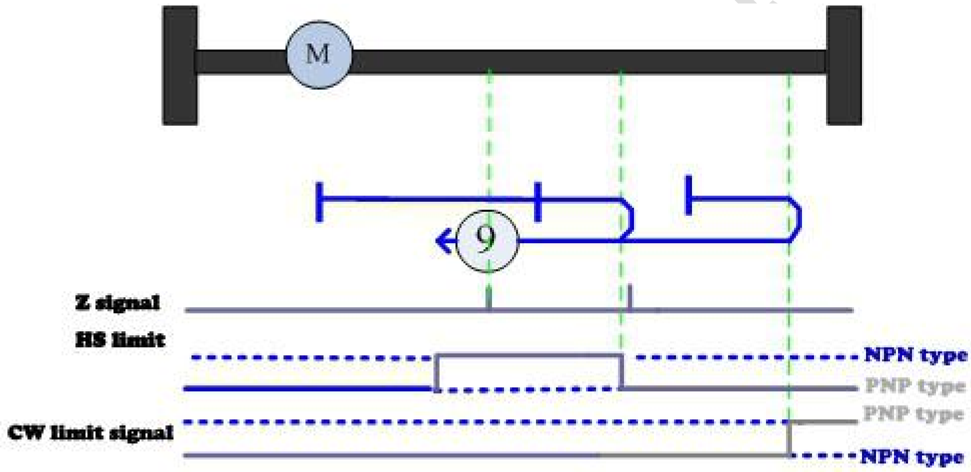


Figure 173 Schematic diagram of Eight trajectories for DomiNO EtherCAT back to zero from a station

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

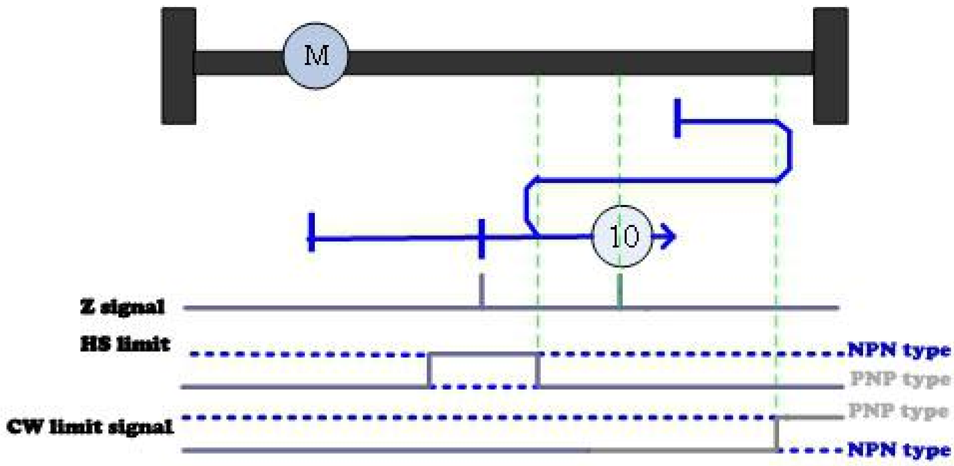


Fig. 175 schematic diagram of 10 track of JMC EtherCAT slave station returning to zero mode

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.

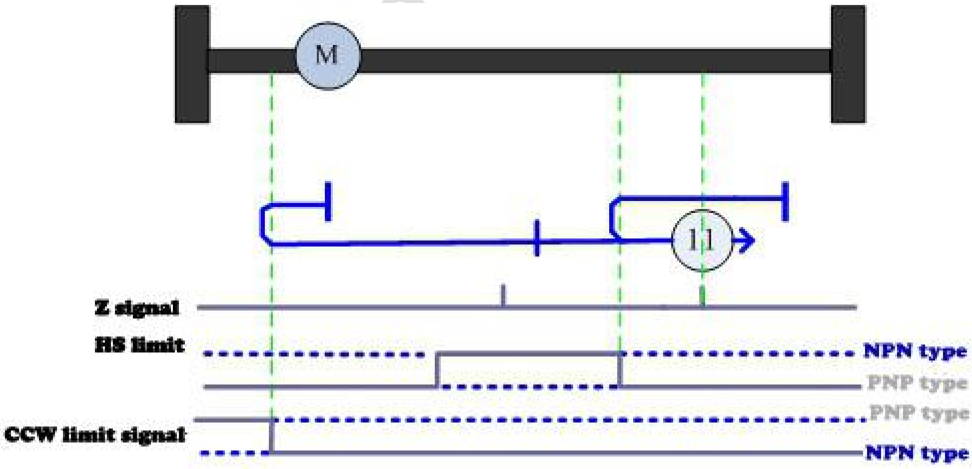


Figure 176 schematic diagram of return to zero mode 11 track of JMC EtherCAT slave station

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.

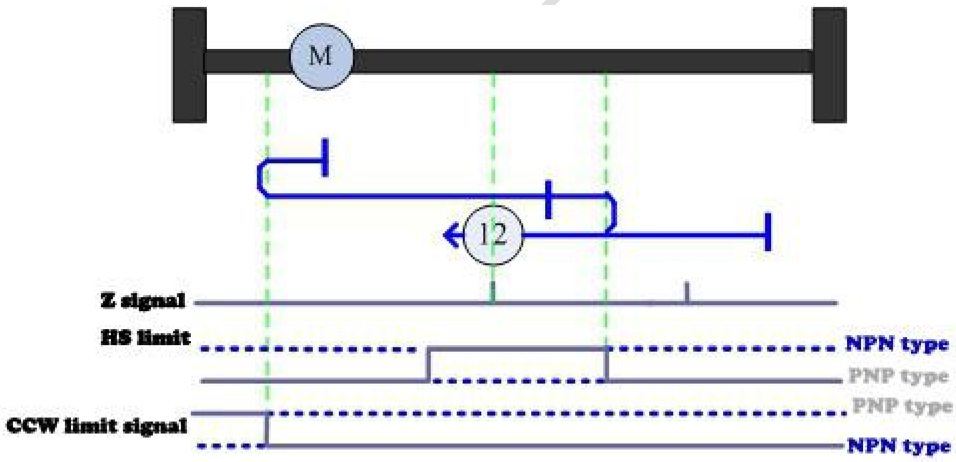


图 39 杰美康 EtherCAT 从站回零方式十二轨迹示意图

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.

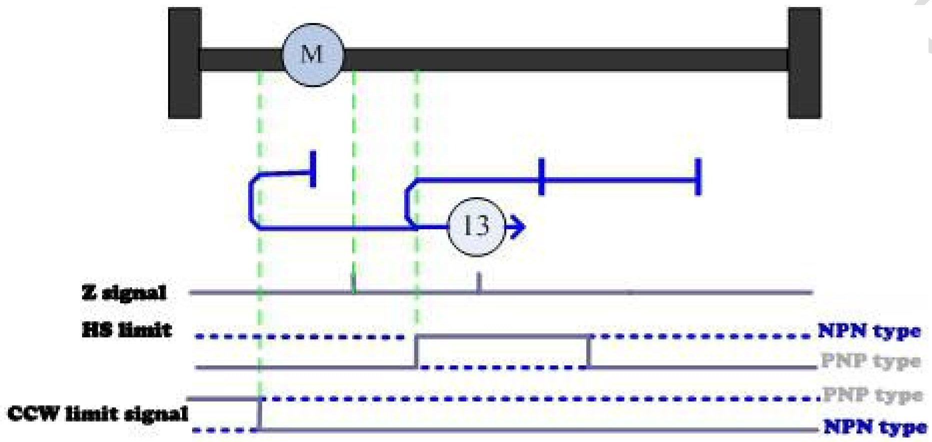


Fig. 178 schematic diagram of 13 track of JMC EtherCAT slave station return to zero mode

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.

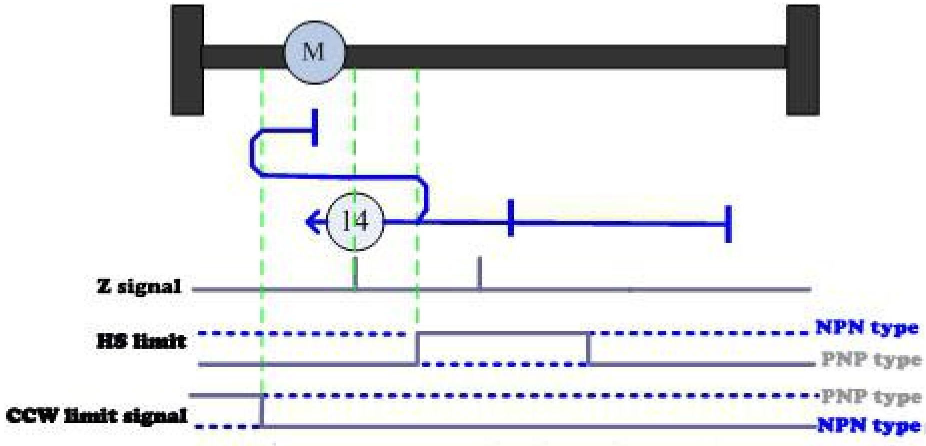


Figure 179 schematic diagram of 14 track in homing mode of JMC EtherCAT slave station

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;

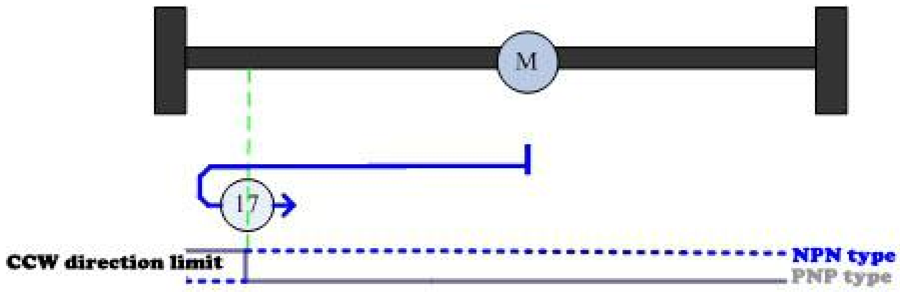


Fig. 180 17 trajectory diagram of EtherCAT slave return to zero mode

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;

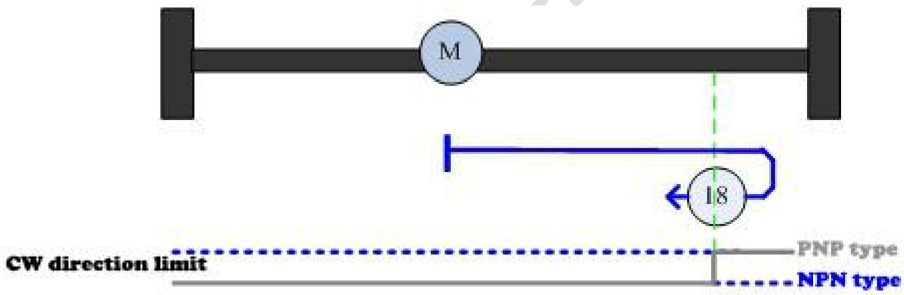


Fig. 181 18 trajectory diagram of EtherCAT slave return to zero mode

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。

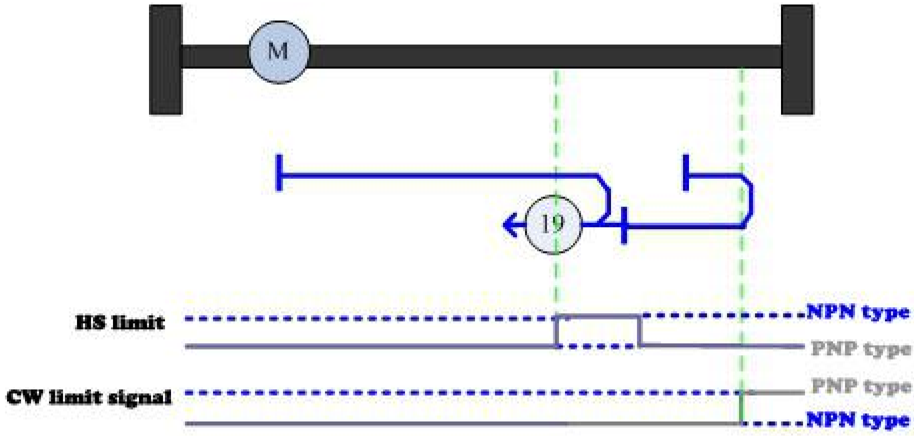


Fig. 182 19 trajectory diagram of EtherCAT slave return to zero mode

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;

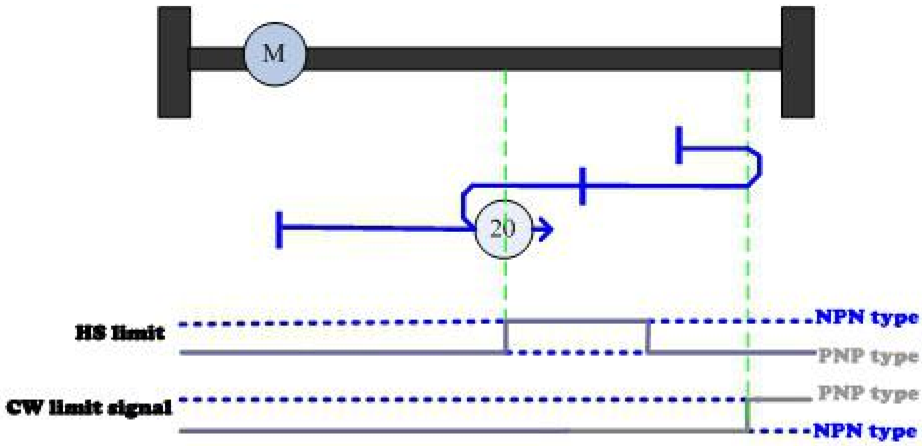


Figure 183 Schematic diagram of 20 trajectories for DomiNO EtherCAT returning from the station to zero mode

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;

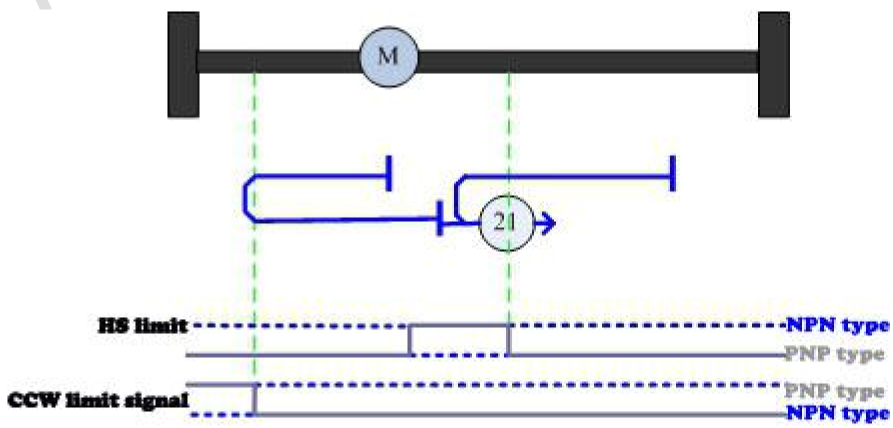


Fig. 184 21 trajectory diagram of EtherCAT slave return to zero mode

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.

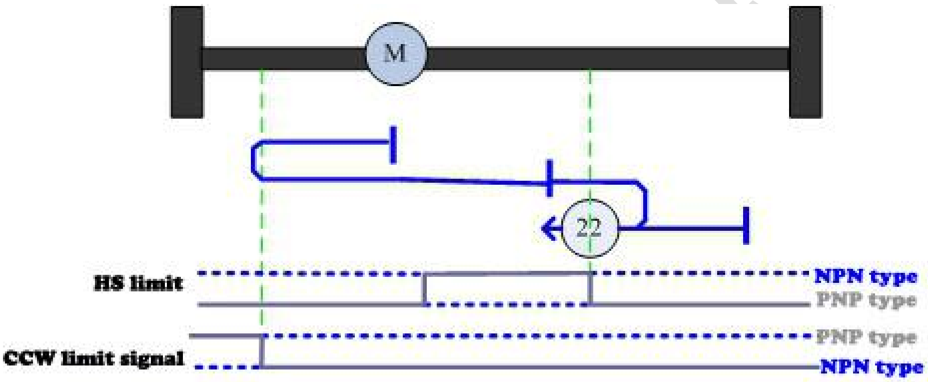


Fig. 185 schematic diagram of 22 track of jemecon EtherCAT slave station return to zero mode

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;

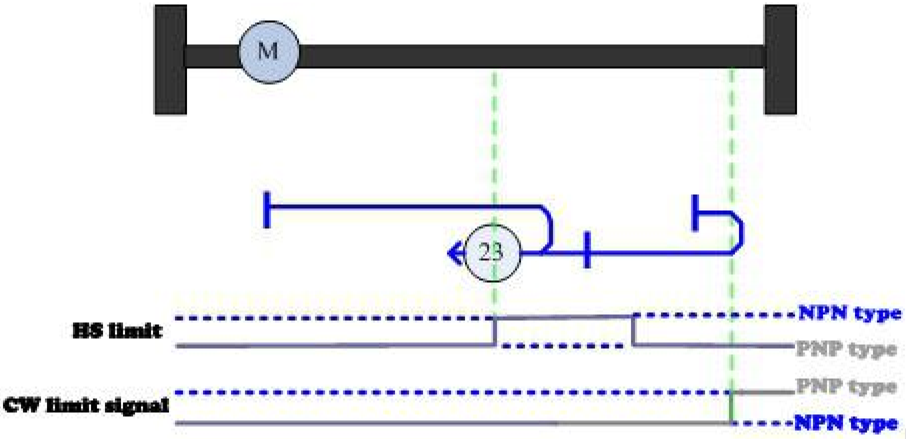


Fig. 186 23 trajectory diagram of EtherCAT slave return to zero mode

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;

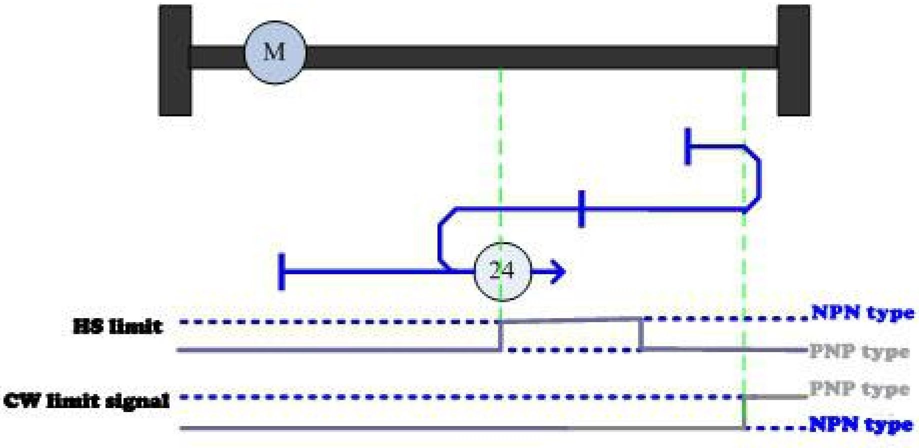


Fig. 187 24 trajectory diagram of EtherCAT slave return to zero mode

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;

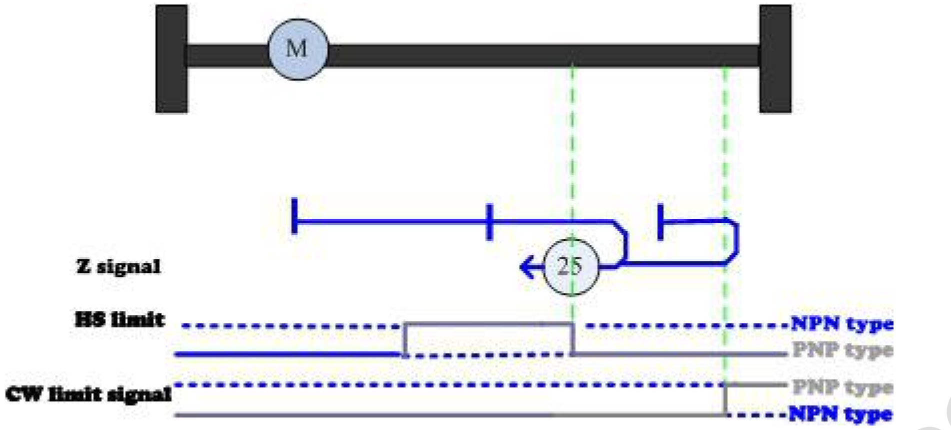


Fig. 188 25 trajectory diagram of EtherCAT slave return to zero mode

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;

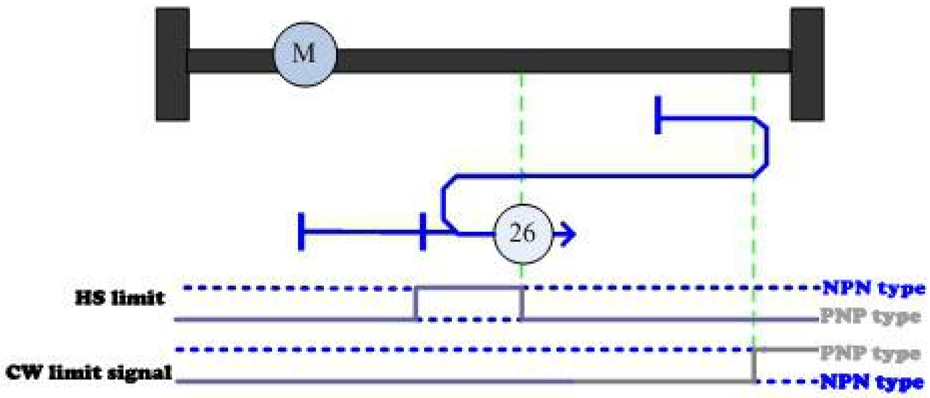


Fig. 189 26 trajectory diagram of EtherCAT slave return to zero mode

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;

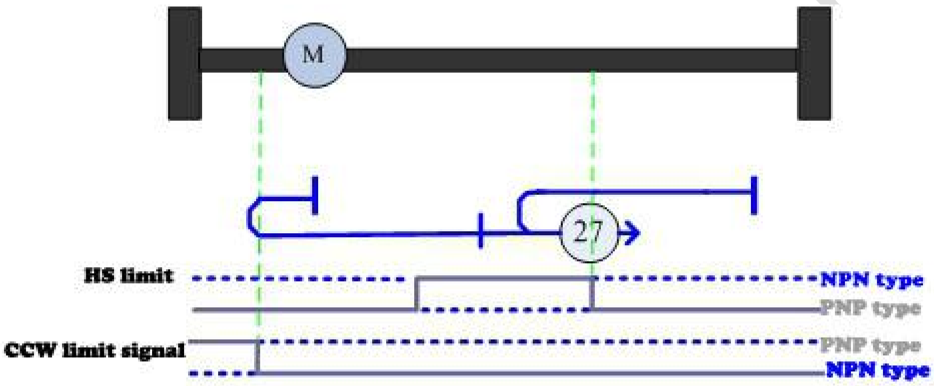


Fig. 190 27 trajectory diagram of EtherCAT slave return to zero mode

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;

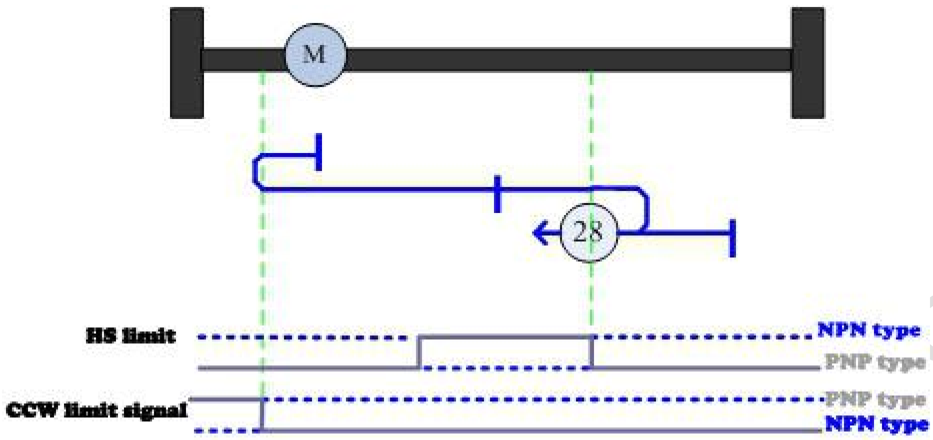


Figure 191 schematic diagram of 28 track in homing mode of JMC EtherCAT slave station

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;

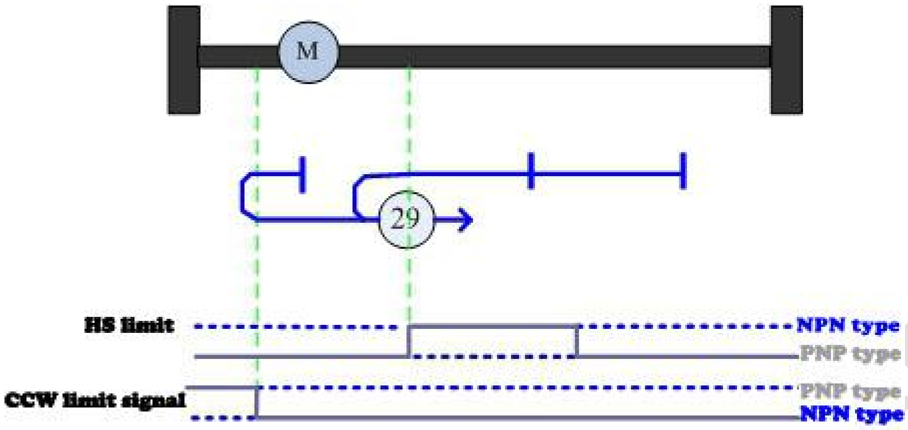


Fig. 192 29 trajectory diagram of EtherCAT slave return to zero mode

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;

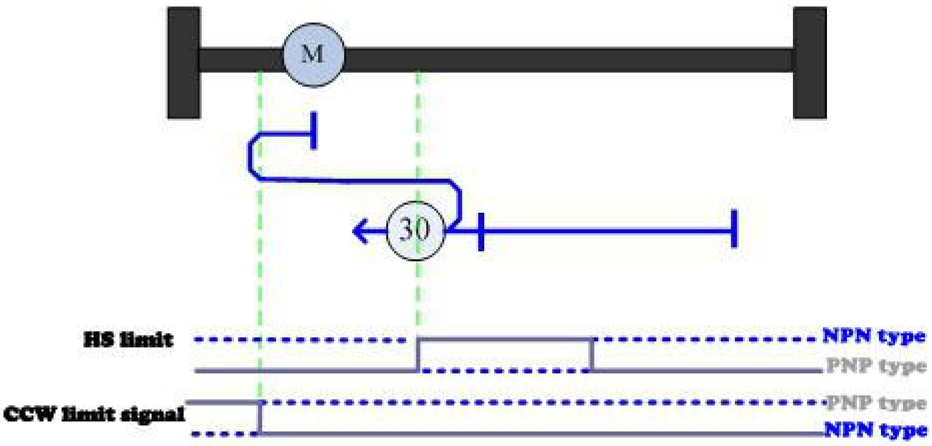


Fig. 193 30 trajectory diagram of EtherCAT slave return to zero mode

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.

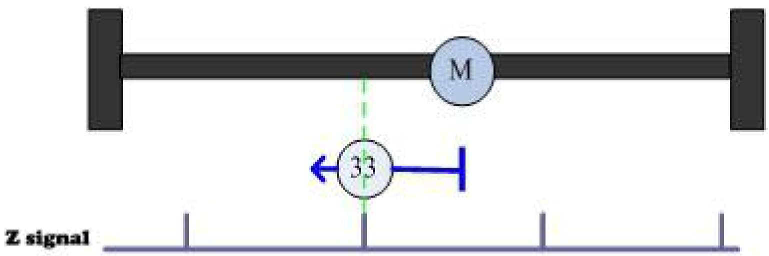


Fig. 194 33 trajectory diagram of EtherCAT slave return to zero mode

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

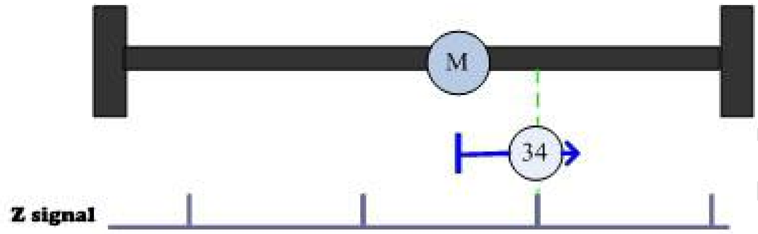


Fig. 195 34 trajectory diagram of EtherCAT slave return to zero mode

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

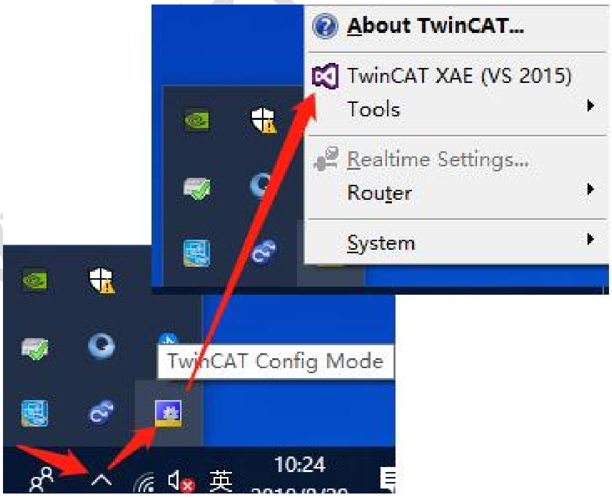


图 40 运行 TwinCAT3

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

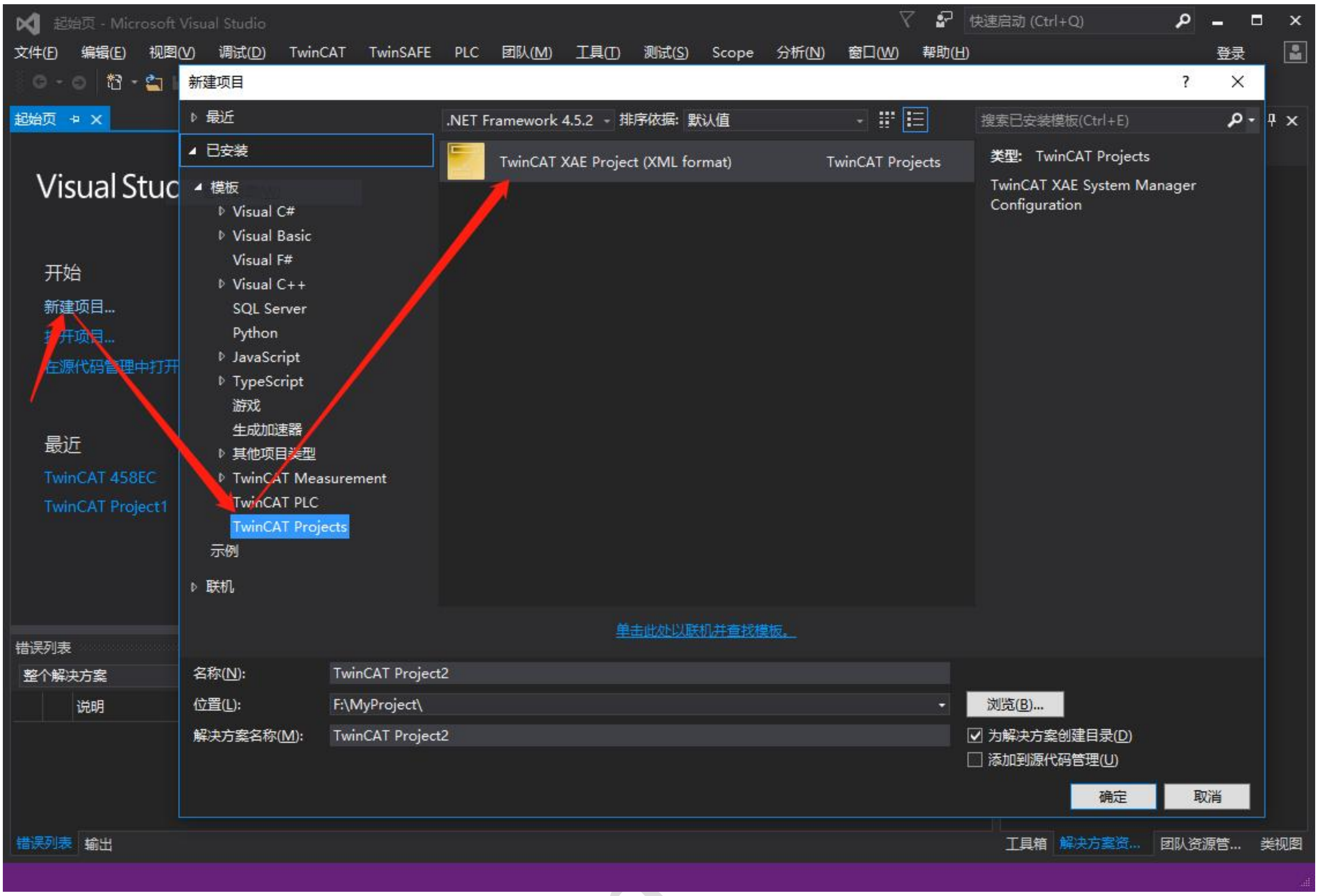


Fig. 197 New TwinCAT project

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)

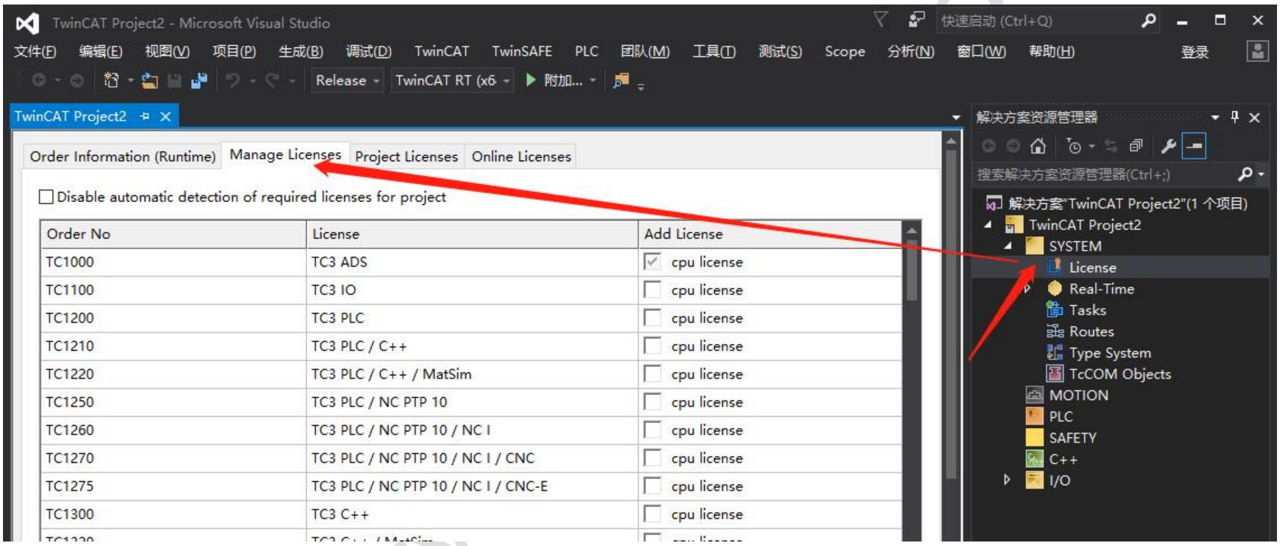


Figure 198 Activate license

- 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

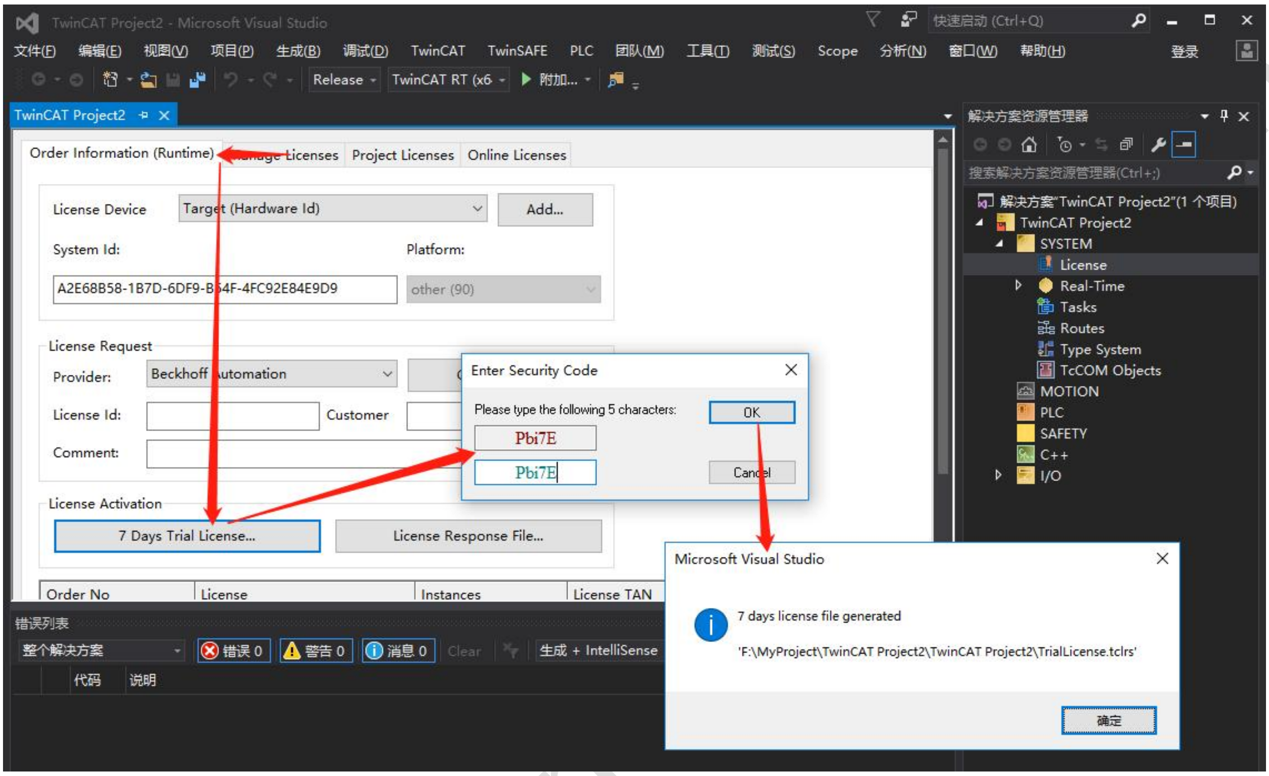


Figure 199 Enter confirmation code

Network card configuration

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

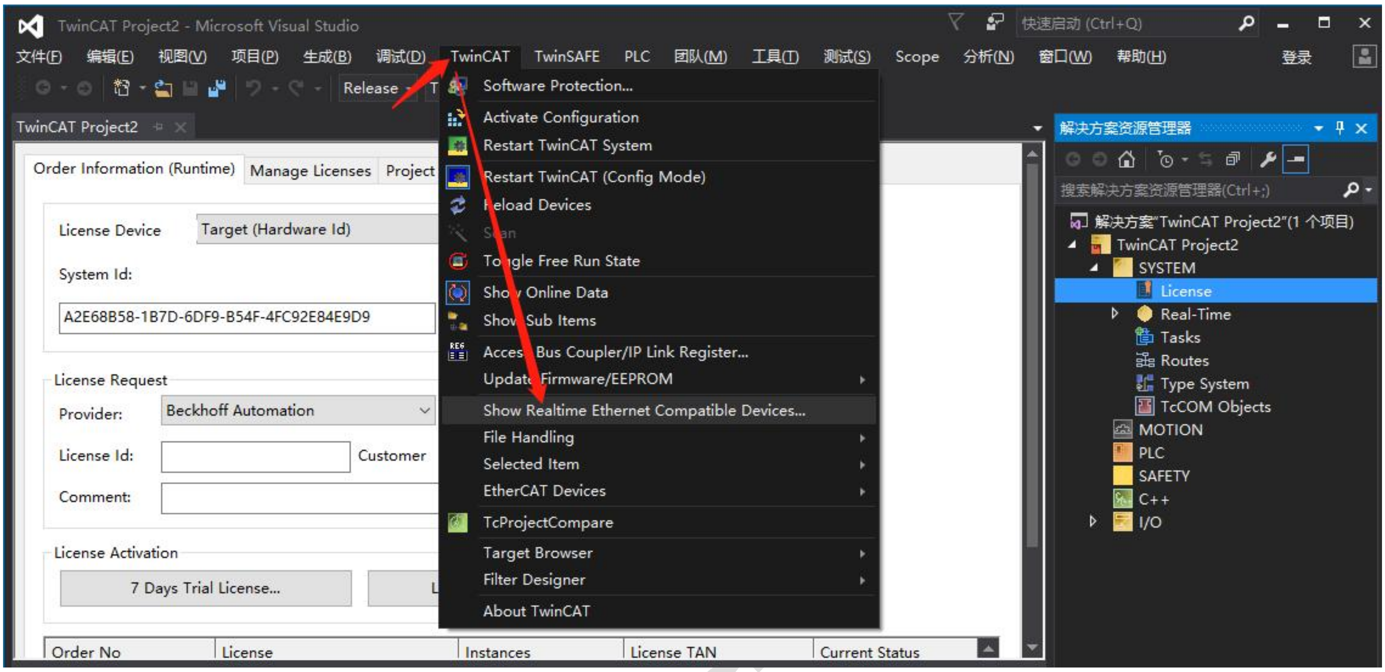


图 41 打开兼容性设备列表

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

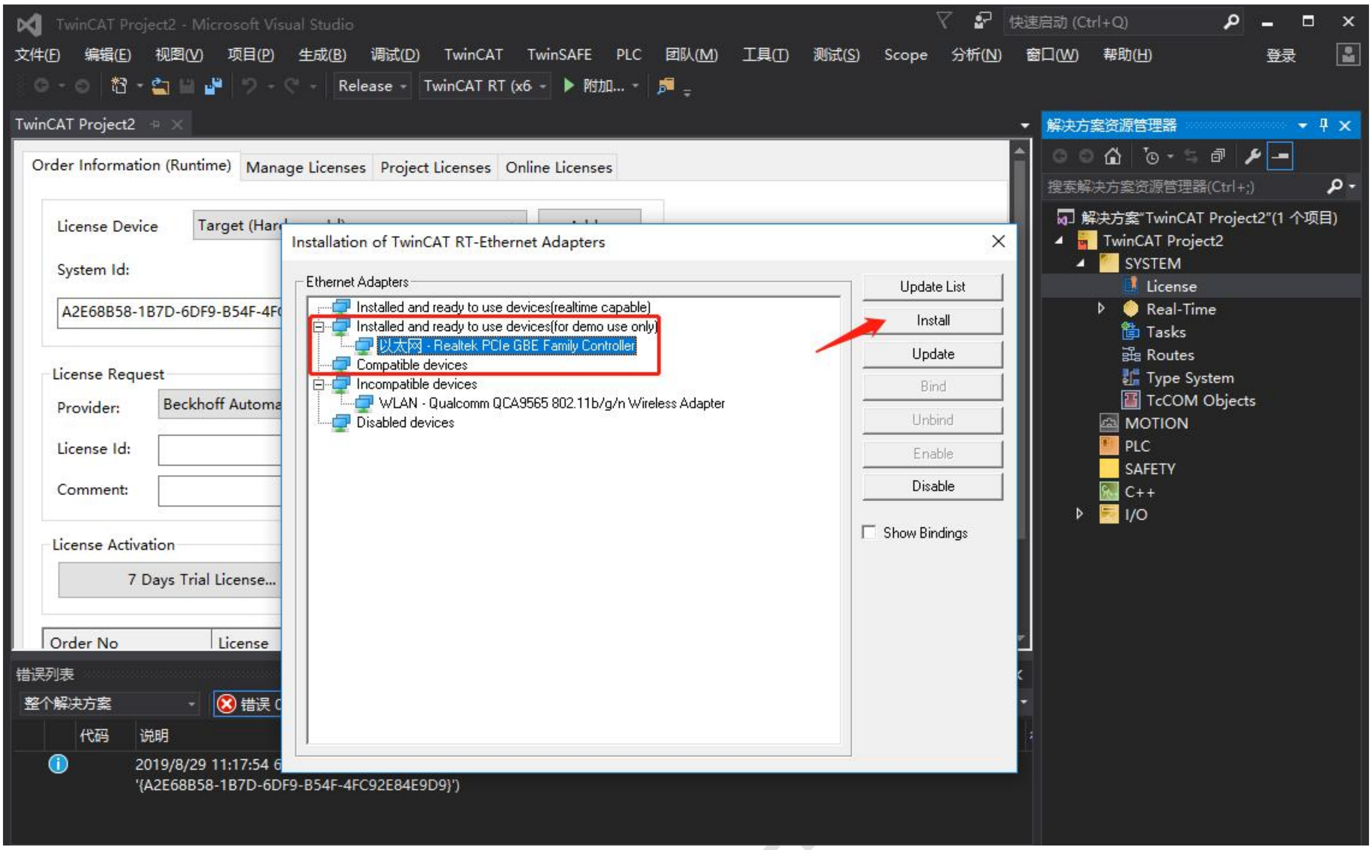


Figure 201 Click on compatible network card

Configuration engineering

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

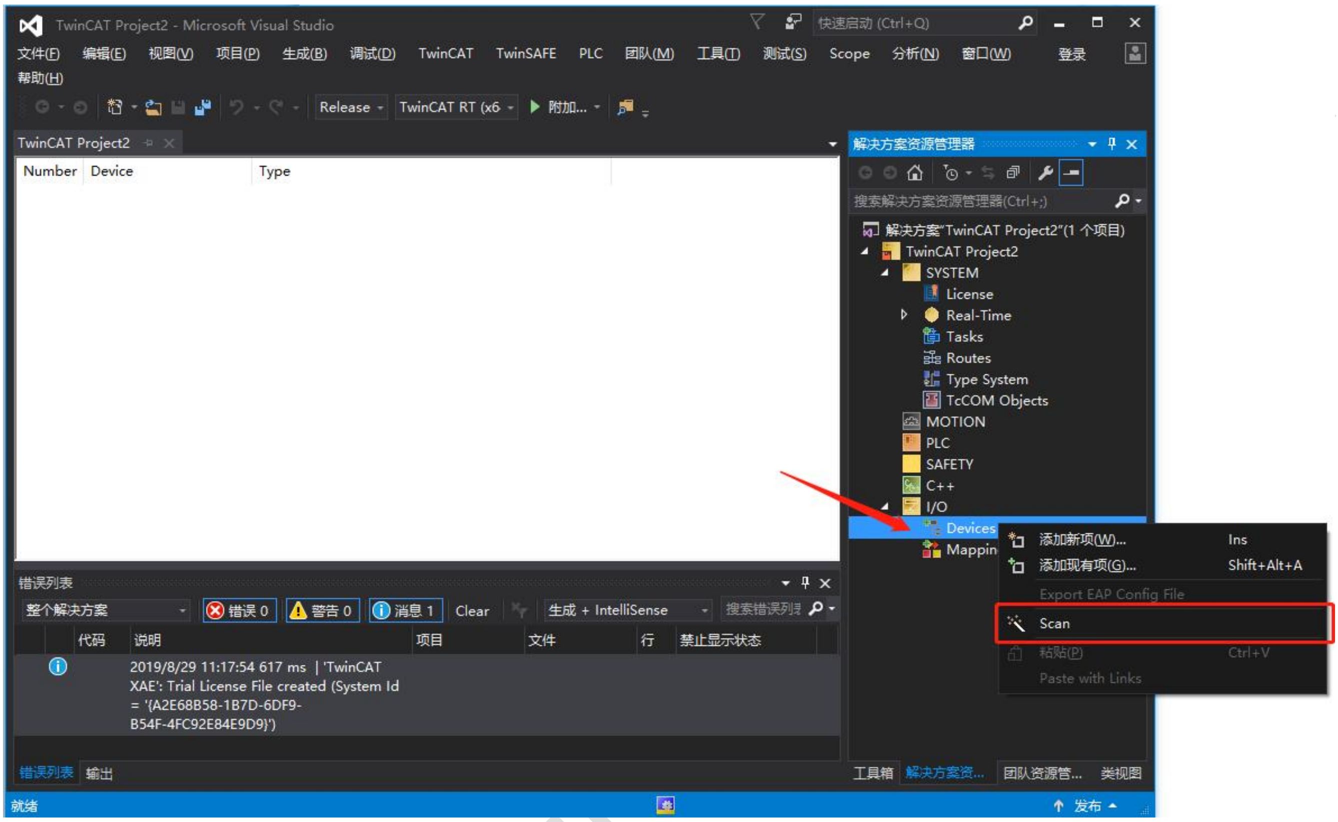


Figure 202 scanning equipment

- 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】

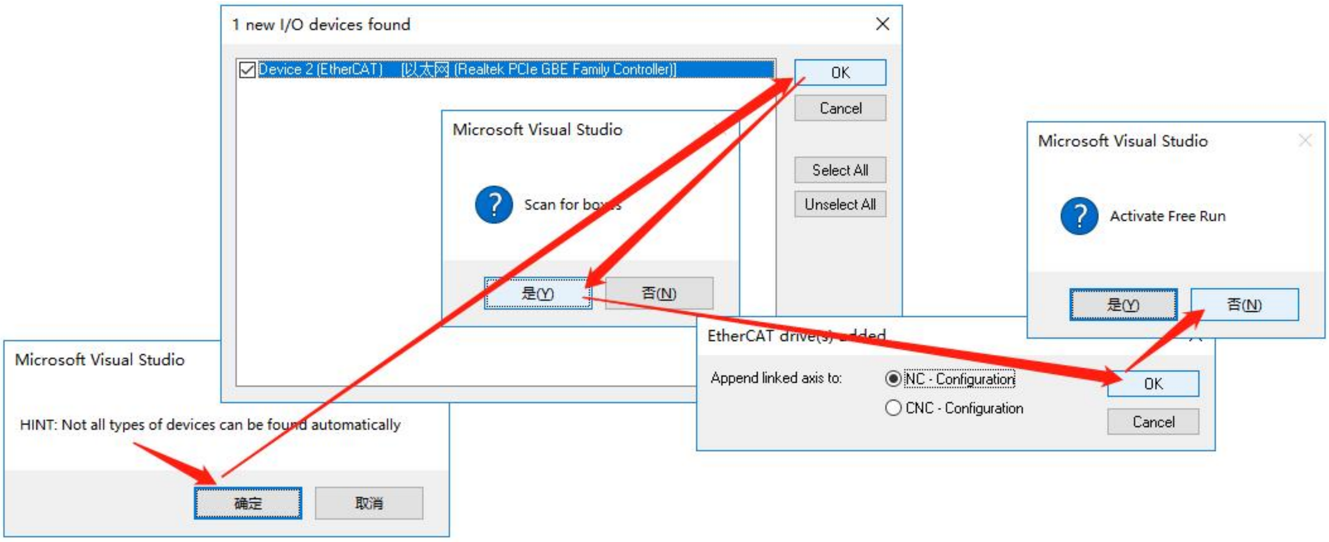


Figure 203 Add IO device

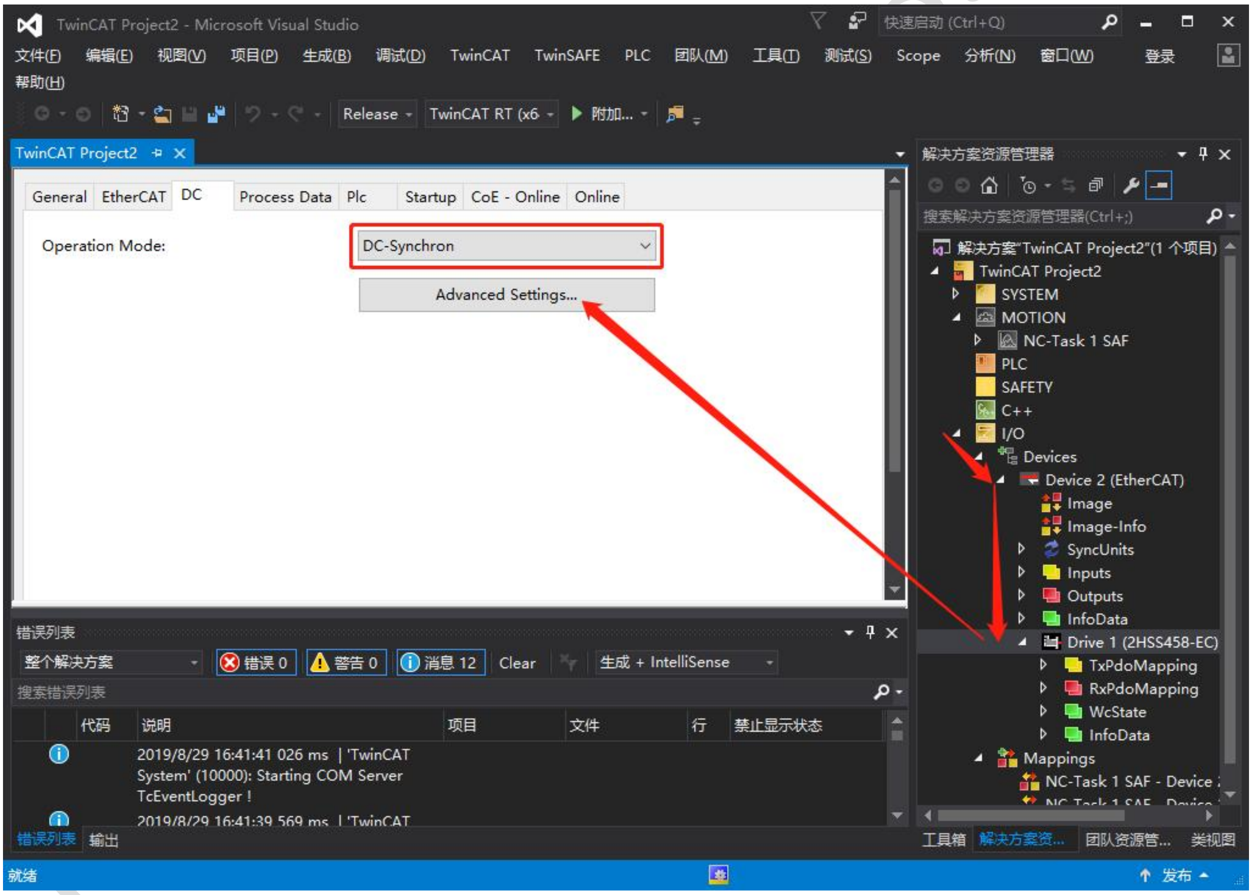


Figure 204 Set distributed clock

- 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

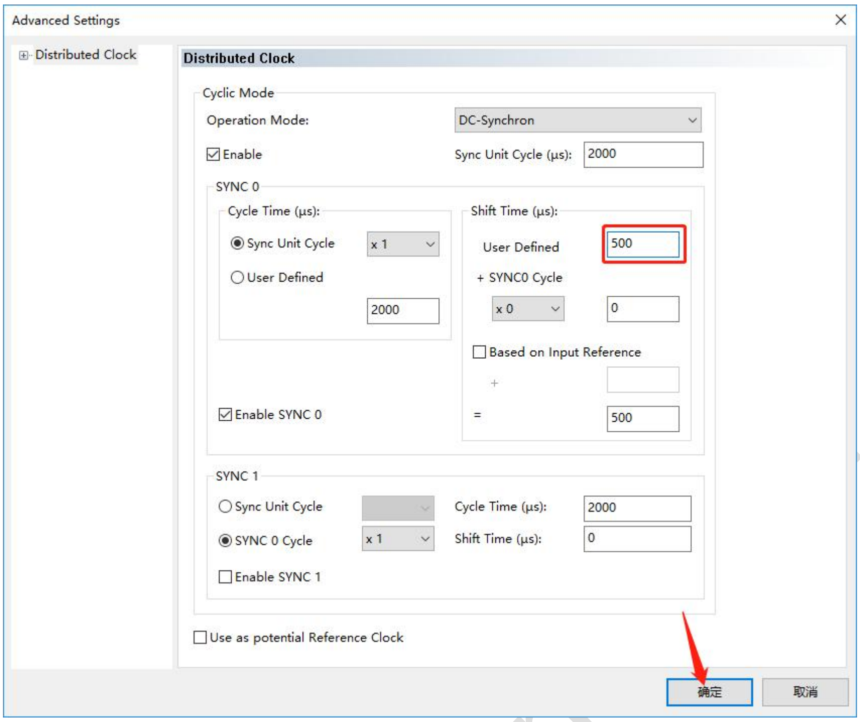


Figure 205 Set offset time

- 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.

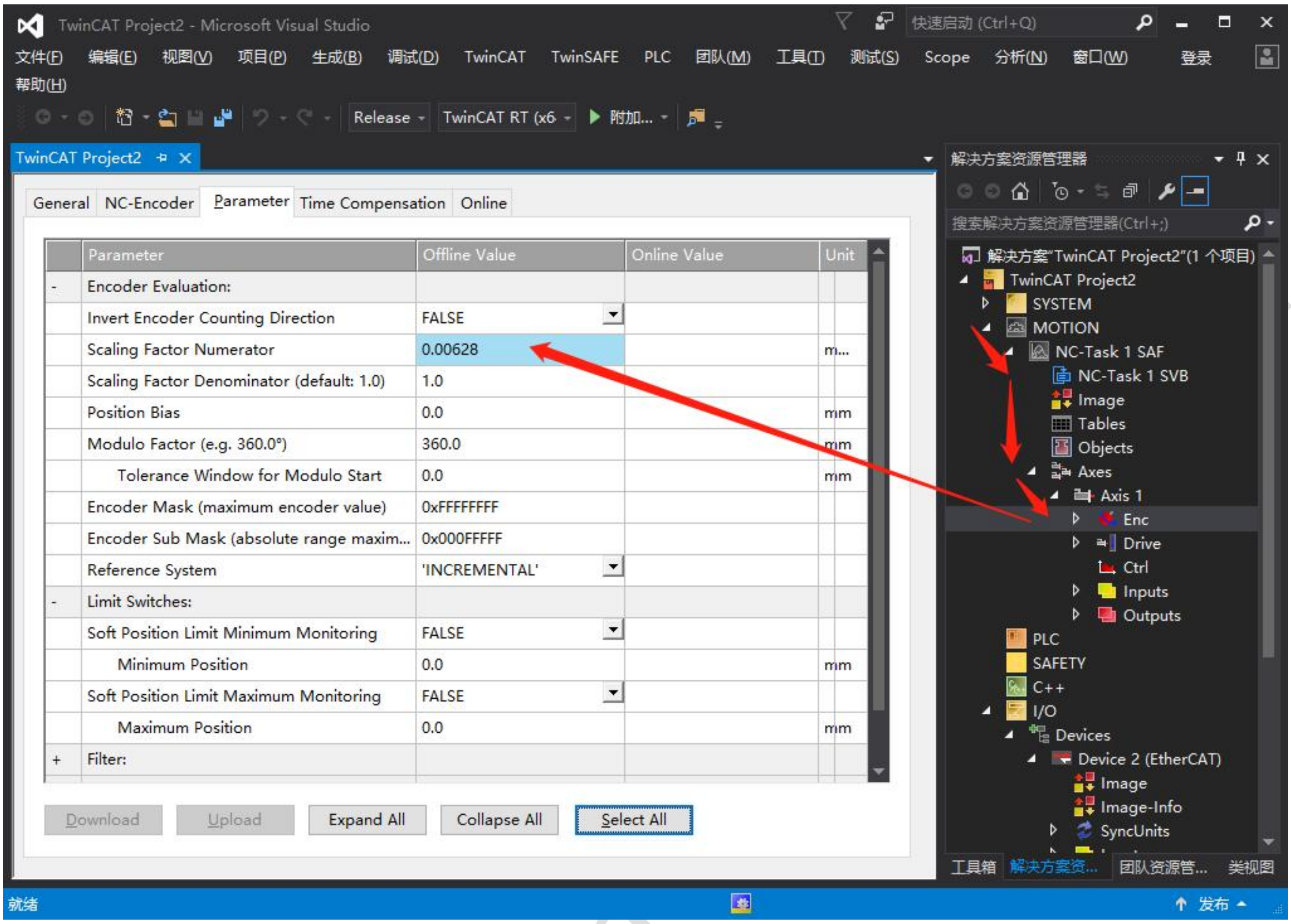


Figure 206 Setting the scale factor

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

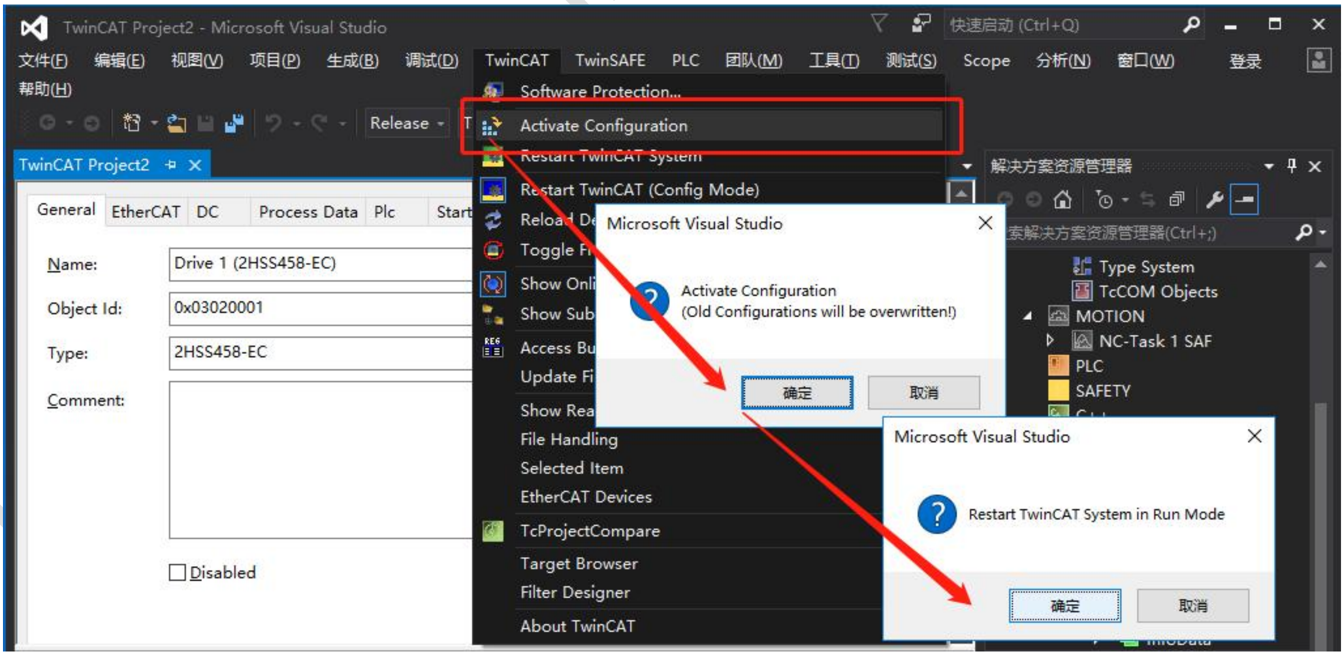


Figure 207 Restart the system

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

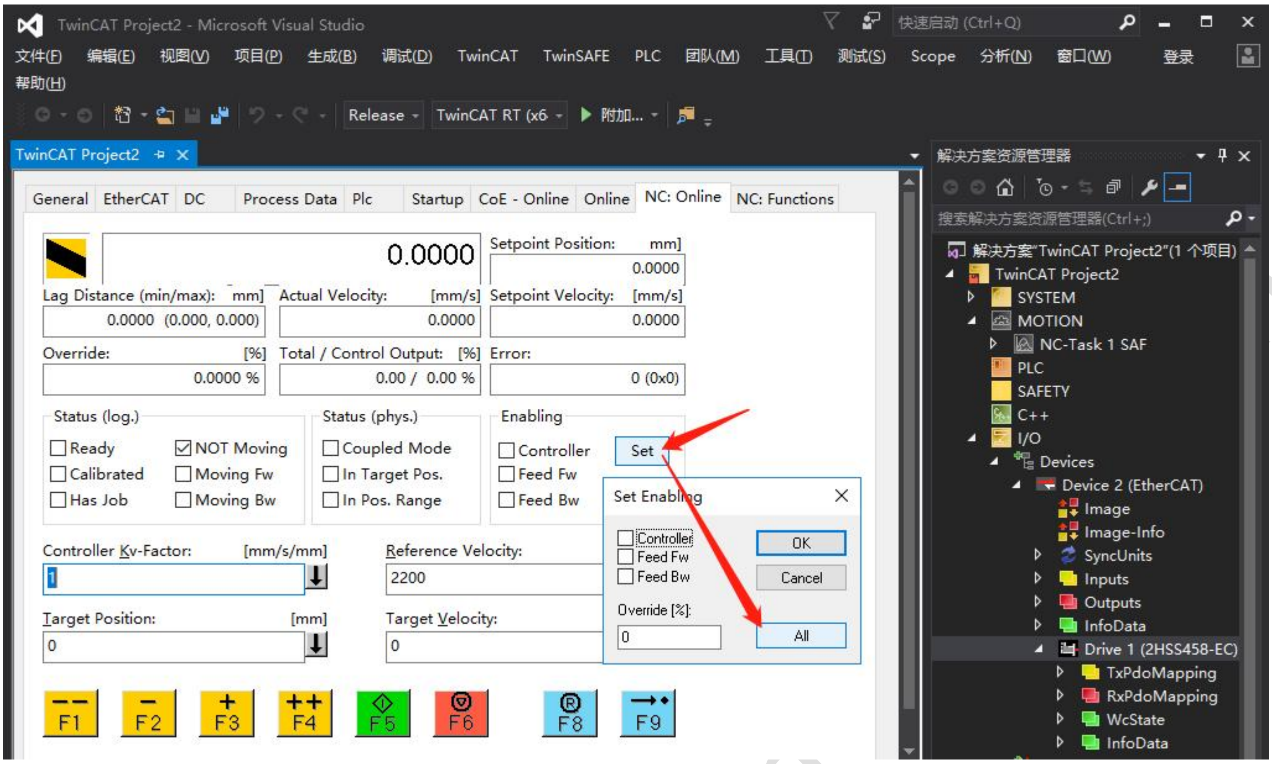
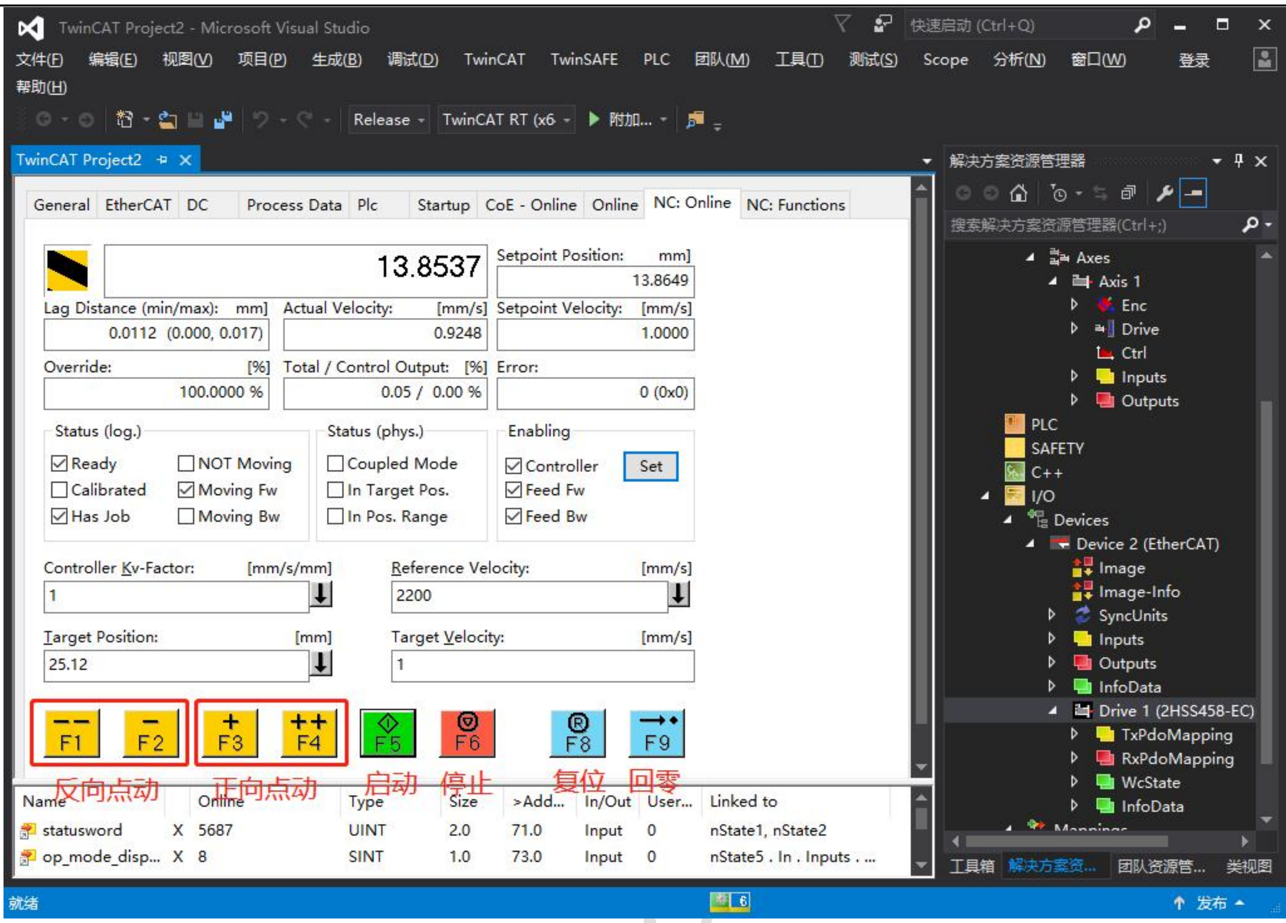


Fig 42 Enable equipment

- 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】

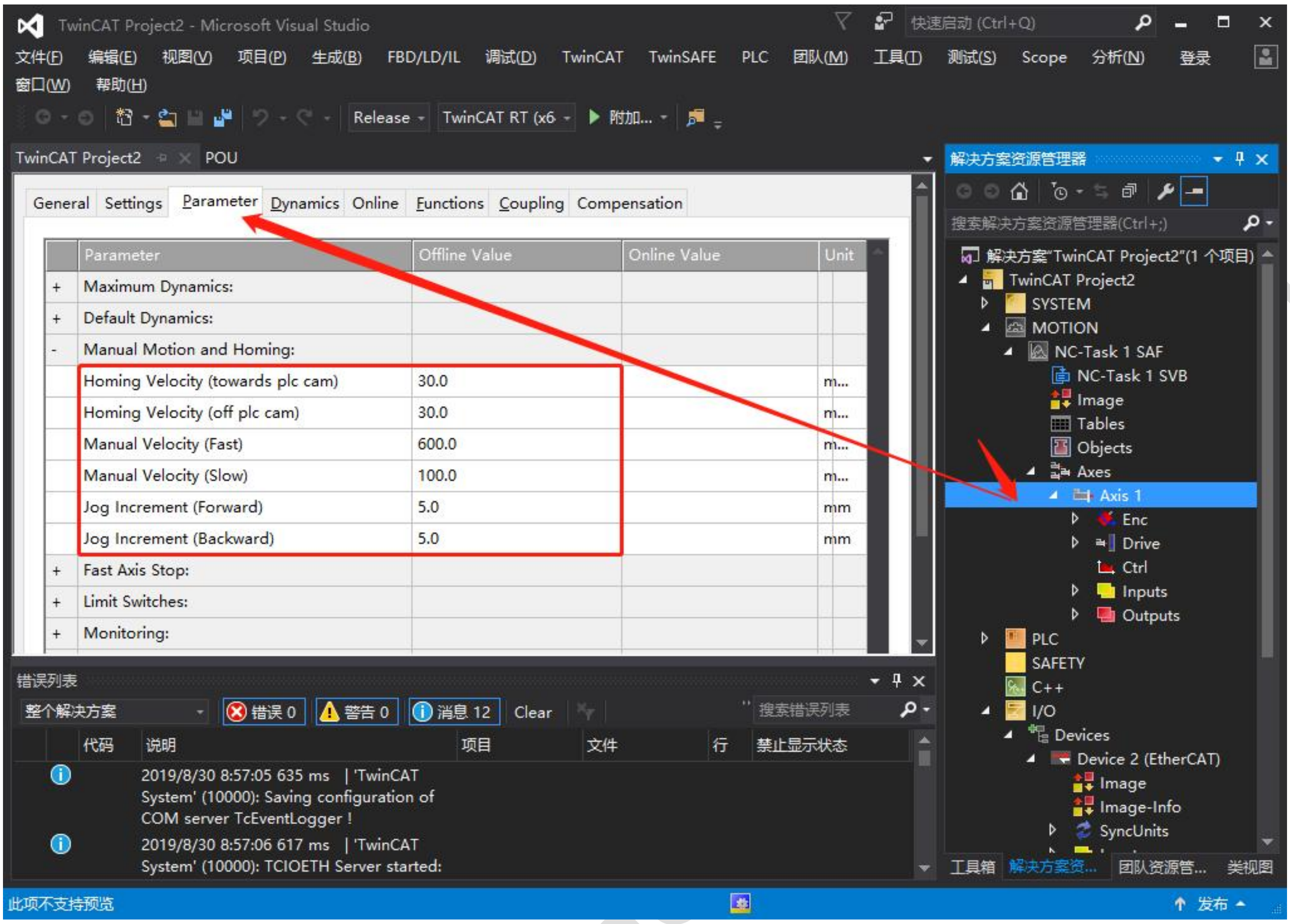


Figure 210 Setting manual control parameters

PLC program creation

- Before starting, click【TwinCAT】→【Restart TwinCAT(Config Mode)】→【OK】→【NO】

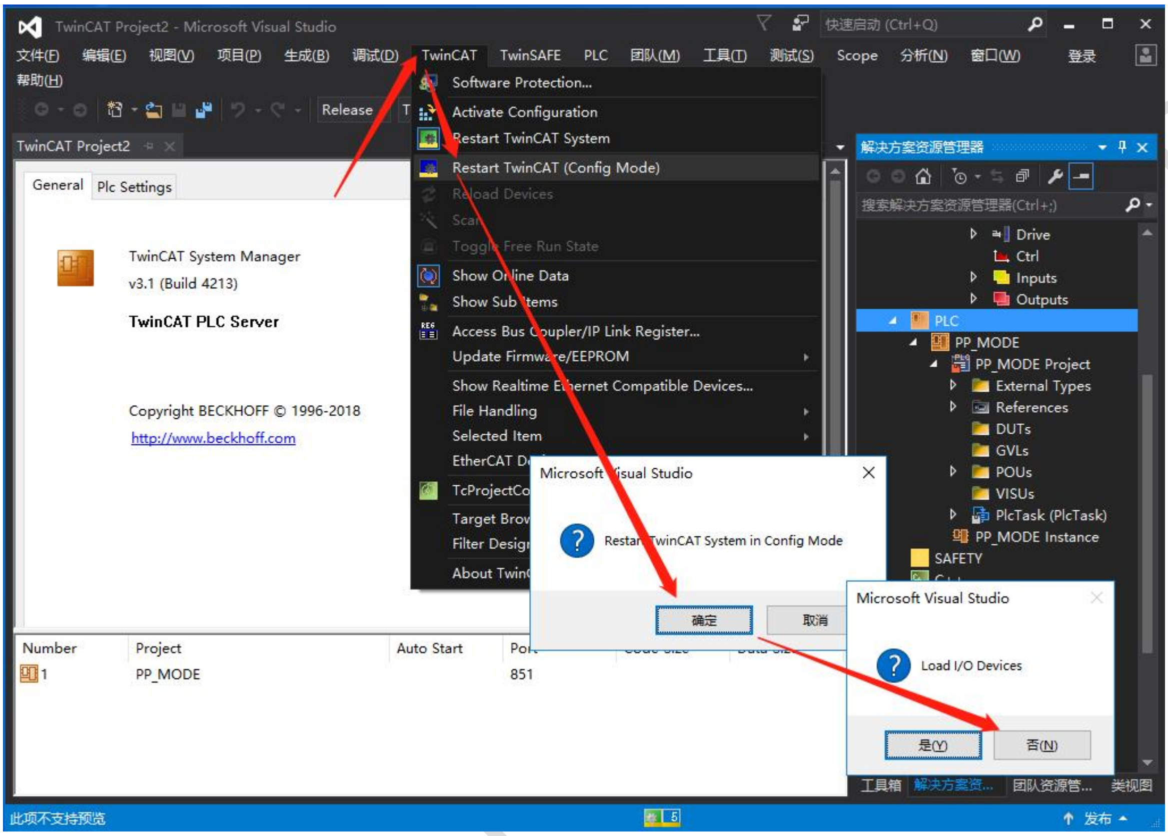


Figure 211 Enter configuration mode

Right mouse button【PLC】→click【Add new item】

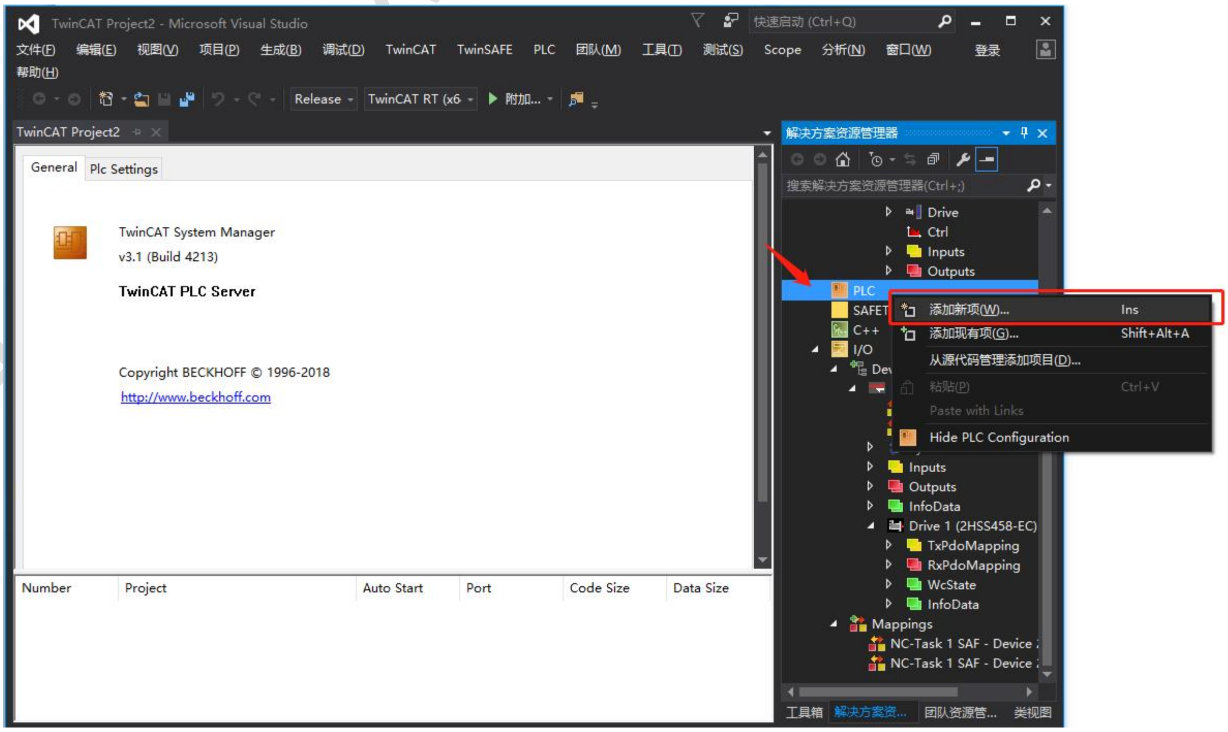


Figure 211 Enter configuration mode

Right mouse button【PLC】→click【Add new item】

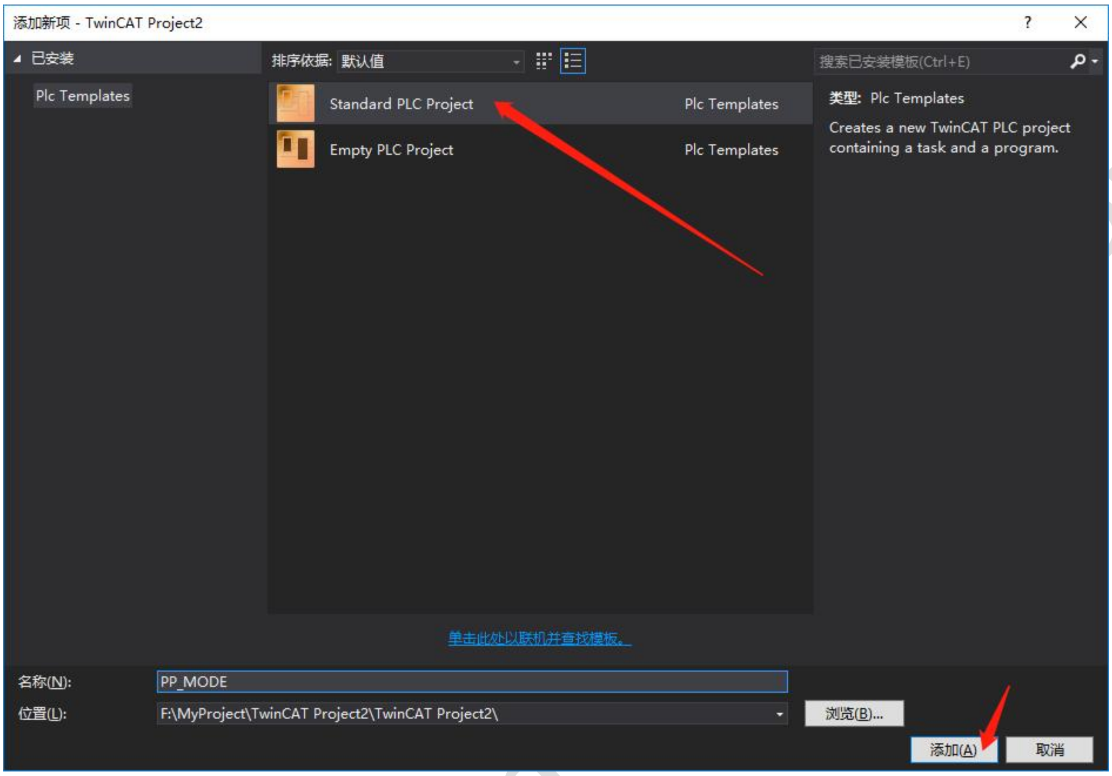


Figure 212 Add PLC project

- 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】

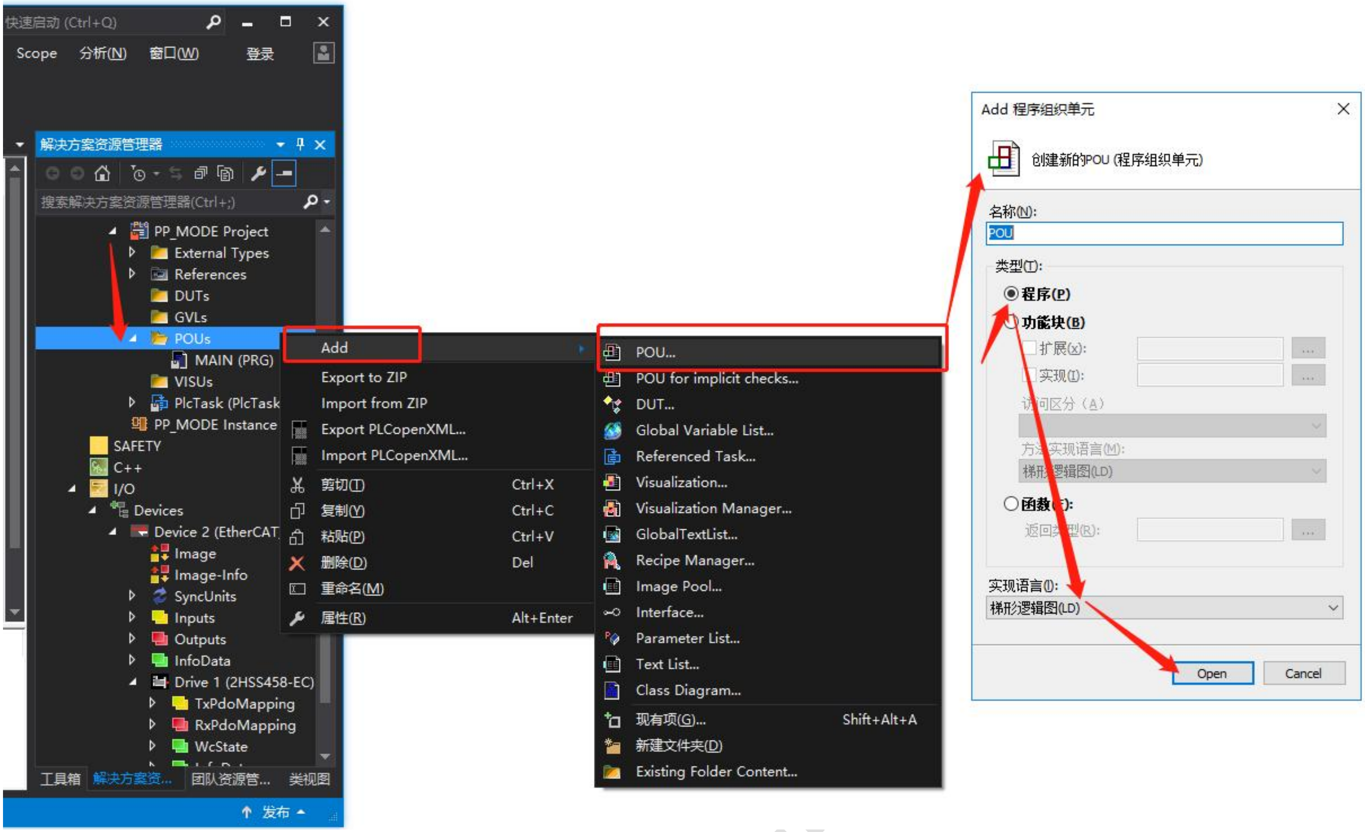


Figure 214 Add POU program

- To add PLC tasks (POUs) to be run, right-click, select 【Add】 → click【Existing Item】

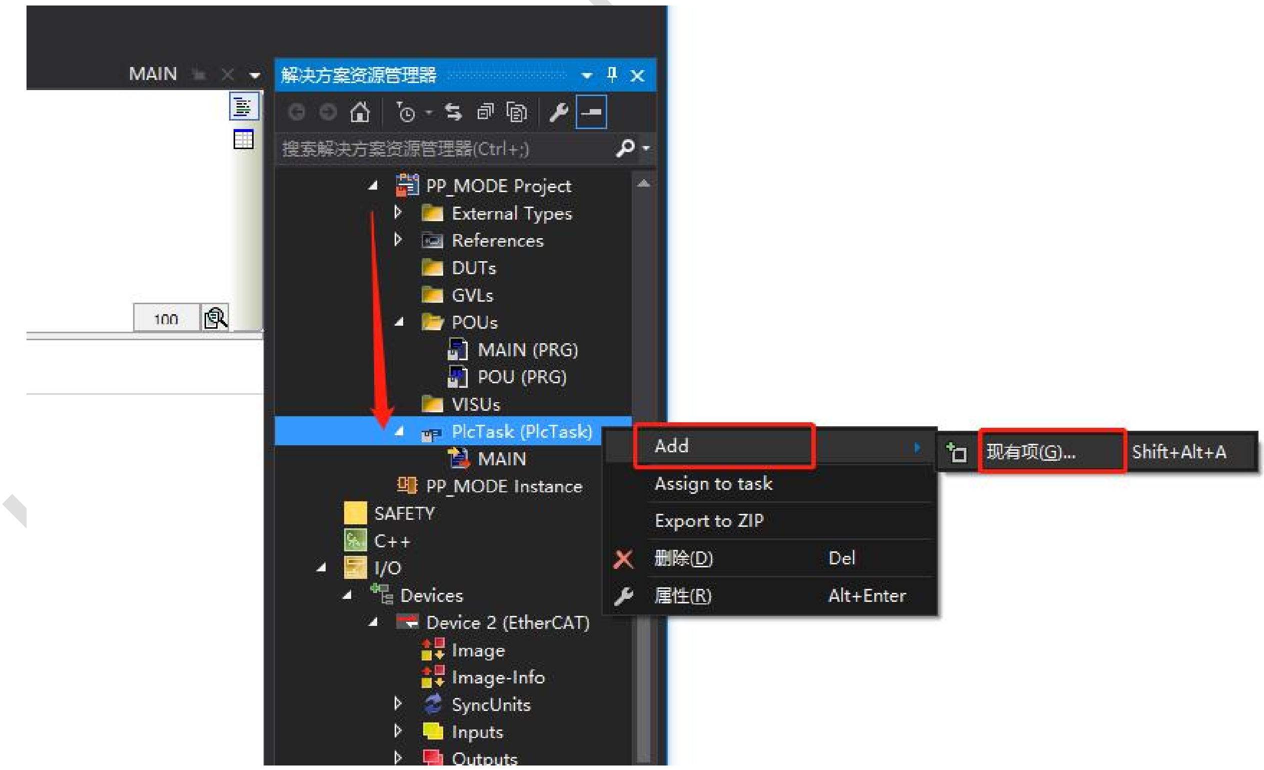


Fig 43 add PLC task

- Click 【Category】 → 【Programs】 → select the required program files under the POUs in the current project → click【OK】

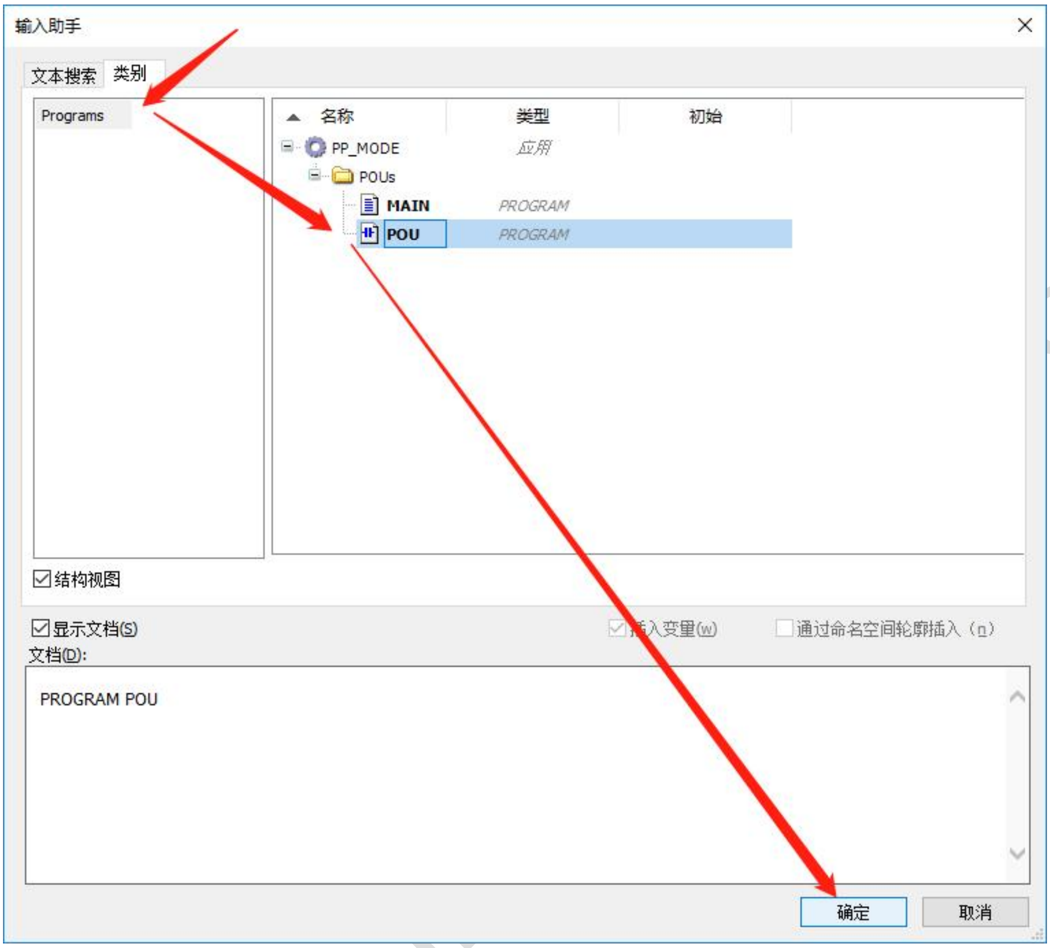
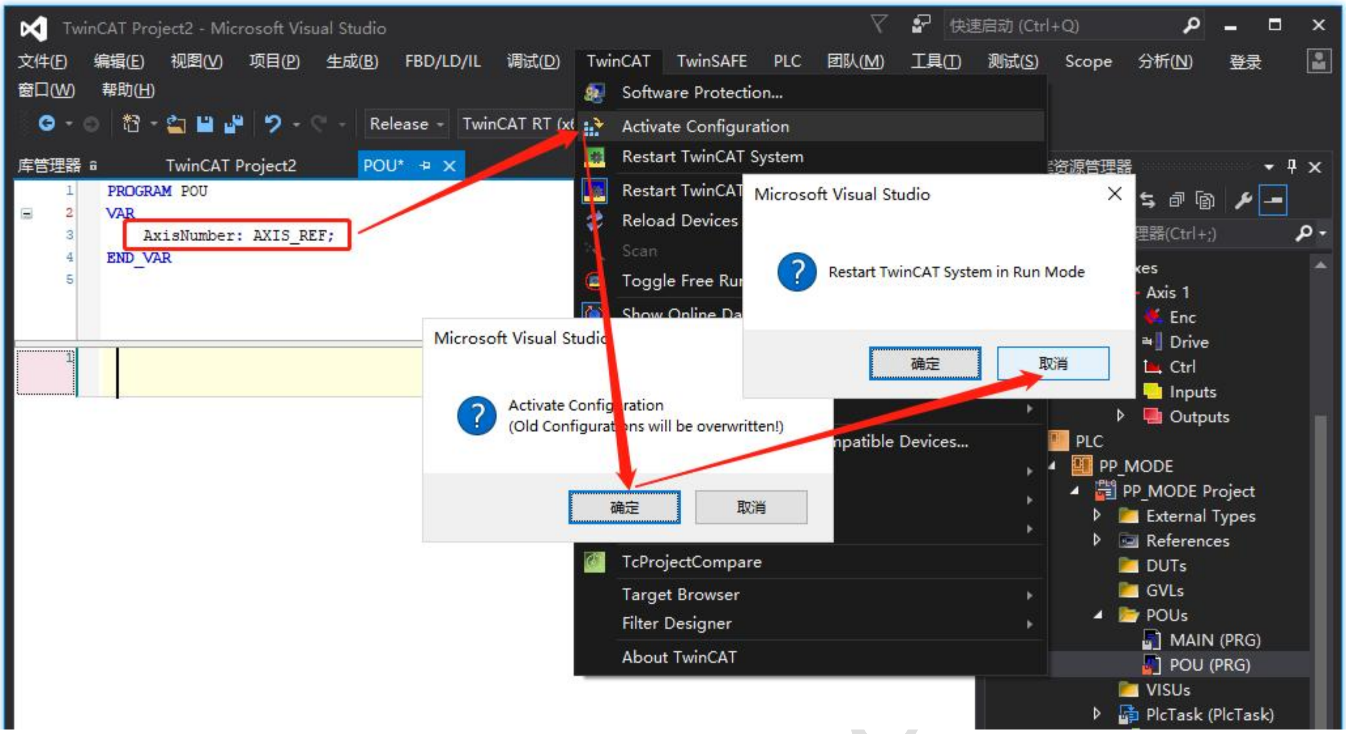


Figure 216 Select PLC task

- 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】

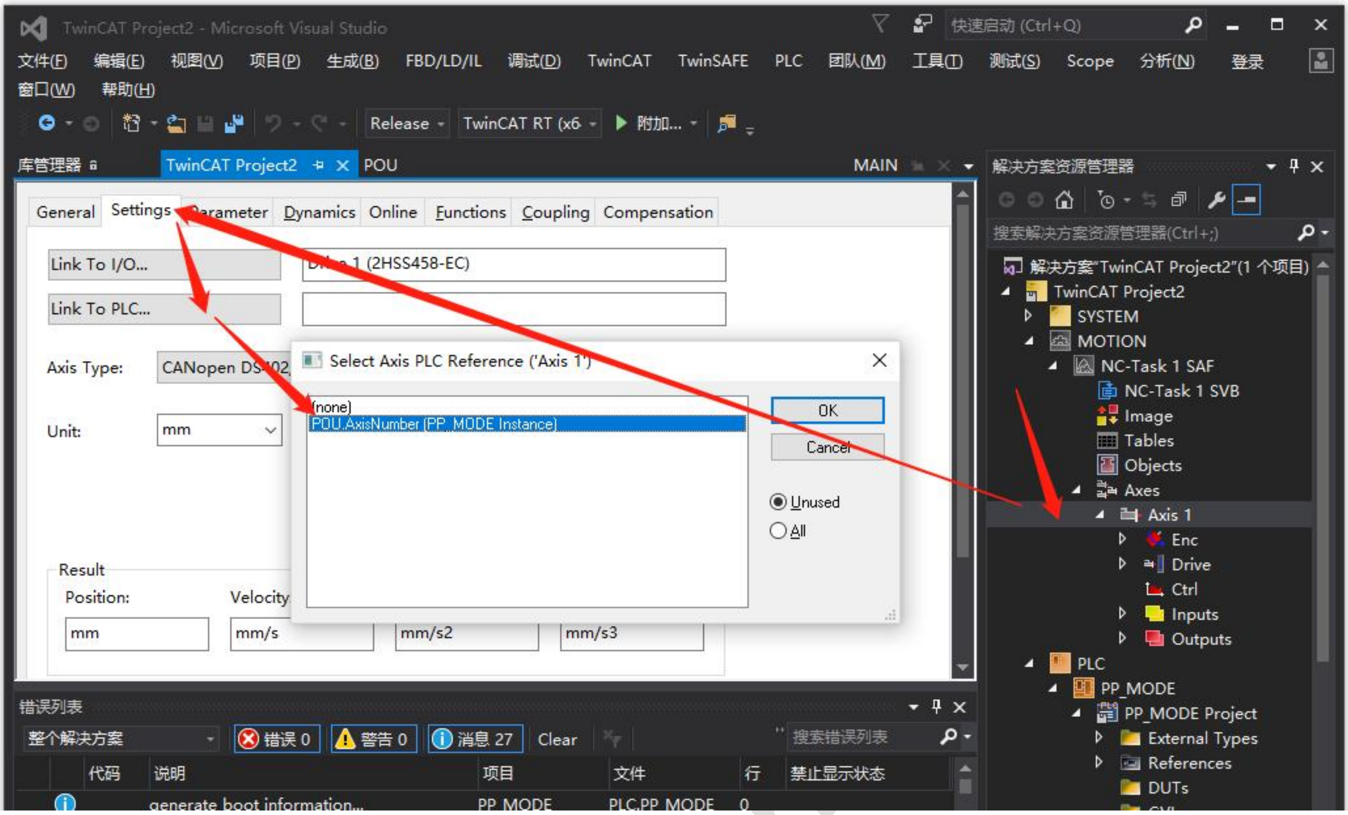


Figure 218. Link axis variables1 Control method I

- Because we will use the official motion control library, we need to add it to the project first.
- Right click【References】→click【Add library】

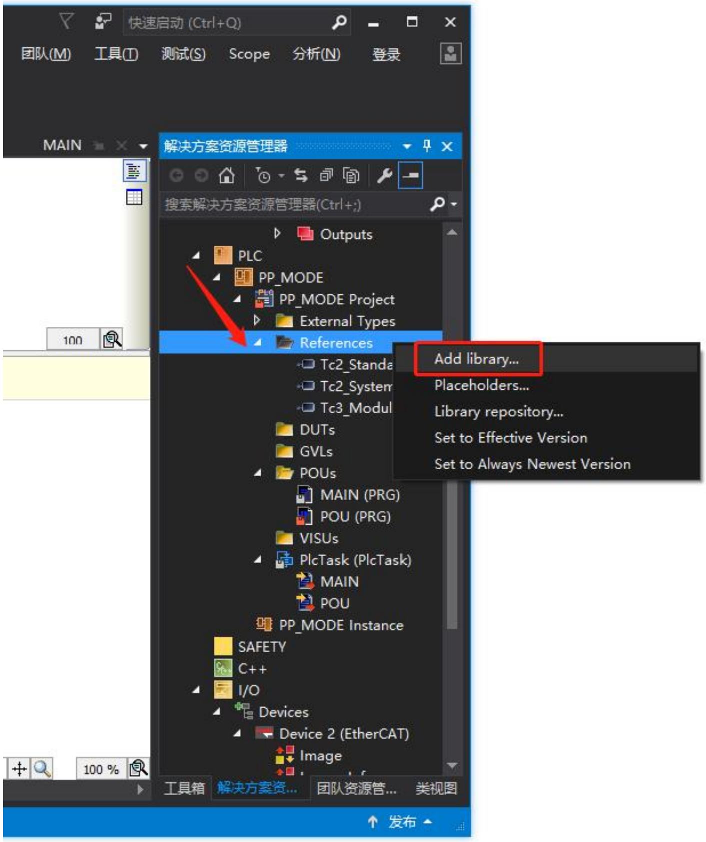


Figure 219 Add library

- Selcet【Motion】→【PTP】→【Tc2_MC2】(Added according to specific needs)

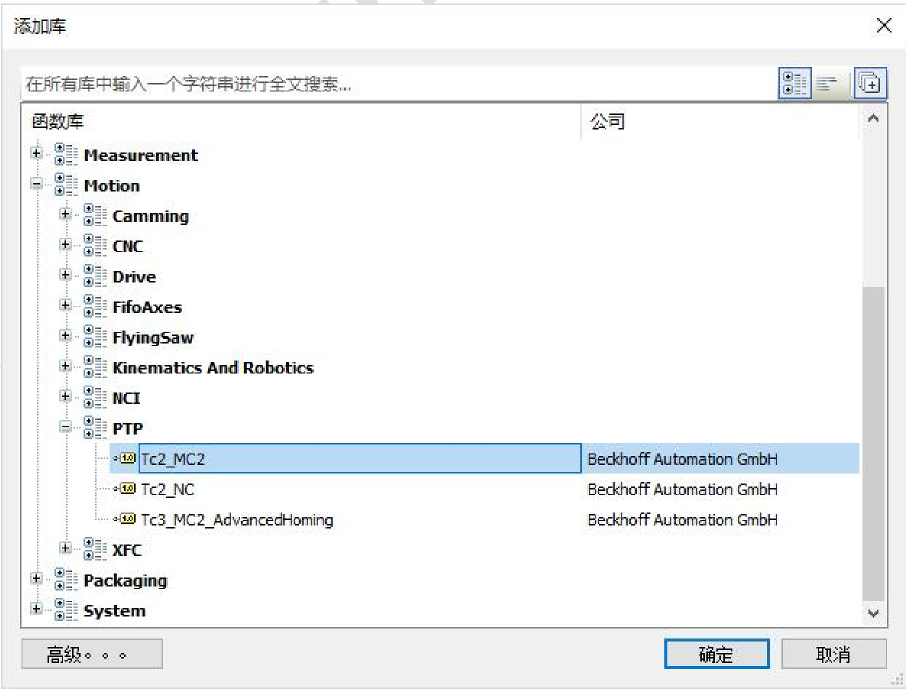


Figure 220 Select control motion library

- Click the created program in 【POUs】, in the program section, right-click and select Insert Operation Block

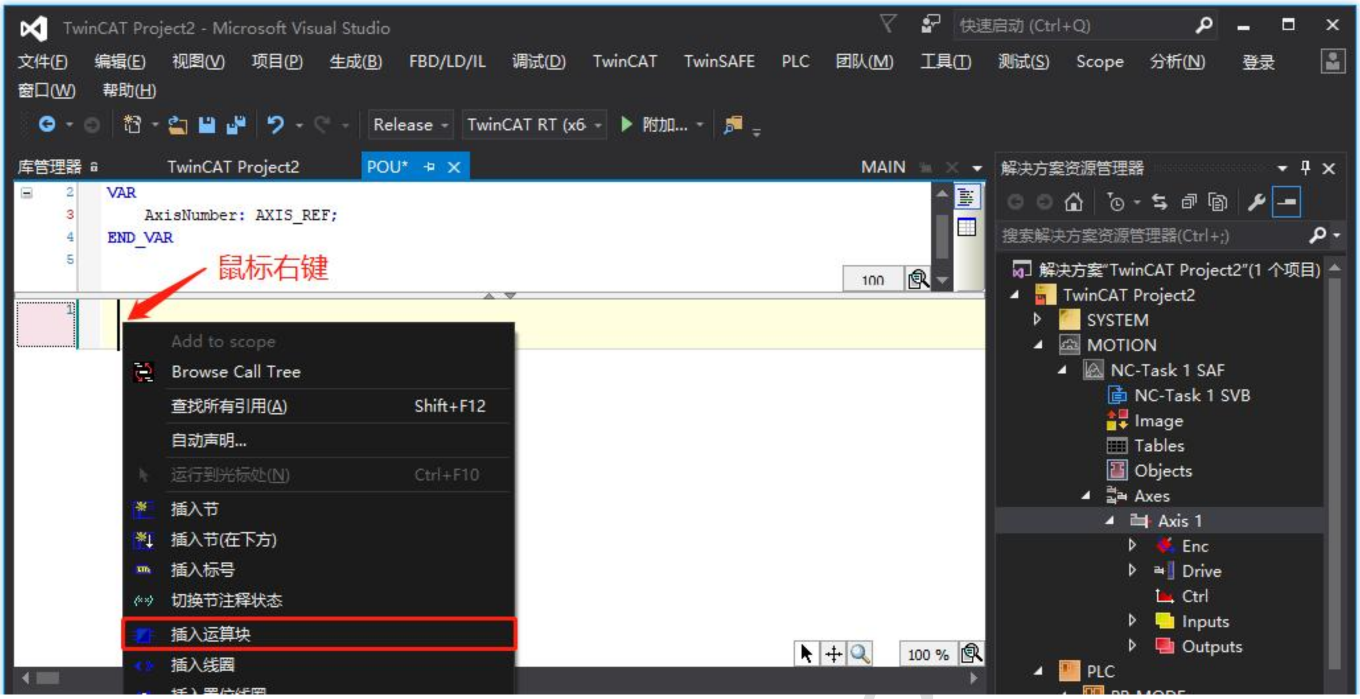


Fig. 221 Insert operation block

- Find the corresponding function block and click 【OK】 (MC_Power is used to send the enable command)
-

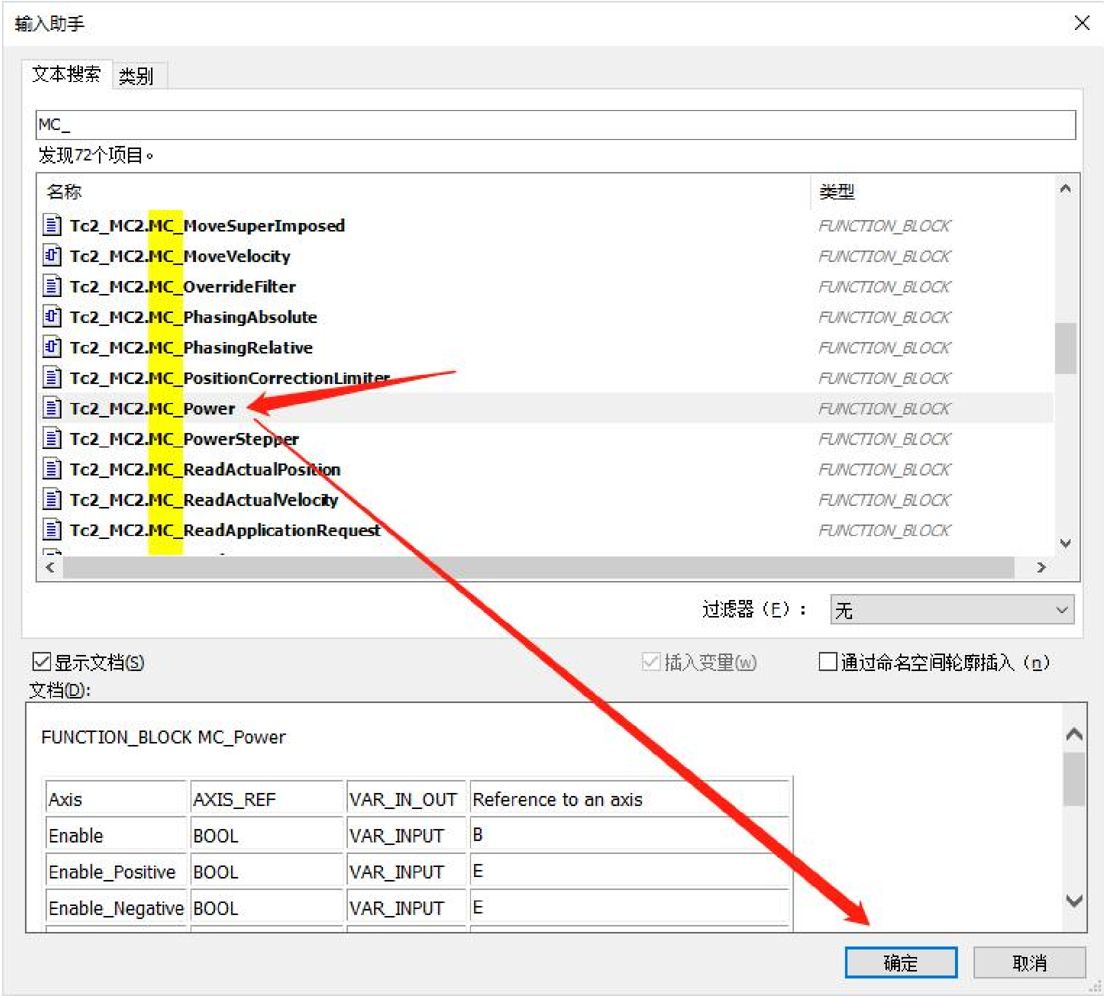


Fig 44 Select function block

- 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

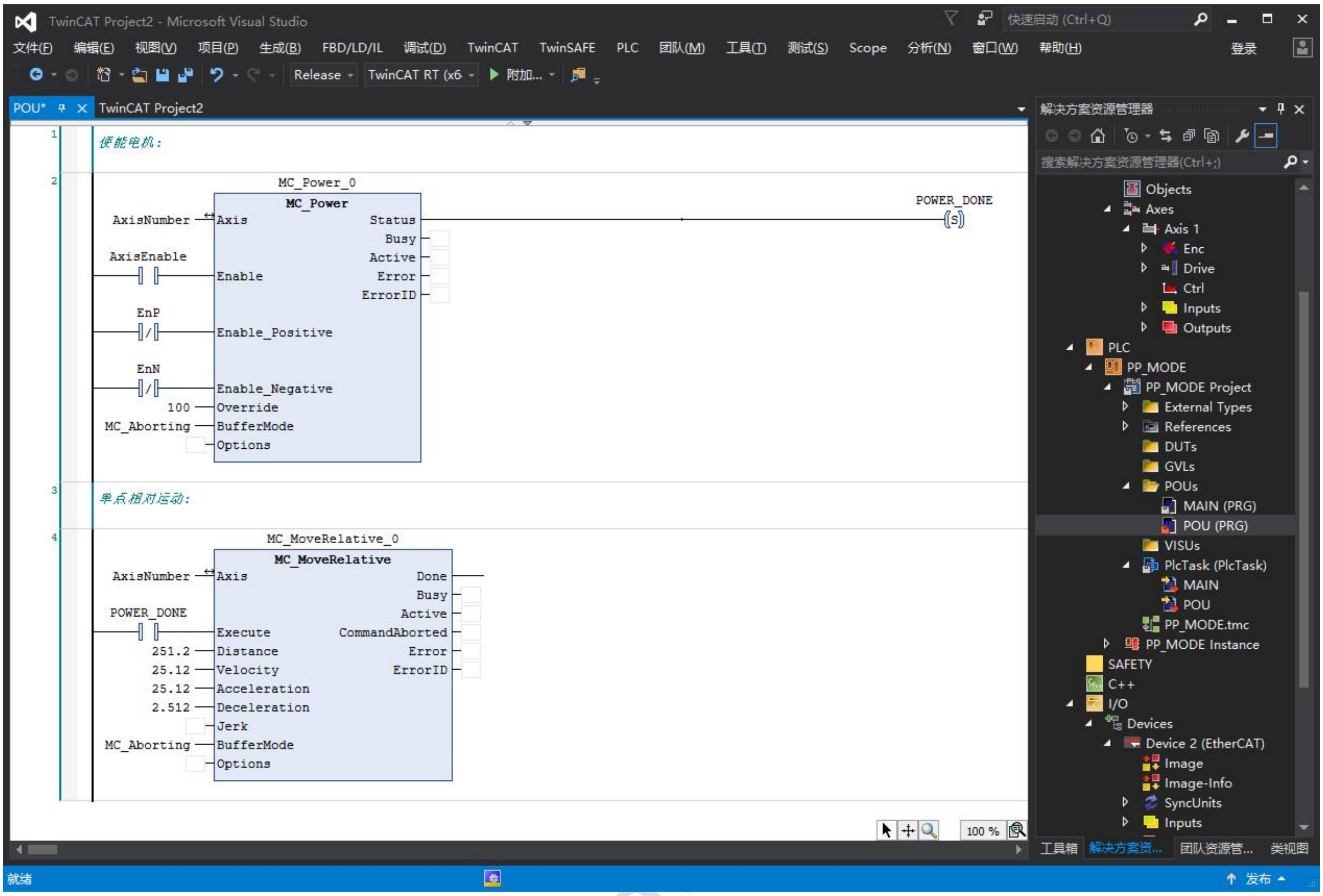


Figure 223 Point control routine

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

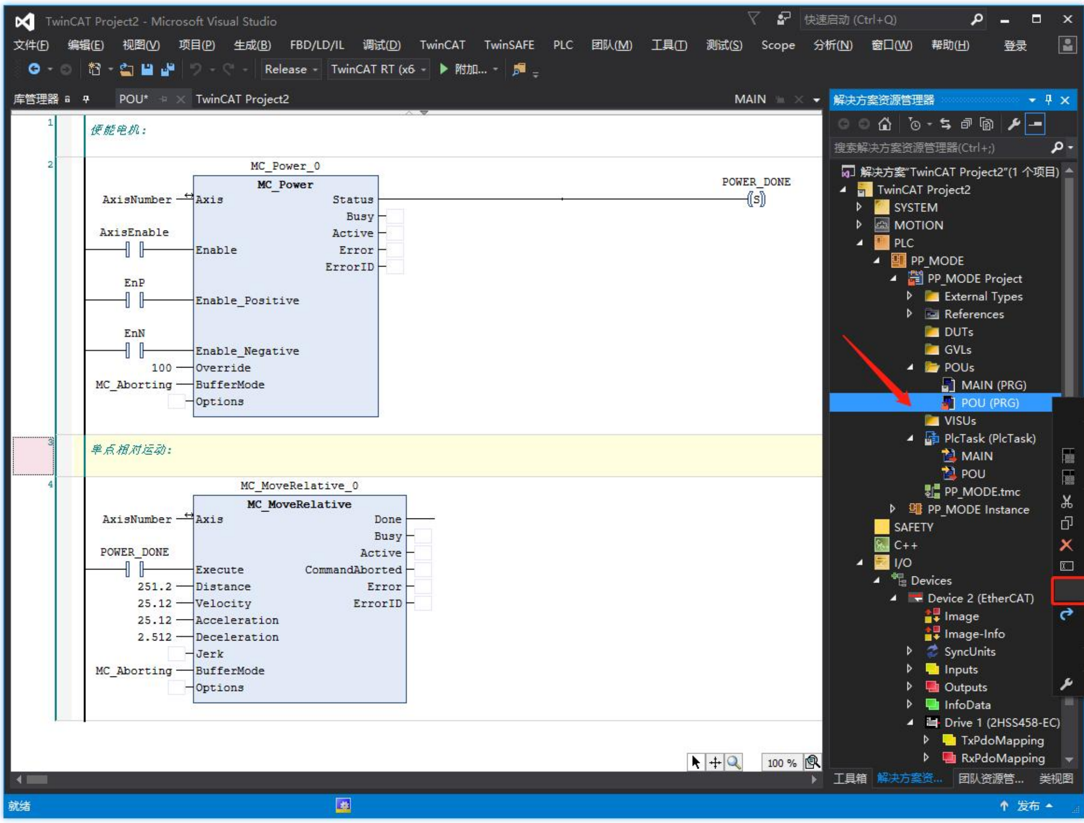


Figure 224 Removes the POU

- 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】

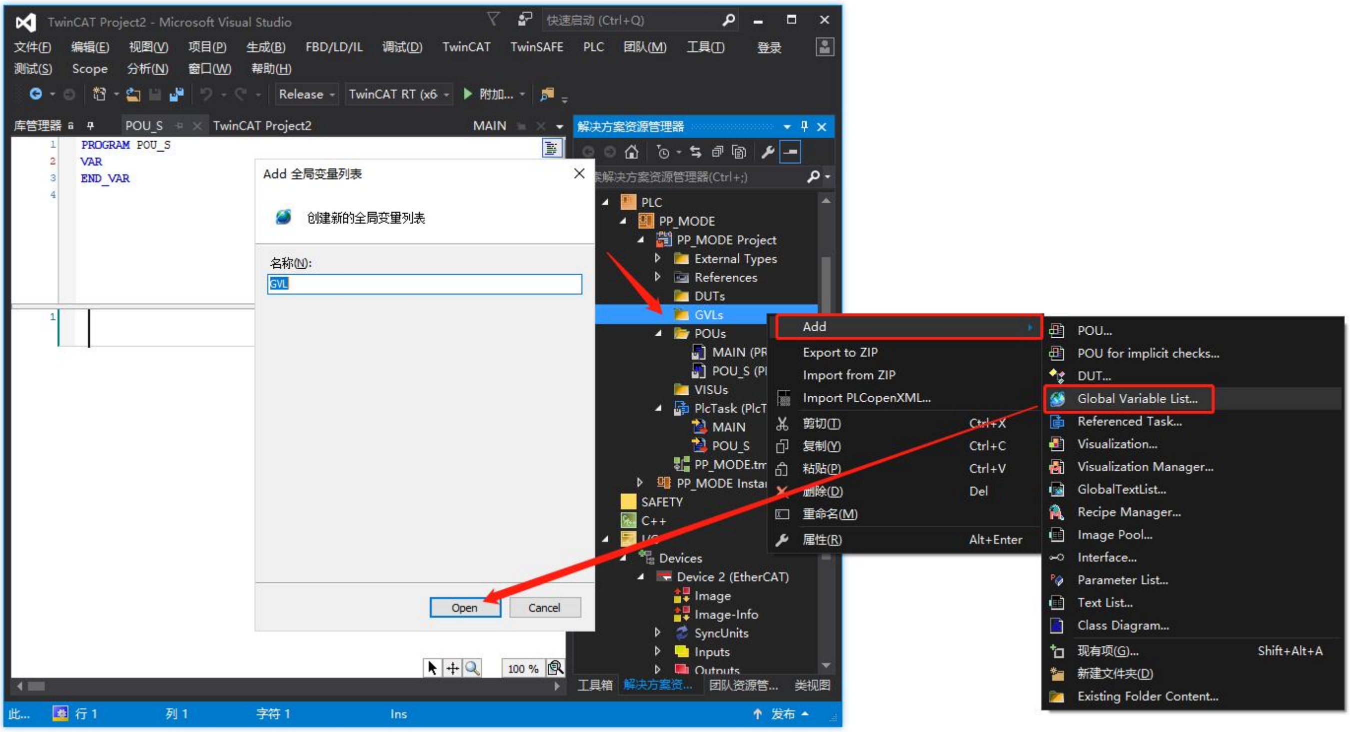


Figure 225 Add global variable list

- 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

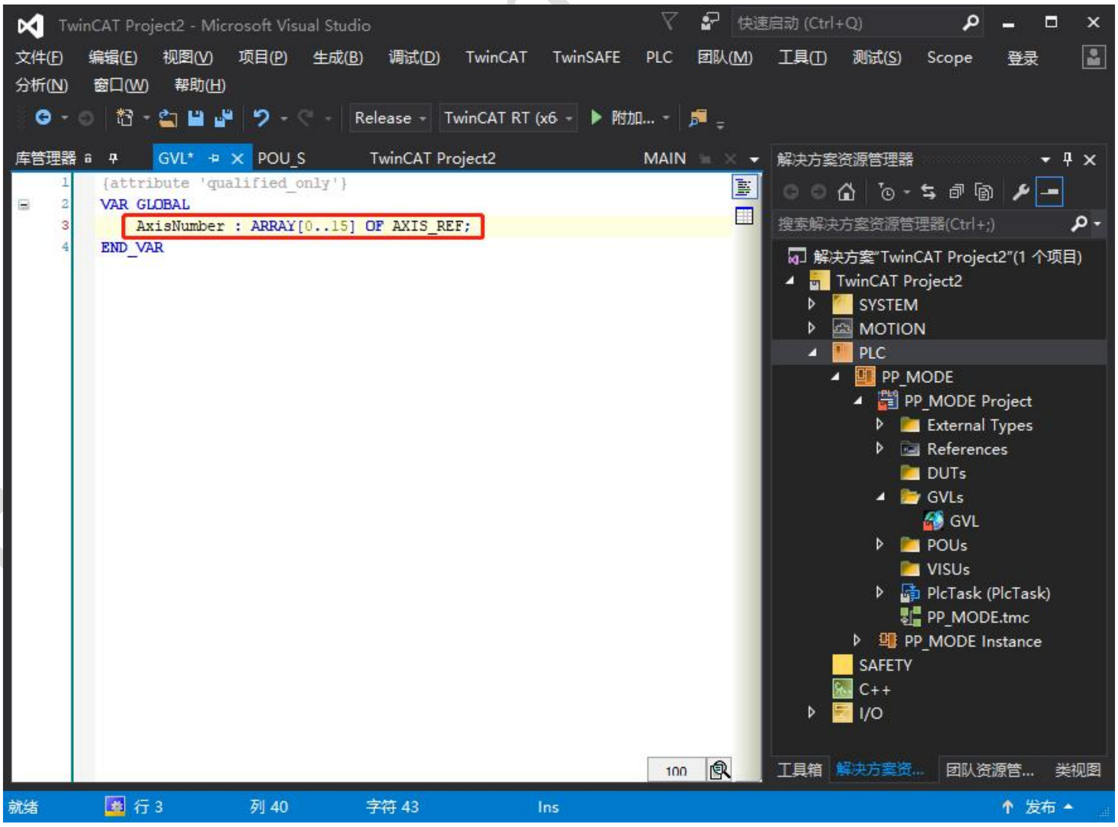


Figure 226 Add axis parameter group

- Select an address in the array to link to the axis, here select GVL.AxisNumber[0]

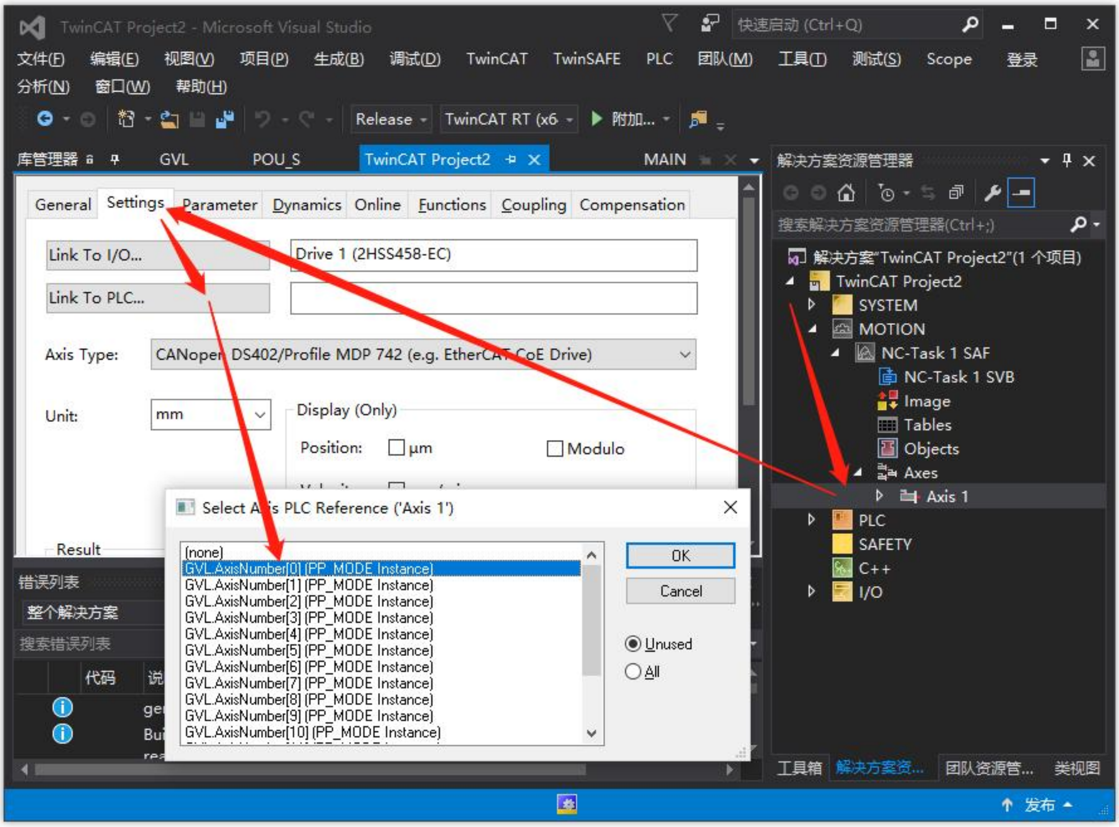


Figure 227 Link to corresponding axis number

- 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

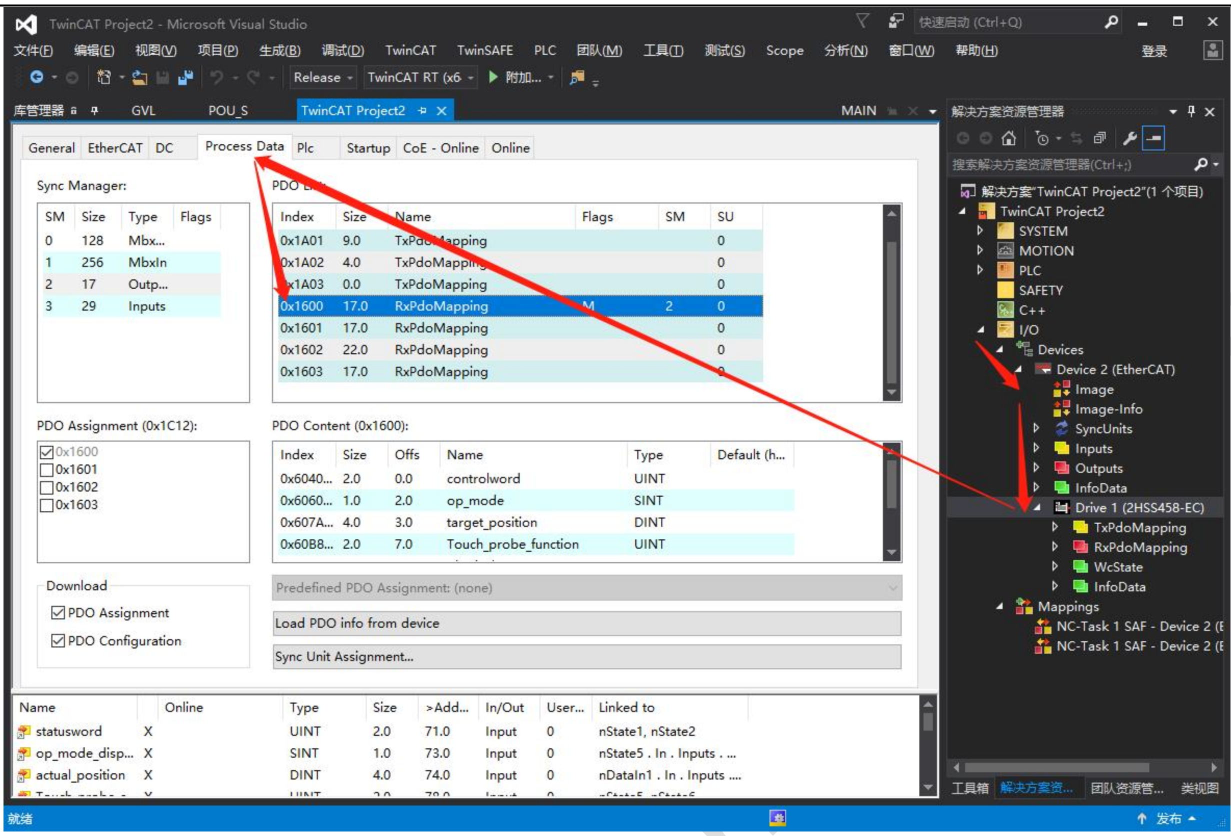


Figure 228 Modify PDO

- Delete 【Delete】 to remove the unnecessary object index, and insert 【Insert】 the required object index

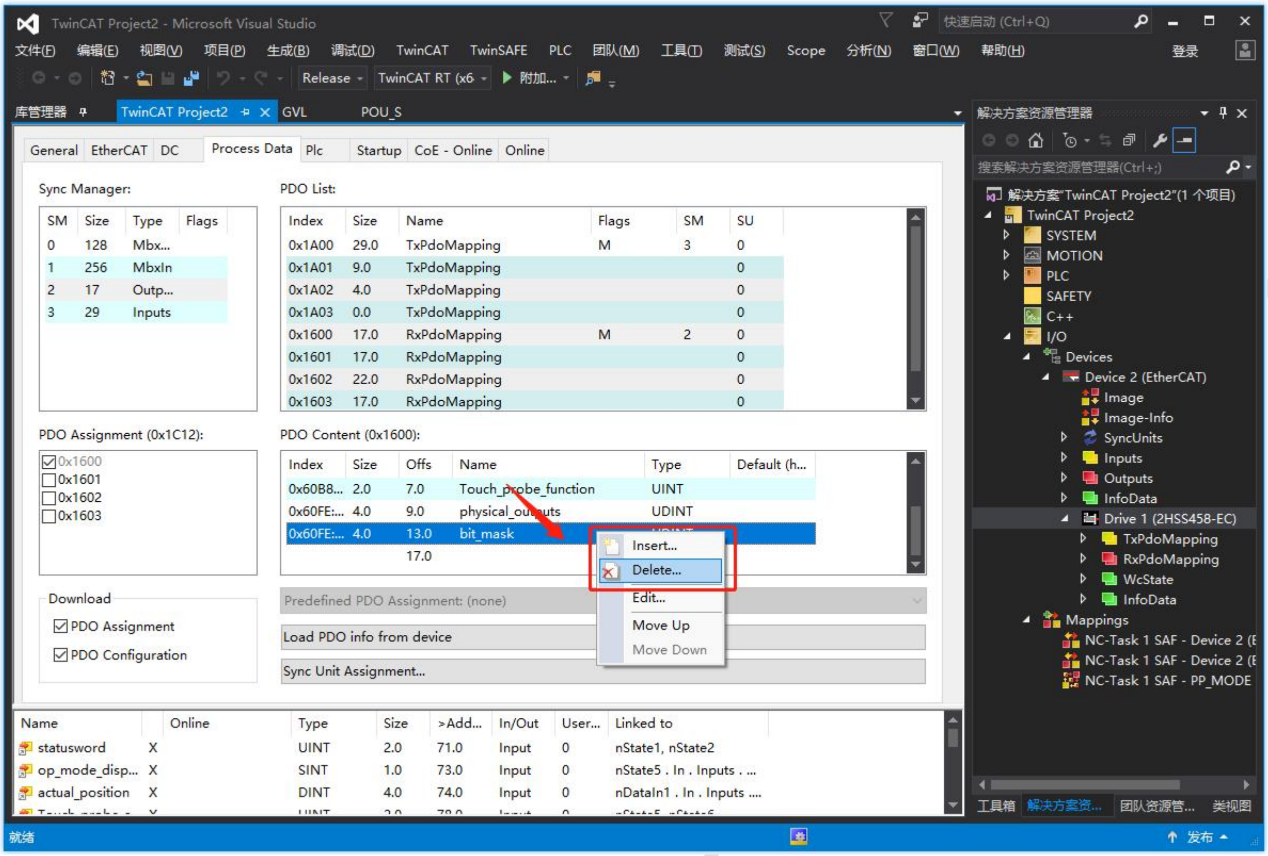


Figure 229 Modify PDO index

- Here we add the commonly used ones to the PDO mapping

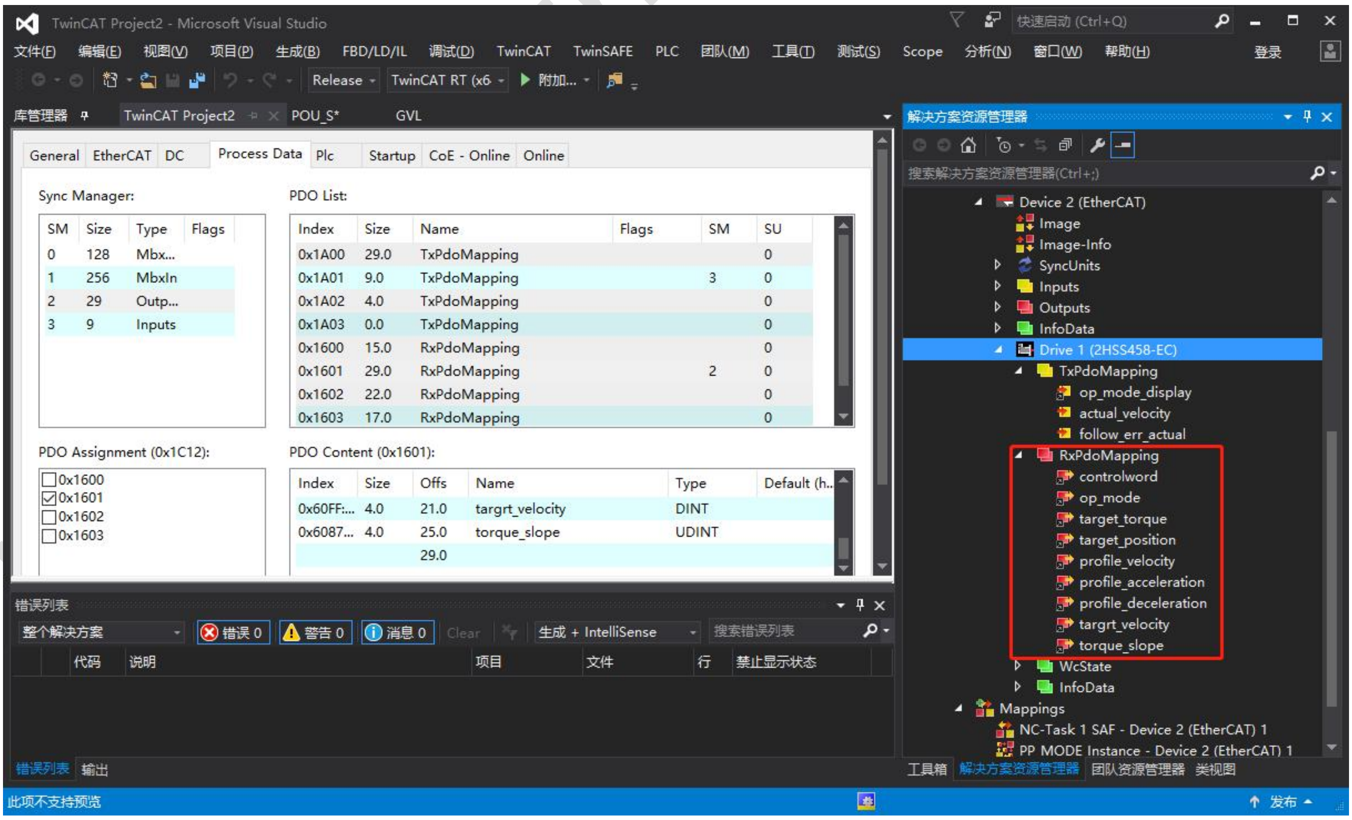


Fig 45 RxPDOMapping

- Then we add the corresponding output variable to the created POU program variable list, and click【Activate Configuration】] to activate the configuration

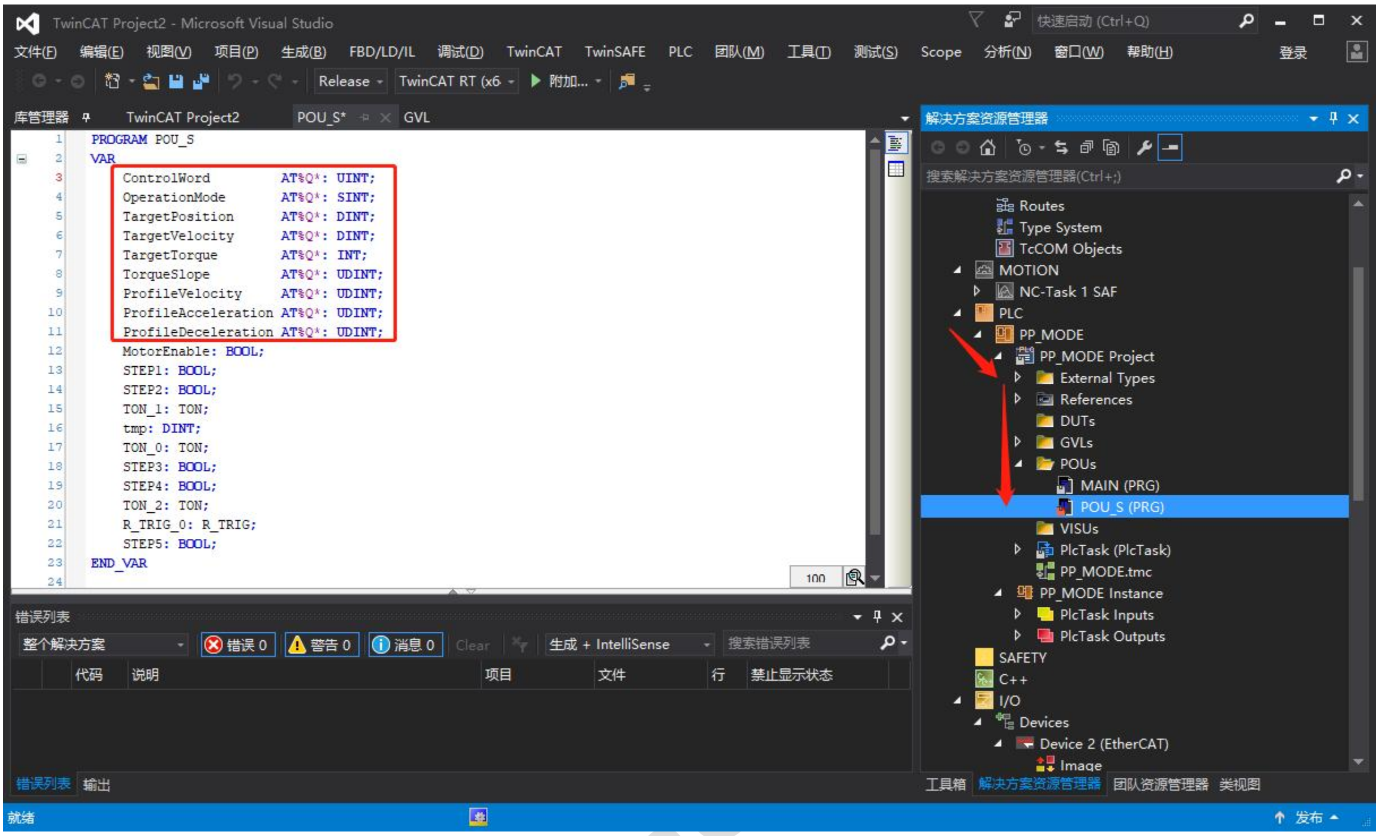


Figure 231 Add output variable

- 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】

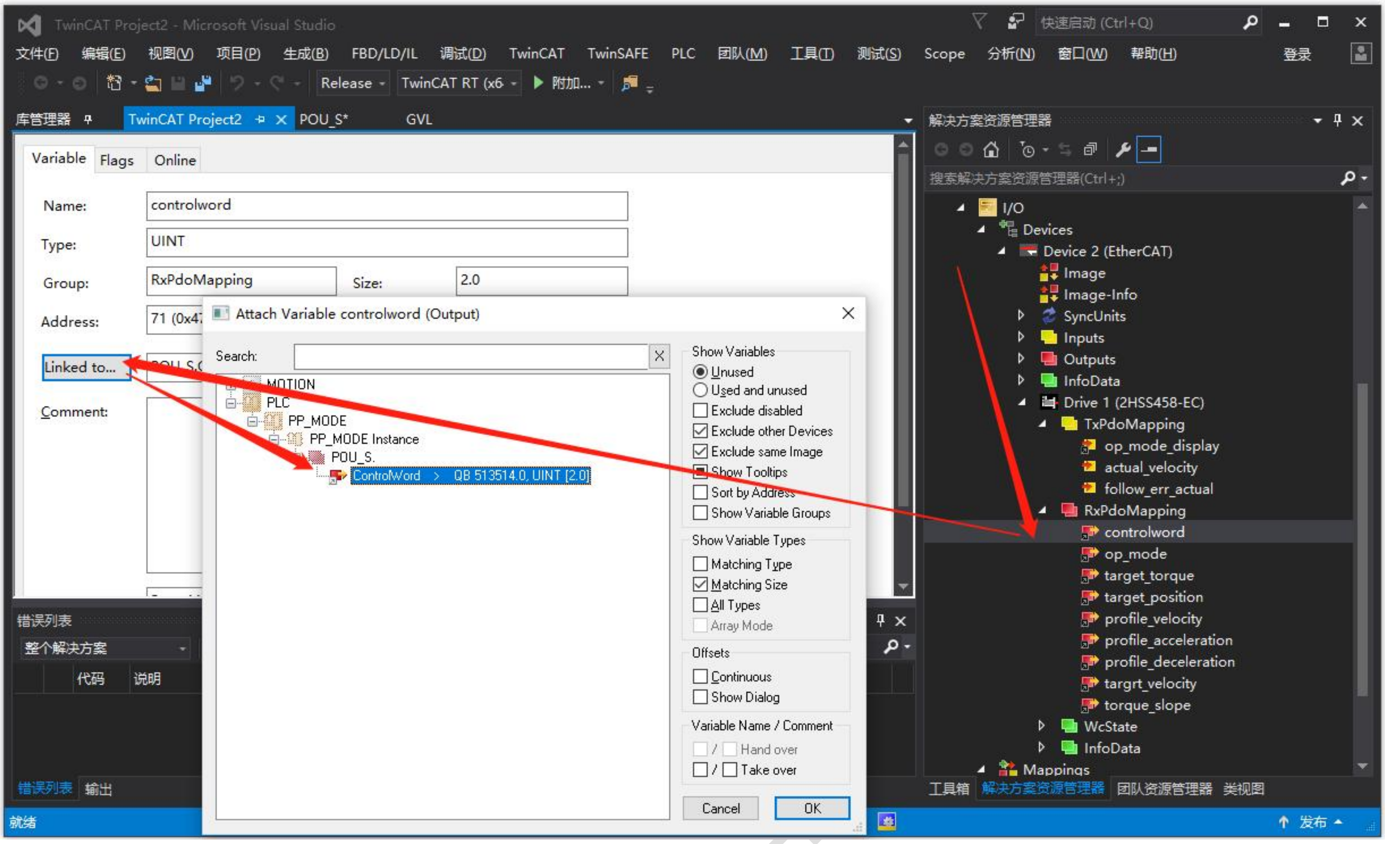


Figure 232 Link to output variable

- 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

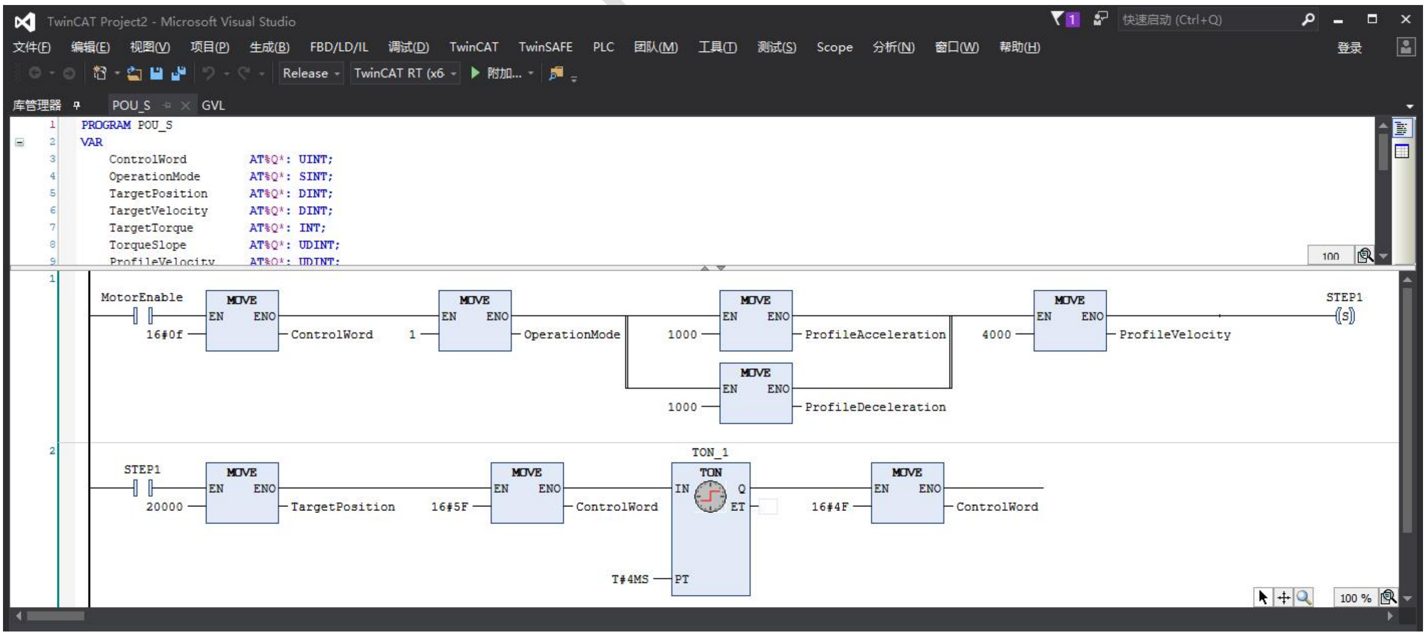


Fig. 233 Enter running mode

- Click [PLC] → select 【Login to】→ continue to download【YES】

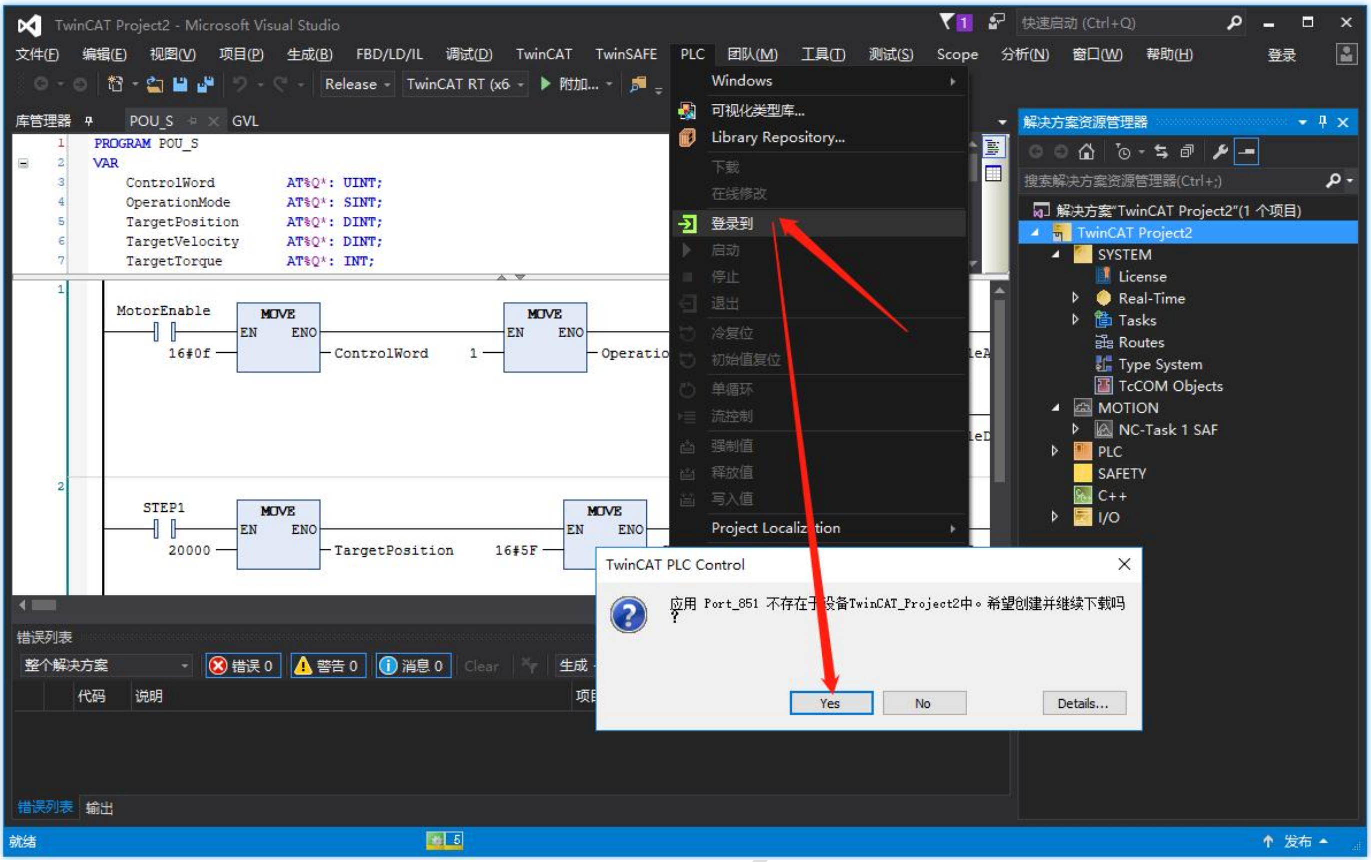


Figure 234 Confirm to continue downloading

- click【PLC】→select【start】

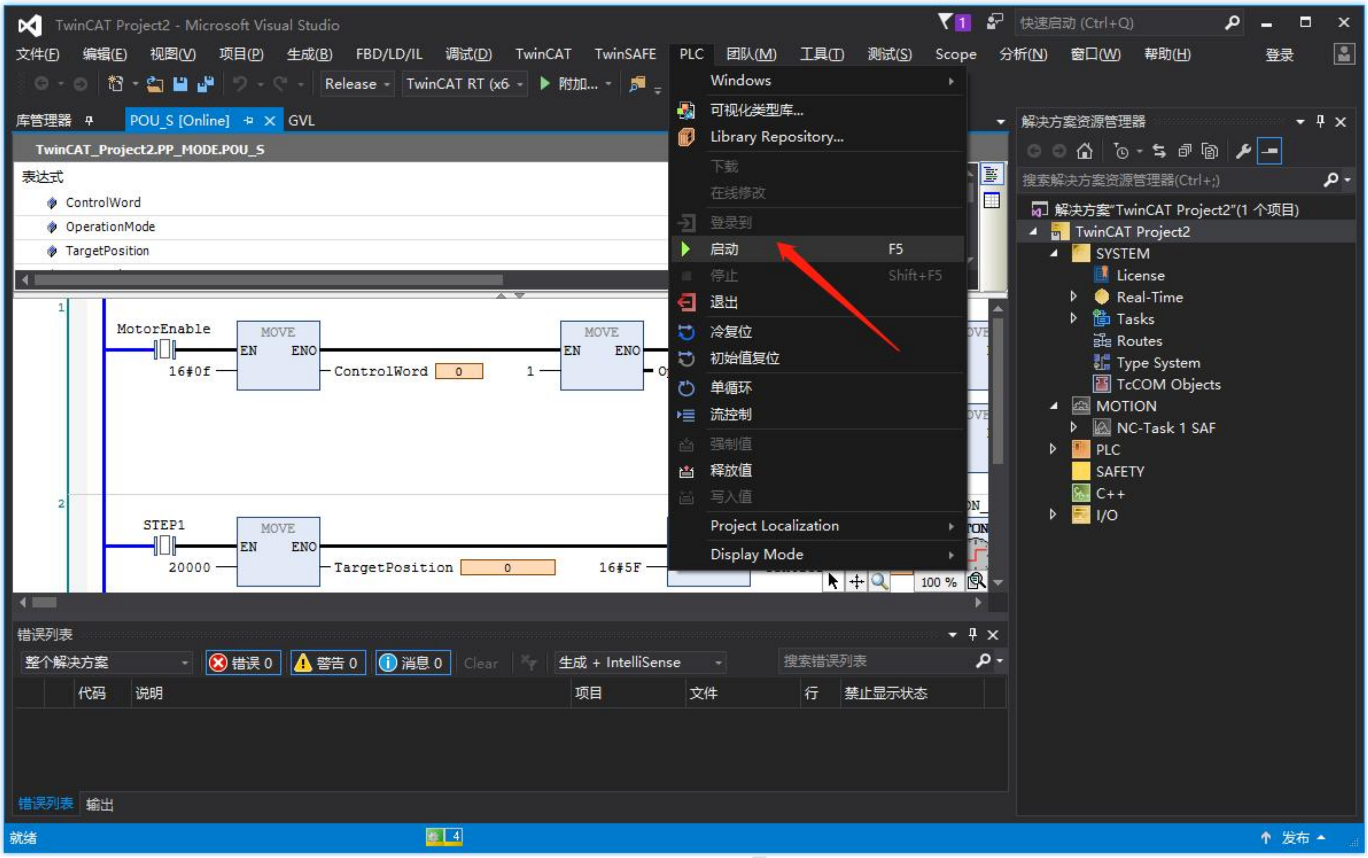


Fig. 235 Start PLC

- Then, the user can start to run the written program

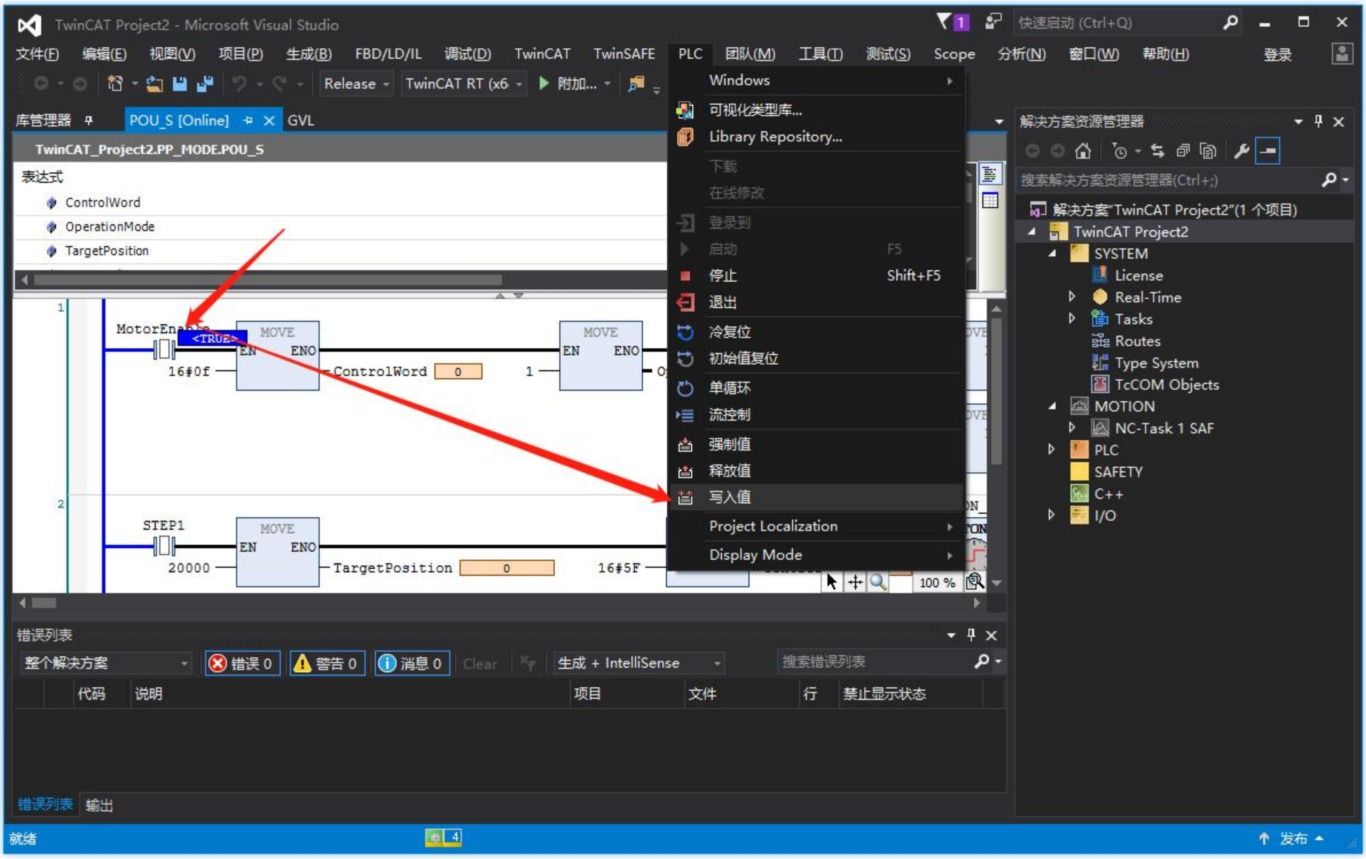


Figure 236 Running the program

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

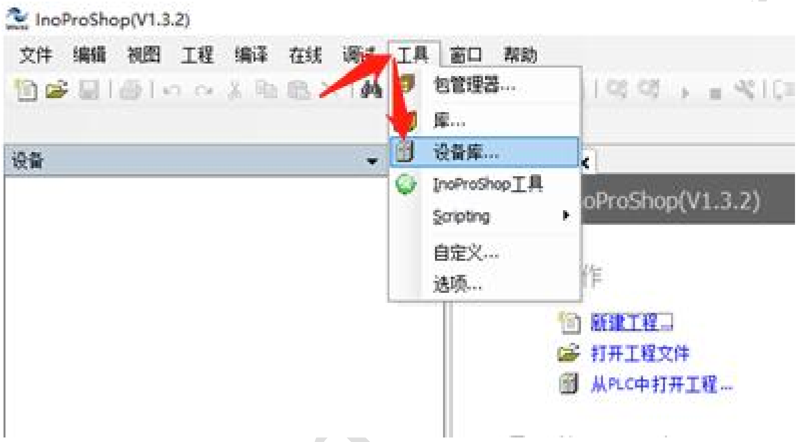


Figure 237 Open the device library

● Installation→Install slave device description file

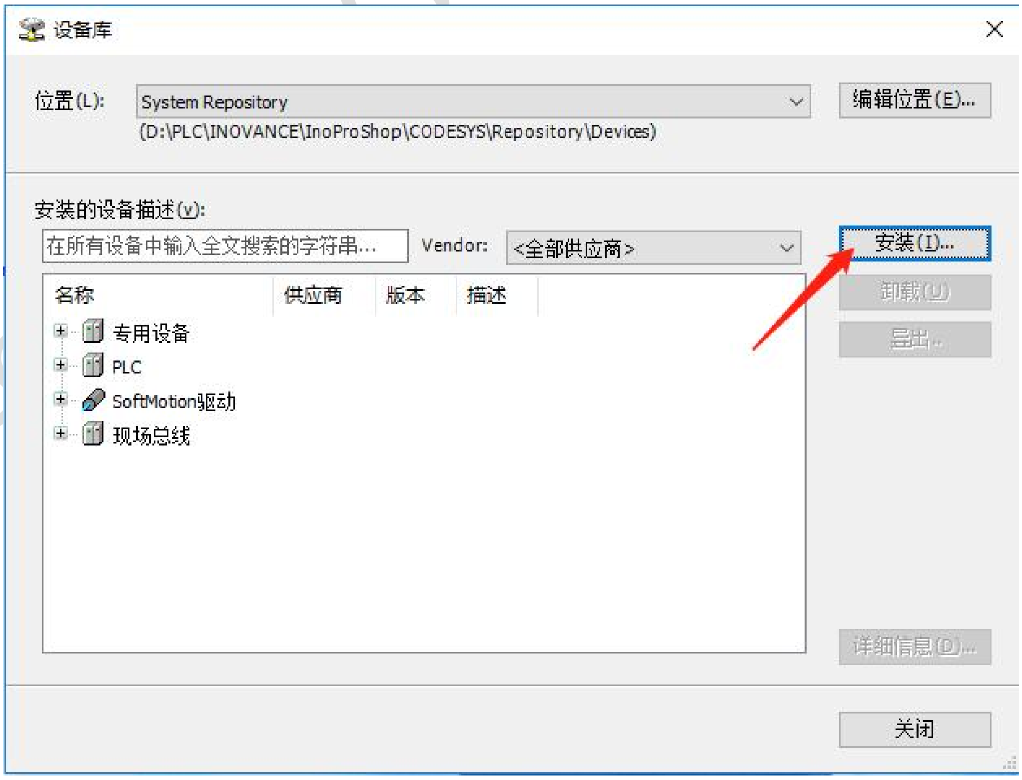


Figure 238 Install device description file

● Select XML file→Open

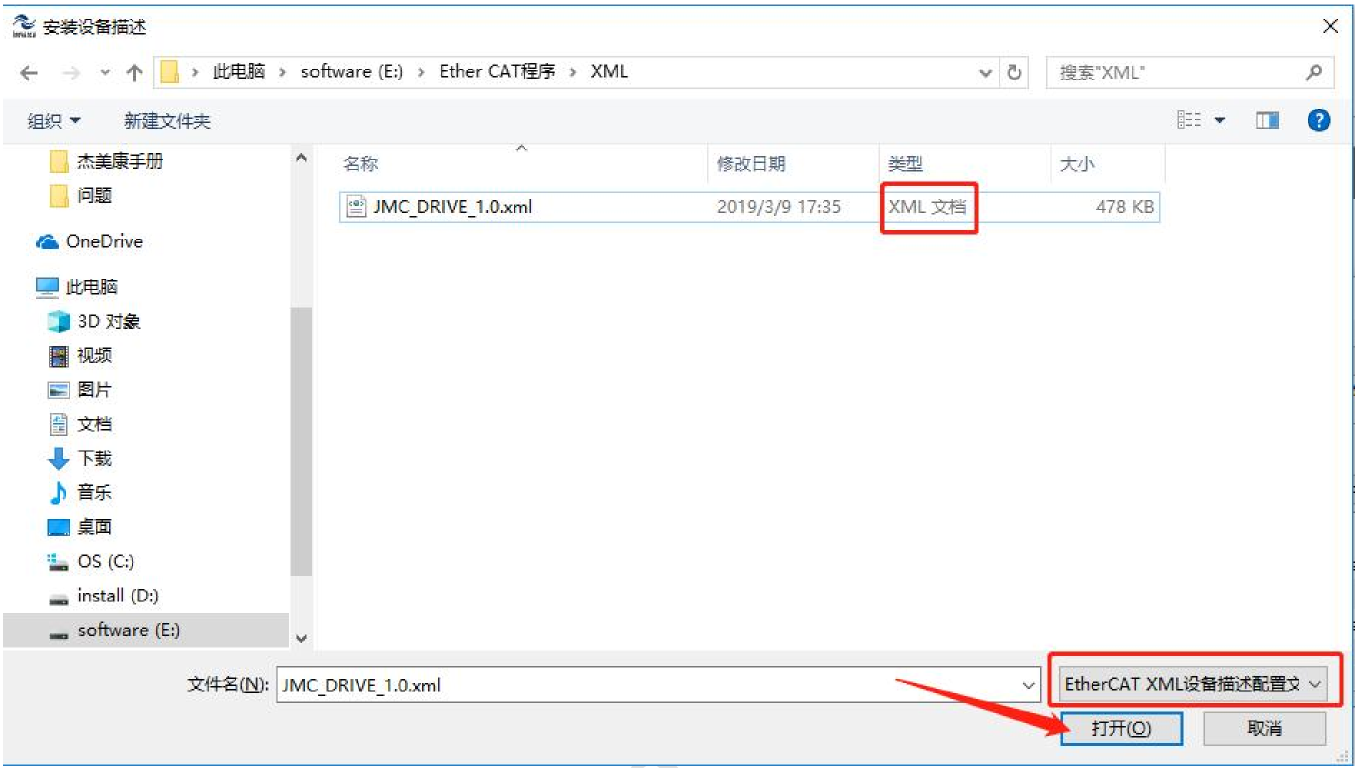


Figure 239 Select XML file

● After successful opening, the "Uninstall" button will NO longer be dim

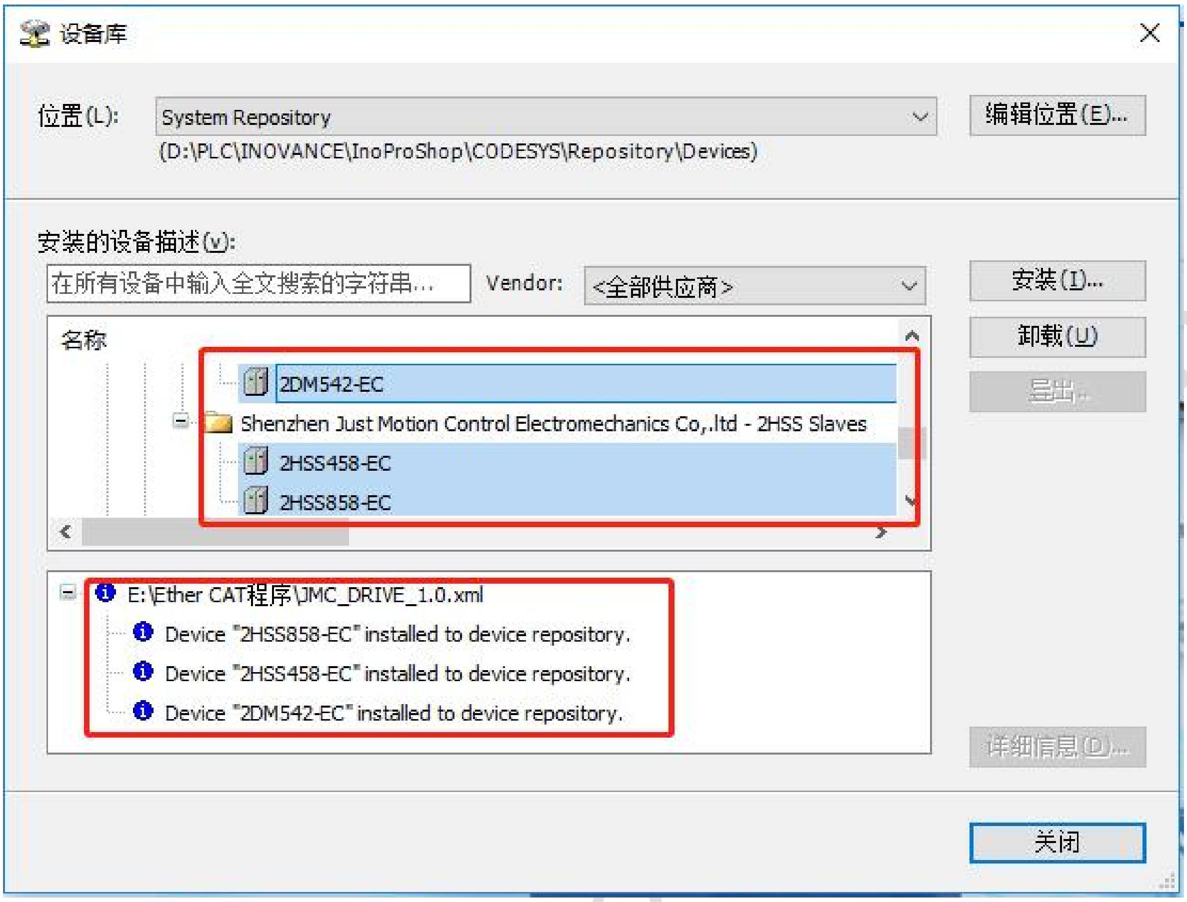


Figure 240 Successful installation

Create a project

- Click New Project

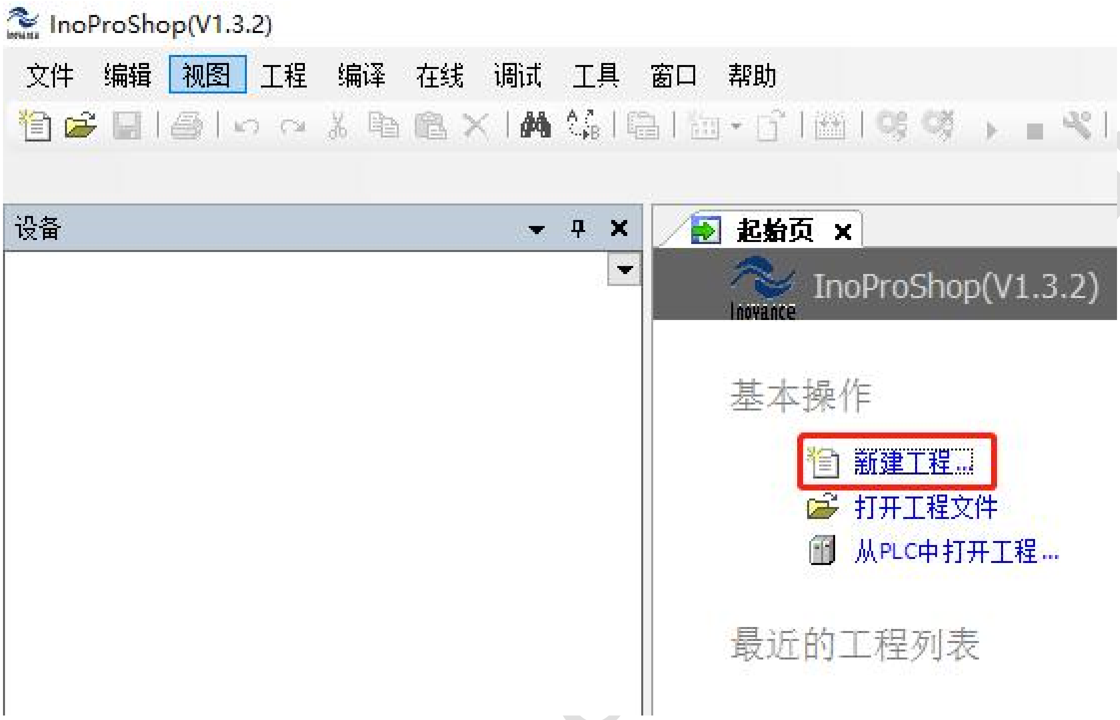


Figure 241 New INOProShop project

- Select "Standard Project" and determine the location and name of the EtherCAT project

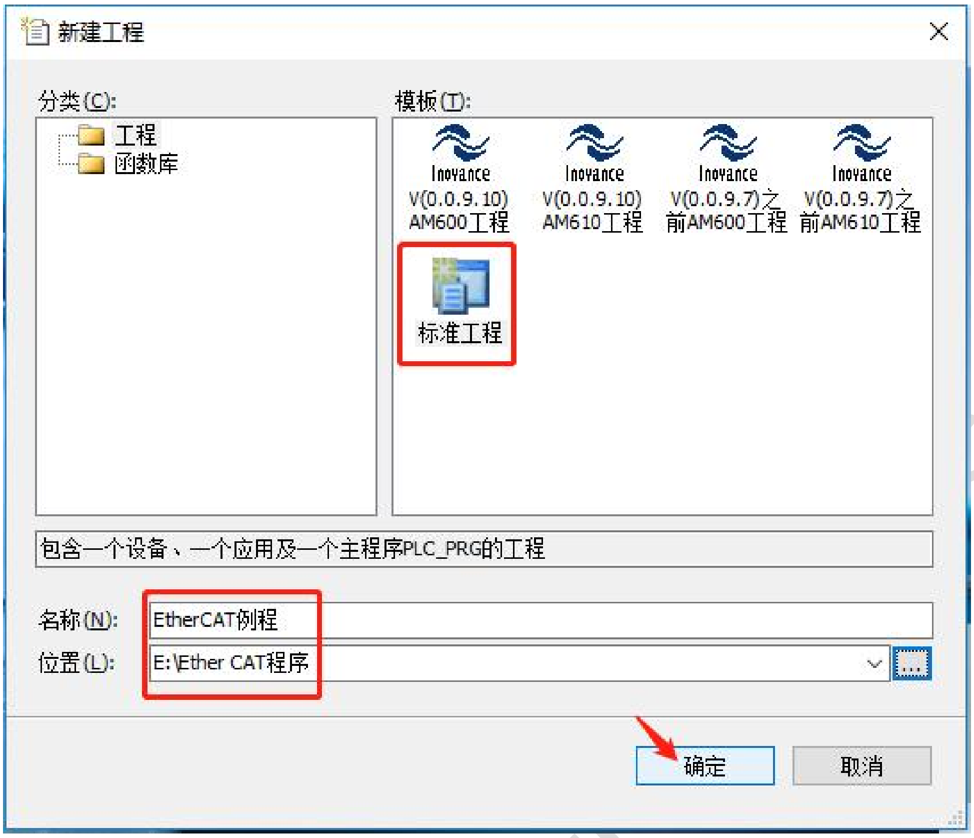


Figure 242 New standard project

- Select the device and programming language used, click OK
-

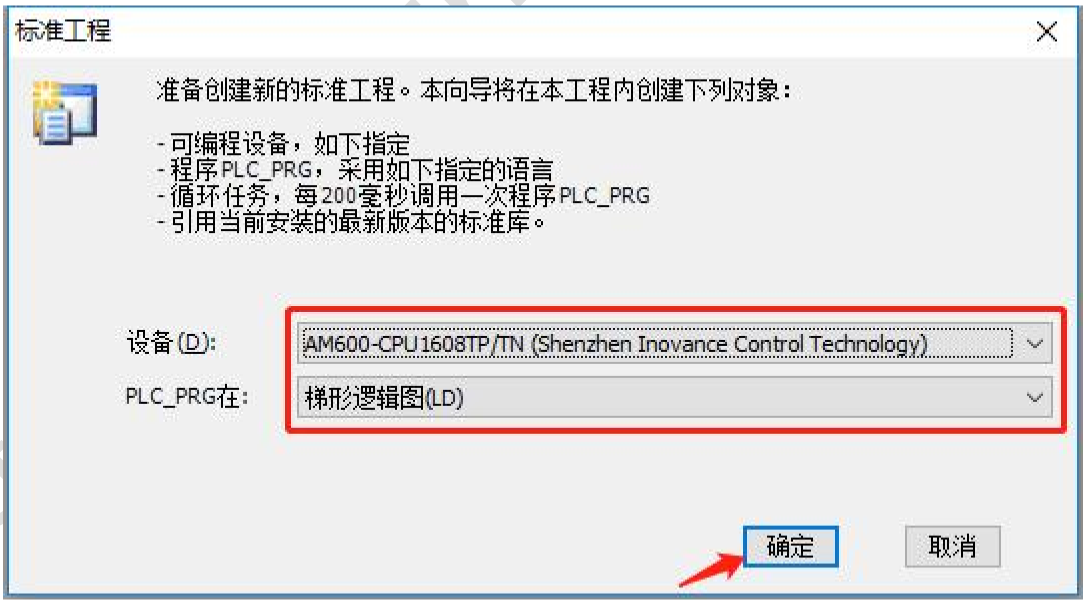


Figure 243 Determining the device and programming language

Add device

- Double-click Network Configuration→click PLC→check EtherCAT master

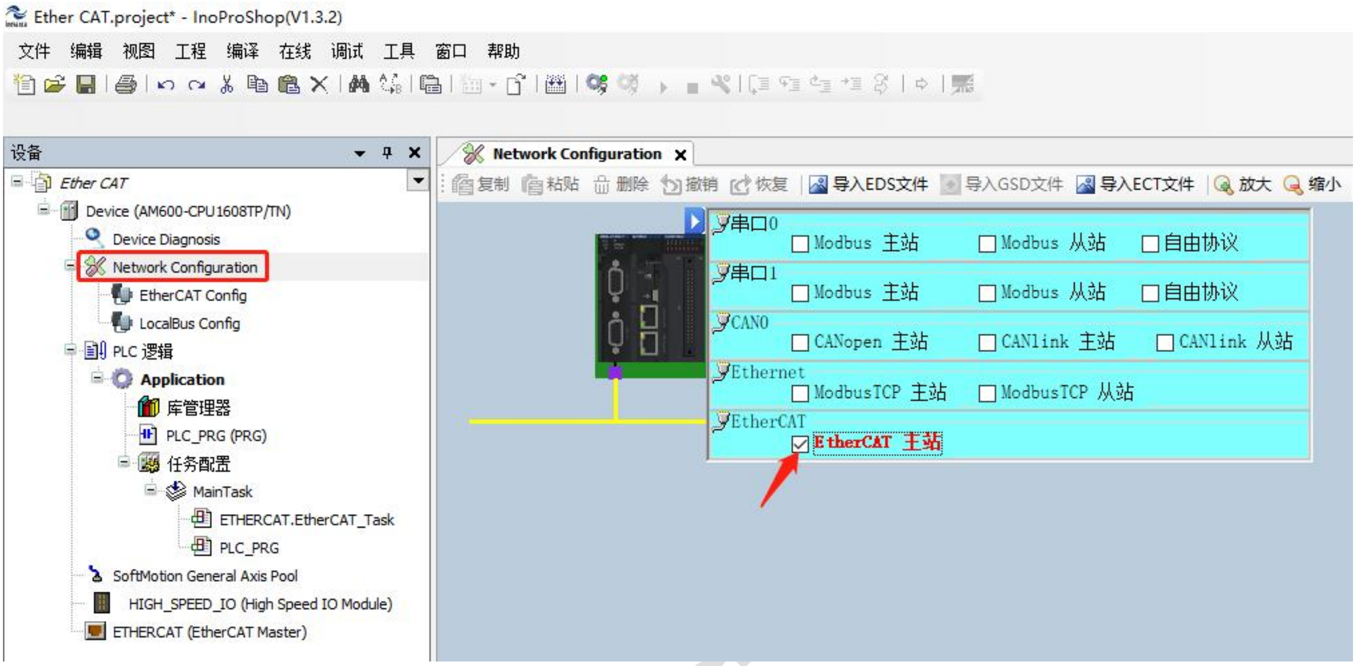


Figure 244 Add EtherCAT master

- Find ‘’ShenZhen Just motion comtrol’’ under the network device list on the right, double-click the slave station to be added.
-

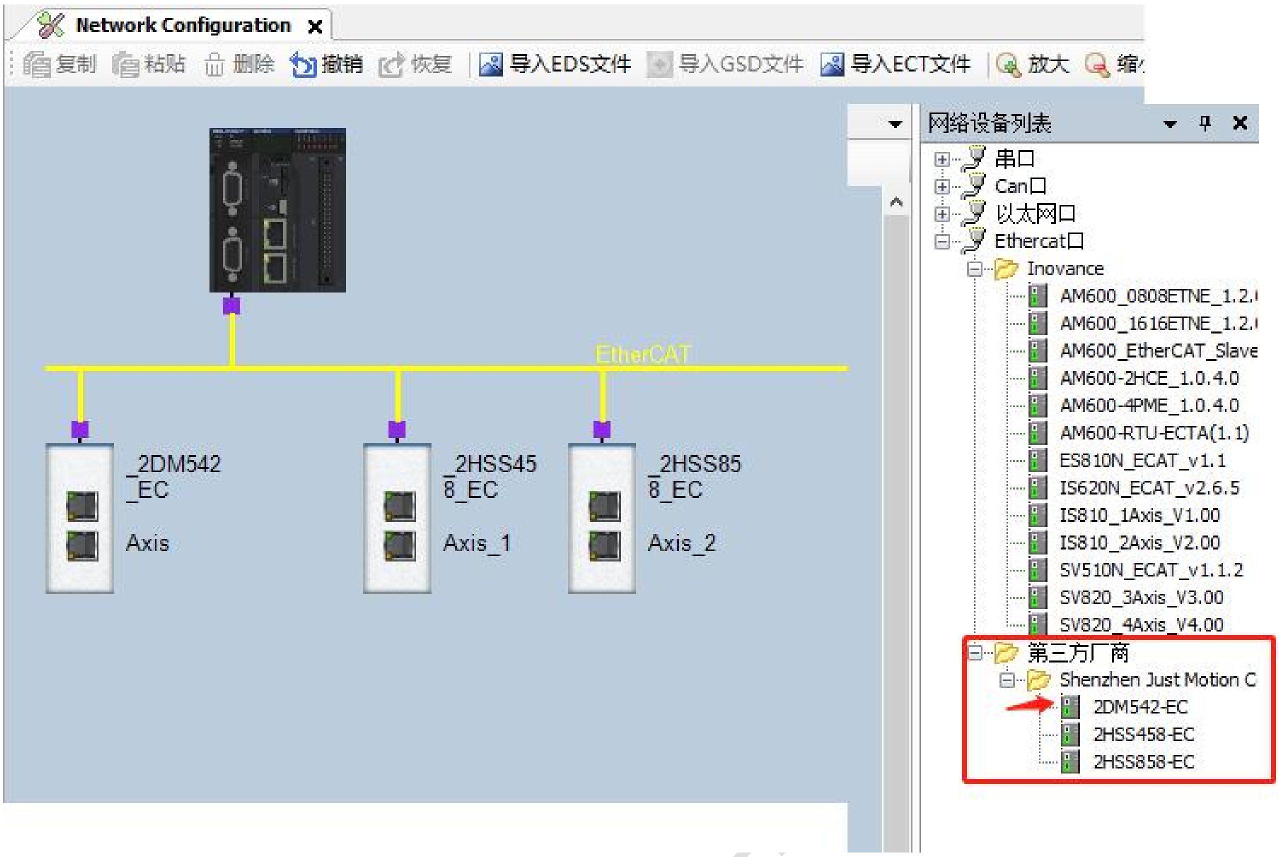


Figure 245 Add slave device

- Find the added slave station under the left device → right click to add CIA 402AIXS

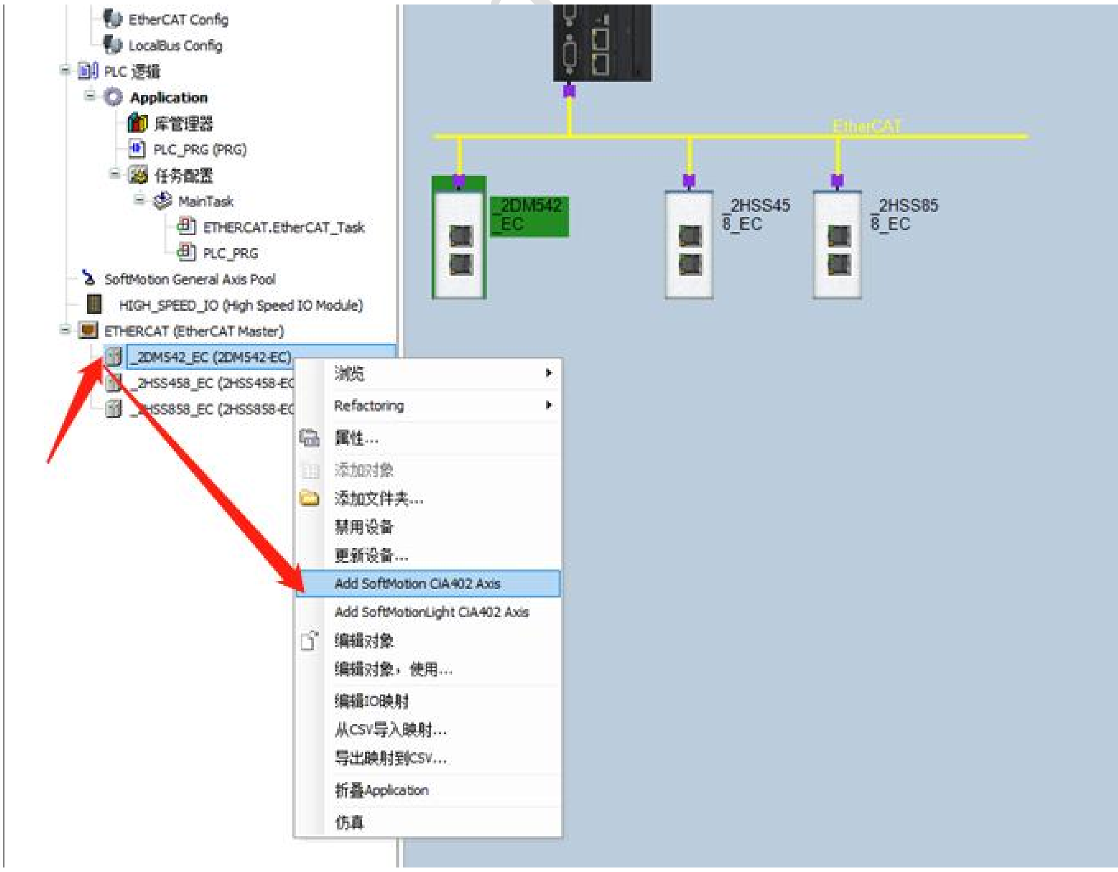


Figure 246 Add 402 axis

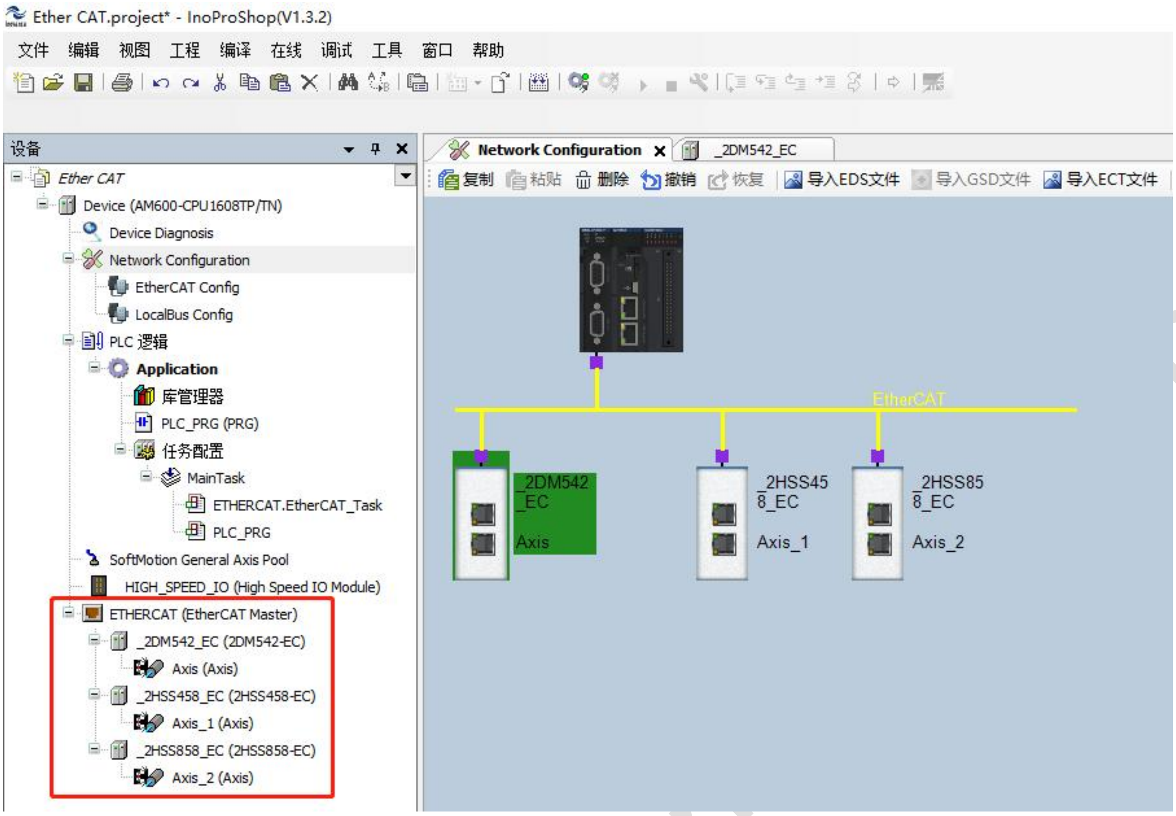


Figure 247 402 axis added

Parameter setting

- Double-click 2DM542-EC → check to enable expert settings under overview

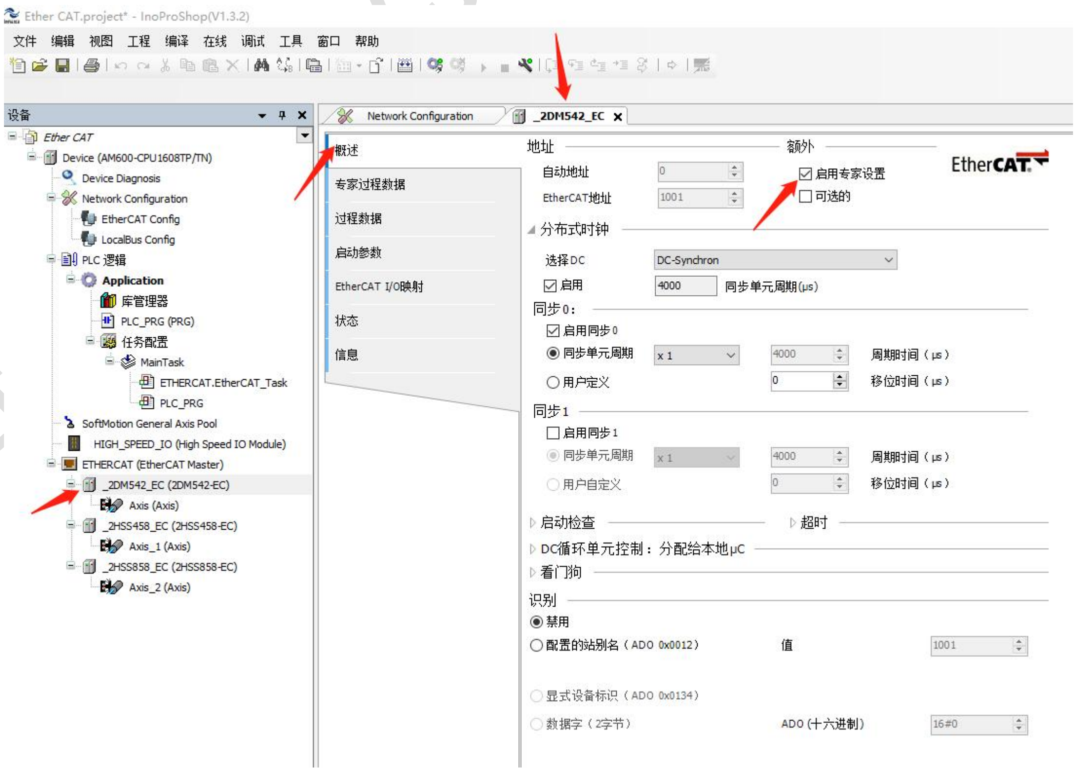


Figure 248 Enable expert settings

- Check PDO allocation and PDO configuration under expert process data

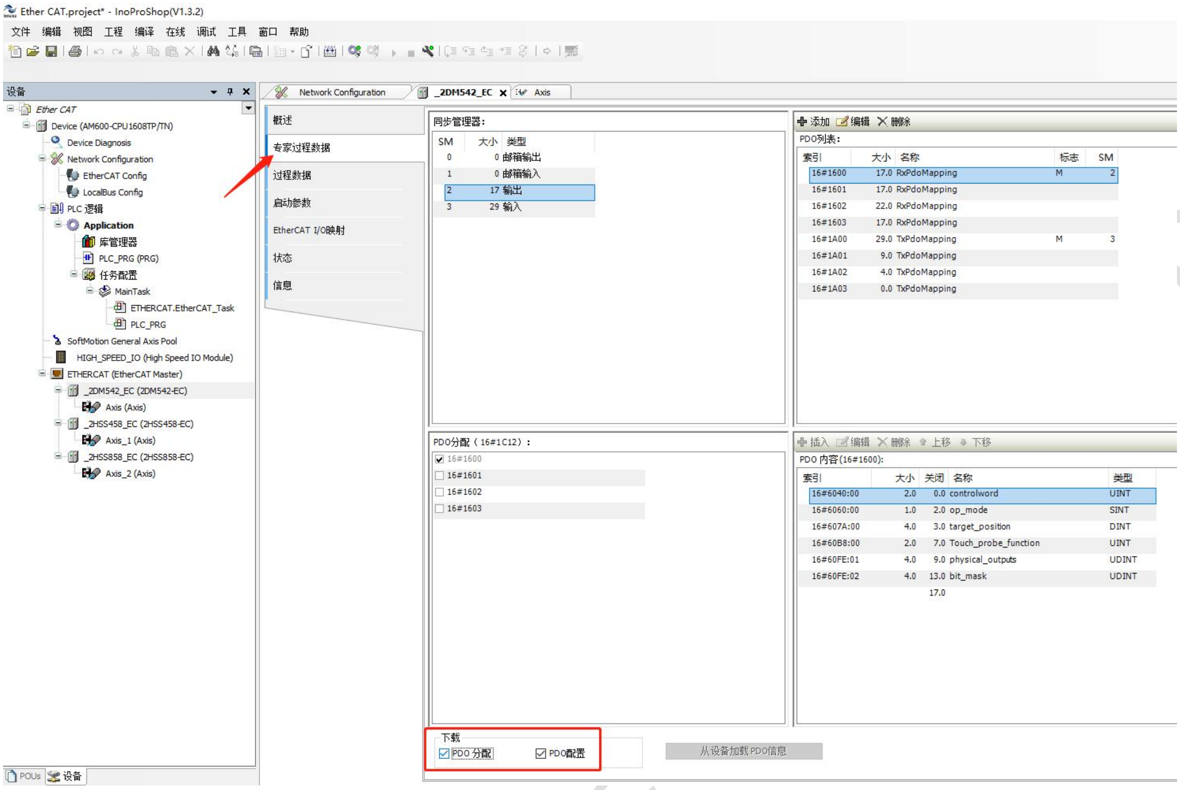


Figure 249 Check PDO configuration

- 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).

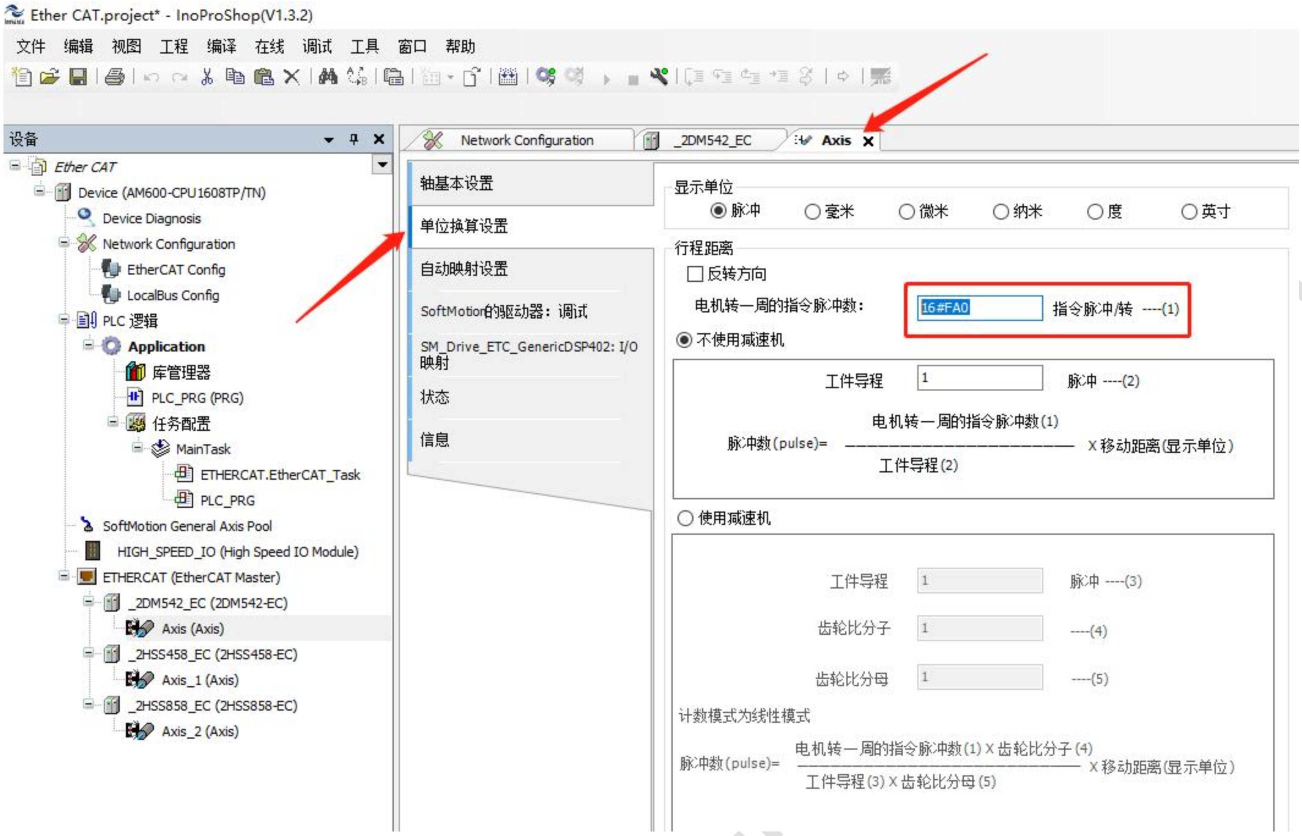


Figure 250 Setting the number of pulses for one revolution of the motor

Add zero return parameter

- Startup parameter→click to add

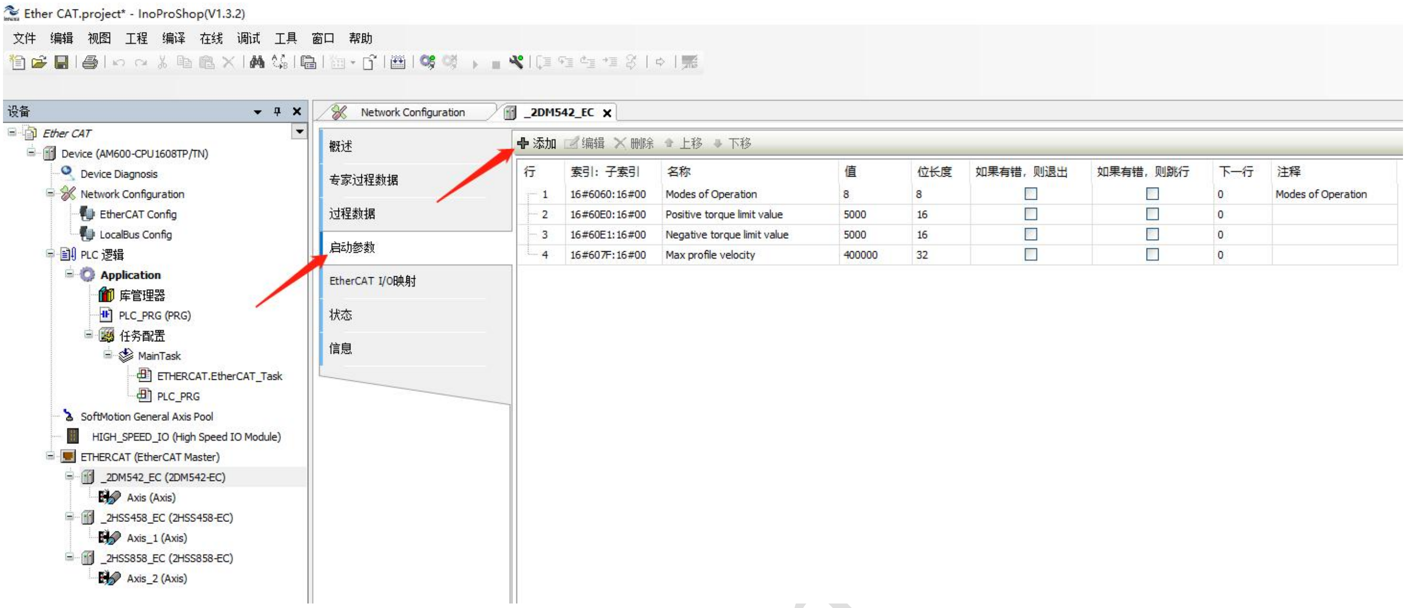


Figure 251 Add startup parameters

- 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

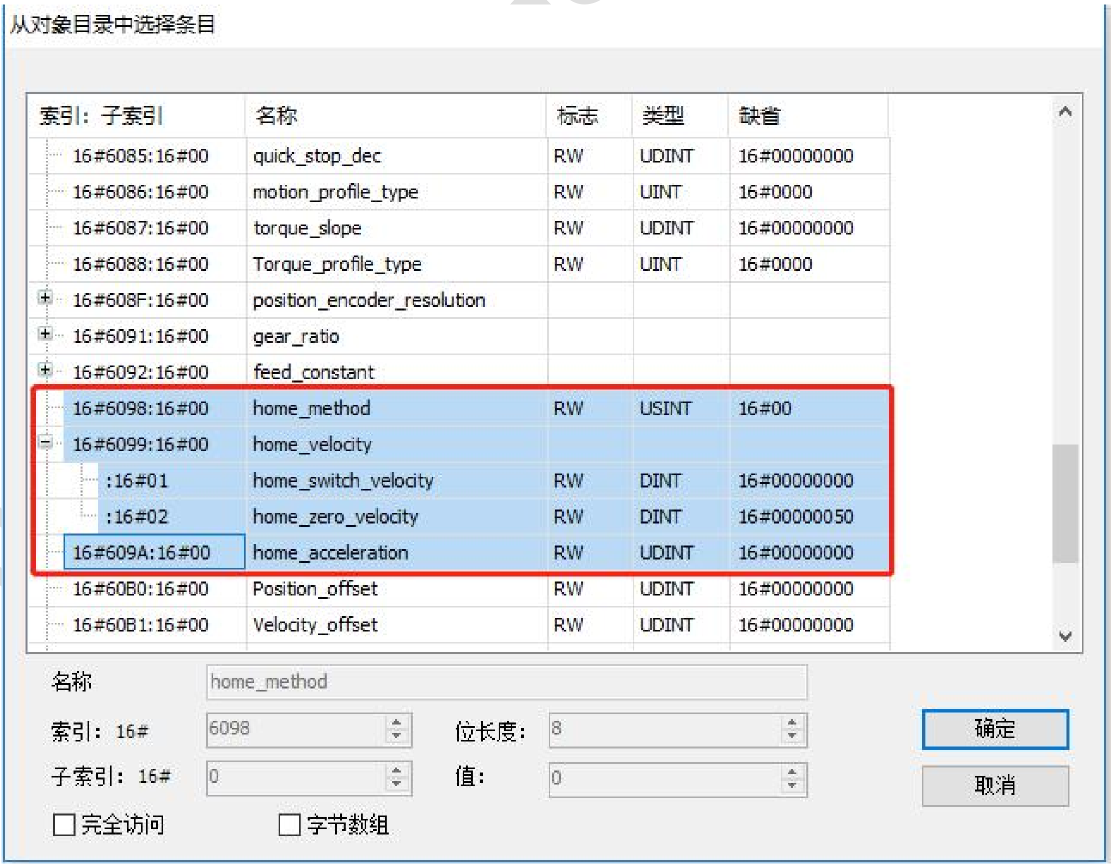


Figure 252 Selection object dictionary

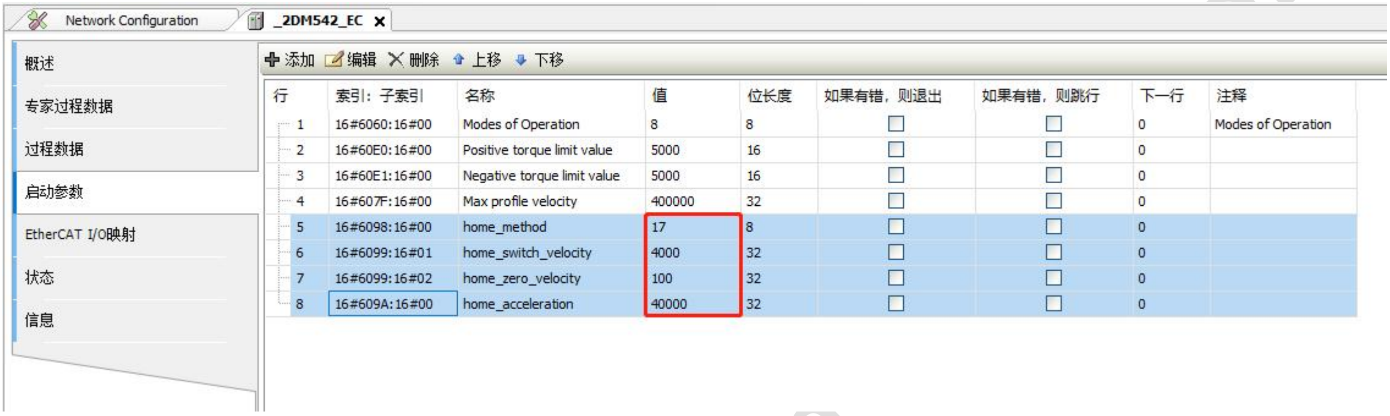
Set the zero return parameter

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



行	索引：子索引	名称	值	位长度	如果有错，则退出	如果有错，则跳行	下一行	注释
1	16#6060:16#00	Modes of Operation	8	8			0	Modes of Operation
2	16#60E0:16#00	Positive torque limit value	5000	16			0	
3	16#60E1:16#00	Negative torque limit value	5000	16			0	
4	16#607F:16#00	Max profile velocity	400000	32			0	
5	16#6098:16#00	home_method	17	8			0	
6	16#6099:16#01	home_switch_velocity	4000	32			0	
7	16#6099:16#02	home_zero_velocity	100	32			0	
8	16#609A:16#00	home_acceleration	40000	32			0	

Figure 253 Setting the zero return parameter

Programming

1 New program organization unit

- Right click Application→Add Object→Program Organization Unit→Name, Type, Language
-

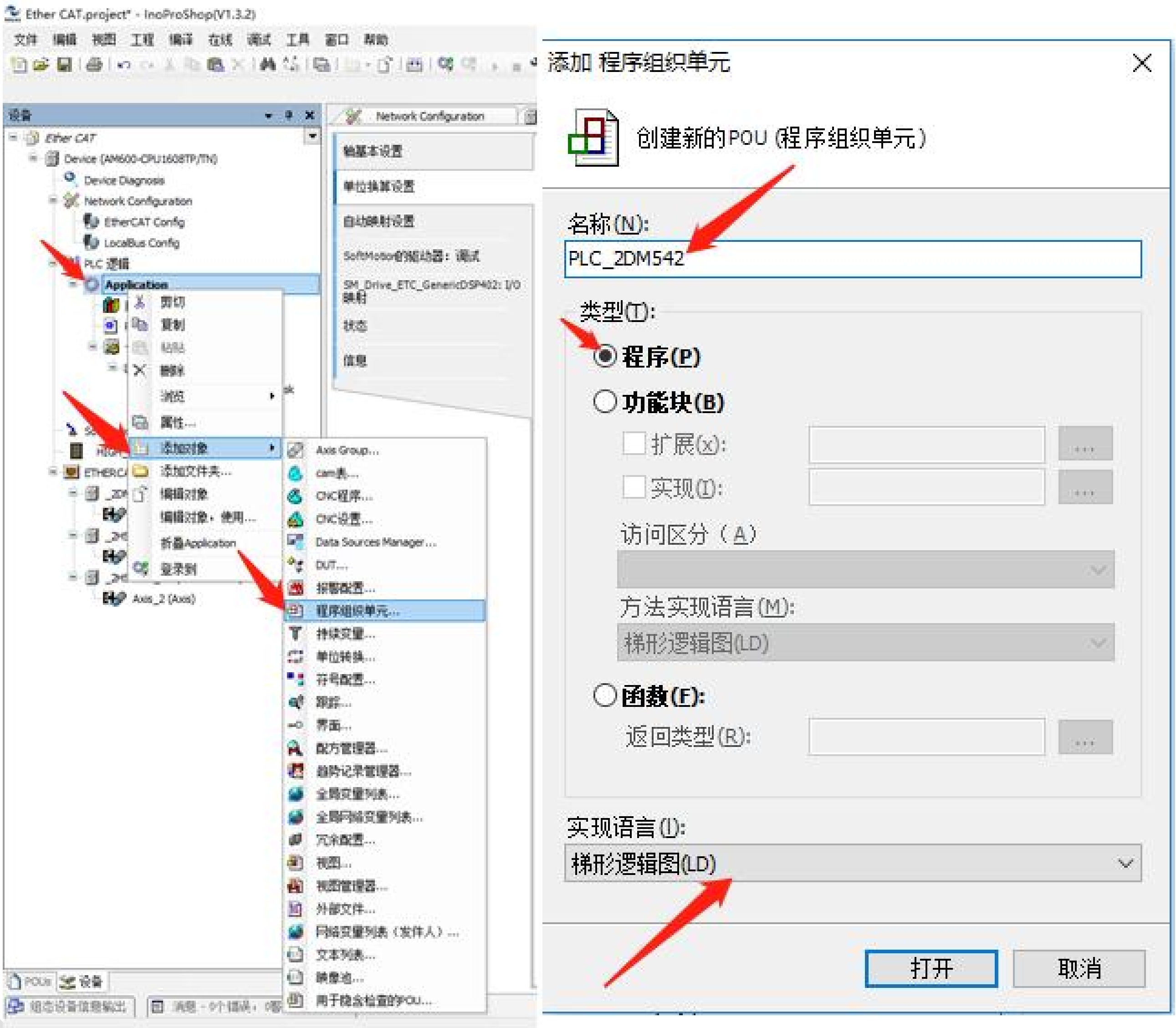


Figure 254 Create POU

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)")

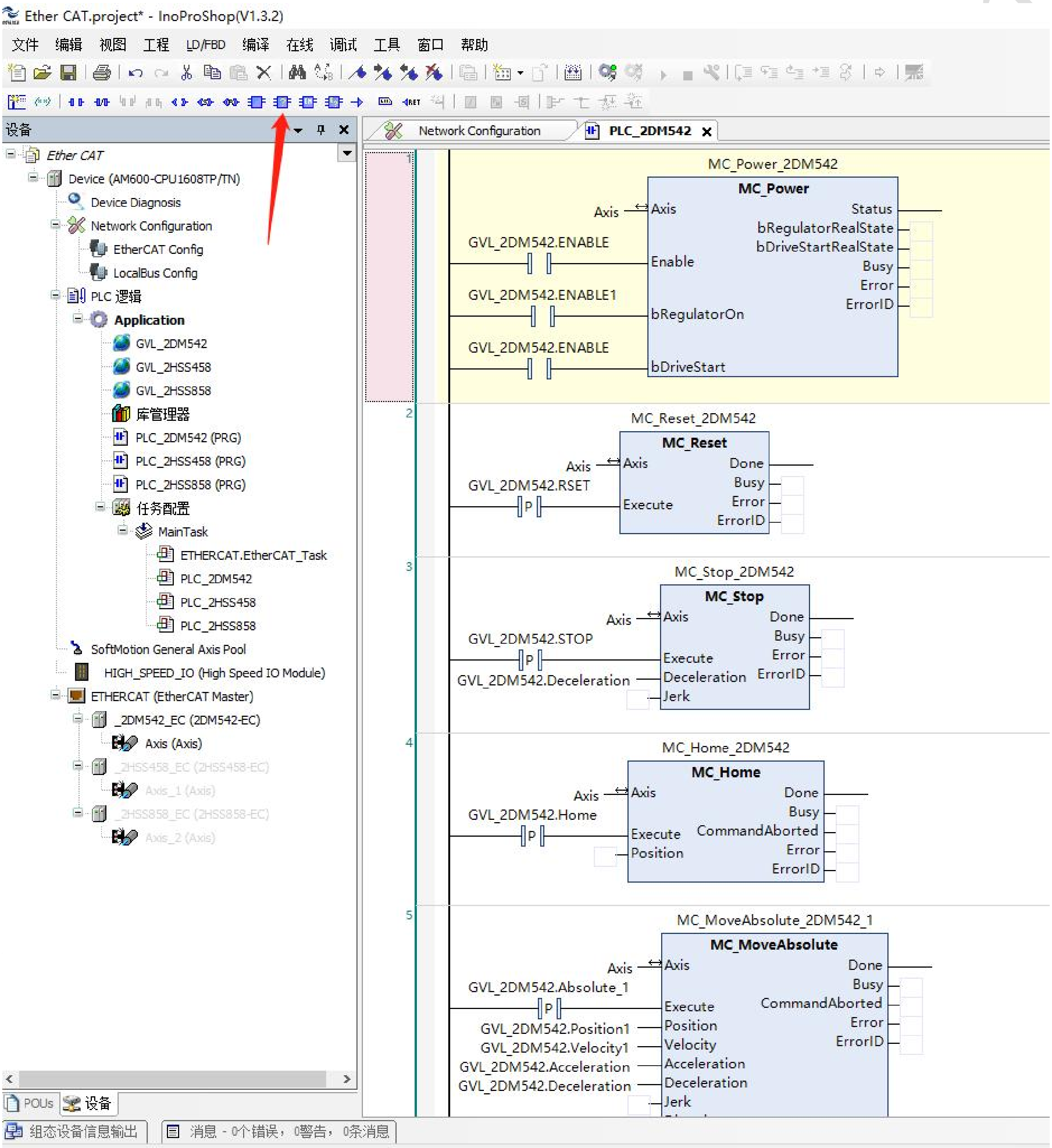


Figure 255 Motion control module

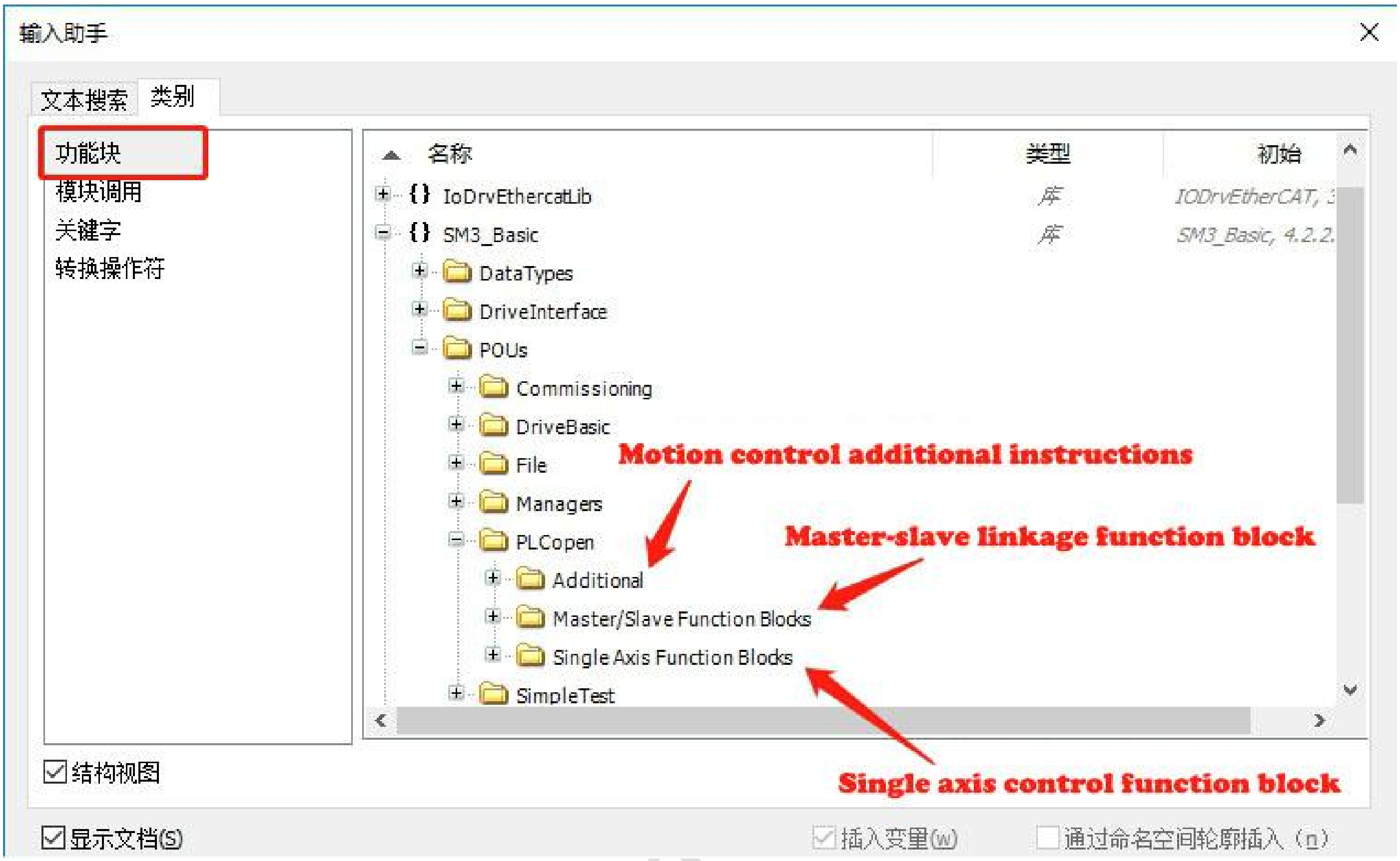
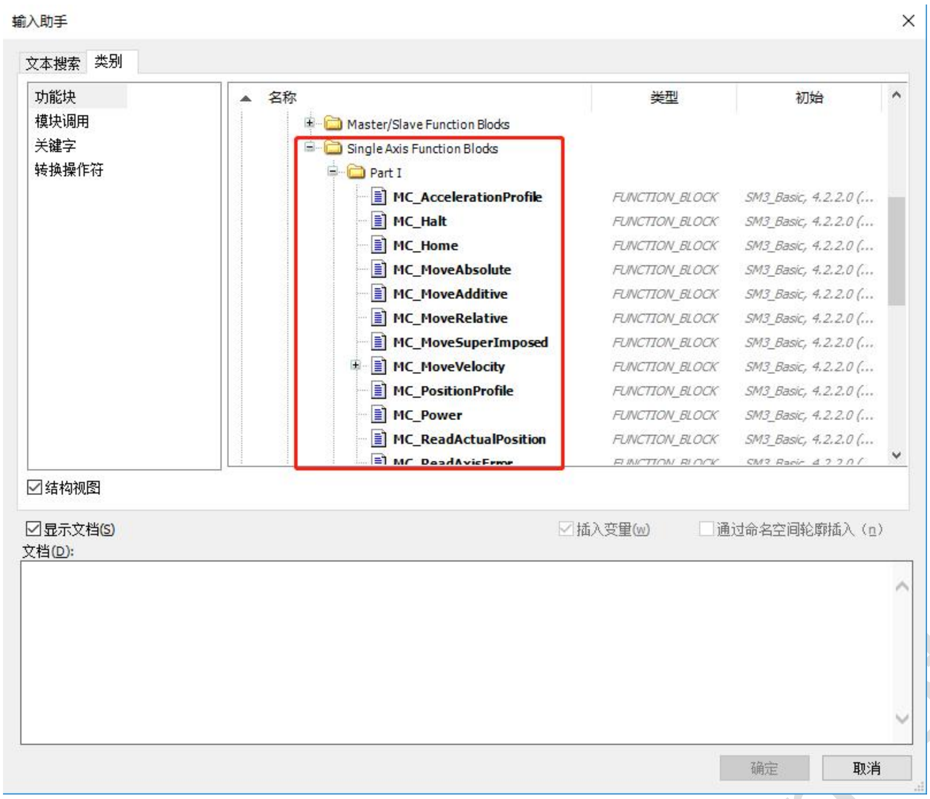


Figure 256 Function block

- The routine used is to control single-axis instructions



3 Add task configuration

- Double-click MainTask→Add Call

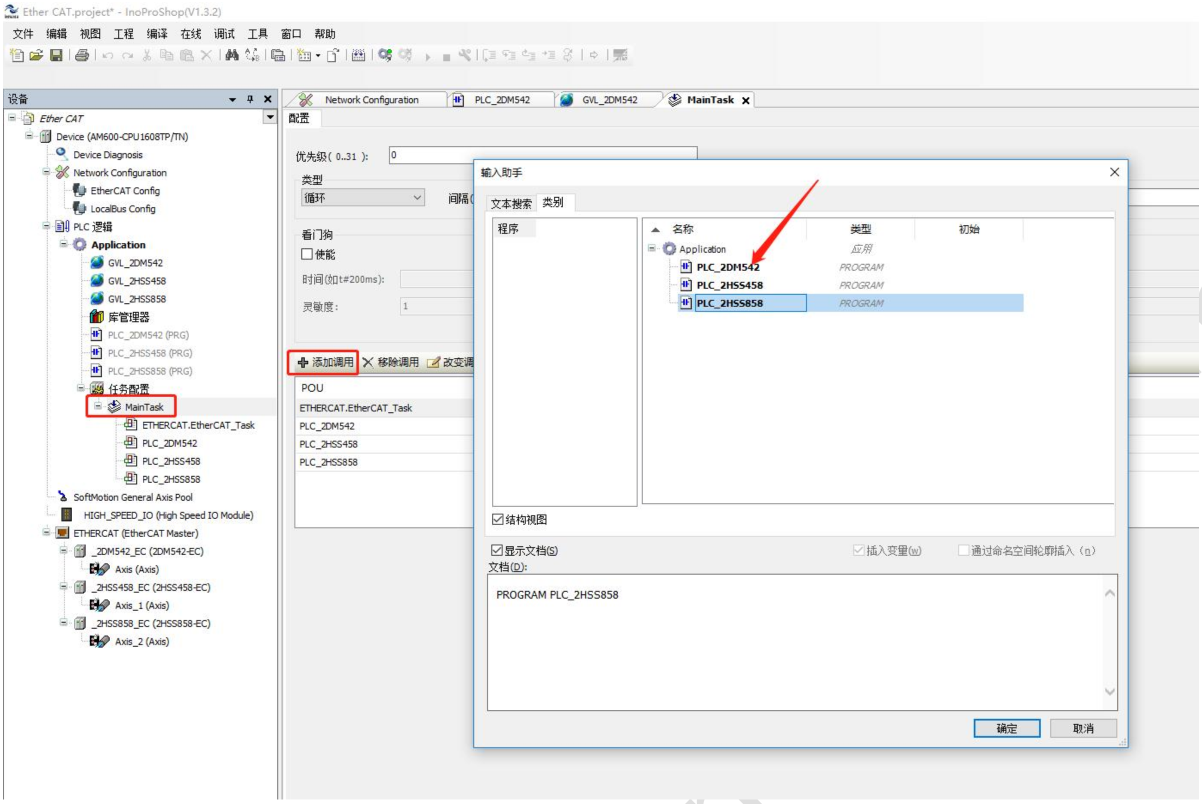


Figure 258 Add task configuration

4 Login to download and debug the program

- Scan the master device

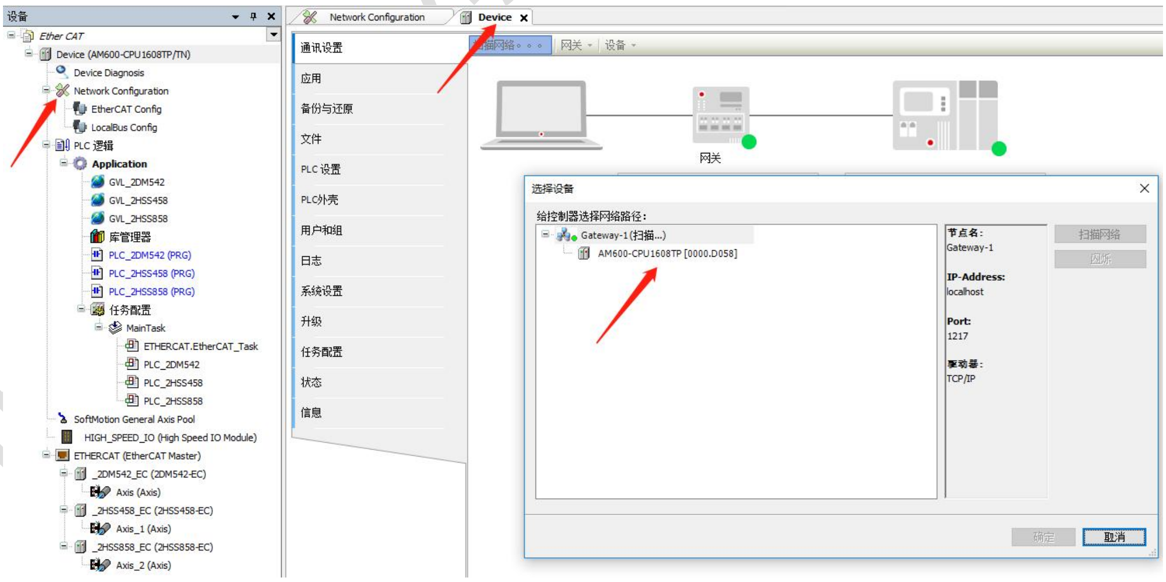
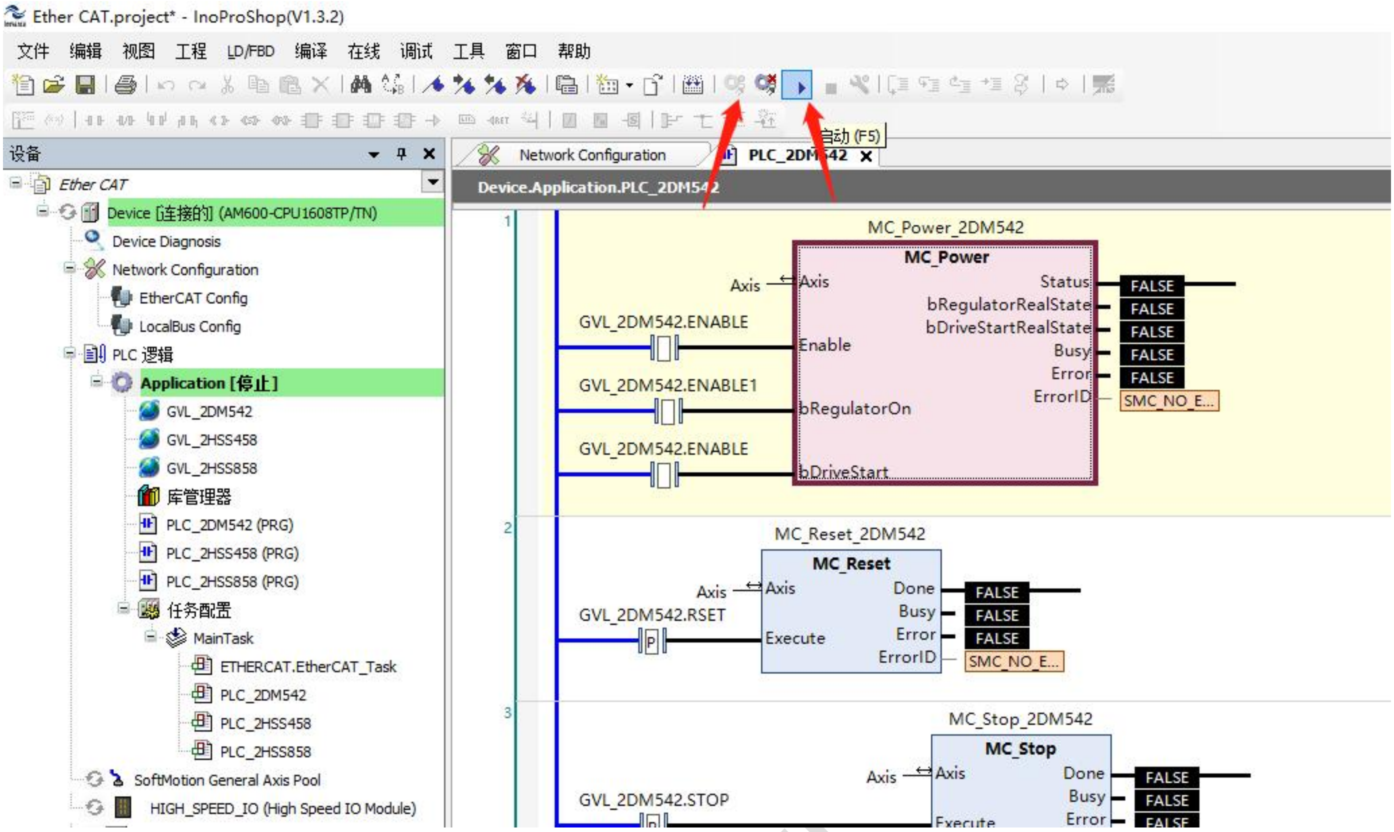


Figure 259 Scanning the master device

- Login→Start



- Figure 260 Log in to the device
- The connection status between the slave station and the master station

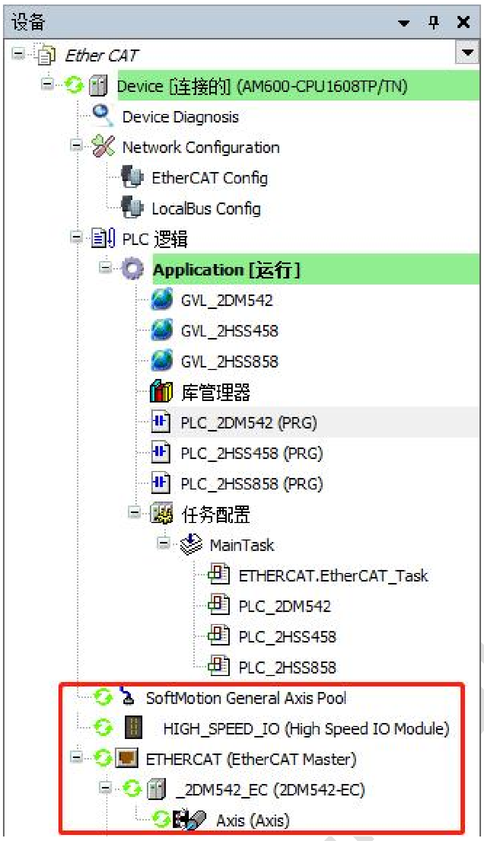


Figure 261 Master-slave connection status

5 Enable device

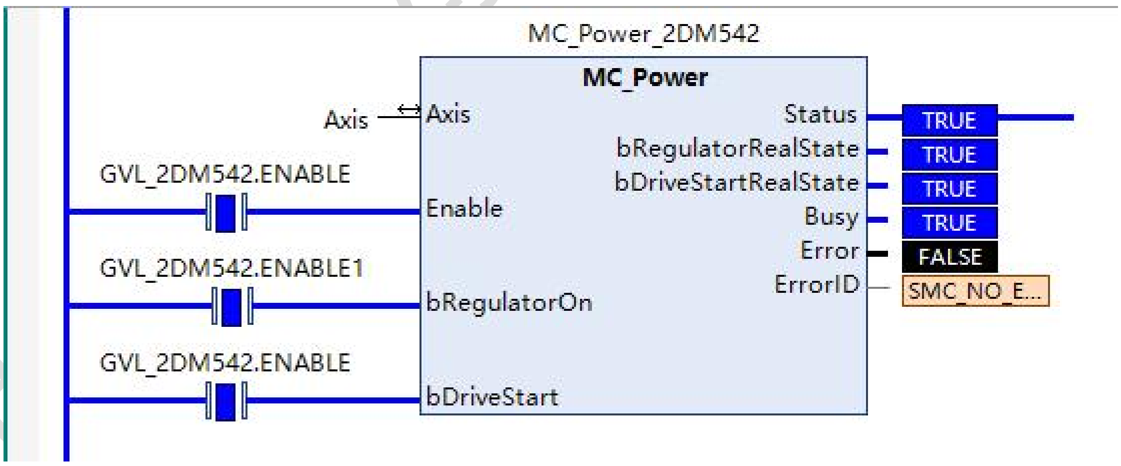
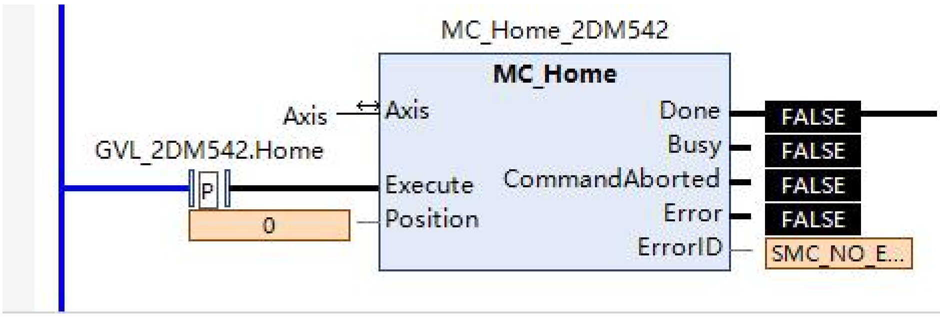


Figure 262 Enabling device

6 Back to zero mode



7 Position mode

- Absolute positioning

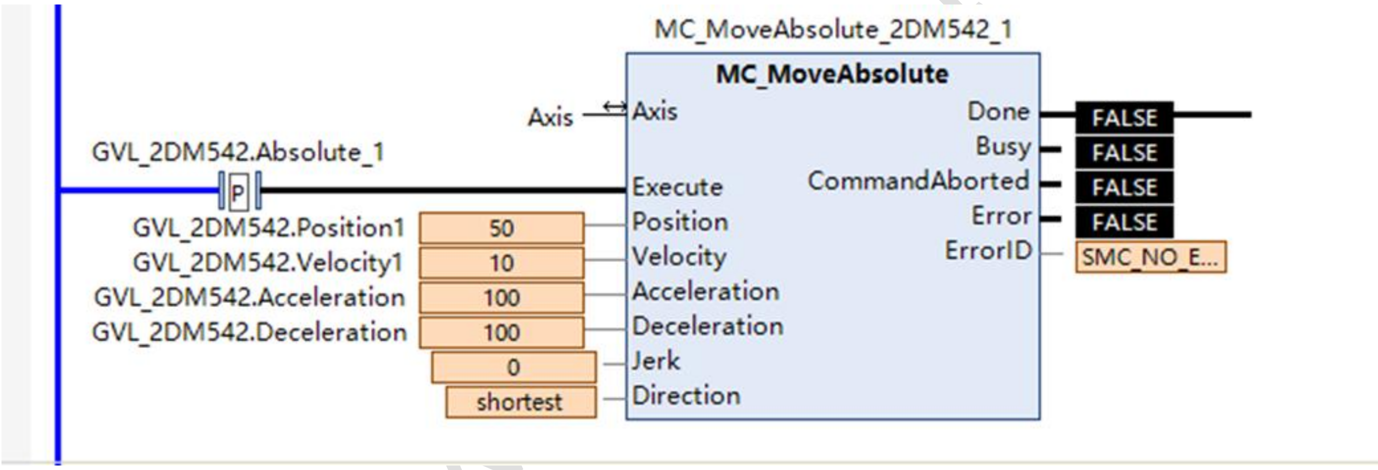
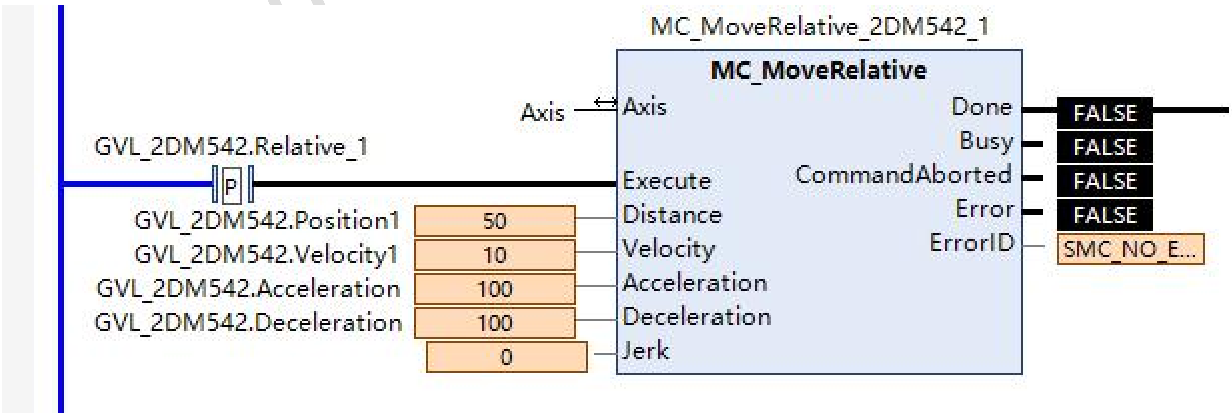


Figure 264 Position mode

- Relative positioning
-



- Figure 46 Relative positioning

8 speed mode

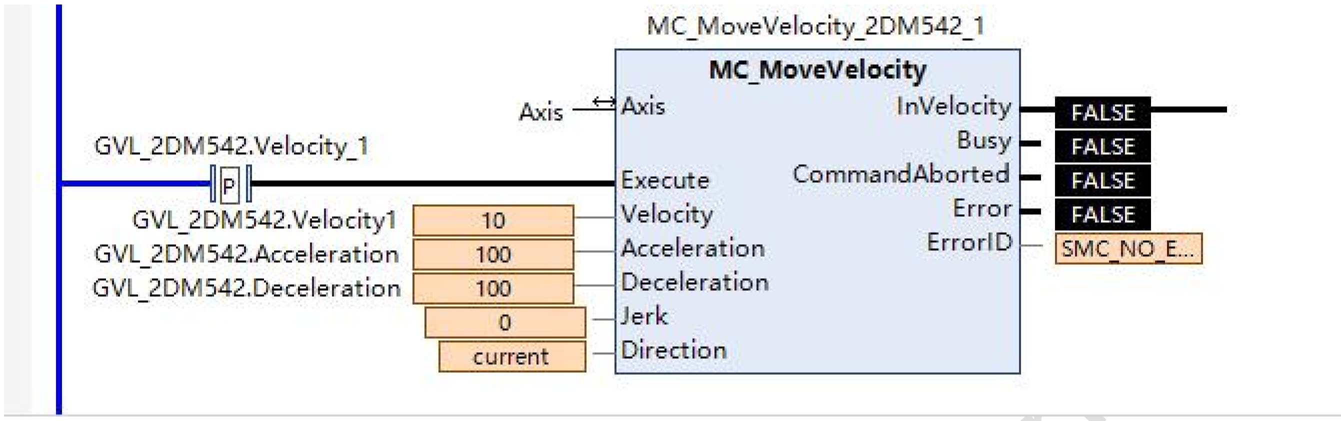


Figure 47 Speed mode

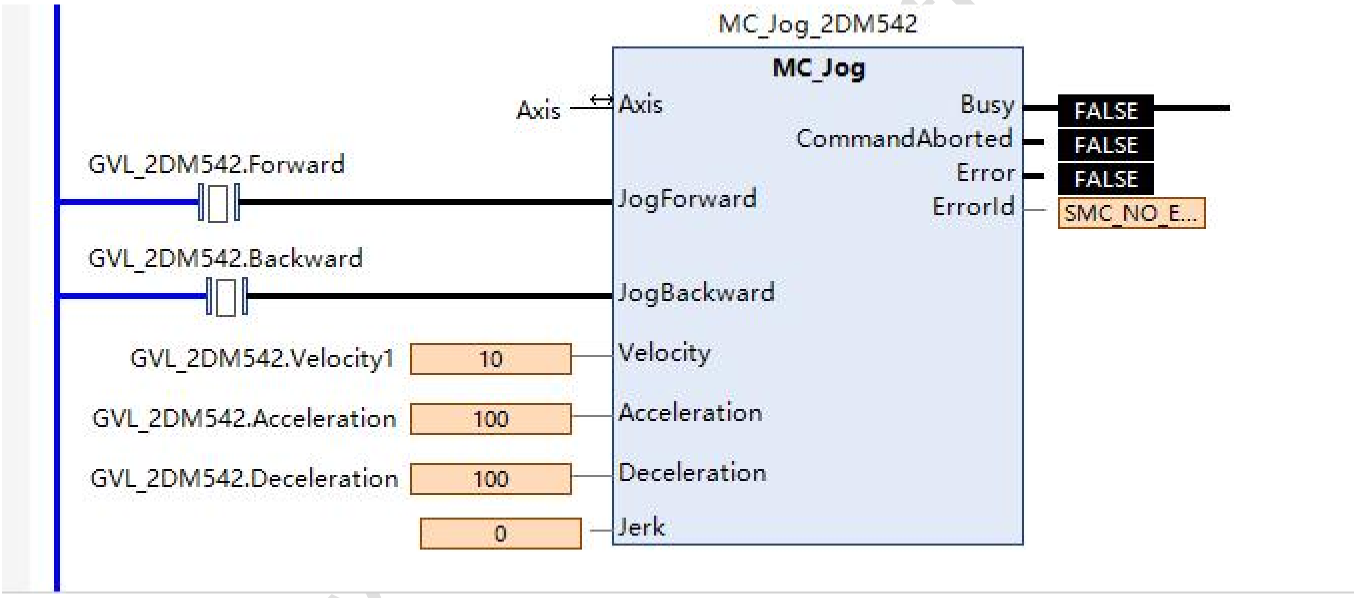


Figure 48 JOG mode

9 Alarm reset

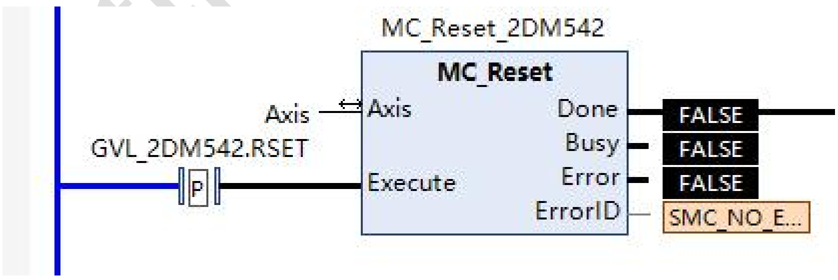


Figure 49 alarm reset

10 Stop the device

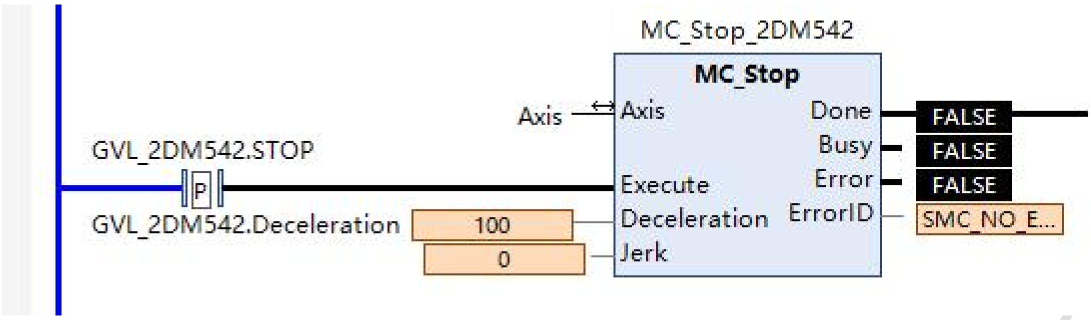


Figure 269 Stop device

EtherCAT communication operation routine based on Omron controller

Install device description file

Open Omron programming software Sysmac Studio→New Project→Create

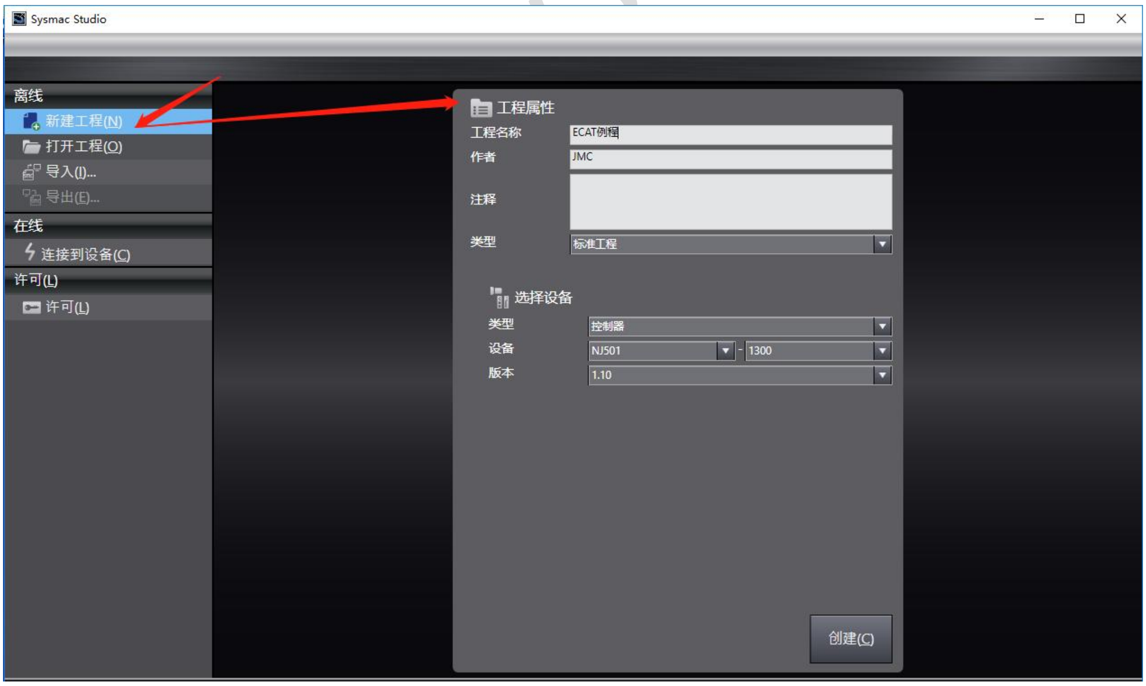


Figure 270 New Sysmac project

- Double-click EtherCAT in the configuration and settings → right-click the main device → click to display the ESI library

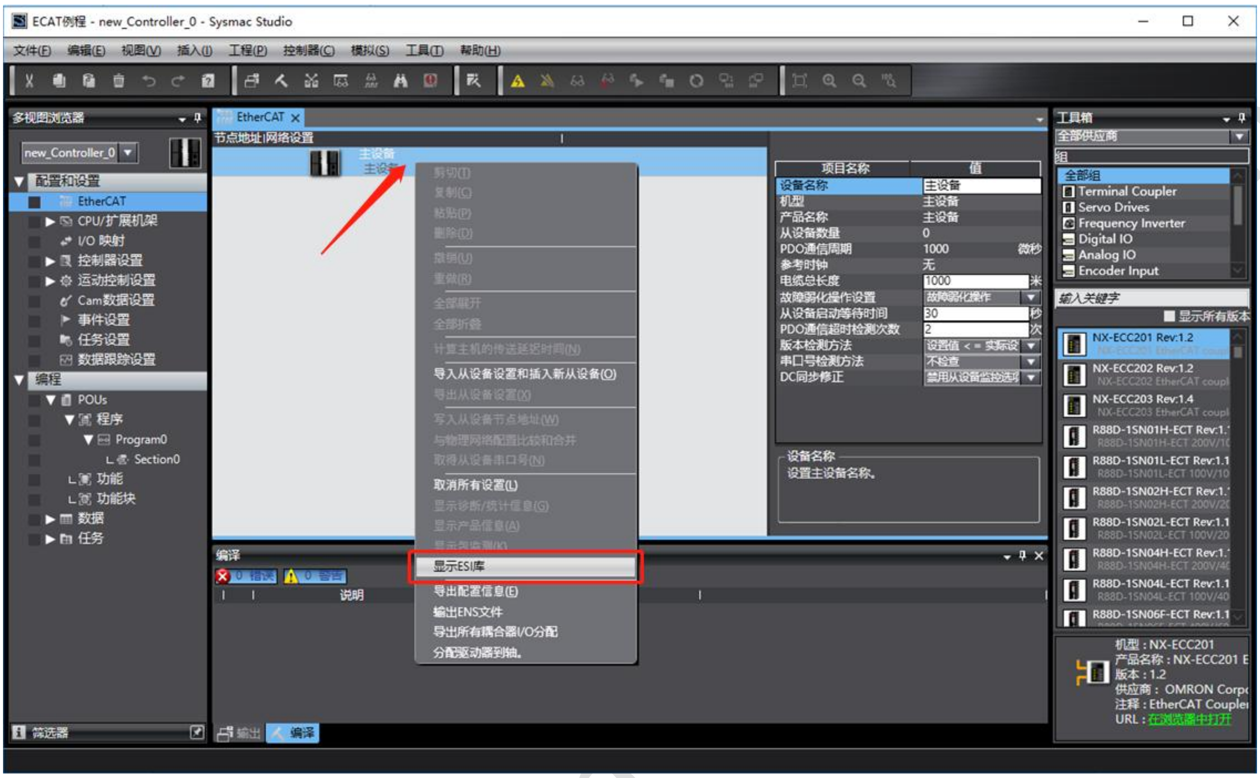


Figure 271 Open the ESI library

- Click on "This Folder"

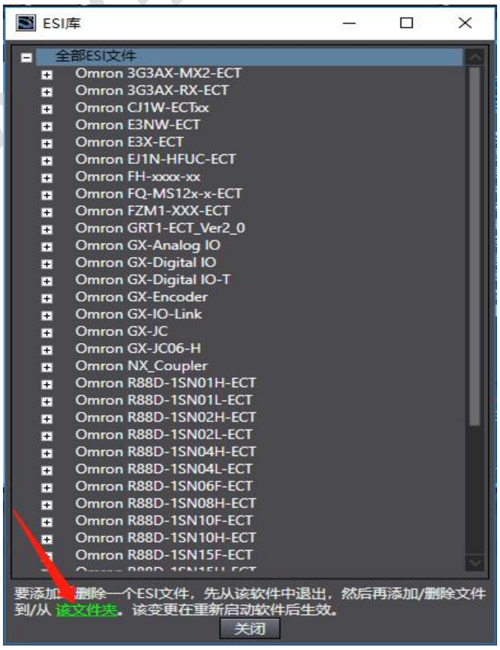


Fig. 272 Click "This Folder"

- Put the device description file of JMC ECAT series into this folder → then close Omron programming software

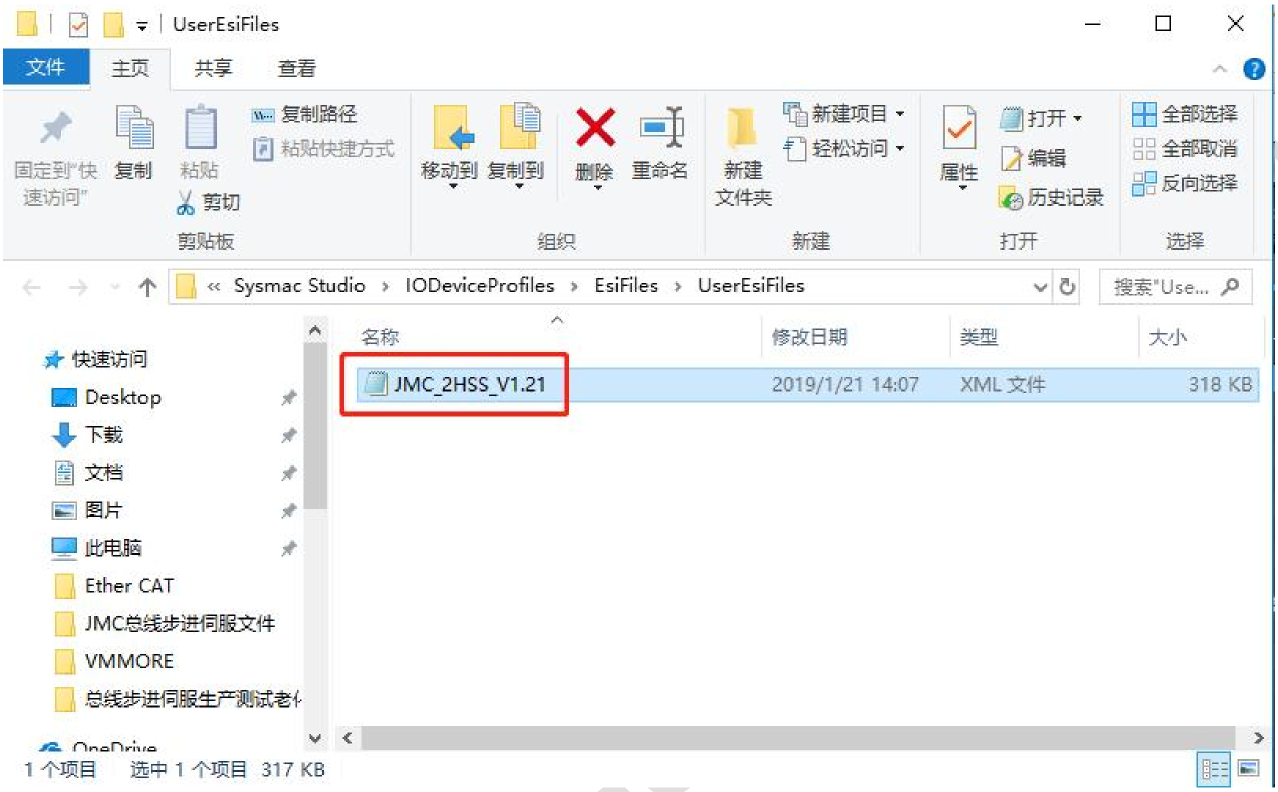


Figure 273 Select XML file

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

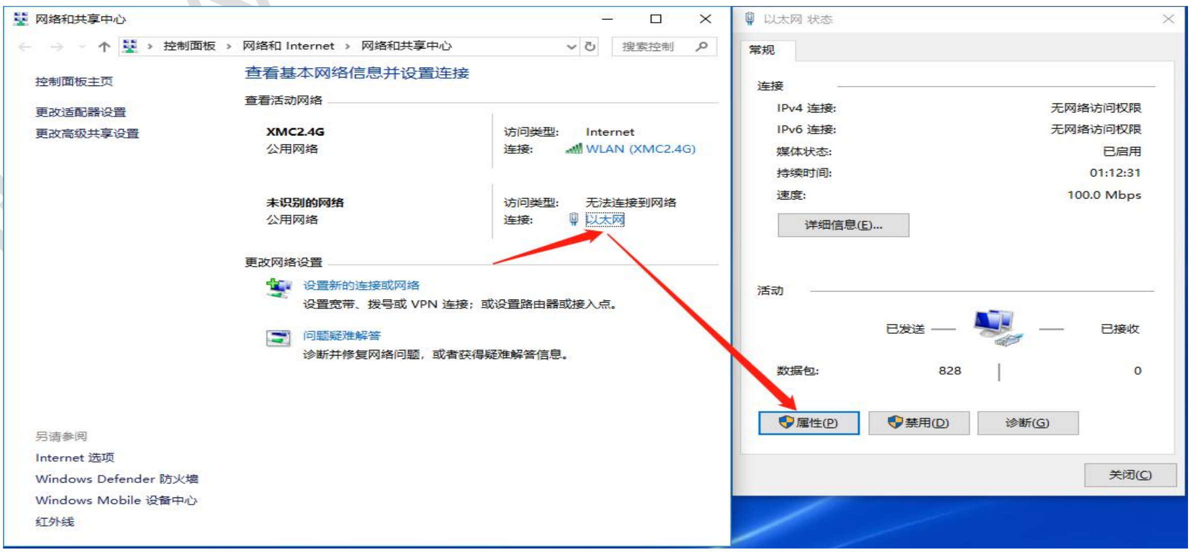


Figure 274 Configure TCP/IP

- Double-click the Internet protocol version 4 → set the IP address according to the controller

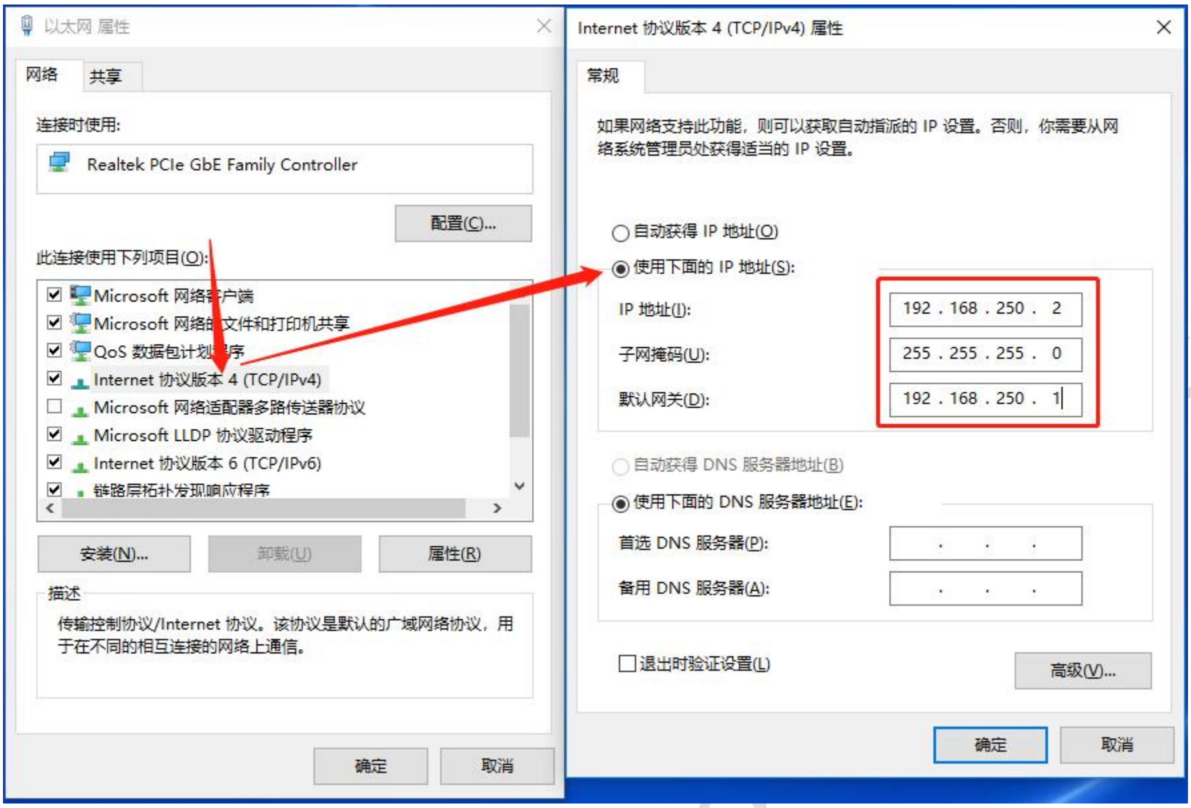


Figure 275 Set IP address

Omron software configuration

1. Open project

- Open Omron programming software→Open project→Open the ECAT routine just created

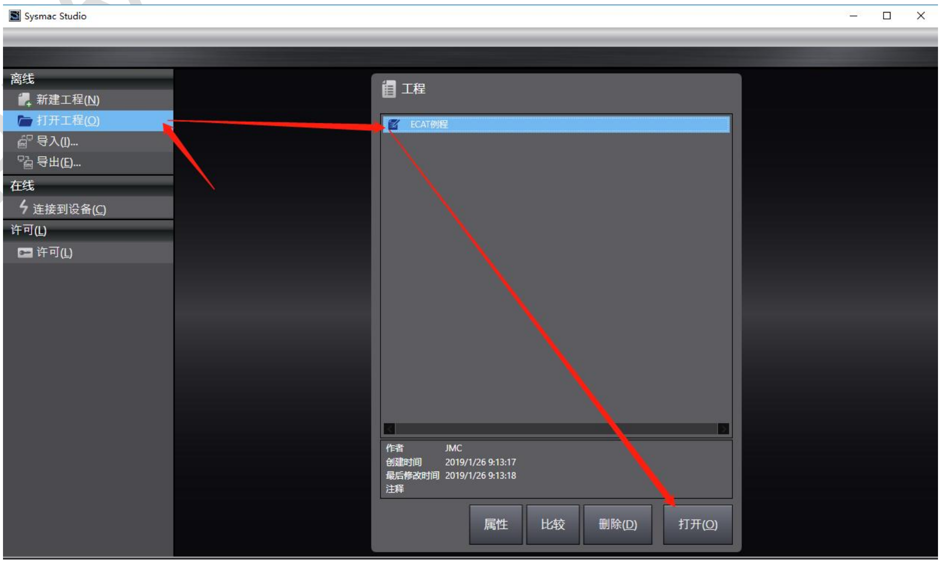


Figure 276 Open project

2 Communication settings

- Controller→Communication Settings

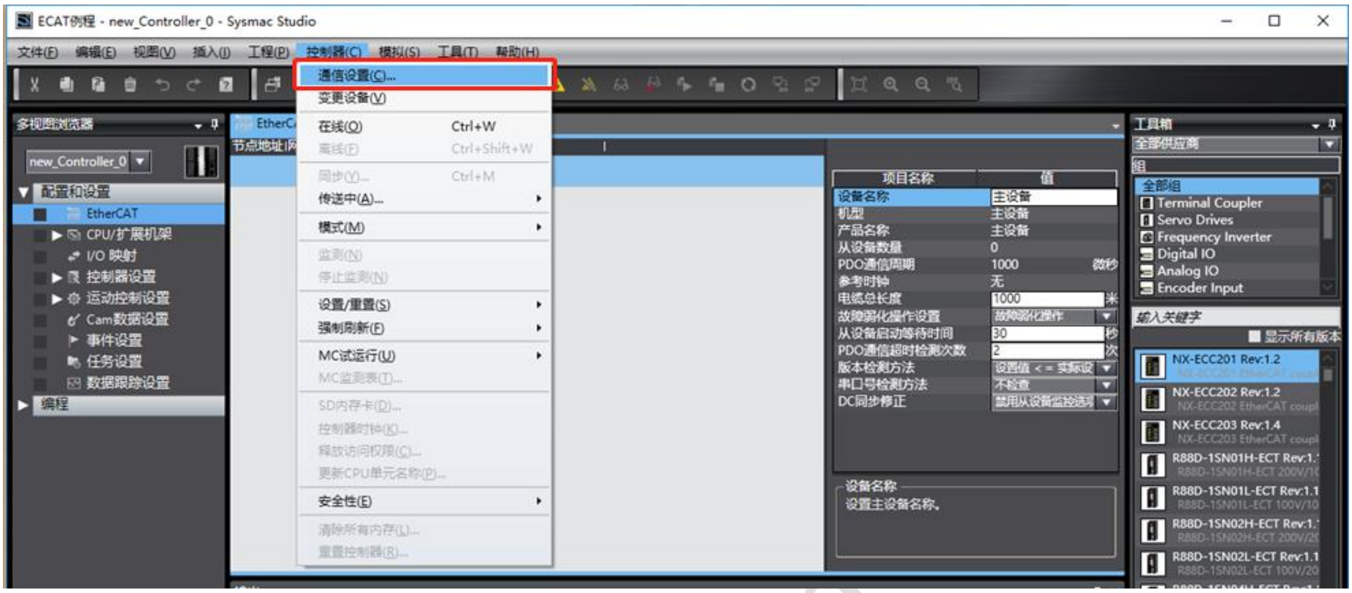


Figure 277 Communication settings

- Select Ethernet communication

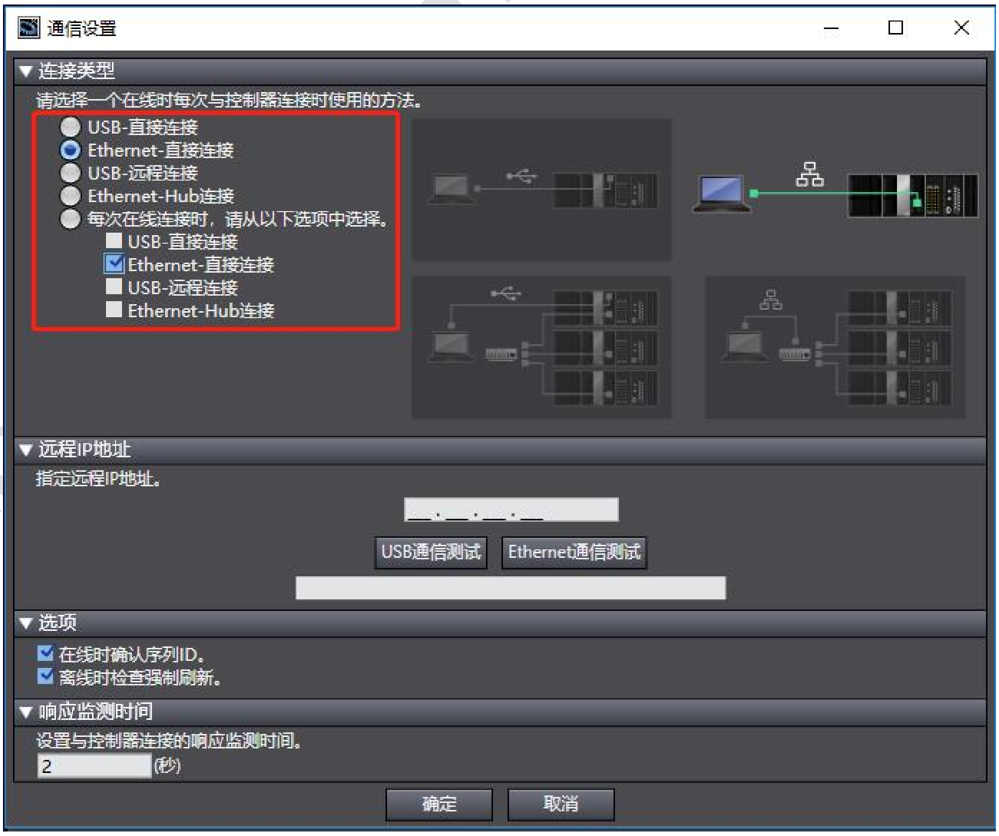


Figure 278 Select Ethernet communication

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

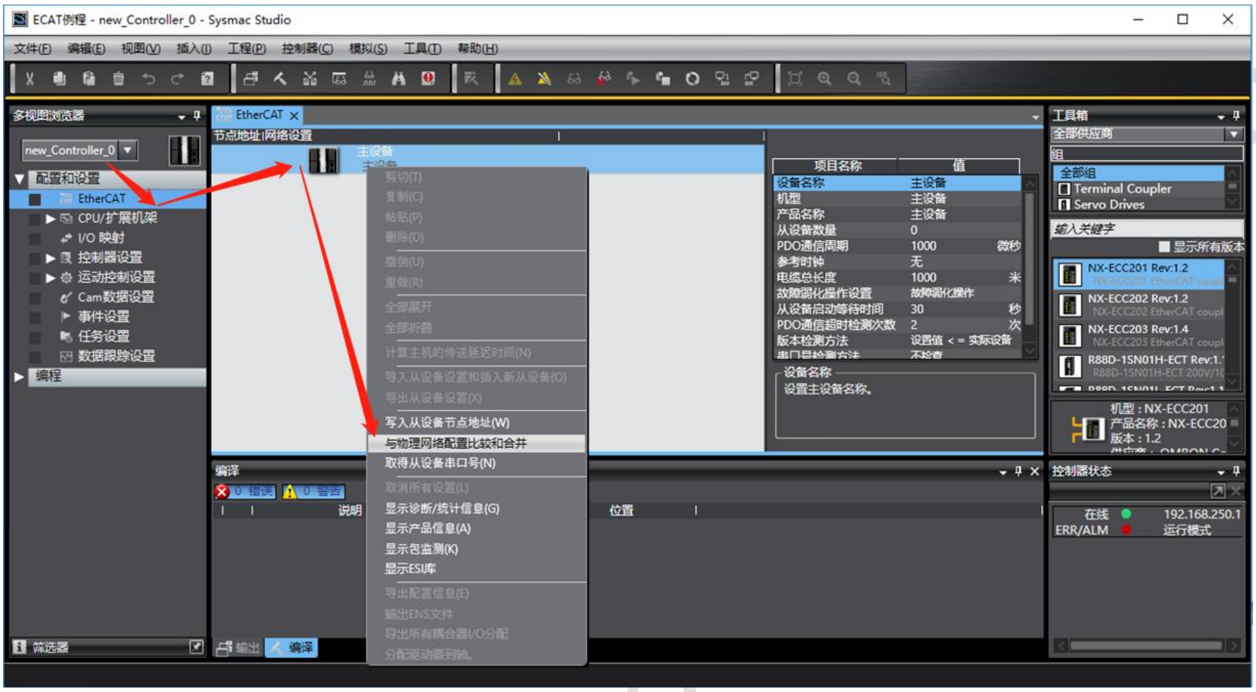


Figure 279 Comparison and merge with physical network configuration

- Apply physical network configuration

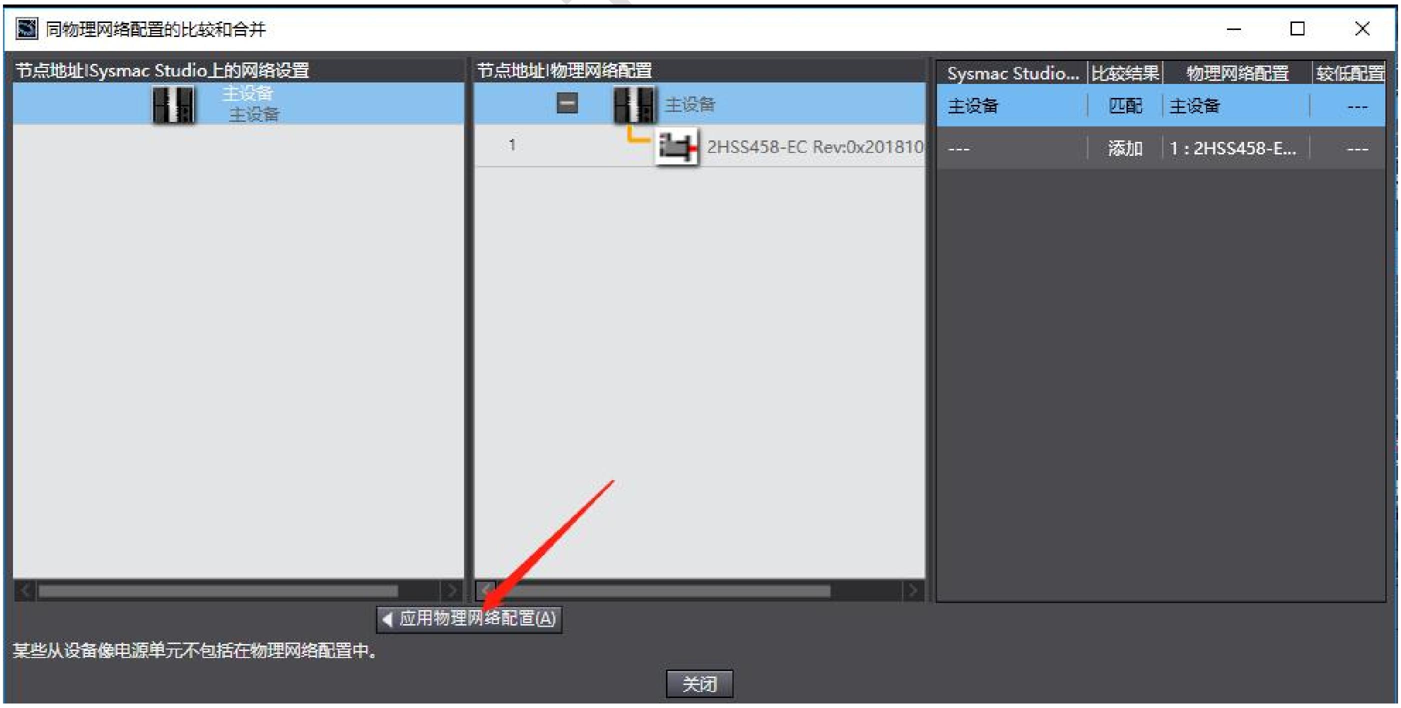


Figure 280 Applied physical network configuration

- Click Apply

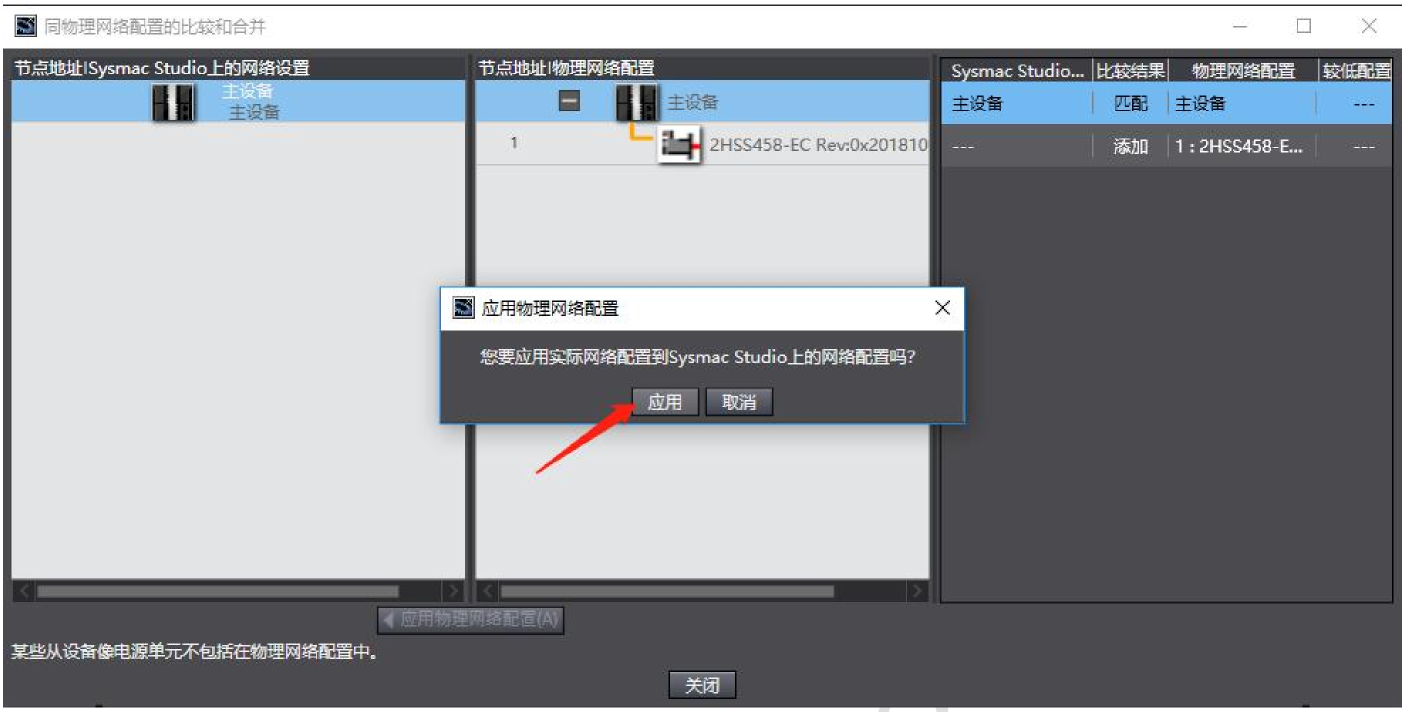


Figure 281 Click Apply

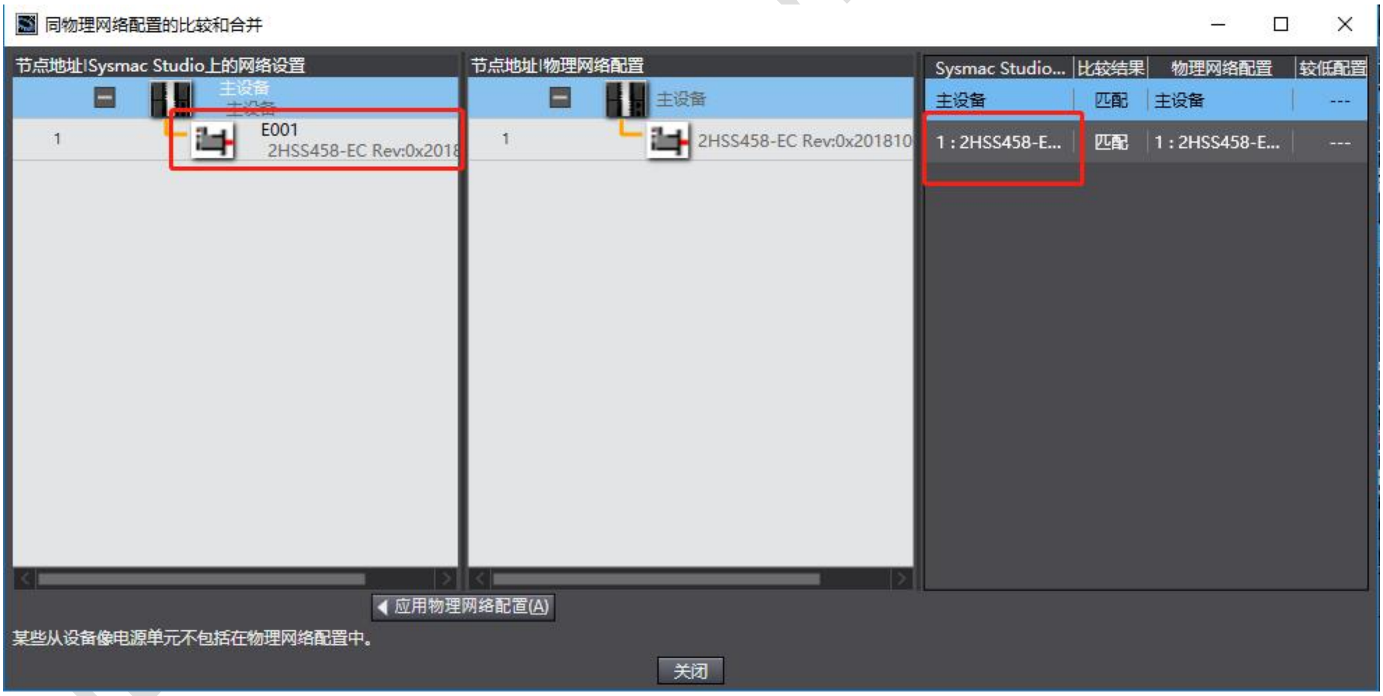


Figure 282 Application effect

4 Axis parameter setting

Offline→Motion control axis→Axis setting→Add→Motion control axis

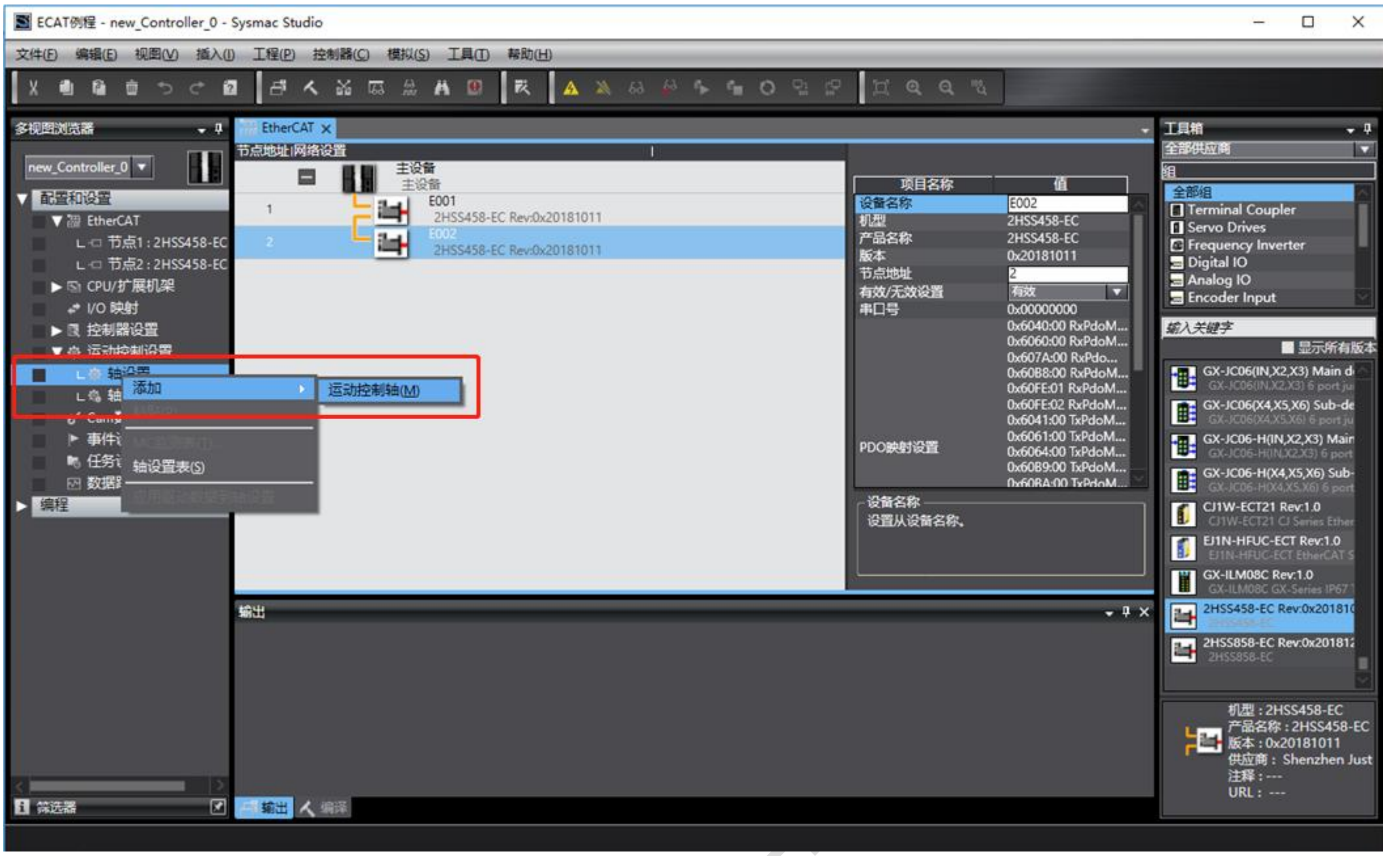


Figure 283 Add motion control axis

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

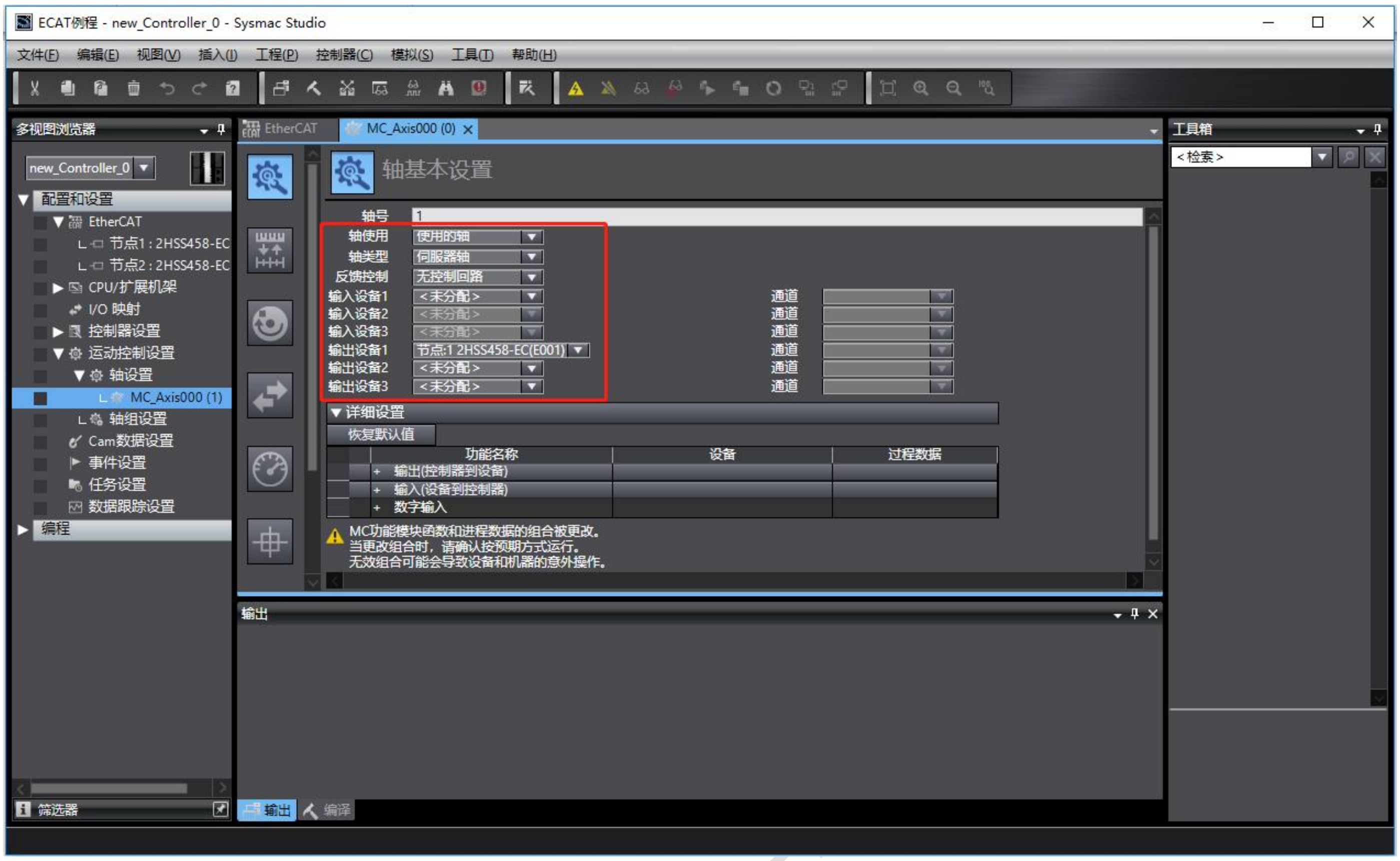


Figure 284 axis assignment

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.

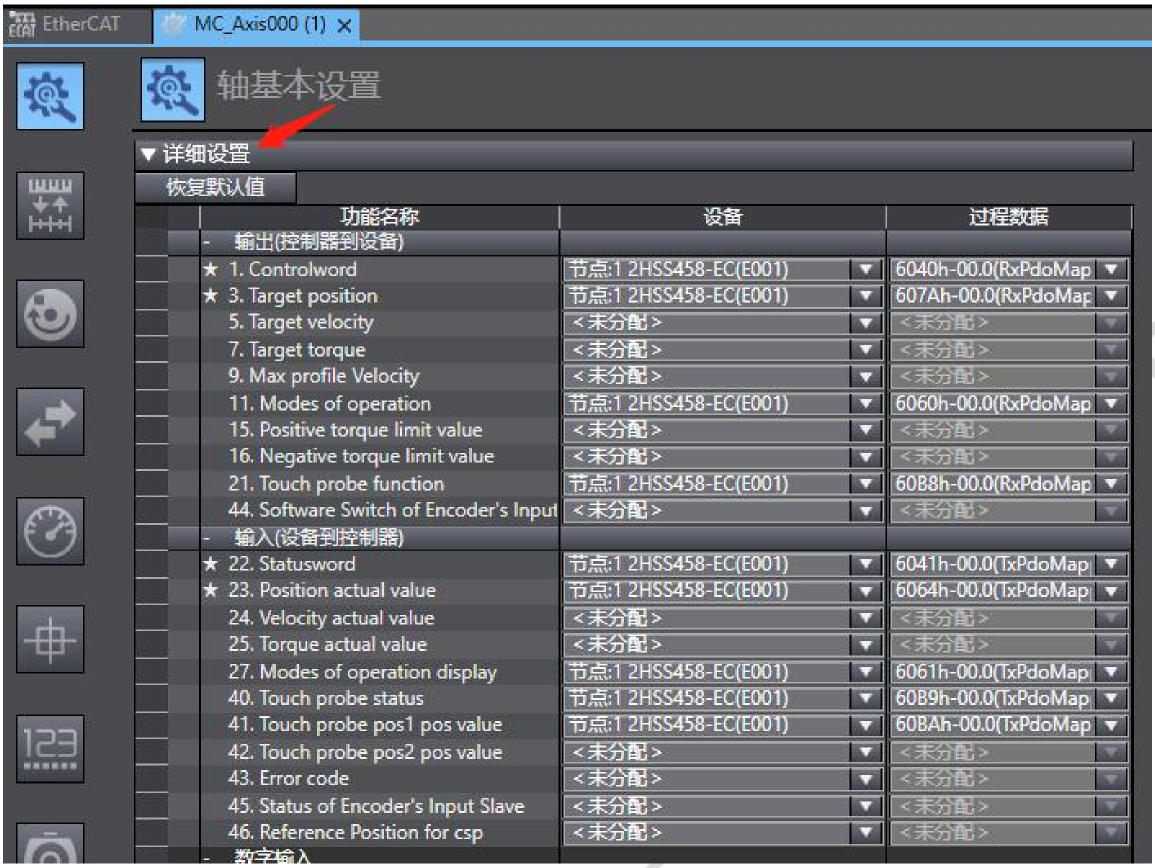


Fig 50 Axis basic setting

7 Unit conversion settings

- Set the number of command pulses for one revolution of the motor according to the actual motor resolution

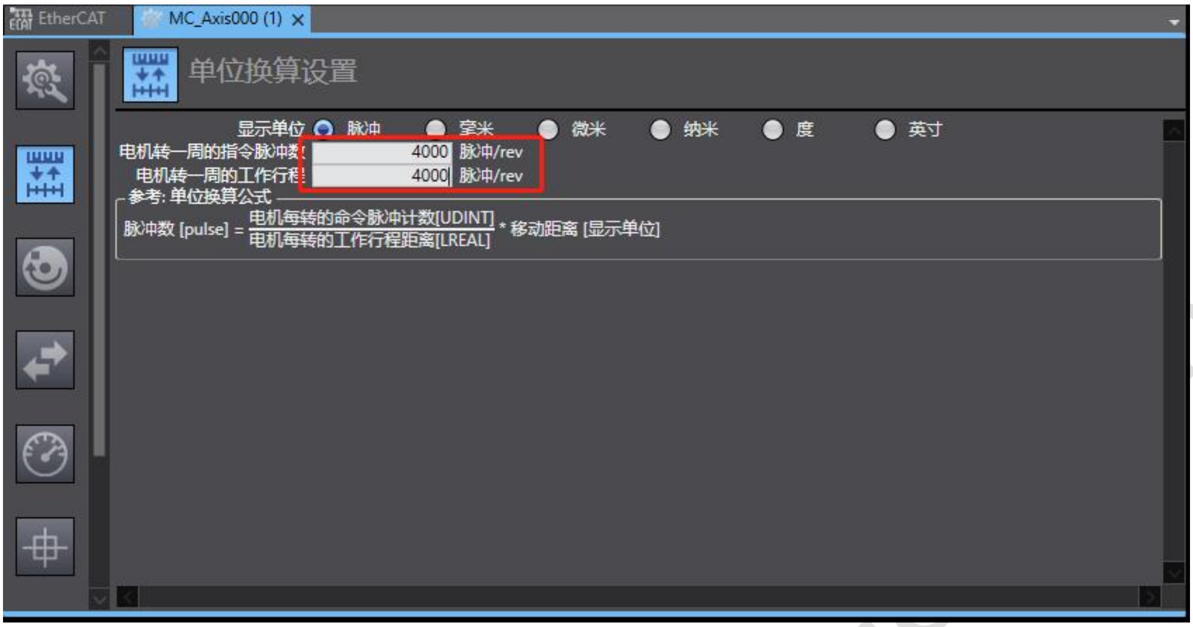


Fig　286 Unit conversion settings

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.

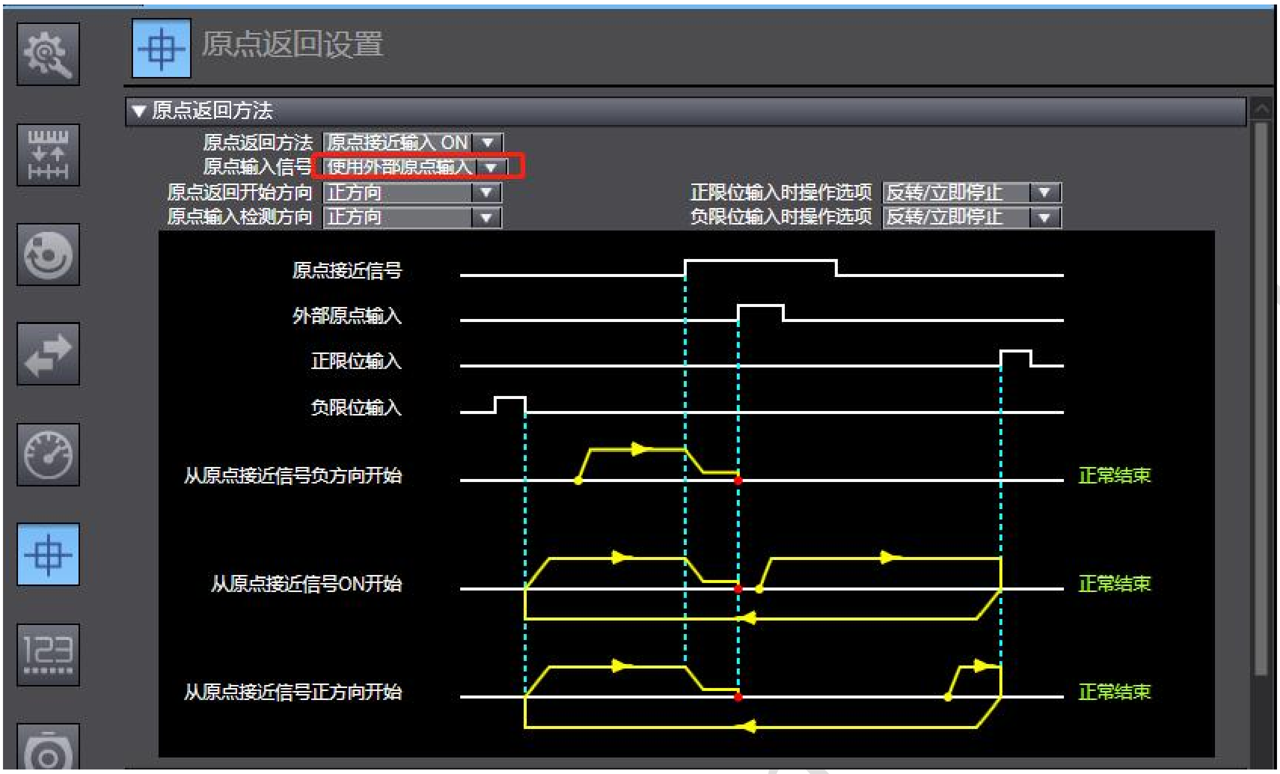


Figure 287 Origin return setting

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.

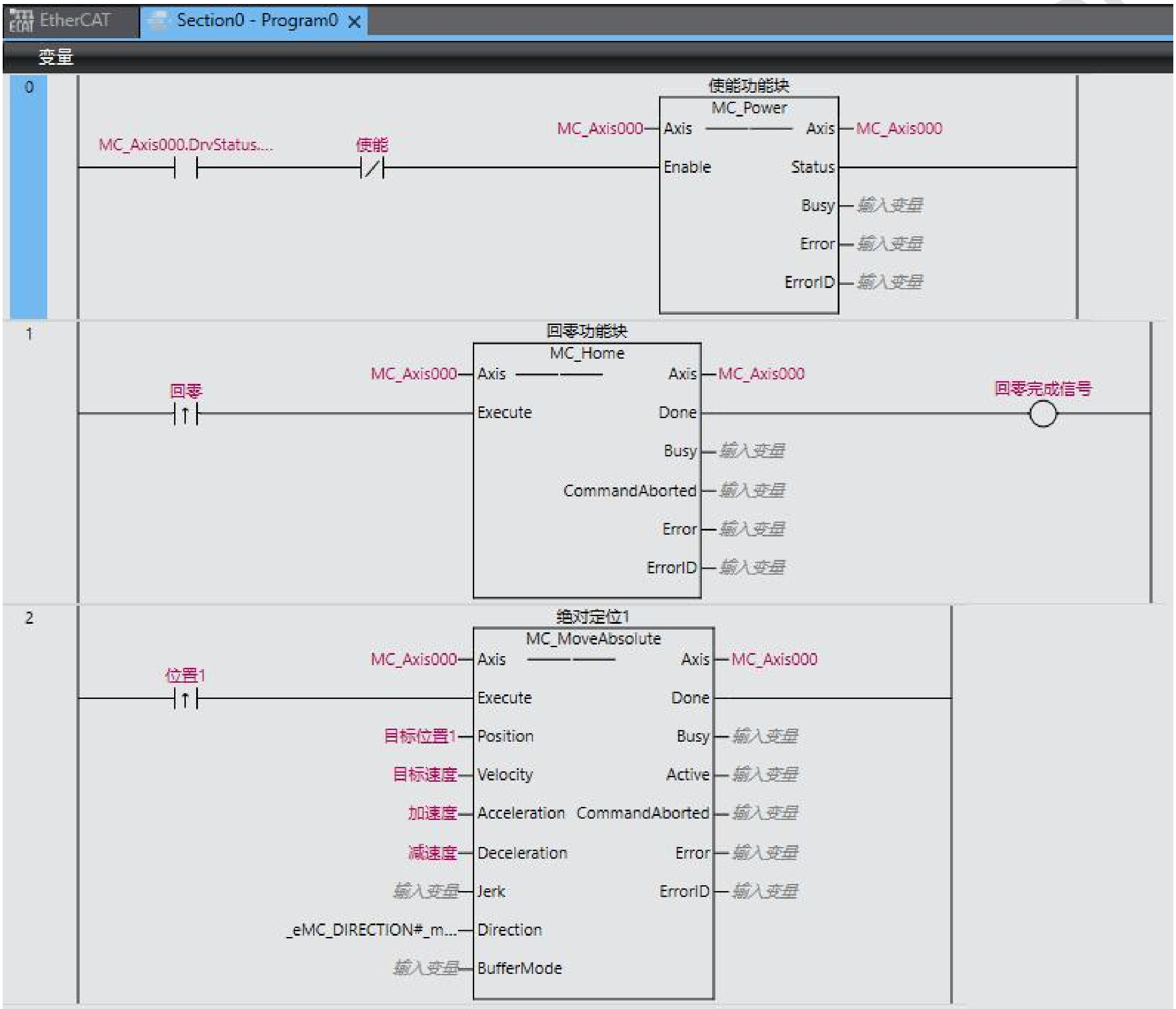


Figure 288 Program control

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

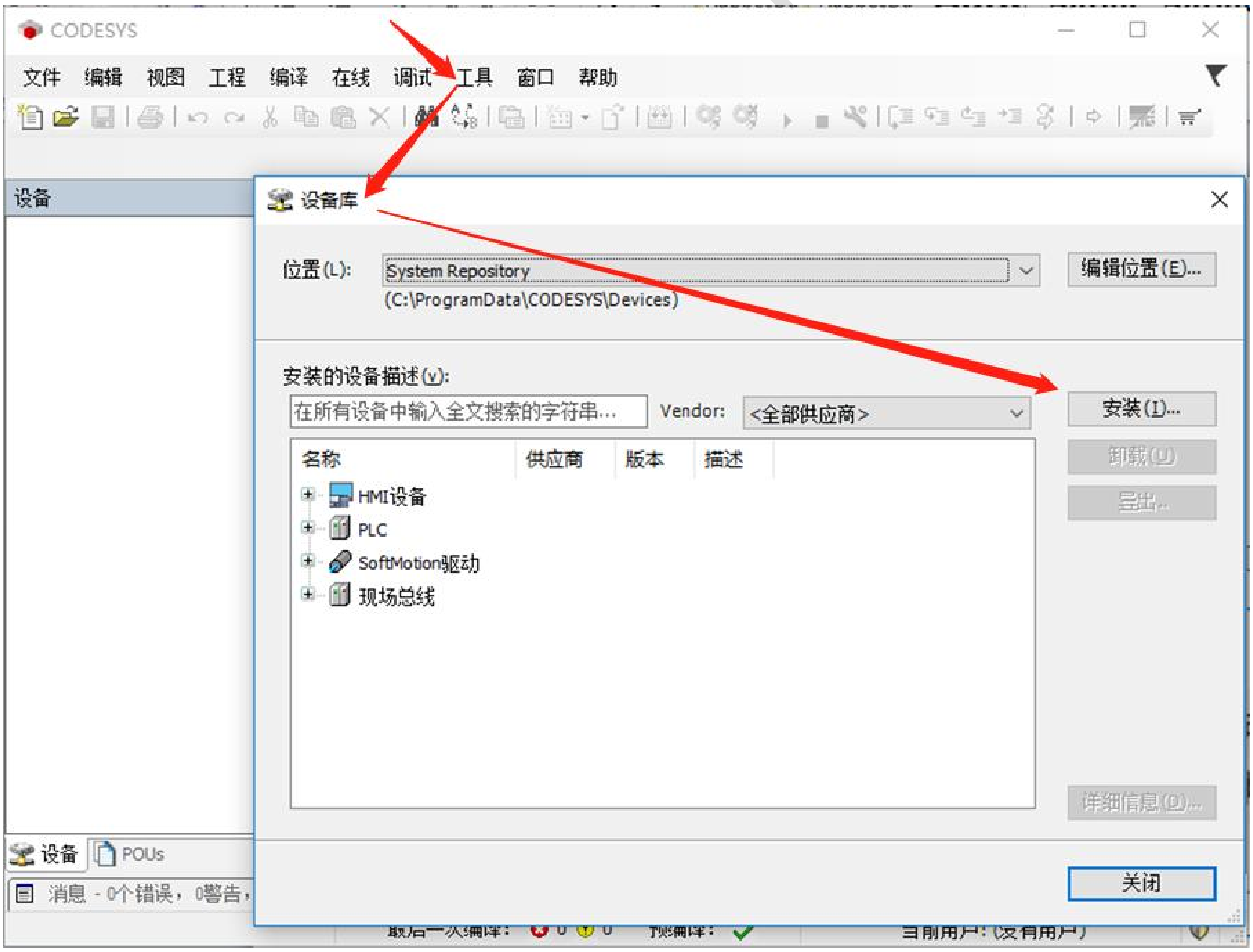


Figure 289 Install device description file

● Install the master station and slave station device description files separately

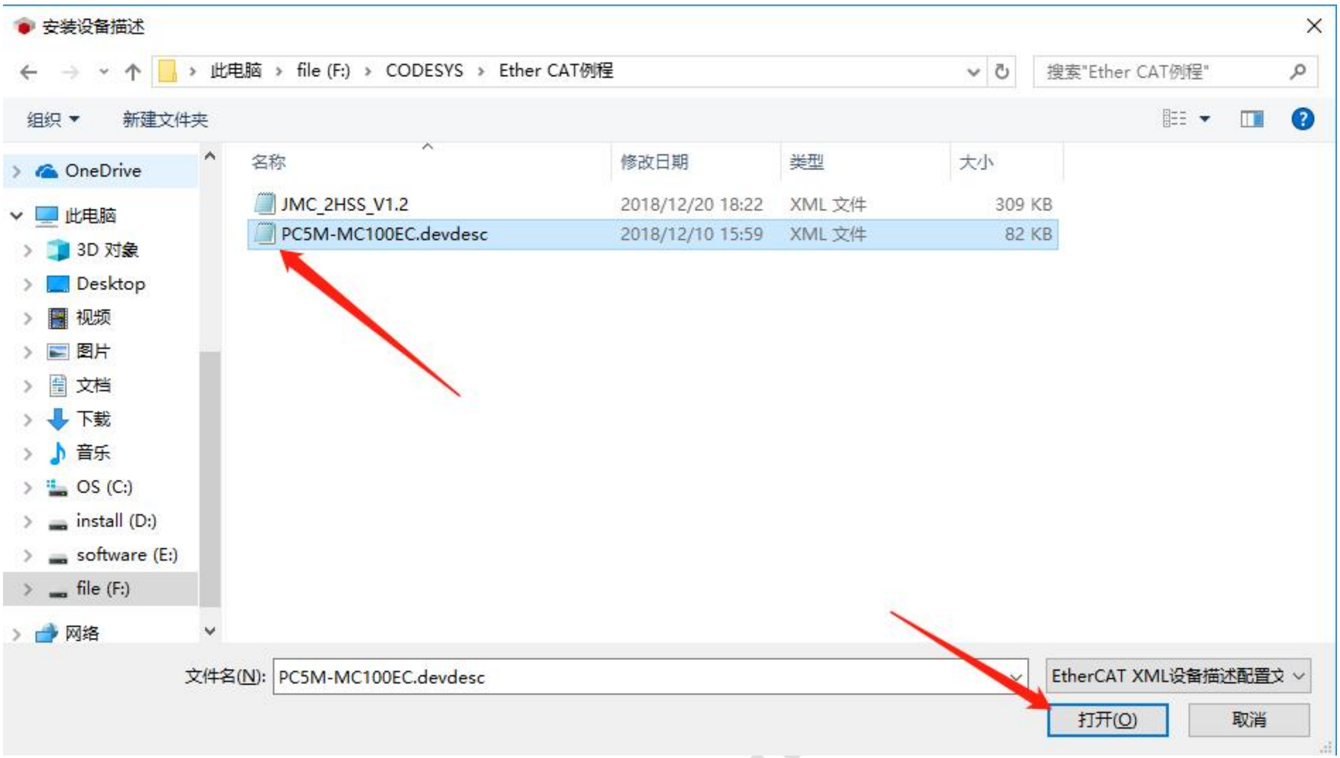


Figure 290 Install the master station and slave station device description files separately

● Waiting it’s installed automatically

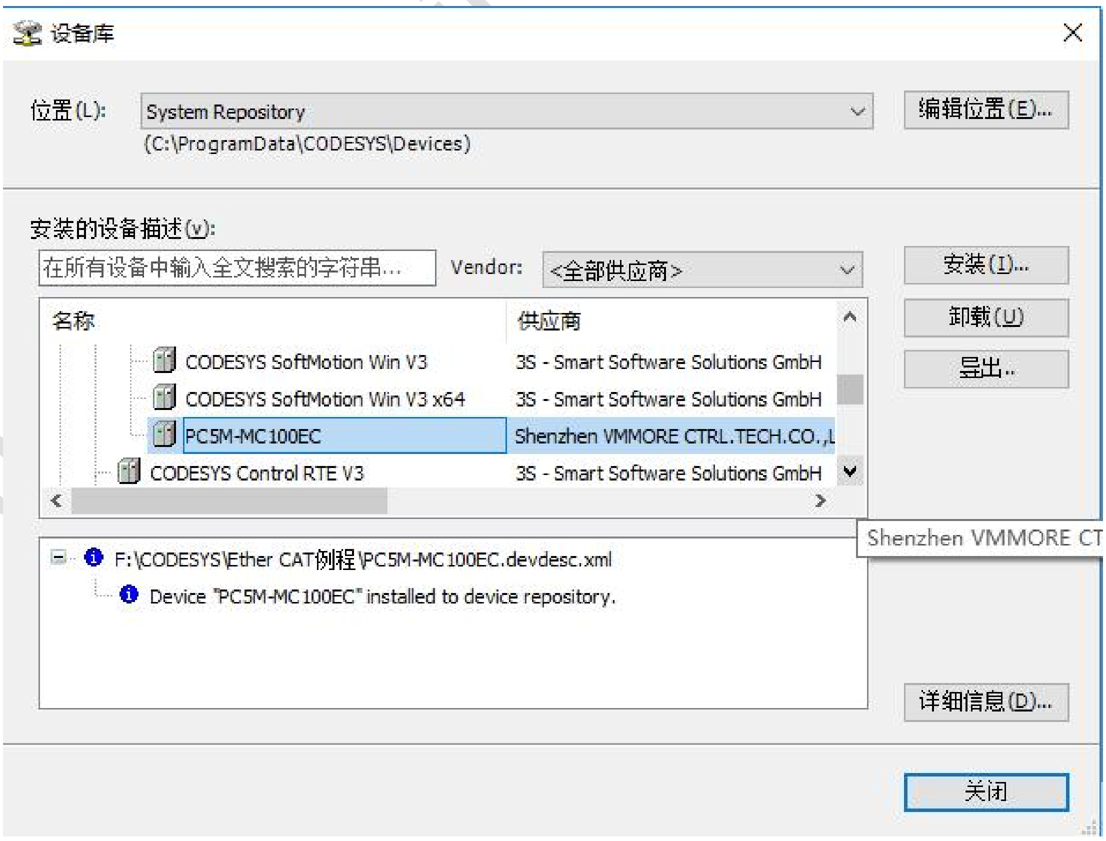


Figure 291 install automatically

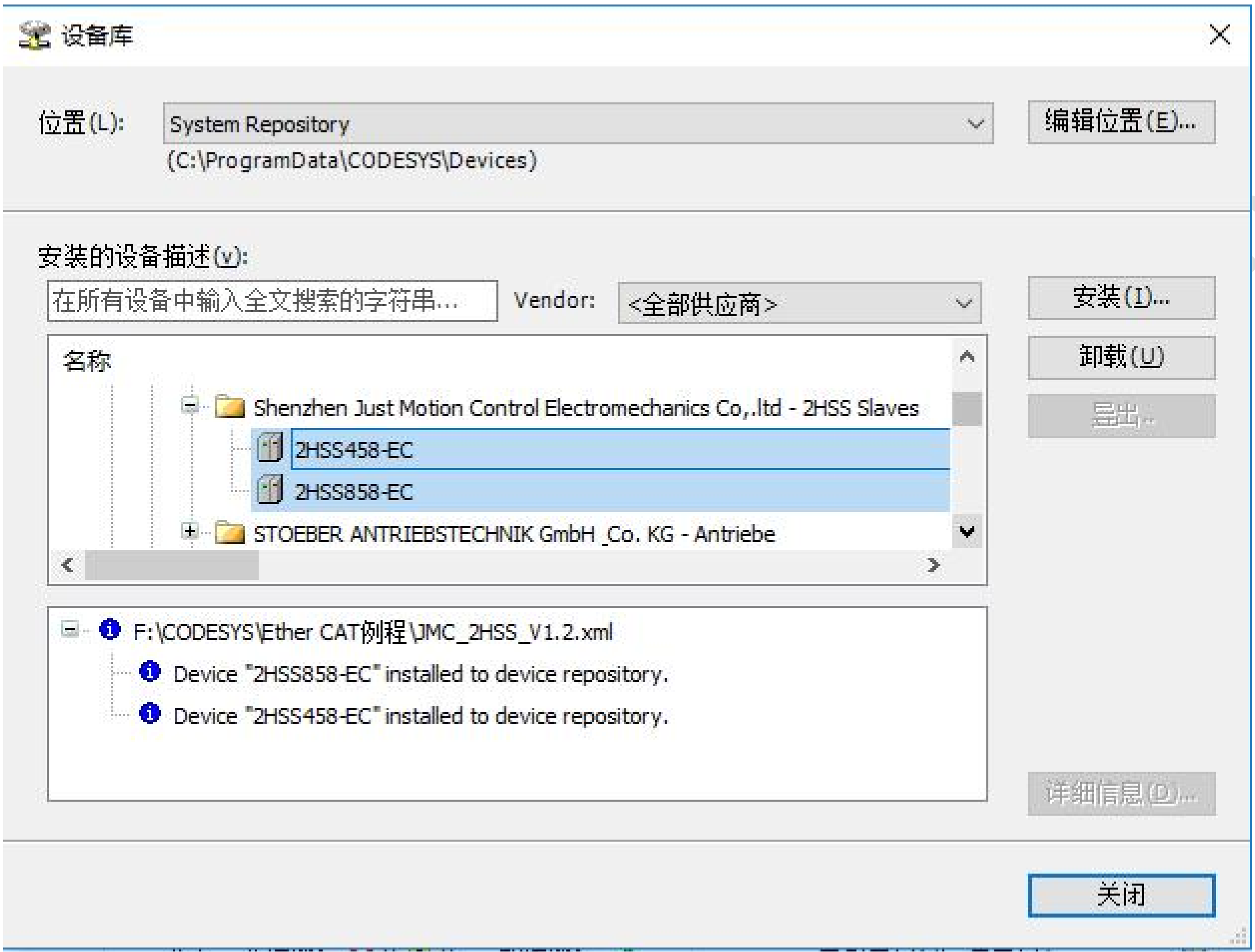


Figure 292 after installing

Create a project

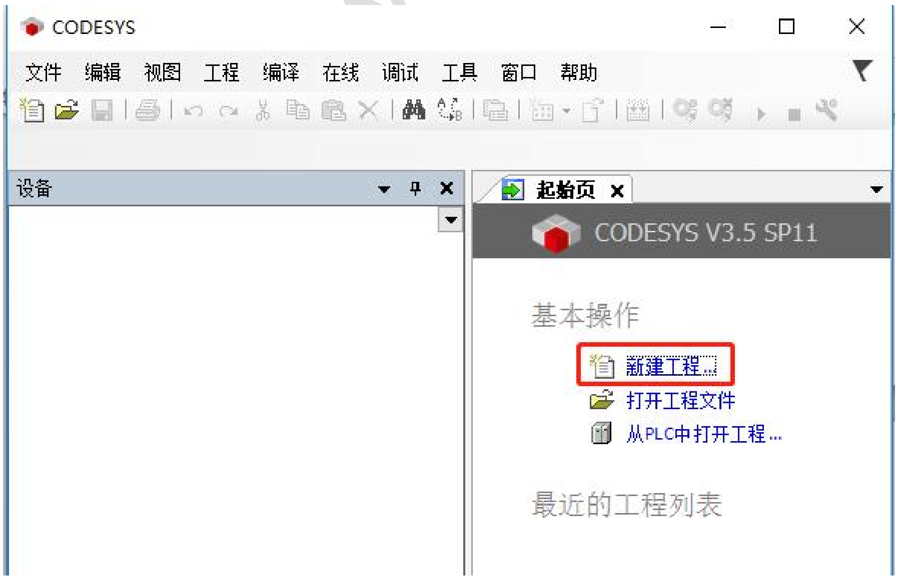


Fig 51 Create CODESYS project

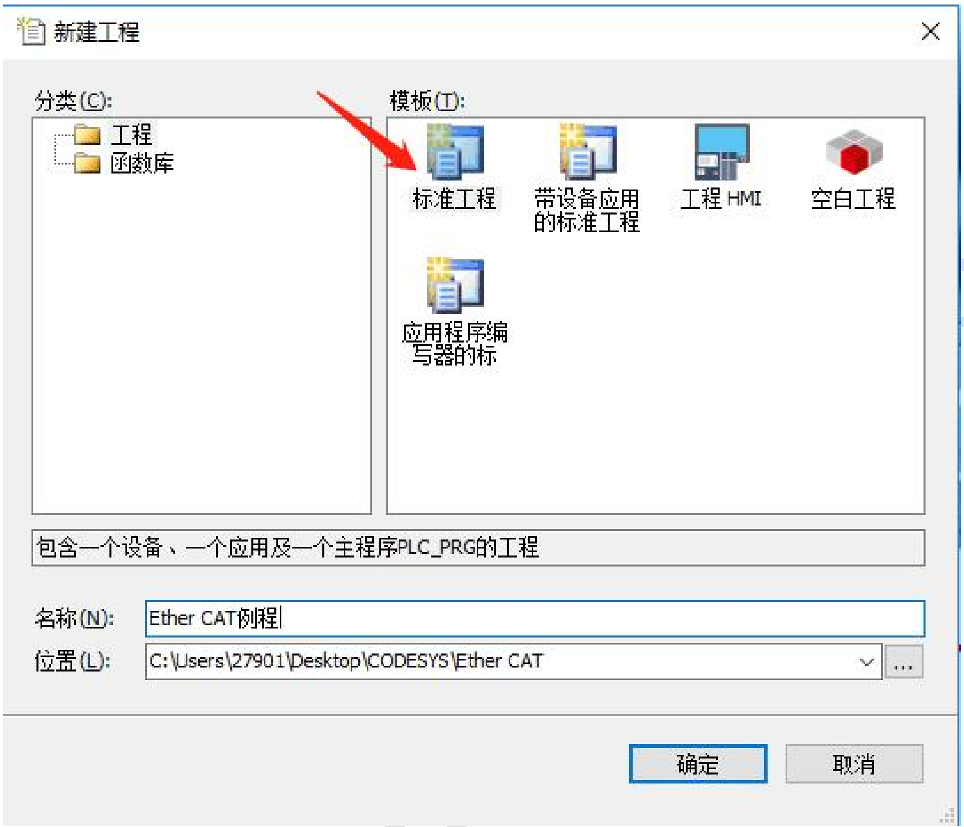


Figure 294 create a standard project

- 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

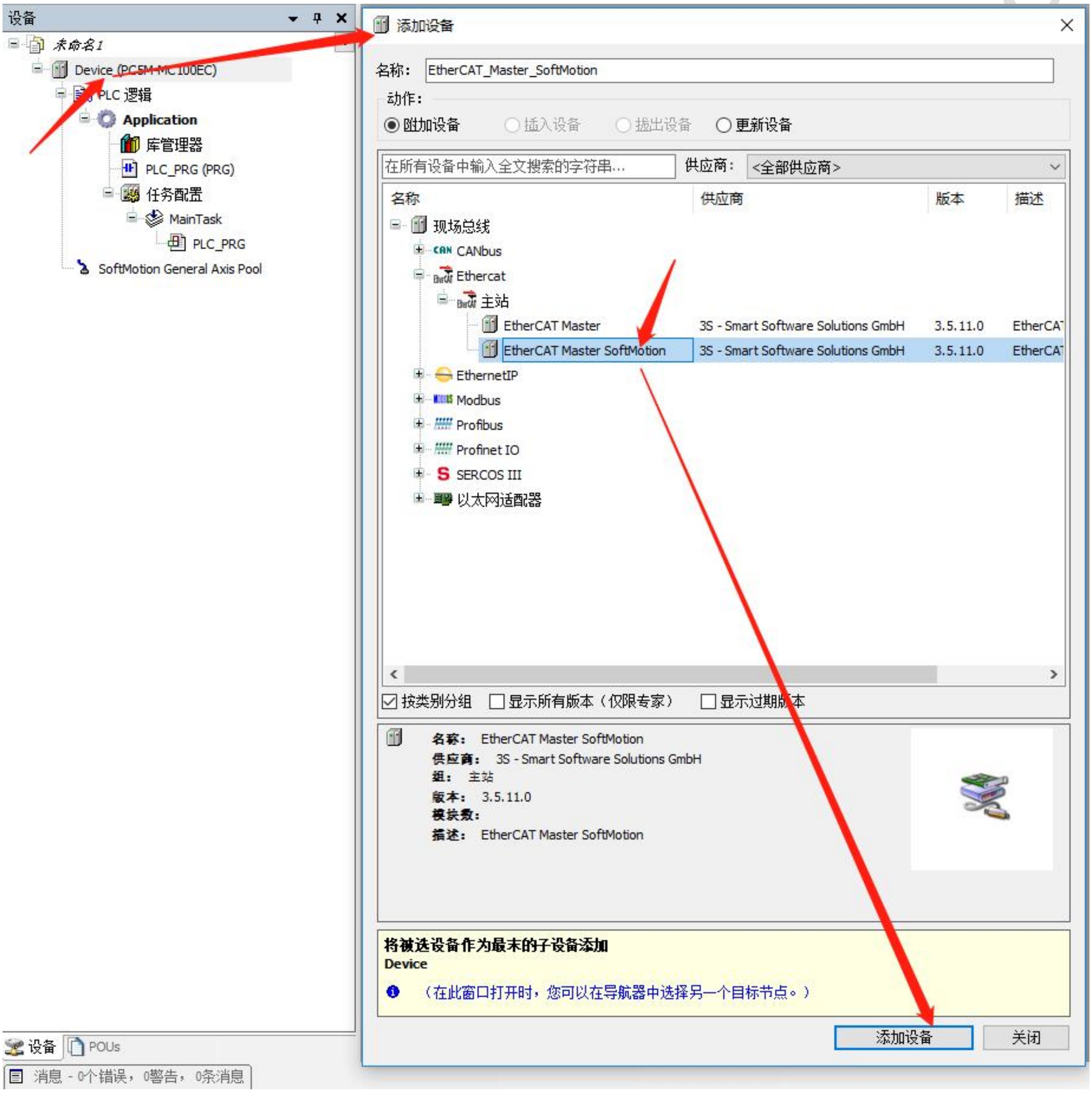


Figure 296 add device

- Right click of EtherCAT_Master_SoftMotion → add device → select 2HSS458_EC → add device → close

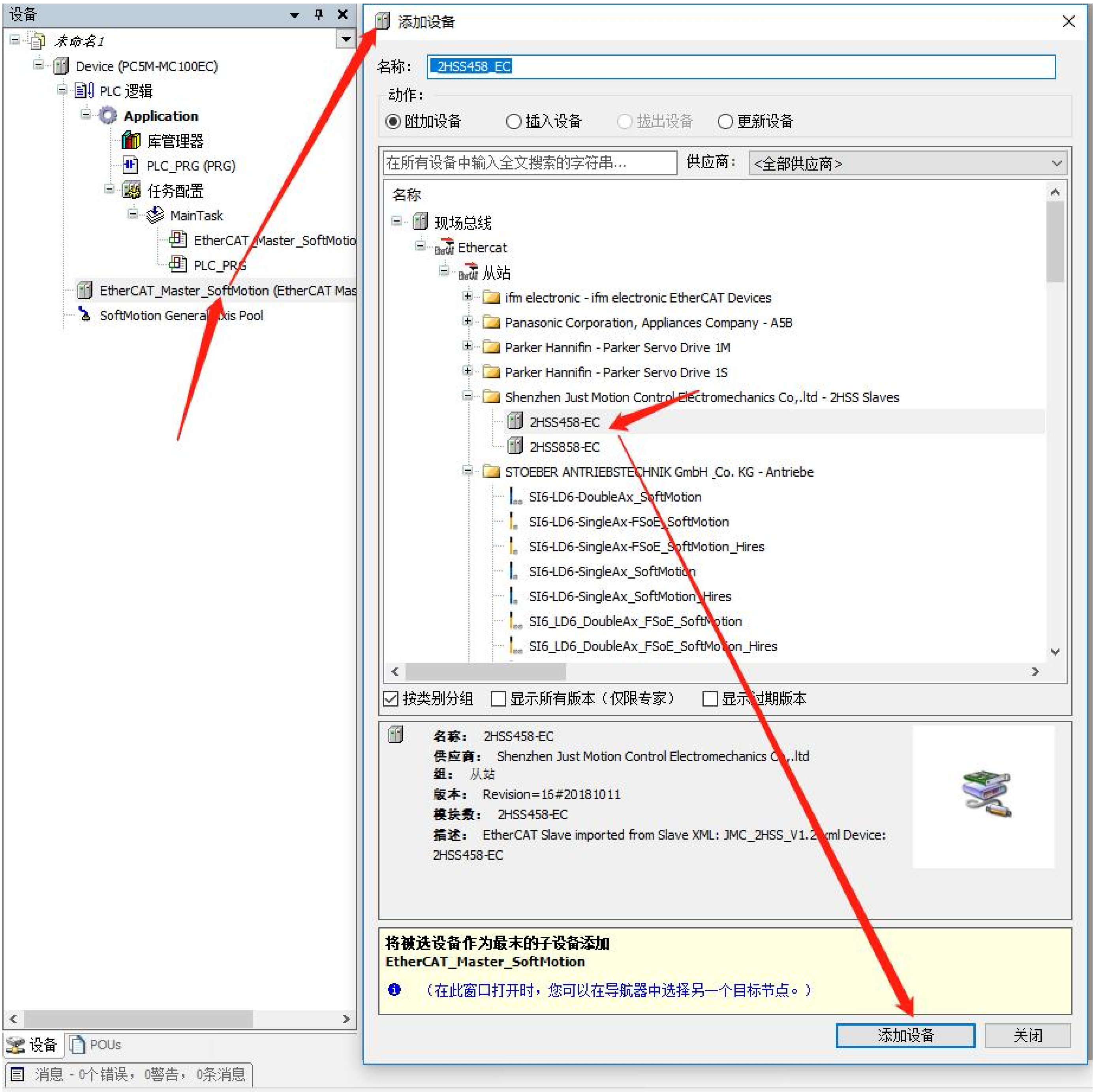


Figure 297 select device

- 2HSS458_EC right-click → add CiA402 axis of SoftMotion

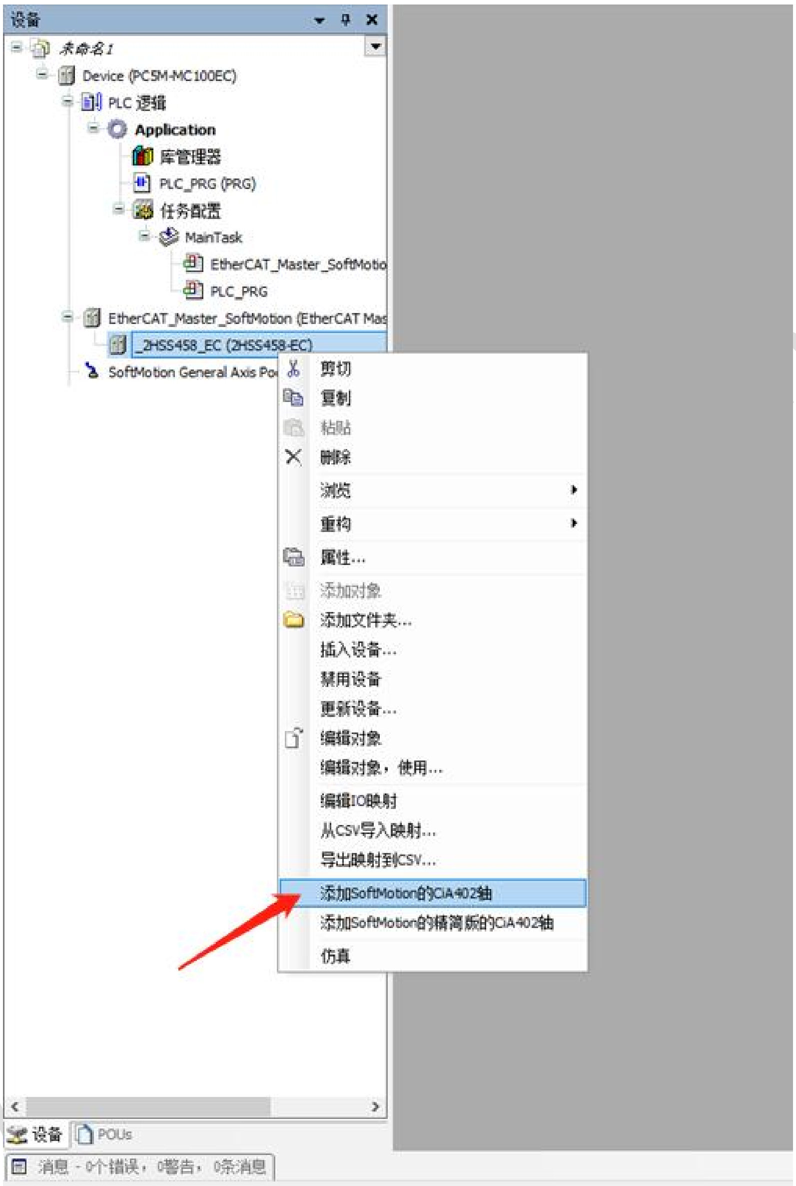


Figure 298 add CiA402 axis of SoftMotion

Parameter setting

Double-click 2HSS458_EC→Enable expert settings→Expert process data

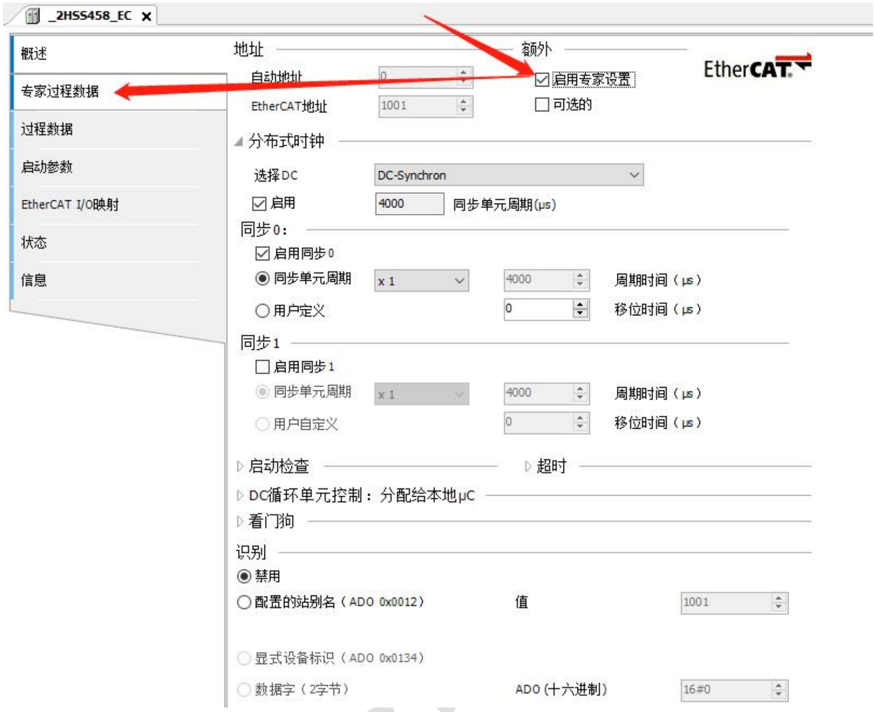


Figure 299 Enable expert settings

- Check the PDO allocation and PDO configuration in the download

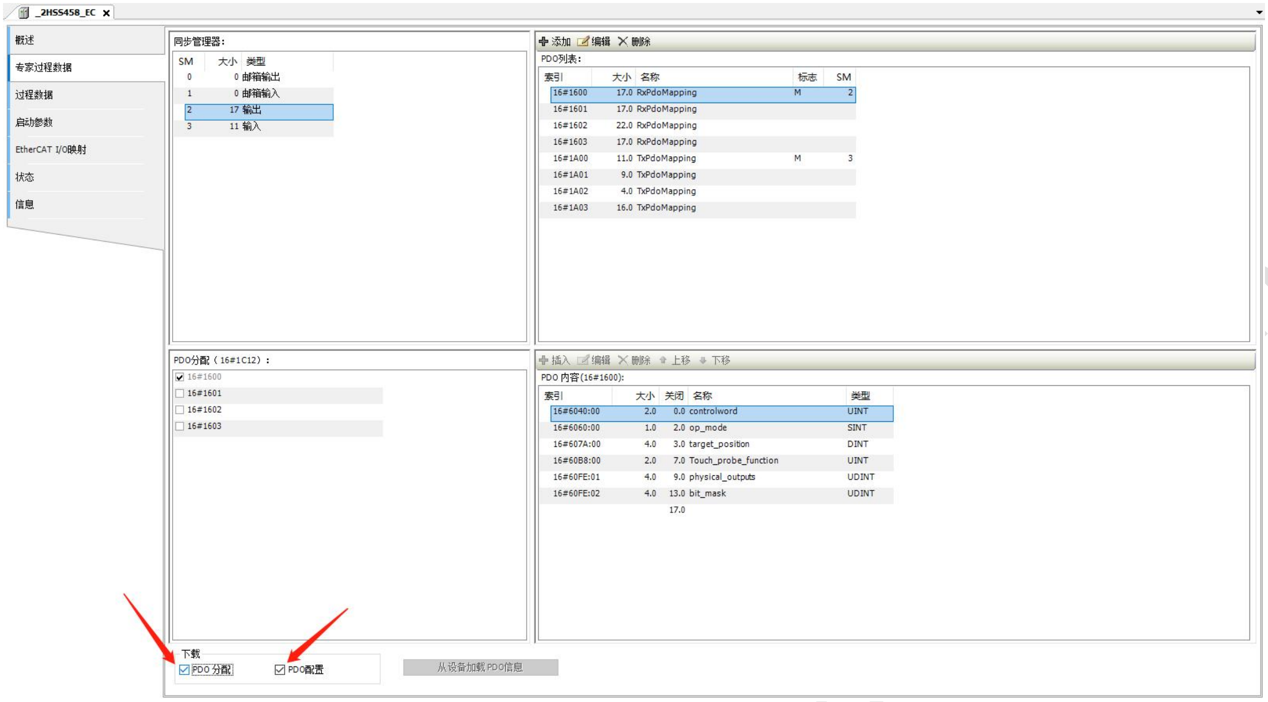


Figure 300 Expert process data

Double-click SM_Drive_GenericDSP402→SoftMotion: Zoom/Map→Change 16#10000 to 16#FA0

●

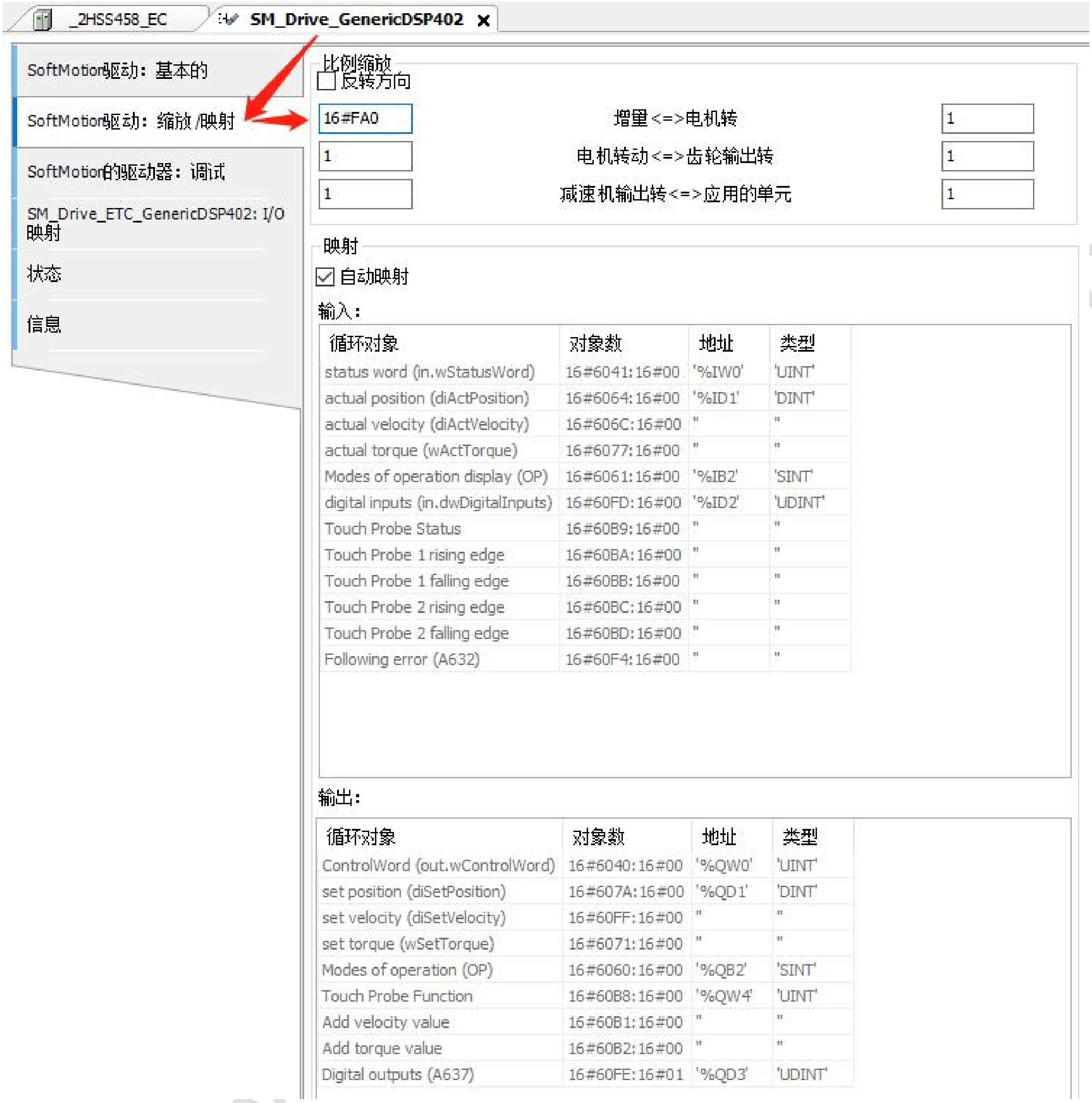


Figure 301 zoom/map

Programming

1 Set homing parameter

- Double-click 2HSS458_EC→Startup parameter→Add

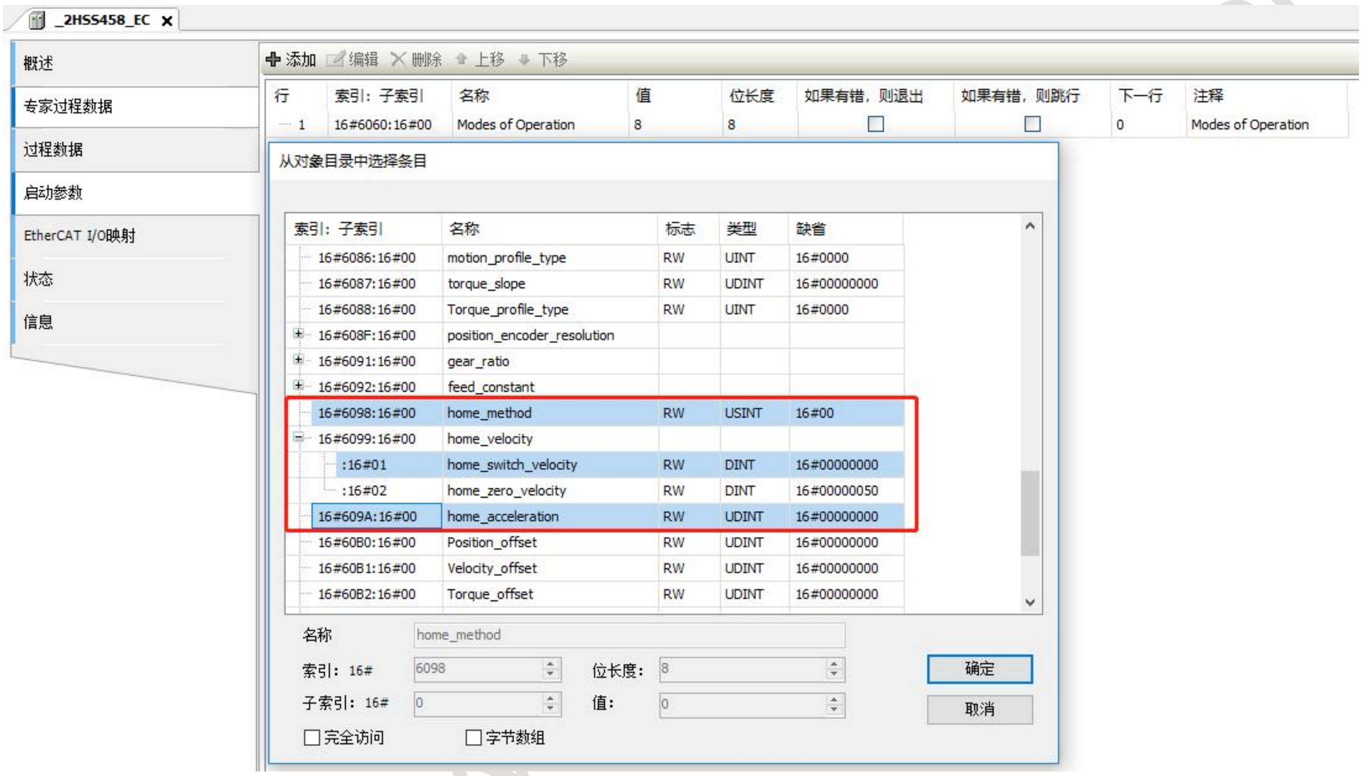


Fig 52 Add start parameter

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

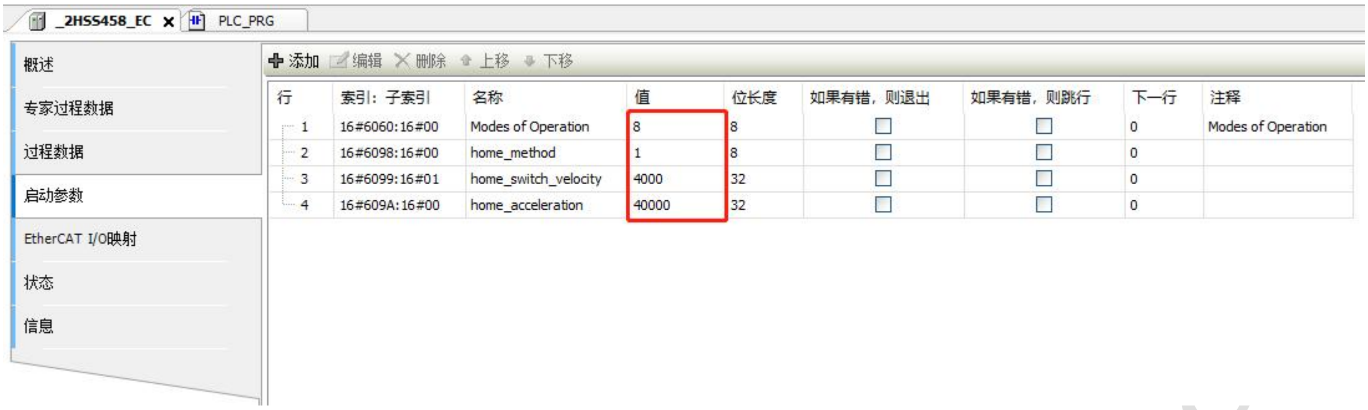
Eg:

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



行	索引：子索引	名称	值	位长度	如果有错，则退出	如果有错，则跳行	下一行	注释
1	16#6060:16#00	Modes of Operation	8	8	☐	☐	0	Modes of Operation
2	16#6098:16#00	home_method	1	8	☐	☐	0	
3	16#6099:16#01	home_switch_velocity	4000	32	☐	☐	0	
4	16#609A:16#00	home_acceleration	40000	32	☐	☐	0	

Figure 53 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.

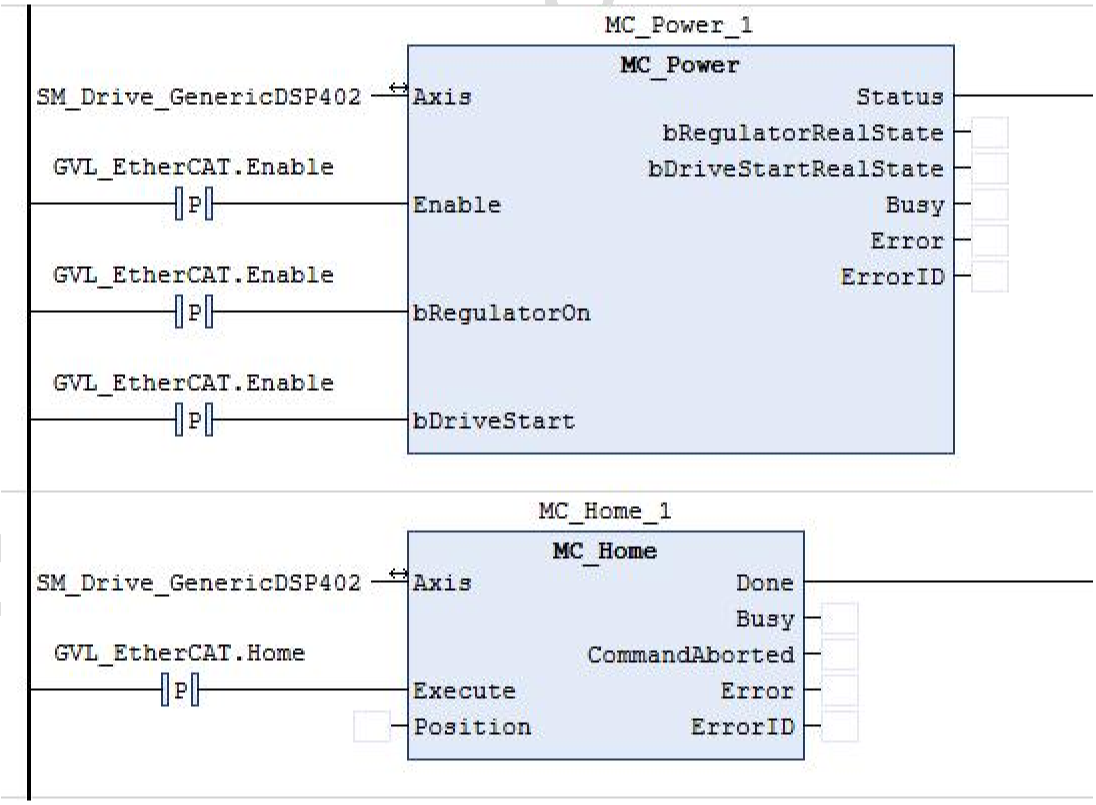


Figure 306 Homing procedure

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

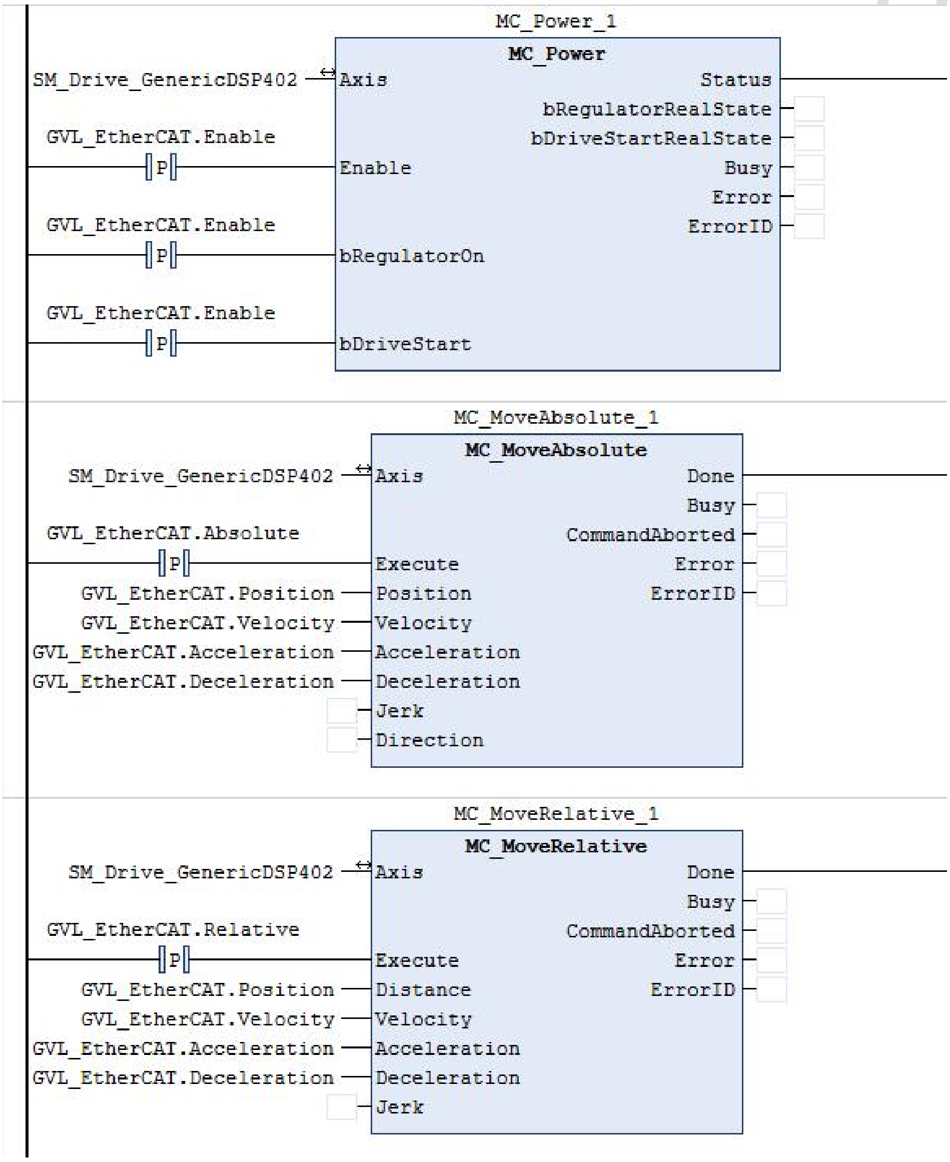


Fig 54 Position mode

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.

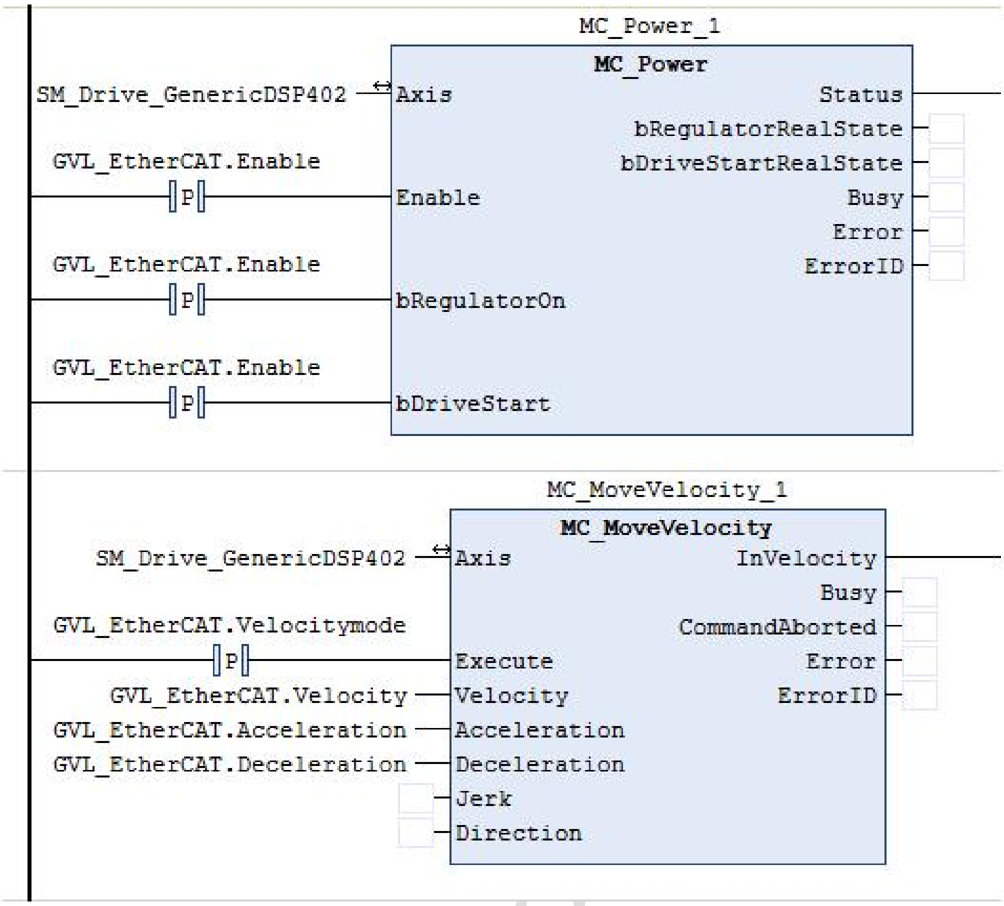


Fig 308 Speed mode

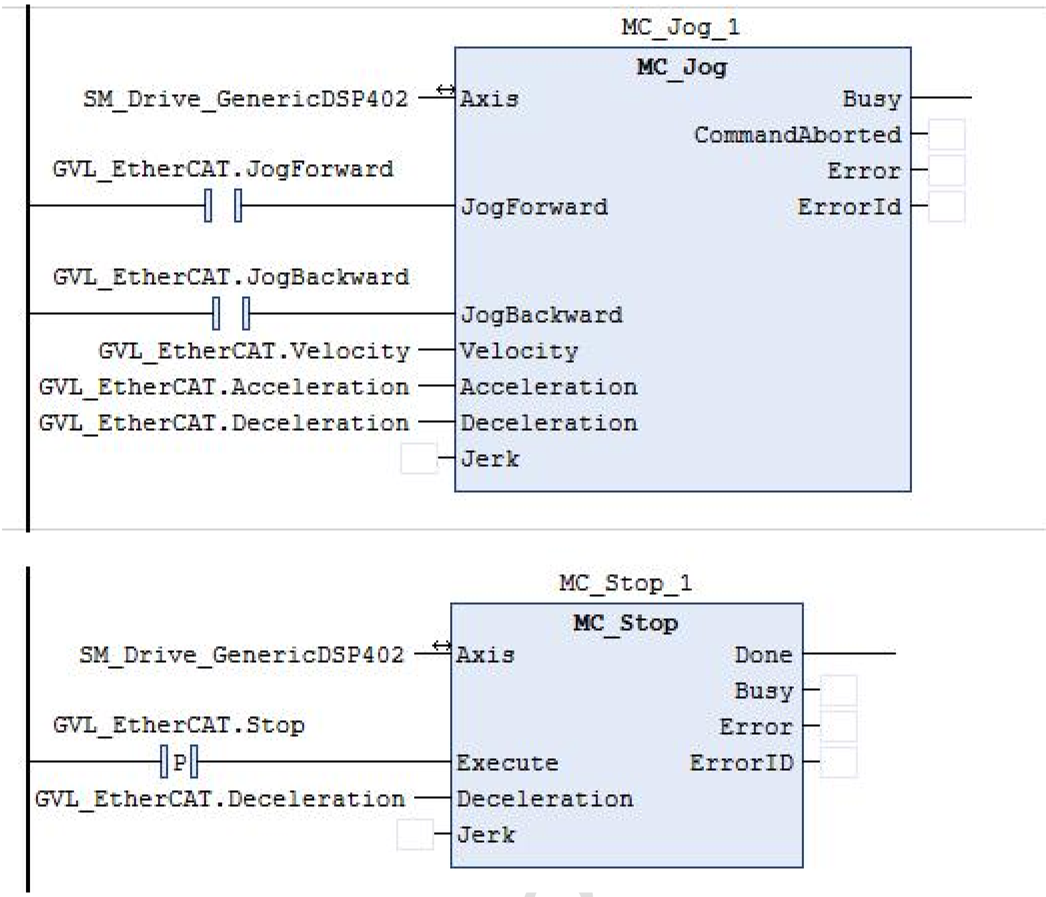


Fig 55 JOG mode

The position, speed, acceleration and deceleration used by the function blocks in the program can be set in global variables.

```
{attribute 'qualified_only'}
VAR_GLOBAL
    Enable : BOOL :=FALSE;
    Home : BOOL :=FALSE;
    Absolute : BOOL :=FALSE;
    Absolute1 : BOOL :=FALSE;
    Relative : BOOL :=FALSE;
    Velocitymode : BOOL :=FALSE;
    JogForward : BOOL :=FALSE;
    JogBackward : BOOL :=FALSE;
    Reset : BOOL :=FALSE;
    Stop : BOOL :=FALSE;

    Position : LREAL :=50;
    Position1 : 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

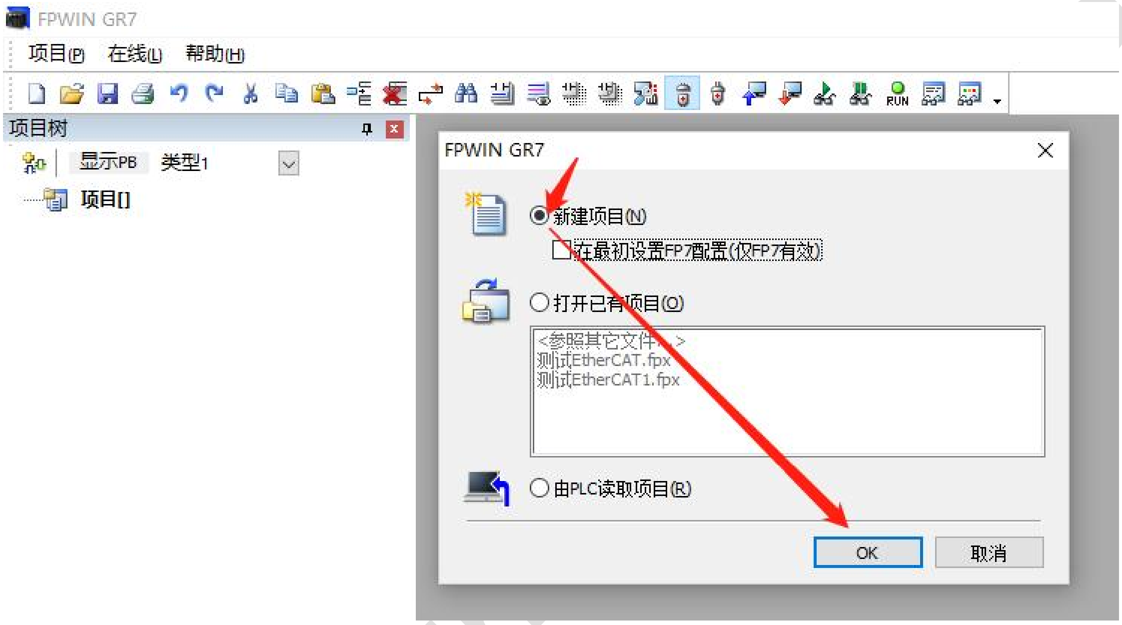


Fig 311 New FPWIN project

- Open the software FPWIN GR7→Project→New→Select CPU Unit and Motion Control Unit →OK

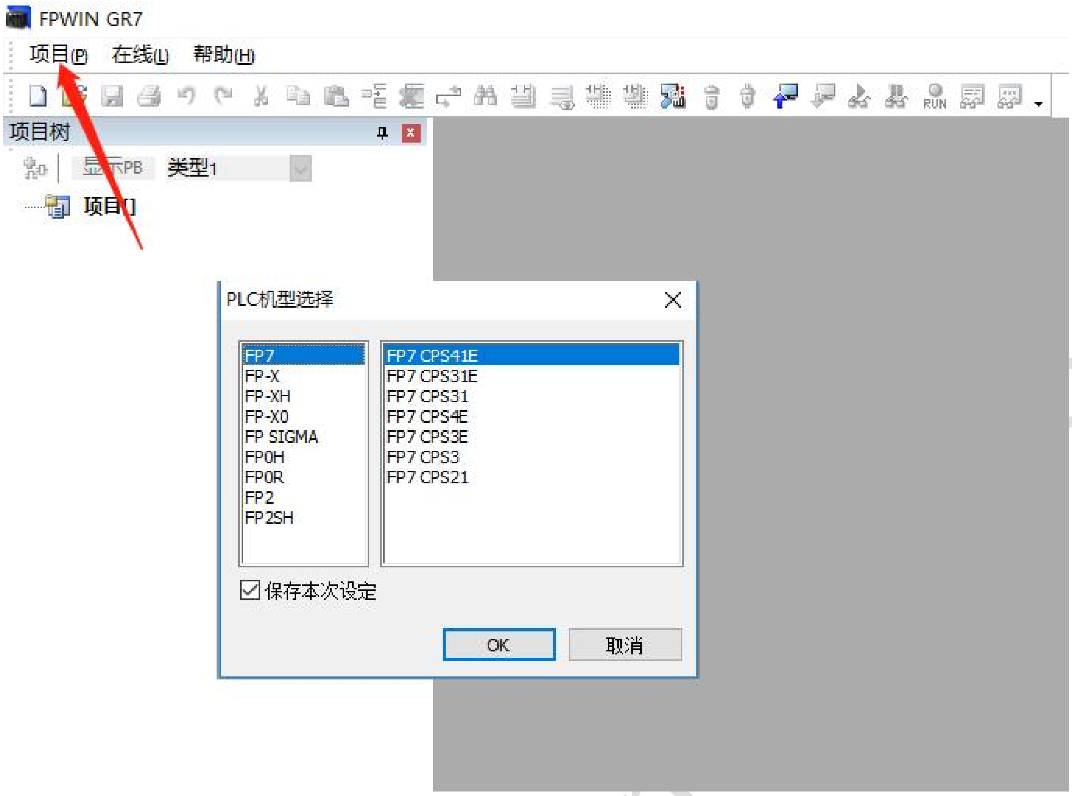


Fig 56 Select CPU unit and motion control unit

- Configure I/O mapping

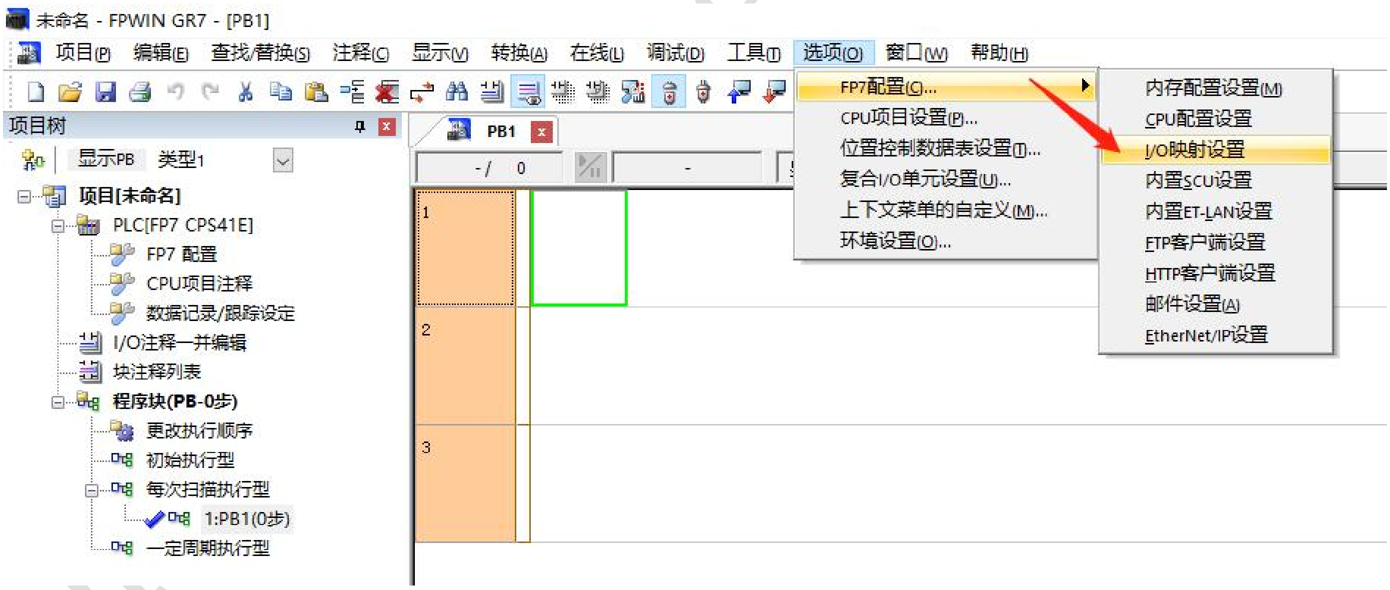


Fig 57 Configure I/O mapping

- Double-click the "Product Number" of slot NO. 0 → enter the unit selection, select the unit type and unit name

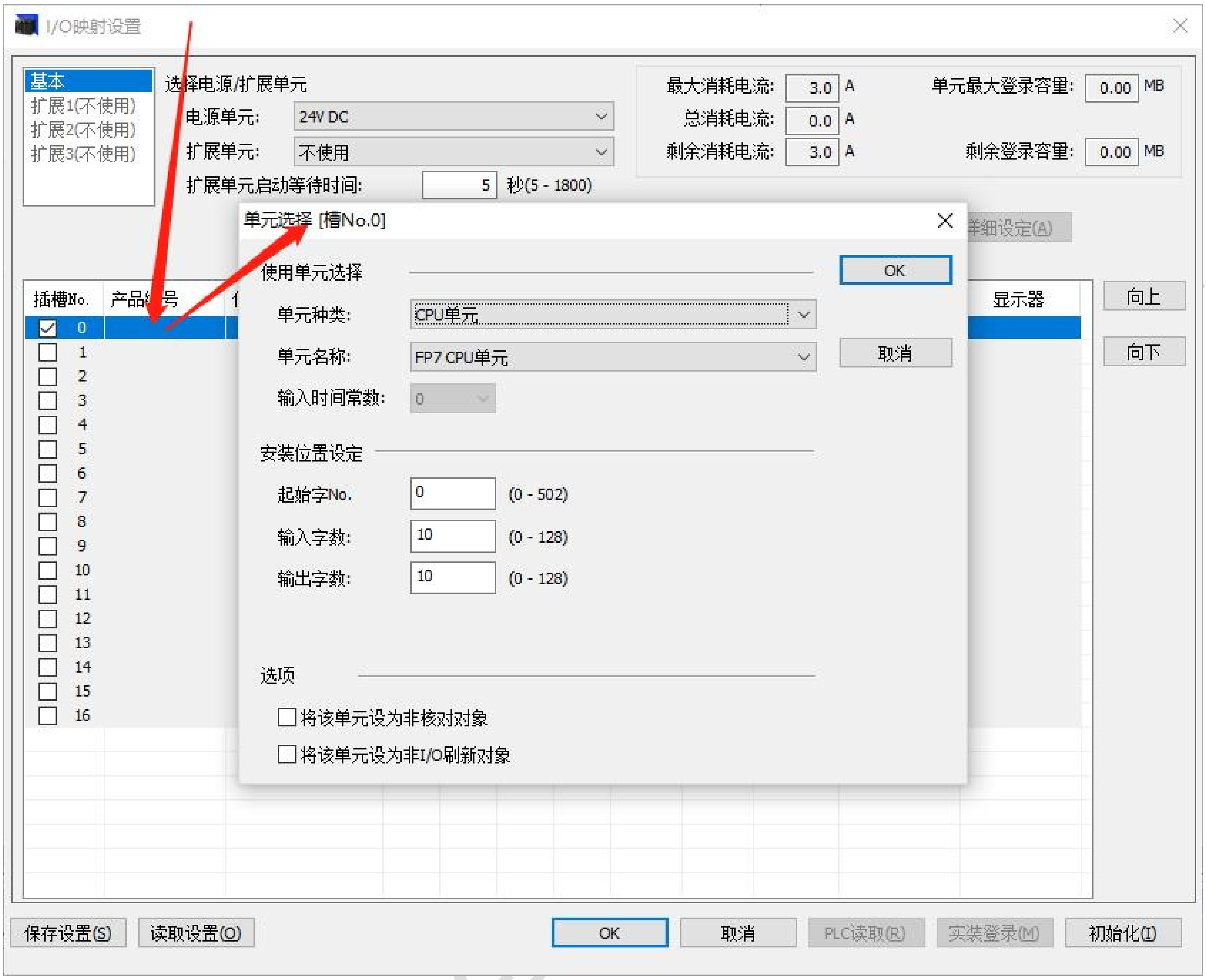


Figure 314 selecting unit type and unit name - slot NO.0

- Slot NO. 1 "Product Number" → enter the unit selection, select the unit type and unit name

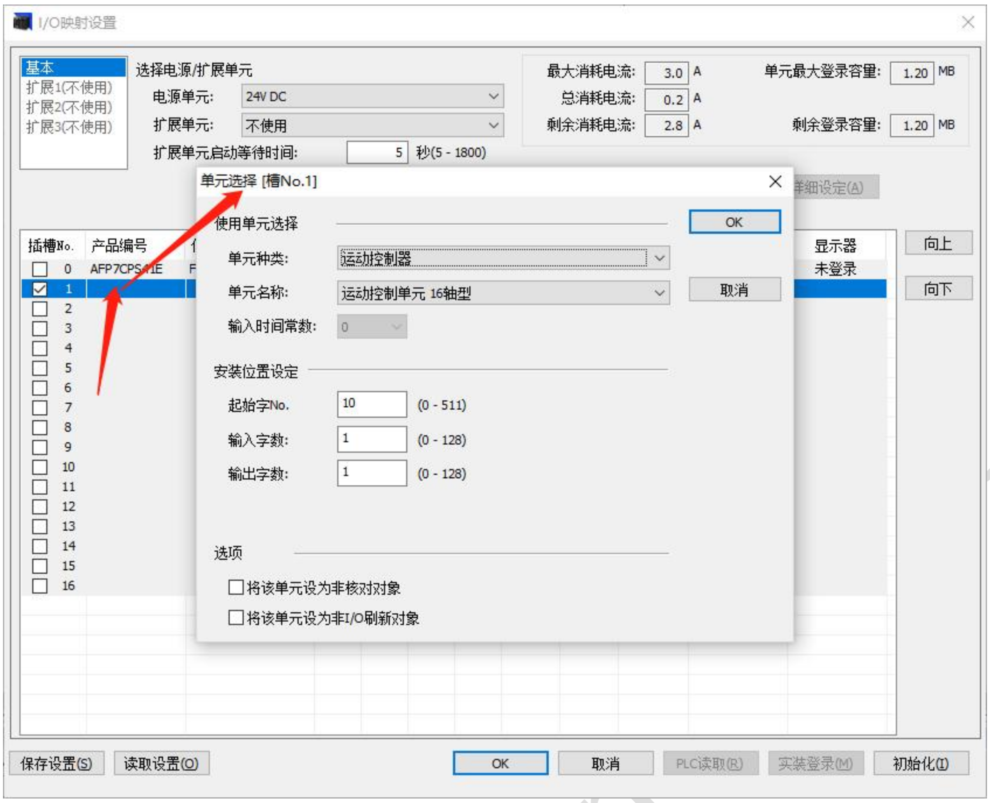


Fig 315.Select the unit type and unit name-Slot NO. 1

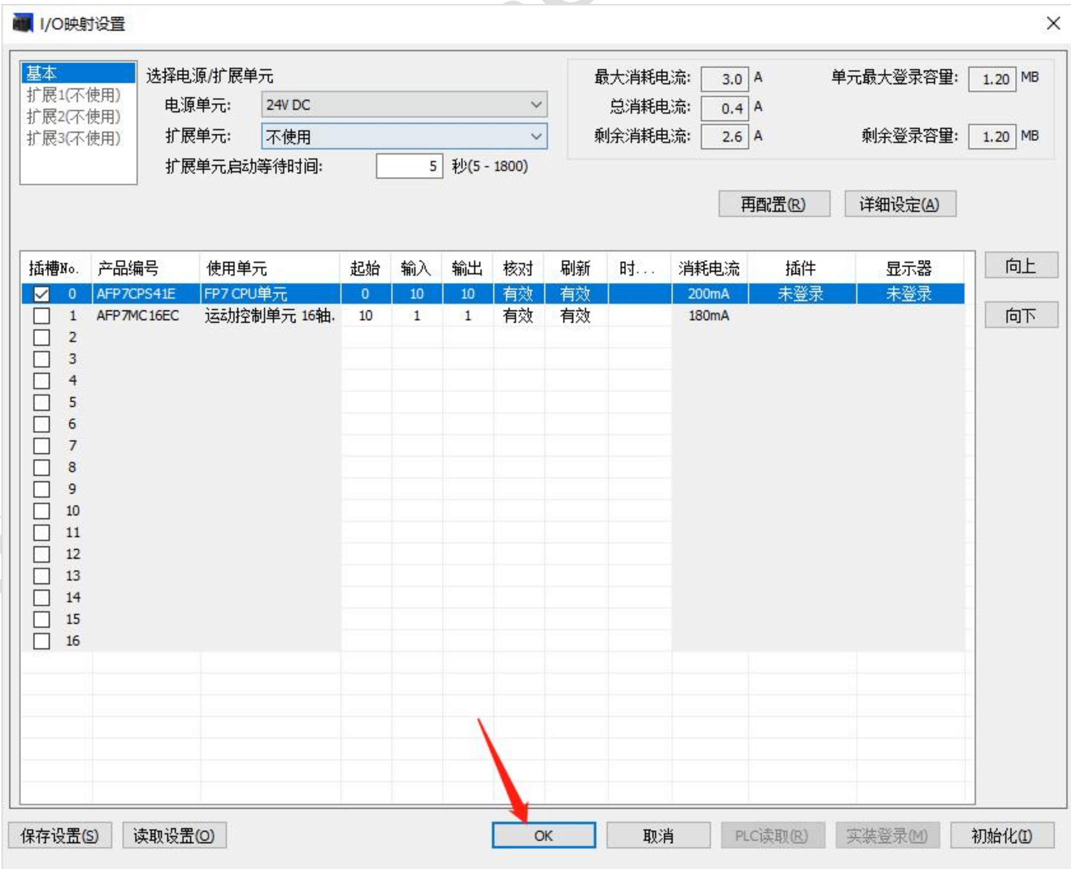


Fig 58 Select complete

Use CMI software to set the parameters of the axis

1 New Project

- Open the software ,Control Motion Integrator→new create

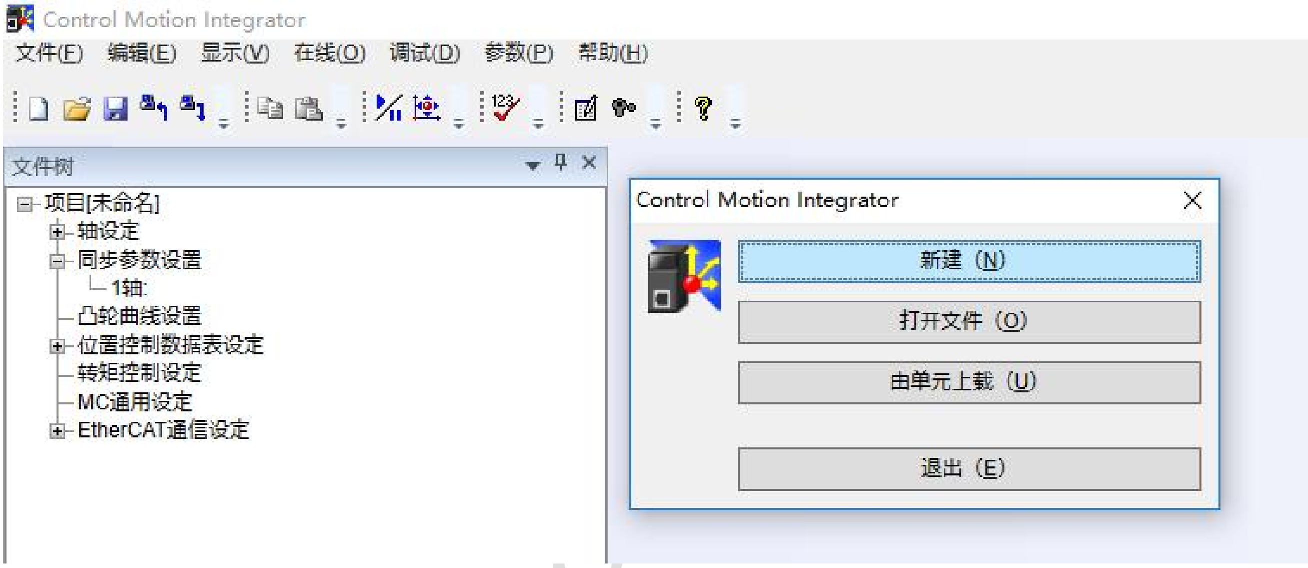


Fig 59 Create New CMI project

- 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
-

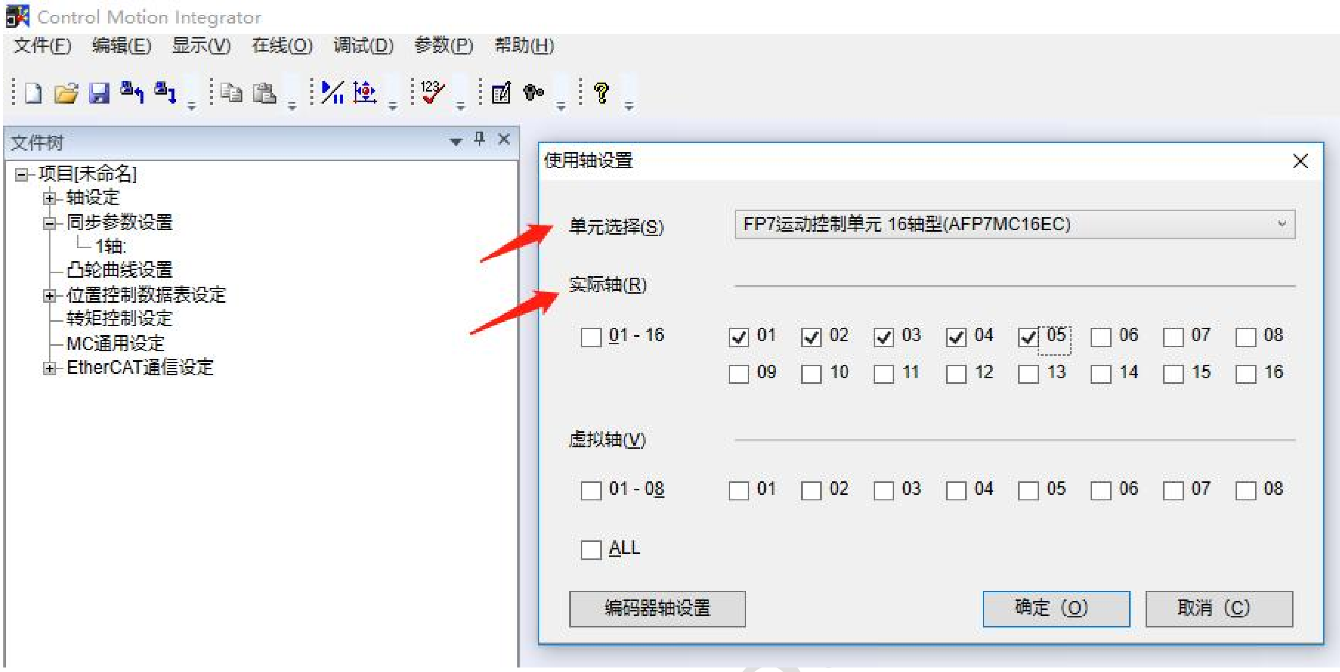


Fig 60 Select Motion Control Unit

- Whether the axis should be interpolated; if necessary, please add the axis to the interpolation group, if NOt, directly confirm
-

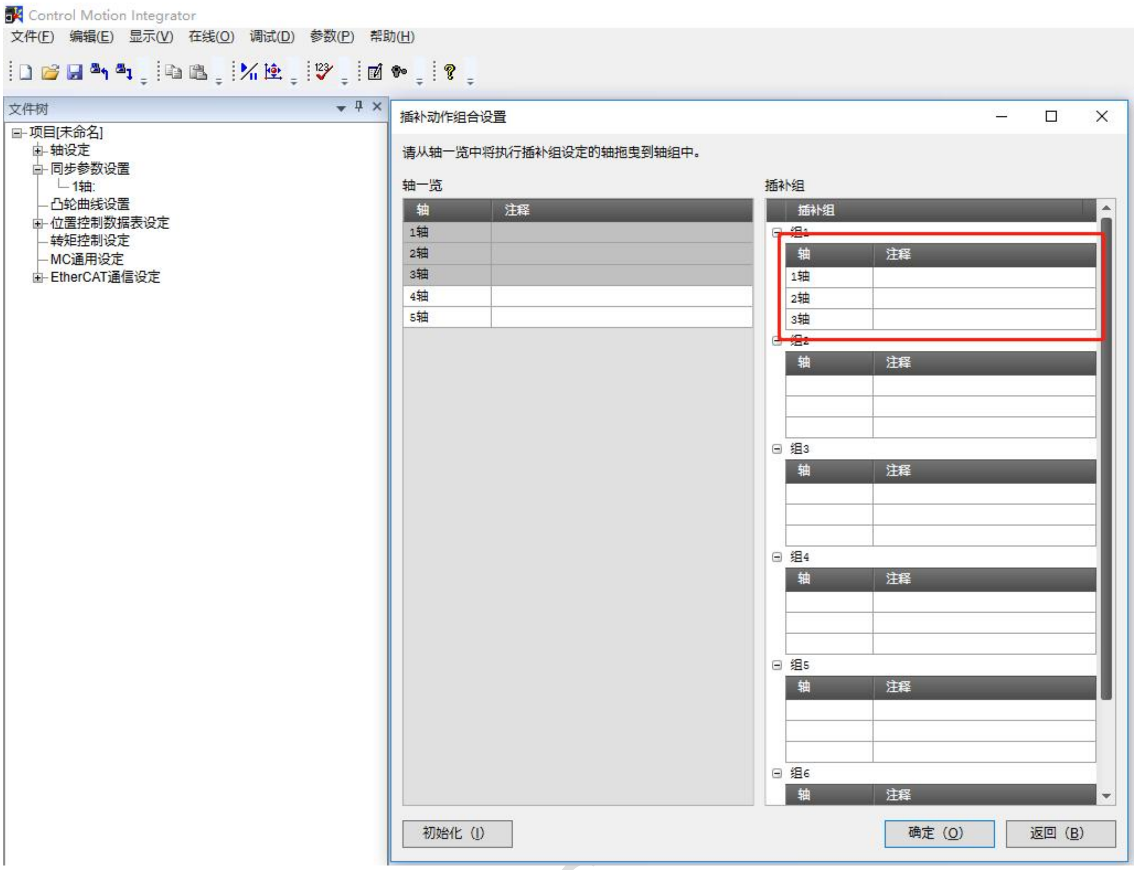


Fig 61 Interpolation group

2 Add ESI file

- Double-click EtherCAT communication settings

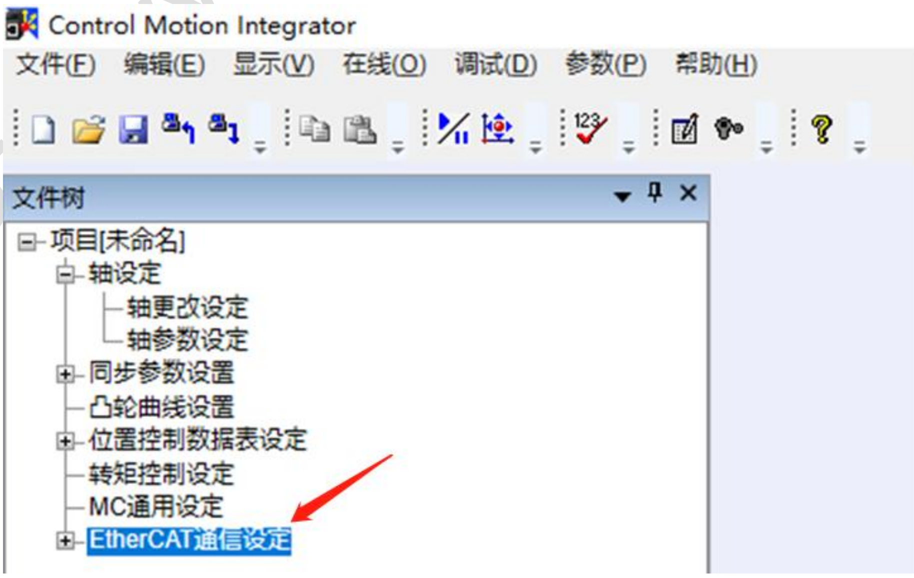


Fig 62 EtherCATCommunication settings

- Enter into EtherCAT Configurator→Press the file →ESI manage

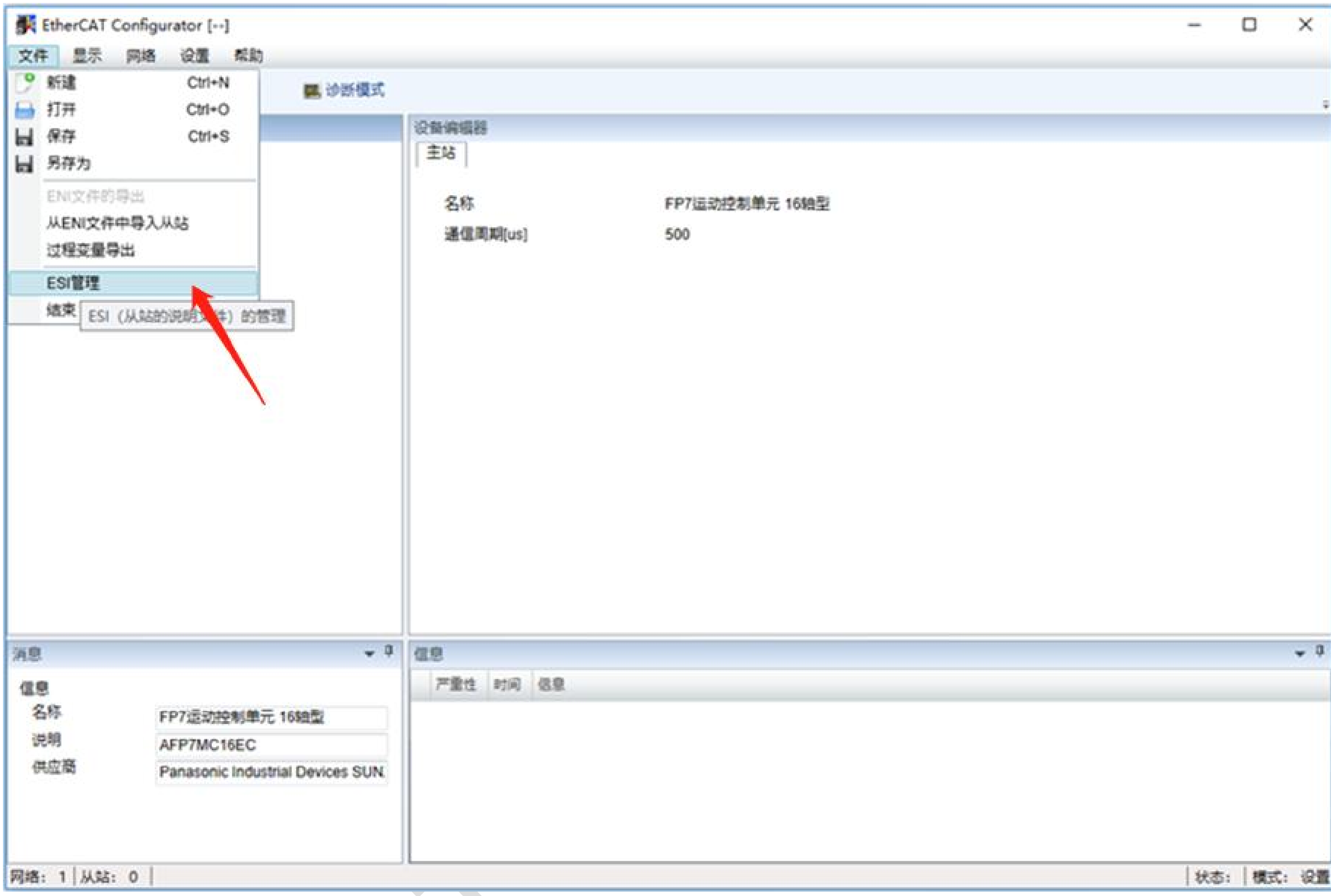


Fig 63 ESI manage

- Click the file to add

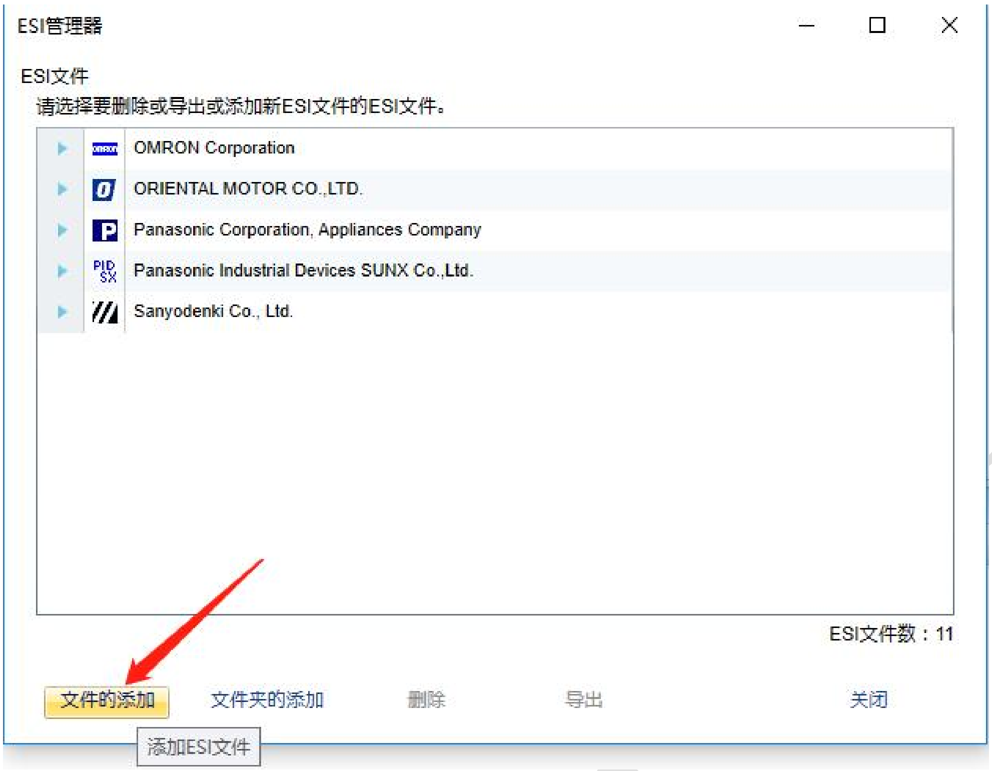


Fig 64 add ESI

Add ESI file→

Open

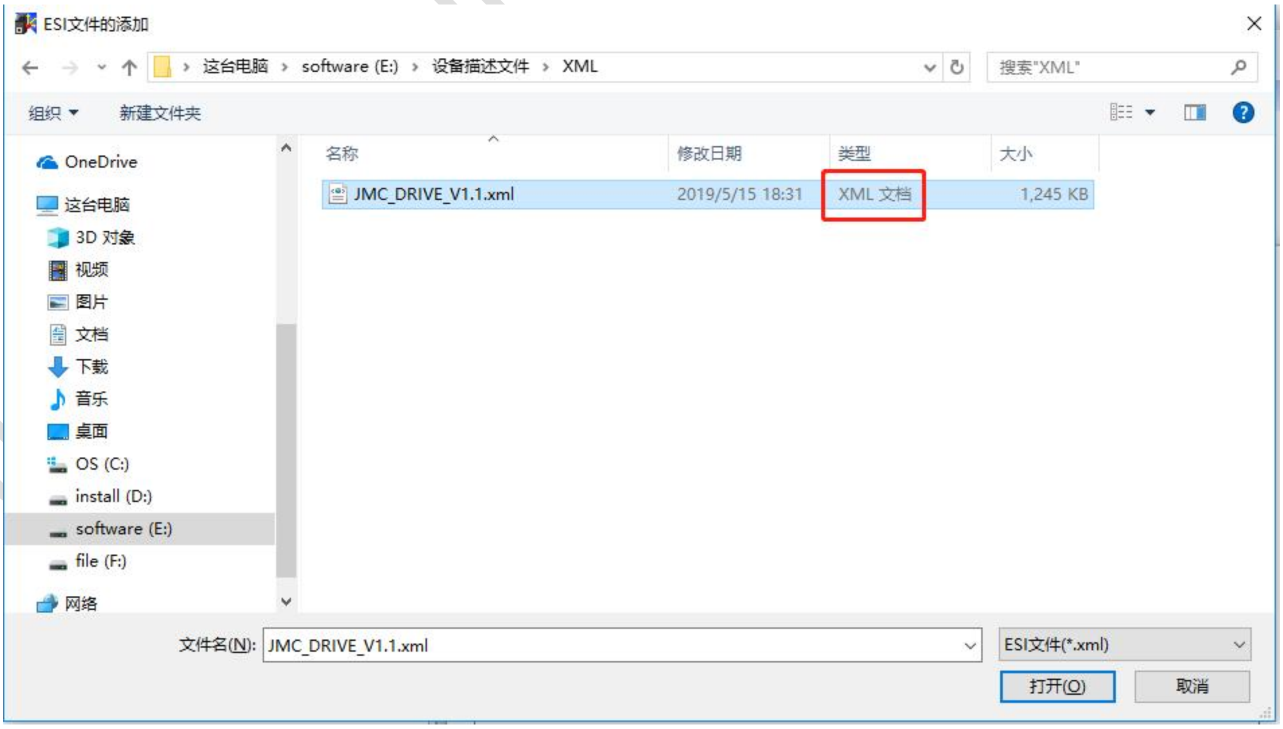


Fig 65 Open XML file

- Add successfully

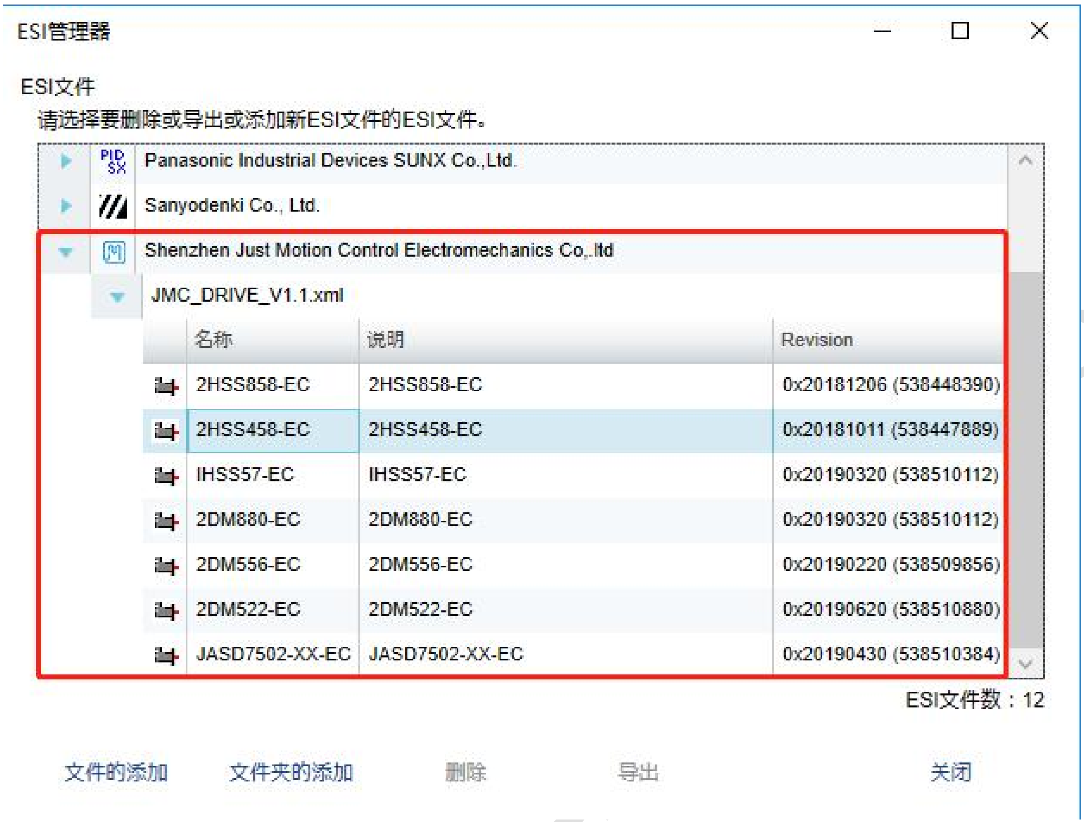


Fig 66 add XML succeed

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

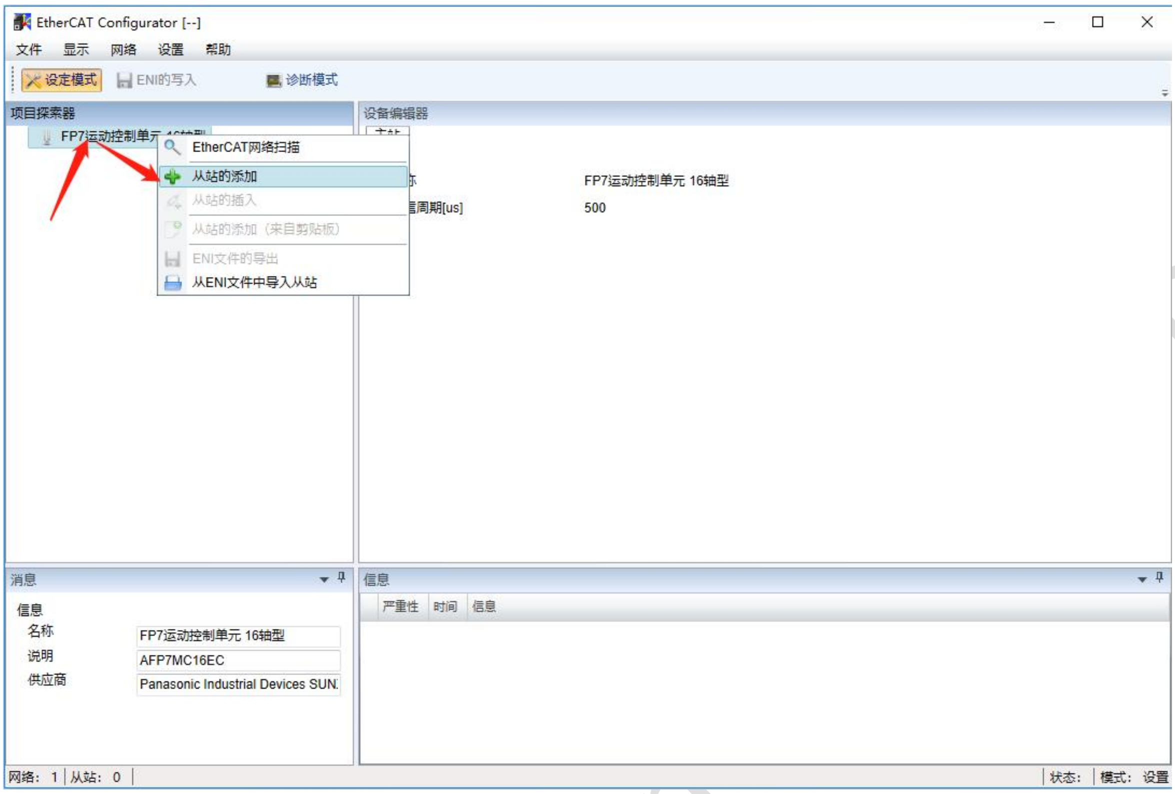


Fig 67 Select shaft model

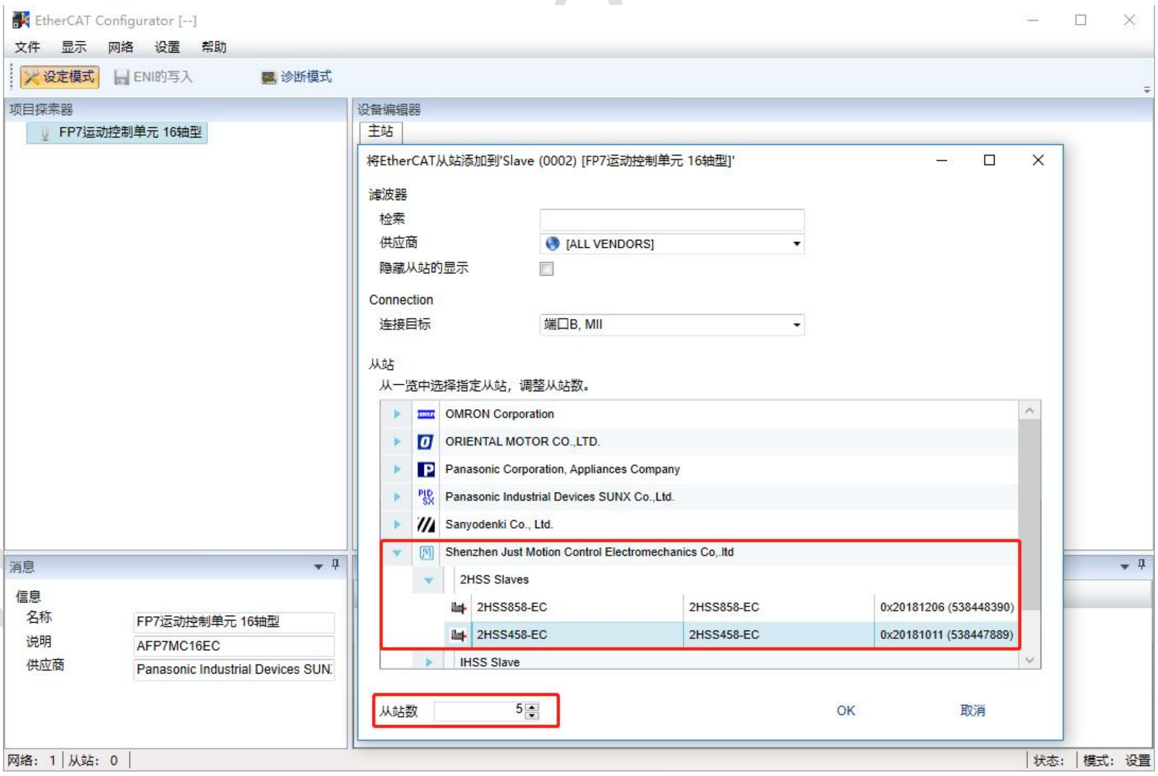


Fig 68 Set the number of slaves

- Add completed

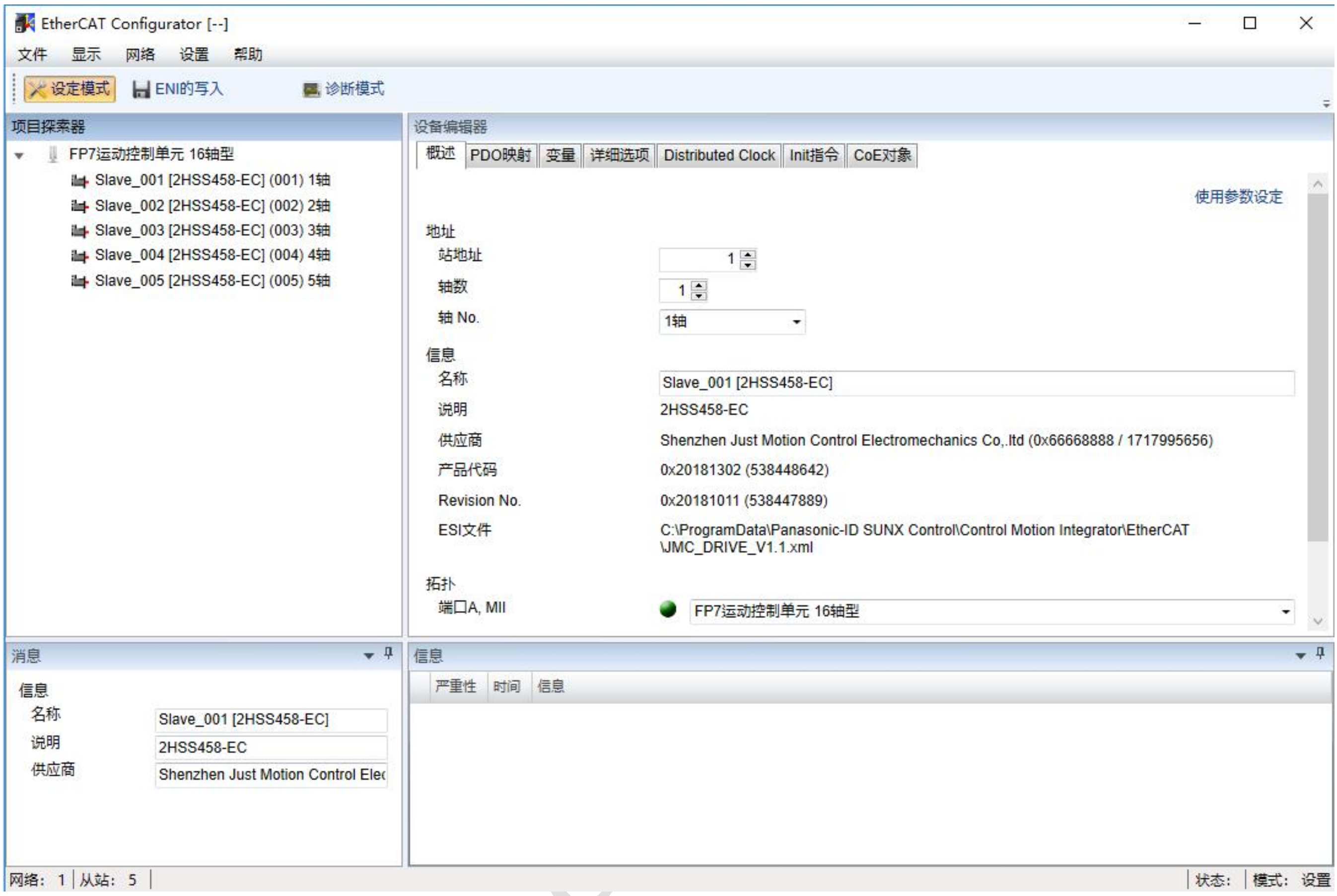


Fig 69 Add completed

4 Setting of axis parameters

- Double-click the axis parameter setting in the file tree

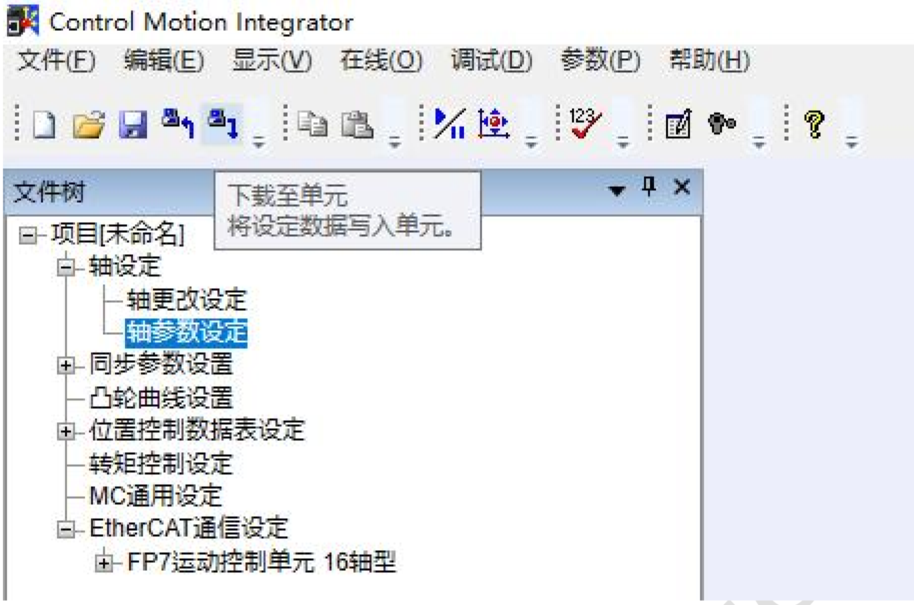
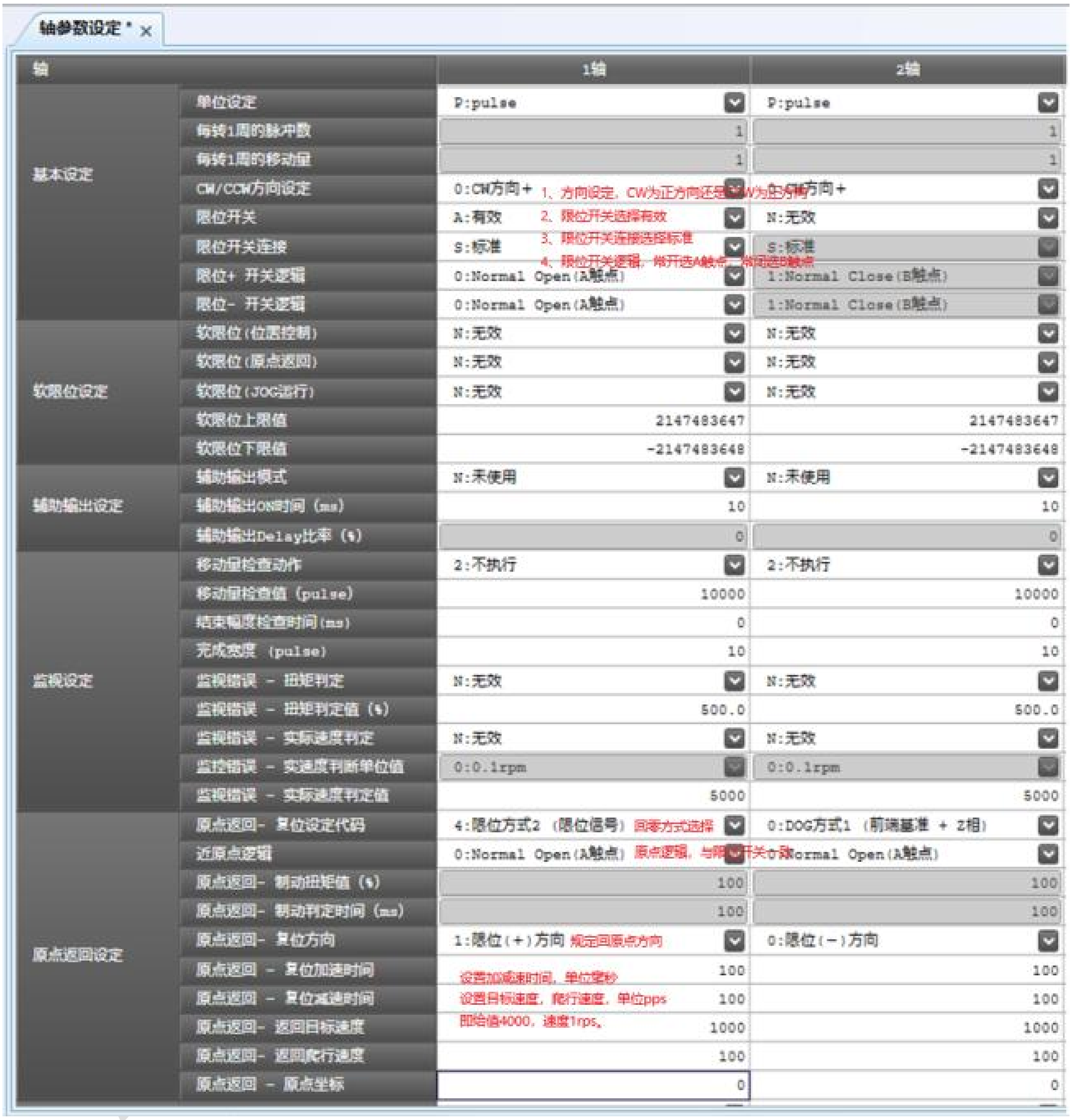


Fig 70 Axis parameter setting

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.



轴参数设定 *

轴		1轴	2轴
基本设定	单位设定	P:pulse	P:pulse
	每转1周的脉冲数	1	1
	每转1周的移动量	1	1
	CW/CCW方向设定	0:CW方向+	0:CW方向+
	限位开关	A:有效	N:无效
	限位开关连接	S:标准	S:标准
	限位+ 开关逻辑	0:Normal Open(A触点)	1:Normal Close(B触点)
	限位- 开关逻辑	0:Normal Open(A触点)	1:Normal Close(B触点)
软限位设定	软限位(位置控制)	N:无效	N:无效
	软限位(原点返回)	N:无效	N:无效
	软限位(JOG运行)	N:无效	N:无效
	软限位上限值	2147483647	2147483647
	软限位下限值	-2147483648	-2147483648
辅助输出设定	辅助输出模式	N:未使用	N:未使用
	辅助输出ON时间 (ms)	10	10
	辅助输出Delay比率 (%)	0	0
监视设定	移动量检查动作	2:不执行	2:不执行
	移动量检查值 (pulse)	10000	10000
	结束幅度检查时间(ms)	0	0
	完成宽度 (pulse)	10	10
	监视错误 - 扭矩判定	N:无效	N:无效
	监视错误 - 扭矩判定值 (%)	500.0	500.0
	监视错误 - 实际速度判定	N:无效	N:无效
	监控错误 - 实速度判断单位值	0:0.1rpm	0:0.1rpm
	监视错误 - 实际速度判定值	5000	5000
原点返回设定	原点返回- 复位设定代码	4:限位方式2 (限位信号)	0:DOG方式1 (前端基准 + Z相)
	近原点逻辑	0:Normal Open(A触点)	0:Normal Open(A触点)
	原点返回- 制动扭矩值 (%)	100	100
	原点返回- 制动判定时间 (ms)	100	100
	原点返回- 复位方向	1:限位(+)方向	0:限位(-)方向
	原点返回 - 复位加速时间	100	100
	原点返回 - 复位减速时间	100	100
	原点返回- 返回目标速度	1000	1000
	原点返回- 返回爬行速度	100	100
	原点返回 - 原点坐标	0	0

Fig 71 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

轴参数设定 * 位置控制 *

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

1轴 2轴 3轴 4轴 5轴

Fig 72 Position parameter setting

6 Download parameters

- Click to download to the unit

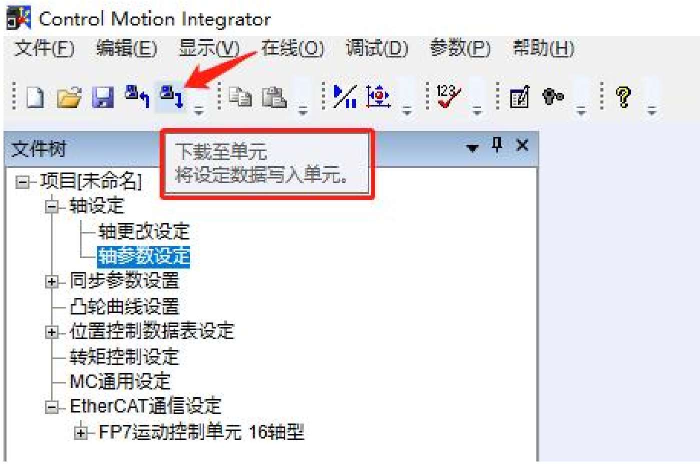


图 73 下载参数

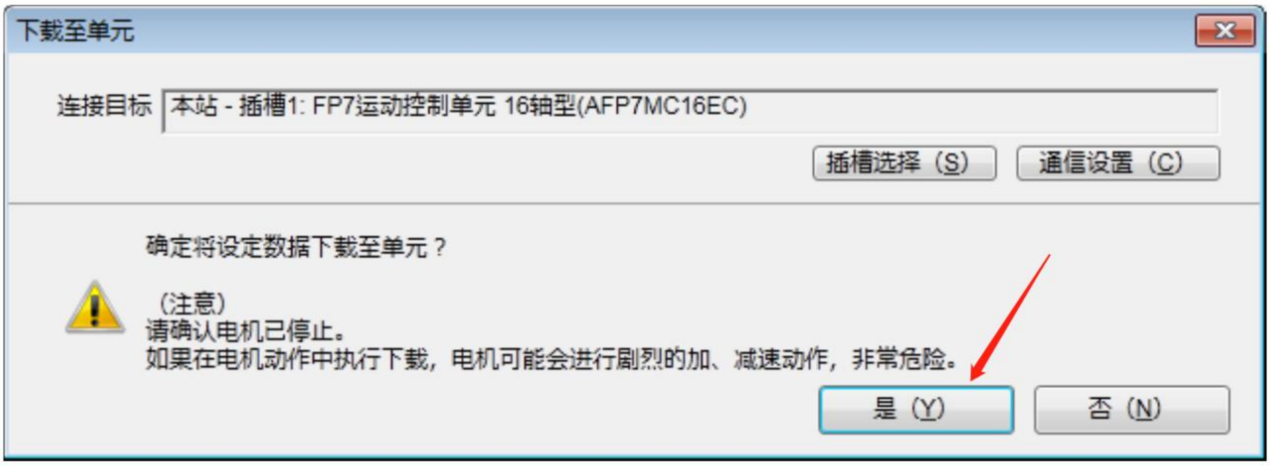


图 74 下载至单元

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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