Just motion control EC Series Drives

User's Manual

V1.3

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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:

Gemicom 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

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.

Revision history

Date	Old version	New version	Change content	Revised by
2019-08-05	V1.0	V1.0	The first version	Step servo field-bus department
2019-09-04	V1.0	V1.1	● Add the TwinCAT3 Using tutorials	
2019-11-04	V1.1	V1.2	● Add JASD AC servo driver ● Revise "communication interface and wiring" ● Modify the bit definition of object dictionary 60fdh	
2019-12-11	V1.2	V1.3	● Add IHSC integrated bus AC servo motor	

Model selection list

DM-EC digital step driver

Model	communication way	Power supply	Output current	Digital signal	Matched motor
2DM522-EC	EtherCAT	24~48VDC	0~2.2A	Digital input Current: 6~16mA Power supply: 12~24VDC Digital output: Current: 0~50mA Power: 5~24VDC	28/35/42motor base
2DM556-EC	EtherCAT	24-48VDC	0~5.6A		57/60 motor base
2DM880-EC	EtherCAT	24~70VAC 24~110VDC	0~8.0A		86 motor base

HSS-EC hybrid stepping servo driver

model	communication way	Power supply	Output current	Digital signal	Matched motor
2HSS458-EC	EtherCAT	24~48VDC	0~5.8A	Digital input : current: 6~16mA Power : 5~24VDC Digital output current: 0~50mA Power: 5~24VDC	28/35/42/57/60 motor base
2HSS858-EC	EtherCAT	70~110VDC 50~90VAC	0~5.8A		60/86 motor base
3HSS2208-EC	EtherCAT	220VAC	0~8.0A		86/110/130 motor base
Note: if you need 28 / 35 base closed-loop motor driver, please contact us for customization.					

IHSS-EC Integrated step servo motor

型号 model	communication way	static torque	Power supply	Digital signal	Matched motor
IHSS57-36-20-EC	EtherCAT	2N•M	24~48VDC Typical value: 36VDC	Digital signal input current: 6~16mA Power : 5~24VDC Digital output : current: 0~50mA	57
IHSS60-36-30-EC	EtherCAT	3N•M	24~48VDC Typical value: 36VDC		60

IHSS86-60-45-EC	EtherCAT	4.5N•M	24~80VDC Typical value: 60VDC	Power : 5~24VDC	86
IHSS86-80-85-EC	EtherCAT	8.5N•M			
Note: if you need 28 / 35 base closed-loop motor driver, please contact us for customization.					

JASD-EC high voltage ac servo driver					
model	communication way	Power supply	Output current	Digital signal	
JASD2002-20B-EC	EtherCAT	220VAC	2.1A	Digital input current: 6~16mA Power: 5~24VDC Digital output current: 0~50mA Power: 5~24VDC	40/60 base
JASD4002-20B-EC	EtherCAT		2.8A		60 base
JASD7502-20B-EC	EtherCAT		5.5A		60/80 base
JASD10002-20B-EC	EtherCAT		8.0A		80/110/130 base
JASD20002-20B-EC	EtherCAT		14A		130base
JASD30002-20B-EC	EtherCAT		20A		130base

IHSV-EC Integrated EC AC servo motor					
model	communication way	Power supply	Digital signal	Rated torque	Motor base
IHSV57-30-14-36-EC	EtherCAT	24~48VDC Typical value: 36VDC	Digital input Current: 6~16mA Power: 5~24VDC Digital output Current: 0~50mA Power : 5~24VDC	0.44N*M	57
IHSV57-30-18-36-EC				0.6N*M	
IHSV60-30-20-48-EC		36~80VDC Typical value: 48VDC		0.64N*M	60
IHSV60-30-40-48-EC				1.29N*M	
IHSV86-30-44-72-EC		48~100VDC Typical value: 72VDC		1.4N*M	86
IHSV86-30-66-72-EC				2.1N*M	

Content

Hardware

DM-EC Fieldbus digital stepping driver series

➢ Product introduction

Dm-EC fieldbus digital stepping driver series is a new type of EtherCAT bus digital stepping driver adopting advanced digital stepping motor algorithm and EtherCAT bus control technology. Combined the CoE communication protocol and CIA402 control protocol control algorithm, the digital stepping driver can avoid the step loss problem effectively of the stepping motor, restrain the temperature rise of the motor effectively and reduce the vibration of the motor significantly when compared with the traditional digital stepping driver. The motor size matched with this driver is compatible with the traditional stepping motor, which is convenient for customers to replace and upgrade. In a word, this digital step driver integrates the advantages of bus communication control, simple wiring, no step loss, low temperature rise, high speed, high torque, low cost, convenient maintenance and so on. It is a very cost-effective motion control product.

➢ Technical features

- ✧ Support standard 100m full duplex EtherCAT communication bus network interface and COE communication protocol
- ✧ It supports standard CIA DS402 protocol, with built-in synchronous cycle position, contour position, contour speed and zero return control mode
- ✧ Built in CW, CCW, HW three 5V or 24V IO signal inputs for limit and zero return reference
- ✧ A brake BRAKE and in place output signal
- ✧ Built in CW, CCW, SW three 5V or 24V IO signal inputs for limit and return to zero
- ✧ Built in PB1 / PB2 two fast probes differential input
- ✧ Small vibration, stable operation at low speed
- ✧ 100% rated torque drive motor 100%
- ✧ Inverter control technology, high current efficiency
- ✧ Built in acceleration and deceleration control to improve start stop smoothness
- ✧ Customize subdivision
- ✧ There is no need to adjust the general application parameters
- ✧ Phase loss protection, overcurrent protection and overvoltage protection

➢ 2DM522-EC

1 Electrical, mechanical and environmental indicators

Table 1 Performance parameters of JMC 2DM522-EC driver

Input voltage		24~48VDC
Continuous current input		2.2A
Communication type		EtherCAT Communication protocol
Maximum communication distance		From station to station 100m
Maximum supported slave number		65535
Maximum communication rate		100Mbps
Logic input current		7~20mA（Typical value 10mA）
protect		Peak value of overcurrent action value 10A±10%
		60VDCOvervoltage action value
Dimension（mm）		118×75.5×34
weight		about 260g
Use environment	occasion	Try to avoid dust, oil mist and corrosive gas
	working temperature	0~40℃
	Storage temperature	-20℃~+40℃
	Humidity	40~90%RH
	Cooling mode	Natural cooling or forced cooling

2 Mechanical installation dimension drawing

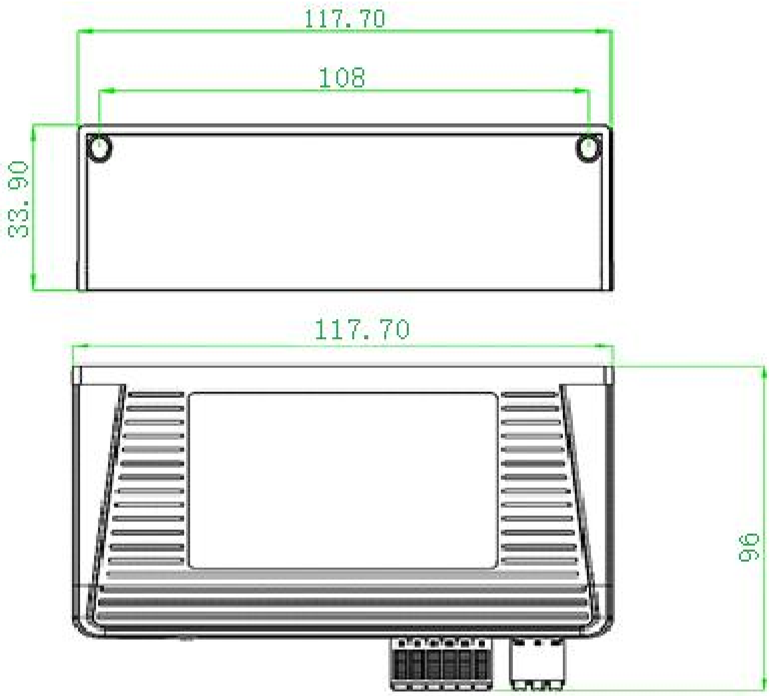


Figure 1, Mechanical installation dimension drawing of 2DM522-EC (unit: mm)

When designing the installation size, it is necessary to consider the size of the terminal and the ventilation and heat dissipation.

1) The reliable working temperature of the driver is usually within 60 ℃, and that of the motor is within 90 ℃;

2) When installing the driver, please use the vertical side installation to form strong air convection on the radiator surface; if necessary, install a fan near the driver to force heat dissipation to ensure that the driver works within the reliable working temperature range.

3 Driver interface and wiring

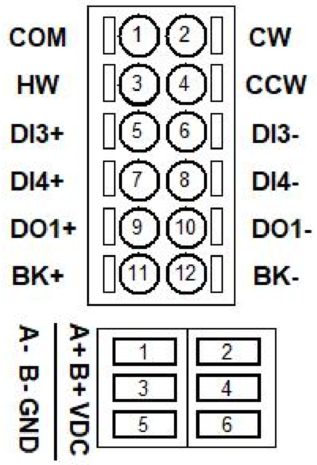


Figure 2 Schematic diagram of JMC 2DM522-EC wiring port

Note: for the communication port, see the "Communication interface and wiring" (CTRL + left mouse button or click text to jump)

3.1 Power signal port

Table 2, 2DM522-EC power signal port

Terminal number	Symbol	name	instruction
1	A-	Motor A-	Motor A phase winding
2	A+	Positive end of motor phase A	
3	B-	Motor B phase negative end	Motor B phase winding
4	B+	Positive end of motor B phase	
5	DC+	Power input positive	DC 24-48VDC is connected between DC + and GND
6	GND	Power input ground	
Note: the phase line color of the motor matched with the JMC driver is generally red (A +, blue (A -), green (B -), black (B -). The user can connect with the port of the JMC driver according to this color. In case of inconsistency between color and phase line, please call JMC technical service personnel			

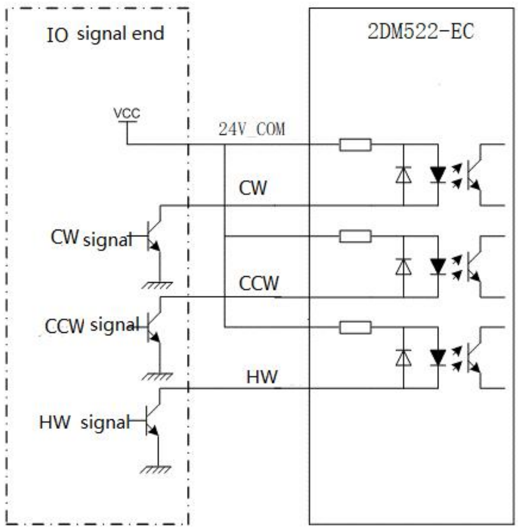
3.2 Control signal port

Table 3 2DM522-EC control signal port

Terminal number	Symbol	Name	Instruction
1	COM	Common end (common Yin / common Yang)	0V or 24VDC
2	CW	Clockwise limit	Input 12 ~ 24VDC (compatible with 5V, but not recommended)
3	HW	Origin limit	
4	CCW	Counter clockwise limit	
5	DI3+	Probe 1 input +	Input 12 ~ 24VDC

6	DI3-	Probe 1 input -	(compatible with 5V, but not recommended)
7	DI4+	Probe 2 input +	Input 12 ~ 24VDC (compatible with 5V, but not recommended)
8	DI4-	Probe 2 input -	
9	DO1+ /ALM+	In place / alarm output+	Bidirectional Optocoupler Compatible 12~24VDC
10	DO1- /ALM-	DO1- /ALM-In place / alarm output-	
11	BRK+	Brake output+	Bidirectional Optocoupler compatible12~24VDC
12	BRK-	Brake output-	

3.3 Wiring diagram of controller



JMC 2DM522-EC control signal co anode connection method

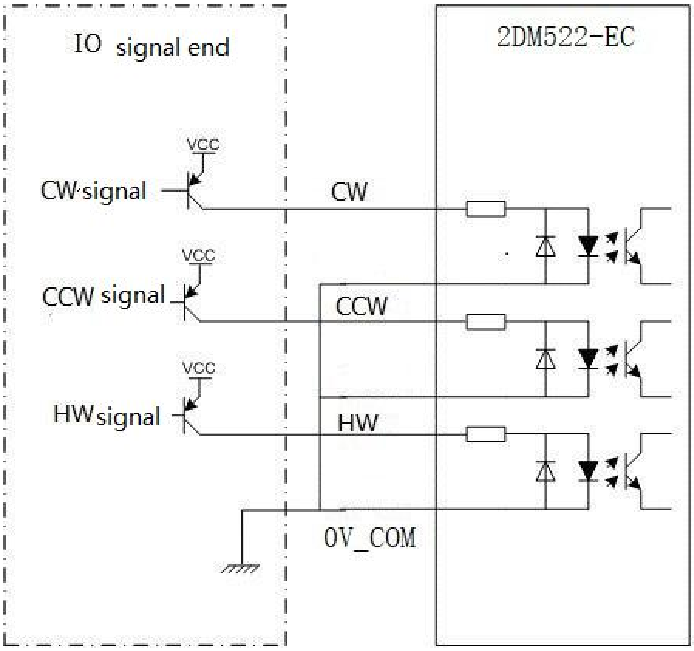


Figure 4 common cathode connection method of JMC 2DM522-EC control signal

Note: the control signal level can be compatible with 0V ground or 24V.

4 Typical application wiring diagram

A typical wiring diagram consisting of 2dm522-ec drives, etc. is shown below. The power supply shall be DC24 ~ 48V according to the voltage level of matching motor.

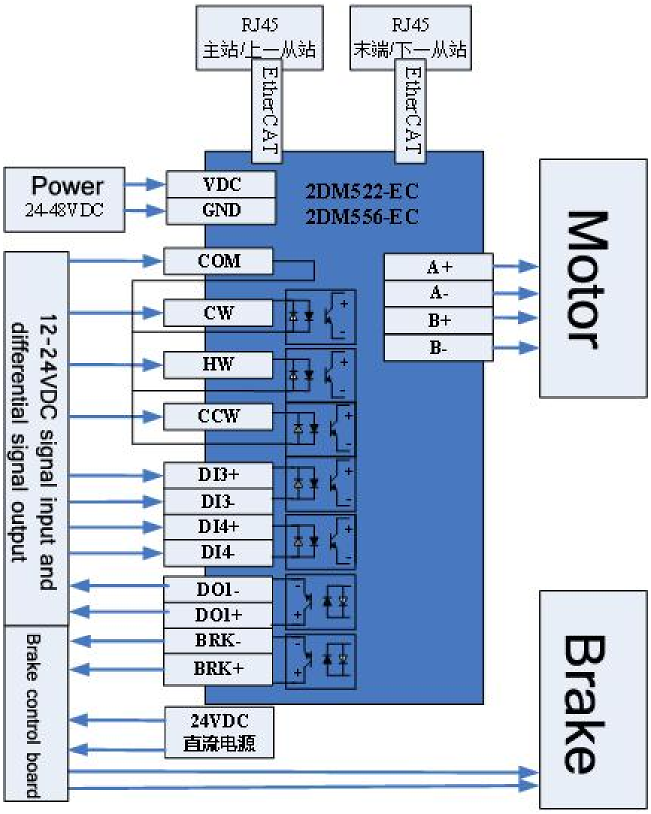


Figure 5 typical application wiring diagram of JMC 2DM522-EC driver

Note

1) BREAK signal needs external relay control for motor brake control, and the maximum passing current is 50mA.

2) RJ45 network interface is connected to other slave stations through 100BASE-TX double foot line, and there is no special difference between the two network ports.

5 Parameter setting of driver

Parameter setting method of 2DM522-EC: users can set parameters through RS232 communication via mini USB through key panel, upper computer software of bus and HISU debugger. There is a set of the best default factory configuration parameters of the corresponding motor in the drive. The user only needs to adjust the internal parameters of the drive according to the specific use conditions. The specific parameters and functions are shown in the table below:

Actual value of parameter = set value × corresponding dimension

Table 4 Just motion control 2DM522-EC Parameter

No.	Name	Range	dimensional	Restart	Default parameter
P1	Current loop proportional gain	0—4000	1	NO	1000
P2	Current loop integral gain	0—1000	1	NO	100
P3	Driver damping coefficient	0—500	1	NO	250
P4	Position loop proportional gain	0—3000	1	NO	2000
P5	Integral gain of position loop	0—1000	1	NO	200
P6	Speed loop proportional gain	0—3000	1	NO	500
P7	Integral gain of velocity loop	0—1000	1	NO	1000
P8	Open loop current of driver	0—60	0.1	NO	40
P9	Factory parameter	Keep	Keep	Keep	Keep
P10	Driver alarm level	0—1	1	NO	0
P11	Driver direction level	0—1	1	NO	1
P12	Factory parameter	Keep	Keep	Keep	Keep
P13	Factory parameter	Keep	Keep	Keep	Keep
P14	Driver in place level	0—1	1	NO	0
P15	Factory parameter	Keep	Keep	Keep	Keep
P16	Factory parameter	Keep	Keep	Keep	Keep

P17	Drive segment selection	0—15	1	Yes	2
P19	Driver instruction smoothing	0—10	0	NO	2
P20	User defined breakdown	4—1000	50	Yes	8
P21	Factory parameter	Keep	Keep	Keep	Keep
P22	Factory parameter	Keep	Keep	Keep	Keep
P23	Factory parameter	Keep	Keep	Keep	Keep
P24	Factory parameter	Keep	Keep	Keep	Keep
P25	Open loop superposition ratio	0—40	1	NO	10
P26	Drive stop damping	0—500	1	NO	200
P27	Drive low speed damping	0—500	1	NO	50
P28	Factory parameter	Keep	Keep	Keep	Keep
P29	Factory parameter	Keep	Keep	Keep	Keep
P30	Driver phase loss detection	0—1	1	是	1
P31	Factory parameter	Keep	Keep	Keep	Keep
P32	Factory parameter	Keep	Keep	Keep	Keep
P33	Factory parameter	Keep	Keep	Keep	Keep
P34	Factory parameter	Keep	Keep	Keep	Keep
P35	Factory parameter	Keep	Keep	Keep	Keep
P36	Half flow time	0—60000	Ms	NO	500
P37	Half current percentage	0—100	1%	NO	50
P38	Driver alarm history 1				
P39	Driver alarm history2				
P40	Drive station number setting	1—65535	1	YES	1

Users can modify the following parameters through the front panel of the drive, or download them to the drive through HISU. The settings of each parameter are described as follows:

- ✧ Parameters P1, P2, P3, P4, P5, P6 and P7 is respectively used for the parameters of setting current ring, system damping, position ring and speed ring.
- ✧ Parameter P8 is used to set the open-loop current.
- ✧ Parameter P10 is used for the selection of alarm output level. Parameter 0 indicates that the output triode of coupler is cut off under normal operation; the output triode of coupler is on under driver alarm. vice versa.
- ✧ Parameter P11 is used for selecting the direction level . Through the setting of this

parameter, the control direction of control terminal level can be changed.

- ✧ Parameter P14, select the output level in place, 0 means the output triode of the optocoupler is cut off when the driver meets the conditions in place; if the conditions in place are not met, the output triode of the optocoupler is on. vice versa
- ✧ Parameter p17, subdivision setting of drive.

Table 5 2DM522-EC Driver parameter P17: subdivision

Parameter	0	1	2	3	4	5	6	7
micro-step	Customize micro-step	800	1600	3200	6400	12800	25600	51200
Parameter	8	9	10	11	12	13	14	15
micro-step No.	1000	2000	4000	5000	8000	10000	20000	40000

- ✧ Tip: in addition, the driver also provides users with any subdivision that can be set freely, and the specific parameters are set through P20 mode.

- ✧ Parameter P18, driver single and double pulse setting, 1 is pulse + direction, 0 is double pulse mode.

- ✧ Parameter P19, instruction smoothing coefficient

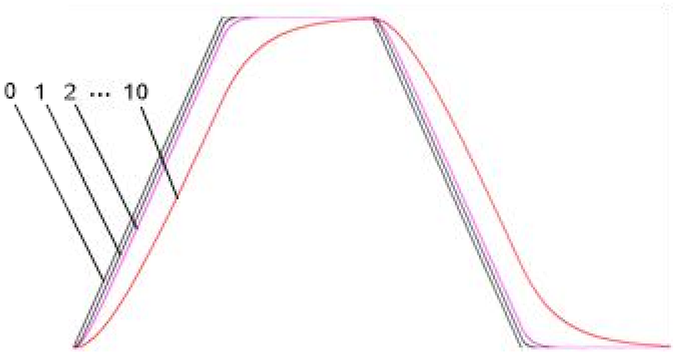


Fig. 6 JMC 2dm522-ec driver parameter P19: Command smoothing coefficient

- ✧ Parameter P20, used for user-defined subdivision.
- ✧ Parameter P30, phase loss detection of driver, 1 means on, 0 means off. Only for manufacturer's maintenance.
- ✧ Parameter p36, half flow time, unit is ms. The default value is 1000, which means after the motor stops for 1000ms,
- ✧ Motor current = set current (P8) × half current percentage (P37).
- ✧ Parameter P37, half flow percentage, unit: 1%. The default is 50.
- ✧ Parameters 38 and 39 are used to view driver alarm records.
- ✧ Parameter P40, slave station number setting, can be set from 1-65535 station numbers. After the station number is set, it needs to be powered on again before the parameter is used.

6 key panel and parameter adjustment method

6.1 Key Panel

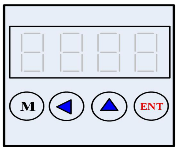


Figure 7 JMC 2DM522-EC key panel

The key panel consists of 4 keys and 4 LED displays. LED indicates power supply and four digit nixie tube display status, and the operation of nixie tube panel is as shown in the figure. Select the display mode by the "M" key, and select the running state of the monitoring motor by the "UP" and "DOWN" keys. The following table represents the meaning of each monitoring code.

2DM522-EC Key panel monitoring code

LED Display	52EC	PA00	EXXX	PSΓP
Meaning	2DM522-EC	Parameter setting	Driver default	Driver recover

1) Shift set key

"◀" : shift function;

"▲" : parameter adjustment, adding function;

2) Function key

"Ent": confirm the save;

"M": undo exit, function switch;

Note: switch to the parameter display function through "M"; "ENT" is for showing the parameter value (power on display is the parameter value you finally view), press "▲" key to switch the function; (the "◀" key is invalid) to exit this function and go to the next function, press "M".

6.2 Operation method of key

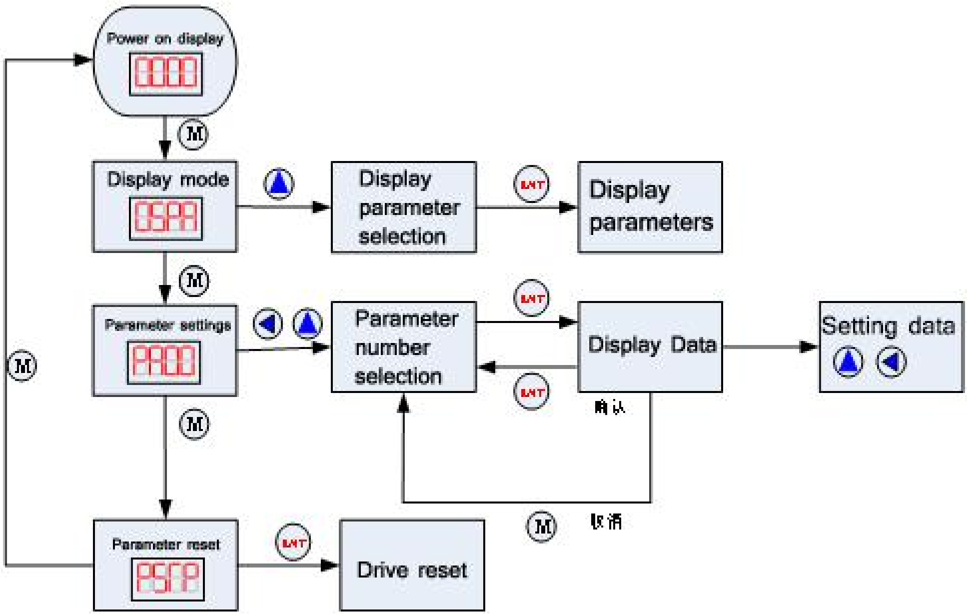


Figure 8 operation flow chart of JMC 2DM522-EC key panel

6.3 operation example

1) Example of mode operation

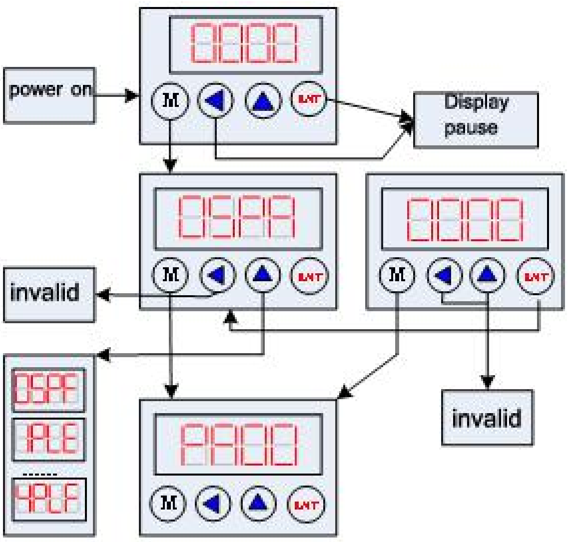


Figure 9 Display mode operation diagram of JMC 2DM522-EC key panel

2) Example of parameter adjustment operation

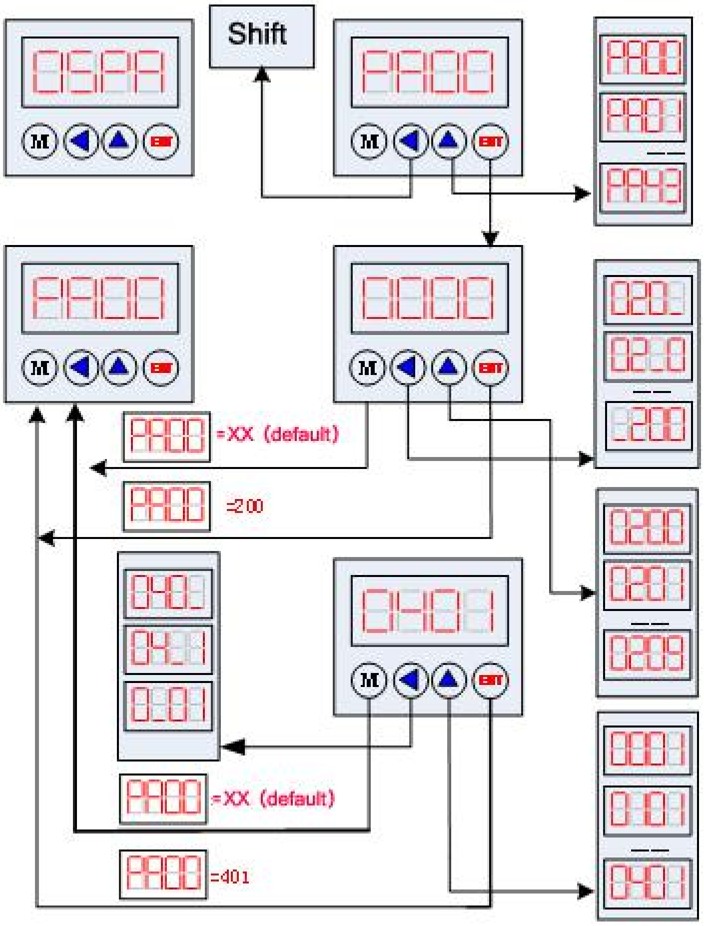


Fig. 10 operation diagram of JMC 2dm522-ec key panel parameter adjustment

Note: the factory default current ring, position ring and speed ring parameters of the driver are the best parameters of the matching motor. Generally, the customer does not need to modify them, but only needs to select the motor micro-step and the percentage of open and closed-loop current according to the needs of the system control.

7 Fault alarm

Table 7 fault alarm of JMC 2DM522-EC key panel

Panel Display	Fault description	Remove or not
E101	Over current fault	Can’t remove
E102	Reference voltage fault	Can’t remove
E103	Parameter read / write failure	Can’t remove
E104	Over voltage fault	Can’t remove
E105	Motor phase failure	Can’t remove
E106	Position out of tolerance fault	Can remove
E107	Motor enable	Can remove

8 Matched motor

Table 8 Matched motor of 2DM522-EC

Motor matched with 2DM522-EC								
Base		Model	Step angle (deg)	Static moment (N·m)	Rated Current (A)	Phase resistance (ohms)	Phase inductance (mH)	Positioning moment(gcm)
2Phase	28	28J1834-408	1.8	0.06	0.8	2.5	4.8	
		28J1845-410	1.8	0.095	1	2.2	14	
		28J1851-407	1.8	0.1	0.7	8.5	7.5	
		28J1851-410	1.8	0.12	1	1.45	1.1	
	35	35J1834-407	1.8	0.11	0.7	2.5	4.8	120
	39	39J1834-403	1.8	0.13	0.3	4	2.5	120
		39J1834-406	1.8	0.22	0.6	1.6	1.2	120
		39J1844-403	1.8	0.29	0.3	4	10	130
	42	42J1825-404	1.8	0.35	0.4	2.1	1.3	150
		42J1834-408	1.8	0.38	0.8	2.1	3.2	160
		42J1840-408	1.8	0.4	0.8	7.5	8.1	220
		42J1848-810	1.8	0.48	1	4.6	4	260
		42J1848-425	1.8	0.48	2.5	1.25	2.5	260
		42J1860-417	1.8	0.7	1.7	3	6.2	360

Table 9 Matched motor of 2DM522-EC (continue)

Motor matched with 2DM522-EC							
Base		Model	rotor inertia(g-cm ^{2})	Insulation class	Number of leads	Weight (kg)	Length (mm)
2phase	28	28J1834-408	8	B	4	0.11	34
		28J1845-410	11	B	4	0.14	45
		28J1851-407	18	B	4	0.18	51
		28J1851-410	13	B	4	0.18	51
	35	35J1834-407	14	B	4	0.18	34
	39	39J1834-403	20	B	4	0.18	34
		39J1834-406	20	B	4	0.18	34
		39J1844-403	40	B	4	0.25	44
	42	42J1825-404	20	B	4	0.15	25
		42J1834-408	54	B	4	0.3	34
		42J1840-408	57	B	4	0.32	40
		42J1848-810	82	B	8	0.35	48
		42J1848-425	82	B	4	0.35	48
		42J1860-417	117	B	4	0.5	60

9 Quick guide

9.1 Hardware wiring

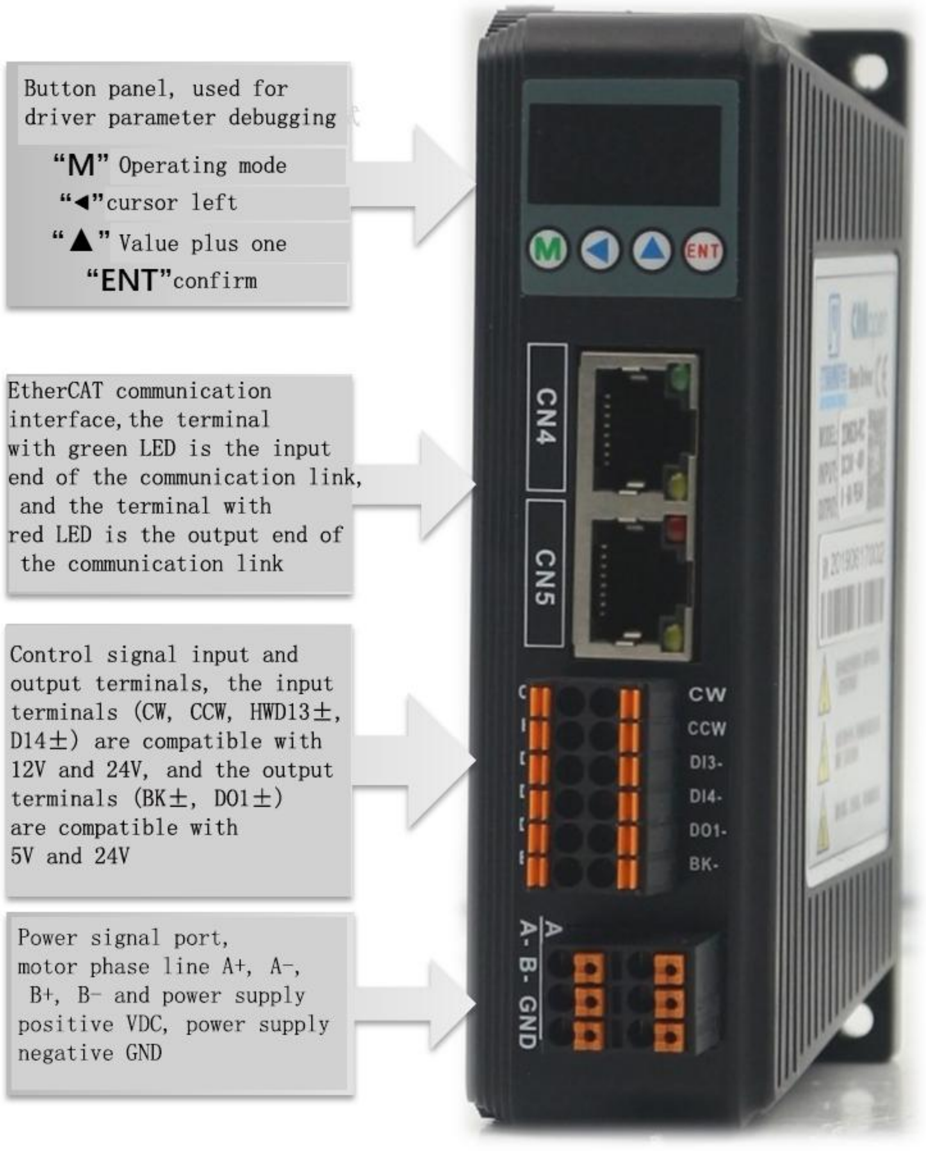


Table 11 Physical drawing of JMC 2DM522-EC

For the specific definition of each port, see "driver interface and wiring" (Ctrl + left mouse button or click the text to jump).

9.2 Parameter Setting

The panel usage of 2DM522-EC is basically the same as "2DM556-EC". You can jump to "2DN556-EC key panel parameter p43 setting flow chart" (Ctrl + left mouse button or click text to jump) to view.

➢ 2DM556-EC

1 Electrical, mechanical and environmental indicators

Table 10 performance parameters of JMC 2DM556-EC driver

Input power voltage		24~48VDC
Continuous current input		6.0A
Communication type		EtherCAT (CoE)
Maximum communication distance		Slave station 100M
Maximum supported slave number		65535
Logic input current		7~20mA (10mATypical value)
Protect		Peak value of overcurrent action value10A±10%
		Overvoltage action value 60VDC
Dimension (mm)		118×75.5×34
Weight		About 260g
Environment	occasion	Try to avoid dust, oil mist and corrosive gas
	Working Temp	0~40℃
	Storage temperature	-20℃~+40℃
	Humidity	40~90%RH
	Cooling mode	Natural cooling or forced cooling

2 Mechanical installation dimension drawing

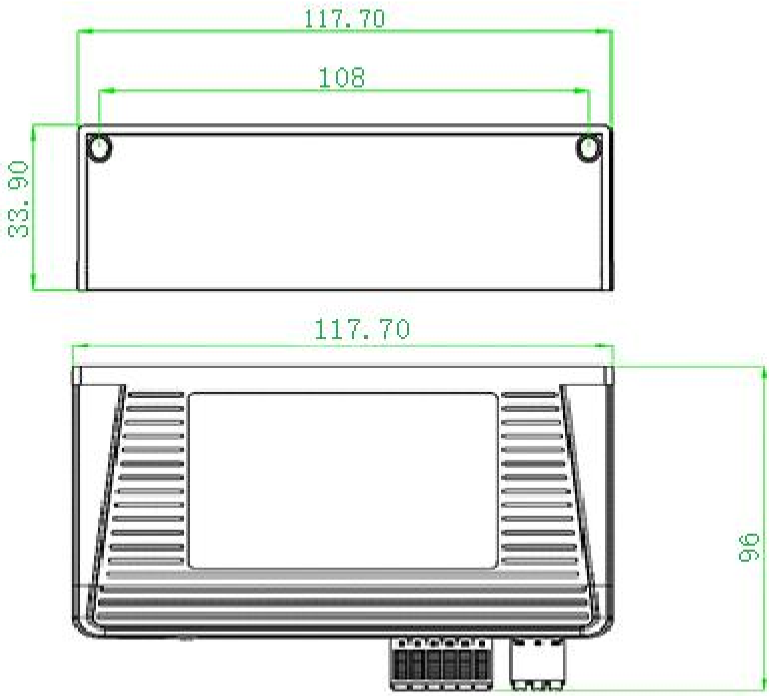


Figure 12 Mechanical installation dimension drawing of JMC 2DM556-EC (unit: mm)

When designing the installation size, it is necessary to consider the size of the terminal and the ventilation and heat dissipation.

1) The reliable working temperature of the driver is usually within 60 ℃, and that of the motor is within 90 ℃;

2) When installing the driver, please use the vertical side installation to form strong air convection on the radiator surface; if necessary, install a fan near the driver to force heat dissipation to ensure that the driver works within the reliable working temperature range.

3 Driver interface and wiring

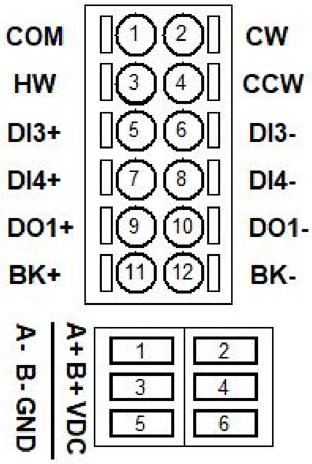


Figure 13 schematic diagram of JMC 2DM556-EC wiring port

Note: for the communication port, see "communication interface and wiring" (Ctrl + left mouse button or click the text to jump).

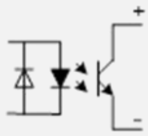
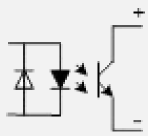
3.1 Power signal port

Table 11 JMC 2DM556-EC motor signal port

Terminal No.	Symbol	Name	Instruction
1	A−	Negative end of phase a of motor	Motor phase a winding
2	A+	Positive end of motor phase a	
3	B−	phase negative end	Motor phase B winding
4	B+	Positive end of motor B phase	
5	DC+	Power input positive	Connect DC 24−48vdc between DC + and GND
6	GND	Power input ground	
Note: the phase line color of the motor matched with the JMC driver is generally red (a +, blue (a −), green (B −), black (B −). The user can connect with the port of the JMC driver according to this color. In case of inconsistency between color and phase line, please call JMC technical service personnel.			

3.2 Control signal port

2DM556-EC Control Signal Port

Pin	Symbol	Name	Instruction
1	COM	Common end (common Yin / common Yang)	0V or 24VDC
2	CW	Clockwise limit	Input 12 ~ 24VDC (compatible with 5V, but not recommended)
3	HW	Origin limit	
4	CCW	Counter clockwise limit	
5	DI3+	Probe 1 input +	Input 12 ~ 24VDC (compatible with 5V, but not recommended
6	DI3-	Probe 1 input -	
7	DI4+	Probe 2 input +	Input 12 ~ 24VDC (compatible with 5V, but not recommended)
8	DI4-	Probe 2 input -	
9	DO1+ /ALM+	In place / alarm output +	 12~24VDCBidirectional Optocoupler compatible
10	DO1- /ALM-	In place / alarm output -	
11	BRK+	Brake output +	 12~24VDC Bidirectional Optocoupler compatible
12	BRK-	Brake output -	

3.3 Wiring diagram of controller

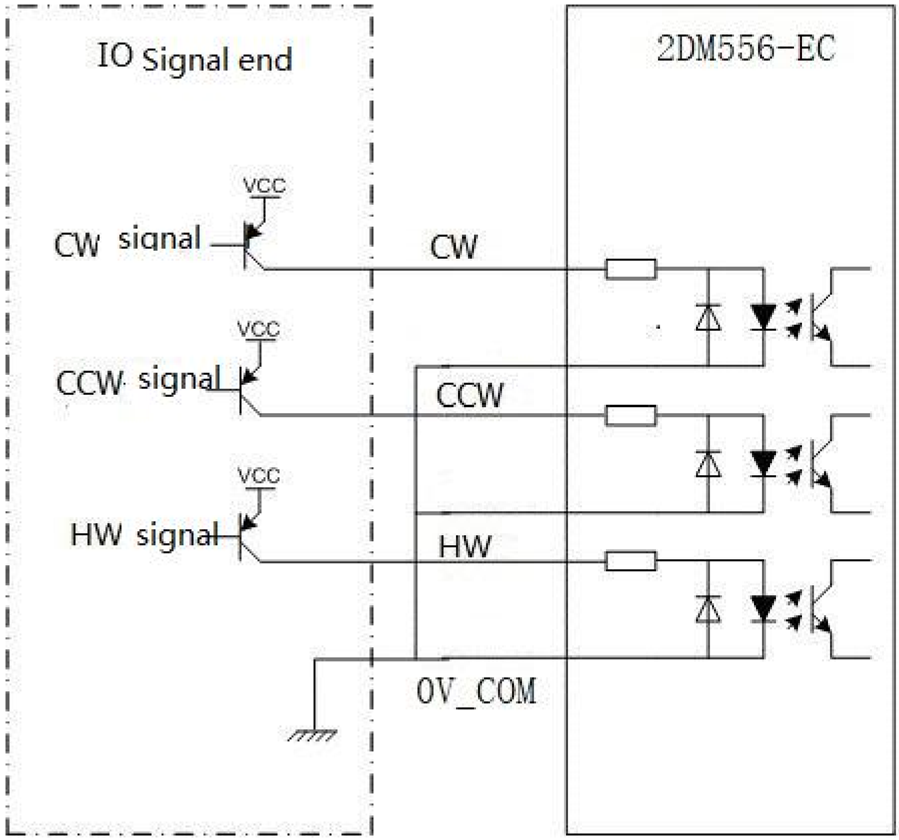


Figure 14 common anode connection of JMC 2DM556-EC control signal

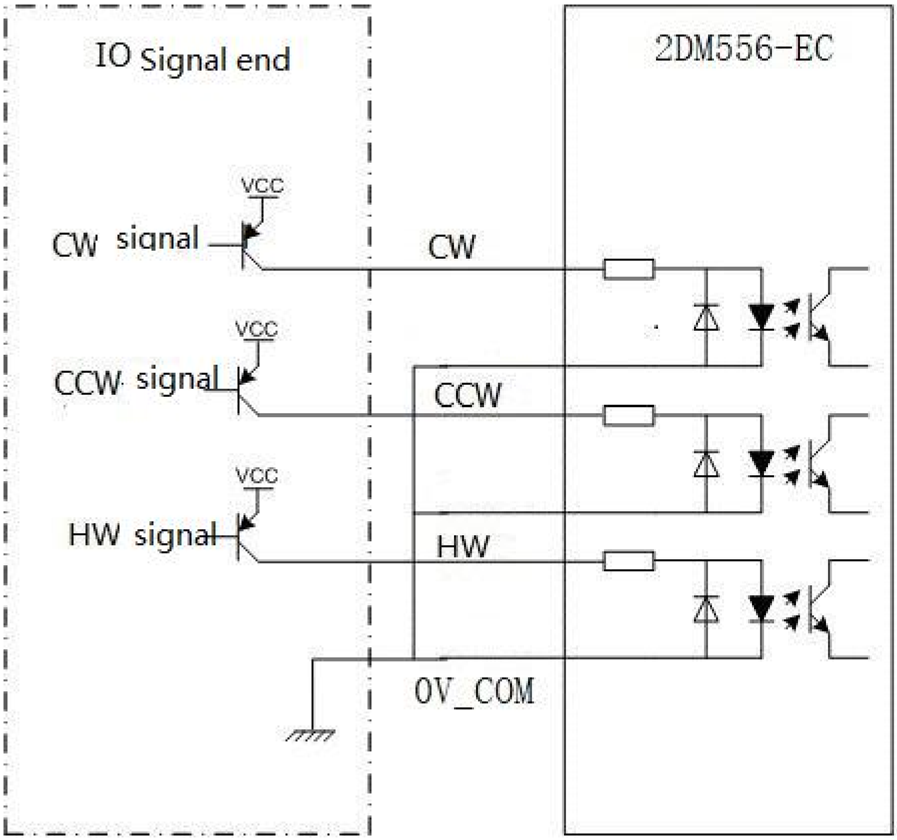


Figure 15 common cathode connection of JMC 2DM556-EC control signal

Note: the control signal level can be compatible with 0V ground or 24V.

4 Typical application wiring diagram

A typical wiring diagram consisting of 2DM556-EC drives, etc. is shown below. The power supply shall be DC24 ~ 48V according to the voltage level of matching motor.

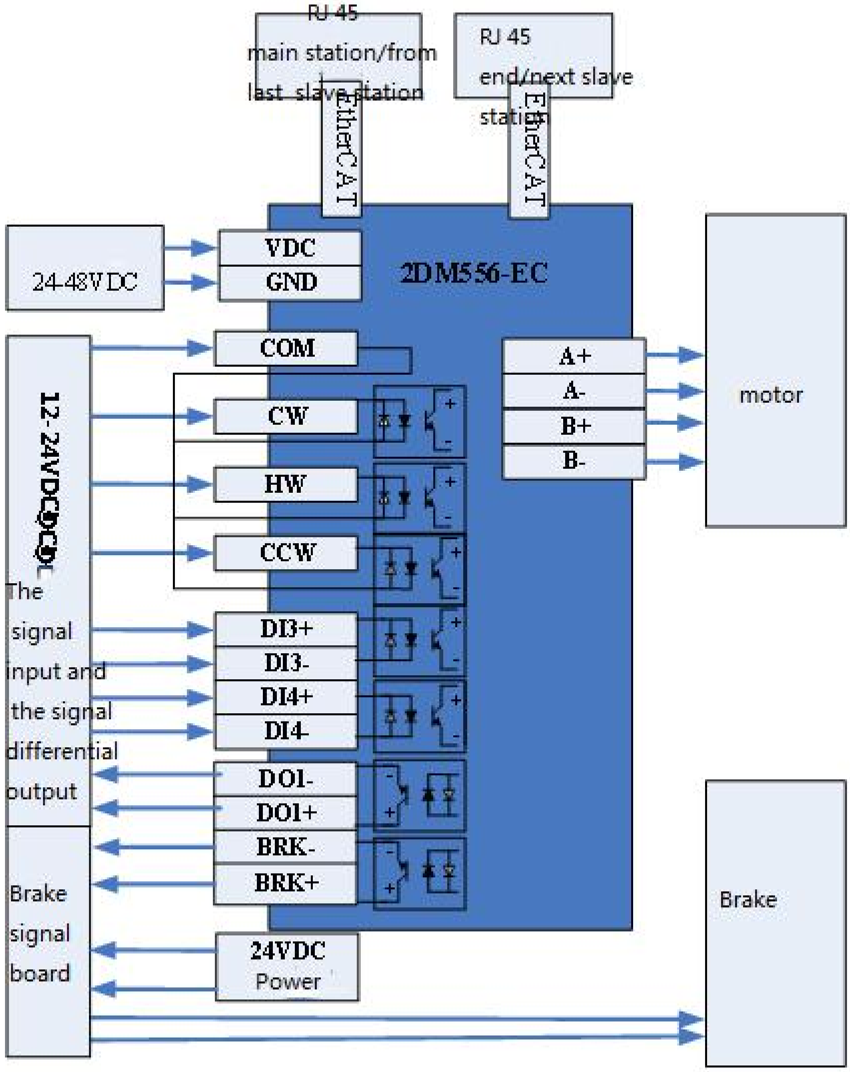


Figure 16 typical application wiring diagram of JMC 2dm556-ec driver

Note:

1) Break signal needs external relay control for motor brake control, and the maximum passing current is 50mA.

2) RJ45 network interface is connected to other slave stations through 100BASE-TX double foot line, and there is no special difference between the two network ports.

5 Drive parameter settings

Parameter setting method of 2DM556-EC driver: users can set parameters through key panel, upper computer software and HISU RS232 communication via mini USB through key panel, of bus and HISU debugger. There is a set of the best default factory configuration parameters of the corresponding motor in the drive. The user only needs to adjust the internal parameters of the drive according to the specific use conditions. The specific parameters and functions are shown in the table below:

Actual value of parameter = set value × corresponding dimension

Table 13 internal parameters of JMC 2DM556-EC

NO.	Name	Range	Dimension	Restart	Default parameter
P1	Current loop proportional gain	0—4000	1	NO	1000
P2	Current loop integral gain	0—1000	1	NO	100
P3	Driver damping coefficient	0—500	1	NO	250
P4	Position loop proportional gain	0—3000	1	NO	2000
P5	Integral gain of position loop	0—1000	1	NO	200
P6	Speed loop proportional gain	0—3000	1	NO	500
P7	Integral gain of velocity loop	0—1000	1	NO	1000
P8	Open loop current of driver	0—60	0.1	NO	40
P9	Factory parameter	keep	keep	keep	keep
P10	Driver alarm level	0—1	1	NO	0
P11	Driver direction level	0—1	1	NO	1
P12	Factory parameter	keep	keep	keep	keep
P13	Factory parameter	keep	keep	keep	keep
P14	Driver in place level	0—1	1	NO	0
P15	Factory parameter	keep	keep	keep	keep
P16	Factory parameter	keep	keep	keep	keep
P17	Drive segment selection	0—15	1	Yes	2
P19	Driver instruction smoothing	0—10	0	NO	2
P20	User defined breakdown	4—1000	50	Yes	8
P21	Factory parameter	keep	keep	keep	keep
P22	Factory parameter	keep	keep	keep	keep
P23	Factory parameter	keep	keep	keep	keep
P24	Factory parameter	keep	keep	keep	keep
P25	Open loop superposition ratio	0—40	1	NO	10
P26	Drive stop damping	0—500	1	NO	200

P27	Drive low speed damping	0—500	1	NO	50
P28	Factory parameter	keep	keep	keep	keep
P29	Factory parameter	keep	keep	keep	keep
P30	Driver phase loss detection	0—1	1	Yes	1
P31	Factory parameter	keep	keep	keep	keep
P32	Factory parameter	keep	keep	keep	keep
P33	Factory parameter	keep	keep	keep	keep
P34	Factory parameter	keep	keep	keep	keep
P35	Factory parameter	keep	keep	keep	keep
P36	Half flow time	0—60000	Ms	NO	500
P37	Half current percentage	0—100	1%	NO	50
P38	Drive alarm history 1				
P39	Drive alarm history 2				
P40	Drive station number setting	1—65535	1	Yes	1

Users can modify the following parameters through the front panel of the drive, or download them to the drive through HISU. The settings of each parameter are described as follows:
Parameters P1, P2, P3, P4, P5, P6 and P7 respectively are used for setting current ring, system damping, position ring and speed ring.
Parameter P8 is used to set the open-loop current.
Parameter P10 is used for the selection of alarm output level. Parameter 0 indicates that the output triode of coupler is cut off under normal operation; the output triode of coupler is on under driver alarm. vice versa.
Parameter P11 is used for direction level selection. Through the setting of this parameter, the control direction of control terminal level can be changed.
Parameter P14, select the output level in place, 0 means the output triode of the optocoupler is cut off when the driver meets the conditions in place; if the conditions in place are not met, the output triode of the optocoupler is on. vice versa.
Parameter p17, micro-step setting of drive.
✧

Table 14 JMC 2DM556-EC parameters p17: micro-step of driver

Parameter	0	1	2	3	4	5	6	7
Micro-step	Customize micro-step	800	1600	3200	6400	12800	25600	51200
Parameter	8	9	10	11	12	13	14	15
Micro-step	1000	2000	4000	5000	8000	10000	20000	40000

✧ Tip: in addition, the driver also provides users with any microstep that can be set freely, and the specific parameters are set through mode P20.

✧ Parameter P19, instruction smoothing coefficient

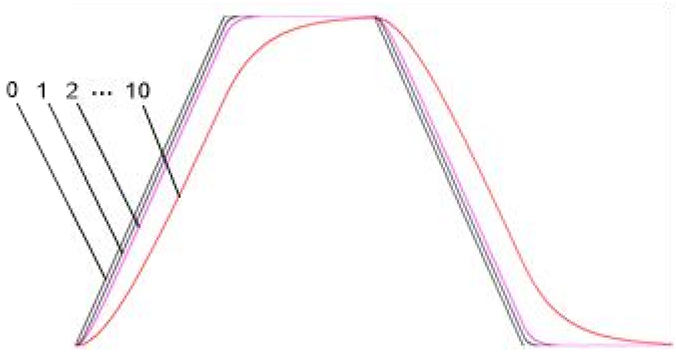


Figure 17 JMC parameter P19 of 2DM556-EC: Command smoothing coefficient

✧ Parameter P20, used for setting micro-step by user

✧ Parameter P30, drive phase loss detection, 1 means on, 0 means off. Only for manufacturer's maintenance.

✧ Parameter p36, half flow time, unit is ms. The default value is 1000, which means after the motor stops for 1000ms,

Motor current = set current (P8) × half current percentage (P37).

✧

✧ Parameter P37, half flow percentage, unit: 1%. The default is 50.

✧

✧ Parameters p38 and P39 are used to view alarm records.

✧

✧ Parameter P40, slave station number setting, can be set from 1-65535 station numbers. After the station number is set, it needs to be powered on again before the parameter is used.

6 Key panel and parameter adjustment method

6.1 Key panel

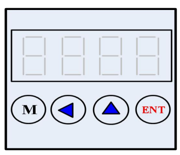


Figure 18 JMC 2DM556-EC key panel

The key panel consists of 4 keys and 4 LED displays. LED indicates power supply and four digit nixie tube display status, and the operation of nixie tube panel is as shown in the figure. Select the display mode by the "M" key, and select the running state of the monitoring motor by the “UP” and “DOWN” keys. The following table represents the meaning of each monitoring code.

Table 15 monitoring code of 2DM556-EC key panel

LED Display	55EC	PA00	EXXX	PSΓP
Meaning	2DM556-EC	Parameter setting	Driver default	Driver recover

1) Shift set key

"◀" : shift function;

"▲" : parameter adjustment, adding function;

2) Function key

"ENT": confirm the save;

"M": undo exit, function switch key;

Note: switch to the parameter display function through "M"; use "ENT" key to view the parameter value (power on display is the parameter value you finally view), press "▲" key to switch the function; (the "◀" key is invalid) to exit this function and go to the next function, press "M".

6.2 Key operation method

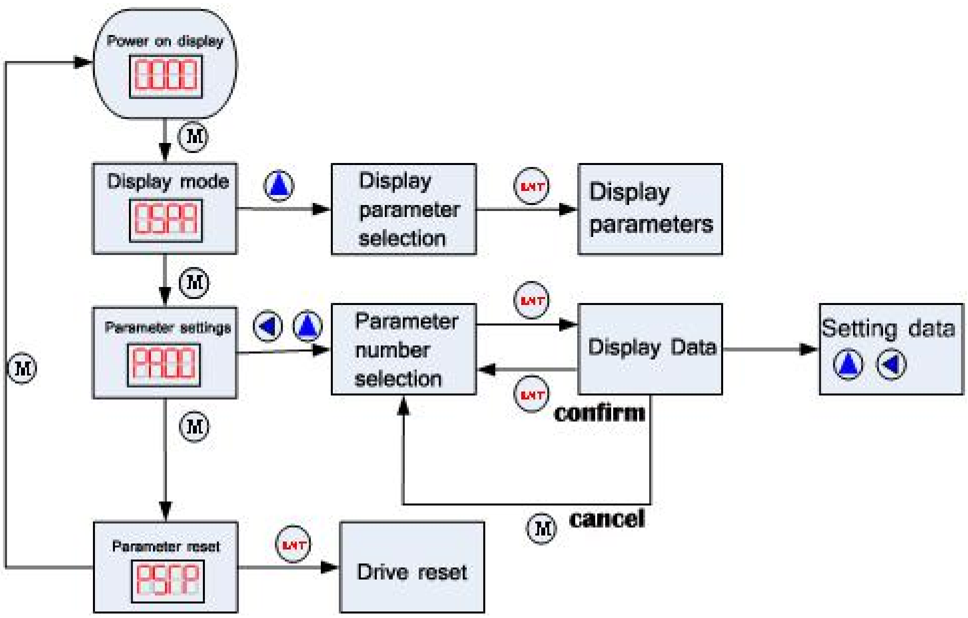


Figure 19 operation flow chart of JMC 2DM556-EC key panel

6.3 Example of operation

1) Example of mode operation

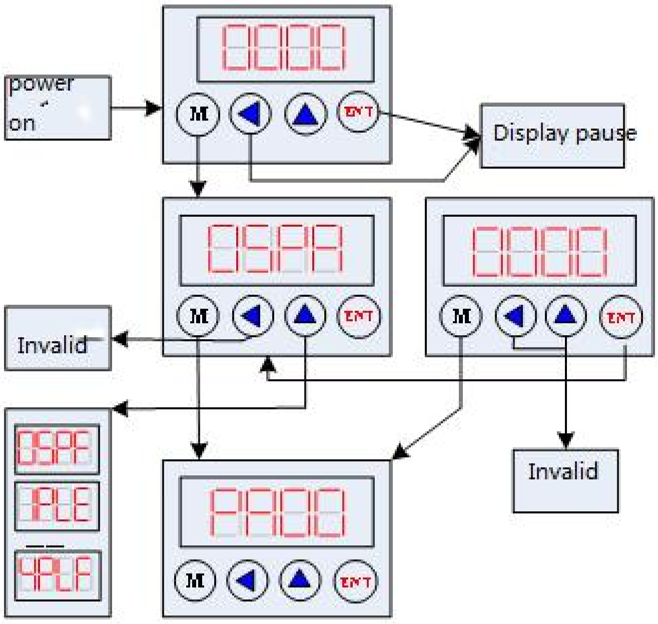


Figure 20 Display mode operation diagram of JMC 2DM556-EC key panel

2） Example of parameter adjustment operation

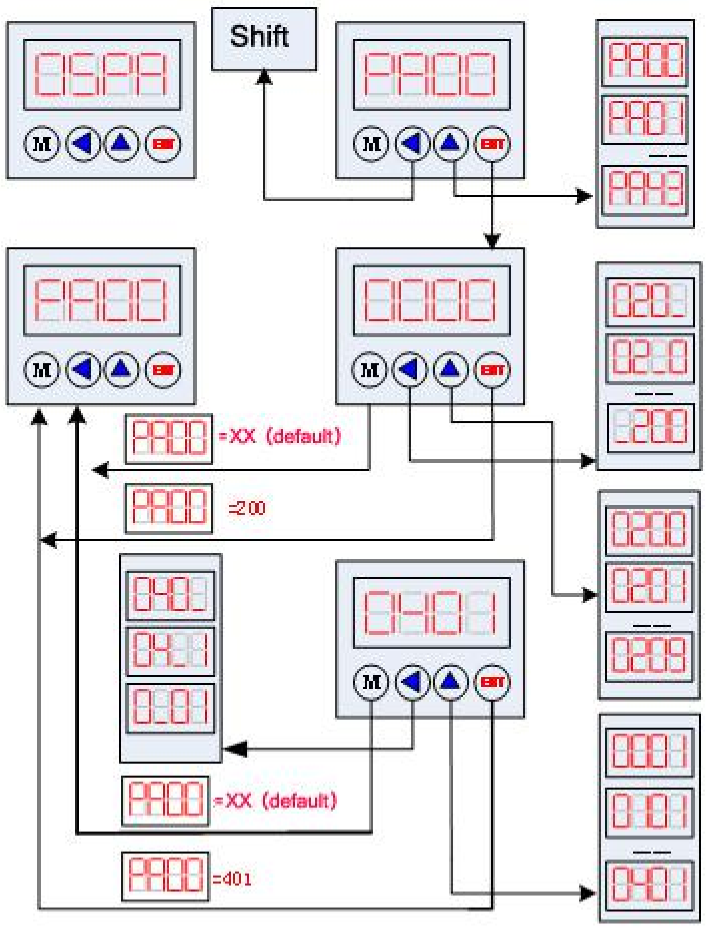


Figure 21 Parameter adjustment operation diagram of JMC 2DM556-EC key panel

Note: the factory default current ring, position ring and speed ring parameters of the driver are the best parameters of the matching motor. Generally, the customer does not need to modify them, but only needs to select the motor fraction and the percentage of open and closed-loop current according to the needs of the system control.

7 Fault alarm

Table 16 fault alarm of JMC 2DM556-EC key panel

Panel Display	Fault description	Remove or not
E101	Over current fault	Can’t remove
E102	Reference voltage fault	Can’t remove
E103	Parameter read / write failure	Can’t remove
E104	Overvoltage fault	Can’t remove
E105	Motor phase failure	Can’t remove
E106	Position out of tolerance fault	Can remove
E107	Motor enable	Can remove

8 Matched motor

Table 17 Matched motor for 2DM556-EC

Matched motor for 2DM556-EC								
Base		Model	Step angel (deg)	Static moment (N•m)	Rate current (A)	Phase resistance (ohms)	Phase inductance (mH)	Positioning moment(gcm)
2-phase	57	57J1841-420	1.8	0.75	2	1.3	3.2	250
		57J1854-828	1.8	0.85	2.8	0.95	1.2	350
		57J1856-440	1.8	1.2	4	0.43	1.35	350
		57J1876-828	1.8	1.6	2.8	0.95	1.85	700
		57J1876-447	1.8	2	4.7	0.37	1.75	700
		57J1880-450	1.8	2.2	5	0.4	1.8	700
		57J1880-830	1.8	2	3	0.95	1.8	700
		57J18100-840	1.8	2.8	4	0.95	3.4	1000
		57J18112-435	1.8	3	3.5	0.65	2	1200
	60	60J1887-440	1.8	3.3	4	0.7	2.5	1200
		60J18100-440	1.8	3.3	4	0.8	3	1500

Table 18 Matched motor for 2DM556-EC (continue)

JMC 2dm556-ec driver matched motor							
Base		Model	rotor inertia (g-cm²)	Insulation class	Number of leads	Weight (kg)	Length (mm)
2-phase	57	57J1841-420	157	B	4	0.4	41
		57J1854-828	280	B	8	0.6	54
		57J1856-440	280	B	4	0.6	56
		57J1876-828	460	B	8	1	76
		57J1876-447	480	B	4	1.05	76
		57J1880-450	520	B	4	1.15	80
		57J1880-830	480	B	8	1.1	80
		57J18100-840	700	B	8	1.45	100
		57J18112-435	780	B	4	1.7	112
	60	60J1887-440	900	B	4	1.4	87
		60J18100-440	950	B	4	1.7	100

9 Quick Guide

The following is an introduction of how to use the hardware for help users quickly build the platform, mainly including the wiring between the motor and the driver and the parameter setting operation of the driver.

This chapter does not include the introduction of bus communication protocol (refer to "Communication Chapter" for this part) and the program routine of controller (refer to "routine chapter" and "appendix" for this part).

9.1 Hardware wiring

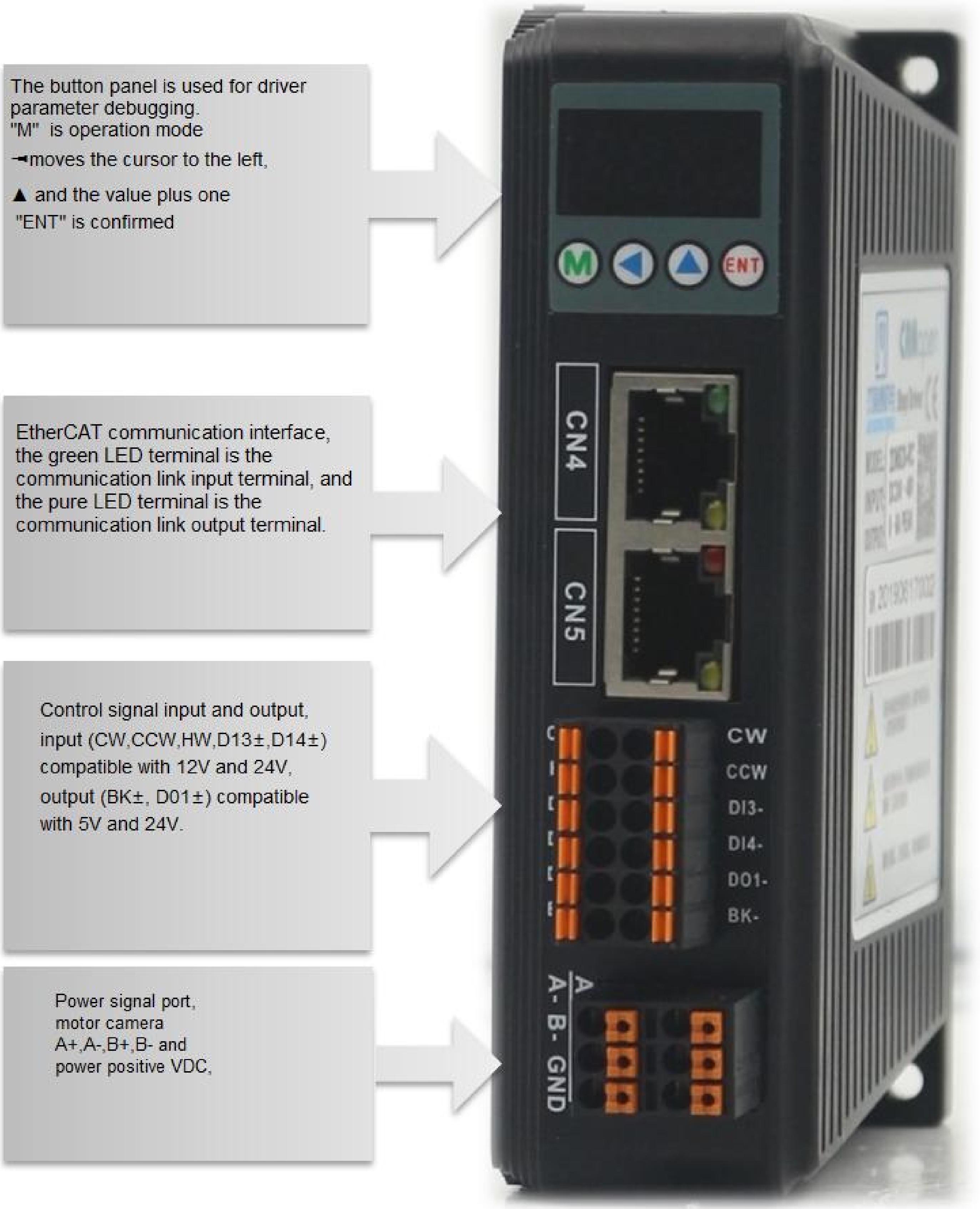


Figure 22 physical drawing of JMC 2DM556-EC

For the specific definition of each port, see "driver interface and wiring" (Ctrl + left mouse button or click the text to jump).

9.2 Parameter setting

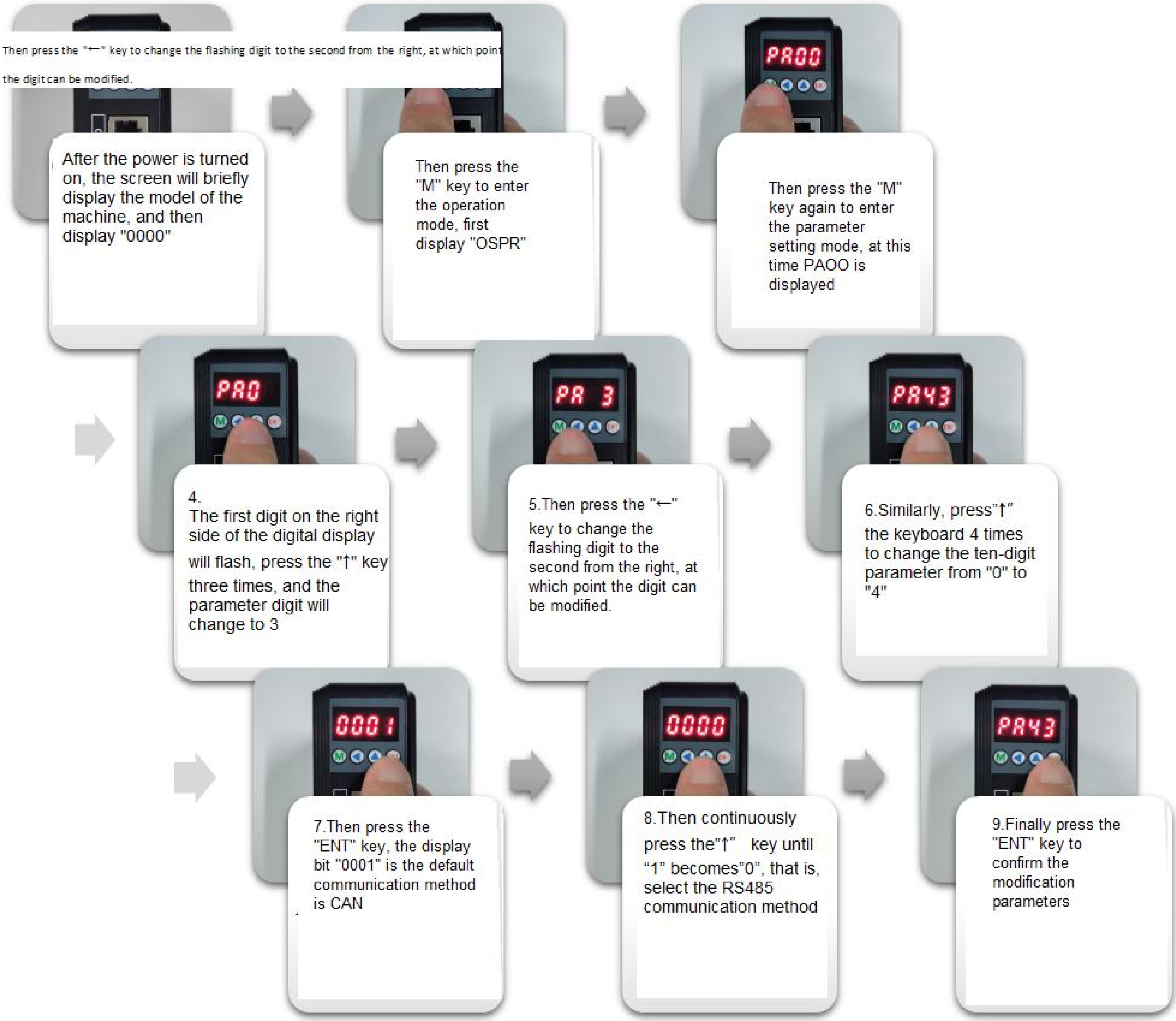


Figure 23 2DM556-EC key panel parameter p43 setting flow chart

The above is an example of the operation mode of RC series drivers (the communication mode of EC series cannot be changed to 485 or CAN), which is the same as that of EC series but has different functions. Other operations are similar. According to the above flow chart, you can master the operation mode of key panel.

➢ 2DM880-EC

1 Electrical, mechanical and environmental indicators

Table 19 performance parameters of JMC 2DM880-EC

Input voltage		24~110VDC, 24~70VAC
Continuous current input		0~8.0A
Communication type		EtherCAT communication protocol (CoE)
Maximum communication distance		100M
Maximum supported slave number		65535
Logic input current		6~16mA (10mA Typical value)
Protect		Over-current action value Peak value 10A±10%
		Over-voltage action value 60VDC
Dimension (mm)		150.4×115.86×36.90
Weight		About 260g
Environment	occasion	Try to avoid dust, oil mist and corrosive gas
	Working Temp	0~40℃
	Storage Temp	-20℃~+40℃
	humidity	40~90%RH
	Cooling mode	Natural cooling or forced cooling

2 Mechanical installation dimension

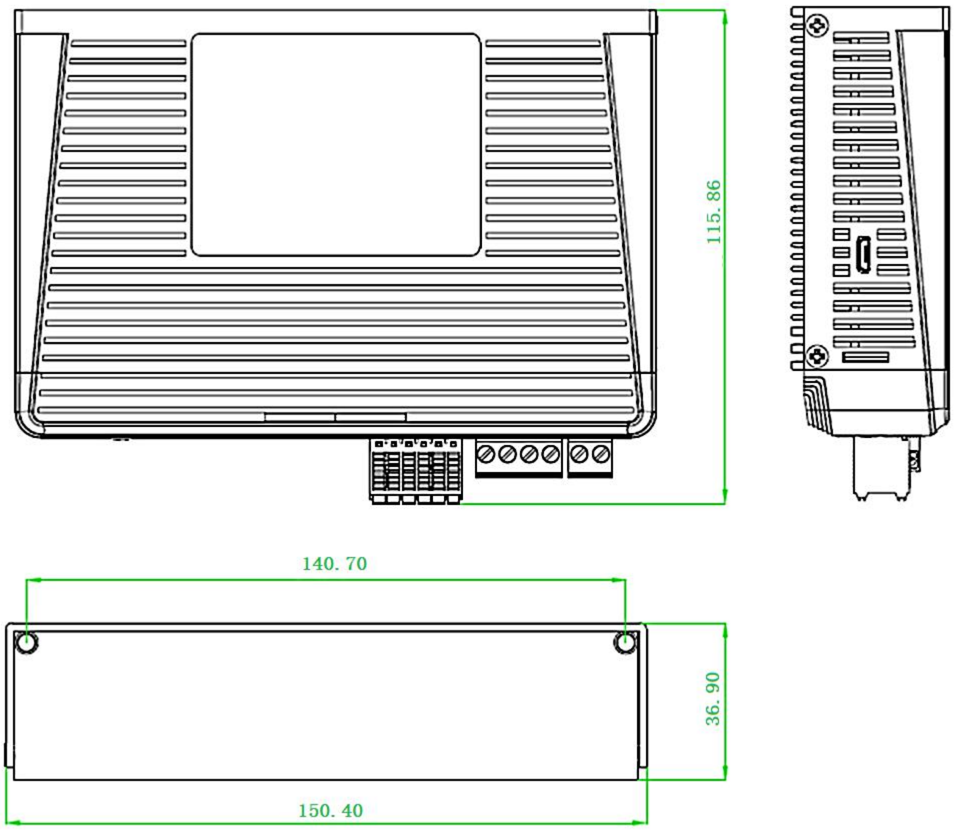


Figure 24 mechanical installation dimension drawing of JMC 2DM880-EC (unit: mm)

3 Driver interface and wiring

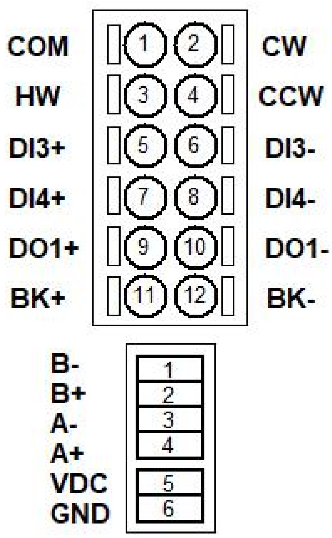


Figure 25 Schematic diagram of JMC 2DM880-EC wiring port

Note: for the communication port, see "communication interface and wiring" (Ctrl + left mouse button or click the text to jump).

3.1 Power signal port

Table 20 2DM880-EC motor signal port

Pin	Symbol	Name	Instruction
1	B-	Motor B phase -	Motor phase B winding
2	B+	Motor B phase +	
3	A-	Motor A phase -	Motor phase a winding
4	A+	Motor A phase +	
5	DC+	Power input positive	DC 24 ~ 48VDC is connected between DC + and GND
6	GND	The power input terminal is grounded	
Note: the phase line color of the motor matched with the JMC driver is generally red (a +, blue (a -), green (B -), black (B -). The user can connect with the port of the JMC driver according to this color. In case of inconsistency between color and phase line, please call JMC technical service personnel.			

3.2 Control signal interface

Table 21 control signal interface

Terminal number	Symbol	Name	Instruction
1	COM	Commend end (common Yin/Common yang)	0V or 24VDC
2	CW	Clockwise limit	Input 12~24VDC (compatible with 5V, But not recommended)
3	HW	Origin limit	
4	CCW	Counter clockwise limit	
5	DI3+	Probe 1 input +	Input 12~24VDC (compatible with 5V, But not recommended)
6	DI3-	Probe 1 input negative-	
7	DI4+	Probe 2 input+	Input 12~24VDC (compatible with 5V, But not recommended)
8	DI4-	Probe 2 input -	
9	DO1+ /ALM+	In place / alarm output +	Bidirectional Optocoupler Compatible 12~24VDC
10	DO1- /ALM-	In place / alarm output -	
11	BRK+	Brake output +	Bidirectional

12	BRK-	Brake output -	Optocoupler compatible12~24VDC

3.3 Wiring diagram of controller

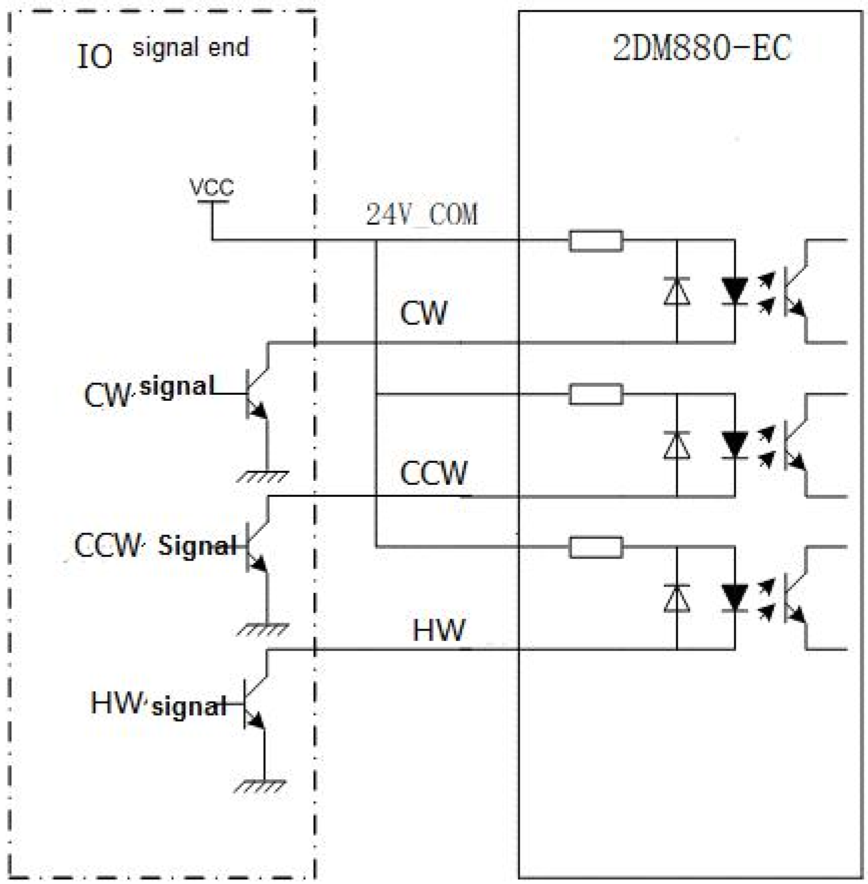


Figure 26 2DM880-ec control signal co anode connection method

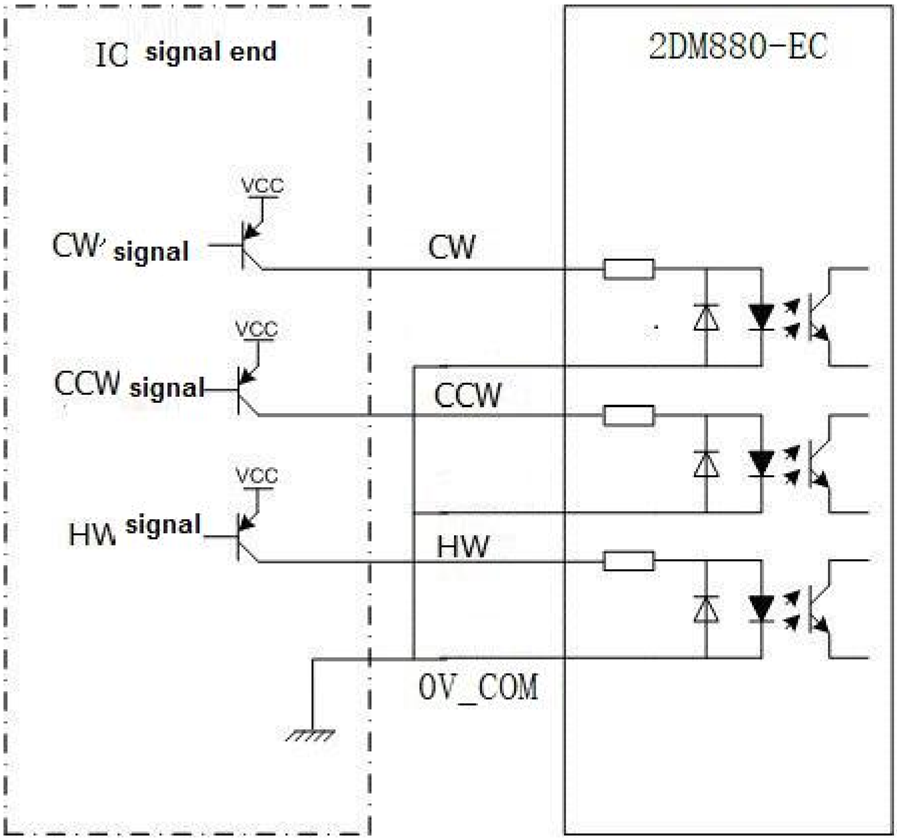
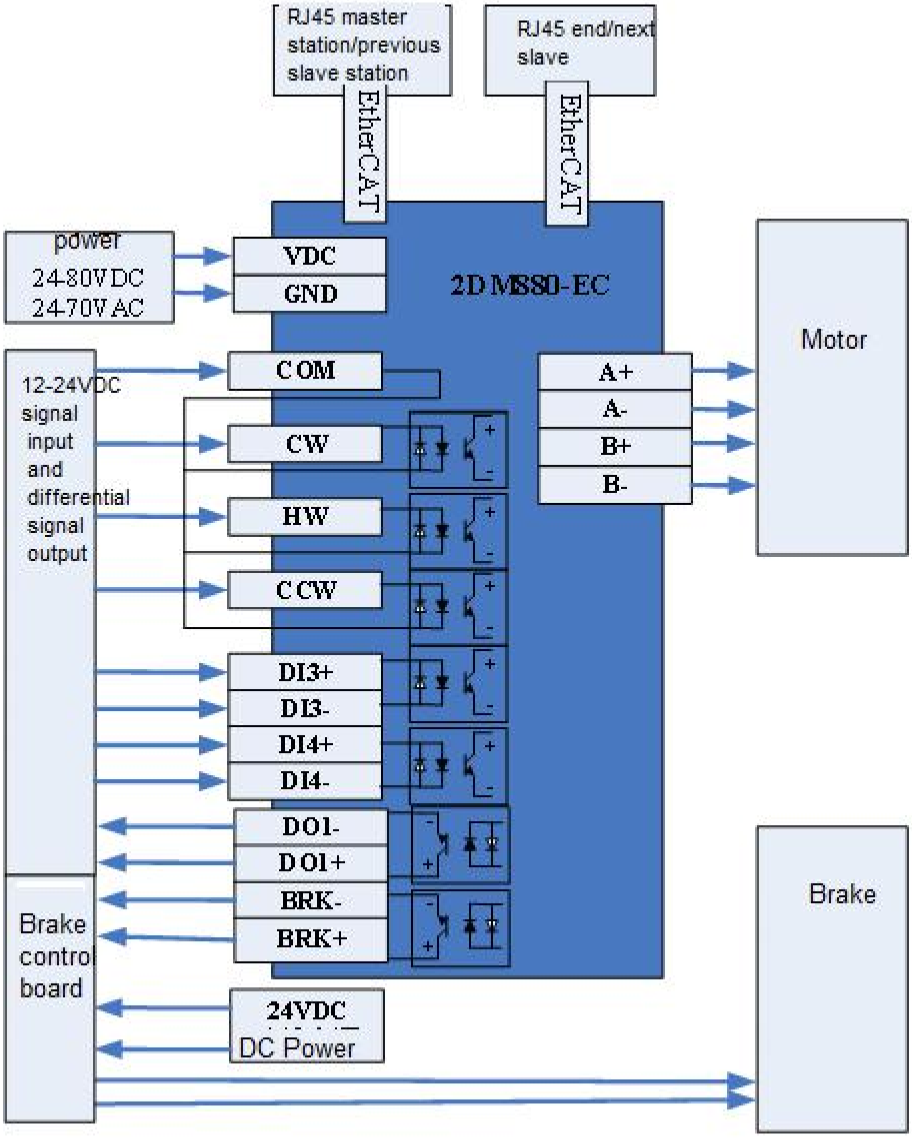


Figure 27 common cathode connection of JMC 2DM880-EC control signal

Note: the control signal level can be compatible with 0V GND or 24V.

4 Diagram of typical application wiring

A typical wiring diagram consisting of 2dm880-ec drives, etc. is shown below. The power supply shall be 24-80vdc or 24-70vac according to the voltage level of matching motor.



28 Typical application wiring diagram of 2DM880-EC

Note:

1) BREAK signal needs external relay control for motor brake control, and the maximum passing current is 50mA.

2) RJ45 network interface is connected to other slave stations through 100BASE-TX double foot line, and there is no special difference between the two network ports.

5 Driver parameter setting

Parameter setting method of 2DM880-EC driver: users can communicate RS232 via mini USB via the key panel, the bus host computer software and HISU debugger to complete parameter setting. There is a set of optimal default factory configuration parameters of the corresponding motor stored in the driver. Users only need to adjust the internal parameters of the driver according to the specific use situation. See the following table for the specific parameters and functions:

The actual value of the parameter = the set value × the corresponding dimension

Table 222DM880-EC Internal drive parameters

No.	Name	Range	Dimension	Restart	Default parameter
P1	Current loop proportional gain	0—4000	1	NO	1000
P2	Current loop integral gain	0—1000	1	NO	100
P3	Driver damping coefficient	0—500	1	NO	250
P4	Position loop proportional gain	0—3000	1	NO	2000
P5	Position loop integral gain	0—1000	1	NO	200
P6	Velocity loop proportional gain	0—3000	1	NO	500
P7	Velocity loop integral gain	0—1000	1	NO	1000
P8	Drive open loop current	0—60	0.1	NO	40
P9	Factory parameter	keep	keep	keep	keep
P10	Driver alarm level	0—1	1	NO	0
P11	Driver direction level	0—1	1	NO	1
P12	Factory parameter	keep	keep	keep	keep
P13	Factory parameter	keep	keep	keep	keep
P14	Driver in place level	0—1	1	NO	0
P15	Factory parameter	keep	keep	keep	keep
P16	Factory parameter	keep	keep	keep	keep
P17	Drive segment selection	0—15	1	Yes	2
P19	Driver instruction smoothing	0—10	0	NO	2
P20	User defined breakdown	4—1000	50	Yes	8
P21	Factory parameter	keep	keep	keep	keep
P22	Factory parameter	keep	keep	keep	keep
P23	Factory parameter	keep	keep	keep	keep
P24	Factory parameter	keep	keep	keep	keep
P25	Open closed loop superposition ratio	0—40	1	NO	10
P26	Drive stop damping	0—500	1	NO	200
P27	Drive low speed damping	0—500	1	NO	50

P28	Factory parameter	keep	keep	keep	keep
P29	Factory parameter	keep	keep	keep	keep
P30	Driver phase failure detection	0—1	1	Yes	1
P31	Factory parameter	keep	keep	keep	keep
P32	Factory parameter	keep	keep	keep	keep
P33	Factory parameter	keep	keep	keep	keep
P34	Factory parameter	keep	keep	keep	keep
P35	Factory parameter	keep	keep	keep	keep
P36	Half flow time	0—60000	Ms	NO	500
P37	Half current percentage	0—100	1%	NO	50
P38	Drive alarm history 1				
P39	Drive alarm history 2				
P40	Drive station number setting	1—65535	1	Yes	1

✧ Users can modify the following parameters through the front panel of the drive, or download them to the drive through HISU. The settings of each parameter are described as follows:

Parameters P1, P2, P3, P4, P5, P6 and P7 respectively are used for setting current ring, system damping, position ring and speed ring.

✧ Parameter P8 is used to set the open-loop current.

✧ Parameter P10 is used for the selection of alarm output level. Parameter 0 indicates that the output triode of coupler is cut off under normal operation; the output triode of coupler is on under driver alarm. vice versa.

✧ Parameter P11 is used for direction level selection. Through the setting of this parameter, the control direction of control terminal level can be changed.

✧ Parameter P14, select the output level in place, 0 means the output triode of the optocoupler is cut off when the driver meets the conditions in place; if the conditions in place are not met, the output triode of the optocoupler is on. vice versa.

✧ Parameter p17, subdivision setting of drive.

Table23 2DM880-EC Parameter of 2DM880-EC

Parameter	**0**	**1**	**2**	**3**	**4**	**5**	**6**	**7**
microstep	Micro-step customize	800	1600	3200	6400	12800	25600	51200
Parameter	8	9	10	11	12	13	14	15
microstep	1000	2000	4000	5000	8000	10000	20000	40000

✧

Tip: in addition, the driver also provides users with any micro-step that can be set freely, and the specific parameters are set through mode P20.

✧ Parameter P18, driver single and double pulse setting, 1 is pulse + direction, 0 is double pulse mode.
✧ Parameter P19, instruction smoothing coefficient

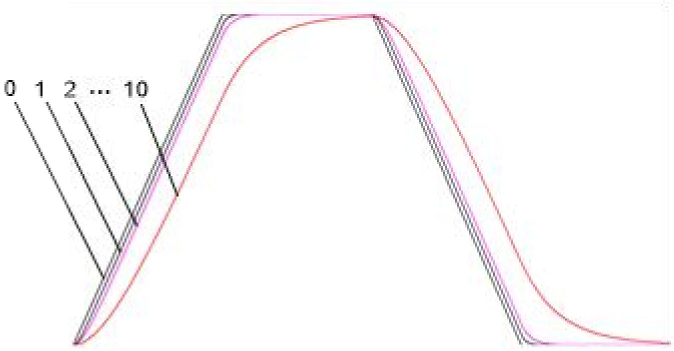


Figure 29 JMC 2dm880-ec driver parameter P19: Command smoothing coefficient

✧ Parameter P20, used for setting micro-step by user
✧ Parameter P30, phase loss detection of driver, 1 indicates on, 0 indicates off. Only for manufacturer's maintenance.
✧ Parameter p36, half flow time, Unit: ms. The default value is 1000, which means after the motor stops for 1000ms,
✧ Motor current = set current (P8) × half current percentage (P37).
✧ Parameter P37, half flow percentage, unit: 1%. The default is 50.
✧ Parameters p38 and P39 are used to view the alarm history.
✧ Parameter P40, slave station number setting, station number can be set from 1-65535 stations. After the station number is set, it needs to be powered on again before the parameter is used.

6 key panel and parameter adjustment method

6.1 Key panel

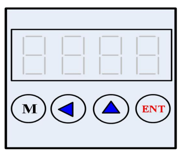


Figure 30 JMC 2dm880-ec key panel

The key panel consists of 4 keys and 4 LED displays. LED indicates the power supply and four digit nixie tube to display the status, and the operation of nixie tube panel is shown in the figure. Select the display mode by "M" key, and select the running state of the monitoring motor by "UP" and "DOWN" keys. The following table represents the meaning of each monitoring code.

Table 24 monitoring code of JMC 2dm880-ec key panel

LED display	88EC	PA00	EXXX	PSΓP
Meaning	2DM880-EC	Parameter setting	Driver default	Drive reset

1) Shift set key

"◀" : shift function;

"▲" : parameter adjustment, adding function;

2) Function key

"ENT" key: confirm and save;

"M" key: undo exit, function switch key;

Note: switch to the parameter display function through "M"; use "ENT" key to view the parameter value (power on display is the parameter value you finally view), press "▲" to switch the function; (the "◀" key is invalid) to exit this function and go to the next function, press "M".

6.2 Key operation method

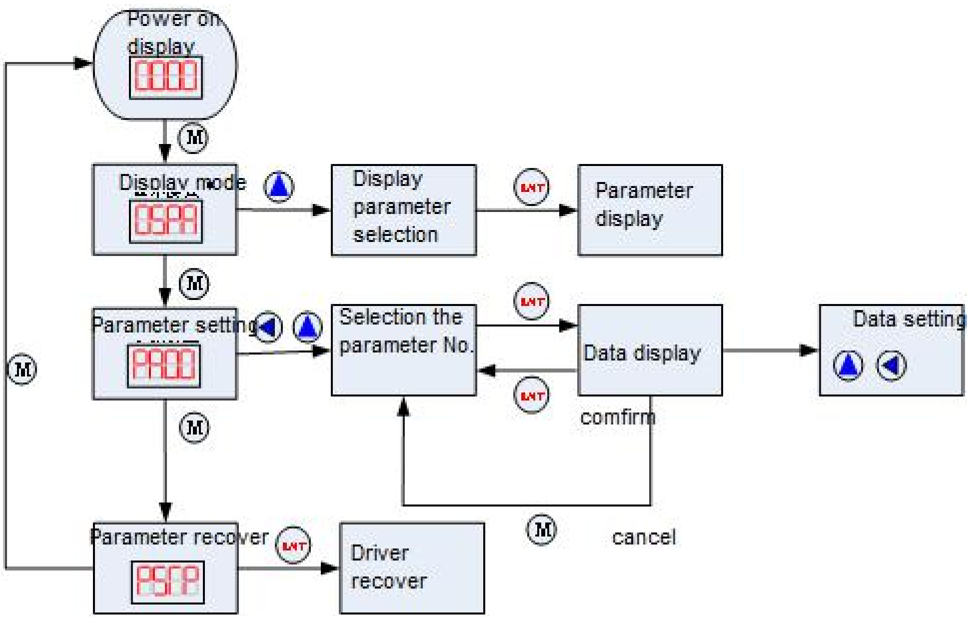


Figure31 Operation flow chart of key panel of 2DM880-EC

6.3 Example of operation

1) Example of mode operation

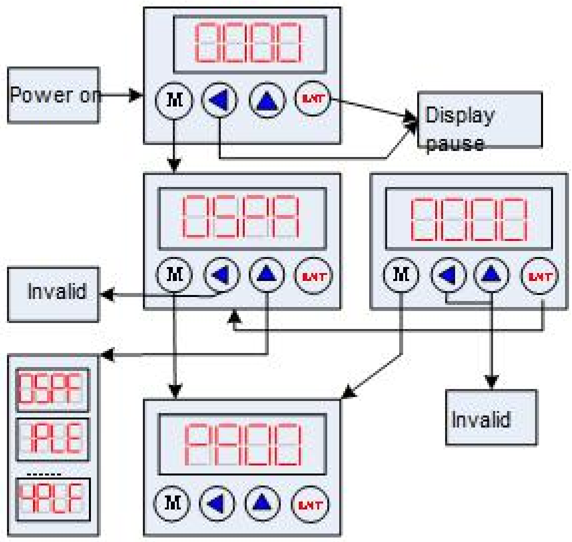


Figure 32 Display mode operation diagram of JMC 2DM880-EC key panel

2） Example of parameter adjustment operation

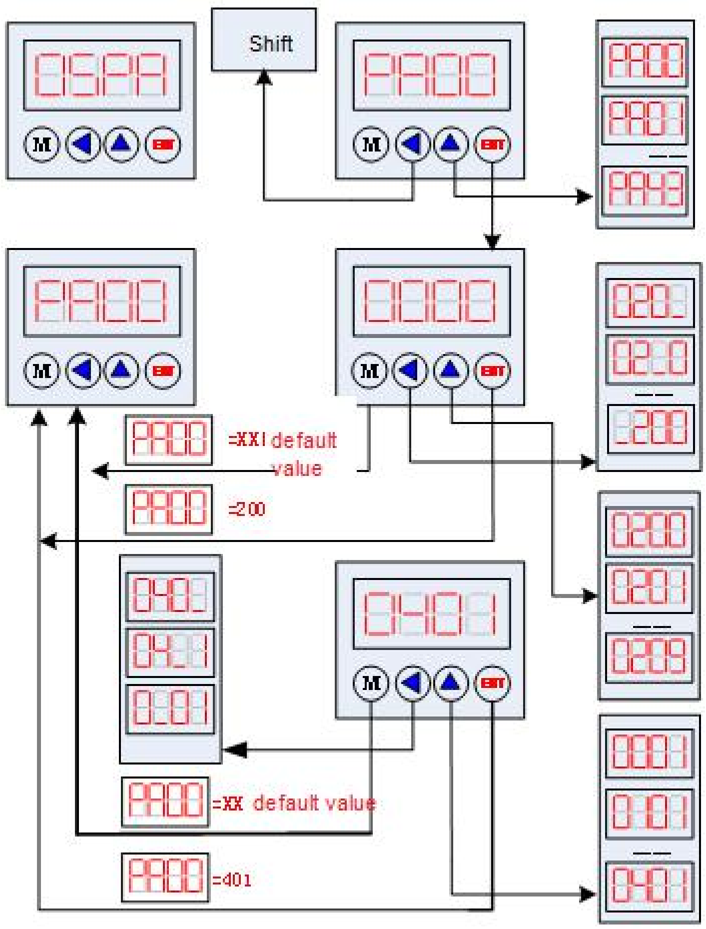


Figure 33 parameter adjustment operation diagram of JMC 2DM880-EC key panel

Note: the factory default current ring, position ring and speed ring parameters of the driver are the best parameters of the matching motor. Generally, the customer does not need to modify them, but only needs to select the motor fraction and the percentage of open and closed-loop current according to the needs of the system control.

7 Fault alarm

Table 25 fault alarm of JMC 2DM880-EC key panel

Panel display	Fault description	Removable or not
E101	Over current fault	No
E102	Reference voltage fault	No
E103	Parameter read / write failure	No
E104	Over-voltage fault	No
E105	Motor phase failure	No
E106	Position out of tolerance fault	Yes
E107	Motor enable	Yes

8 Matched motor

Table 26 Matched motor or 2DM880-EC

Matched motor of 2DM880-EC								
Base		Model	Step angel (deg)	Static moment (N·m)	Rated current (A)	Phase resistance (ohms)	Phase inductance (mH)	Positioning moment(gcm)
2 phase	86	86J1865-828	1.8	3.5	2.8	0.24	1.7	550
		86J1880-842	1.8	4.5	4.2	0.58	4	650
		86J1880-460	1.8	4.5	6	0.29	4	650
		86J18101-450	1.8	6	5	0.58	4.2	950
		86J18118-842	1.8	8.5	4.2	0.56	3	1250
		86J18118-460	1.8	8.5	6	0.28	3	1250
		86J18156-845	1.8	12	4.5	0.82	5.2	2500
		86J18156-460	1.8	12	6	0.41	5.2	2500

Table 27 Matched motor of 2DM880-EC (continue)							
Base		Model	rotor inertia(g-cm²)	Insulation class	Number of leads	Weight (kg)	Length (mm)
2 phase	86	86J1865-828	950	B	8	2	65
		86J1880-842	1400	B	8	2.3	80
		86J1880-460	1400	B	4	2.3	80

		86J18101-450	2300	B	4	3.25	101
		86J18118-842	2700	B	8	3.8	118
		86J18118-460	2700	B	4	3.8	118
		86J18156-845	4000	B	8	5.4	156
		86J18156-460	4000	B	4	5.4	156

9 Quick guide

9.1 Hardware wiring

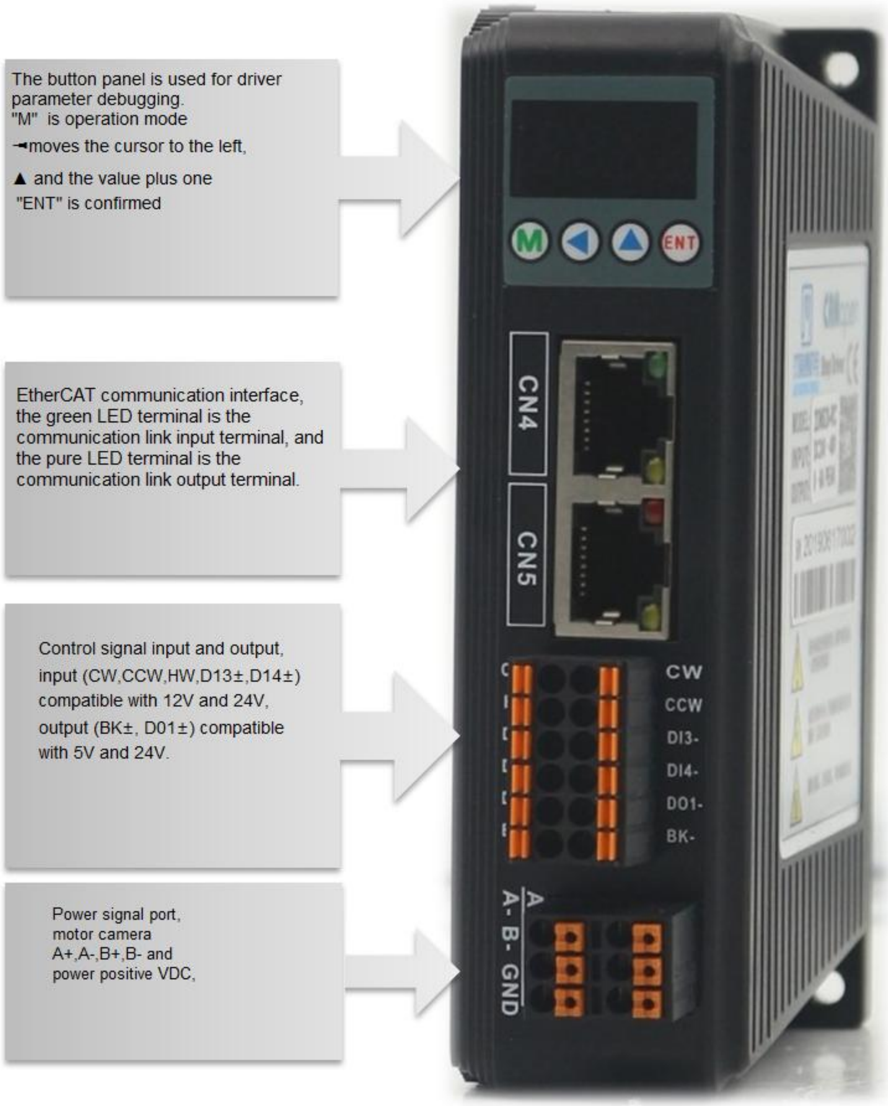


Figure 34 physical drawing of JMC 2DM880-EC

For the specific definition of each port, see "driver interface and wiring" (Ctrl + left mouse button or click the text to jump).

9.2 Parameter setting

The usage of this panel is almost the same as "2DM556-EC". Jump to " Setting flow chart of 2DM556-EC key panel parameter P43" (Ctrl + left mouse button or click text to jump).

➢ Common problems and trouble shooting

When the driver has problem, the key panel will display, and the user can determine the problem according to the fault alarm code in the panel. For example, the motor does not run after starting the power supply, and the key panel displays "E107", that is, the motor is not enabled, so the error can be cleared after sending the enable command again. At the same time, you can also check the error by viewing the object dictionary 0x1001 or check the driver status by using the status word 0x6041.

1 Led light no display when power on

✧ If the input power supply fails, please check the power circuit and use the voltmeter to check whether the voltage at the input end of the power supply is too low

2 Alarm after power on or running for a small angle

Check whether the motor feedback signal line and motor power phase line are connected, and whether the key panel displays "E106" (the open loop does not display the position error)

Whether the input power voltage of step servo driver is too high or too low, and whether the key panel displays "E104"

Whether the phase sequence of the motor is correctly connected. If not, please refer to the phase sequence corresponding to the motor identification and the driver

In the driver configuration parameters, whether the number of lines of the motor encoder is consistent with the actual parameters of the connected motor, if not, reset it

3 Display alarm signal on driver when power on

- ✧ Check whether the master station and the slave station communicate normally. If not, check the station number and baud rate settings
- ✧
- ✧ After the baud rate and station number are confirmed to be correct, the communication cannot be established. Please check whether the terminal resistance is connected to the network
- ✧
- ✧ Check whether there is an error alarm in the status word. If there is, check the object dictionary 0x1001 or 0x1003 sub index 1 to check the reason of current error

4 The motor does not run after all parameters are given

- ✧ Check whether the given parameters meet the parameter requirements
- ✧ Check whether the limit switch has alarm limit

HSS-EC hybrid stepping servo driver series

➢ Product introduction

HSS-EC bus hybrid stepping servo driver series products is a new type of bus simple stepping servo driver which perfectly integrates servo technology and EtherCAT control technology. The step servo driver adopts the latest 32-bit DSP, and integrates the advanced power angle closed-loop control algorithm, COE standard EtherCAT bus communication protocol and ds402 control protocol control algorithm. Compared with the traditional step driver, it can effectively avoid step loss of the step motor, effectively restrain the temperature rise of the motor, significantly reduce the motor vibration, and greatly enhance the high-speed performance of the motor. The cost of the driver is 50% of the AC servo system, and the size of the adaptive motor is compatible with the traditional stepping motor, which is convenient for customers to replace and upgrade. In a word, this stepping servo driver integrates the advantages of bus communication control, simple wiring, no step loss, low temperature rise, high speed, high torque, low cost, convenient maintenance and so on. It is a very cost-effective motion control product.

➢ Technical features

- ✧ No step lose, accurate positioning
- ✧ Support standard 100M full duplex EtherCAT field-bus network interface and COE communication protocol
- ✧ The synchronous cycle position, contour position, contour speed and zero return control mode of the built-in DS402 motion control protocol
- ✧ Built in CW, CCW, SW three 5V or 24V IO signal inputs for limit position and zero return reference
- ✧ One BRAKE brake signal output signal and one in place signal
- ✧ Up to 100m communication distance between stations
- ✧ 100% rated torque drive motor
- ✧ Inverter control technology, high current efficiency
- ✧ Small vibration, stable operation at low speed
- ✧ Built in acceleration and deceleration control to improve start stop smoothness
- ✧ User can customize micro-step
- ✧ Compatible with 1000 line and 2500 line encoders
- ✧ There is no need to adjust the general application parameters
- ✧ Lack of phase protection, over-current protection, over-voltage protection and over differential protection
- ✧ The six digit nixie tube display is convenient for setting parameters and monitoring motor operation status

➢ 2HSS458-EC

1 Electrical, mechanical and environmental indicators

Input voltage		24~50VDC
Continuous current input		Max 6.0A
Communication type		EtherCAT Communication protocol
Maximum communication distance		100M
Maximum supported slave number		65535
Logic input current		7~20mA (10mATypical value)
Protect		Peak value of overcurrent action value10A±10%
		Overvoltage action value 70VDC
Dimension (mm)		125×101×48
Weight		About 280g
Environment	occasion	Try to avoid dust, oil mist and corrosive gas
	working temperature	0~70℃
	Storage temperature	-20℃~+80℃
	humidity	40~90%RH
	Cooling mode	Natural cooling or forced cooling

Table 28 performance parameters of 2HSS458-EC

2 Mechanical installation dimension drawing

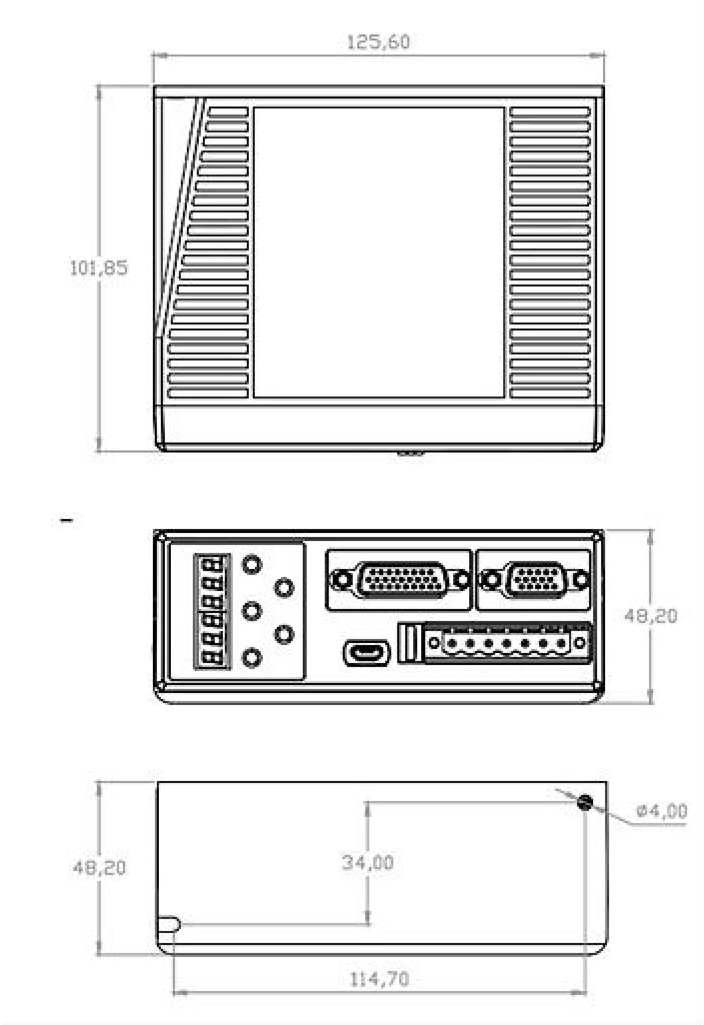


Figure 35 mechanical installation dimension drawing of 2HSS458-EC (unit: mm)

3 Driver interface and wiring

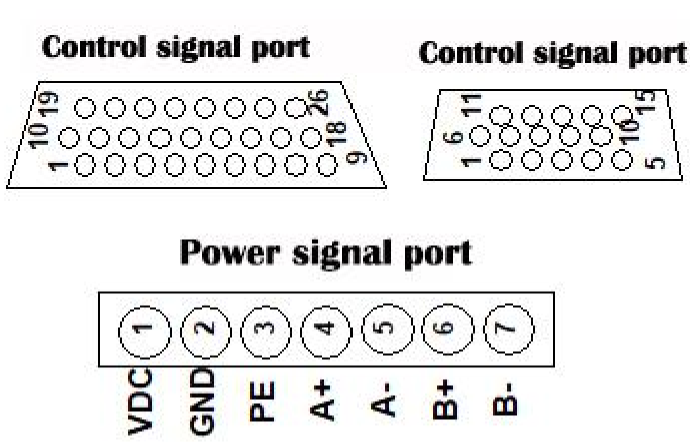


Figure 36 schematic diagram of JMC 2HSS458-EC wiring port

Note: for the communication port, see "communication interface and wiring" (Ctrl + left mouse button or click the text to jump)

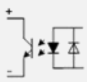
3.1 Power signal port

Table 29 Power signal port of 2HSS458-EC

Terminal NO.	Symbol	Name	Instruction
1	A+	Positive terminal of motor phase line a	Motor A phase winding
2	A-	Negative end of motor phase line A	
3	B+	Positive terminal of motor phase line B	Motor B phase winding
4	B-	Negative end of motor phase line B	
5	VDC	DC power input +	24~48VDC
6	GND	DC power input -	
Note: the phase line color of the motor matched with the JMC driver is generally red (a +, blue (a -), green (B -), black (B -). Users can connect with the port of the JMC driver according to this color. In case of inconsistency between color and phase line, please call JMC technical service personnel.			

3.2 Control signal port

Table 30 control signal port of 2HSS458-EC

DB head pin	Symbol	name	Instruction
1	EN+	-	keep
2	EN-	-	keep
3	DI3+	Probe 1 input+	Input 12V ~ 24VDC (compatible with 5V, but not recommended)
4	DI3-	Probe 1 input -	
5	DI4+	Probe 2 input positive	Input 12V ~ 24VDC (compatible with 5V, but not recommended)
6	DI4-	Probe 2 input -	
7	CCW+	Counter clockwise limit+	Input 12V ~ 24VDC (compatible with 5V, but not recommended)
8	CCW-	Counter clockwise limit negative	
9	HW+	Origin limit positive	Input 12V ~ 24VDC (compatible with 5V, but not recommended)
10	HW-	Zero limit negative	
11	CW+	Clockwise limit +	Input 12V ~ 24VDC (compatible with 5V, but not recommended)
12	CW-	Clockwise limit -	
13	NC	Empty terminal	not used
14	ALM+/BRK+	Alarm / brake signal output +	 Output 5V~24VDC
15	ALM-/BRK-	Alarm / brake signal output -	
16	PEND+	In place signal output +	Output

17	PEND-	In place signal output -	5V~24VDC
18	SGND	Signal ground	-
19	+5V	Power signal	-
20	OUTA+	Encoder a channel output +	
21	OUTA-	Encoder a channel output -	
22	OUTB+	Encoder B channel output +	
23	OUTB-	Encoder B channel output -	
24	OUTZ+	Encoder C channel output +	
25	OUTZ-	Encoder C channel output -	
26	SGND	Signal ground	-

3.3 Signal Port of Encoder

Table 31 Encoder signal port of 2HSS458-EC

DB head pin	Symbol	Description
1	EA+	Encoder A channel input +
2	EB+	Encoder B channel input +
3	GND	Encoder input GND
11	EA-	Encoder a channel input-
12	EB-	Encoder B channel input -
13	VCC	5VEncoder power input + 5V

3.4 Wiring diagram of controller

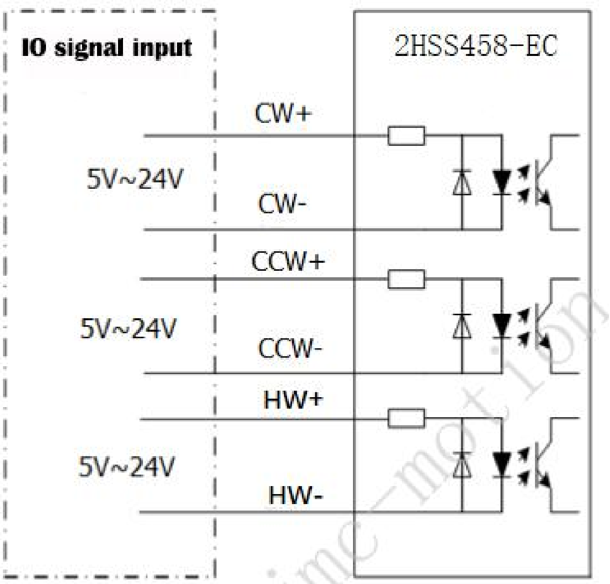


Figure 37 control signal IO differential signal connection method of 2HSS458-EC

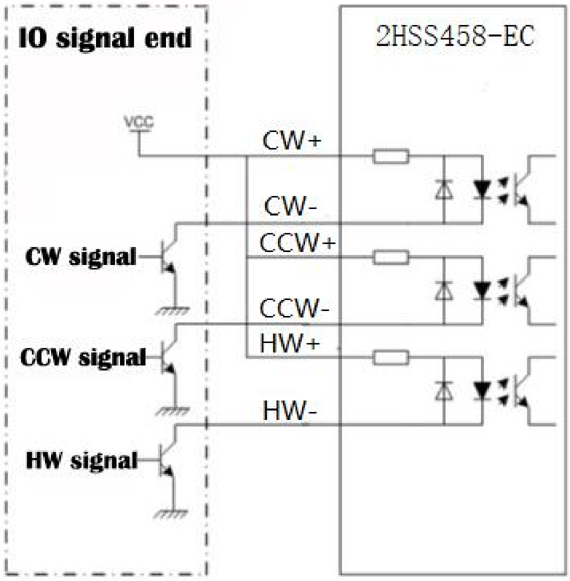


Figure 38 IO common anode connection of control signal

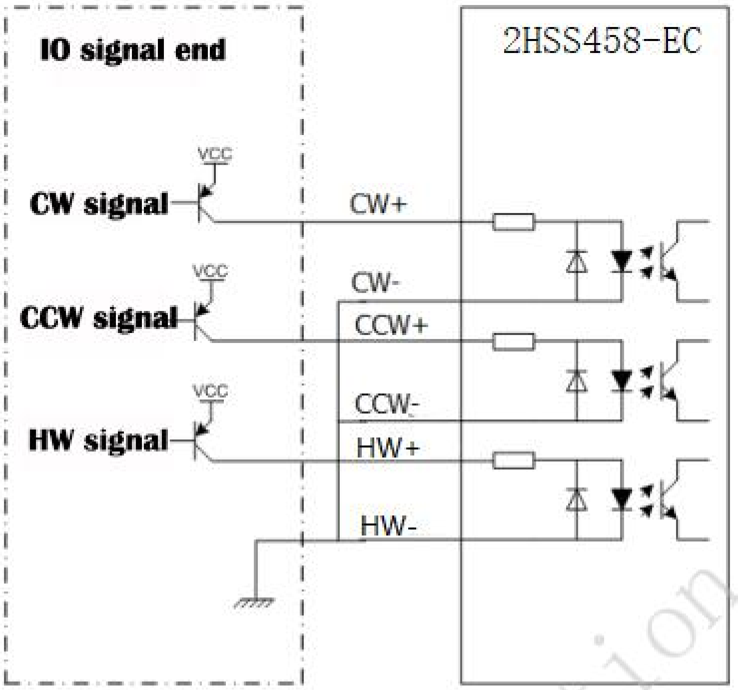


Figure 39 Control signal IO common cathode connection

4 Wiring diagram Of typical application

A typical wiring diagram consisting of 2HSS458-EC drives, etc. is shown below. The power supply shall be 24-48vdc according to the voltage level of matching motor.

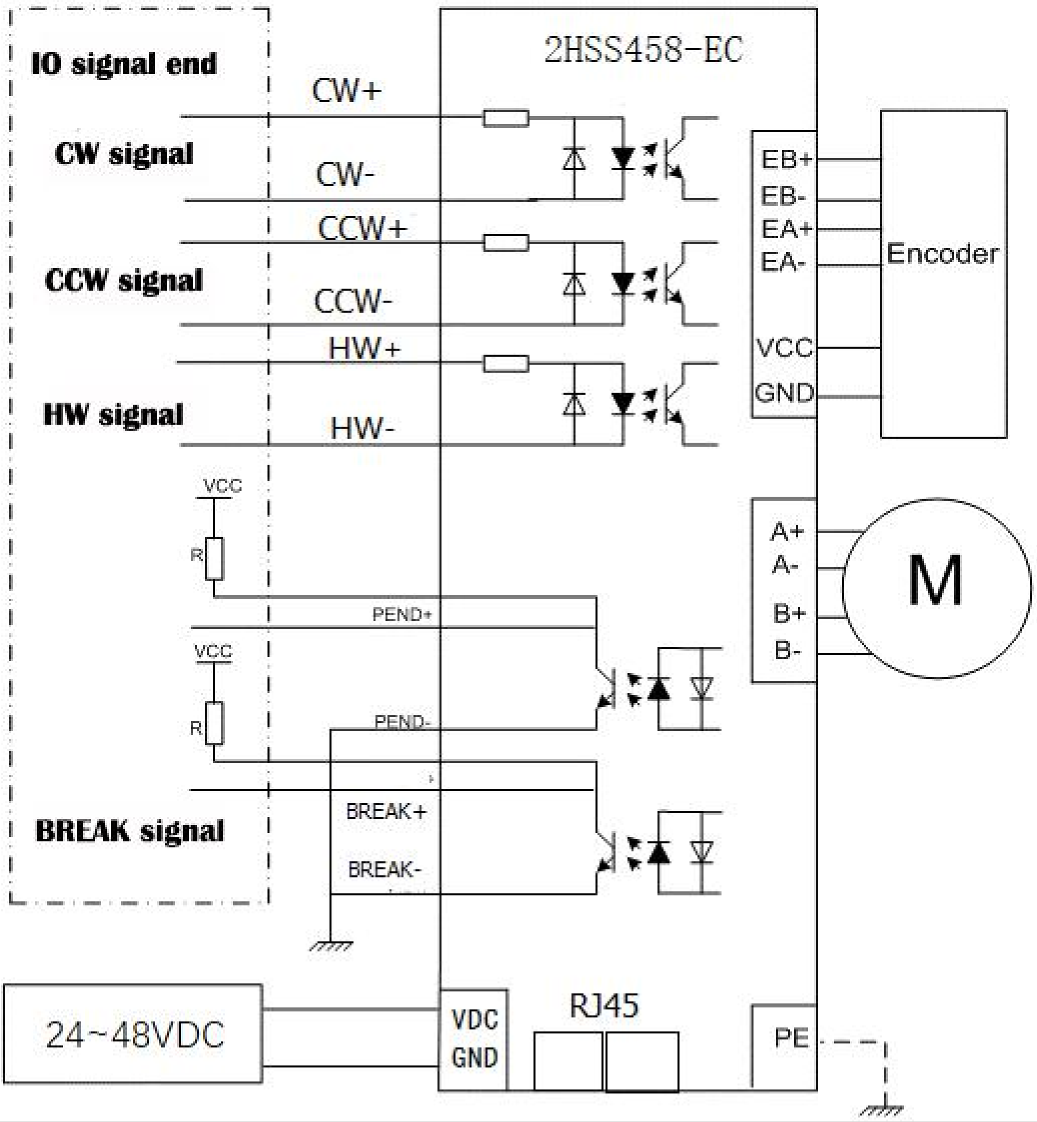


Figure 40 typical application wiring diagram of JMC 2HSS458-EC driver

1) BREAK signal needs external relay control for motor brake control, and the maximum passing current is 50mA.

2) RJ45 network interface is connected to other slave stations through 100BASE-TX double foot line, and there is no special difference between the two network ports.

5 Drive parameter settings

Parameter setting method of 2HSS458-EC: parameters can be set through the front panel of the driver; parameters can also be set through RS232 serial communication port of the HISU with special debugging software. There is a set of the best default factory configuration parameters of the corresponding motor in the drive. The user only needs to adjust the internal details of the drive according to the specific usage. See the following table for the specific parameters and functions:

Actual value of parameter = set value × corresponding dimension

Table 32 internal parameters of JMC 2HSS458-EC

No.	Name	Range	Dimension	Restart	Default parameters
P1	Current loop proportional gain	0—4000	1	No	1000
P2	Current loop integral gain	0—1000	1	No	100
P3	Driver damping coefficient	0—500	1	No	250
P4	Position loop proportional gain	0—3000	1	No	2000
P5	Integral gain of position loop	0—1000	1	No	200
P6	Speed loop proportional gain	0—3000	1	No	500
P7	Integral gain of velocity loop	0—1000	1	No	1000
P8	Open loop current of driver	0—60	0.1	No	40
P9	Drive closed-loop current	0—40	0.1	No	20
P10	Driver alarm level	0—1	1	No	0
P11	Driver direction level	0—1	1	No	1
P12	Manufacturer's parameters	Keep	Keep	Keep	Keep
P13	Manufacturer's parameters	Keep	Keep	Keep	Keep
P14	Driver in place level	0—1	1	No	0
P15	Factory parameter	Keep	Keep	Keep	Keep
P16	Factory parameter	Keep	Keep	Keep	Keep
P17	Micro-step selection of driver	0—15	1	Yes	2
P19	Driver instruction smoothing	0—10	0	No	2

P20	User defined subdivision	4—1000	50	Yes	8
P21	Factory parameter	Keep	Keep	Keep	Keep
P22	Factory parameter	Keep	Keep	Keep	Keep
P23	Factory parameter	Keep	Keep	Keep	Keep
P24	Factory parameter	Keep	Keep	Keep	Keep
P25	Open and closed loop stack ratio	0—40	1	NO	10
P26	Damping of driver stop	0—500	1	NO	200
P27	Low speed damping of driver	0—500	1	NO	50
P28	Factory parameter	Keep	Keep	Keep	Keep
P29	Factory parameter	Keep	Keep	Keep	Keep
P30	Driver phase missing detection	0—1	1	Yes	1
P31	Factory parameter	Keep	Keep	Keep	Keep
P32	Factory parameter	Keep	Keep	Keep	Keep
P33	Factory parameter	Keep	Keep	Keep	Keep
P34	Factory parameter	Keep	Keep	Keep	Keep
P35	Factory parameter	Keep	Keep	Keep	Keep
P36	Half flow time	0—60000	Ms	NO	500
P37	half flow ratio	0—100	1%	NO	50
P38	Drive alarm history1				
P39	Drive alarm history 2				
P40	Drive station number Settings	1—65535	1	Yes	1

✧ Users can modify the following parameters through the front panel of the drive, or download them to the drive through HISU. The settings of each parameter are described as follows:

- ✧ Parameters P1, P2, P3, P4, P5, P6 and P7 respectively are used for setting current ring, system damping, position ring and speed ring.
- ✧ Parameter P8, P9 is used to set the open-loop current and close -loop current (Actual current = open loop current + closed loop current)
- ✧ Parameter P10 is used for the selection of alarm output level. Parameter 0 indicates that the output triode of coupler is cut off under normal operation; the output triode of coupler is on under driver alarm. vice versa.
- ✧ Parameter P11 is used for direction level selection. Through the setting of this parameter, the control direction of control terminal level can be changed.
- ✧ Parameter P14, select the output level in place, 0 means the output triode of the optocoupler is cut off when the driver meets the conditions in place; if the conditions in place are not met, the output triode of the optocoupler is on. vice versa.
- ✧ P15,choose the encoder line, 0 means 1000 line and 1 means 2500 line.
- ✧ P16,Set the threshold value of position over tolerance (actual value = set value × 10)
- ✧ Parameter p17, subdivision setting of drive.

Table 17 2HSS458-EC P17: Micro-step of driver

Parameter	0	1	2	3	4	5	6	7
Micro-step	Micro-step customization	800	1600	3200	6400	12800	25600	51200
Parameter	8	9	10	11	12	13	14	15
Micro-step	1000	2000	4000	5000	8000	10000	20000	40000

- ✧ Tip: in addition, the driver also provides users with any micro-step that can be set freely, and the specific parameters are set through mode P20.
- ✧ Parameter P18, driver single and double pulse setting, 1 is pulse + direction, 0 is double pulse mode.
- ✧ Parameter P19, instruction smoothing coefficient

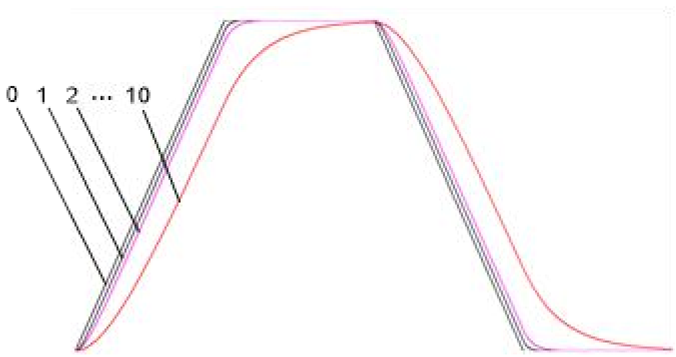


Figure 41 JMC 2hss458-ec driver parameter P19: Command smoothing coefficient

- ✧ Parameter P20, used for setting micro-step by user
- ✧ Parameter P30, phase loss detection of driver, 1 indicates on, 0 indicates off. Only for manufacturer's maintenance.

- ✧ Parameter p36, half flow time, Unit: ms. The default value is 1000, which means after the motor stops for 1000ms,
- ✧ Motor current = set current (P8) × half current percentage (P37).
- ✧ Parameter P37, half flow percentage, unit: 1%. The default is 50.
- ✧ Parameters p38 and P39 are used to view the alarm history.
- ✧ Parameter P40, slave station number setting, station number can be set from 1-65535 stations. After the station number is set, it needs to be powered on again before the parameter is used.

6 key panel and parameter adjustment method

6.1 Control key panel

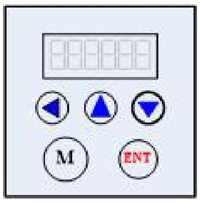


Figure 42 2HSS458-EC key panel

The key panel consists of 4 keys and 4 LED displays. LED indicates the power supply and four digit nixie tube to display the status, and the operation of nixie tube panel is shown in the figure. Select the display mode by "M" key, and select the running state of the monitoring motor by "UP" and "DOWN" keys. The following table represents the meaning of each monitoring code.

Table 34Monitoring code of JMC 2HSS458-EC key panel

LED display	d00SPR	d01SPF	d02PLE	d03PLR	d04PLF	XX_Err	En_OFF
meaning	Reference speed	Feedback speed	Position error	Position given	Position feedback	Driver fault	Drive off line

1) Shift set key

"◀" : shift function;

"▲" : parameter adjustment, adding function;
"▼" parameter adjustment, reduce function;

2) Function key

"ENT" key: confirm and save;

"M" key: undo exit, function switch key;

Note: switch to the parameter display function by "M"; use "ENT" key to view the parameter value (power on display is the parameter value you finally view), press "▲" to switch the function; (the "◄" key is invalid) to exit this function and go to the next function, press "M".

6.2 Operate method of the key panel

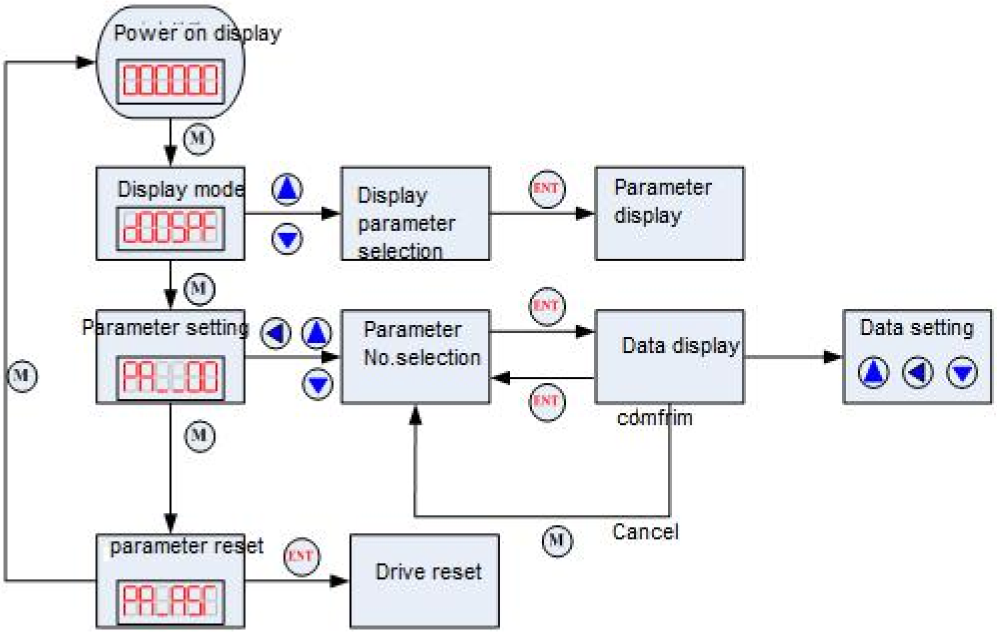


Figure 43 Operation flow chart of key panel of 2HSS458-EC

6.3 Example of operation

1) Example of mode operation

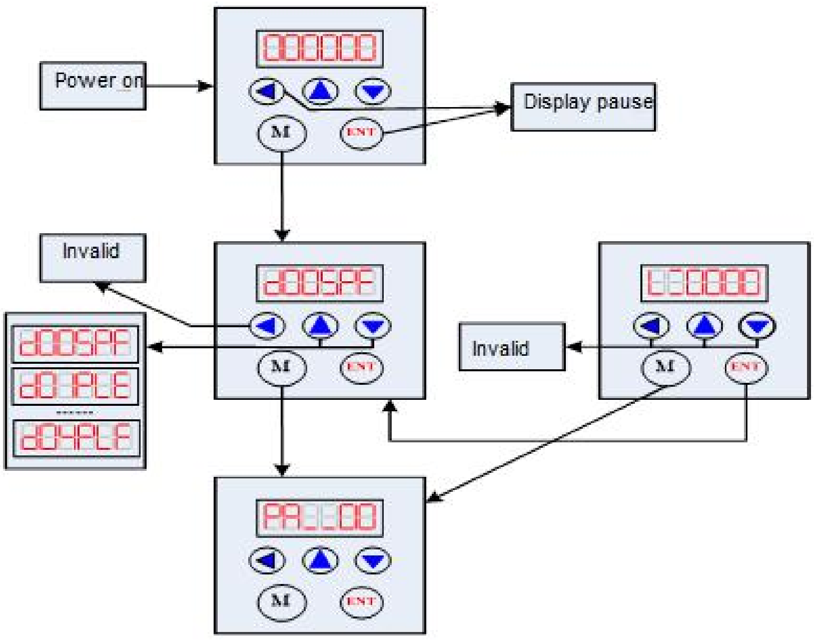


Figure 44 Display mode operation diagram of JMC 2HSS458-EC key panel

2） Example of parameter adjustment operation

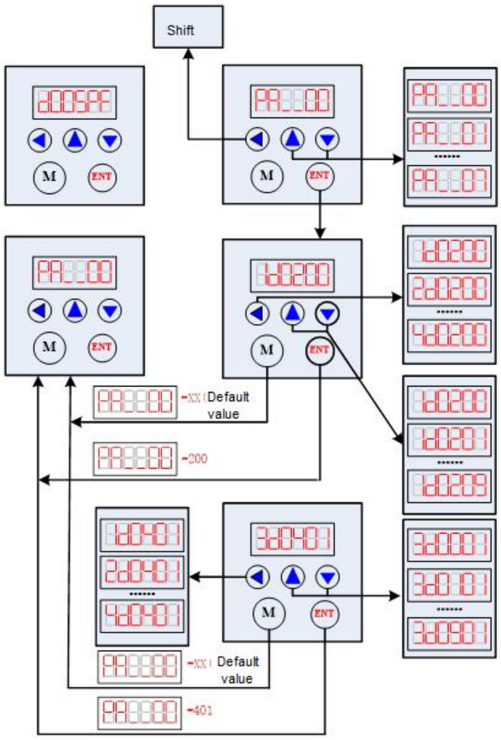


Fig. 45 operation diagram of JMC 2hss458-EC key panel parameter adjustment

Note: the factory default current ring, position ring and speed ring parameters of the driver are the best parameters of the matching motor. Generally, the customer does not need to modify them, but only needs to select the motor fraction and the percentage of open and closed-loop current according to the needs of the system control.

7 Fault alarm

Table 35 Fault alarm key panel

Panel display	Fault description	Removable or not
E101	Over current fault	NO
E102	Reference voltage fault	NO
E103	Parameter read / write failure	NO
E104	Over-voltage	NO
E105	Motor phase failure	NO
E106	Position error	YES
E107	Motor enable	YES

8 Matched motor

Table 36Matched motor of 2HSS458-EC

Base		Model	Step angel (deg)	Static moment (N•m)	Rated current 流 (A)	rotor inertia (g-cm²)	Weight (kg)	Length (mm)
Two phase	42	42J1848EC-1000(*)	1.8	0.48	1.5	80	0.45	48
		42J1860EC-1000	1.8	0.7	2.5	110	0.55	60
	57	57J1854EC-1000(*)	1.8	0.9	4	280	38.1	54
		57J1880EC-1000(*)	1.8	2	5	480	38.1	80
		57J18100EC-1000	1.8	2.8	5			100
	60	60J1856EC-1000	1.8	1.5	3.5	340	0.9	56
		60J1887EC-1000(*)	1.8	3	5	690	1.45	87
		60J18100EC-1000	1.8	3.5	5	1200	1.9	100

9 Quick guide

9.1 Hardware wiring

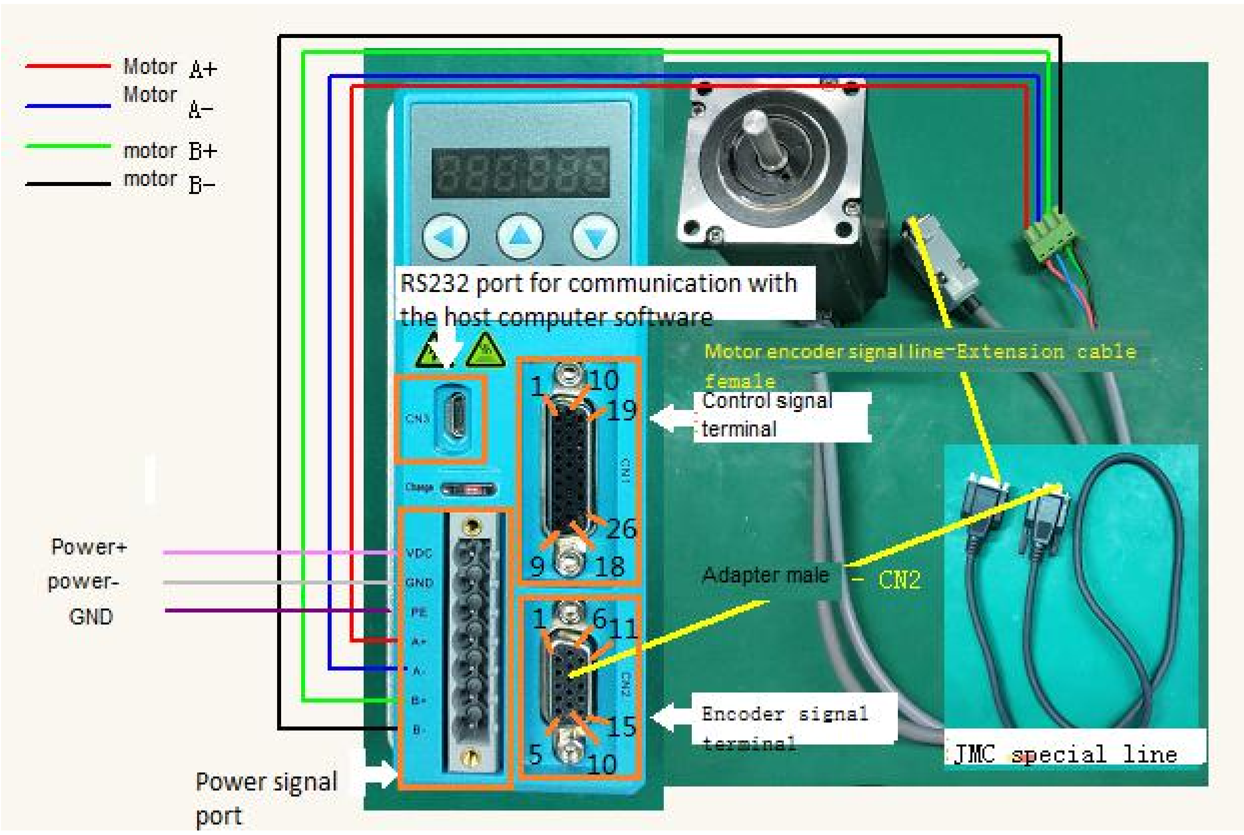


Figure 46 hardware wiring diagram of 2hss458-ec

For the specific definition of each port, see "driver interface and wiring" (Ctrl + left mouse button or click the text to jump).

9.2 Parameter setting

Fig. 472 flow chart of setting parameters p43 in key panel of 2HSS458-EC

The above is the operation mode of the RC series driver (EC series cannot change the communication mode to 485 or CAN). The operation mode is the same as that of EC series but has different functions, while other operations are similar. You can master the operation mode of the key panel according to the flow chart above.

➢ 2HSS858-EC

1 Electrical, mechanical and environmental indicators

Table 37 Performance parameters of JMC 2HSS858-EC

Input voltage		50~90VAC
Continuous current input		8.0A
Communication type		EtherCAT Communication protocol (CoE)
Maximum communication distance		100MFrom station to station 100m
Maximum supported slave number		65535
Logic input current		7~20mA (10mATypical value)
Protect		12A±10%Peak value of overcurrent action value
		200VDCOvervoltage action value
		The overmiss alarm threshold can be set through the front panel of the driver or the handheld smart regulator
(mm) Dimension		140×70×56
Weight		1500g
Environment	occasion	Try to avoid dust, oil mist and corrosive gas
	working temperature	Max 70℃
	Storage temperature	-20℃~+65℃
	humidity	40~90%RH
	Cooling way	Natural cooling or forced cooling

2 Mechanical installation dimension drawing

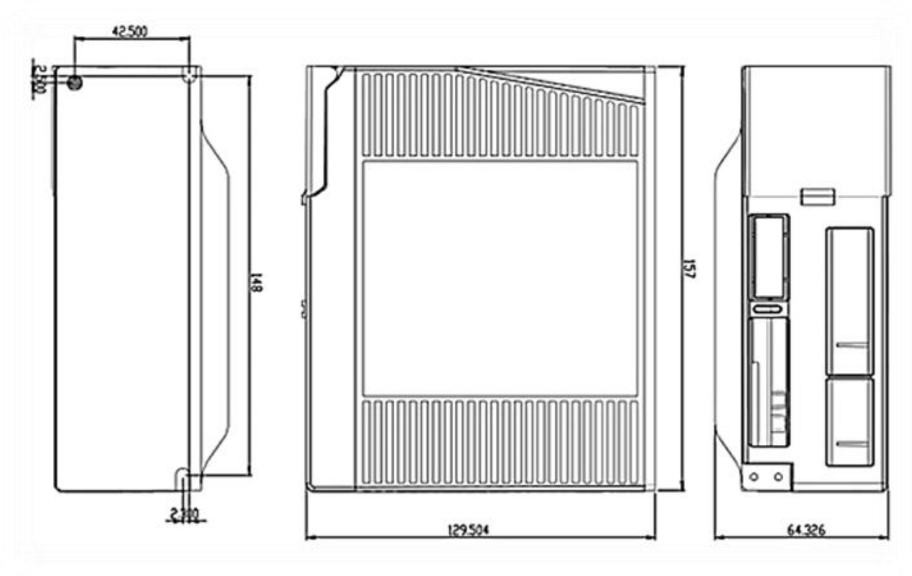


Fig. 48 mechanical installation dimension drawing of JMC 2HSS858-EC

（单位：mm）

1)When designing the installation size, it is necessary to consider the size of the terminal and the ventilation and heat dissipation.

2) The reliable working temperature of the driver is usually within 60 ℃, and that of the motor is within 90 ℃;

3 Interface and wiring of Driver

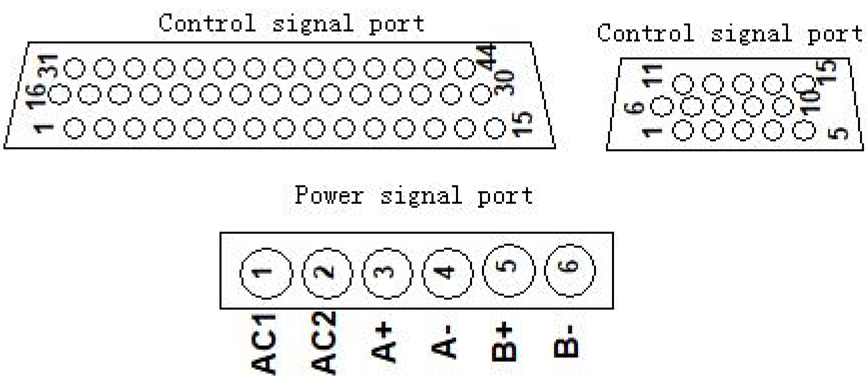


Figure 49 Schematic diagram of JMC 2HSS858-EC wiring port

Note: for the communication port, see the “Communication interface and wiring” (CTRL + left mouse button or click text to jump)

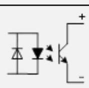
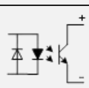
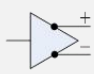
3.1 Power signal port

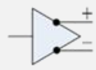
Table 38 power signal port

Terminal number	Symbol	Name	instruction
1	AC1	Power input L	L and N indirect AC 50 ~ 90VAC
2	AC2	Power input N	
3	A+	Wiring of motor A+	Motor A phase winding
4	A-	Wiring of motor A-	
5	B+	Wiring of motor B+	Motor B phase winding
6	B-	wiring of motor B-	

3.2 Control signal port (44 pin and DB head)

Table 39 Control signal port 2HSS858-EC

Terminal number	Symbol	Name	Instruction
1	HW+	mechanical origin limit+	Input 12 ~ 24VDC (compatible with 5V, but not recommended)
2	HW-	mechanical origin limit-	
23	CW+	Clockwise limit+	Input 12 ~ 24VDC (compatible with 5V, but not recommended)
24	CW-	Clockwise limit-	
25	CCW+	Counter clockwise limit+	Input 12 ~ 24VDC (compatible with 5V, but not recommended)
26	CCW-	Counter clockwise limit-	
9	PEND+	Signal in place +	 5~24VDC 0~50mA
10	PEND-	Signal in place -	
32	BK+	Brake signal+	 5~24VDC 0~50mA
31	BK-	Brake signal -	
30	OUTA-	Encoder Channel A-	
44	OUTA+	Encoder Channel A+	
14	OUTB+	Encoder Channel B+	

15	OUTB-	Encoder Channel B-	
13	OUTZ+	Encoder Channel Z+	
29	OUTZ+	Encoder Channel Z-	

3.3 Signal port of encoder

Table 40 Encoder signal terminal 2HSS858-EC

DB head pin	signal	Description
1	EA+	Encoder Channel A input +
2	EB+	Encoder Channel A input +
3	GND	Encoder input GND
11	EA-	Encoder Channel A input -
12	EB-	Encoder Channel B input -
13	VCC	Encoder power input +5V

3.4 Wiring diagram of control signal

Wiring Control signal input and output interface

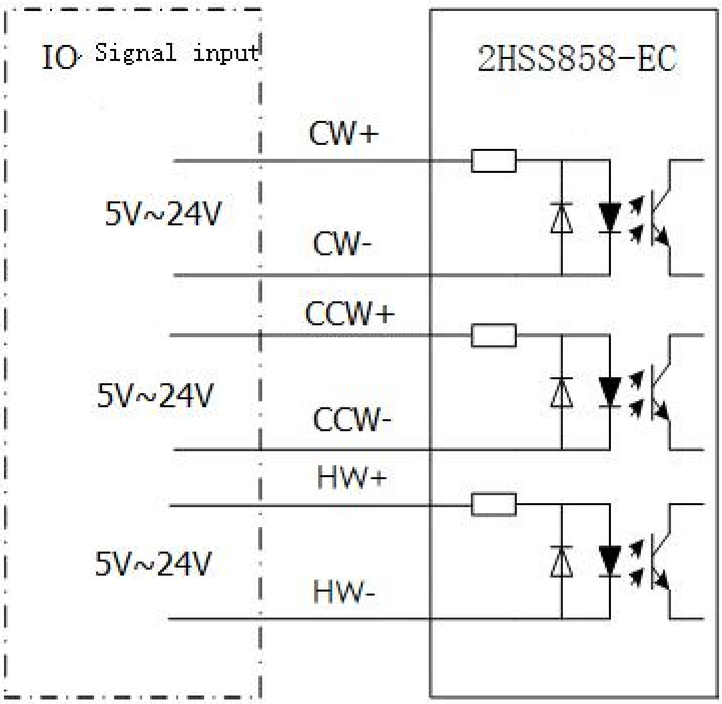


Figure 50 connection
Of Control signal IO differential signal

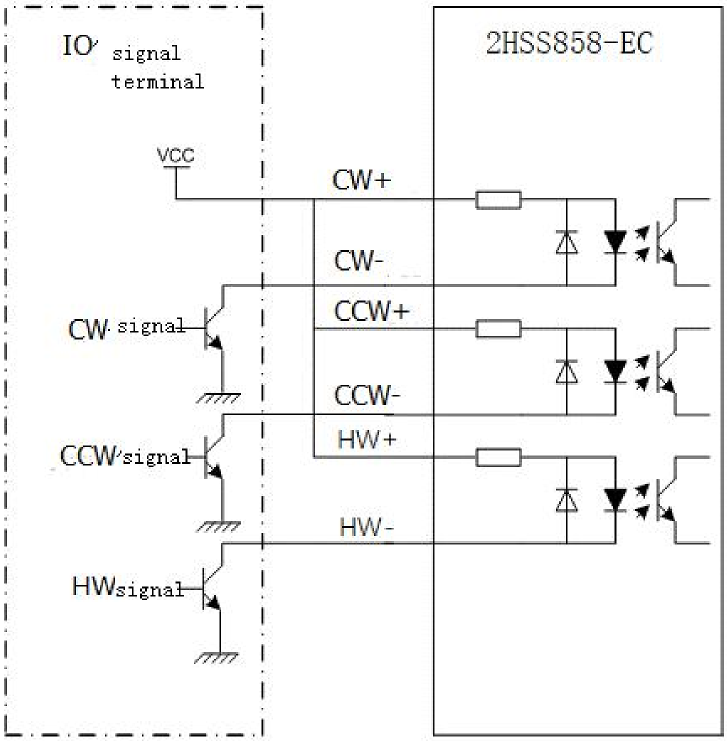


Figure 51 2HSS858-ECconnection method of control signal co- anode

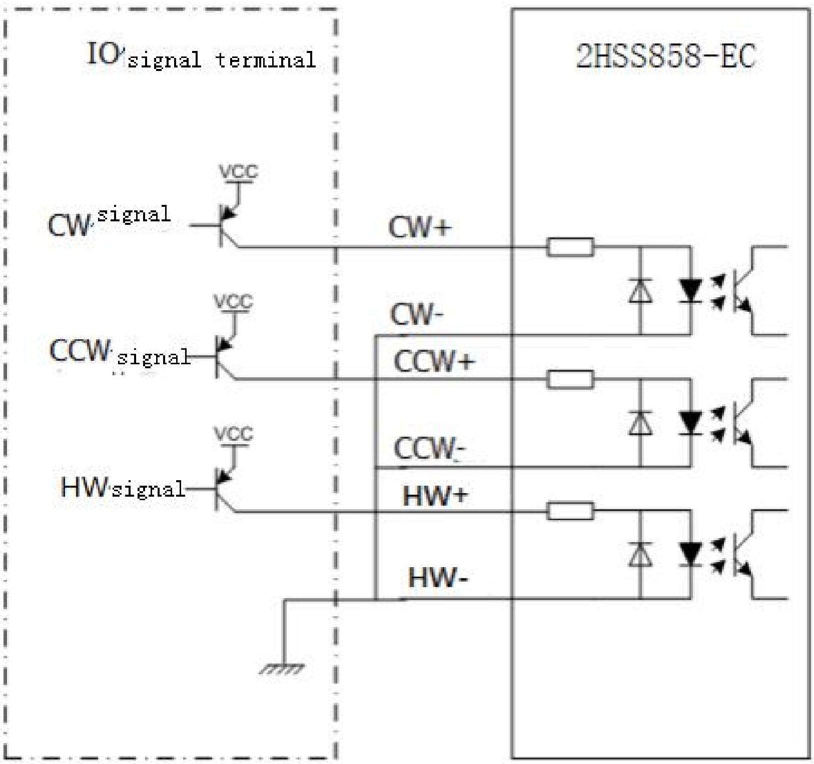


Figure 52Common cathode connection for control signals

4 Diagram of typical application wiring

A typical wiring diagram consisting of 2HSS858-EC drives, etc. is shown below. The power supply shall be AC50-90V according to the voltage level of matching motor.

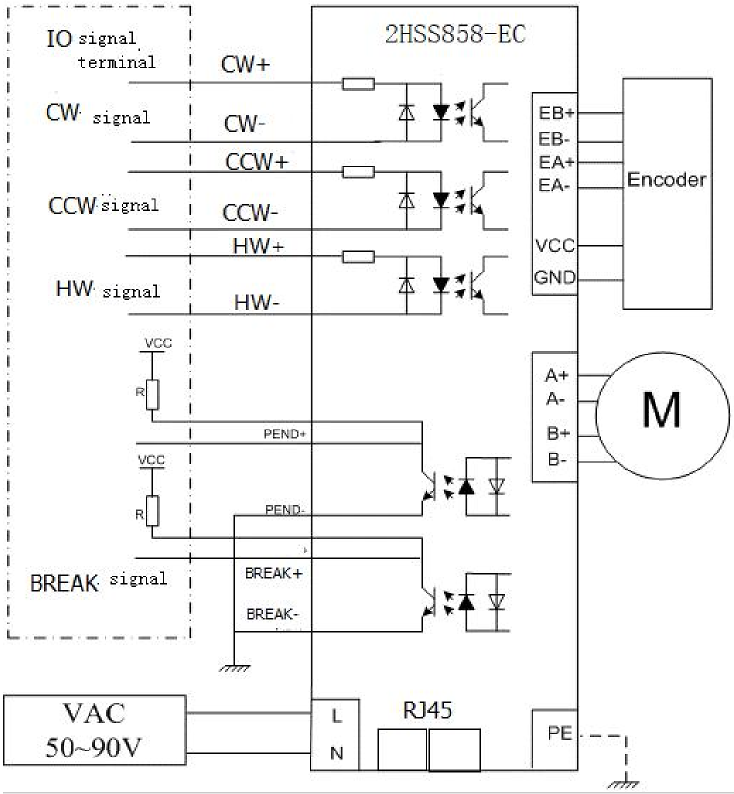


Figure 53 typical application wiring diagram of JMC 2hss858-ec driver

Note:

1) BREAK signal needs external relay control for motor brake control, and the maximum passing current is 50mA.

2) RJ45 network interface is connected to other slave stations through 100BASE-TX double foot line, and there is no special difference between the two network ports.

5 Parameter setting of driver

2HSS858-EC Driver parameter setting method: Parameters can be set through the front panel of the driver; through the RS232 serial communication port of HISU, using special debugging software to complete the parameter setting. There is a set of the best default factory configuration parameters for the motor stored in the driver. The user only needs to adjust the internal fine score of the driver according to the specific use. The specific parameters and functions are shown in the following table:

The actual value of the parameter = the set value × the corresponding dimension

Table 41JMC 2HSS858-EC Internal parameters of drive

No.	Name	Range	Dimension	Restart	Default parameters
P1	Current loop proportional gain	0—4000	1	NO	1000
P2	Current loop integral gain	0—1000	1	NO	100
P3	damping factor of driver	0—500	1	NO	250
P4	Position ring proportional gain	0—3000	1	NO	2000
P5	Position loop integral gain	0—1000	1	NO	200
P6	Proportional gain of speed loop	0—3000	1	NO	500
P7	The speed loop integral gain	0—1000	1	NO	1000
P8	open loop current of driver	0—60	0.1	NO	40
P9	close loop current of driver	0—40	0.1	NO	20
P10	Factory parameter	Keep	Keep	Keep	Keep
P11	direction electrical level of driver	0—1	1	NO	1
P12	Factory parameter	Keep	Keep	Keep	Keep
P13	Factory parameter	Keep	Keep	Keep	Keep
P14	Driver in place level	0—1	1	NO	0
P15	Factory parameter	Keep	Keep	Keep	Keep
P16	Factory parameter	Keep	Keep	Keep	Keep
P17	Drive segment selection	0—15	1	Yes	2
P19	Driver instruction smoothing	0—10	0	NO	2
P20	User defined	4—1000	50	Yes	8

	micro-step				
P21	Factory parameter	Keep	Keep	Keep	Keep
P22	Factory parameter	Keep	Keep	Keep	Keep
P23	Factory parameter	Keep	Keep	Keep	Keep
P24	Factory parameter	Keep	Keep	Keep	Keep
P25	Open closed loop stack ratio	0—40	1	NO	10
P26	Driver stop damping	0—500	1	NO	200
P27	Driver low speed damping	0—500	1	NO	50
P28	Factory parameter	Keep	Keep	Keep	Keep
P29	Factory parameter	Keep	Keep	Keep	Keep
P30	Driver phase missing detection	0—1	1	yes	1
P31	Factory parameter	Keep	Keep	Keep	Keep
P32	Factory parameter	Keep	Keep	Keep	Keep
P33	Factory parameter	Keep	Keep	Keep	Keep
W P34	Factory parameter	Keep	Keep	Keep	Keep
P35	Factory parameter	Keep	Keep	Keep	Keep
P36	half-flow time	0—60000	Ms	NO	500
P37	half-flow percentage	0—100	1%	NO	50
P38	Drive alarm history1				
P39	Drive alarm history2				
P40	Drive station number Settings	1—65535	1	YES	1

Users can modify the following parameters through the front panel of the drive, or download them to the drive through HISU. The settings of each parameter are described as follows: Parameters P1, P2, P3, P4, P5, P6 and P7 respectively are used for setting current ring, system damping, position ring and speed ring.

- ✧ Parameter P8 is used to set the open-loop current. P9 is for close-loop current.(Actual current = open loop current + closed loop current)
- ✧ Parameter P10 is used for the selection of alarm output level. Parameter 0 indicates that the output triode of coupler is cut off under normal operation; the output triode of coupler is on under driver alarm. vice versa.
- ✧ Parameter P11 is used for direction level selection. Through the setting of this parameter, the control direction of control terminal level can be changed.
- ✧ Parameter P14, select the output level in place, 0 means the output triode of the optocoupler is cut off when the driver meets the conditions in place; if the conditions in place are not met, the output triode of the optocoupler is on. vice versa.
- ✧ Parameter p15: select the number of encoder lines, 0 for 1000 lines, 1 for 2500 lines.
- ✧ Parameter p16, set the threshold value of position over tolerance (actual value = set value × 10).
- ✧ Parameter p17, subdivision setting of drive.

Table 42JMC 2HSS858-EC driver parameter P17: micro-step of driver

parameter	0	1	2	3	4	5	6	7
micro-step	Micro-step customize	800	1600	3200	6400	12800	25600	51200
parameter	8	9	10	11	12	13	14	15
micro-step	1000	2000	4000	5000	8000	10000	20000	40000

Tip: in addition, the driver also provides users with any micro-step that can be set freely, and the specific parameters are set through mode P20.

- ✧ Parameter P18, driver single and double pulse setting, 1 is pulse + direction, 0 is double pulse mode.
- ✧ Parameter P19, instruction smoothing coefficient
- ✧

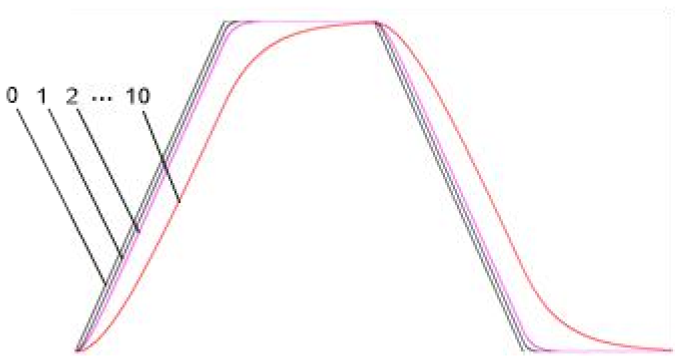


Figure 54 JMC 2HSS858-EC driver parameter P19: Command smoothing factor

- ✧ Parameter P20, used for setting micro-step by user
- ✧ Parameter P30, phase loss detection of driver, 1 indicates on, 0 indicates off. Only

for manufacturer's maintenance.

- ✧ Parameter p36, half flow time, Unit: ms. The default value is 1000, which means after the motor stops for 1000ms,
- ✧ Motor current = set current (P8) × half current percentage (P37).
- ✧ Parameter P37, half flow percentage, unit: 1%. The default is 50.
- ✧ Parameters p38 and P39 are used to view the alarm history.
- ✧ Parameter P40, slave station number setting, station number can be set from 1-65535 stations. After the station number is set, it needs to be powered on again before the parameter is used.

6 key panel and parameter adjustment method

6.1 key panel

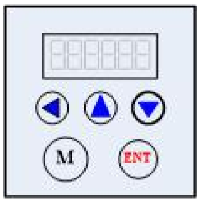


Figure 55 JMC 2hss858-EC key panel

The key panel consists of 4 keys and 4 LED displays. LED indicates the power supply and four digit nixie tube to display the status, and the operation of nixie tube panel is shown in the figure. Select the display mode by "M" key, and select the running state of the monitoring motor by "UP"

Table 43 monitoring code of JMC 2HSS858-EC key panel

LED display	d00SPR	d01SPF	d02PLE	d03PLR	d04PLF	XX_Err	En_OFF
Meaning	Reference speed	Feedback speed	position error	Location given	Position feedback	Drive failure	Drive offline

1) Shift set key

"◀" : shift function;

"▲" : parameter adjustment, adding function;
"▼" :parameter adjustment, reduce function

2) Function key

"ENT" key: confirm and save;

"M" key: undo exit, function switch key;

Note: switch to the parameter display function through "M"; use "ENT" key to view the parameter value (power on display is the parameter value you finally view), press "▼" or "▲" to switch the function; (the "◀" key is invalid) to exit this function and go to the next function, press "M".

6.2 Key operation method

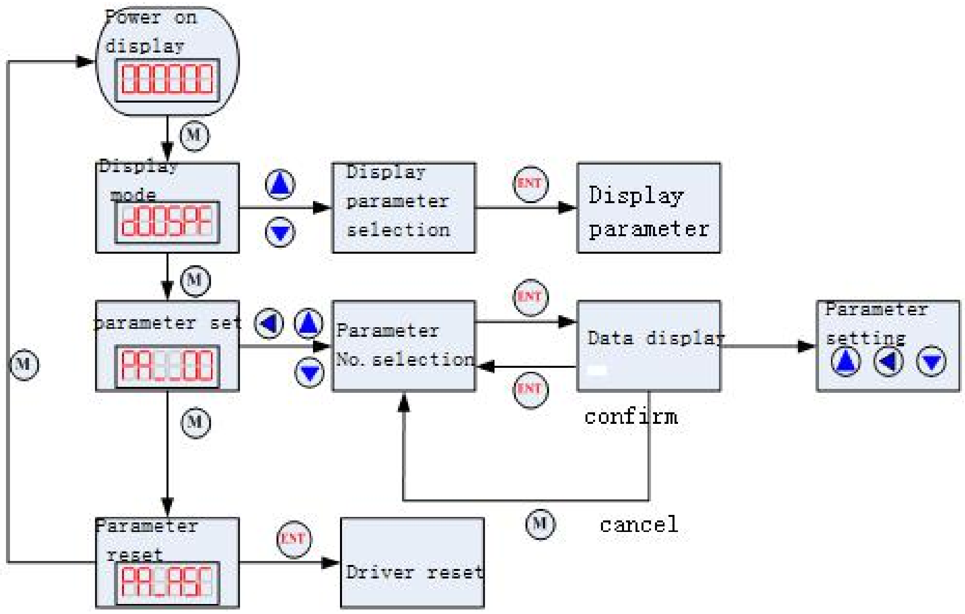


Figure 56 Operation flow chart of key panel of 2HSS858-EC

6.3 Example of operation

1) Example of mode operation

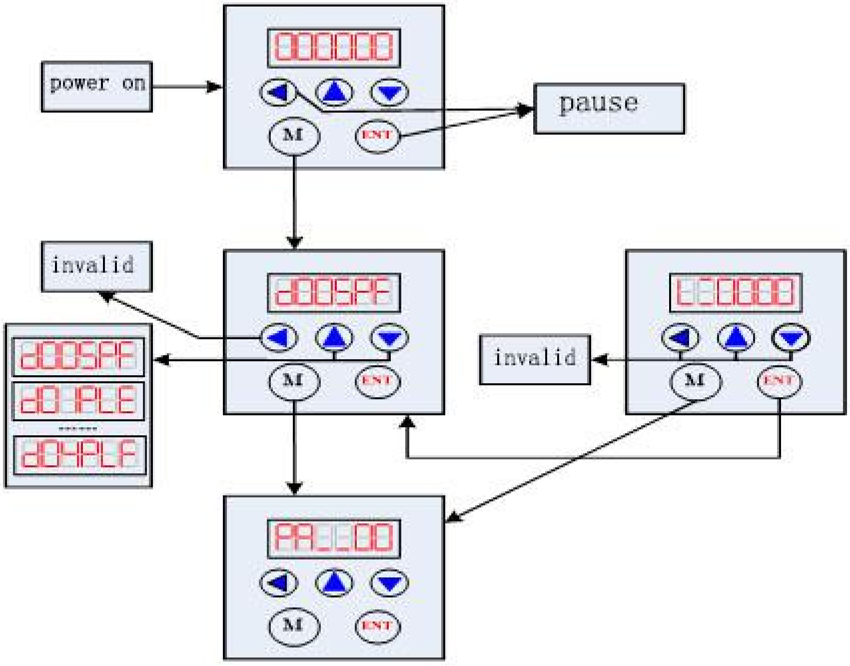


Figure 57 Display mode operation diagram of JMC 2HSS858-EC key panel

2） Example of parameter adjustment operation

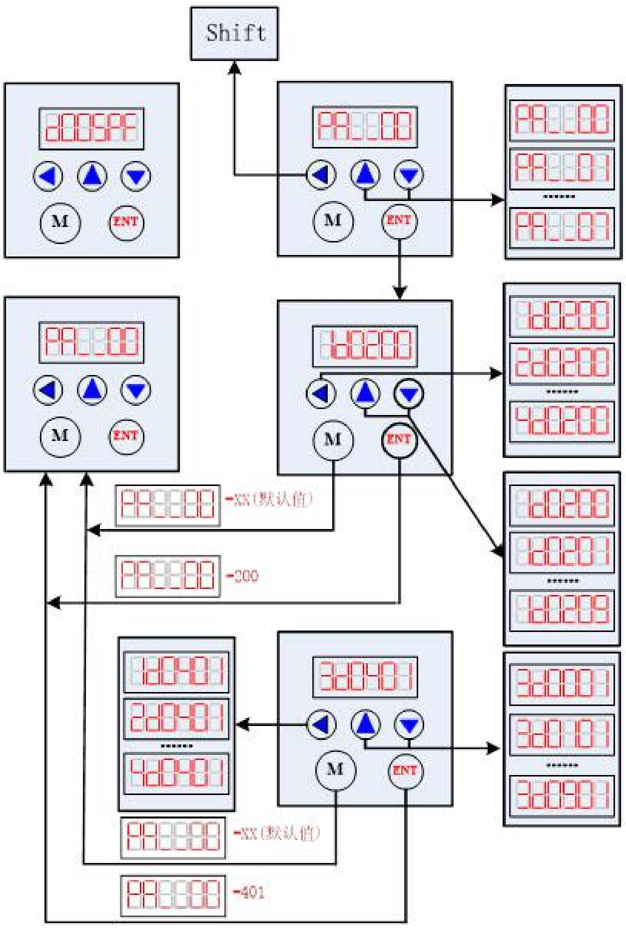


Fig. 58 operation diagram of JMC 2HSS858-EC key panel parameter adjustment

Note: the factory default current ring, position ring and speed ring parameters of the driver are the best parameters of the matching motor. Generally, the customer does not need to modify them, but only needs to select the motor fraction and the percentage of open and closed-loop current according to the needs of the system control.

7 Fault alarm

Table 44 Fault alarm of driver 2HSS858-EC

Panel Display	Fault description	Removable or not
E101	Over current	No
E102	Reference voltage fault	No
E103	Parameter read / write failure	No
E104	Over-voltage	No
E105	Motor phase failure	No
E106	Position out of tolerance	No
E107	Motor enable	No

8 Matched motor

Table 45 Matched motor of 2HSS858-EC

Base		Model	Step angle (deg)	Static moment (N•m)	Rated current (A)	rotor inertia (g-cm²)	Weight (kg)	Length (mm)
Two phase	86	86J1880EC-1000(*)	1.8	4.5	6	1400	2.4	80
		86J1895EC-1000(*)	1.8	6.5	6	2200	3.4	95
		86J18118EC-1000(*)	1.8	8.5	6	2700	3.9	118
		86J18156EC-1000(*)	1.8	12	6	4000	5.3	156

9 Quick guide

9.1 Hardware wiring

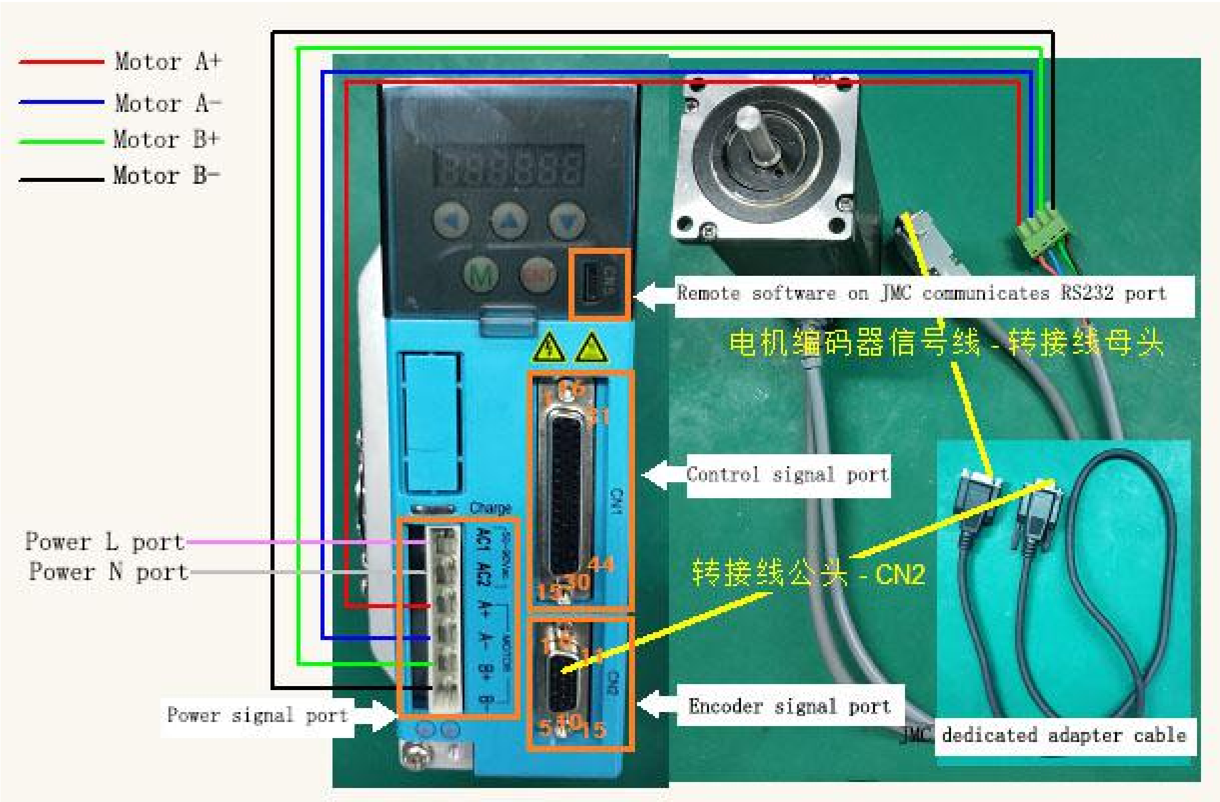


Figure 59 hardware wiring diagram of JMC 2HSS858-EC

For the specific definition of each port, see "driver interface and wiring" (Ctrl + left mouse button or click the text to jump).

9.2 Parameter setting

The usage of this panel is almost the same as "2HSS458-EC". Jump to " Setting flow chart of 2HSS458-EC key panel parameter P43" (Ctrl + left mouse button or click text to jump).

Frequently asked question and solve

When the drive fails, the key panel will display, and the user can determine the problem according to the fault alarm code in the panel. For example, after the power is turned on, the motor does not run or the key panel displays "44_Err" when running, that is, the motor position is out of tolerance alarm. Check whether the motor is overloaded or the encoder feedback wiring is loose. After processing, power on and reset. At the same time, you can also query the error by checking the object dictionary 0x1001, or query the status of the drive through the status word 0x6041.

1 No digital display after power on

- ✧ Input power failure, please check the power line, whether the voltage is too low

2 Alarm after powering on or running a small angle

- ✧ Check whether the motor feedback signal line and the motor power phase line are connected, and whether the key panel displays "55_Err"
- ✧ Whether the input power voltage of the stepping servo driver is too high or too low, and whether the key panel displays "33_Err"
- ✧ Whether the phase sequence of the motor is connected correctly. If it is not correct, please refer to the motor logo and connect the corresponding phase sequence of the driver
- ✧ In the driver configuration parameters, whether the number of lines of the motor encoder is consistent with the actual parameters of the connected motor, if it is different, reset it

3 Power on, display alarm signal on the driver

- ✧ Check whether the master station and the slave station are communicating normally, if they cannot communicate, check the station number and baud rate setting
- ✧ After the baud rate and station number are confirmed, the communication cannot be established, please check whether the terminal resistance is connected to the network
- ✧ Check whether there is an error alarm in the status word, if there is, you can check the object dictionary 0x1001 or 0x1003 sub-index 1 to view the current error reason

4 The motor does not run after giving various parameters

- ✧ Check whether the given parameters meet the parameter requirements
- ✧ Check if the limit switch has alarm limit

HSS-EC Integrated bus hybrid stepper servo motor series

➢ Product introduction

IHSS-EC integrated bus hybrid stepper servo motor series products are a new type of bus integrated stepper motor that is perfectly integrated into the EtherCAT bus communication control technology. The stepper motor driver uses standard EtherCAT bus communication protocol (CoE) and DS402 control protocol control algorithm. Compared with the combination of traditional stepper driver and stepper motor, the cost is lower, the installation is more convenient, and it can effectively avoid the stepper motor step loss problem, suppress the motor temperature rise, significantly reduce the motor vibration, and greatly enhance the high-speed performance of the motor. This integrated stepper motor integrates the advantages of bus communication control, simple wiring, no step loss, low temperature rise, high speed, high torque, low cost, and easy maintenance. It is a cost-effective motion control product.

➢ Technical characteristics

- ✧ No lost steps, accurate positioning
- ✧ Support standard 100M full-duplex EtherCAT bus network interface and CoE communication protocol
- ✧ Built-in DS402 motion control protocol synchronization cycle position, contour position, contour speed and homing control mode
- ✧ Built-in CW, CCW, HW three 5V or 24V IO signal input for limit and zero return
- ✧ A BRAKE signal output signal and in-position signal
- ✧ 100% rated torque drive motor
- ✧ Variable current control technology, high current efficiency
- ✧ Low vibration, stable operation at low speed
- ✧ Built-in acceleration and deceleration control to improve the smoothness of start and stop
- ✧ User can customize microstep
- ✧ Compatible with 1000 encoder line and 2500 encoder line
- ✧ No need to adjust general application parameters
- ✧ Over-current protection, over-voltage protection, under-voltage protection and over-tolerance protection

➢ IHSS57-EC

1 Electrical, mechanical and environmental indicators

Form 46 JMC IHSS57-EC Integrated motor performance parameters

Input Power		20~50VDC
Continuous current input		4.0A
Communication type		EtherCAT Protocol（CoE）
Maximum communication distance		Between slaves 100M
Maximum support slave station number		65535
Logic input current		7~20mA（10mA Typical value）
Protection		Overcurrent operating value, peak value 12A ± 10%
		Overvoltage voltage action value 200VDC
		Tolerance alarm threshold can be set via the driver's front panel or handheld smart regulator
Dimensions（mm）		128×91×56
Weight		About 1500g
Environment	Occasion	Try to avoid dust, oil mist and corrosive gas
	Working Temperature	0~70℃
	Storage temperature	-20℃~+80℃
	Humidity	40~90%RH
	Cooling method	Natural cooling or strong cooling air

2 Mechanical installation dimensions

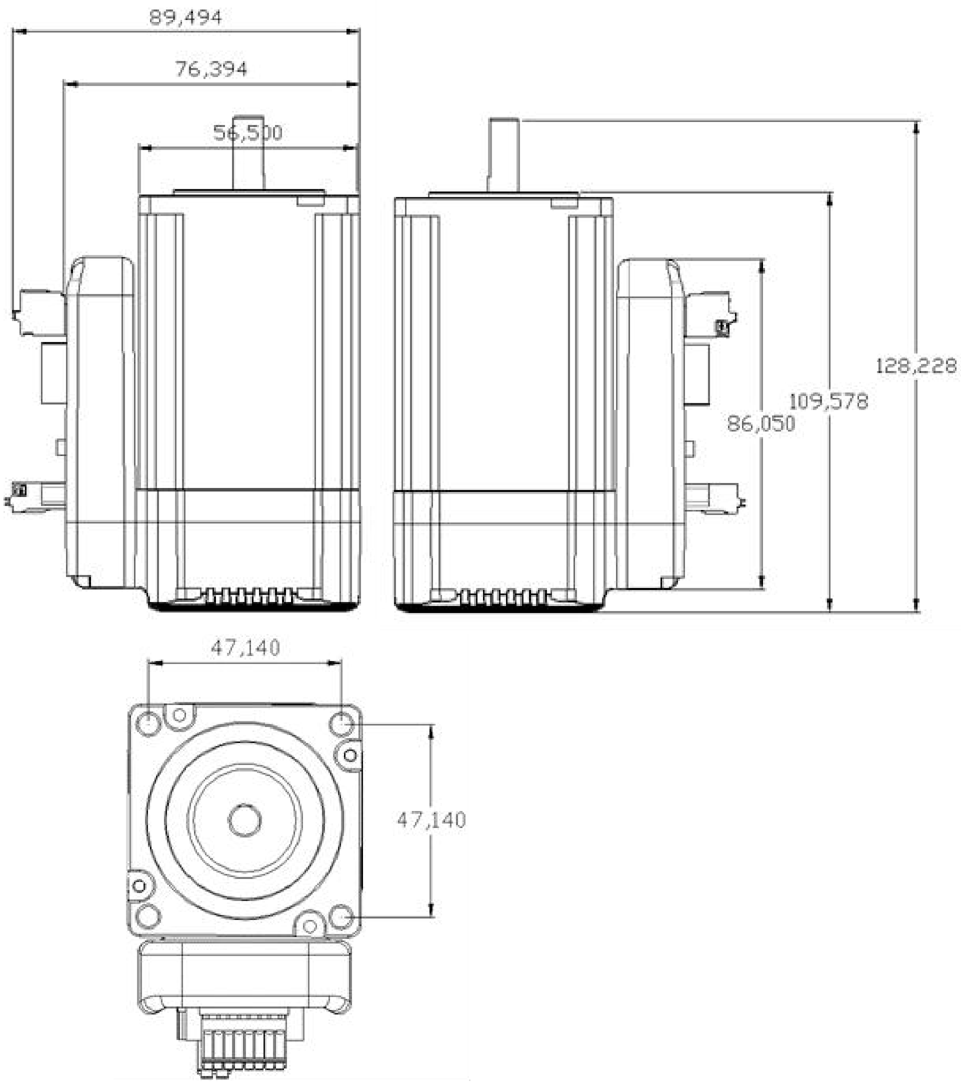


Figure 60 JMC IHSS57-EC Mechanical installation dimensions of integrated motor (Unit: mm)

3 Driver interface and wiring

3.1 Power signal port

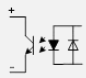
Table 47 JMC IHSS57-EC power signal port

Port	Symbol	Name	Explanation
1	DC+	Power input positive	DC + and GND indirect 24~48VDC
2	GND	Power input ground	
3	BK+	Brake power supply +	24V

4	BK-	Brake power supply -	0V

3.2 Control signal port（10 pin）

Table 48 JMC IHSS57-EC control signal port

Port	Symbol	Name	Explanation
1	COM	Public end	24VDC/GND
2	CW-	Clockwise limit -	
3	HW+	Mechanical origin limit +	Compatible with 5V and 24V
4	CCW+	Counterclockwise limit +	
5	DI3	Probe 1 input	Compatible with 5V and 24V
6	DI4	Probe 2 input	
7	DO1+	Alarm Output +	
8	DO1-	Alarm Output -	
9	DO2+	Output in place +	
10	DO2-	Output in place -	

3.3 Control signal interface circuit diagram

Control signal input and output interface circuit diagram

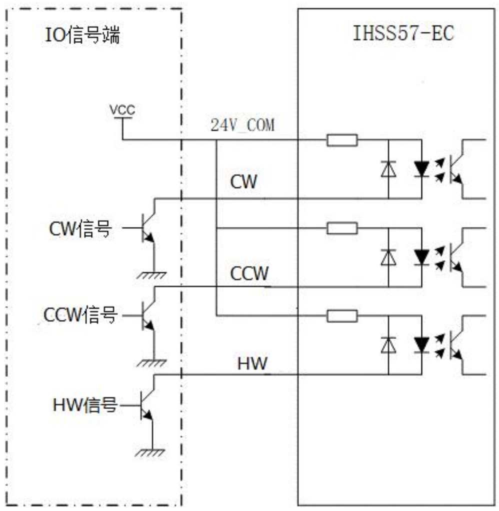


Figure 61 JMC IHSS57-EC Control signal common anode connection

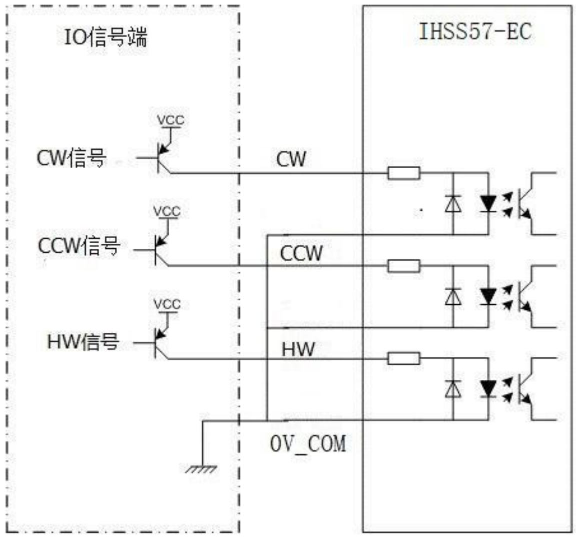


Figure 62 JMC IHSS57-EC Control signal common cathode connection

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

4 Typical application wiring diagram

The typical wiring diagram composed of IHSS57-EC driver is shown in the figure below. The power supply selects DC20 ~ 50V according to the matching motor voltage level.

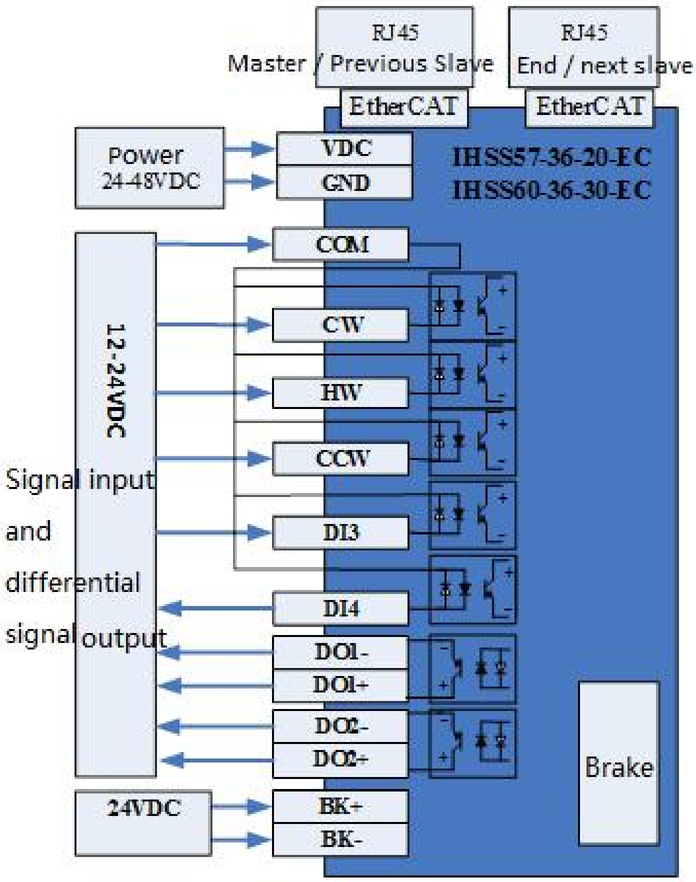


Figure 62 JMC IHSS57-EC Control signal common cathode connection

Note:

1) BRAKE signal needs external relay control for motor brake control, the maximum passing current is 50mA.

2) The RJ45 network interface is connected to other slave stations through a 100BASE-TX two-pin cable. There is no special difference between the two network ports.

5 Parameter setting of driver

Driver parameter setting method: Through the RS232 serial communication port of the HISU debugger, special debugging software is used to complete the parameter setting. There is a set of best default factory configuration parameters corresponding to the motor inside the drive. The user only needs to adjust the internal subdivision number of the drive according to the specific usage. The specific parameters and functions are shown in the following table:

The actual value of the parameter = set value × corresponding dimension

Table 49 JMC IHSS57-EC Drive internal parameters

No.	Name	Range	dimension	Restart the driver	Default parameter
P1	Current loop proportional gain	0—4000	1	No	1000
P2	Current loop integral gain	0—1000	1	No	100
P3	Drive damping coefficient	0—500	1	No	250
P4	Position loop proportional gain	0—3000	1	No	2000
P5	Position loop integral gain	0—1000	1	No	200
P6	Speed loop proportional gain	0—3000	1	No	500
P7	Speed loop integral gain	0—1000	1	No	1000
P8	Drive open loop current	0—60	0.1	No	40
P9	Manufacturer parameters	Reserved	Reserved	Reserved	Reserved
P10	Manufacturer parameters	Reserved	Reserved	Reserved	Reserved
P11	Drive direction level	0—1	1	No	1
P12	Manufacturer parameters	Reserved	Reserved	Reserved	Reserved
P13	Manufacturer parameters	Reserved	Reserved	Reserved	Reserved
P14	Driver in place level	0—1	1	No	0
P15	Manufacturer parameters	Reserved	Reserved	Reserved	Reserved
P16	Manufacturer parameters	Reserved	Reserved	Reserved	Reserved
P17	Drive segmentation	0—15	1	Yes	2

	selection				
P19	Drive command smoothing	0—10	0	No	2
P20	User-defined Subdivision	4—1000	50	Yes	8
P21	Manufacturer parameters	Reserved	Reserved	Reserved	Reserved
P22	Manufacturer parameters	Reserved	Reserved	Reserved	Reserved
P23	Manufacturer parameters	Reserved	Reserved	Reserved	Reserved
P24	Manufacturer parameters	Reserved	Reserved	Reserved	Reserved
P25	Open and closed loop superimposed ratio	0—40	1	No	10
P26	Drive stops damping	0—500	1	No	200
P27	Drive low speed damping	0—500	1	No	50
P28	Manufacturer parameters	Reserved	Reserved	Reserved	Reserved
P29	Manufacturer parameters	Reserved	Reserved	Reserved	Reserved
P30	Drive phase loss detection	0—1	1	Yes	1
P31	Manufacturer parameters	Reserved	Reserved	Reserved	Reserved
P32	Manufacturer parameters	Reserved	Reserved	Reserved	Reserved
P33	Manufacturer parameters	Reserved	Reserved	Reserved	Reserved
P34	Manufacturer parameters	Reserved	Reserved	Reserved	Reserved
P35	Manufacturer parameters	Reserved	Reserved	Reserved	Reserved
P36	Half flow time	0—60000	Ms	No	500
P37	Half flow percentage	0—100	1%	No	50
P38	Drive alarm history 1				
P39	Drive alarm History 2				
P40	Drive station number setting	1—65535	1	Yes	1

The user can modify the following parameters through the panel of the driver, or download them to the driver through HISU. The setting of each parameter is explained separately below:

- ✧ Parameters P1, P2, P3, P4, P5, P6, and P7 are used to set the current loop, system damping, position loop, and speed loop.
- ✧ Parameters P8 and P9 are used to set open-loop current and closed-loop control current (actual current = open-loop current + closed-loop current).
- ✧ Parameter P10 is used for alarm output level selection. Parameter 0 indicates that the optocoupler output transistor is cut off during normal operation; when the driver alarms, the optocoupler output transistor is turned on. vice versa.
- ✧ Parameter P11 is used for direction level selection. Through the setting of this parameter, the control direction of the control terminal level can be changed.
- ✧ Parameter P14, select the in-place output level, 0 means the optocoupler output transistor is off when the driver meets the in-place condition; the optocoupler output transistor is on when the in-position condition is not met vice versa.
- ✧ Parameter P15, encoder line number selection, 0 means 1000 lines, 1 means 2500 lines.
- ✧ Parameter P16, set the threshold of position deviation (actual value = set value × 10).

✧ Parameter P17, the subdivision setting of the driver.

Table 50 JMC IHSS57-ECDriver parameter P17: driver micro-step

Parameter	0	1	2	3	4	5	6	7
Micro-step	Customize micro-step	800	1600	3200	6400	12800	25600	51200
parameter	8	9	10	11	12	13	14	15
Micro-step	1000	2000	4000	5000	8000	10000	20000	40000

Tip: In addition, the driver also provides users with any subdivision that can be set freely. The specific parameters are set by mode P20.

✧ Parameter P18, drive single and double pulse setting, 1 is pulse + direction, 0 is double pulse mode.

✧ Parameter P19, command smoothing coefficient

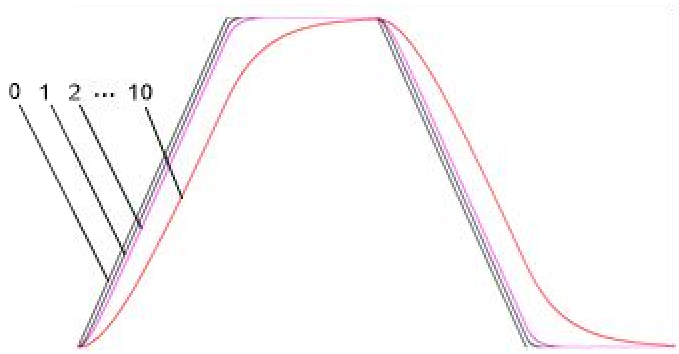


Figure 64 JMC IHSS57-EC Drive parameter P19: command smoothing coefficient

✧ Parameter P20, used for user-defined subdivision.

✧ Parameter P30, drive phase loss detection, 1 means open, 0 means close. Limited to factory maintenance use.

✧ Parameter P36, half flow time, unit ms. The default is 1000, which means that after the motor stops for 1000ms,

✧ Motor current = set current (P8) * half current percentage (P37).

✧ Parameter P37, half flow percentage, unit 1%. The default is 50.

✧ Parameters P38 and P39 are used to view the alarm records.

✧ Parameter P40, slave station number setting, the station number can be set from 1-65535 station numbers. After setting the station number, you need to power on again to use this parameter.

6 Parameter adjustment method

6.1 Connect with HISU debugger

The cable connected to the HISU servo debugger must be a dedicated cable. Please confirm before use to avoid damage.

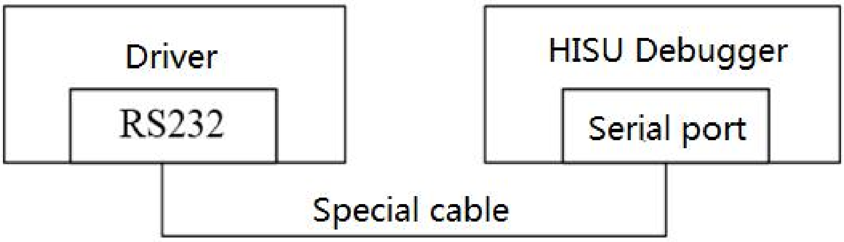


Figure 65 JMC IHSS57-EC Connect with HISU debugger

6.2 Set driver parameters

The method of setting the driver parameters through the HISU debugger: the RS232 serial communication port of the driver is connected to the HISU debugger, and a special communication cable is used for key operation and panel prompts.

1) Operation Introduction

① The rEAdy__ diagram at power-on is as follows:

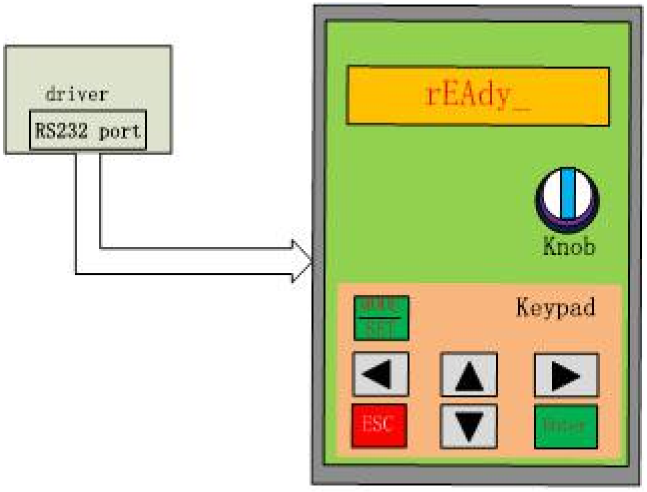


Figure 66 JMC HISU (Handhold intelligent setup unit) power on display

② It displays as follows when the connection is successful (the LED digital tube will keep flashing if not connected):

Figure 67 JMC HISU Successful display of connection

③ Mode function switching (after successful connection, enter various mode functions by MODE key, the following figure is the parameter reset function):

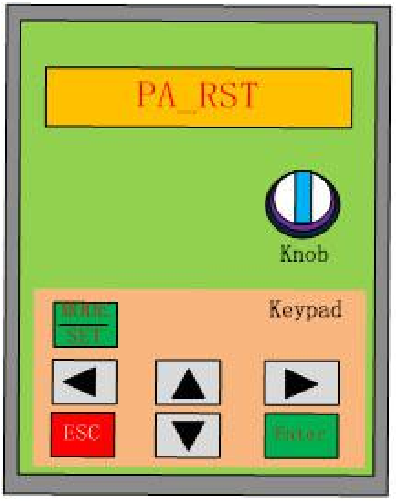


Figure 68 JMC HISU Handheld debugger mode function switch

The function description is shown in the table below:

Table 51 JMC HISU mode function description

LED display	Function	Remarks
PR_RST	Parameter reset	Parameter initialization
PA_ _01	Parameter adjustment	Adjust parameter value
dA_ _UP	Parameter upload / download	Multi-group parameter upload / download

2) Detailed operation

①General block diagram of key operation

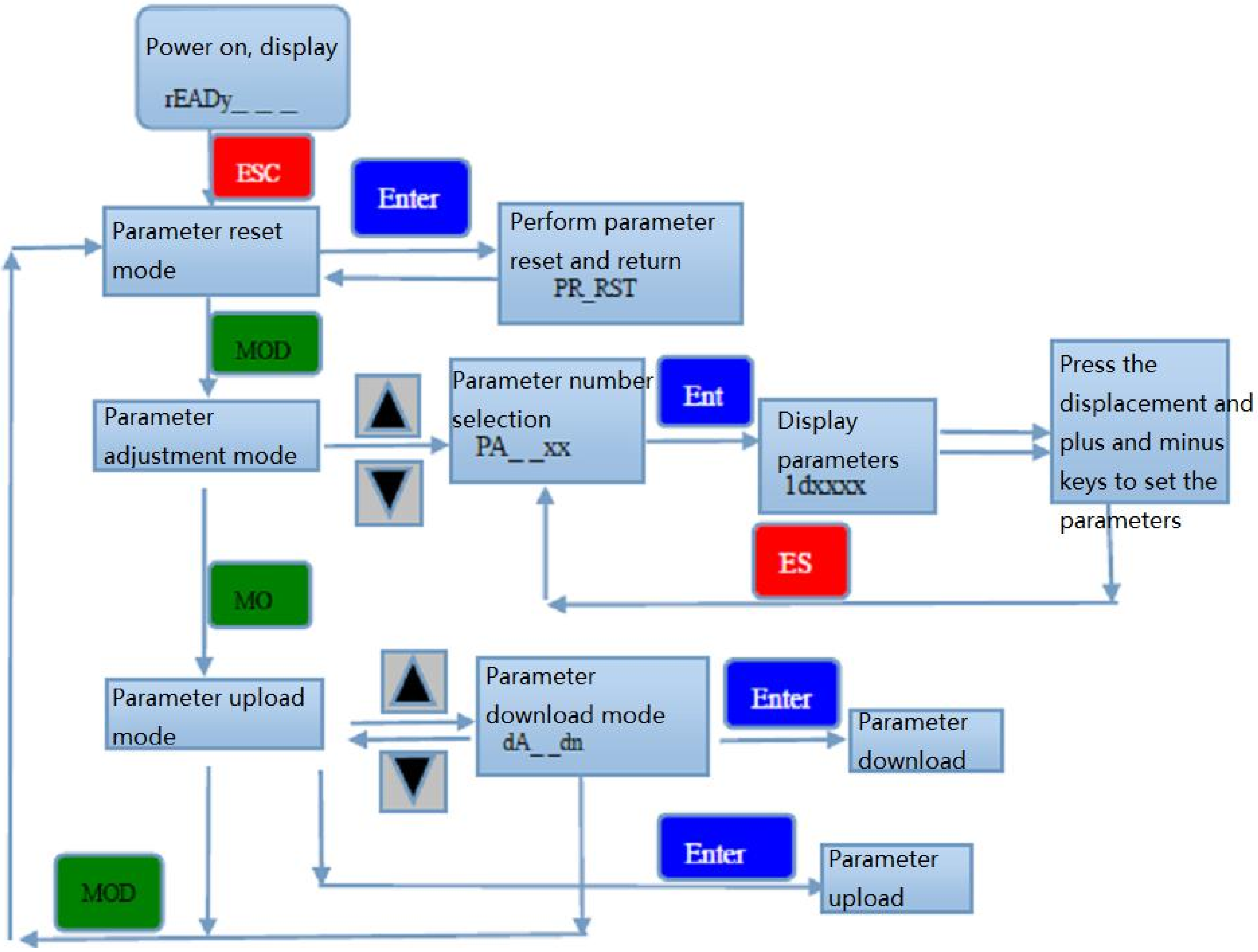


Figure 69 JMC HISU key operation flow chart

Note: Press each function key to adjust the mode or parameter. The arrow indicates the effect after pressing the key.

②Operation example of parameter mode

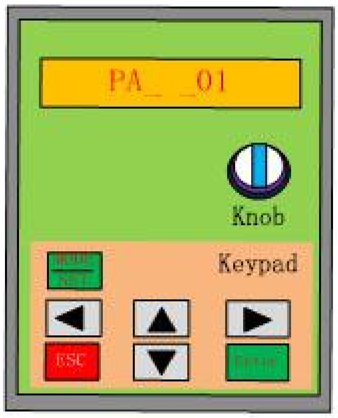


Figure 70 JMC HISU Parameter adjustment

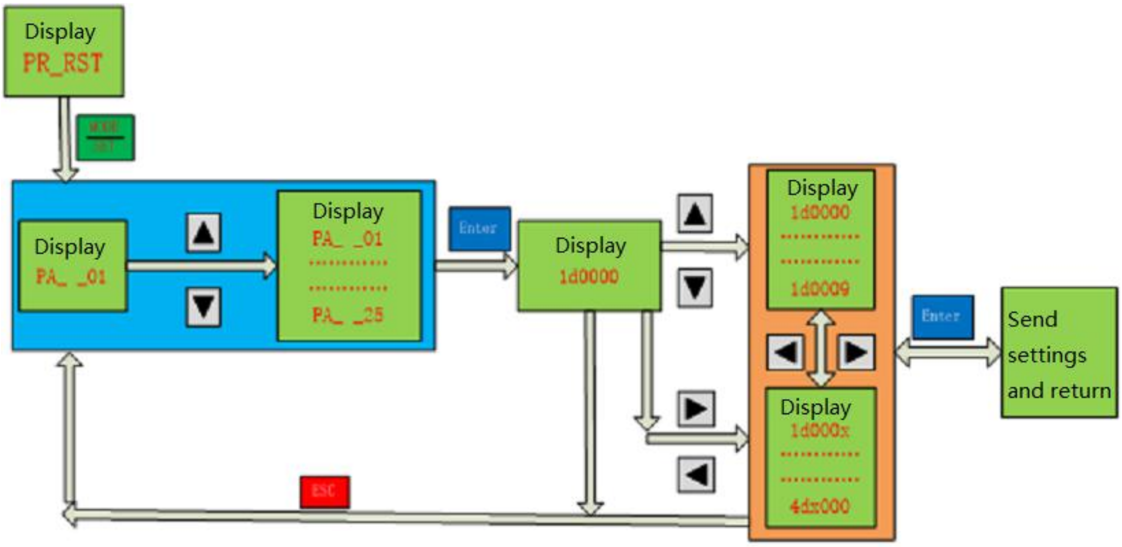


Figure 71 JMC HISU parameter adjustment flowchart

Note: The adjustment range of each parameter is 0--4000. When you press the Enter key to enter the adjustment parameter, you can view the initial value of the parameter. After changing the parameter, the actual return value of the drive is displayed (such as: Change the sending value to 9, and actually return to 1, it will display as 1).

7 Fault alarm

7.1 Alarm timing diagram

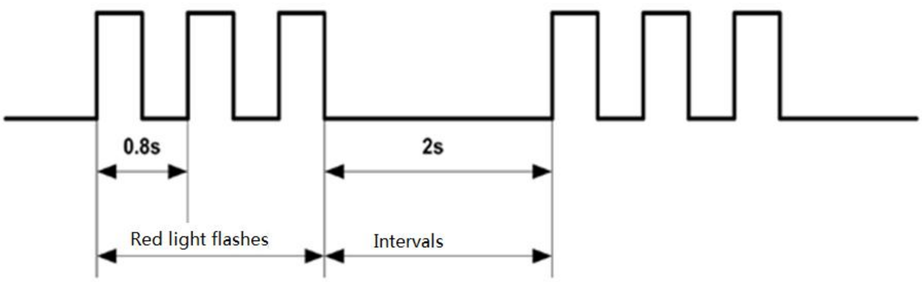


Figure 72 JMC IHSS57-EC Integrated motor alarm timing

7.2 Signal flashing times

Table 52 JMC IHSS57-EC The meaning of the blinking of the integrated motor signal lamp

Flashing Times		Alarm description
Red	Green	
No	Flashing	Drive CAN communication is not linked
No	Light up	The drive is powered on normally
1	Light up	Drive overcurrent
2	Light up	Drive parameter upload error
3	Light up	Drive supply voltage is below the minimum
4	Light up	Drive position is out of tolerance
5	Light up	Drive communication error
6	Light up	CCW direction limit
7	Light up	CW direction limit
8	Light up	SW direction limit
9	Light up	Drive overheated
10	Light up	Motor phase loss

8 Quick guide

8.1 Hardware wiring

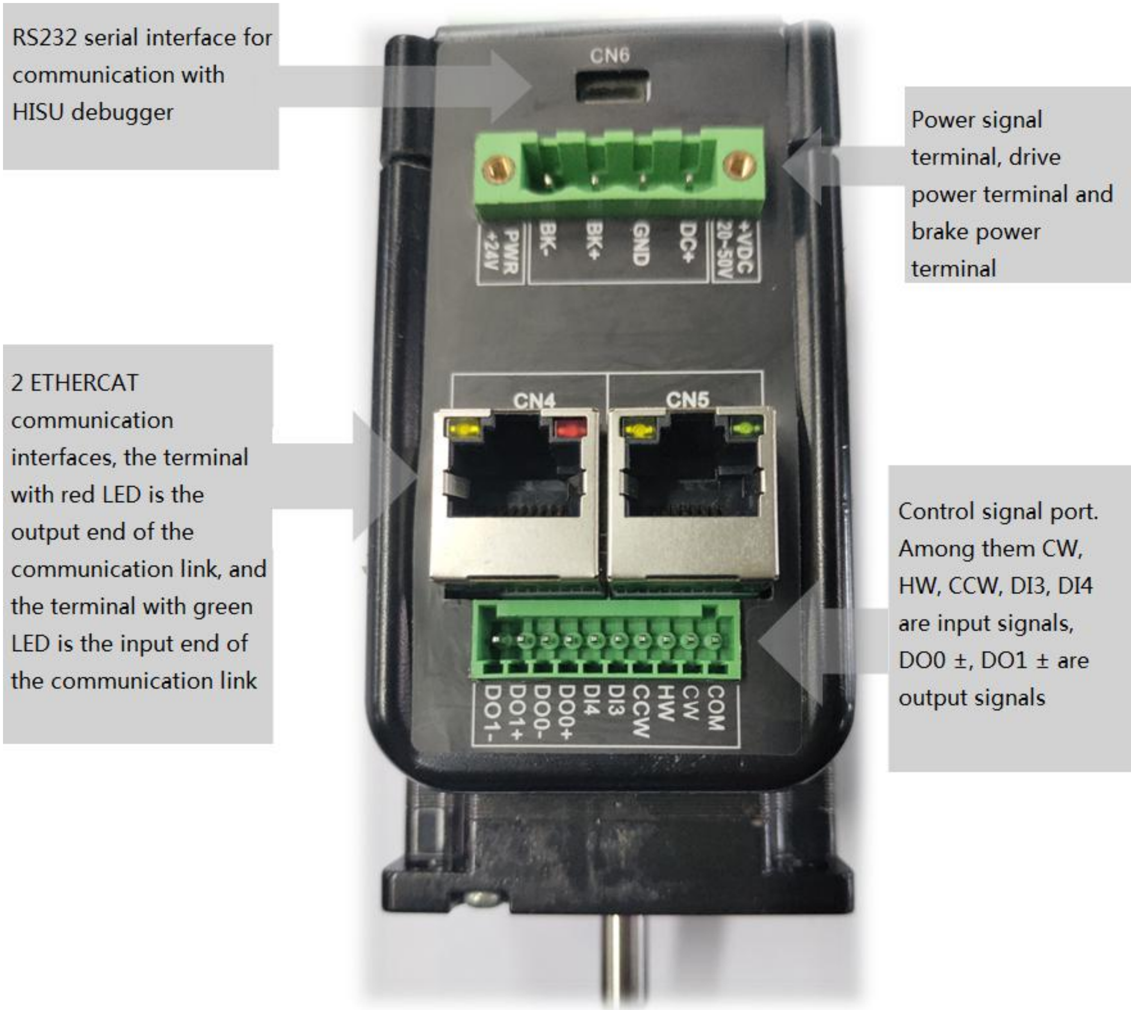


Figure 73 JMC IHSS57-EC Picture of integrated motor

For the specific definition of each port, please refer to "*Drive interface and wiring*" (Ctrl + left mouse button or click the text to jump).

8.2 Parameter settings

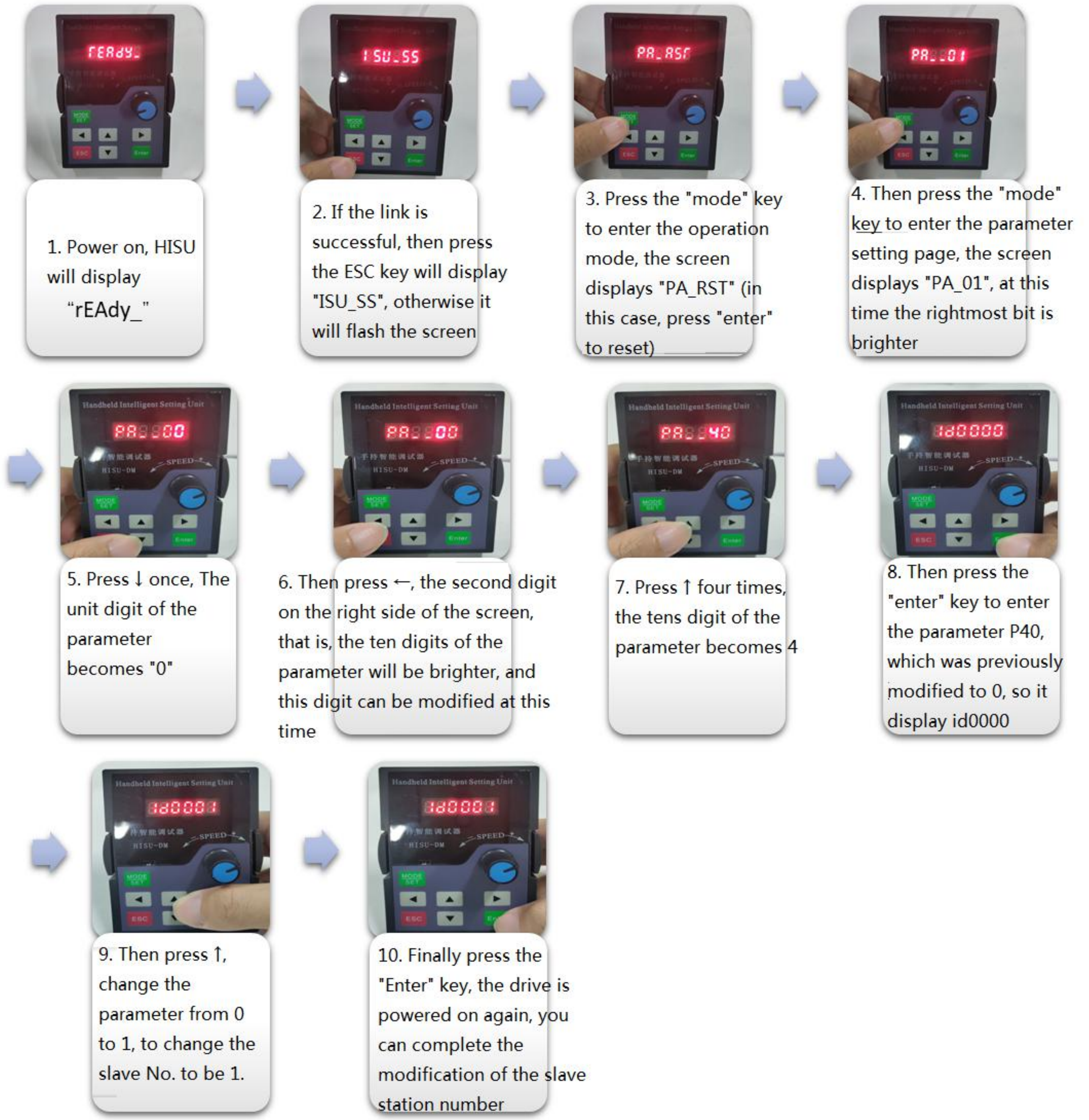


Figure 74 Flow chart of setting the IHSS57-EC parameter P43 by the HISU

The above is an example of the operation mode of the RC series driver. It is the same as the EC series operation but different in function. Other operations are similar. You can grasp the operation mode of the key panel according to the above flowchart.

➢ IHSS60-EC

1 Electrical, mechanical and environmental indicators

Table 53 JMC IHSS60-EC Integrated motor performance parameters

Input Power		20~50VDC
Continuous current input		4.0A
Communication type		EtherCAT Protocol
Maximum communication distance		Between slaves 100M
Maximum support slave station number		128
Logic input current		7~20mA（10mA Typical value）
Protection		Overcurrent operating value, peak value 12A ± 10%
		Overvoltage voltage action value 200VDC
		Tolerance alarm threshold can be set via the driver's front panel or handheld smart regulator
Dimensions（mm）		151×96×60
Weight		About 1500g
Environment	Occasion	Try to avoid dust, oil mist and corrosive gas
	Working Temperature	0~70℃
	Storage temperature	-20℃~+80℃
	Humidity	40~90%RH
	Cooling method	Natural cooling or strong cooling air

2 Mechanical installation dimensions

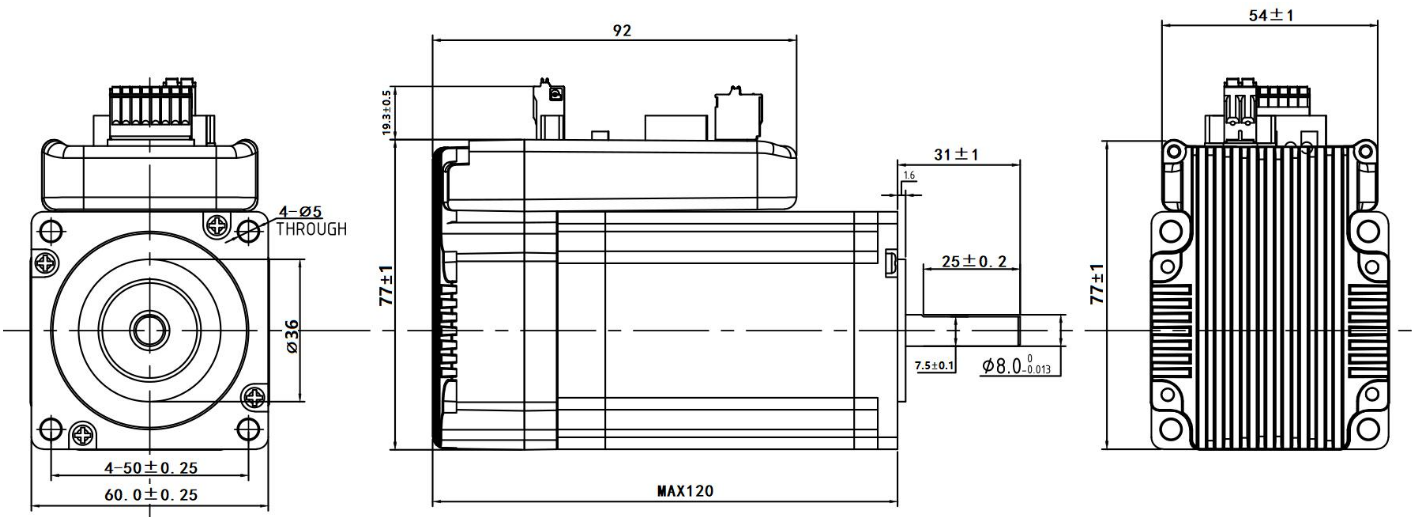


Figure 75 JMC IHSS60-EC Mechanical installation dimensions of integrated motor (Unit: mm)

3 Driver interface and wiring

3.1 Power signal port

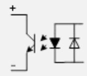
Tabel 54 JMC IHSS60-EC Power signal port

Port	Symbol	Name	Explanation
1	DC+	Power input positive	DC + and GND indirect 24~48VDC
2	GND	Power input ground	
3	BK+	Brake power supply +	24V
4	BK-	Brake power supply -	0V

3.2 Control signal port (10 pin)

Tabel 55 JMC IHSS60-EC Control signal port

Port	Symbol	Name	Explanation
1	COM	Public End	Compatible with 5V and 24V
2	CW	Clockwise limit	
3	HW	Mechanical origin limit	Compatible with 5V and 24V
4	CCW	Counterclockwise limit	
5	DI3	Probe 1 input	Compatible with 5V and 24V
6	DI4	Probe 2 input	
7	DO1+	Alarm Output +	

8	DO1-	Alarm Output -	
9	DO2+	Output in place +	
10	DO2-	Output in place -	

3.3 Control signal interface circuit diagram

Control signal input and output interface circuit diagram

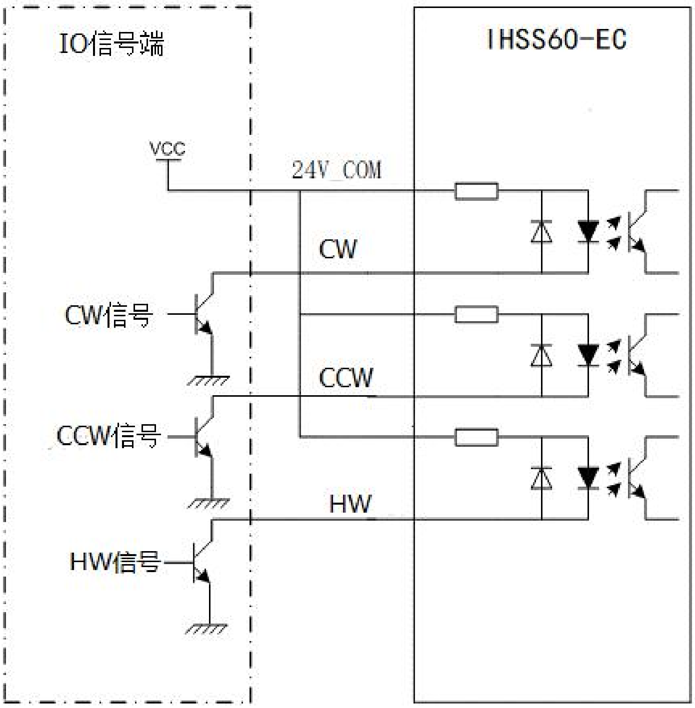


Figure 76 JMC IHSS60-EC Control signal common anode connection

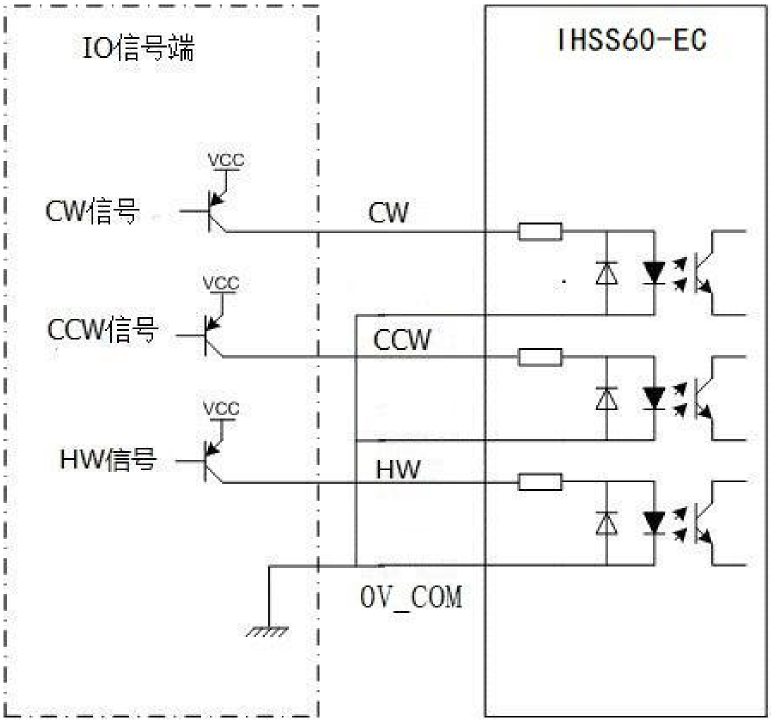


Figure 77 JMC IHSS60-EC Control signal common cathode connection

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

4 Typical application wiring diagram

The typical wiring diagram composed of IHSS60-EC driver is shown in the figure below. The power supply selects DC20 ~ 50V according to the matching motor voltage level.

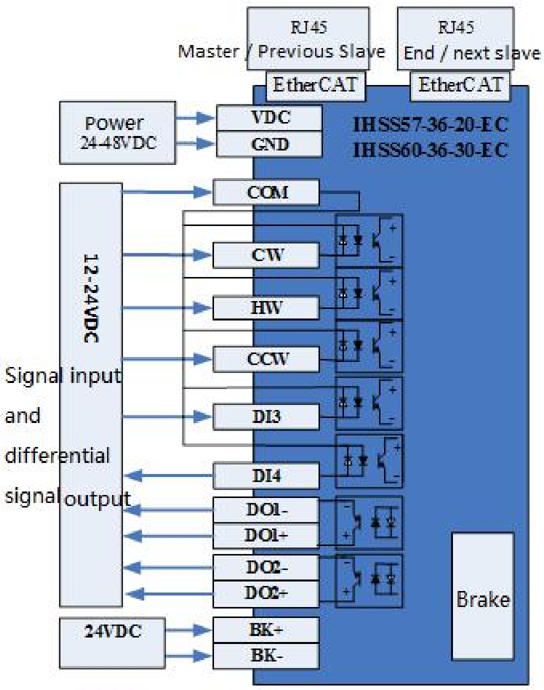


Figure 78 JMC IHSS60-EC Typical application wiring diagram of integrated motor

Note:

1) BRAKE signal needs external relay control for motor brake control, the maximum passing current is 50mA.

2) The RJ45 network interface is connected to other slave stations through a 100BASE-TX two-pin cable. There is no special difference between the two network ports.

5 Parameter setting of driver

IHSS60-EC driver parameter setting method: Through the RS232 serial communication port of the HISU debugger, special debugging software is used to complete the parameter setting. There is a set of best default factory configuration parameters corresponding to the motor inside the drive. The user only needs to adjust the internal subdivision number of the drive according to the specific usage. The specific parameters and functions are shown in the following table:

The actual value of the parameter = set value × corresponding dimension

Table 56 JMC IHSS60-EC Driver internal parameters

No.	Name	Range	Dimension	Restart the driver	Default parameter
P1	Current loop proportional gain	0—4000	1	No	1000
P2	Current loop integral gain	0—1000	1	No	100
P3	Drive damping coefficient	0—500	1	No	250
P4	Position loop proportional gain	0—3000	1	No	2000
P5	Position loop integral gain	0—1000	1	No	200
P6	Speed loop proportional gain	0—3000	1	No	500
P7	Speed loop integral gain	0—1000	1	No	1000
P8	Drive open loop current	0—60	0.1	No	40
P9	Manufacturer parameters	Reserved	Reserved	Reserved	Reserved
P10	Manufacturer parameters	Reserved	Reserved	Reserved	Reserved
P11	Drive direction level	0—1	1	No	1
P12	Manufacturer parameters	Reserved	Reserved	Reserved	Reserved
P13	Manufacturer parameters	Reserved	Reserved	Reserved	Reserved
P14	Driver in place level	0—1	1	No	0
P15	Manufacturer parameters	Reserved	Reserved	Reserved	Reserved
P16	Manufacturer parameters	Reserved	Reserved	Reserved	Reserved
P17	Drive segmentation selection	0—15	1	Yes	2
P19	Drive command smoothing	0—10	0	No	2
P20	User-defined subdivision	4—1000	50	Yes	8

P21	Manufacturer parameters	Reserved	Reserved	Reserved	Reserved
P22	Manufacturer parameters	Reserved	Reserved	Reserved	Reserved
P23	Manufacturer parameters	Reserved	Reserved	Reserved	Reserved
P24	Manufacturer parameters	Reserved	Reserved	Reserved	Reserved
P25	Open and closed loop superimposed ratio	0—40	1	No	10
P26	Drive stops damping	0—500	1	No	200
P27	Drive low speed damping	0—500	1	No	50
P28	Manufacturer parameters	Reserved	Reserved	Reserved	Reserved
P29	Manufacturer parameters	Reserved	Reserved	Reserved	Reserved
P30	Drive phase loss detection	0—1	1	Yes	1
P31	Manufacturer parameters	Reserved	Reserved	Reserved	Reserved
P32	Manufacturer parameters	Reserved	Reserved	Reserved	Reserved
P33	Manufacturer parameters	Reserved	Reserved	Reserved	Reserved
P34	Manufacturer parameters	Reserved	Reserved	Reserved	Reserved
P35	Manufacturer parameters	Reserved	Reserved	Reserved	Reserved
P36	Half flow time	0—60000	Ms	No	500
P37	Half flow percentage	0—100	1%	No	50
P38	Drive alarm history 1				
P39	Drive Alarm History 2				
P40	Drive station number setting	1—65535	1	Yes	1

The user can modify the following parameters through the panel of the driver, or download them to the driver through HISU. The setting of each parameter is explained separately below:

✧ Parameters P1, P2, P3, P4, P5, P6, and P7 are used to set the current loop, system damping, position loop, and speed loop.

✧ Parameters P8 and P9 are used to set open-loop current and closed-loop control current (actual current = open-loop current + closed-loop current).

✧ Parameter P10 is used for alarm output level selection. Parameter 0 indicates that the optocoupler output transistor is cut off during normal operation; when the driver alarms, the optocoupler output transistor is turned on. vice versa.

✧ Parameter P11 is used for direction level selection. Through the setting of this parameter, the control direction of the control terminal level can be changed.

✧ Parameter P14, select the in-place output level, 0 means the optocoupler output transistor is off when the driver meets the in-place condition; the optocoupler output transistor is on when the in-position condition is not met vice versa.

✧ Parameter P15, encoder line number selection, 0 means 1000 lines, 1 means 2500 lines.

✧ Parameter P16, set the threshold of position deviation (actual value = set value × 10).

✧ Parameter P17, the subdivision setting of the driver.

Table 57 JMC IHSS60-EC Driver parameter P17: driver subdivision

Parameter	0	1	2	3	4	5	6	7
Micro-step	Customize micro-step	800	1600	3200	6400	12800	25600	51200
Parameter	8	9	10	11	12	13	14	15
Micro-step	1000	2000	4000	5000	8000	10000	20000	40000

- ✧ Tip: In addition, the driver also provides users with any subdivision that can be set freely. The specific parameters are set by mode P20.
- ✧ Parameter P18, drive single and double pulse setting, 1 is pulse + direction, 0 is double pulse mode.
- ✧ Parameter P19, command smoothing coefficient

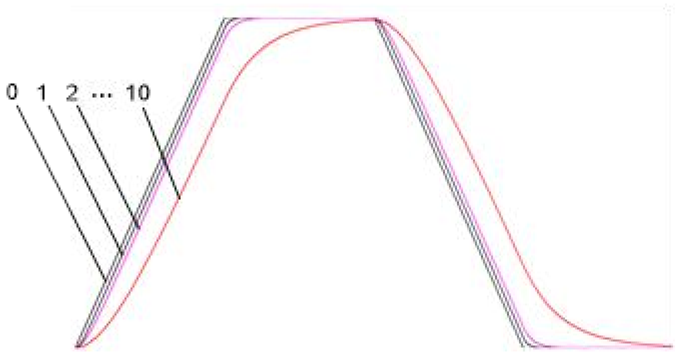


Figure 79 JMC IHSS60-EC Drive parameter P19: command smoothing coefficient

- ✧ Parameter P20, used for user-defined subdivision.
- ✧ Parameter P30, drive phase loss detection, 1 means open, 0 means close. Limited to factory maintenance use.
- ✧ Parameter P36, half flow time, unit ms. The default is 1000, which means that after the motor stops for 1000ms,
- ✧ Motor current = set current (P8) * half current percentage (P37).
- ✧ Parameter P37, half flow percentage, unit 1%. The default is 50.
- ✧ Parameters P38 and P39 are used to view the alarm records.
- ✧ Parameter P40, slave station number setting, the station number can be set from 1-65535 station numbers. After setting the station number, you need to power on again to use this parameter.

6 Parameter adjustment method

6.1 Connect with HISU debugger

The cable connected to the HISU servo debugger must be a dedicated cable. Please confirm before use to avoid damage.

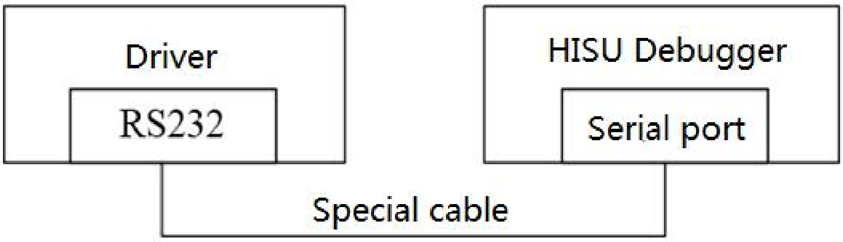


Figure 80 JMC IHSS60-EC Connect with HISU debugger

6.2 Set driver parameters

The method of setting the driver parameters through the HISU: the RS232 serial communication port of the driver is connected to the HISU, and a special communication cable is used for key operation and panel prompts.

1) Operation Introduction

① The rEAdy__ diagram at power-on is as follows:

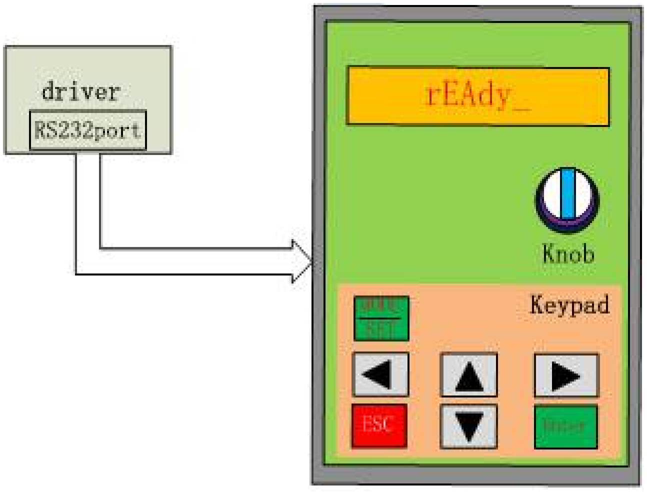


Figure 81 The HISU display when power on

② It will display as following when connect successfully. (the LED digital tube will keep flashing if not connected):

Figure 82 Display of HISU connect successfully

③ Mode function switching (after successful connection, enter various mode functions by MODE key, the following figure is the parameter reset function):

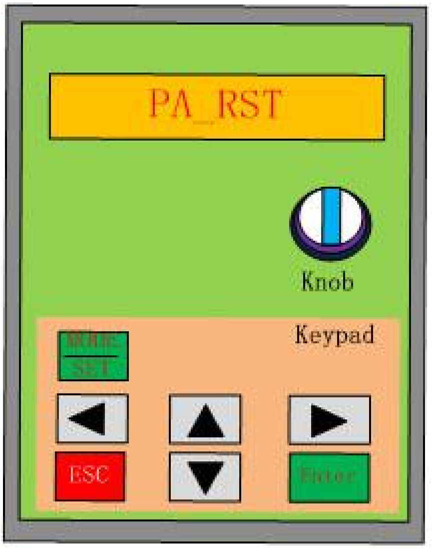


Figure 83 JMC HISU Handheld debugger mode function switch

The function description is shown in the table below:

Table 58 Mode function description of HISU

LED display	Function	Remarks
PR_RST	Parameter reset	Parameter initialization
PA_ _01	Parameter adjustment	Adjust parameter value
dA_ _UP	Parameter upload / download	Multi-group parameter upload / download

2) Detailed operation

① Operation picture of keys

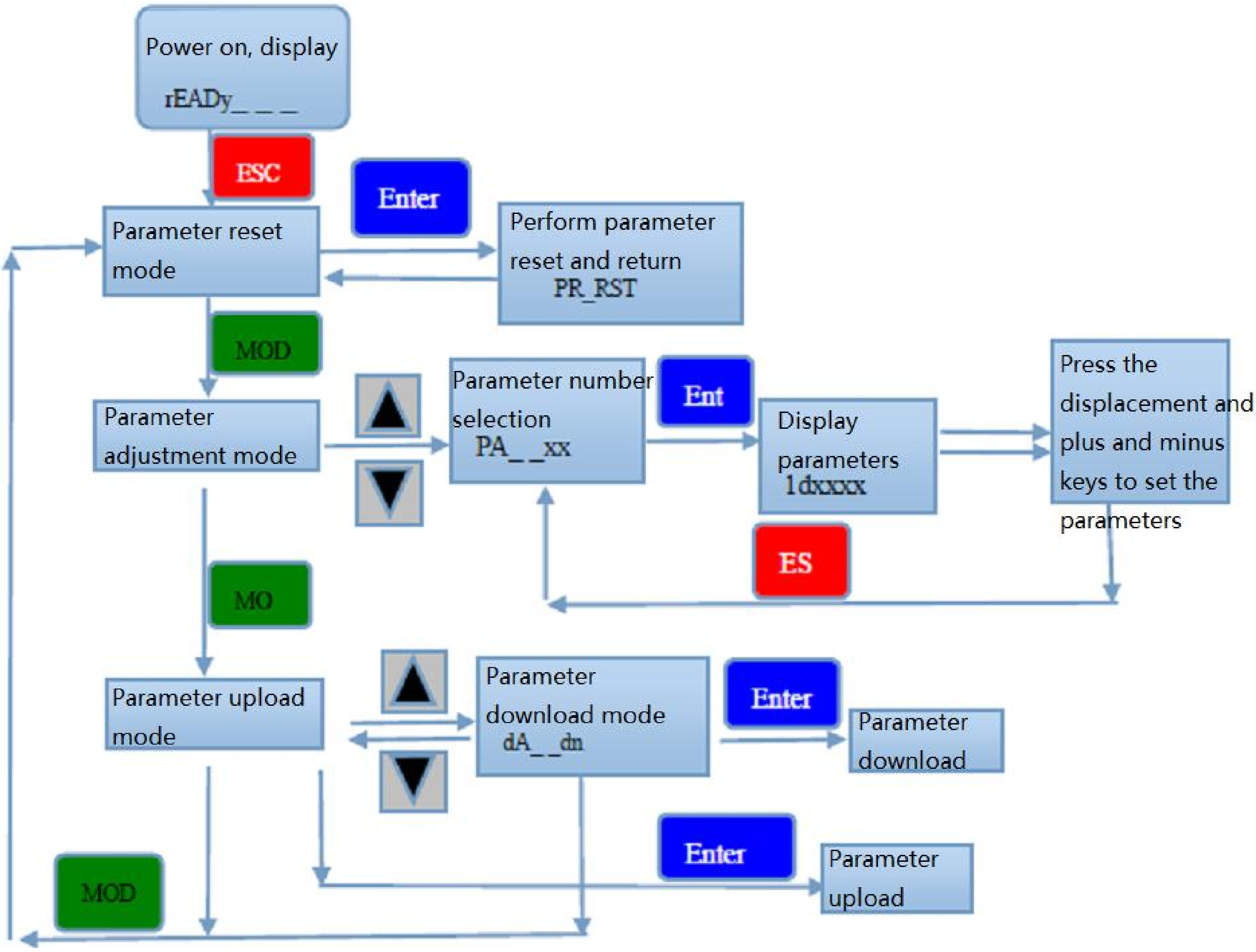


Figure 84 JMC Operation flow chart of key

Note: Press each function key to adjust the mode or parameter. The arrow indicates the effect after pressing the key.

② Example of parameter mode operation

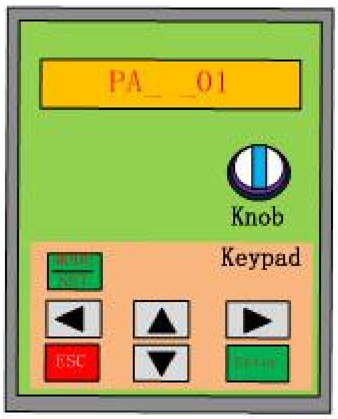


Figure 85 Parameter adjustment display of HISU

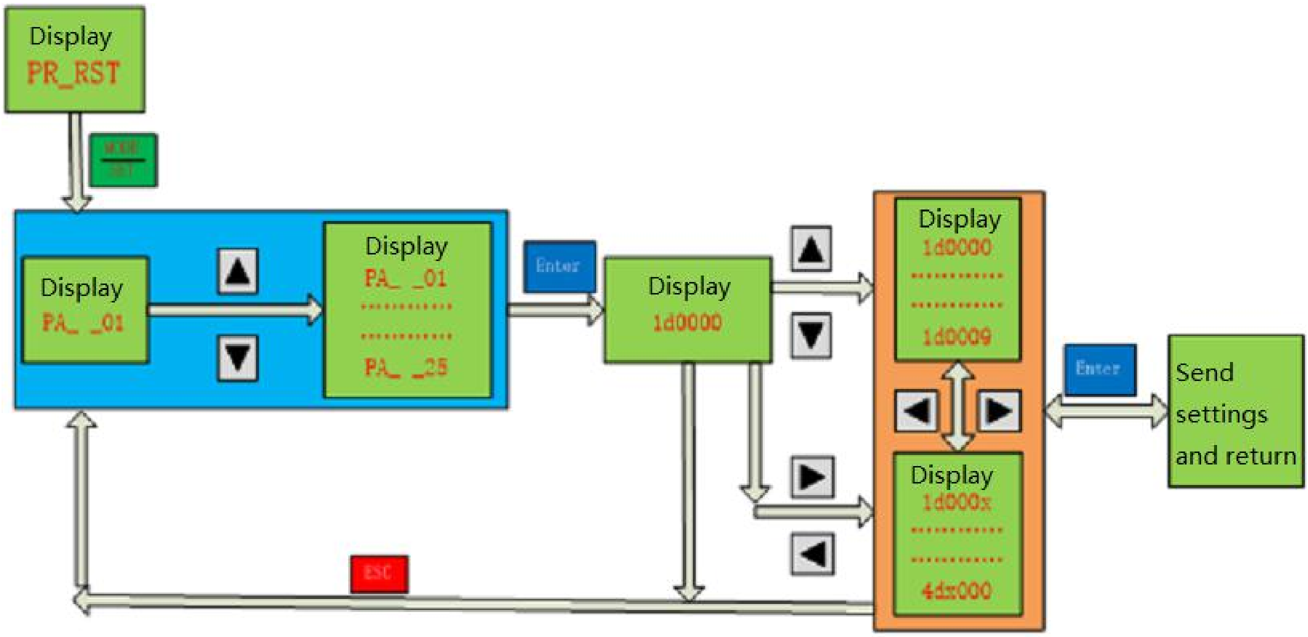


Figure 86 Parameter adjustment flowchart of HISU

Note: The adjustment range of each parameter is 0--4000. When you press the Enter key to enter the adjustment parameter, you can view the initial value of the parameter. After changing the parameter, the actual return value of the drive is displayed (such as: Change the sending value to 9, and actually return to 1, it will display as 1).

7 Error alarm

7.1 Alarm timing diagram

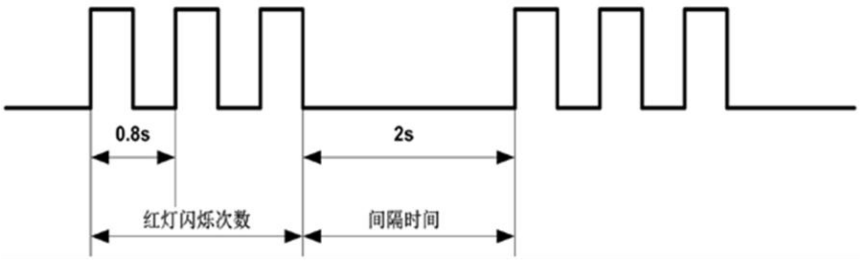
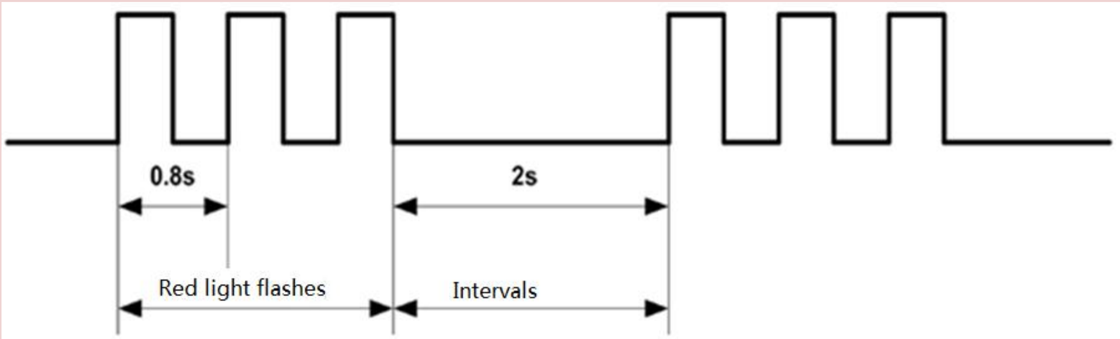


Figure 87 JMC IHSS57-EC Integrated motor alarm timing

7.2 Signal flashing times

Table 59 JMC IHSS60-EC The meaning of the blinking of the integrated motor signal lamp

Flashing Times		Alarm description
Red	Green	
No	Flashing	Drive CAN communication is not linked
No	Light up	The dr  ive is powered on normally
1	Light up	Drive overcurrent
2	Light up	Drive parameter upload error
3	Light up	Drive supply voltage is below the minimum
4	Light up	Drive position is out of tolerance
5	Light up	Drive communication error
6	Light up	CCW direction limit
7	Light up	CW direction limit
8	Light up	SW direction limit
9	Light up	Drive overheated
10	Light up	Motor phase loss

8 Quick guide

It is basically the same as IHSS57-EC, please refer to IHSS57-EC's "*Quick User Guide*"。

Frequently asked question and solve

1. Power light is off

✧ The input power supply is error, please check power supply line and whether the power supply voltage is too low.

2 Alarm after powering on or running a small angle

- ✧ Check whether the power cord is in good connection;
- ✧ Check whether the power supply voltage is correct;
- ✧ Check whether the parameters of P8 and P9 are correct.

3 Communication is normal, but failed to run

- ✧ Check whether the order and sequence sent by the master station are correct;
- ✧ Check whether the corresponding parameters are correct;
- ✧ Check whether the communication type and wiring are correct.

4 Drive position is out of tolerance

- ✧ Check whether the P16 parameter is correct.

5 Parameter upload error

- ✧ Set the parameters again.

6 Input voltage is too high

- ✧ Check if the input voltage exceeds 50V, if it exceeds 50V, reduce the input voltage.

7 CW, SW, CCW direction limit

- ✧ Check whether the corresponding limit switch is activated.

IHSV-EC Integrated field-bus AC servo motor series

➢ Product introduction

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

➢ Technical characteristics

- ✧ No lost steps, accurate positioning
- ✧ Support standard EtherCAT bus
- ✧ CSP / CSV / CST / PP / PV / PT / HM and other modes following the CIA402 motion control protocol, easy to develop
- ✧ Built-in CW, CCW, SW three 5V or 24V IO signal input for limit and zero return reference
- ✧ Built-in brake circuit, external input 24VDC power supply is enough
- ✧ RJ45 standard network connection, the slave stations can be connected by twisted pair network cable
- ✧ 100% rated torque drive motor
- ✧ Variable current control technology, high current efficiency
- ✧ Low vibration, stable operation at low speed
- ✧ Built-in acceleration and deceleration control to improve the smoothness of start and stop
- ✧ User can customize subdivision
- ✧ Compatible with 1000 line and 2500 line encoder
- ✧ No need to adjust general application parameters
- ✧ Overcurrent protection, overvoltage protection, undervoltage protection and over-tolerance protection

✧ Strong compatibility, can communicate with mainstream brand PLC controllers, such as: Beckhoff, Panasonic, Omron, Panasonic, Keyence, Innovance, JMC, etc.

➢ Application

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

➢ 1 Safety Precautions

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

⚠Danger	Indicates great possibility of death or serious injury.
⚠Caution	Indicates possibility of injury or property damage.
🚫	Indicates something that must not be done.

1.1 Precaution of receiving and installation

⚠Danger:

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

1.2 Wiring precautions

⚠Danger:

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

⚠Caution:

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

1.3 Precaution of operation

⚠ Danger:

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

⚠ Caution:

1. Please set drive parameters first, and then do long-term test in case of not working properly.
2. Please confirm switches like start, stop, turn off are work well before running the machine.

3. Please don’t turn on or off power supply frequently.

1.4 Maintenance & Inspection

:

1、 Don’t touch drive or motor inside while running in case of electric shock.

2、 Don’t touch power supply or wiring connector of power line in case of electric shock.

3、 Don’t change wires while power is on in case of electric shock or injury.

4、 Operation and daily maintenance must be done by trained professionals.

10. Please don’t dis-assembly or repair except JMC technicians.

➢ 2 Product description

2.1 Technical index

Table 60 IHSV-EC Technical index

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

2.2 Naming rules

IHSV 57 - 30 - 14 - 36 - EC - XXX

① ② ③ ④ ⑤ ⑥ ⑦

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

➢ 3 interface and wiring of driver

3.1 Interface definition

3.1.1Power port

Table 61 Power port

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

3.1.2 Control signal port (10 pin)

Table 62 Control signal port

Port	Symbol	Name	Explanation
1	CW+	Clockwise limit +	5~24VDC
2	CW-	Clockwise limit-	
3	HW+	Origin limit +	
4	HW-	Origin limit-	
5	CCW+	Counterclockwise direction limit +	
6	CCW-	Counterclockwise direction limit-	

7	BK+	Brake power input +	24VDC
8	BK-	Brake power input-	24VGND
9	PE+	Output in place +	0~30VDC
10	PE-	Output in place-	

Remarks: EC series brake power input BK24V, BK0V are located beside the power input

Note: For the communication port, see "Communication Interface and Wiring" "*Communication Interface and Wiring*" in the communication section (Ctrl + left mouse button or click the text to jump).

3.2 Control signal interface circuit diagram

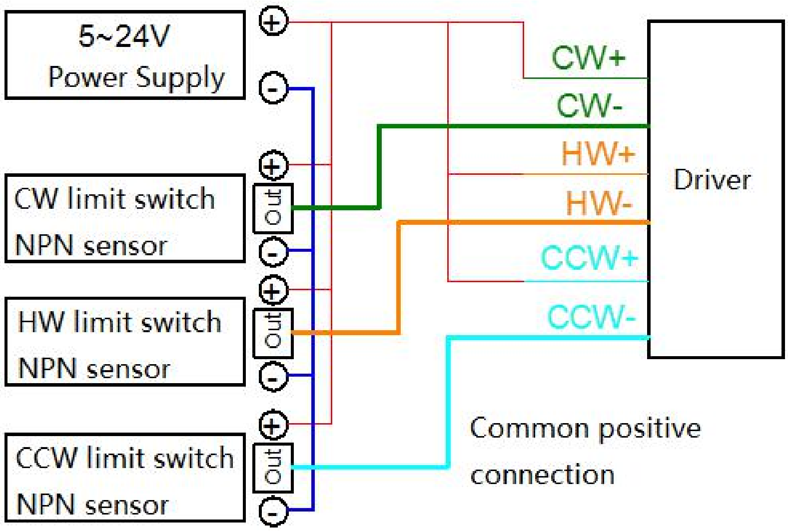


Figure 88 Common positive connection

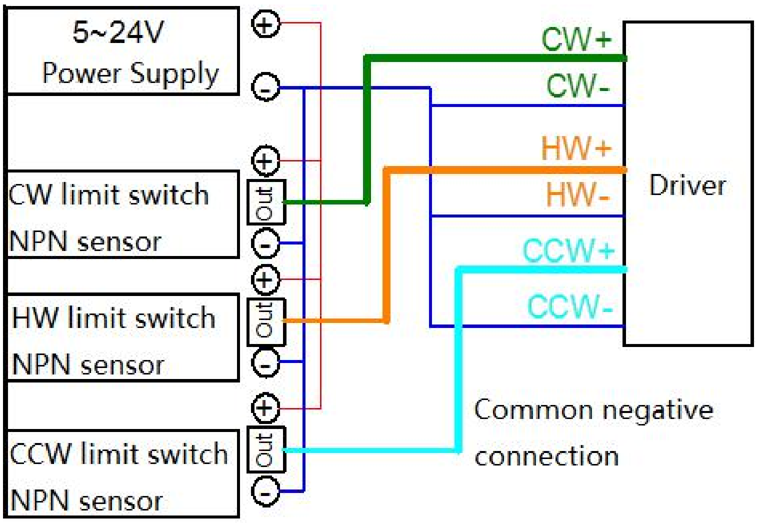


Figure 89 Common negative connection

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

3.3 Serial interface 232 wiring diagram

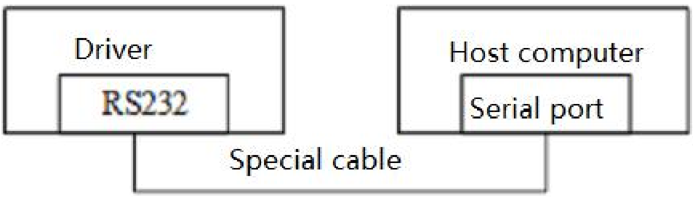


Figure 90 Schematic diagram of parameter debugging wiring

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

3.4 Typical application wiring diagram

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

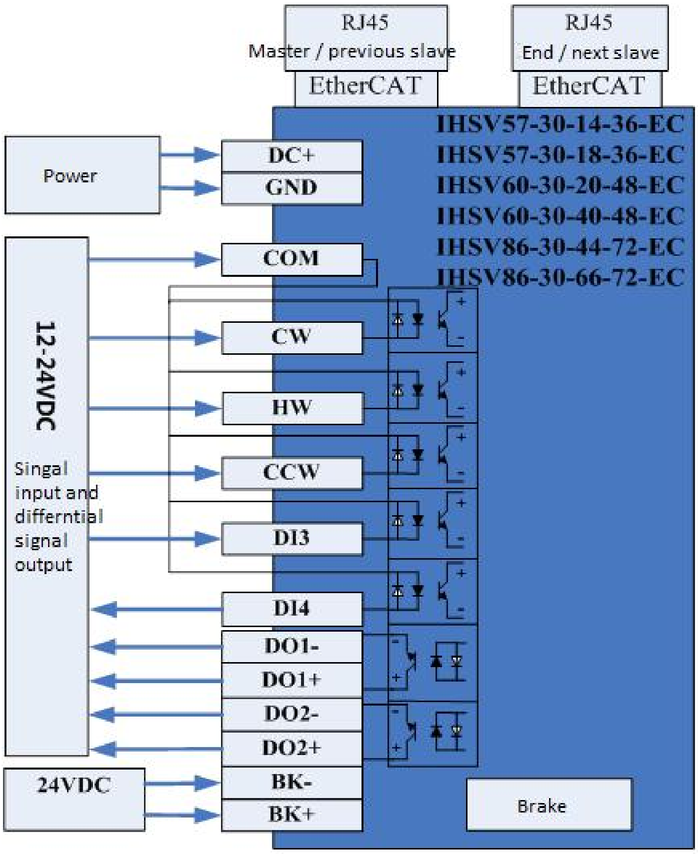


Figure 91 Typical wiring diagram of IHSV-EC

➢ 4 Installation instructions and fault alarm

4.1Installation dimensions

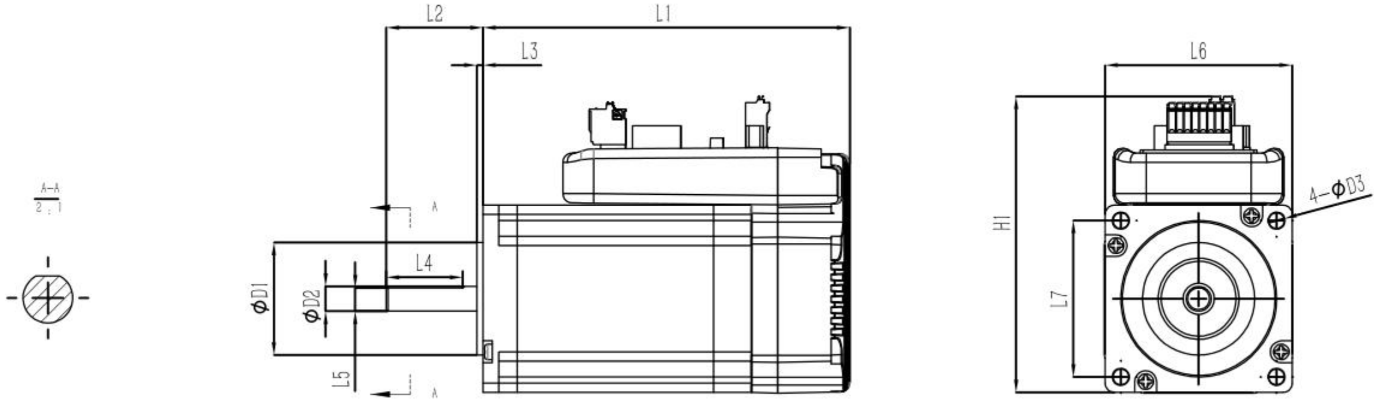


Figure 92 JMC IHSV-EC Integrated motor installation size

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

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

4.2 Installation environment

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

1. Working environment temperature : 0 to 55℃. Work environment humidity: 10% to 90% or less (free from condensation).
2. Storage environment: -20℃～+85℃; Storage humidity: 90% or less （free from condensation）.
3. Vibration : 0.5G or less
4. To prevent rain or damp environment.
5. Avoid exposure in the sun.
6. To prevent oil mist, the erosion of salt.
7. To prevent corrosive liquid, gas, etc.
8. To prevent dust, lint and metal fines.
9. Stay away from the radioactive material and fuel.
10. Reserve space around the drive in the oven for easy loading, unloading and maintenance.
11. Pay attention to the tank in the air flow, if necessary, add outer fan to enhance the air flow, reduce drive environmental temperature for heat dissipation; The long-term working temperature should under 55 ℃.
12. Try to avoid near the vibration source, adding damping device such as vibration absorber or antivibration rubber gasket.
13. If there is electromagnetic interference sources, the power of the drive and control line Louis interference caused by misoperation, noise filter can be added or used in a variety of effective anti-interference measures in order to ensure the normal operation of the drive (noise filter can increase the leakage current, need to load an isolation transformer on the drive power input end).

4.3 LED Indicator light

4.3.1 Alarm timing diagram

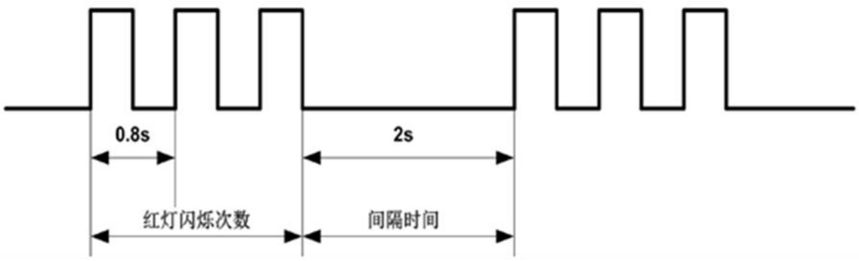


Figure 93 Integrated motor alarm timing of IHSV-EC

4.3.2 flashing times of Signal light

Table 63 Error Alarm

Red light Flashing Times	Alarm description
Red off, green flashing	Drive CAN communication is not linked
Red off, green on	The drive is powered on normally
Red flash once, green on	Drive overcurrent
Red flash twice, green on	Drive supply voltage exceeds maximum
Red flash 3 times, green on	Drive supply voltage is below the minimum
Red flash 4 times, green on	Drive position is out of tolerance
Red flash 5 times, green on	Drive communication error
Red flash 6 times, green on	CCW direction limit
Red flash 7 times, green on	CW direction limit
Red flash 8 times, green on	SW direction limit
Red flash 9 times, green on	Drive encoder error
Red flash 10 times, green on	Overload alarm

Red flash 11 times, green on	EEPROM read and write errors
Red flash 12 times, green on	Incorrect electronic gear ratio setting
Red flash 13 times, green on	The host computer needs to be powered on to modify the parameters
Red flash 14 times, green on	Incorrect current range

➢ 5 Physical reference

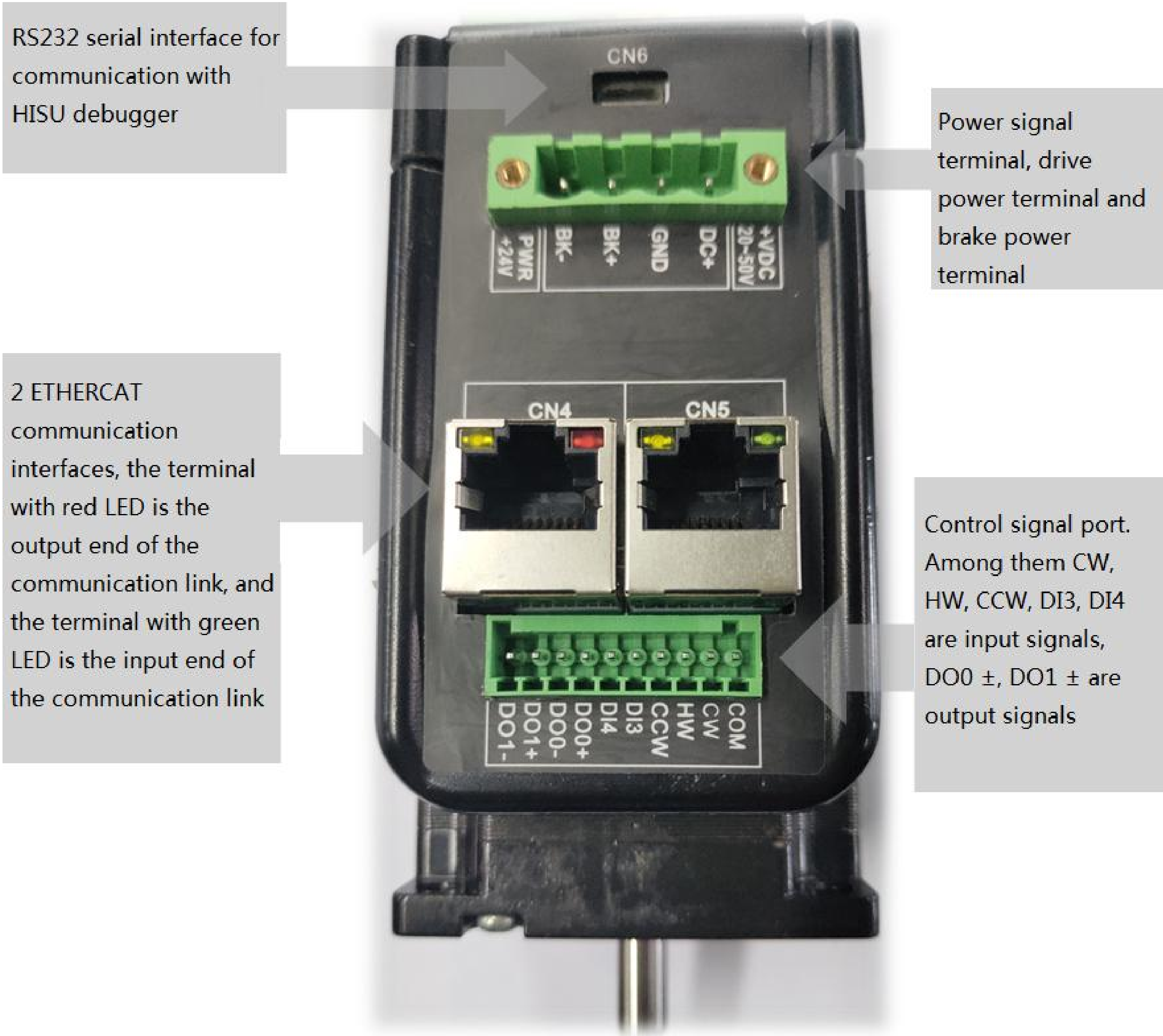


Figure 94 Picture of integrated motor IHSV-EC

➢ 6 Use of servo adjustment software

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

●

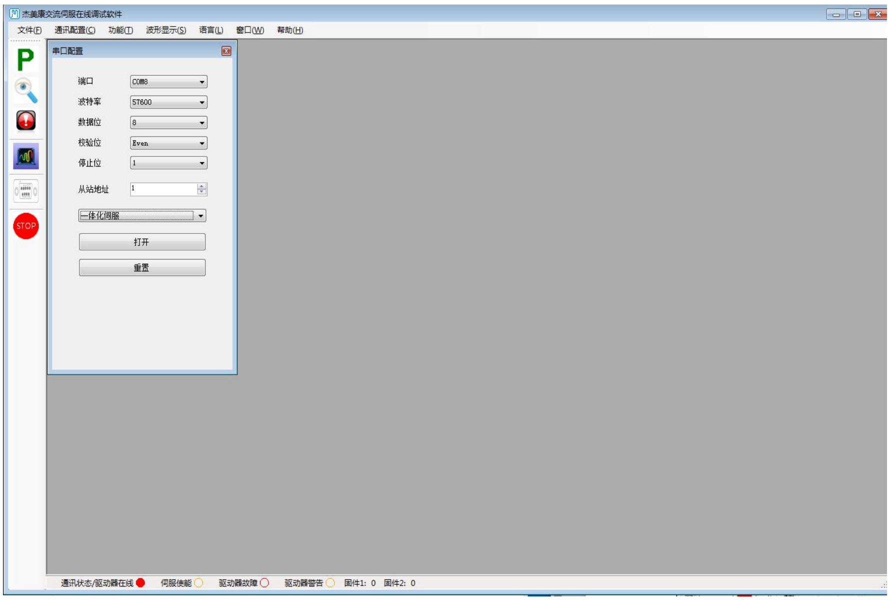


Figure 95 Servo adjustment software

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

●

Figure 96 serial port setting of servo debugging software

● After clicking Open, if the communication is successful, the following picture will be displayed:

●

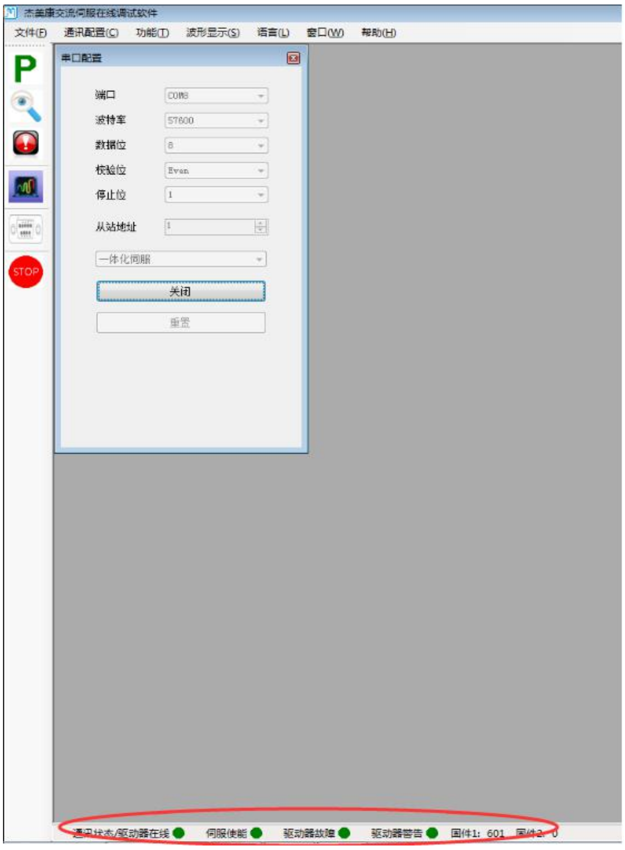


Figure 97　Software communication Successful

Note: If the connection cannot be made, please confirm whether the COM port is selected correctly and whether the communication line is connected. After confirming the connection, follow the above steps to reconnect.

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

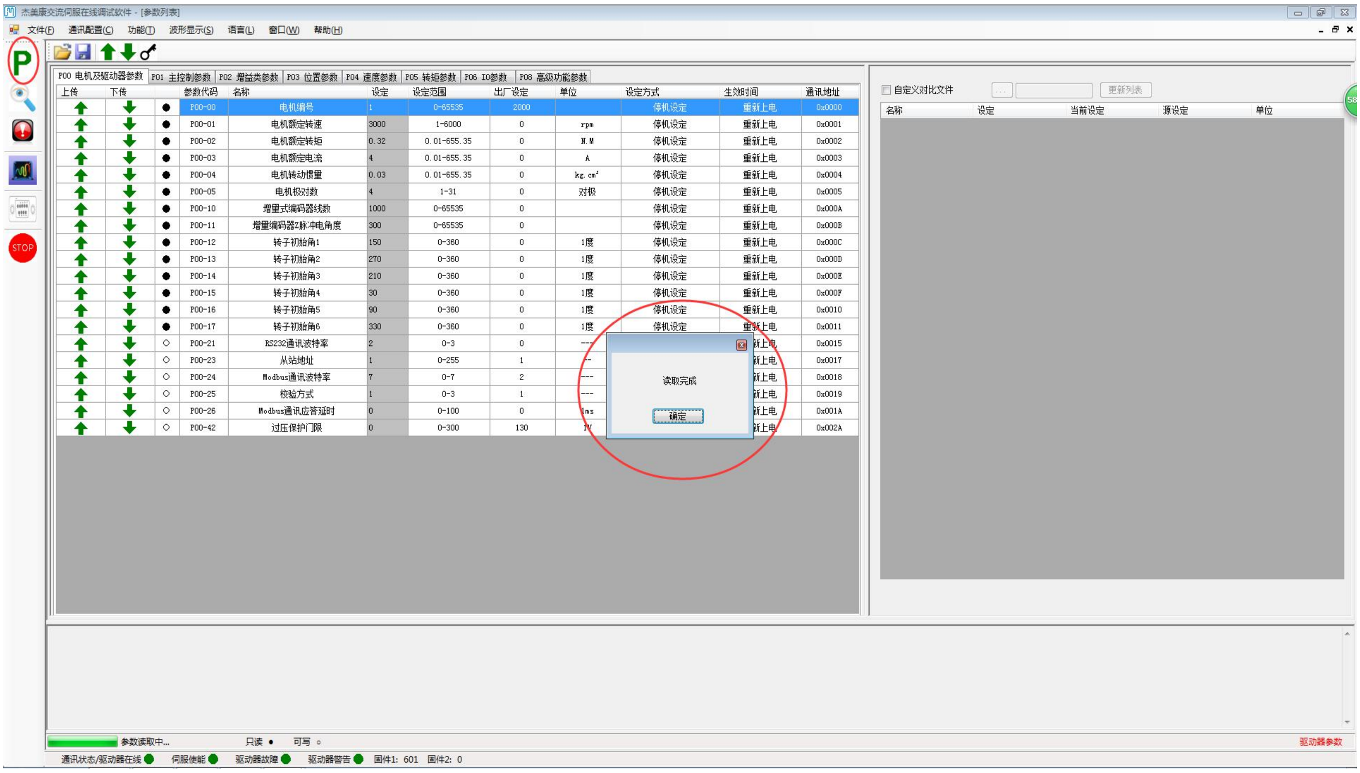


Figure 98 Parameter reading completed

Note: P00-xx are motor and driver parameters, which have been set at the factory and will not be provided to customers for modification.

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

Figure 99 Parameter setting process

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

➢ 7 Gain adjustment by hand

When the automatic gain adjustment does not reach the expected effect, you can manually fine-tune the gain to optimize the effect. The servo system consists of three control loops, the basic control block diagram is as follows:

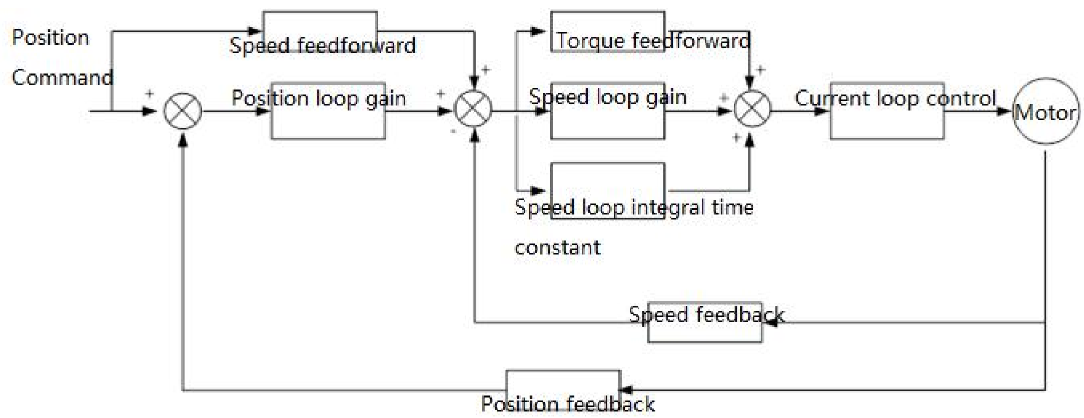


Figure 100 Servo system control block diagram

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

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

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

Table 64 Basic gain parameter

Parameter code	Name	Setting range	Default	Description
P01-02	Real-time automatic adjustment mode	0-2	2	0: Manually adjust the rigidity. 1: Standard mode automatically adjusts rigidity. In this mode, the parameters P02-00, P02-01, P02-10, P02-11, P02-13, P02-14, P08-20 will be based on the rigidity level set by P01-03 Automatic setting, manual adjustment of these parameters will have no effect. To The following parameters are set by the user: P02-03 (speed feedforward gain), P02-04 (speed feedforward leveling Slip constant). 2: The positioning mode automatically adjusts the rigidity. In this mode, this mode Next, the parameters P02-00, P02-01, P02-10, P02-11, P02-13, P02-14, P08-20 will be set according to P01-03 Rigidity level is set automatically, manual adjustment of these parameters will not be able to effect. 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	Real-time automatic adjustment of rigidity settings	0-31	13	Built-in 32 kinds of gain parameters, when P01-02 is set to 1, or 2 time to work. Can be directly called and set according to the actual situation The larger the value, the stronger the rigidity.
P02-00	Position control gain 1	0-3000. 0	80.0	▸ The larger the setting value, the higher the gain, the greater the rigidity, and the position lags The smaller it is, but the value is too large, the system will oscillate and overshoot. ▸ Gain at rest.
P02-01	Position	0-3000.0	80.0	▸ The larger the setting value, the higher

	control gain 2			the gain, the greater the rigidity, and the position lags The smaller the value, but the larger the value, the more shock and overshoot. ▸ Increase the value as much as possible without vibration. For gain during exercise.
P02-03	Speed feedforward gain	0-100.0	30.0	For the feedforward gain of the speed loop, the larger the parameter value, the smaller the system position tracking error and the faster the response. But if the feedforward gain is too large, it will Make the position loop of the system unstable, and it is easy to produce overshoot and vibration.
P02-04	Speed feedforward Smoothing constant	0-64.00	0	This parameter is used to set the time constant of the speed loop feedforward filter. value The larger, the filtering effect increases, but at the same time the phase lag increases.
P02-10	Speed ratio Gain 1	1-2000.0	40.0	▸ The larger the setting value, the greater the gain and rigidity. Machine and load settings. ▸ Increase the value as much as possible without vibration. ▸ Gain at rest.
P02-11	Speed integral Constant 1	0.1-1000.0	10.0	▸ Integral time constant of speed regulator, the smaller the setting value, the integral The faster the speed, the greater the stiffness. Out of noise. ▸ Under the condition of no vibration in the system, try to reduce the value of this parameter
P02-12	Pseudo-differential Feed Control System Number 1	0-100.0	100.0	▸ When set to 100.0%, the speed loop adopts PI control, and the dynamic response is fast; when set to 0, the integral effect of the speed loop is obvious, Low frequency interference can be filtered, but the dynamic response is slow. ▸ By adjusting this coefficient, the speed loop can have better dynamics Response, while increasing the resistance to low-frequency interference.

P02-13	Speed proportional gain 2	1-2000.0	45.0	▸ The larger the setting value, the greater the gain and rigidity. The parameter value is set according to the motor and load conditions. ▸ Increase the value as much as possible without vibration. ▸ Gain during exercise.
P02-14	Speed integral constant 2	0.1-1000.0	1000.0	The integral time constant of the speed regulator. The smaller the setting value, the faster the integral speed and the greater the stiffness. If it is too small, it will easily cause vibration and noise. ▸ Under the condition that the system does not oscillate, try to reduce the value of this parameter. ▸ This parameter is for steady state response.
P02-15	Pseudo-differential feedforward control coefficient 2	0-100.0	100.0	▸ When set to 100.0%, the speed loop adopts PI control, and the dynamic response is fast; when set to 0, the integral effect of the speed loop is obvious, which can filter low-frequency interference, but the dynamic response is slow. ▸ By adjusting this coefficient, the speed loop can have better dynamics Response, while increasing the resistance to low-frequency interference.

➢ 8 Parameter and Function

8.1 Parameter list

P00-xx: motor and drive’s parameter

P01-xx: Main Control parameter

P02-xx: Gain parameter

P03-xx: Position parameter

P04-xx: Speed parameter

P05-xx: Torque parameter

P06-xx: I/O parameter

P08-xx: Advanced Function parameter

➢

Table 65 parameter list

Type	Parameter code	Name	Range	Default	Unit	Set method	Effective time
Motor and driver parameters	P00-00	Motor SN	0-65535	---		Stop & set	Power-On again
	P00-01	Motor rated speed	1-6000	---	rpm	Stop & set	Power-On again
	P00-02	Motor rated torque	0.01-655.35	---	N.M	Stop & set	Power-On again
	P00-03	Motor rated current	0.01-655.35	---	A	Stop & set	Power-On again
	P00-04	Motor rotary inertia	0.01-655.35	---	kg.cm²	Stop & set	Power-On again
	P00-05	Motor pole pairs	1-31	---	Polar logarithm	Stop & set	Power-On again
	P00-10	Incremental encoder PPR	0-65535	---		Stop & set	Power-On again
	P00-11	Incremental encoder Z pulse electrical angle	0-65535	---		Stop & set	Power-On again
	P00-12	Rotor initial angel 1	0-360	---	1°	Stop & set	Power-On again
	P00-13	Rotor initial angel 2	0-360	---	1°	Stop & set	Power-On again
	P00-14	Rotor initial angel 3	0-360	---	1°	Stop & set	Power-On again
	P00-15	Rotor initial angel 4	0-360	---	1°	Stop & set	Power-On again
	P00-16	Rotor initial angel 5	0-360	---	1°	Stop & set	Power-On again
	P00-17	Rotor initial angel 6	0-360	---	1°	Stop & set	Power-On again
	P00-21	RS232 baud rate	0-3	2	---	Stop & set	Power-On again
	P00-23	Slave address	0-255	1	---	Stop &	Power-On

						set	again
	P00-25	Verification method	0-3	1	---	Stop & set	Power-On again
	P00-42	Overvoltage protection threshold	0-300	0	1V	Stop & set	Power-On again
Main control parameters	P01-01	Control mode setup	0-6	0	---	Stop & set	Immediate
	P01-02	Real-time automatic adjustment mode	0-2	1	---	Running & set	Immediate
	P01-03	Real-time automatic adjustment of rigidity settings	0-31	13	---	Running & set	Immediate
	P01-04	Inertia ratio	0-100.00	1	1 time	Running & set	Immediate
	P01-30	Brake-command-servo off, delay time (brake open delay)	0-255	100	1ms	Running & set	Immediate
	P01-31	brake output speed limitation	0-3000	100	1rpm	Running & set	Immediate
	P01-32	Servo OFF brake command waiting time	0-255	100	1ms	Running & set	Immediate
Gain parameters	P02-00	Position control gain 1	0-3000.0	48.0	1/S	Running & set	Immediate
	P02-01	Position control gain 2	0-3000.0	57.0	1/S	Running & set	Immediate
	P02-03	Speed feedforward gain	0-100.0	30.0	1.0%	Running & set	Immediate
	P02-04	Speed feedforward smooth constant	0-64.00	0.5	1ms	Running & set	Immediate
	P02-10	Speed ratio gain 1	1.0-2000.0	27.0	1Hz	Running & set	Immediate
	P02-11	Speed integral constant 1	0.1-1000.0	10.0	1ms	Running & set	Immediate
	P02-12	Fake differential feed-forward control ratio 1	0-100.0	100.0	1.0%	Running & set	Immediate
	P02-13	Speed ratio gain 2	1.0-2000.0	27.0	1Hz	Running & set	Immediate
	P02-14	Speed integral gain	0.1-1000.0	1000	1ms	Running &	Immediate

		2		.0		set	
	P02-15	Fake differential feed-forward control ratio 2	0-100.0	100.0	1.0%	Running & set	Immediate
	P02-19	Torque feedforward gain	0-30000	0	1.0%	Running & set	Immediate
	P02-20	Torque feedforward smooth constant	0-64.00	0.8	1ms	Running & set	Immediate
	P02-30	Gain switching mode	0-10	0	---	Running & set	Immediate
	P02-31	Gain switching grade	0-20000	800	---	Running & set	Immediate
	P02-32	Gain switching lag	0-20000	100	---	Running & set	Immediate
	P02-33	Gain switching delay	0-1000.0	10.0	1ms	Running & set	Immediate
	P02-34	Position gain switching time	0-1000.0	10.0	1ms	Running & set	Immediate
	P02-41	Mode switch selection	0-20000	10000	---	Running & set	Immediate
	P02-50	Torque command added value	-100.0-100.0	0	1.0%	Running & set	Immediate
	P02-51	CW torque compensation	-100.0-100.0	0	1.0%	Running & set	Immediate
	P02-52	Reverse torque compensation	-100.0-100.0	0	1.0%	Running & set	Immediate
Positional parameter	P03-00	Source of location command	0-1	0	---	Stop & set	Immediate
	P03-03	Instruction Pulse Inversion	0-1	0	---	Stop & set	Immediate
	P03-04	Position Pulse filtering	0-3	2	---	Running & set	Immediate
	P03-05	Positioning completion criteria	0-2	1	---	Running & set	Immediate
	P03-06	Location complete range	0-65535	30	Encoder Unit	Running & set	Immediate
	P03-09	Number of instruction pulses per turn of motor	0-65535	4000	Pulse	Running & set	Power-On again
	P03-10	Electron Gear 1 molecule	1-65535	4000	---	Running & set	Power-On again
	P03-11	Electronic gear 1	1-65535	4000	---	Running &	Power-On

		Denominator				set	again
	P03-15	Excessive position deviation setting	0-65535	0	Command unit *10	Running & set	Immediate
	P03-16	Position Instruction smoothing filter time constant	0-1000.0	0	1ms	Running & set	Immediate
Speed parameter	P04-00	Speed instruction source	0-1	1	---	Stop & set	Immediate
	P04-01	Speed instruction analog counter	0-1	0	---	Stop & set	Immediate
	P04-02	Digital speed given value	-6000—6000	0	1rpm	Running & set	Immediate
	P04-05	Overspeed alarm value	0-6500	6400	1rpm	Running & set	Immediate
	P04-06	Forward speed limit	0-6000	5000	1rpm	Running & set	Immediate
	P04-07	Reverse speed limit	0-6000	-5000	1rpm	Running & set	Immediate
	P04-10	Zero velocity detection value	0-200.0	40	1rpm	Running & set	Immediate
	P04-14	Acceleration time	0-10000	500	1ms/1000rpm	Running & set	Immediate
	P04-15	Deceleration time	0-10000	500		Running & set	Immediate
Torque parameters	P05-10	Internal Forward Torque limit	0-300.0	200.0	1.0%	Running & set	Immediate
	P05-11	Internal reverse torque limit	0-300.0	200.0	1.0%	Running & set	Immediate
I/O	P06-00	Enable the effective level of the input port	0-4	1	---	Running & set	Power-On again
	P06-20	Alarm output port effective level	0-1	1	---	Running & set	Power-On again
	P06-22	Effective level of output port	0/1	1	---	Running & set	Power-On again
Advanced function para	P08-19	Feedback speed low-pass filter constant	0-25.00	0.8	1ms	Running & set	Immediate
	P08-20	Torque command filter constant	0-25.00	0.84	1ms	Running & set	Immediate

mete rs	P08-25	Disturbance torque compensation gain	0-100.0	0	%	Running & set	Immediate
	P08-26	Disturbance torque filtering time constant	0-25.00	0.8	1ms	Running & set	Immediate

8.2 Description of parameter

8.2.1 P00-xx P00-xx Motor and driver parameters

Table 66 P00-xx Motor & driver parameter

Parameters Code	Name	Description
P00-00	Motor number	Default set 0: P0-01 to P0-17 is available
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: pairs Default value
P00-10	Incremental encoder lines	Default set
P00-11	incremental encoder Z pulse electric angle	Default set
P00-12	Rotor initial angle 1	Default set
P00-13	Rotor initial angle 2	Default set
P00-14	Rotor initial angle 3	Default set
P00-15	Rotor initial angle 4	Default set
P00-16	Rotor initial angle 5	Default set
P00-17	Rotor initial angle 6	Default set
P00-21	RS232 communication baud rate selection	Set range: 0-3; Choose baud rate to communicate with PC: 0: 9600 1: 19200 2: 57600 3: 115200

P00-23	Slave address	Set range: 0-255; Default:1; Set according to device required.
P00-25	Calibration method	Set range: 0-3; Default: 1. 0: no calibration, 2 stop bit. 1: even calibration, 1 stop bit. 2: odd calibration, 1 stop bit. 3.no calibration, 1 stop bit.
P00-42	Overvoltage protection threshold	Setting range: 0-300, unit V

8.2.2 P01-xx Main control parameters

<table>
<tr><th>Parameters Code</th><th>Name</th><th>Description</th></tr>
<tr><td>P01-01</td><td>Control mode setting</td><td>Setting range:0-6
0: Position control mode.
1: Speed control mode.
2: Torque control mode
3: Speed, torque control mode. Need to use an external input port in CN1 to switch, set the selected DI port input port function selection to 5
(control mode switching). Control the logic state of the port to switch the control mode
<table>
<tr><td>Port logic</td><td>Control mode</td></tr>
<tr><td>Valid</td><td>Speed mode</td></tr>
<tr><td>Invalid</td><td>Torque mode</td></tr>
</table>
4: Position and speed control mode. Need to use an external input port in CN1 to switch, set the selected DI port input port function selection to 5 (control mode switching). Control the logic state of the port to switch the control mode.
<table>
<tr><td>Port logic</td><td>Control mode</td></tr>
<tr><td>Valid</td><td>Position mode</td></tr>
<tr><td>Invalid</td><td>Speed mode</td></tr>
</table>
5: Position and torque control mode. Need to use an external input port in CN1 to switch, set the selected DI port input port function selection to 5 (control mode switching). Control the logic state of the port to switch the control mode.
<table>
<tr><td>Port logic</td><td>Control mode</td></tr>
</table>
</td></tr>
</table>

		Valid: Position mode Invalid: Torque mode 6: Fully closed loop
P01-02	Real time automatic adjustment mode	Setting range:0-2 0: Manual adjustment of rigidity 1: Standard mode automatically adjusts rigidity. In this mode, parameters P02-00, P02-01, P02-10, P02-11, P02-13, P02-14, P08-20 will be set automatically according to the stiffness level set by P01-03, and these parameters can not be adjusted by manual. The following parameters are set by the user: P02-03 (speed feedforward gain), P02-04 (speed feedforward smoothing constant). 2 : Positioning mode automatically adjusts rigidity. In this mode, parameters P02-00, P02-01, P02-10, P02-11, P02-13, P02-14, P08-20 will be set automatically according to the rigidity level set by P01-03. and these parameters can not be adjusted by manual. The following parameters will be fixed and cannot be changed: P02-03 (speed feedforward gain), 30% P02-04 (speed feedforward smoothing constant).0.5
P01-03	Automatically adjust the rigidity setting	Setting range: 0-31 Built-in 32 kinds of gain parameters. It works when P01-02 is set to 1, 2, or 3. It can be called directly according to the actual situation. The larger the set value, the stronger the rigidity.
P01-04	Rotor inertia ratio	Setting range: 0-100, unit: times Set the load inertia ratio to related motor. The setting method is as follows: P01-04 = Load inertia / motor inertia This inertia ratio can use the value after AF-J-L automatic inertia recognition, write the recognized value into the parameter
P01-30	Brake command-Servo OFF delay time (brake open delay)	Setting range: 0-255, unit: ms When enabling: The drive will only receive the position command after the time of P01-30 is executed under the enable command is executed. When the enable is off: When the motor is at a static state, after the close enable command is executed, the time after the brake is closed and

		the motor becomes non-energized.
P01-31	Speed limit value of brake command output	Setting range: 0-3000, unit: rpm Motor speed threshold when the brake output is active when the motor is rotating. Less than this threshold, the brake output command is valid, otherwise it will wait for P01-32 time, the brake output command is valid.
P01-32	Servo OFF-brake command waiting time	Setting range: 0-255, unit: ms The maximum waiting time for the brake output when the motor is rotating.

8.2.3 P02-xx Gain parameters

Table 67 P02-xx Gain parameters

Parameters 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 gain 2	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	Speed 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 gain 2	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

<table>
<tr><td></td><td></td><td>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.</td></tr>
<tr><td>P02-15</td><td>Pseudo-differential feedforward control coefficient 2</td><td>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.</td></tr>
<tr><td>P02-19</td><td>Torque feedforward gain</td><td>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.</td></tr>
<tr><td>P02-20</td><td>Torque feed-forward smoothing constant</td><td>Setting range: 0-64.00, unit: ms
This parameter is used to set the torque feedforward filtering time constant.</td></tr>
<tr><td>P02-30</td><td>Gain switching mode</td><td>Setting range: 0-10
The condition to set the 1st and 2nd gain switching mode
<table>
<tr><td>Value</td><td>Switch condition</td><td>Remark</td></tr>
<tr><td>0</td><td>fix to the 1st gain</td><td>P02-00、P02-10、P02-11、P02-12</td></tr>
<tr><td>1</td><td>fix to the 2nd gain</td><td>P02-01、P02-13、P02-14、P02-15</td></tr>
<tr><td>2</td><td>Use DI input switching</td><td>Need to set the DI port to 9 (gain switching input)
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</td></tr>
</table></td></tr>
</table>

				first gain.	
		4	Speed command changes a lot	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.	
		5	Big speed command	When the speed command is greater than the threshold (determined by P02-31 and P02-32), it switches to the second gain. When it is less than the threshold and exceeds the P02-33 delay setting, it switches to the first gain.	
		6	Large position deviation	When the position deviation is greater than the threshold (determined by P02-31 and P02-32), switch to the second gain. When it is less than the threshold and exceeds the P02-33 delay setting, it switches to the first gain.	
		7	There is position command	Switch to the second gain when there is a position command. When the position command ends and the P02-33 delay setting is exceeded, it switches to the first gain.	
		8	Incomplete positioning	Switch to the second gain when positioning is not completed. When the positioning is completed and the P02-33 delay setting is exceeded, it switches to the first gain.	
		9	Actual	Switch to the second gain	

			speed is big	when the actual speed is greater than the threshold (determined by P02-31 and P02-32). When it is less than the threshold and exceeds the P02-33 delay setting, it switches to the first gain.
		10	With position command + actual speed	Switch to the second gain when there is a position command. When there is no position command and the actual speed is less than the threshold (determined by P02-31 and P02-32), and when the delay setting of P02-33 is exceeded, it switches to the first gain.
P02-31	Gain switching level	Setting range: 0-20000 Judgment threshold when gain is switched. Torque unit: 1000bit = 25% of rated torque Speed unit: 1000bit = 200 rpm Position unit: 131072bit per revolution		
P02-32	Gain switching hysteresis	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		
P02-33	Gain switching delay	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.		
P02-34	Position gain switching time	Setting range: 0-1000.0, unit: ms Time for position control gain 1 to smoothly switch to position control gain 2		
P02-41	Mode switch level	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		
P02-50	Torque command added value	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.
P02-51	Forward torque compensation	Setting range: -100.0-100.0, unit: 1.0% Valid in position control mode. For compensating forward static friction
P02-52	Reverse torque compensation	Setting range: -100.0-100.0, unit: 1.0% Valid in position control mode. Used to compensate reverse static friction

8.2.4 P03-xx Position parameters

Table 68 P03-xx Position parameters

Parameters Code	Name	Description
P03-00	Source of position command	0: pulse command 1: Given the number, use it when communicating with control
P03-03	Instruction Pulse Inversion	Used to adjust the direction of the pulse instruction count 0: Normal 1: In The Opposite Direction
P03-04	Position Pulse filter setting	Set range:0-1 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	Setting range: 0-65535, unit: encoder unit Used to set the threshold value for positioning completion output. If an incremental encoder motor is used, the number of encoder lines per revolution is calculated by * 4
P03-09	Number of instruction pulses per turn of motor	Setting range: 0-65535 Absolute encoder motor is effectively used to set motor rotation number of instructions pulse. When this parameter is set to 0, P03-10 and

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

8.2.5 P04-xx Speed Parameter

Table 69 P04-xx Speed parameter

Parameter 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 command analog inversion	Used to adjust the polarity relationship of analog quantity 0: Normal 1: Polarity is inversion
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
P04-05	Overspeed alarm value	Setting range: 0-6500, unit: rpm Set the maximum allowable speed value, if it exceeds the set value, AL.420 overspeed alarm
P04-06	Forward speed limit	Set range: 0-6000, Unit: rpm Limit forward speed of motor

P04-07	Reverse speed limit	Set range: -6000-0, Unit: rpm Limit reverse speed of motor
P04-10	Zero speed detection value	Zero speed detection value Set Zero speed detection threshold, motor speed below the threshold can be output through the output port "zero speed motor output" signal
P04-14	Acceleration time	Set range: 0-10000, Unit: 1ms/1000rpm Set the acceleration time in speed control
P04-15	Deceleration time	Set range: 0-10000, Unit: 1ms/1000rpm Set the deceleration time in speed control

8.2.6 P05-xx Torque parameter

Table 70 P05-xx Torque parameter

Parameter code	Name	Description
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

8.2.7 P06-xx I/O Parameter

Table 71 P06-xx I/O parameter

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

	effective level	
P06-22	In place output port effective level	Setting range: 0-1, Default: 1

8.2.8 P08-xx Advanced function parameters

Table 72 P08-xx Advanced function parameters

Parameter code	Name	Description
P08-19	Feedback speed low-pass filter constant	Set range: 0-25.00, Unit: ms Feedback speed low-pass filter time constant, when the motor running when there is a howling, the value can be set up properly
P08-20	Torque command filter constant	Set range: 0-25.00, Unit: ms 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.

8.3 List of monitoring items

Table 73 List of monitoring items

Display serial number	Display item	Description	Unit
d00.C.PU	Sum of position	This parameter can monitor the number	User unit

	instruction pulses	of pulses sent by the user to the servo driver, which can confirm whether there is the phenomenon of missing pulses	
d01.F.PU	Sum of position feedback pulses	This parameter can monitor the pulse number of servo motor feedback. The unit is consistent with the User Input Instruction Unit	User unit
d02.E.PU	Number of position deviation pulses	This parameter can monitor the pulse number of the position lag in the process of the SERVO system. The unit is consistent with the User Input Instruction Unit	User unit
d03.C.PE	Sum of position given pulses / Gantry motor feedback pulse	This parameter can monitor the number of pulses sent by the user to the servo drive. Unit: When using the absolute value motor, it is calculated as 131072bit per revolution. If an incremental encoder motor is used, the number of encoder lines per revolution is calculated by * 4.	Encoder unit/ User unit
d04.F.PE	Sum of position feedback pulses	This parameter can monitor the pulse number of servo motor feedback. Unit: 131072 bit per turn when using absolute value motor. Use Incremental encoder motor, then each turn according to encoder line number * 4 calculate.	Encoder unit/ User unit
d05.E.PE	Position deviation pulse number / Gantry pulse deviation	This parameter can monitor the pulse number of the position lag in the process of the SERVO system. Unit: 131072 bit per turn when using absolute value motor. Use Incremental encoder motor, then each turn according to encoder line number * 4 calculate.	Encoder unit/ User unit
d06.C.Fr	Pulse Command input frequency	This parameter can monitor the input frequency of external pulse instruction	KPPS
d07.C.SP	Speed Control Command		rpm
d08.F.SP	Motor speed	This parameter can monitor the speed of servo motor when it is running	rpm

d09. C.tQ	Torque instruction	This parameter can monitor the Torque of the servo motor when it is running	%
d10. F.tQ	Feedback value of torque	This parameter can monitor the Torque of the servo motor when it is running	%
d11.AG.L	Average torque	This parameter can monitor the average torque of the servo motor in the past 10 seconds	%
d12.PE.L	Peak torque	This parameter can monitor the peak torque of servo motor after power-on	%
d13.oL	Overload rate	This parameter can monitor the servo motor's load occupancy in the past 10 seconds	%
d14.rG	Regeneration load rate	This parameter monitors the load rate of the regeneration resistor	%
d16.I.Io	Input IO status	This parameter can monitor the input port status of CN1. The upper vertical bar represents the high level (photocoupler cut-off), and the lower vertical bar represents the low-level photocoupler conduction). The corresponding relationship with the input port is that the operation panel from right to left 4 vertical bars correspond to DI1-DI4 respectively	Binary
d17.o.Io	Output IO status	This parameter can monitor the output port status of CN1. The upper vertical bar represents the optocoupler conduction, the lower vertical bar represents the optocoupler cutoff, and the corresponding relationship with the output port is the operation panel from right to left.	Binary
d18.AnG	Mechanical angle of motor	This parameter can monitor the mechanical angle of the motor and rotate 1 turn is 360 degrees	0.1 degree
d19.HAL	Motor UVW phase sequence	This parameter can monitor the phase sequence position of the incremental encoder motor	
d20.ASS	Absolute Value Encoder single-loop value	This parameter can monitor the feedback value of absolute encoder, rotating a circle for 0xffff	0-0xFFFF
d21.ASH	Absolute Value	This parameter can monitor the number	

	Encoder multi-loop value	of turns of the absolute encoder motor	
d22.J-L	Inertia ratio	This parameter can monitor the real-time inertia of the load of the motor	%
d23.dcp	Main Circuit Voltage (AC value)	This parameter can monitor the input voltage value of the main circuit	V
d24.Ath	Driver temperature	This parameter can monitor the drive temperature	Centigrade degree
d25.tiE	Cumulative running time	This parameter monitors the drive elapsed time, in seconds	Seconds
d26.1.Fr	Resonance 1	This parameter can monitor resonance frequency 1	Hz
d28.2.Fr	Resonance 2	This parameter can monitor resonance frequency 2	Hz
d30.Ai1	Analog quantity instruction 1 input voltage (V_REF)	This parameter can monitor the input voltage value of CN1 analog command.	0.01V
d31.Ai2	Analog quantity instruction 1 input (T_REF)	This parameter can monitor the input voltage value of CN1 analog command.	0.01V

➢ 9 Failure analysis and treatment

9.1 Fault alarm information list

Alarm type	Code	Alarm content
hardware malfunction	AL.051	Eeprom parameter abnormal
	AL.052	Programmable Logic configuration fault
	AL.053	Initialization Failed
	AL.054	System abnormal
	AL.060	Product model Select fault
	AL.061	Product matching fault
	AL.062	Parameter storage fault
	AL.063	over current checkout
	AL.064	Servo power on , Self-Test find out the output short circuit fault
	AL.066	servo unit control power supply low voltage
	AL.070	AD Sample fault1
	AL.071	Current sample fault
	AL.100	Parametric combination abnormal

	AL.101	AI Setting fault
	AL.102	DI distributing fault
	AL.103	DO allocation failure
	AL.105	Electronic gear Configuration error
	AL.106	Frequency splitting pulse output Setting abnormal
	AL.110	Need to power-on again after the parameter setting
	AL.120	Servo ON Instruction invalid
	AL.401	Under voltage
	AL.402	Over voltage
	AL.410	Overload (instantaneous Maximum load)
	AL.411	Driver overload
	AL.412	Motor overload（Continuous maximum load）
	AL.420	Over speed
	AL.421	Lose Control check out
	AL.422	runaway fault
	AL.425	AI collect sample over voltage
	AL.435	Stroke current Limited overload resistance
	AL.436	DB overload
	AL.440	Radiator overheat
	AL.441	Motor overheat fault
	AL.500	Crossover pulse output overspeed
	AL.501	Position deviation is too large
	AL.502	Full closed loop encoder position and Motor position error are too large
	AL.505	Pulse Command input pulse abnormal
	AL.550	Inertia identification failure fault
	AL.551	back to origin Point timeout fault
	AL.552	Angle Identification failure fault
Encoder failure	AL.600	Encoder output power short circuit fault
	AL.610	Incremental encoder gets out of line
	AL.611	Incremental encoder Z signal loss
	AL.620	Absolute Encoder gets out of line
	AL.621	Read and write motor encoder EEPROM parameter abnormal
	AL.622	Motor encoder EEPROM data parity error
Warning	AL.900	Location deviation is too large
	AL.901	When servo ON, Location deviation is too large
	AL.910	Motor overload
	AL.912	Driver overload
	AL.941	Need to power-on again after Parameters changing
	AL.942	Write EEPROM frequent warnings
	AL.943	Abnormal serial communication
	AL.950	Over run Warning
	AL.971	Under voltage warning

9.2 Causes and treatment of fault alarm

AL.051: AL.051: EEPROM parameter abnormal

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

AL.052: Programmable logical configuration fault

Causes of fault alarm	Fault alarm checking	Disposal measures
Master control MCU power-on initialization exception, Serial port 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
MCU works abnormal	check connections reconnect power	If always appear, then change a drive

AL.060: Product model selection fault

Causes of fault alarm	Fault alarm checking	Disposal measures
Product parameter setting does not match actual hardware	Check product parameter settings and hardware models The rated current of the selected motor is greater than the output current of the drive	Set product parameters correctly If it always appears, contact the manufacturer

AL.061: Products matching fault

Causes of fault alarm	Fault alarm checking	Disposal measures
servo unit and servo motor does not match	check whether the servo unit can support the motor	Change the servo unit matched with the motor

AL.063: Over-current detection

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

AL.071: Current sampling failure

Causes of fault alarm	Fault alarm checking	Disposal measures
Abnormal sampling data of current sensor device	Is the wiring correct	Correct wiring If it always appears, replace the driver

AL.100: Parameter combination is abnormal

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

AL.102: DI Allocation failure

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

AL.103: DO Allocation failure

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

AL.105: Electronic gear setting error

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

	greater than 128	

AL.106: Frequency division pulse output setting is abnormal

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

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

Causes of fault alarm	Fault alarm checking	Disposal measures
After setting the servo parameters, it shall be powered on 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
The servo ON command executed an auxiliary function R, S, T voltage ports are not powered	Check wiring and input voltage	Check wiring and power on driver again

AL.401: Under voltage

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

AL.402: Over voltage

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

is not		

AL.410: Overload (instantaneous maximum load)

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

AL.412: Motor overload (continuous maximum load)

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

AL.420: Over speed

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

AL.440: Radiator overheating

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

AL.501: Excessive position deviation

Causes of fault alarm	Fault alarm checking	Disposal measures
Position deviation is too large and parameter setting is too small	Confirm p03-15 (position deviation is too large) parameter setting	Increase the set value of p03-15 (position deviation is too large)

The gain value is set too low	Confirm whether the gain class parameters are properly set	Re-adjust the gain class parameters correctly
Internal torque limiter is set too small	Confirm internal torque limiter	Re-adjust the internal torque limiter correctly
Excessive external load	Check external load	Load reduction or high power motor replacement

AL.505: P Command input pulse exception

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

AL.551: Back to the origin timeout failure

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

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

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

AL.610: Incremental encoder offline

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

AL943: Abnormal serial communication

Causes of fault alarm	Fault alarm checking	Disposal measures
Serial communication interference 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

JASD-EC Field-Bus high voltage servo driver series

Introduction

The JASD series universal servo driver is a high-performance AC servo unit developed by JMC. The servo driver of this series uses advanced motor control dedicated DSP chip, FPGA and IPM power module. High integration, stable performance and reliable protection. It has rich digital and analog I/O interfaces, can be used with a variety of host devices, and supports the EtherCAT communication protocol to facilitate networking. Through the optimized PID control algorithm, it realizes full digital control of position, speed and torque accuracy, with the advantages of high precision and fast response. At the same time, it supports 2500 line incremental encoders and 17-bit and 20-bit high-precision absolute encoder motors to meet different requirements for customer performance. Widely used in CNC machine tools, printing and packaging machinery, textile machinery, robots, automated 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 repair.

2 Product Introduction

2.1 Servo Drive

2.1.1 Names of each part of servo drive

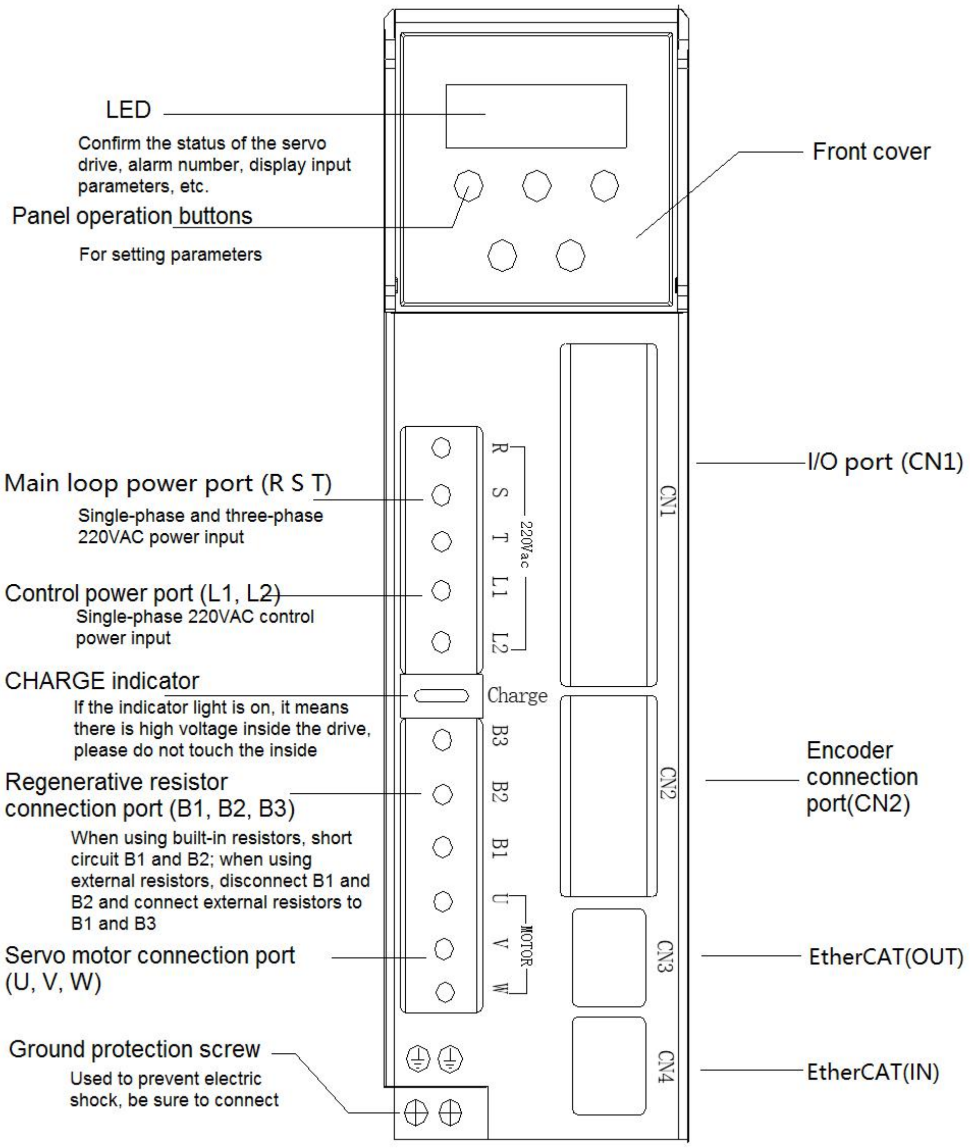


Figure 101 Names of parts of servo driver

2.1.2 Specification of driver

Fig.75 Single phase 220V servo drive

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: Servo ON、Erase warning the warning、Forward overpass signal input、Reverse overpass signal input、Control mode switching、P action instruction input、Positive side external torque limit、Reverse side external torque limit 、Gain switching input 、Zero position fixed input、Instruction pulse inhibit input 、Encoder absolute value data required input 1.Internal set speed switching input 2. Internal set speed switching input 3、Position instruction clear input、Check out input of magnetic pole、Switch input of instruction pulse input multiplier
		point: 5 Function: Alarm output、Band-type brake open output、Servo ready for output、Position complete

	output signal	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

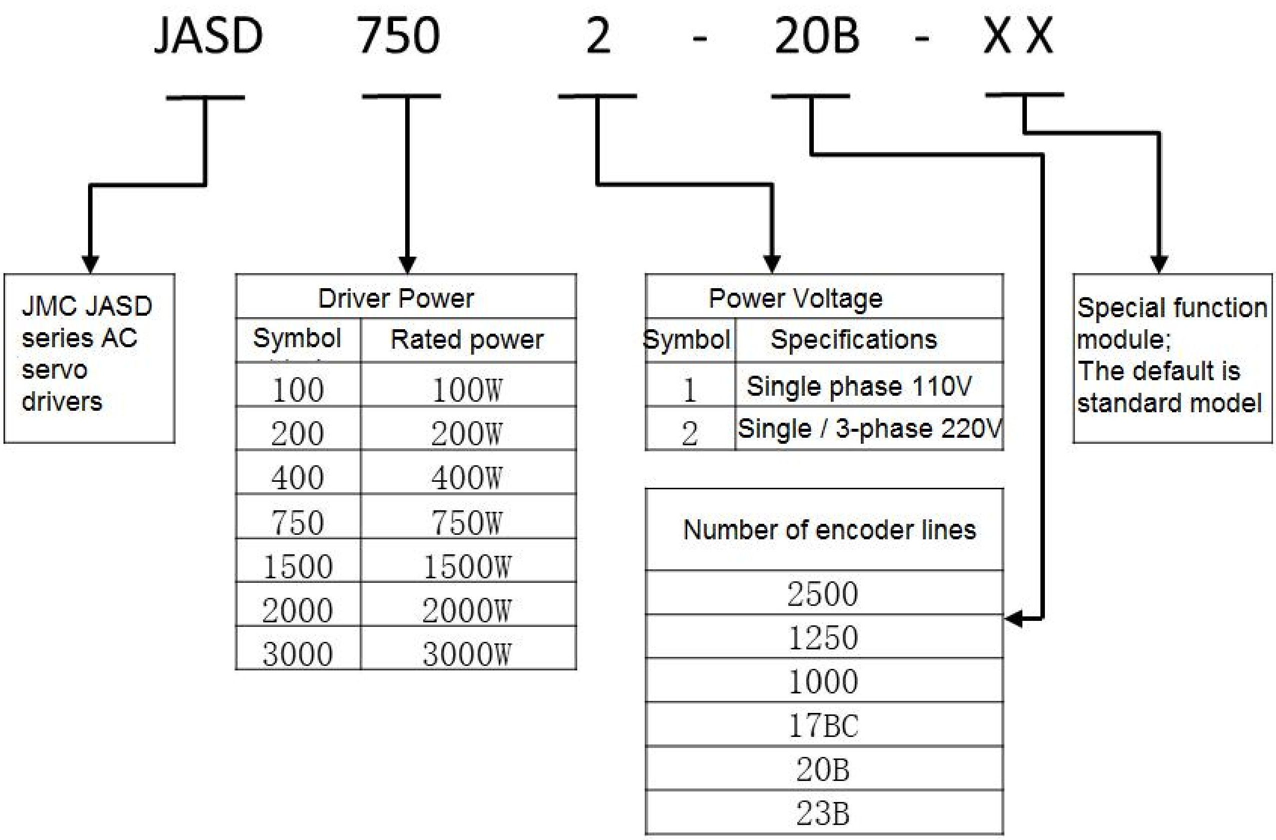


Fig.102 Servo Drive Model

2.1.4 Nameplate of driver

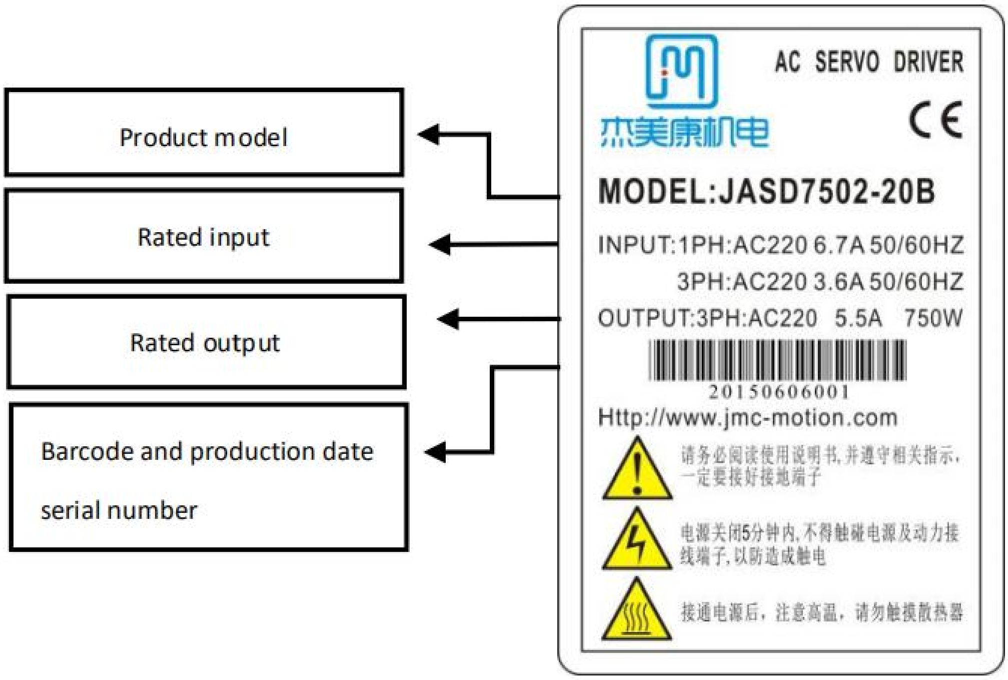


Fig. 103 Nameplate content description

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 features

- ✧ 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

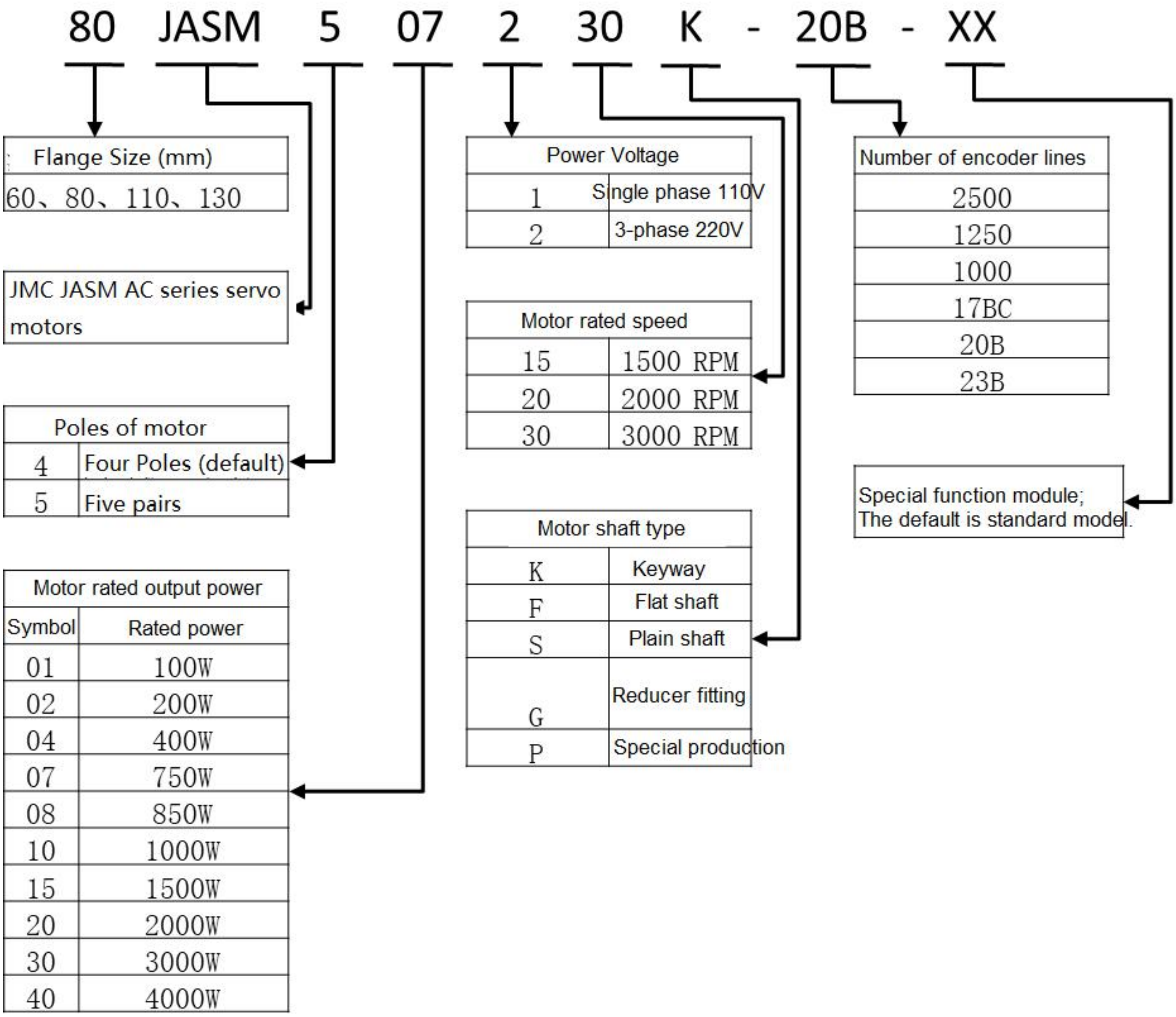


Fig. 104 Servo Motor Model

2.2.4 Nameplate of motor

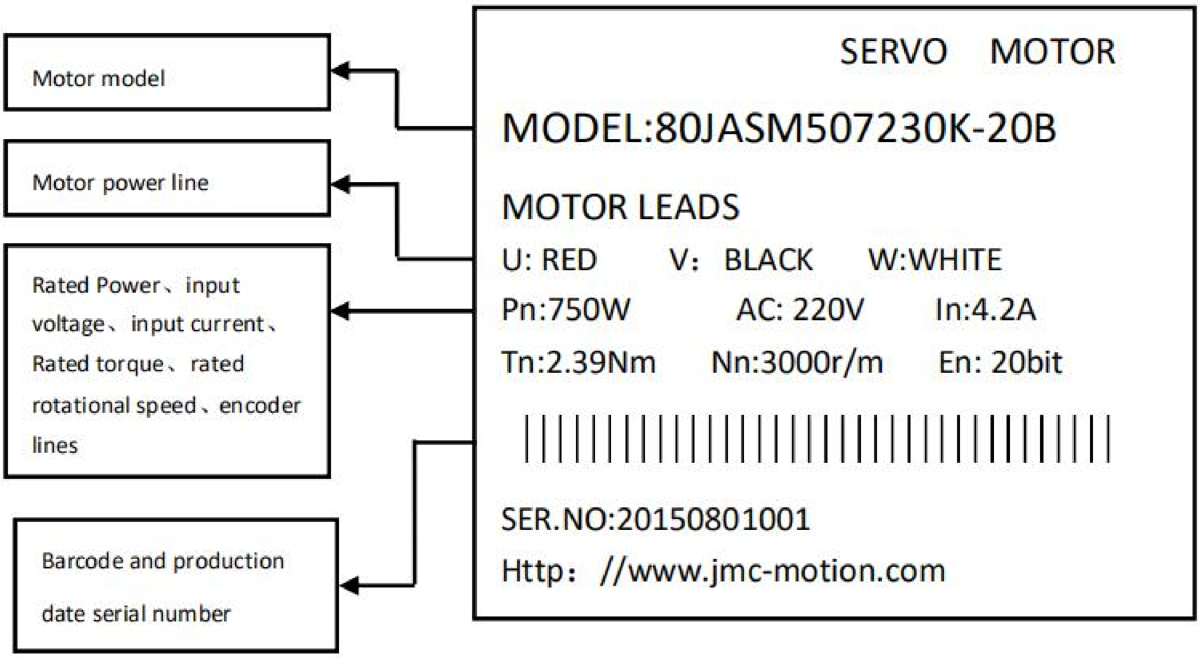


Fig. 105 Nameplate of Motor

2.3 Servo control system and Main power circuit connection

2.3.1 Wiring diagram of servo control system

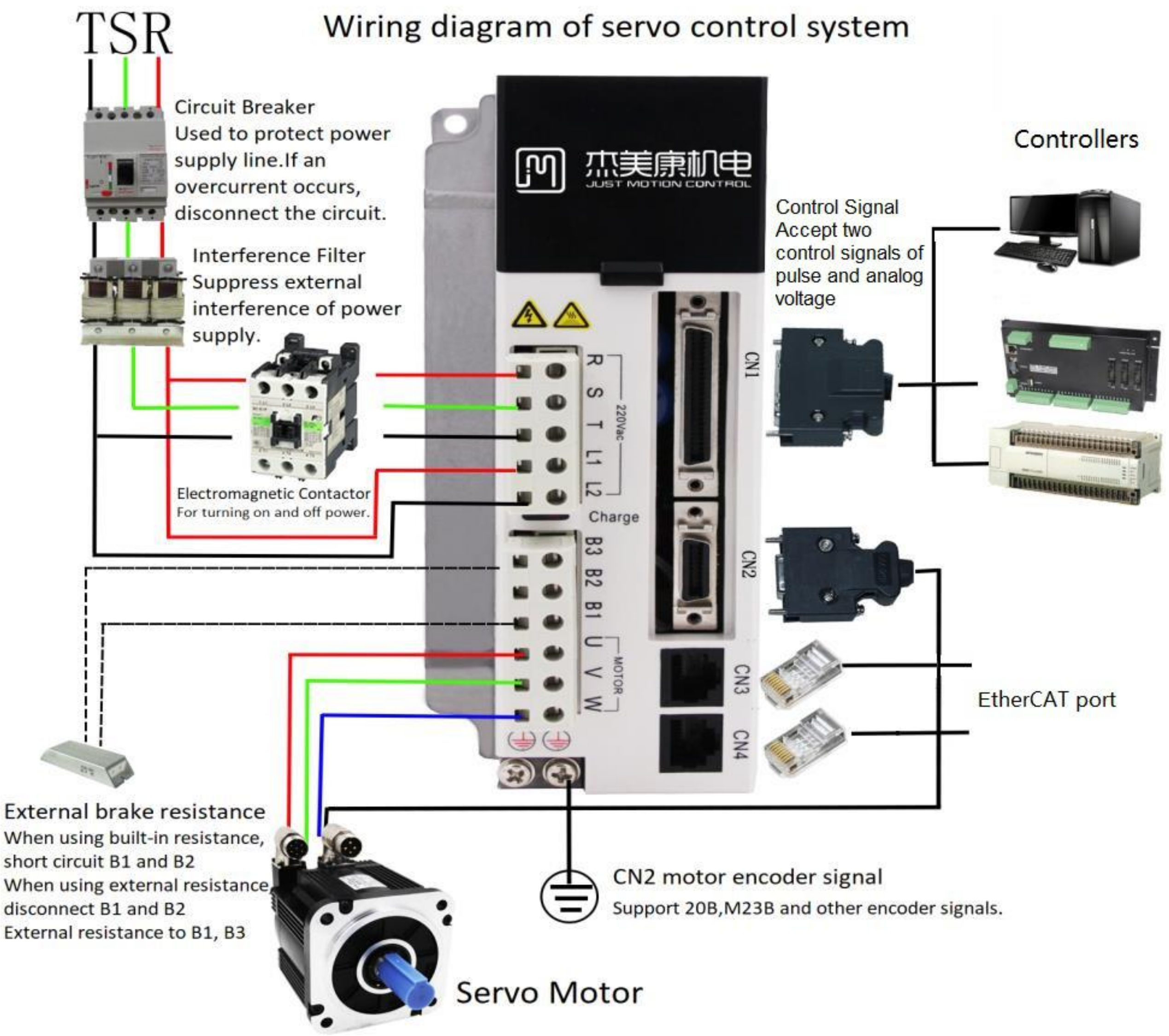


Fig 106 Wiring diagram of servo control system

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

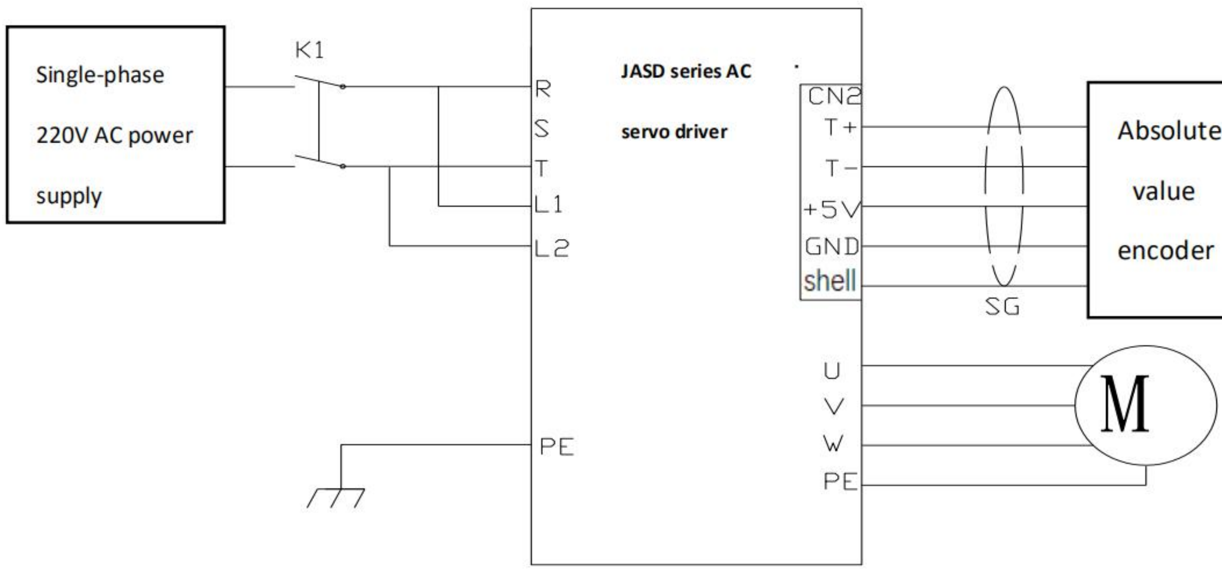


Fig. 107 single-phase power supply

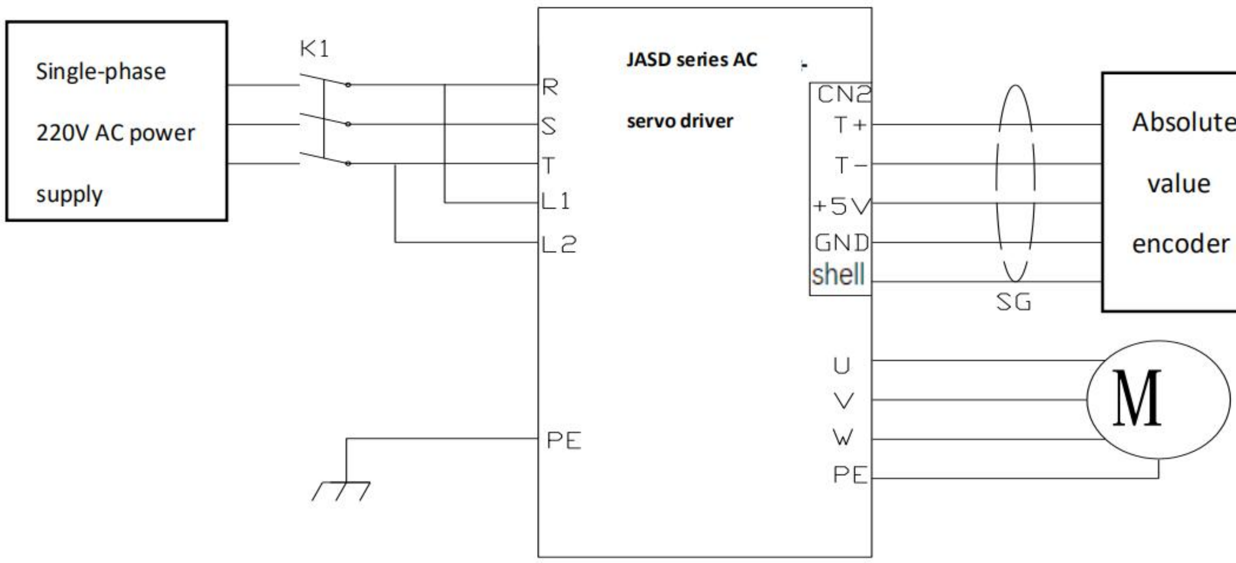


Fig. 108 Three-phase power supply

3 Port description and wiring

3.1 Description of servo driver CN1 control port

3.1.1 Definition of CN1 control port

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

Fig. 109 Description of the ports on the back of the CN1 connector

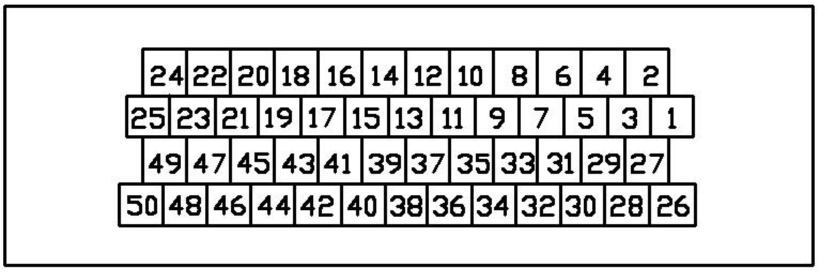
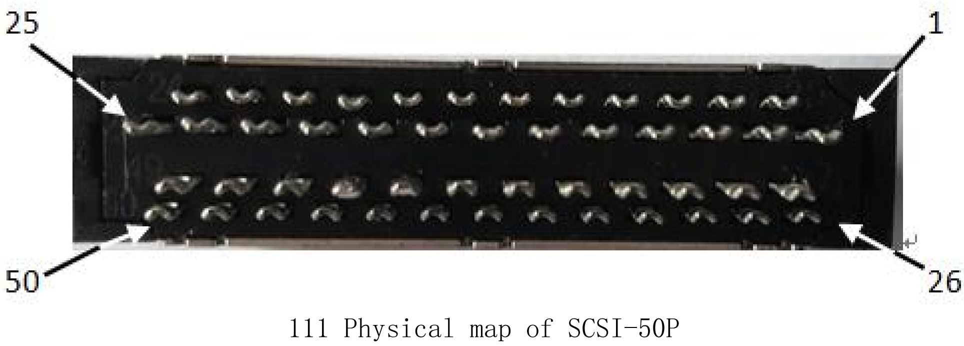


Fig. 110 Distribution diagram of SCSI-50P terminal pins on CN1 port



111 Physical map of SCSI-50P

Fig. 78 Definition 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	

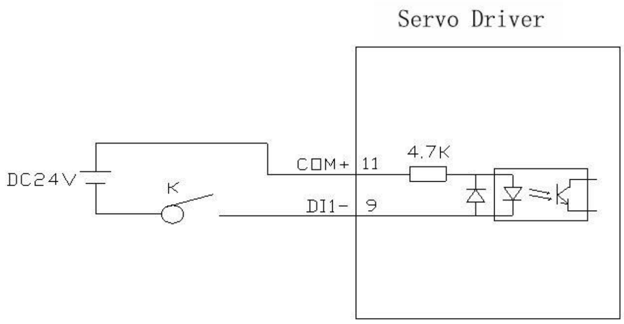
Notice:

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.

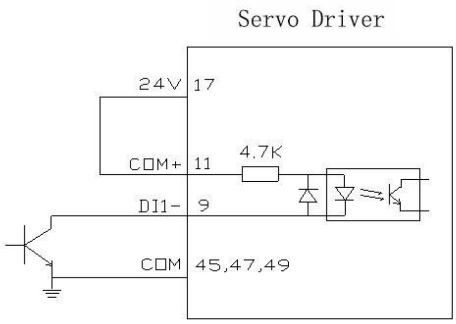
2、Digital input (DI) port、digital output (DO) port, Please set the custom function According to the parameter description.

3.1.2 Connection instructions for CN1 control ports

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/O parameters)

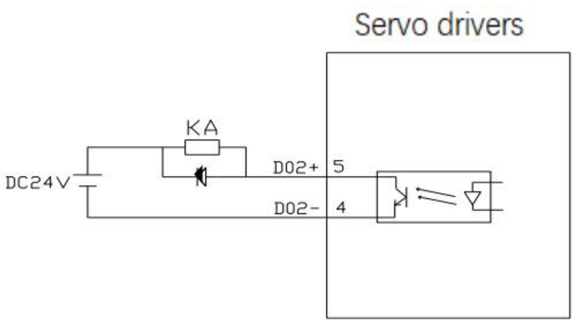


External power input

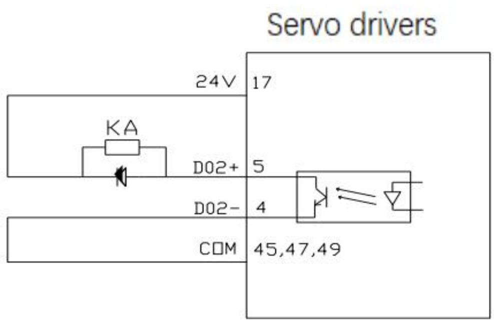


Internal power input

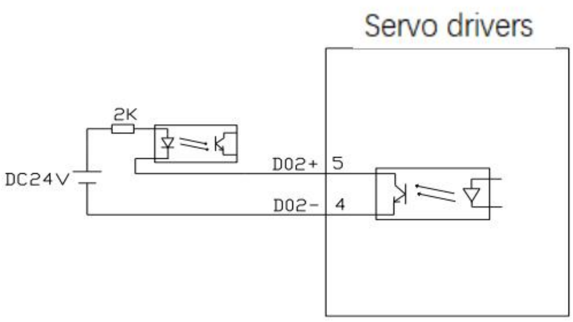
The digital output DO(DO1-DO5) can be connected with relays, photoelectric couplers, etc. The power supply provided inside the drive can be used or external power supply can be used. When using internal power supply, The 24V power supply inside the driver only provides 150mA. If the load is greater than 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/O parameters)



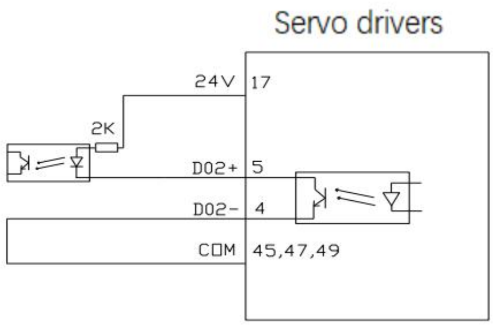
(Relay) External power supply



(Relay) Internal power supply

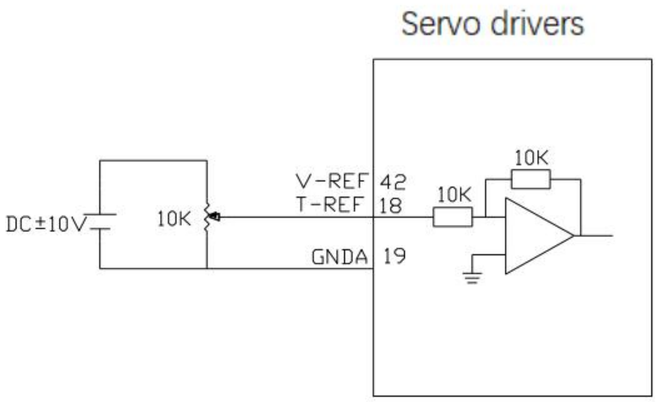


(Optocoupler) External power source

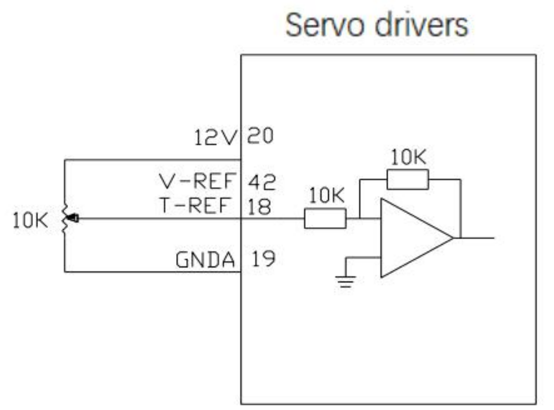


(Optocoupler) Internal power supply

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 encoder connector

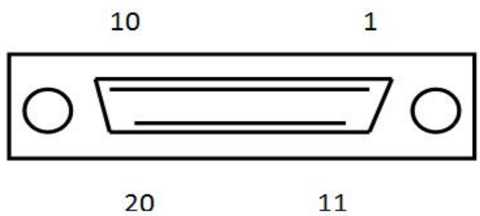


Fig. 112 Port description of CN2

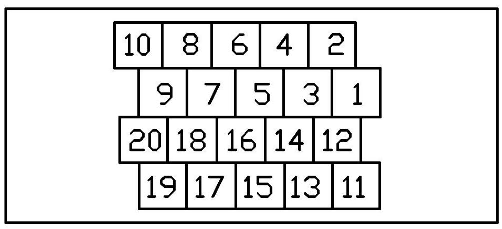


Fig. 113 Pin assignment of SCSI-20P terminal on CN2 port

Fig. 114 SCSI-20P physical map

Table 79 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

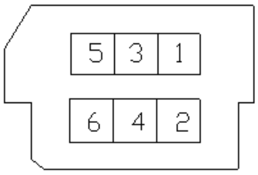


Fig. 115 Encoder connector

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

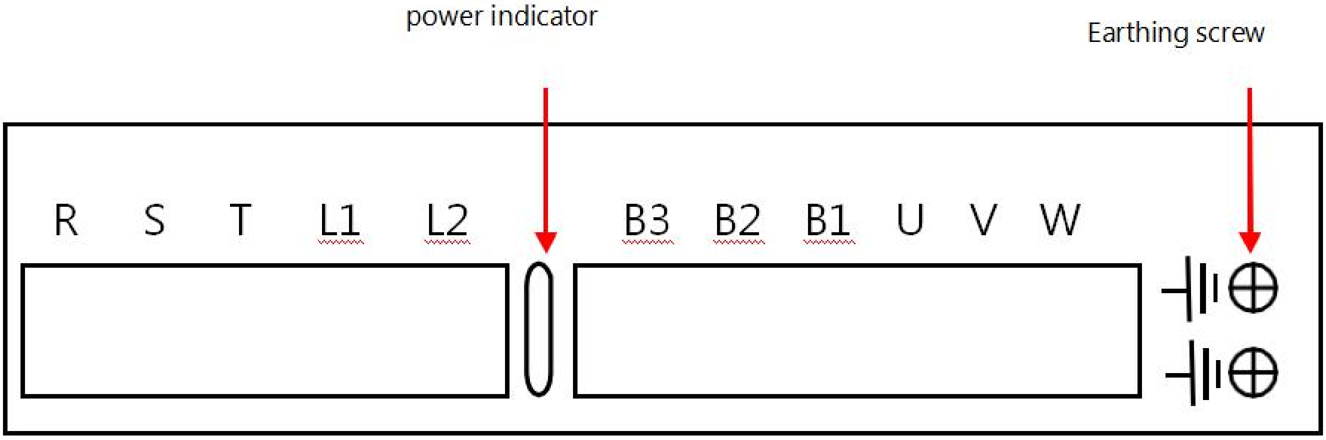


Fig. 116 Drive power line of 400W and below 400W

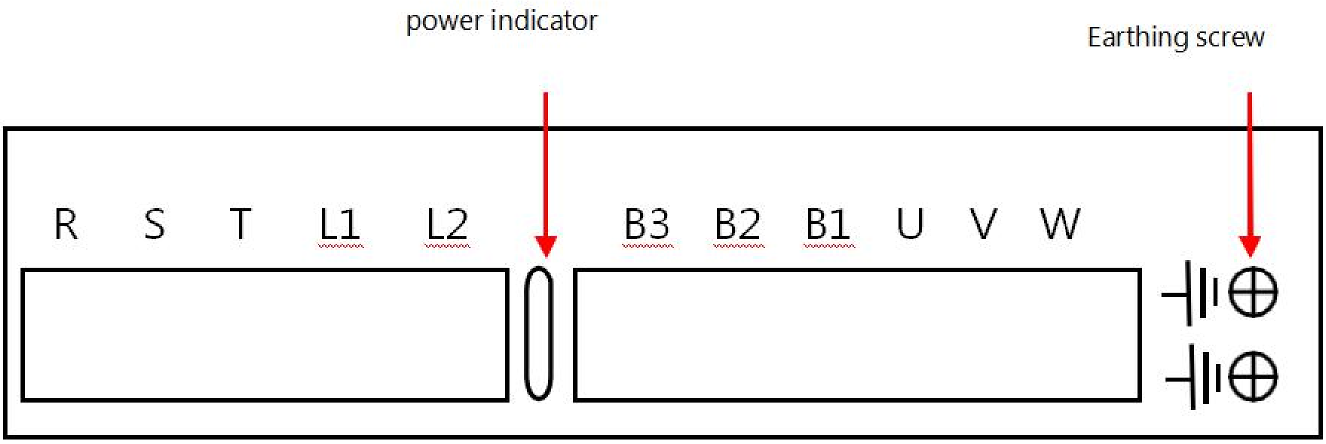


Fig 117 Drive power line of 750W and below 750W

Fig. 81 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

4.1Installation dimension

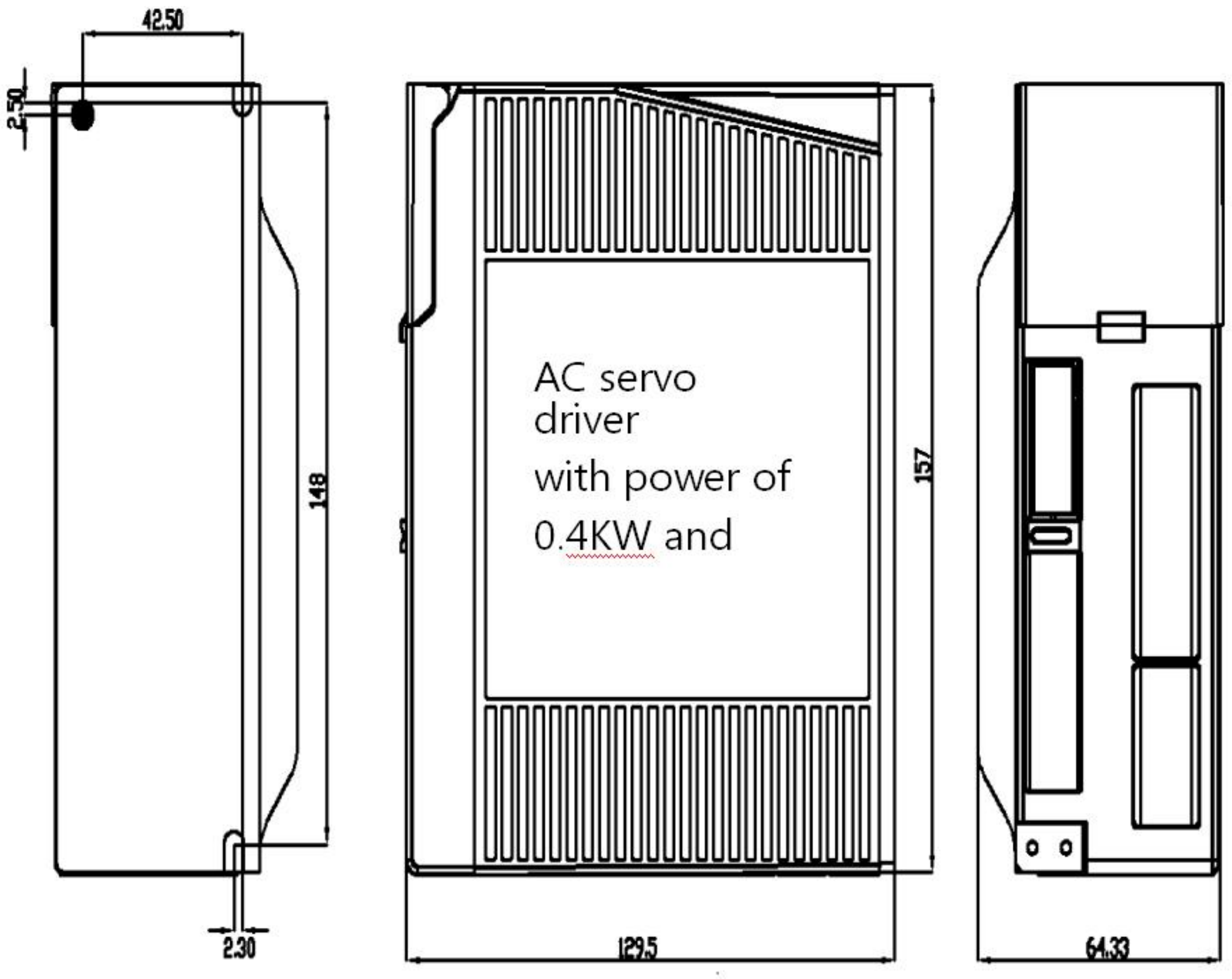


Fig. 118 AC servo driver with power of 400W and below (unit: mm)

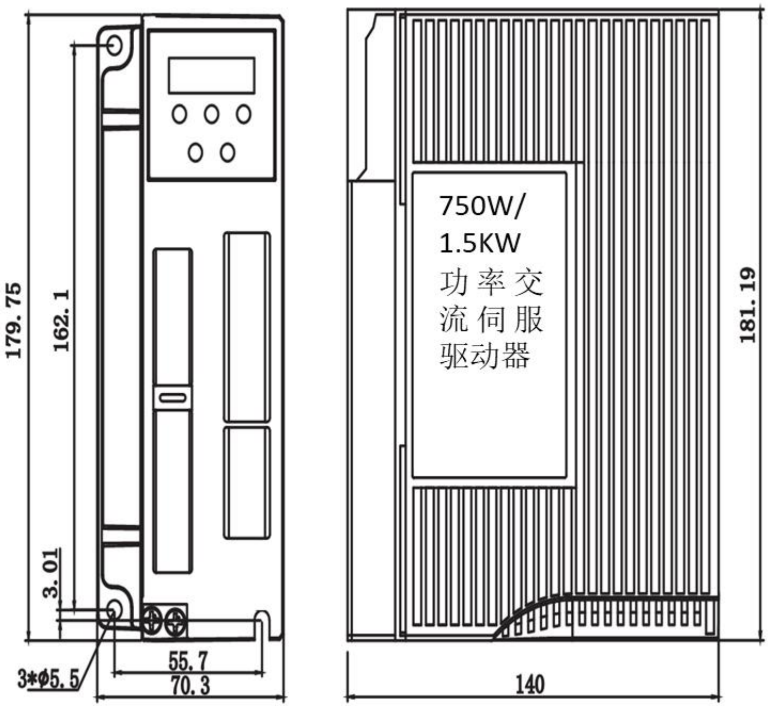


Fig. 119 750W / 1.5KW AC servo driver（unit：mm）

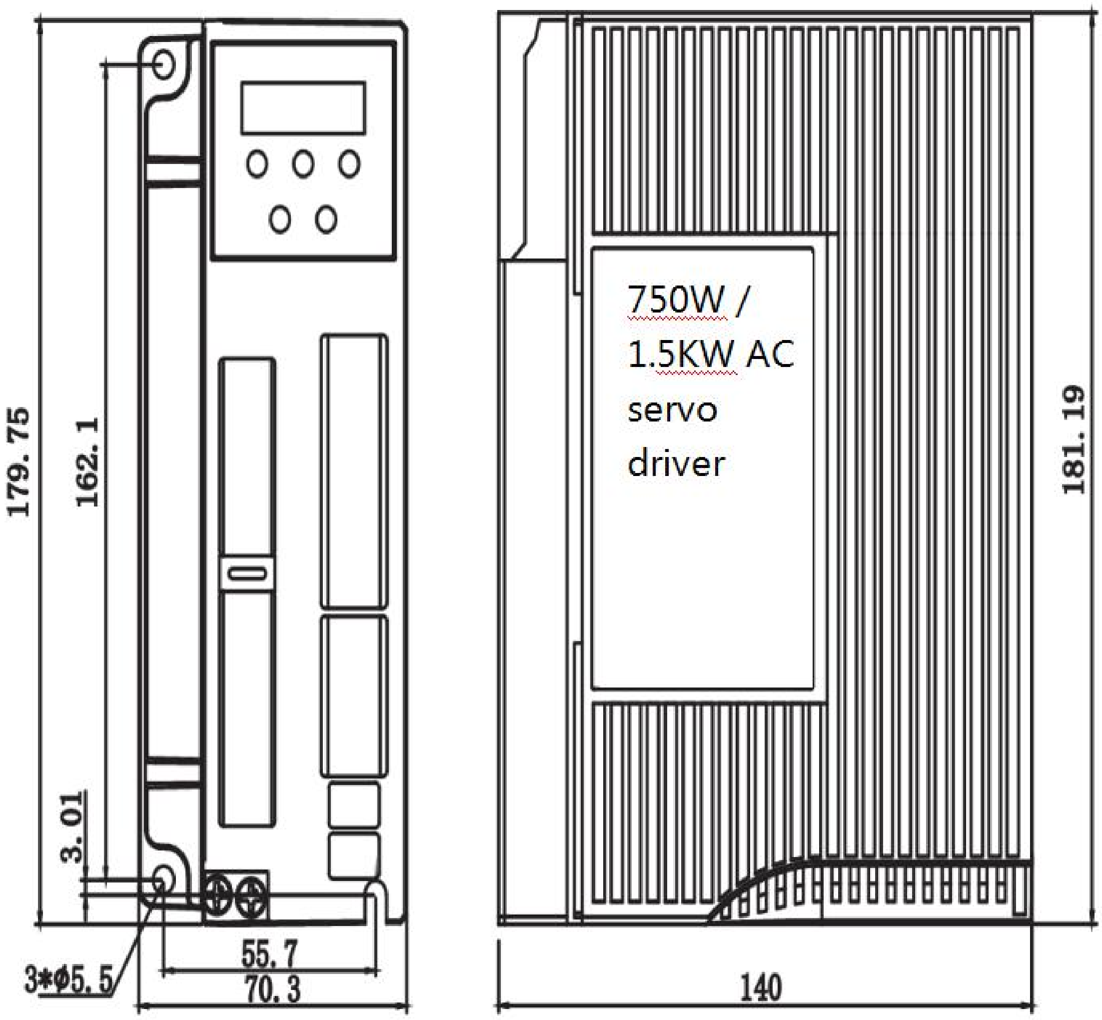


Fig. 120 AC servo driver with 2kW power（unit：mm）

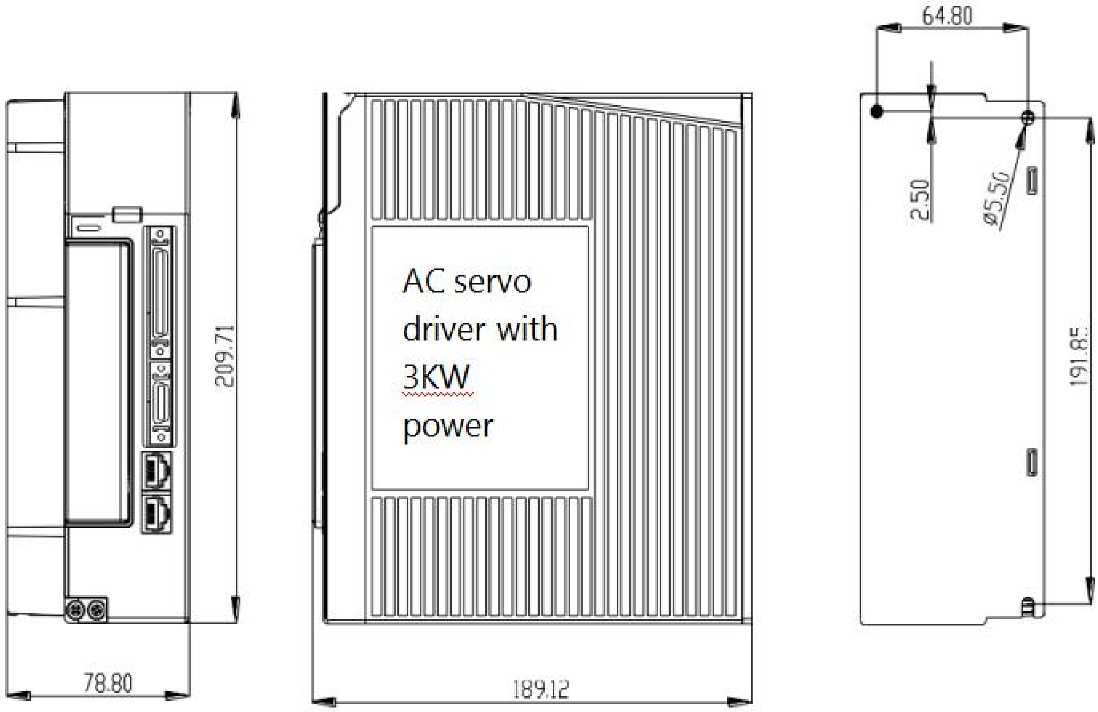


Fig. 121 AC servo driver with 3KW power (nuit: mm)

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 and Settings

5.1 The instructions of the panel functions

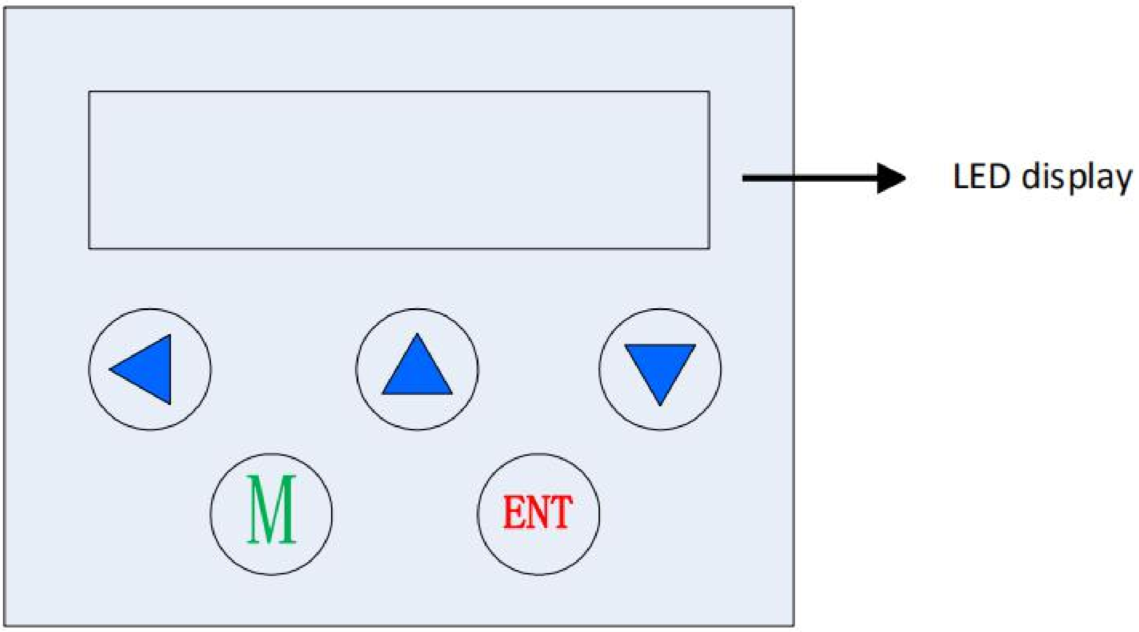
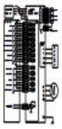


Figure 122 key panel

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

:

Table. 82 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:

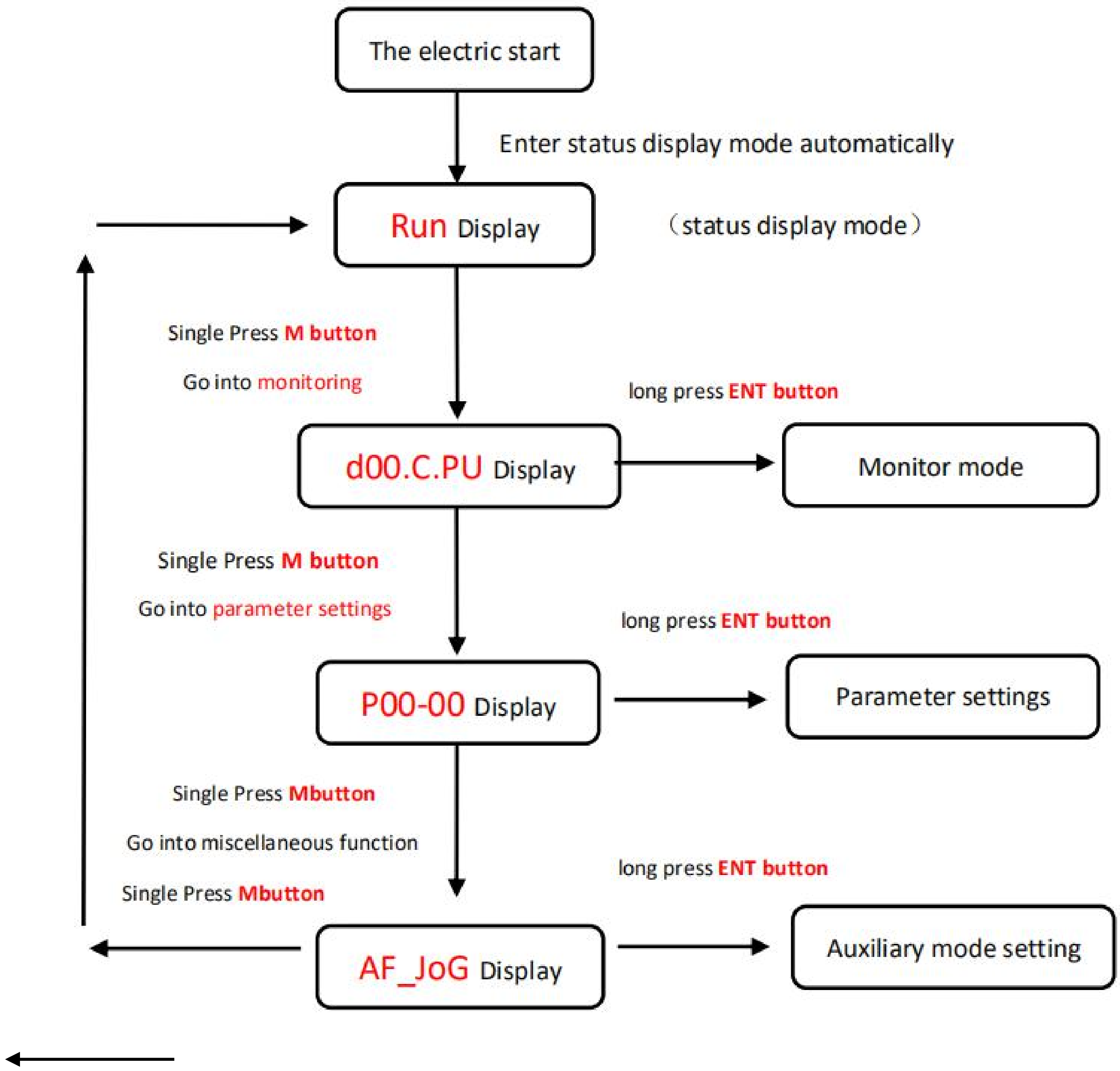


Figure 123 Switching process of operation mode

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

5.3 Status display

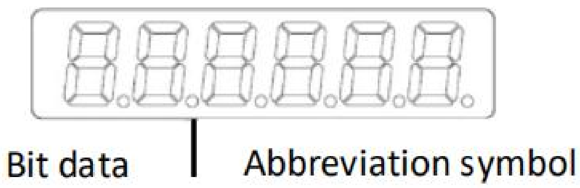


Fig. 124 Digital display

Table 83　Meaning of status display bit data

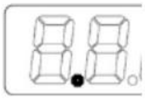
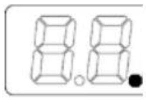
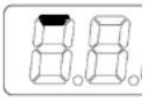
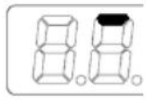
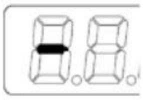
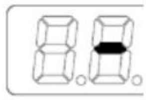
Display	Meaning	Display	Meaning
	Control circuit power on display		Main circuit power supply ready display
	Speed and torque control: consistent display of speed Position control: display after positioning		Rotate the check out display
	Base block display The light is ON at servo OFF state and OFF at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

Table 84 Fig. 84　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

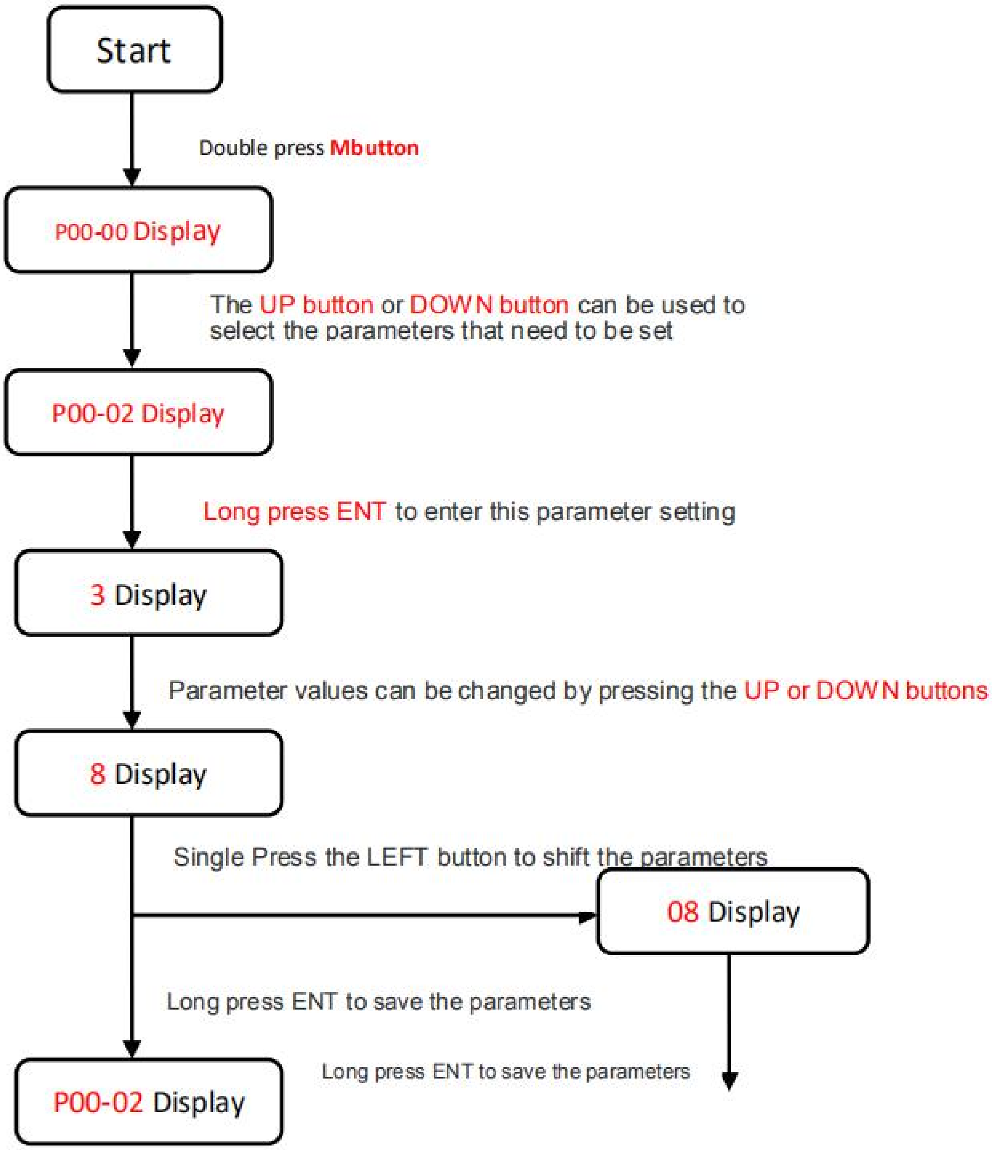


Fig. 125 writing and saving method of parameter setting

6 Control mode and setting

6.1 Position control

6.1.1 Position control wiring diagram

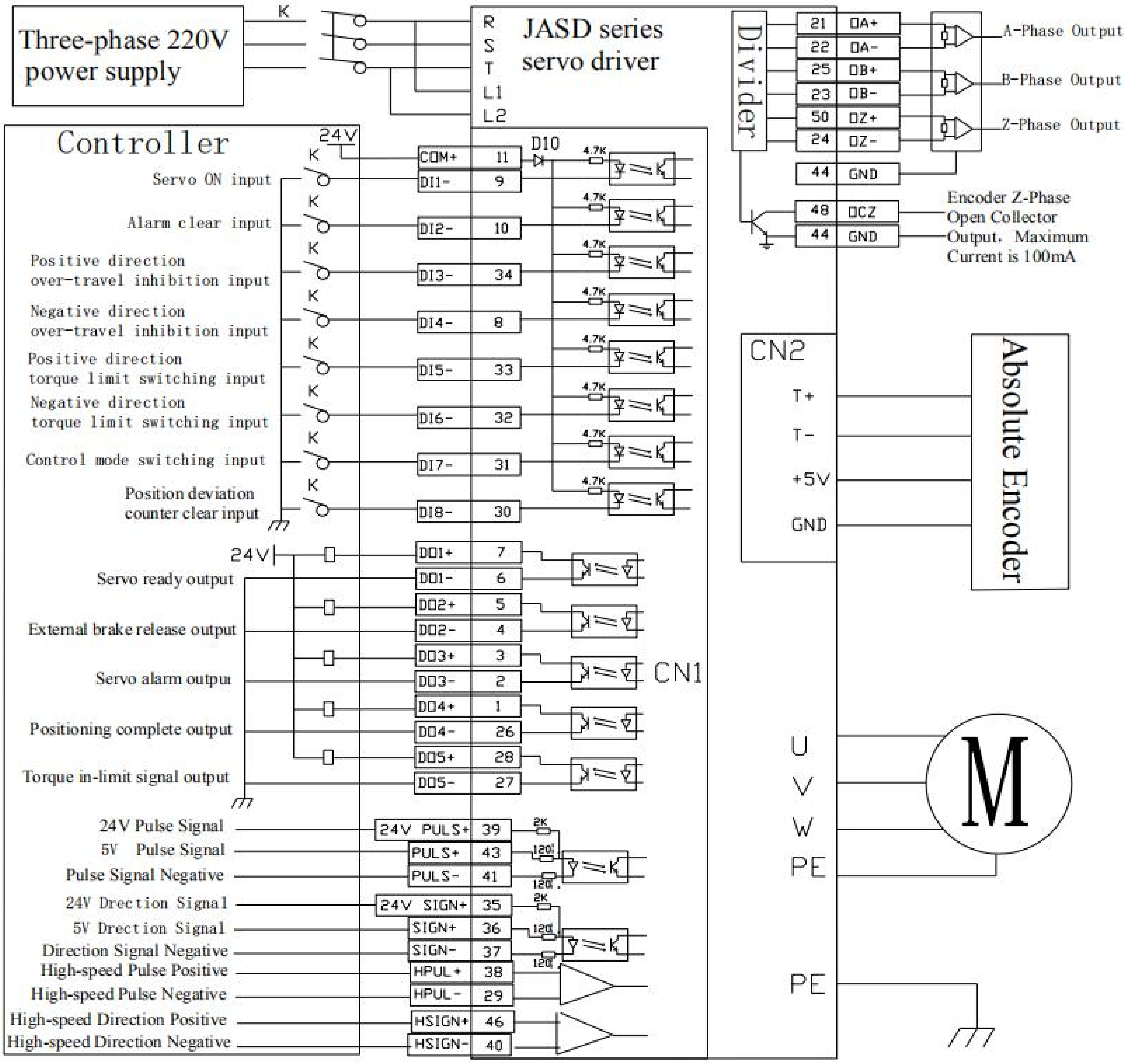
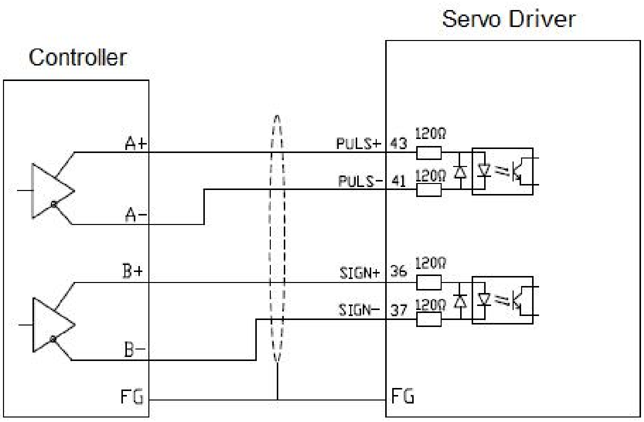


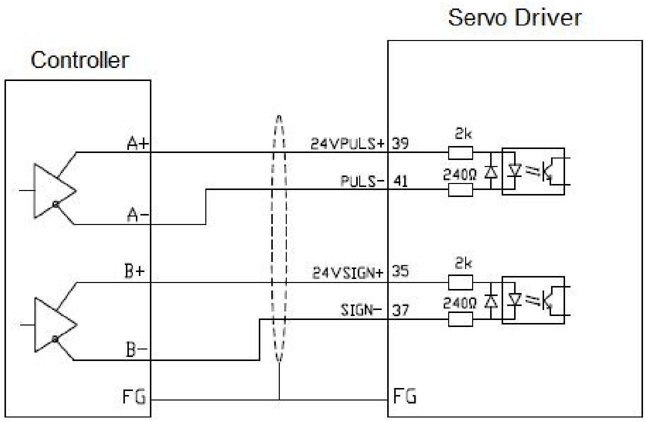
Fig. 126 Position control wiring diagram

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

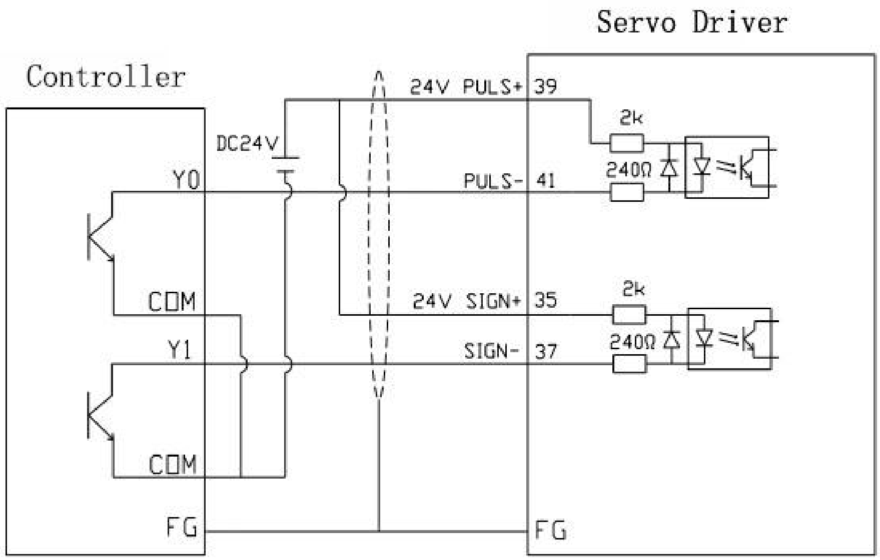


5V pulse + direction input mode

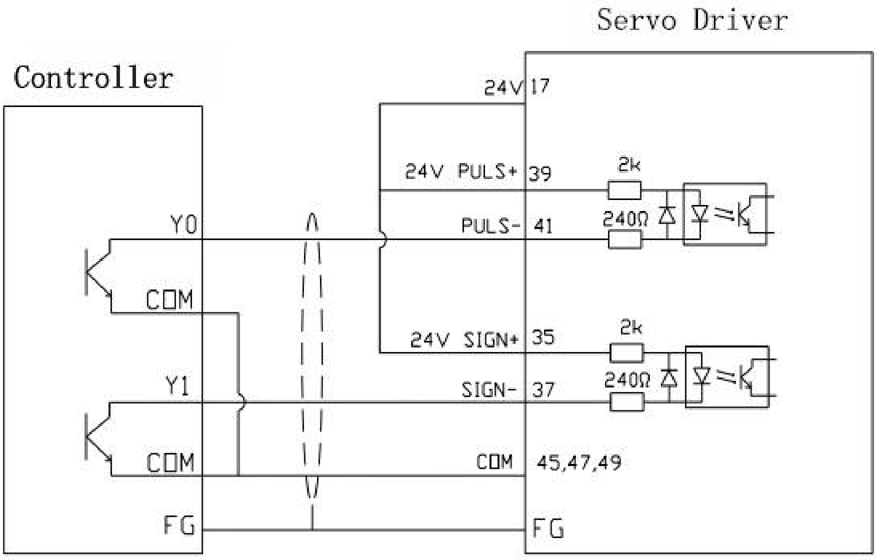


24V pulse + direction input mode

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

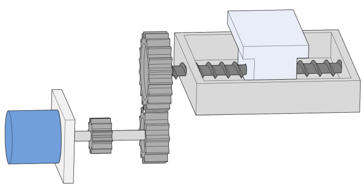


Fig. 127 Ball screw drive

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

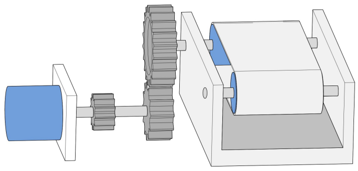


Fig. 128 Belt pulley drive

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

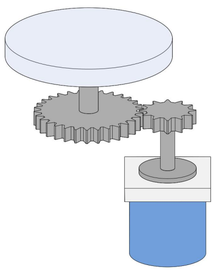


Fig. 129 Rotating load

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 Speed control

6.2.1 Speed control wiring diagram

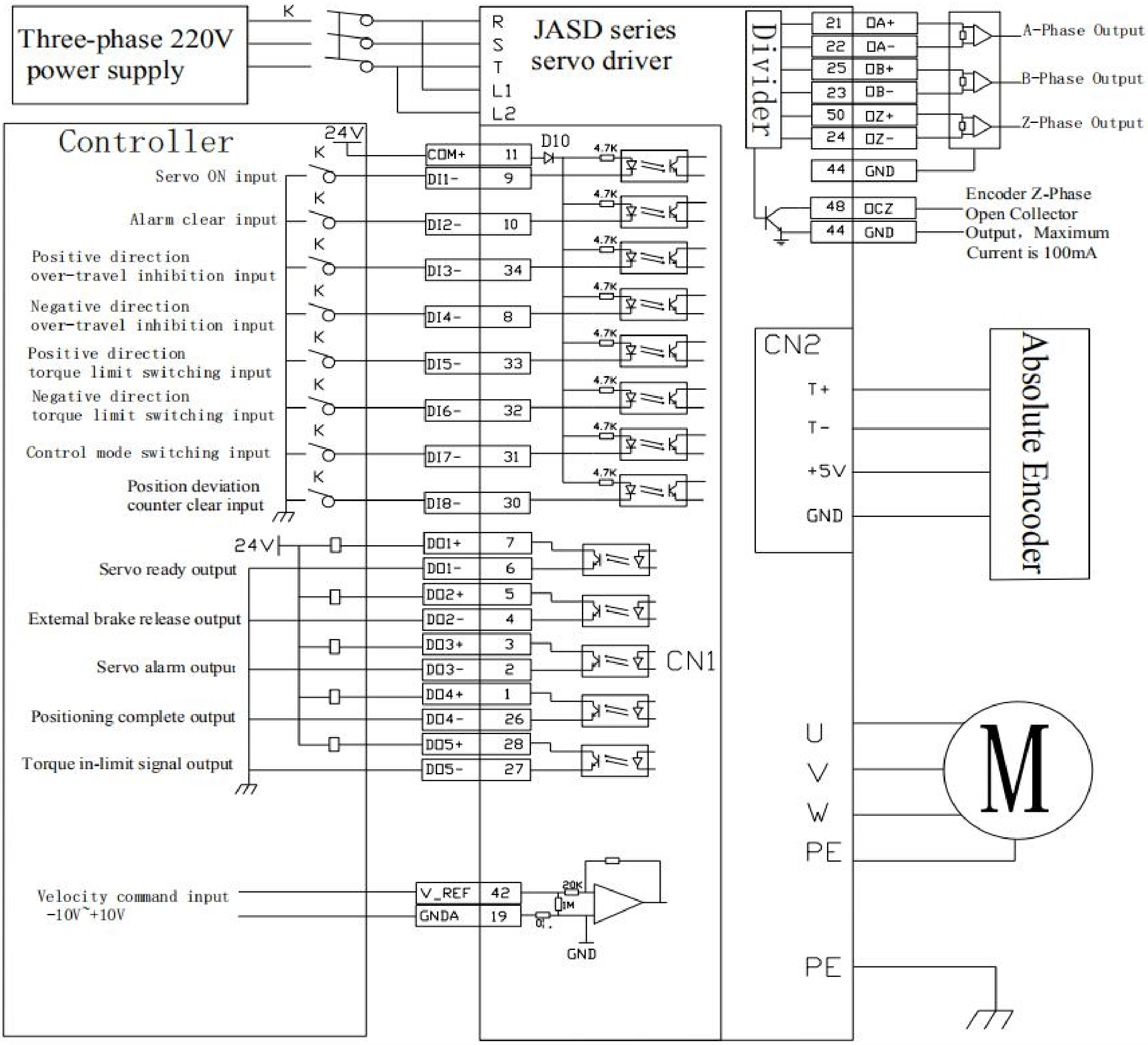


Fig. 130 Speed control wiring diagram

6.2.2 Parameter description of speed control mode

Table 86 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 Torque control

6.3.1 Torque control wiring diagram

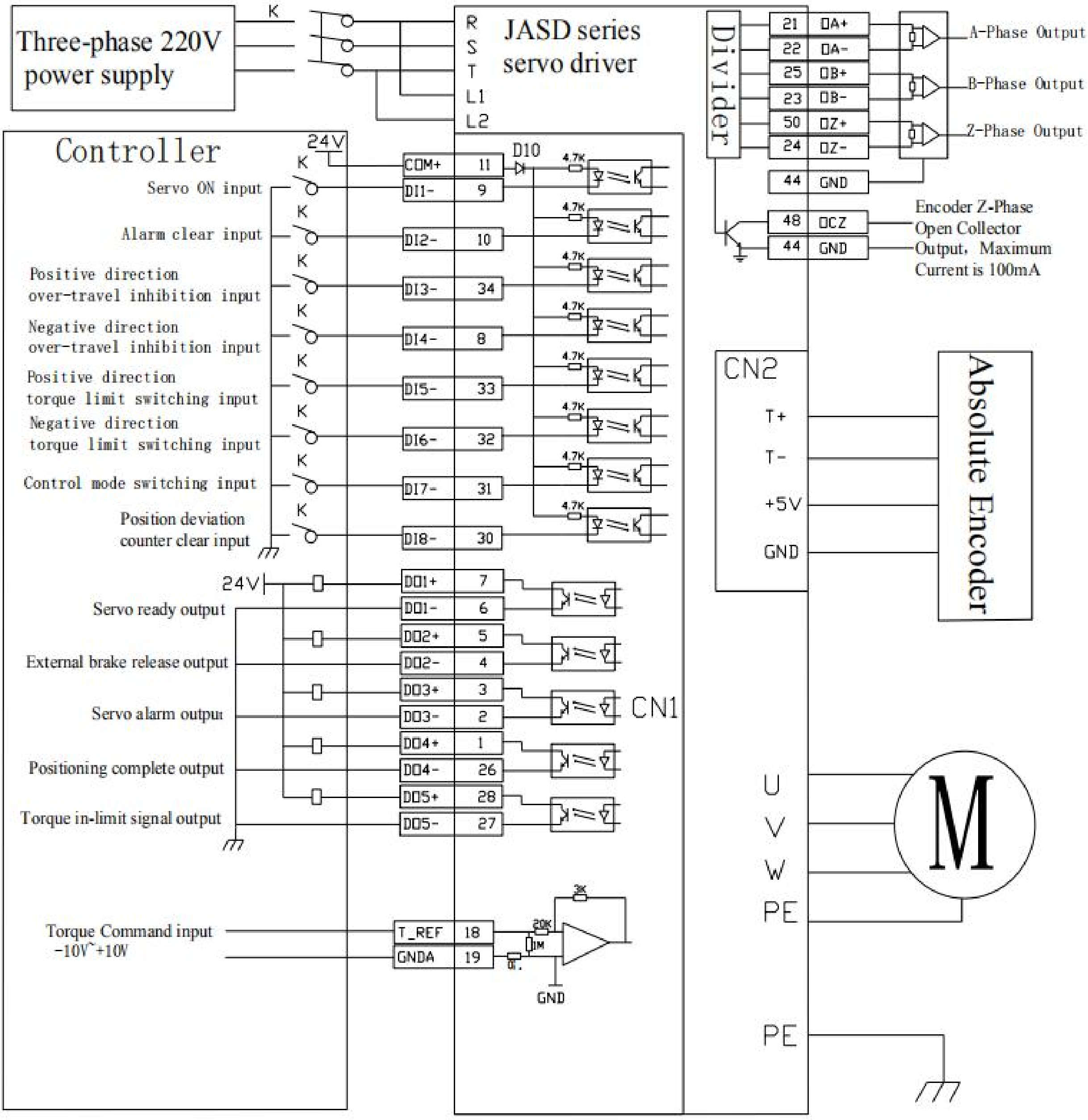


Fig. 131 Torque control wiring diagram

6.3.2 Parameters description in torque control mode

Table 87 Parameters description in torque control mode

Para code	Name	Setting range	set	Description
P01-01	Setting the control Mode	0-6	2	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	---	
P05-00	Source of torque command	0-3	0	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)
P05-01	Torque command analog inversion	0-1	0	Set the initial direction of motor rotation
P05-02	Torque mode speed limit setting value	0-6000	1000	The maximum speed of the motor in setting torque mode. P05-00 is valid when it is 0 and 1
P05-05	Torque limit setting source	0-1	0	Source for adjusting torque limit
P05-10	Limit value of internal positive torque	0-300.0	200.0	Limit forward torque value

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 88 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 anything 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:

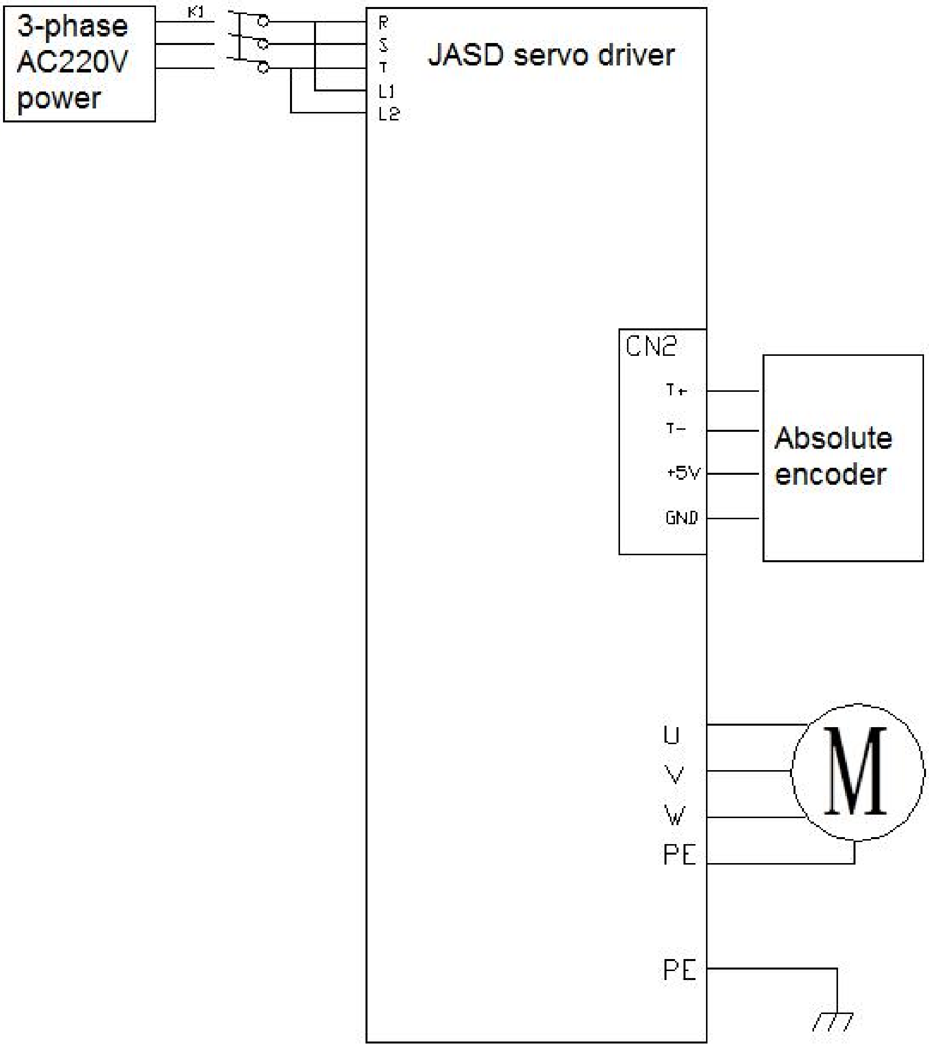


Fig. 132 Wiring diagram in JoG mode

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

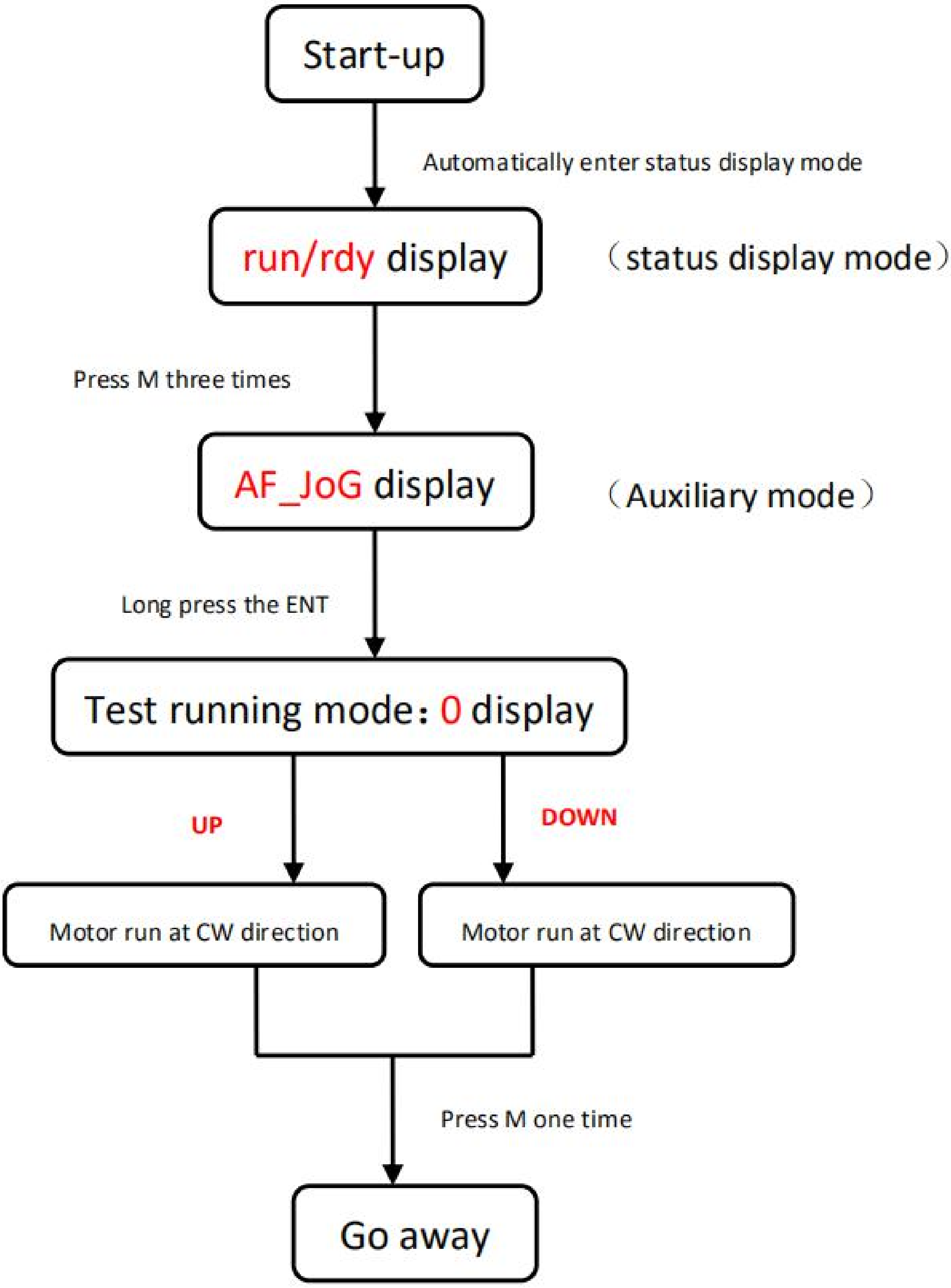


Fig. 133 Flow chart of JoG mode

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.

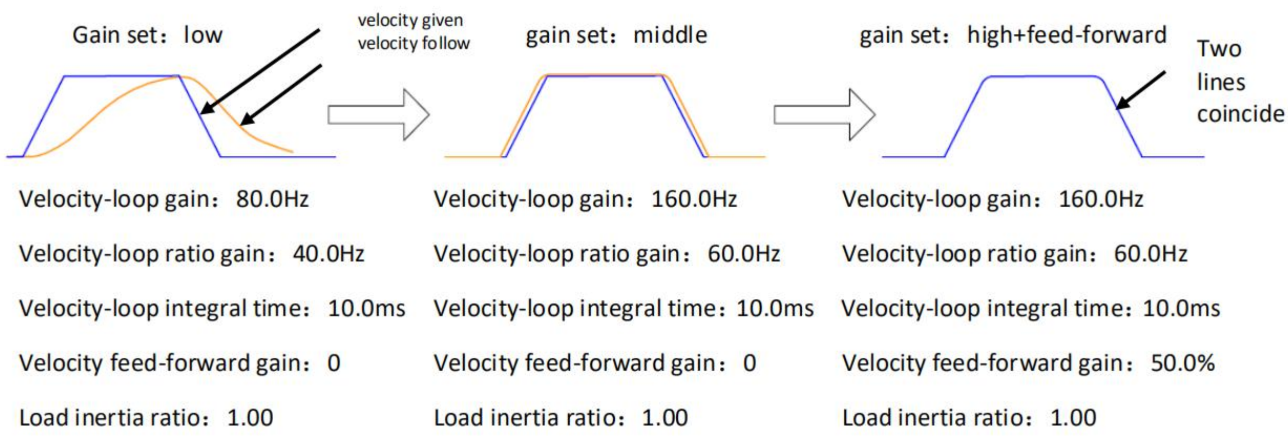


FIG. 134 Curves of different gains

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.

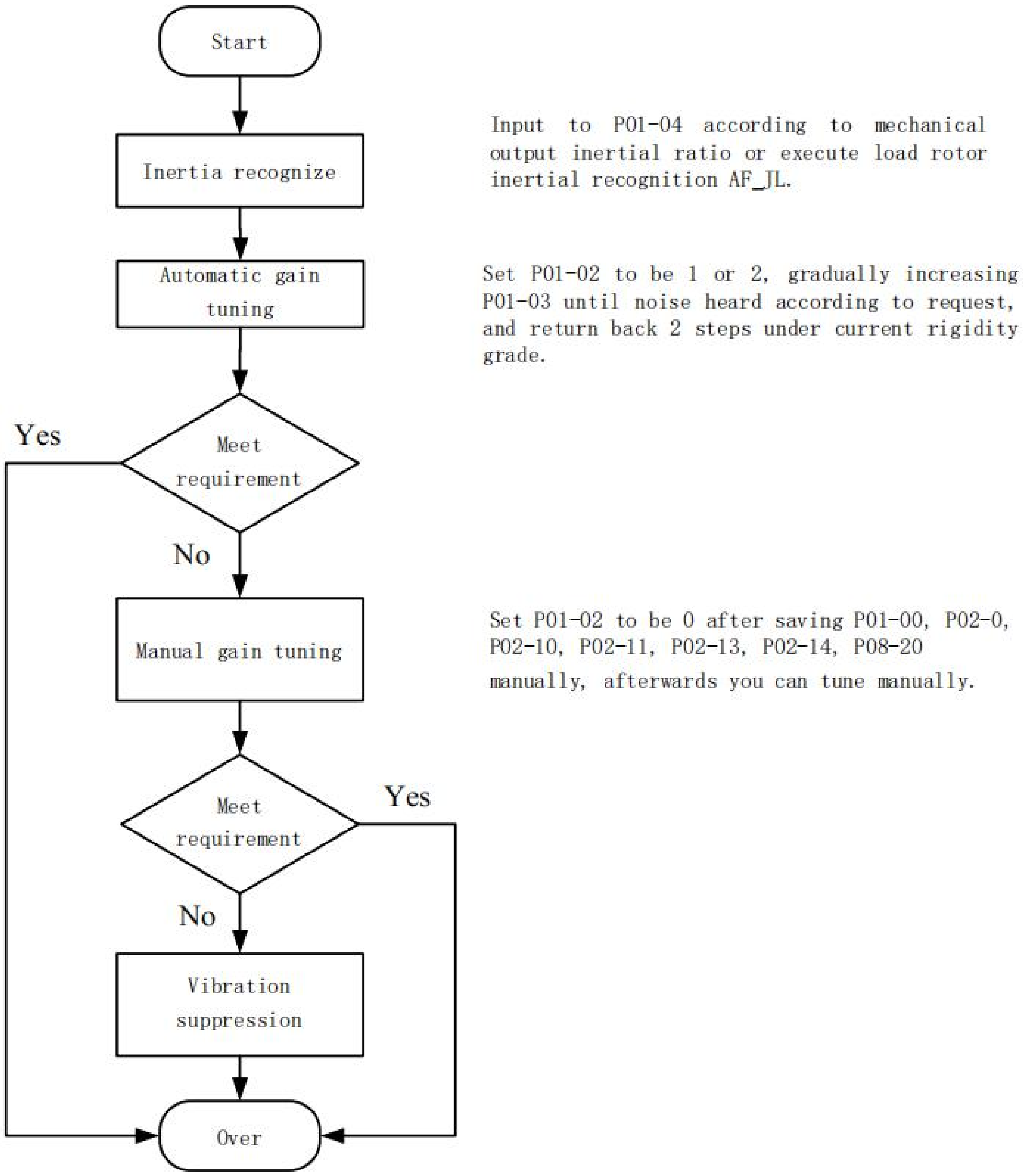


FIG. 135 Gain adjustment flow chart

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:

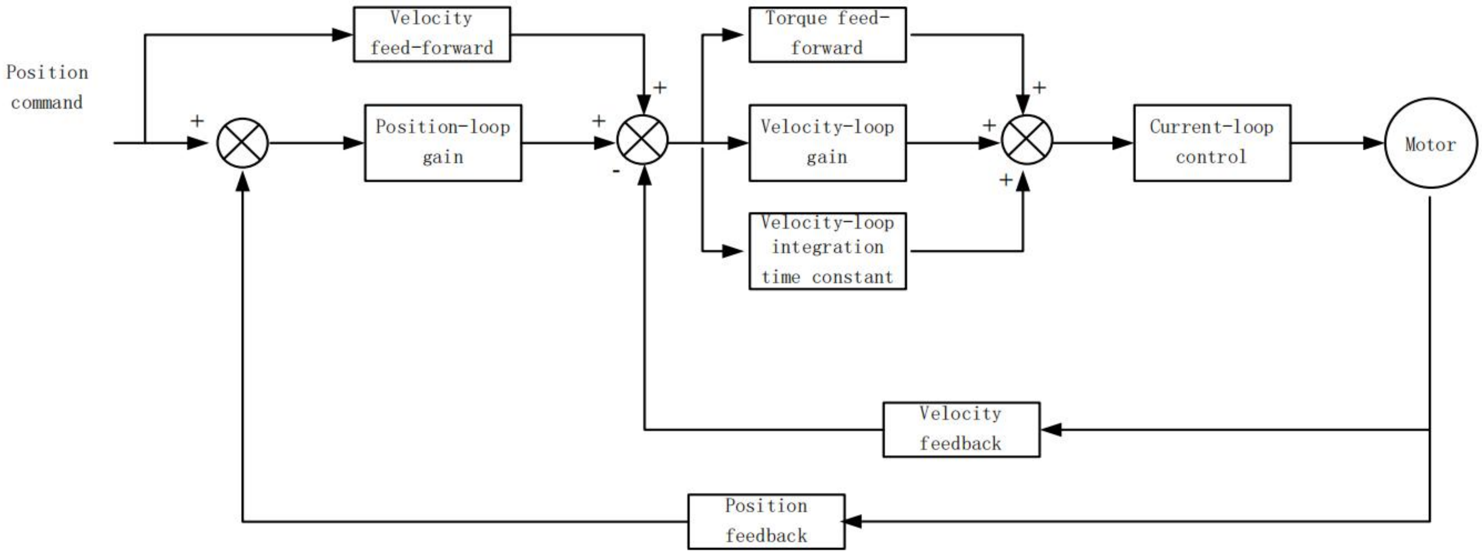


FIG. 136 Control block diagram of servo system

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 89 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 smoothing constant	0-64.00	0	This parameter is used to set the time constant of the speed loop feedforward filter. The larger the value, the greater the filtering effect, but at the same time the phase lag increases.

P02-10	Speed proportiona l 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	0.1-100 0.0	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-diff erential 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 proportiona 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	0.1-100 0.0	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

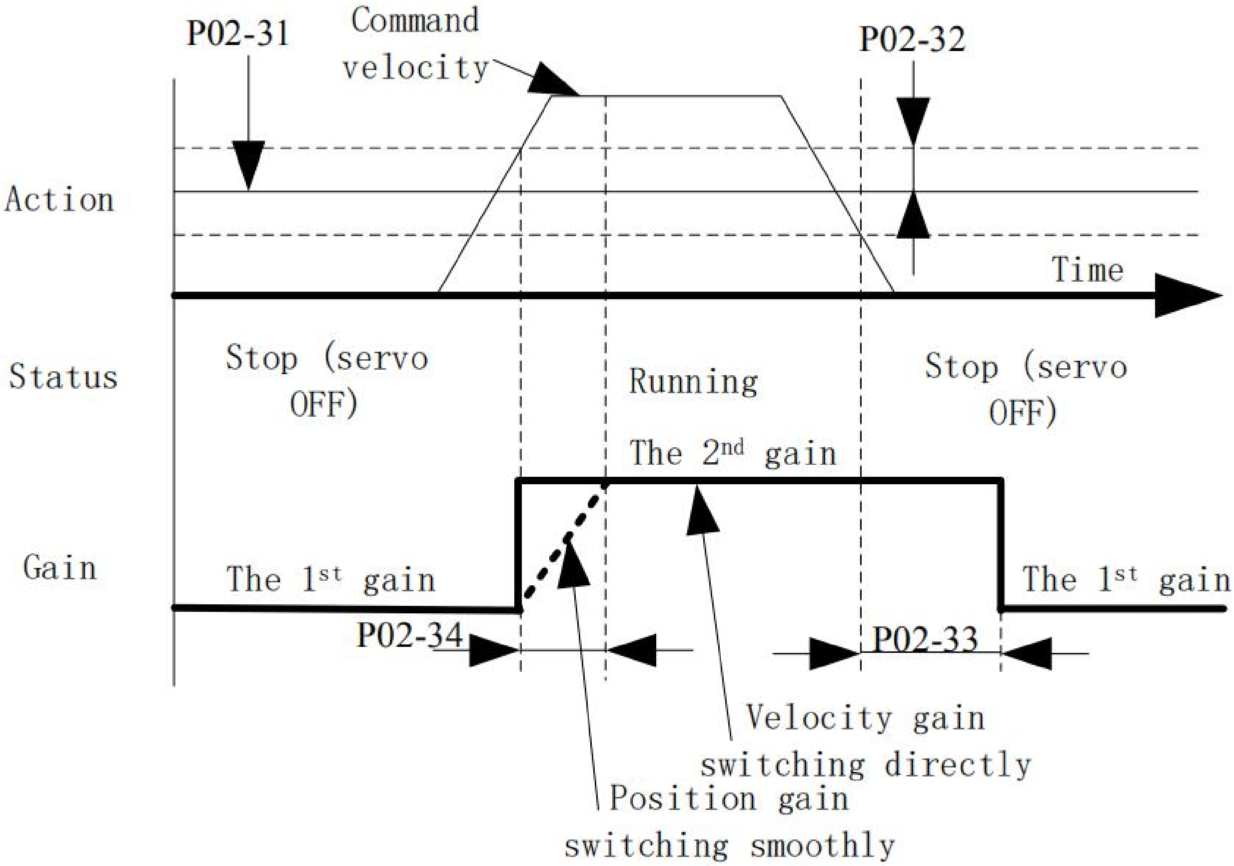


Figure 137 Gain switch

Table 90 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.

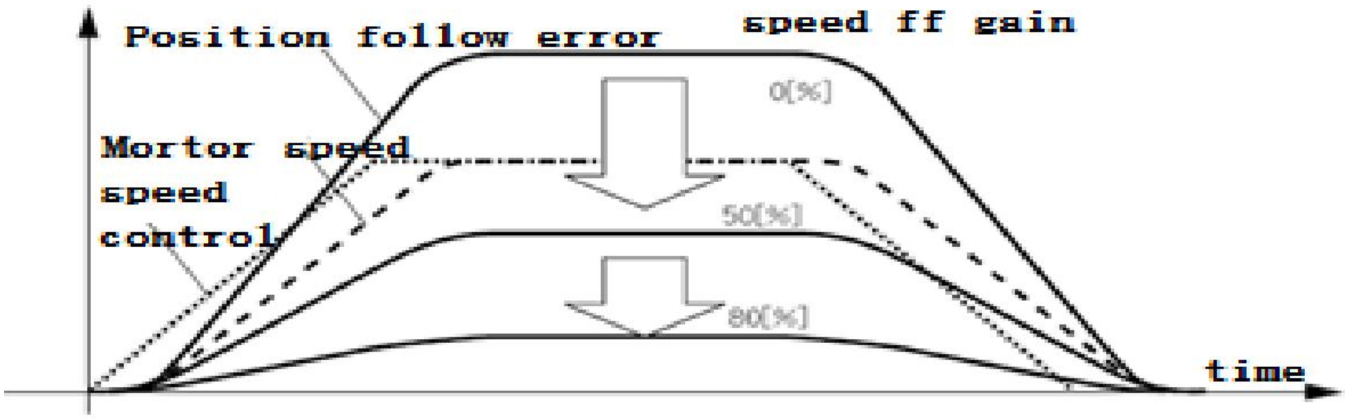


Fig.138 Speed feedforward function

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.

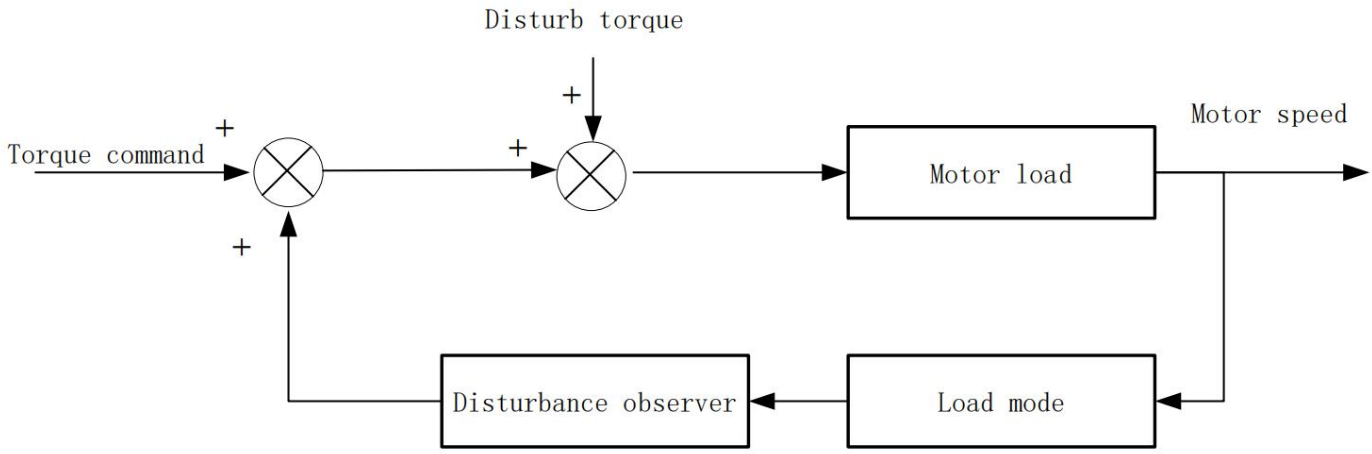


Fig. 139 Disturbance observer

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. 92 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.

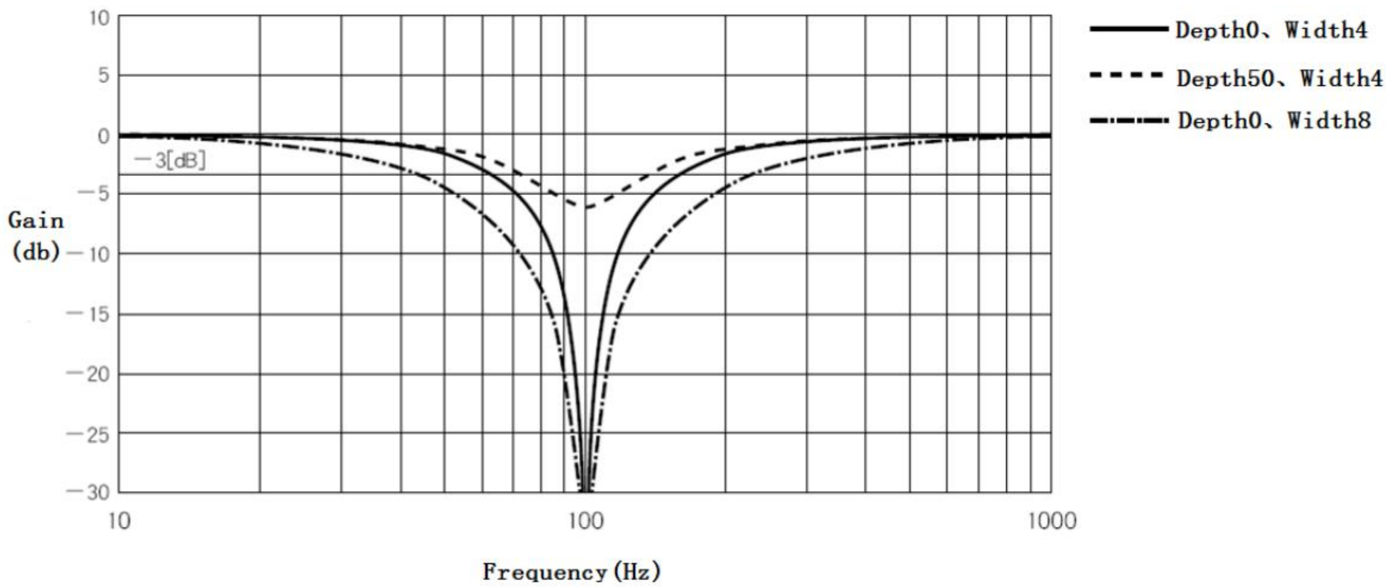


FIG. 140 Frequency characteristics of notch filter

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 97 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.cm²	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 parameter	P01-01	control mode setting	0-6	0	---	Stop & reset	Real time
	P01-02	Automatically tuning mode in real time	0-2	2	---	Running & setting	Real time
	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 & setting	Real time
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	0-64.00	0.5	1ms	Running &	Real time

		smooth constant				setting	
	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 switching time	0-1000.0	10.0	1ms	Running & setting	Real time
	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	Real time
	P03-04	Position Pulse filtering	0-3	2	---	Running & setting	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 & setting	Re-power on
	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	1-65535	1	---	Running &	Real time

		output pulse frequency division ratio molecule				setting	
	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	0-65535	10000	---	Running &	Real time

		position deviation too large settings				setting	
	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 deceleration time	0-5000	0	---	Running & setting	Real 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
Torque parameter	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	0-18	7	---	Running &	Re-poweron

		function selection(Default: Forward torque external torque limit)				setting	
	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 of input port	0-4	0	---	Running & setting	Re-poweron
	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	DO1 Valid level of output port	0-1	1	---	Running & setting	Re-poweron
	P06-21	DO1 Function change of output port (fault:serve ready)	0-11	3	---	Running & setting	Re-poweron
	P06-22	DO2 Valid level of output port	0/1	1	---	Running & setting	Re-poweron
	P06-23	DO2 Function change of output port (fault: brake open)	0-11	2	---	Running & setting	Re-poweron
	P06-24	DO3 Valid level of output port	0/1	1	---	Running & setting	Re-poweron
	P06-25	DO3 Function change of output port (fault: Alarm output)	0-11	1	---	Running & setting	Re-poweron

	P06-26	DO4 Valid level of output port	0/1	1	---	Running & setting	Re-poweron
	P06-27	DO4 Function change of output port (fault: position completed)	0-11	4	---	Running & setting	Re-poweron
	P06-28	DO5 Valid level of output port	0/1	1	---	Running & setting	Re-poweron
	P06-29	DO5 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	50-10000	1000	1ms	Running & setting	Real time

		identification is completed					
	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 filtering time constant	0-25.00	0.8	1ms	Running & setting	Real time
	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 98 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 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	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 99 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>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><th>value</th><th>Switching condition</th><th>Remark</th></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</td></tr>
</table>
</td>
</tr>
</table>

				first gain.	
		7	There is position command	Switch to the second gain when there is a position command. When the position command ends and the P02-33 delay setting is exceeded, it switches to the first gain.	
		8	Incomplete positioning	Switch to the second gain when positioning is not completed. When the positioning is completed and the P02-33 delay setting is exceeded, it switches to the first gain.	
		9	Actual speed is big	Switch to the second gain when the actual speed is greater than the threshold (determined by P02-31 and P02-32). When it is less than the threshold and exceeds the P02-33 delay setting, it switches to the first gain.	
		10	With position command + actual speed	Switch to the second gain when there is a position command. When there is no position command and the actual speed is less than the threshold (determined by P02-31 and P02-32), and when the delay setting of P02-33 is exceeded, it switches to the first gain.	

P02-31	Gain switching level	Setting range: 0-20000 Judgment threshold when gain is switched. Torque unit: 1000bit = 25% of rated torque Speed unit: 1000bit = 200 rpm Position unit: 131072bit per revolution
P02-32	Gain switching hysteresis	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
P02-33	Gain switching delay	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.
P02-34	Position gain switching time	Setting range: 0-1000.0, unit: ms Time for position control gain 1 to smoothly switch to position control gain 2

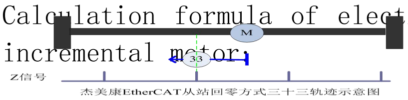
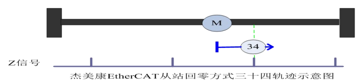
<table>
<tr><td>P02-40</td><td>Mode switch selection</td><td>Setting range: 0-4
Set the conditions of speed loop PI control and P control
<table>
<tr><td>value</td><td>Judge condition</td><td>Remark</td></tr>
<tr><td>0</td><td>Torque command</td><td>When the torque command is less than P02-41, the threshold 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>Acceleration</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>
</table>

P02-50	Torque command added value	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.
P02-51	Forward torque compensation	Setting range: -100.0-100.0, unit: 1.0% Valid in position control mode. For compensating forward static friction
P02-52	Reverse torque compensation	Setting range: -100.0-100.0, unit: 1.0% Valid in position control mode. Used to compensate reverse static friction

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 of motor	Setting range: 0-65535 Absolute encoder motor is effectively used to set motor rotation number of instructions pulse. When this parameter is set to 0, P03-10 and P03-11 are valid
P03-10	Electron Gear 1 molecule	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
P03-11	Electronic gear 1 Denominator	
P03-12	Electron Gear 1 molecular high position	Set range :0-32767 Use this can expand the Electronic gear ratio Molecule value=P03-12*10000+P03-10
P03-15	Position deviation setting is too big	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)

P03-16	Position Instruction smoothing filter constant	Setting range: 1000, in Ms Setting time constant of position instruction smoothing filter
P03-20	Position feedback source	Setting Position Feedback Source 0: Encoder 1: Raster scale
P03-21	Encoder frequency division output enable	Setting CN1 port if it has function of Encoder frequency division output enable: 0: close enable. 1: open enable
P03-22	Increment encoder output pulse frequency division ratio molecule	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 ; $G = \frac{C \times 4}{P \times 4} = \frac{2500 \times 4}{500 \times 4} = \frac{5}{1}$
P03-23	Delta encoder output pulse frequency divider	
P03-25	Absolute number of output pulses per revolution of the motor	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
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

<table>
<tr>
<td>P04-30

P04-37</td>
<td>1-8 inside speed set</td>
<td>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
<table>
<tr><th>DI13</th><th>DI14</th><th>DI15</th><th>Parameter</th></tr>
<tr><td>0</td><td>0</td><td>0</td><td>P04-30</td></tr>
<tr><td>1</td><td>0</td><td>0</td><td>P04-31</td></tr>
<tr><td>0</td><td>1</td><td>0</td><td>P04-32</td></tr>
<tr><td>1</td><td>1</td><td>0</td><td>P04-33</td></tr>
<tr><td>0</td><td>0</td><td>1</td><td>P04-34</td></tr>
<tr><td>1</td><td>0</td><td>1</td><td>P04-35</td></tr>
<tr><td>0</td><td>1</td><td>1</td><td>P04-36</td></tr>
<tr><td>1</td><td>1</td><td>1</td><td>P04-37</td></tr>
</table>
</td>
</tr>
</table>

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

<table>
<tr><td>P05-02</td><td>Torque mode speed limit given value</td><td>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</td></tr>
<tr><td>P05-05</td><td>Torque limiter source</td><td>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.</td></tr>
<tr><td>P05-06</td><td>Torque limit check out delay</td><td>Setting range: 0-10000, unit: Ms Setting DO port output torque limit detection output signal delay time</td></tr>
<tr><td>P05-10</td><td>Internal Forward Torque limit</td><td>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</td></tr>
<tr><td>P05-11</td><td>Internal reverse torque limit</td><td>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</td></tr>
<tr><td>P05-12</td><td>External Positive Torque limit</td><td>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 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>
</table>

<table>
<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 inertia	This parameter is based on P08-02, P08-03, P08-04 set conditions automatically generated the value of the rotation circle

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

8.3 List 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 motor, then each turn according to encoder line number * 4 calculate.	Encoder unit
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 Zero Drift calibration for analog input 1 （VCMD）	1. Press the **M** button in the action panel to switch 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

Chapter 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
Operational Faults	AL.441	Motor overheat fault
	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 correctly 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

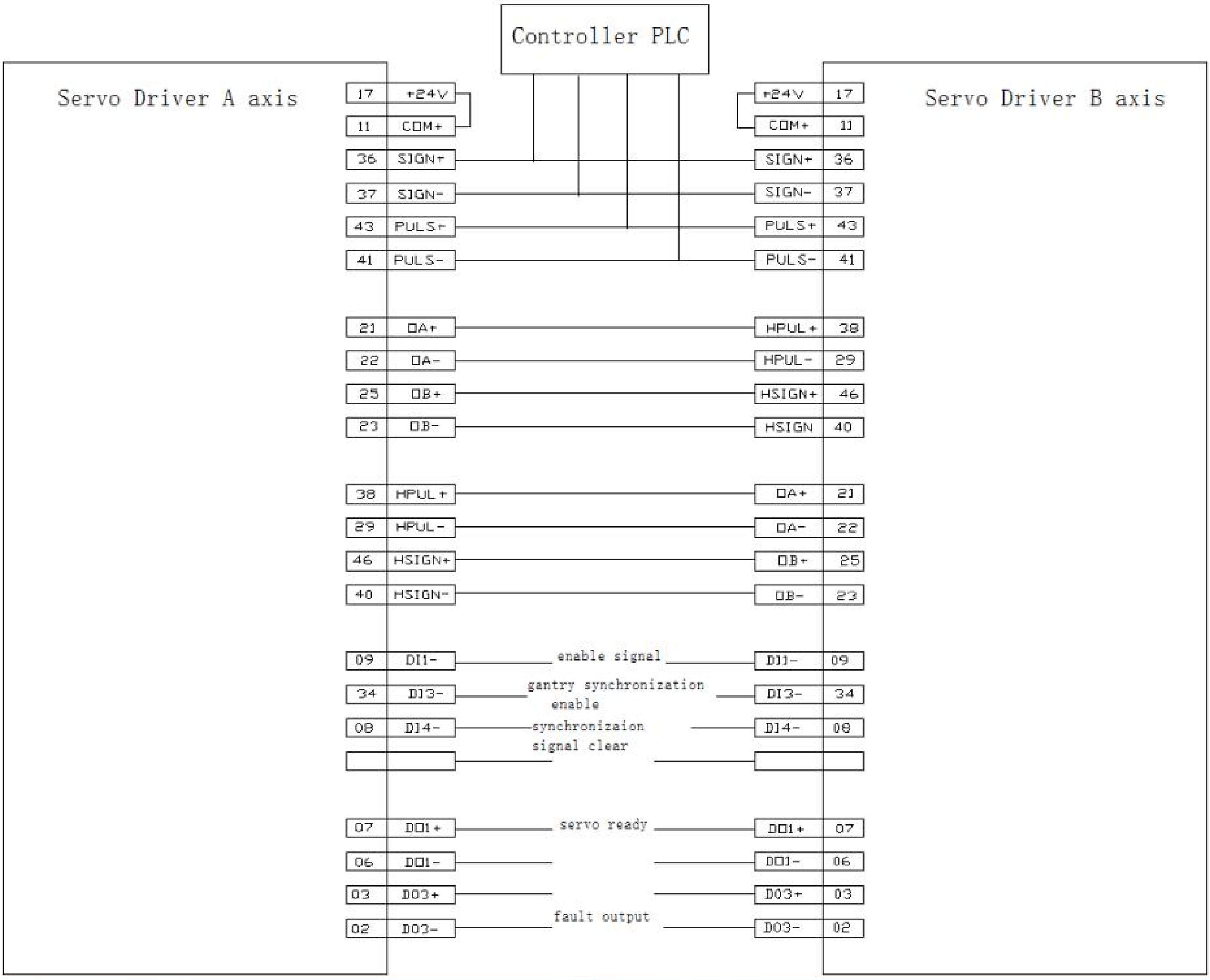


Chart 141 Achieve gantry function wire diagram

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	Set the high and low values of the absolute position of

	offset H	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

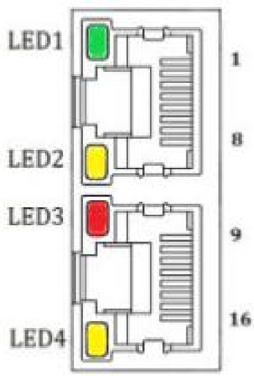
Alarm code	Cause of fault alarm	Fault alarm check	Disposal measures
AL.640	Bus encoder overspeed	Appears on first use	Clear the alarm via AF-EN0 (see parameters and functions for details)
AL.642 AL.643	When the bus encoder is set to multi-turn absolute value, the external battery voltage is low	Check 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, “Link/Activity OUT” status; LED3 is Red, “ERROR” status; LED4 is Yellow, “Link/Activity IN” status;			

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

Table 114 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:

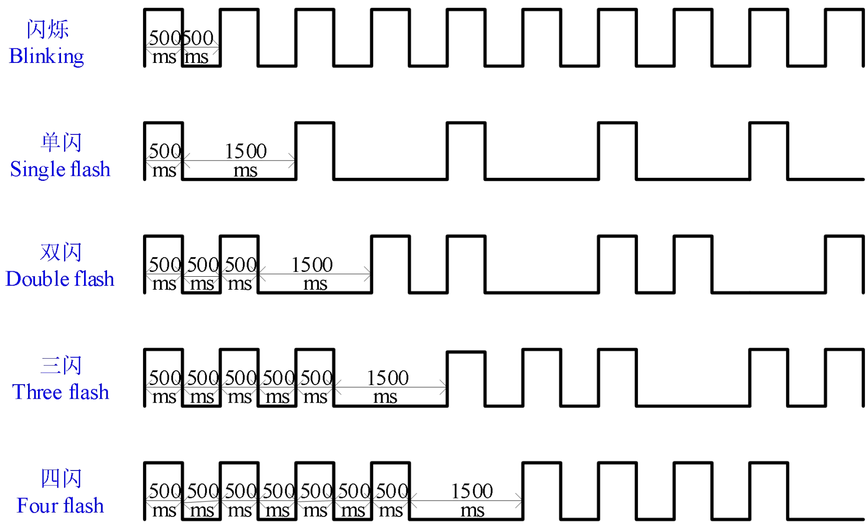


Chart 142 Indicator flashing state chart

➢ EtherCAT Schematic diagram of bus network wiring

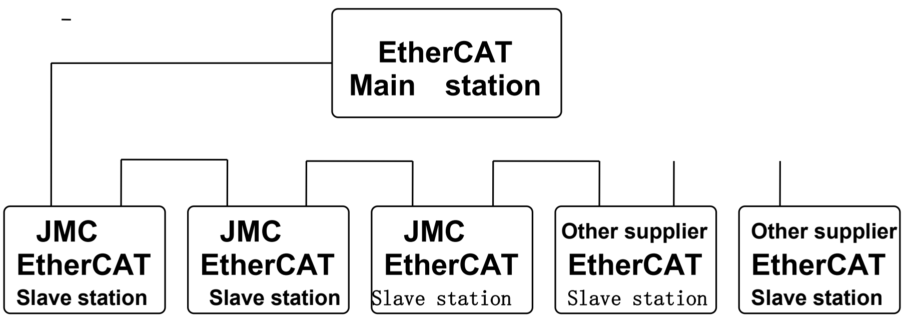


Chart 143 EtherCAT Schematic diagram of bus network wiring

➢ 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:

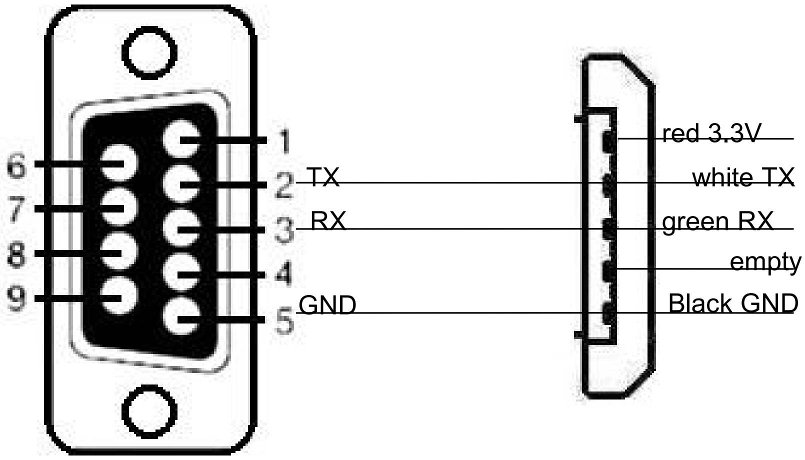


Chart 144 The definition of RS232 communication cable interface between JMC driver and host computer

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

Table 115 JMC communication parameter setting.

name	Baud rate	Start position	Data position	Stop position	Check position
value	0~115200bps	1Bit	8Bit	1Bit	None

COMMUNICATION CHAPTER

EtherCAT

➢ EtherCAT SUMMARY

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

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

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

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

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

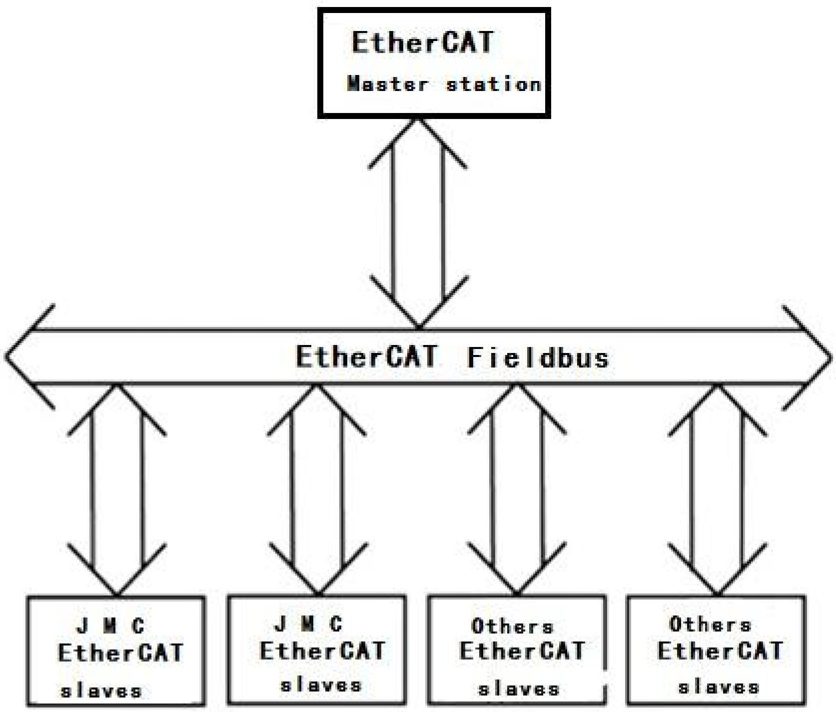


Chart 145 JMC CANopen compatibility diagram

➢ EtherCAT Frame format

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

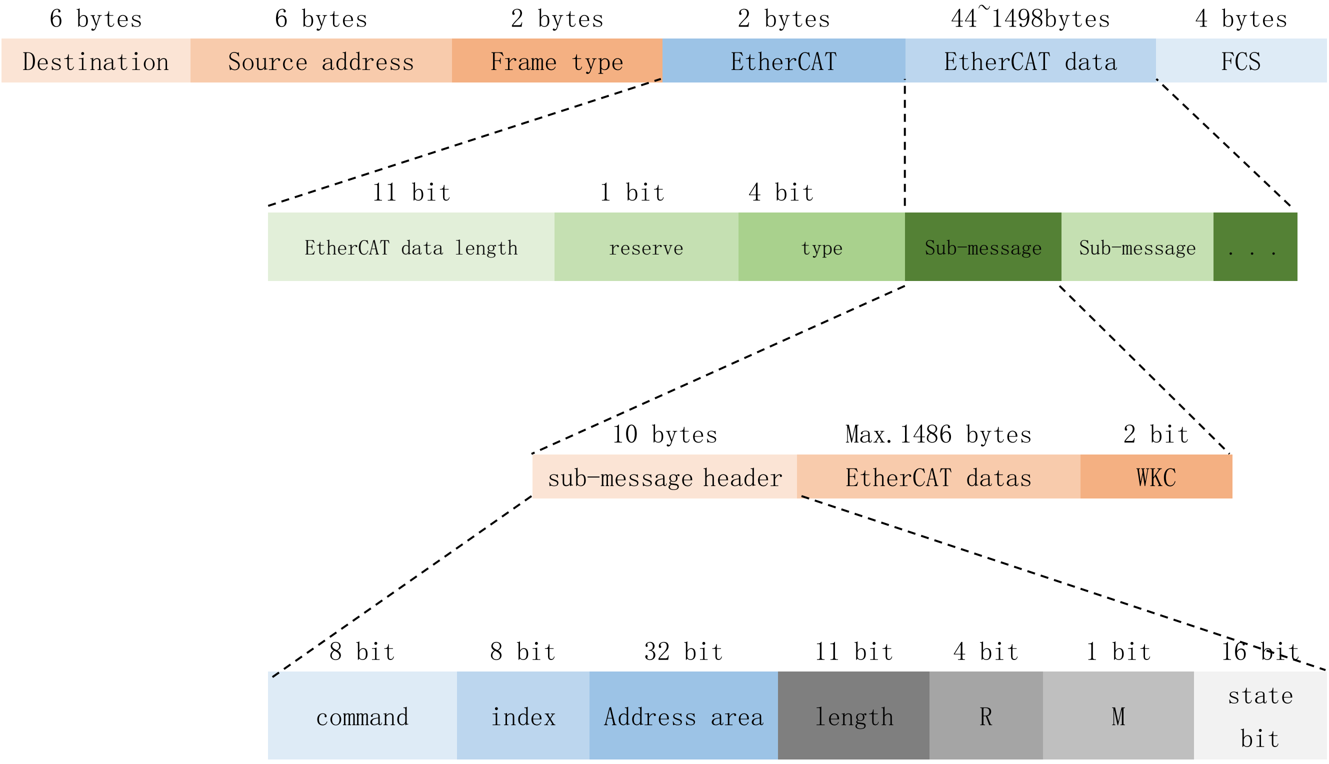


Chart 146 EtherCAT data frame structure

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

Table 116 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 117 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;

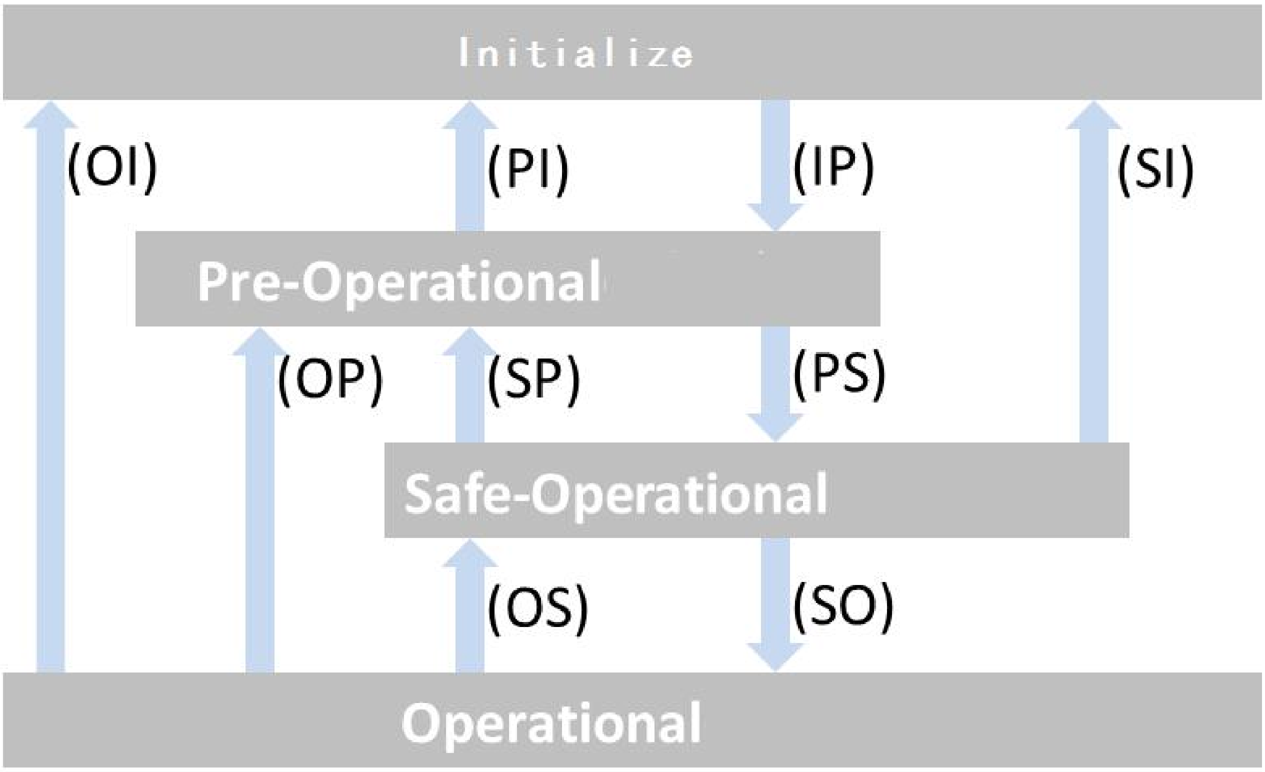


Chart 147 EtherCAT Block diagram of state machine transition operation

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(0)	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.

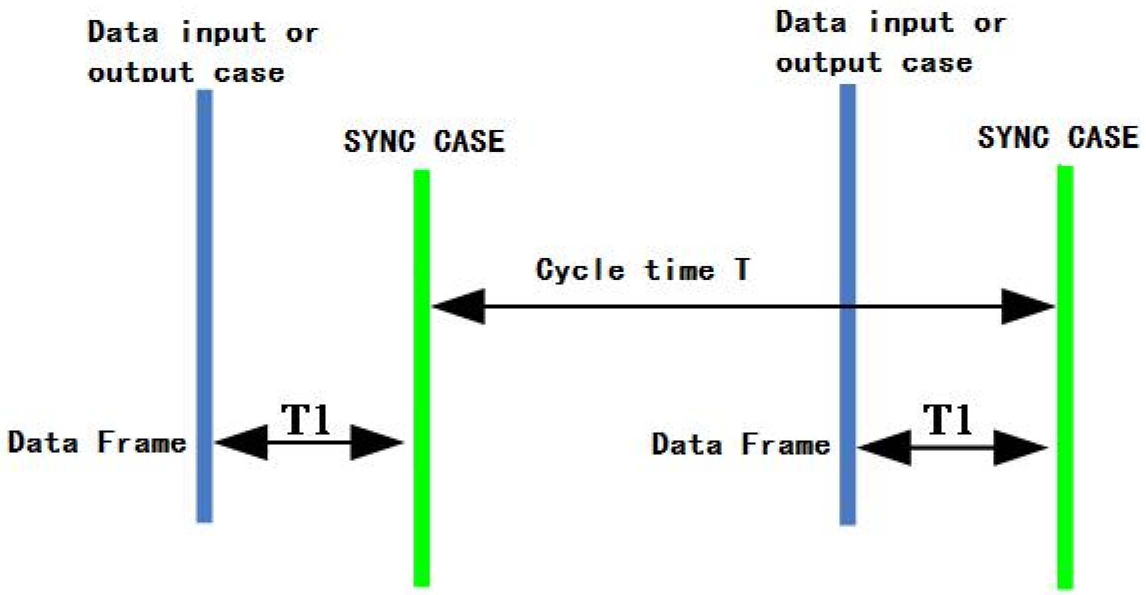


Chart 148 Synchronous mode

2 Free running 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).

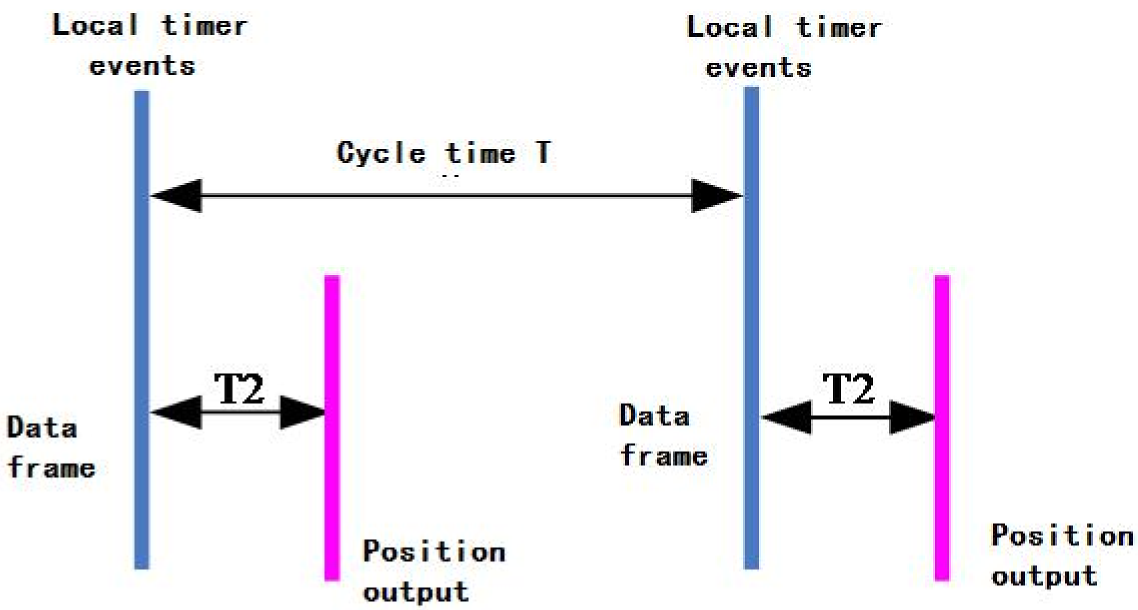


Chart 149 Free run mode

➢ CoE Protocol data transmission

1 Overview of object dictionary

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.

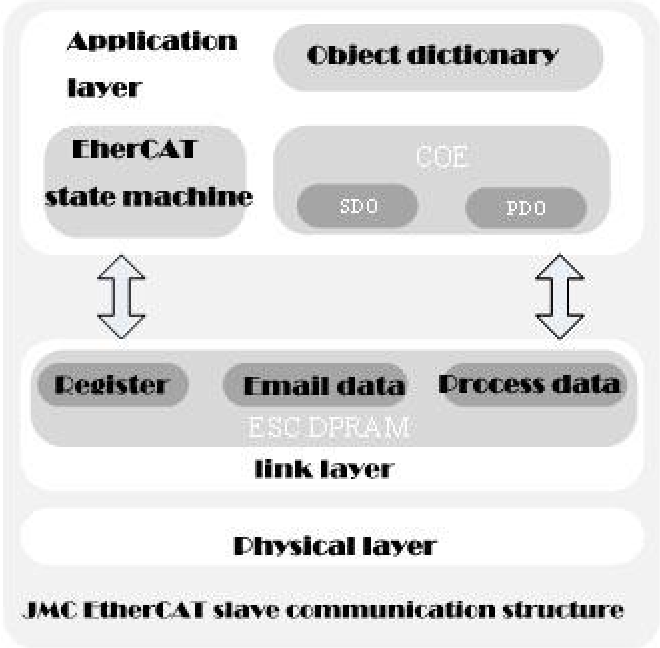


Fig150. EtherCAT communication structure of slave station

Table 119 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.

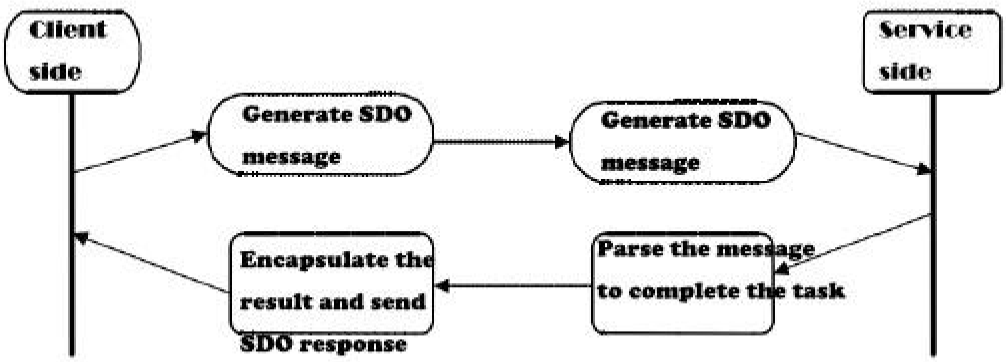


Fig 151 SDO communicate mode

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 120 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.

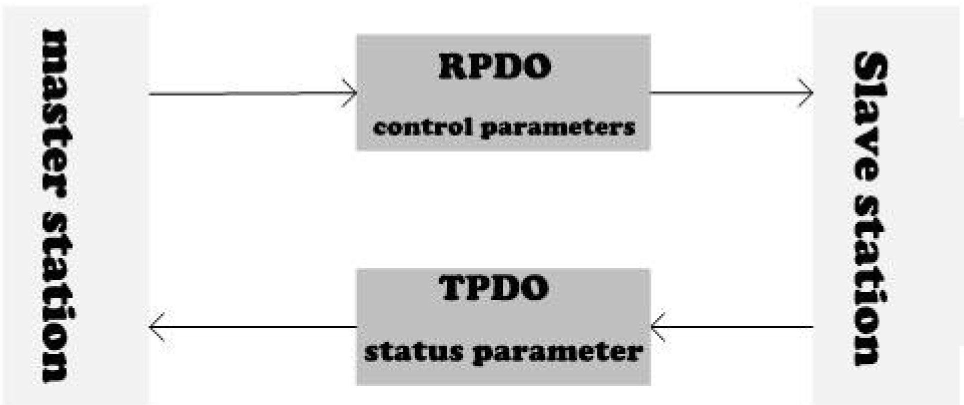


图 152 PDO data transport

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 121 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 122 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 126 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 127 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	yes

			of tolerance	
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

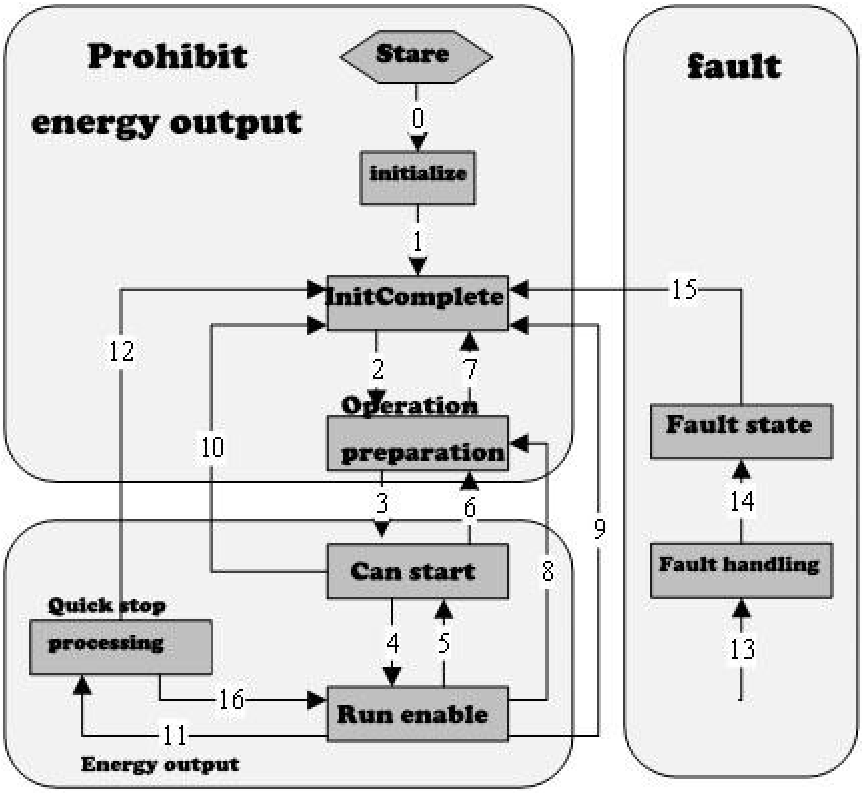


Figure 154 CiA402protocol state machine

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:

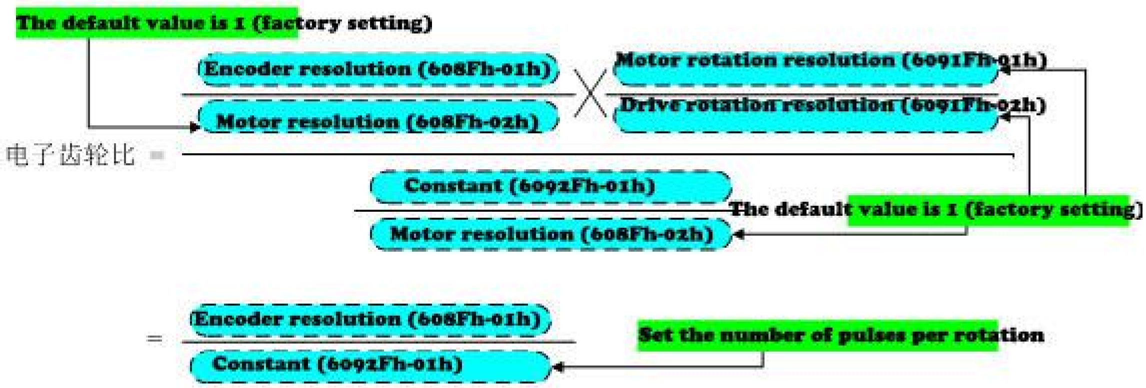
The electronic gear ratio is effective in the range of 1000 ~ 1 / 1000 times. If the value exceeds the range, abnormal protection will occur.

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)

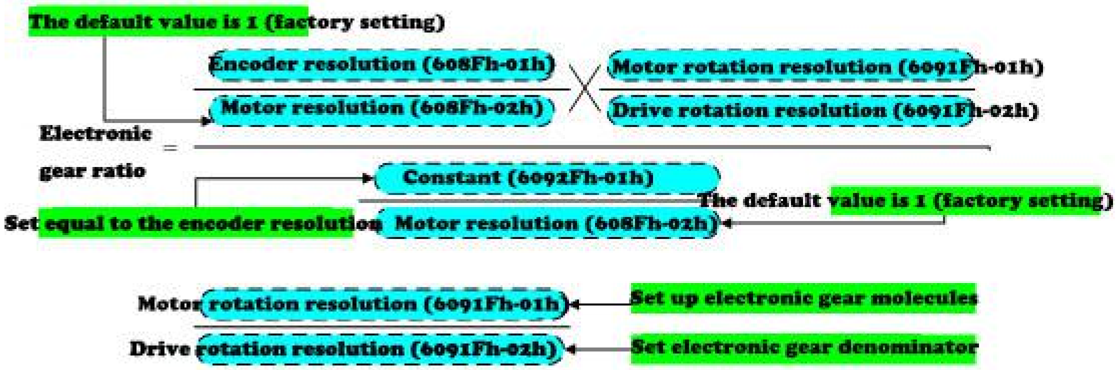


3)

Figure 155 JMC EtherCAT slave gear ratio setting method 1

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 130Equipment 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 131Error 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 132 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 Equipment hardware version number

The description of the device hardware version number object is shown in the following table:

Chart 133 Device 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 134 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:

Chart135 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 136Wrong 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 137 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 138 RPDO Mapping parameters 0x1601

object type	Number of sub indexes
Record	6
0x1601 RPDO Mapping parameters。	

Sub-index	Name	Data type	Character	PDO	Default value

				mapping	
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 139 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	UNSIGNDE32	Read&write	NO	0x60FE0220

	shielding				
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 140 RPDO Mapping parameters 0x1603

object type	No.of sub-index
record	5

0x1603 RPDO

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 141 TPDO mapping parameter 0x1A00

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

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

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

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

Chart142 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 143 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 144 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:

0x1C00 Synchronous management channel

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

Chart 145 synchronous management channels 0x1C00

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

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

0x1C12 SM2distribution

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

Table 146 SM2 assigns 0x1C12

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

Index of the child	Name	The data type	attribute	PDOThe PDO mapping	The default value
00	Maximum number of subindexes	UNSIGNED8	Read and write	NO	1
01	SM2 assignment	UNSIGNED16	Read and	NO	1600h

	1		write		
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	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 152 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	7 Bit 7	3 Bit 3	2 Bit 2	1 Bit 1	0 Bit 0	Conversion instructions
关机（抱闸） Shutdown (holding brake)	0	X	1	1	0	0x0006
输出电压(解除抱 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

<table>
<tr><th>byte</th><th>Bit</th><th>Bit definitio</th><th colspan="2">description</th><th>Mode limitation</th></tr>
<tr><td rowspan="8">LSB</td><td>0</td><td>Ready to start</td><td colspan="2">0: 1: 0: invalid 1: valid</td><td>—</td></tr>
<tr><td>1</td><td>Can start</td><td colspan="2">0: invalid 1: valid</td><td>—</td></tr>
<tr><td>2</td><td>Operating status</td><td colspan="2">0: invalid 1: valid</td><td>—</td></tr>
<tr><td>3</td><td>Fault state</td><td colspan="2">0: invalid 1: valid</td><td>—</td></tr>
<tr><td>4</td><td>Voltage output</td><td colspan="2">0: invalid 1: valid</td><td>—</td></tr>
<tr><td>5</td><td>Quick stop</td><td colspan="2">0: invalid 1: valid</td><td>—</td></tr>
<tr><td>6</td><td>Not operational</td><td colspan="2">0: invalid 1: valid</td><td>—</td></tr>
<tr><td>7</td><td>caveat</td><td colspan="2">0: invalid 1: valid</td><td>—</td></tr>
<tr><td rowspan="13">MSB</td><td>8</td><td>Keep</td><td colspan="2">Keep</td><td>—</td></tr>
<tr><td>9</td><td>remote control</td><td colspan="2">0: invalid 1: valid</td><td>—</td></tr>
<tr><td rowspan="10">10</td><td rowspan="5">Goal reached</td><td colspan="2">0: target position not reached 1: target position reached</td><td>—</td></tr>
<tr><td rowspan="2">0</td><td>When Bit8=0: the target speed is not reached</td><td rowspan="4">PV</td></tr>
<tr><td>When Bit8=1: Decelerate</td></tr>
<tr><td rowspan="2">1</td><td>When Bit8=0: reaching the target speed</td></tr>
<tr><td>When Bit8=1: the speed is 0</td></tr>
<tr><td rowspan="4">Reach home position</td><td rowspan="2">0</td><td>When Bit8=0: the target speed is not reached</td><td rowspan="4">HM</td></tr>
<tr><td>When Bit8=1: Decelerate</td></tr>
<tr><td rowspan="2">1</td><td>When Bit8=0: reaching the target speed</td></tr>
<tr><td>When Bit8=1: the speed is 0</td></tr>
<tr><td>11</td><td>Internal software limit</td><td colspan="2">0: Neither the position command nor position feedback exceeds the limit</td><td>CSP,PP</td></tr>
</table>

		trigger	1: Position command or position feedback overrun	
	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 1: Fault due to excessive position deviation	CSP,CSV,PP,PV
		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 2ˆ32-1, 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.

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 torque

variable	UNSIGNED32	Only Read	YES

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

Table 177 Motor rated torque 0x6076

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

0x6077 Actual torque

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

Table 178 Actual torque 0x6077

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

0x6078 Actual current

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

Table 179 actual current 0x6078

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

0x607A target location

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

Table 180 target position 0x607A

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

0x607B Position change limitation

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

Table 181 Position change limit 0x607B

Object type	type of data	Attributes	PDO mapping	Defaults
ARRAY	UNSIGNED8	Only read	YES	2
Position change limit, including 2 sub indexes, minimum position and maximum position. This parameter limits the range of input values.				

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

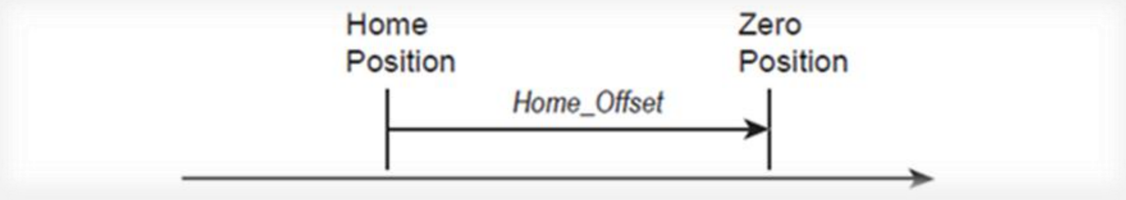
0x607C Zero offset

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

Table 182 zero offset 0x607C

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

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



0x607D Soft position

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

Table 183 position soft limit 0x607D

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

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

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

0x607E Polarity selection

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

Table 184 Polarity selection 0x607E

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

Polarity selection is used to control the rotation direction of the position command and speed command when the motor is actually output. At the same time change the selection of positive and negative limit switches. Among them, bit 7 controls the polarity of the position command and bit 6

controls the polarity of the speed command. When the corresponding bit is 1, it is equivalent to the position command value or speed command value * (-1). The feedback position and speed command value have the same polarity as the given value.

0x607F Maximum contour speed

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

Table 185 Maximum contour speed 0x607F

Object type	type of data	Attributes	PDO mapping	Defaults
variable	UNSIGNED32	Only Read	YES	0x00003840
The maximum contour speed limits the maximum speed of the running path. The unit of this value is the same as the contour speed (0x6081).				

0x6080 Motor speed

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

Table 186 Maximum motor speed 0x6080

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

0x6081 Contour speed

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

Table 187 contour speed 0x6081

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

0x6082 Takeoff speed

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

Table 188 take-off speed 0x6082

Object type	type of data	Attributes	PDO mapping	Defaults
variable	UNSIGNED32	Read &write	YES	0
The take-off speed is the speed at which the motor starts directly and will run to the target speed in this speed mode. The unit is command/s.				

0x6083 Contour acceleration

The outline acceleration objects are described in the following table:

Table 189 contour acceleration 0x6083

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

0x6084 Contour deceleration

The deceleration objects are described in the following table:

Table 190 Deceleration 0x6084

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

0x6085 Quick stop deceleration

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

Table 191 Quick stop deceleration 0x6085

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

0x6086 Movement track type

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

Table 192 Motion track type 0x6086

Object type	type of data	Attributes	PDO mapping	Defaults
variable	UNSIGNED16	Read &write	YES	0
The motion track type is used to select the motion track type when the motor performs the action.				

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

0x6087 Torque slope

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

Table 193 Torque slope 0x6087

Register	Type of data	access permission	Defaults
6087	UNSIGNED16	RW	0
The unit of this value is ‰, the parameter describes the rate of			

change of torque, and the unit is one thousandth of the rated torque per second

0x6088 Torque change type

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

Table 194 Torque change type 0x6088

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

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

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

0x608F Encoder resolution

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

Table 195 Encoder resolution 0x608F

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

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

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

0x6091 Gear ratio

The gear ratio objects are described in the table below:

Table 196 Gear ratio 0x6091

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

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

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

0x6092 Feedback constant

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

Table 197 Feedback constant 0x6092

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

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

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

0x6098 Return to zero

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

Table 198 Return to zero mode 0x6098

Object type	type of data	Attributes	PDO mapping	Defaults

variable	INTEGER8	Read and Write	YES	0
The zero return method is that the user selects the corresponding zero return method to perform the zero return according to his own needs.				

value	description
-128…-1	factory
0	Do not return to zero
1…35	Ways 1 to 35 (see below)
36…127	Keep

0x6099 Return speed

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

Table 199 home speed 0x6099

Object type	Subindex	type of data	Attributes	PDO mapping	Defaults
Array	3	UNSIGNED32	Read and write	YES	0
Mechanical origin speed, find the speed of the mechanical origin (limit switch), that is, find the position of the deceleration point. The speed unit is the command unit/s. The zero offset speed is used to find the zero offset speed, and its unit is the command unit/s.					

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

Return to zero acceleration/deceleration

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

Table 200 Return to zero acceleration and deceleration 0x609A

Object type	type of data	Attributes	PDO mapping	Defaults
variable	UNSIGNED16	Read & write	YES	0
The zero return acceleration is the acceleration and deceleration of				

the slave station motor during zero return, that is, the acceleration and deceleration when it hits the limit.

0x60B0 Position feedforward

The position feedforward objects are described in the following table:

Table 201 Position feedforward 0x60B0

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

0x60B1 Speed feed-forward

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

Table 202 Speed feedforward 0x60B1

Object type	type of data	Attributes	PDO mapping	Defaults
variable	INTEGER32	Read and Write	YES	0
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	Read and Write	YES	0
Probe status.				

bit	value	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 Maximum 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	RPD03	RECORD	RW	U8	N	0Bh
	01h	Homing offset		RW	U32	N	0x607C0020
	02h	Return to zero		RW	U32	N	0x60980008
	03h	Back to machine origin speed		RW	U32	N	0x60990120
	04h	Return to zero speed		RW	U32	N	0x60990220
	05h	Return to zero acceleration		RW	U32	N	0x609A0020
	06h			RW	U32	N	0xFFFFFFFF
	07h			RW	U32	N	0xFFFFFFFF
	08h			RW	U32	N	0xFFFFFFFF
	09h			RW	U32	N	0xFFFFFFFF
	0Ah			RW	U32	N	0xFFFFFFFF
	0Bh			RW	U32	N	0xFFFFFFFF
1A00h	00h	TPD00	RECORD	RW	U8	N	0Bh
	01h	Status word		RW	U32	N	0x60410010
	02h	Mode code response		RW	U32	N	0x60610008
	03h	Actual location		RW	U32	N	0x60640020
	04h	Probe status		RW	U32	N	0x60B90010
	05h	Probe 1 rising edge value		RW	U32	N	0x60BA0020
	06h	Probe 1 falling edge value		RW	U32	N	0x60BB0020
	07h	Probe 2 rising edge value		RW	U32	N	0x60BC0020
	08h	Probe 2 falling edge value		RW	U32	N	0x60BD0020
	09h	Digital input		RW	U32	N	0x60FD0010
	0Ah			RW	U32	N	0xFFFFFFFF

	0Bh			RW	U32	N	0xFFFFFFFF
1A01h	00h	TPDO1	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	TPDO2	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 section

EtherCAT 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 (CSP)

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.

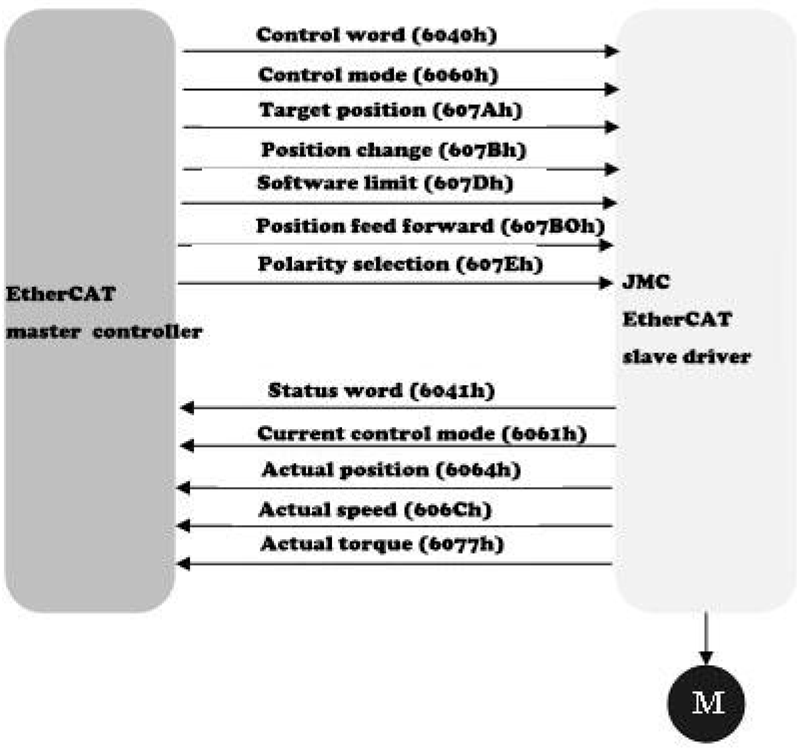


Figure 157 Cycle synchronization position mode control diagram

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 Introduction Of Related Object Dictionary

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		RW	I32	Y	0X80000000

		position					
	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.

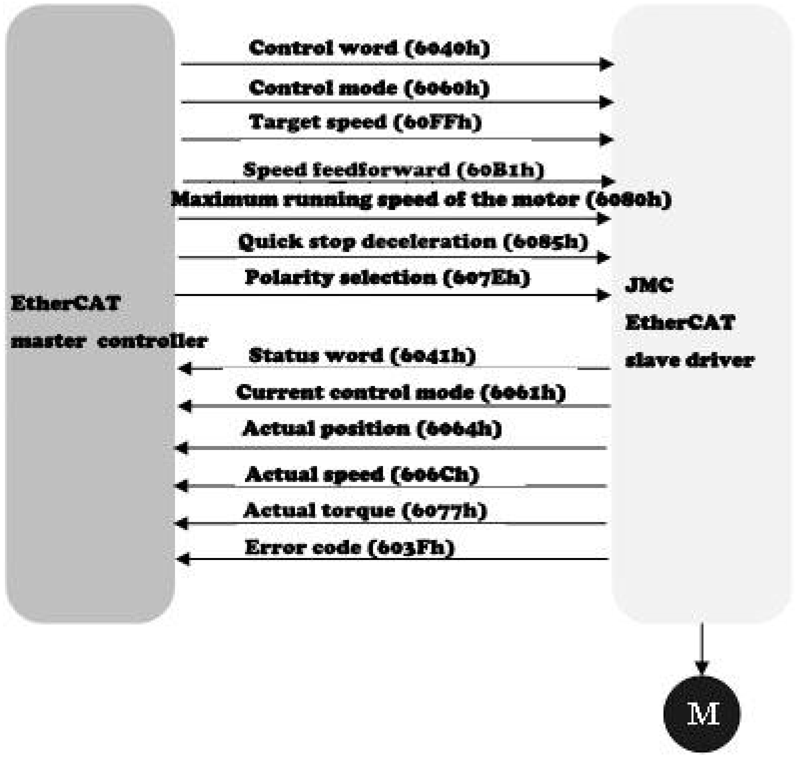


Figure 158 control chart of periodic synchronous speed mode

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	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 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 245 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

Table 246 Recommended PDO mapping configuration-CSV

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

3 Application process

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

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

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

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

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

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

Contour position mode (PP)

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

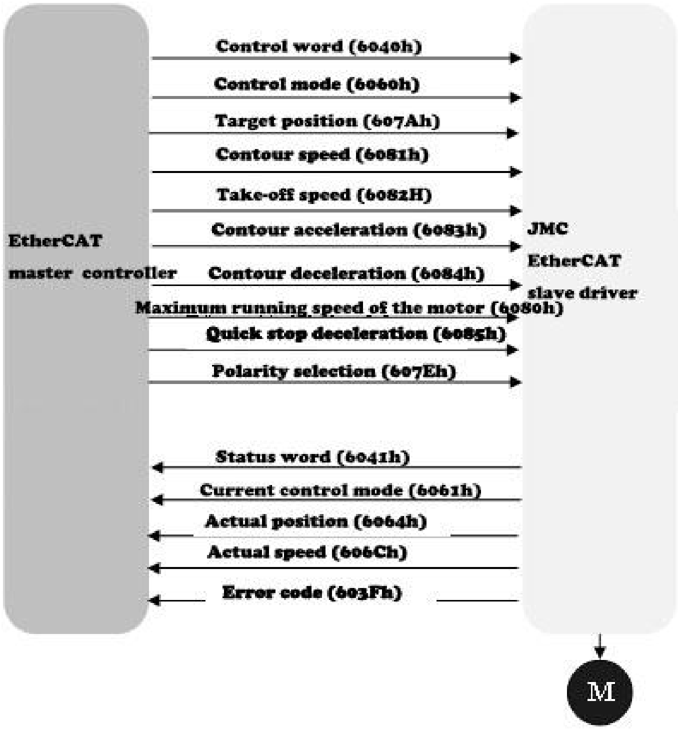


Figure 159 Contour position mode control chart

1 Related Object Dictionary Introduction

Table 247 Control word 6040h

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

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

bit	bit definition	Description
0	start up	0: invalid 1: valid
1	Voltage given	0: invalid 1: valid
2	Quick stop	0: valid 1: invalid
3	Motor power-on enable	0: invalid 1: valid
4	Collect new target location	0→1: The rising edge will collect the target position, speed, acceleration and deceleration, and execute
5	Update location now	0: non-immediate update 1: immediate update
6	Absolute position/relative position	0: absolute position command 1: relative position command
7	Fault reset clear	0: invalid 1: valid
8	time out	0: invalid 1: valid, pause according to 605Dh

		setting

Table 249 Status word 6041h

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

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

bit	bit definition	Description
10	Goal reached	0: The target position is not reached 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:

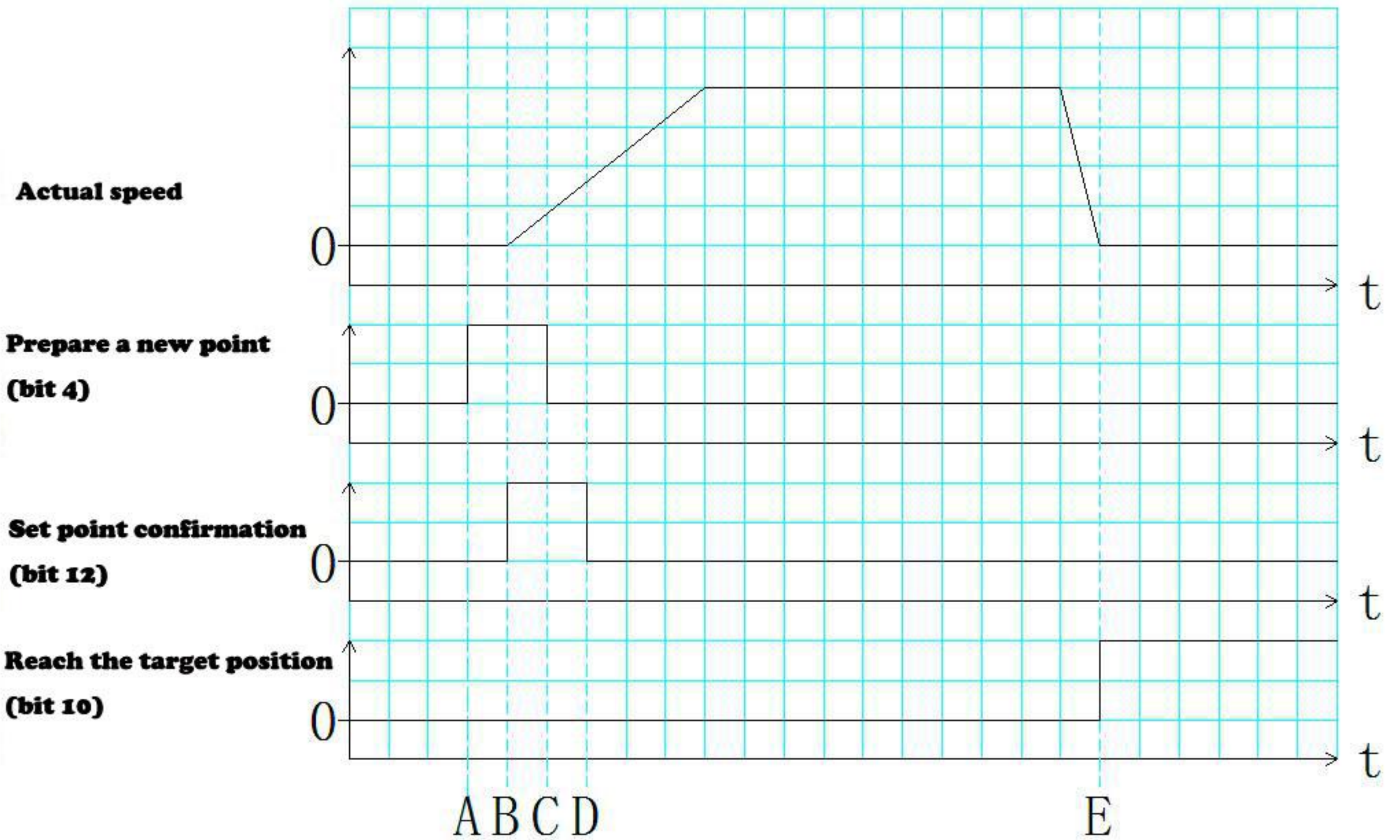


Figure 160 Single point motion

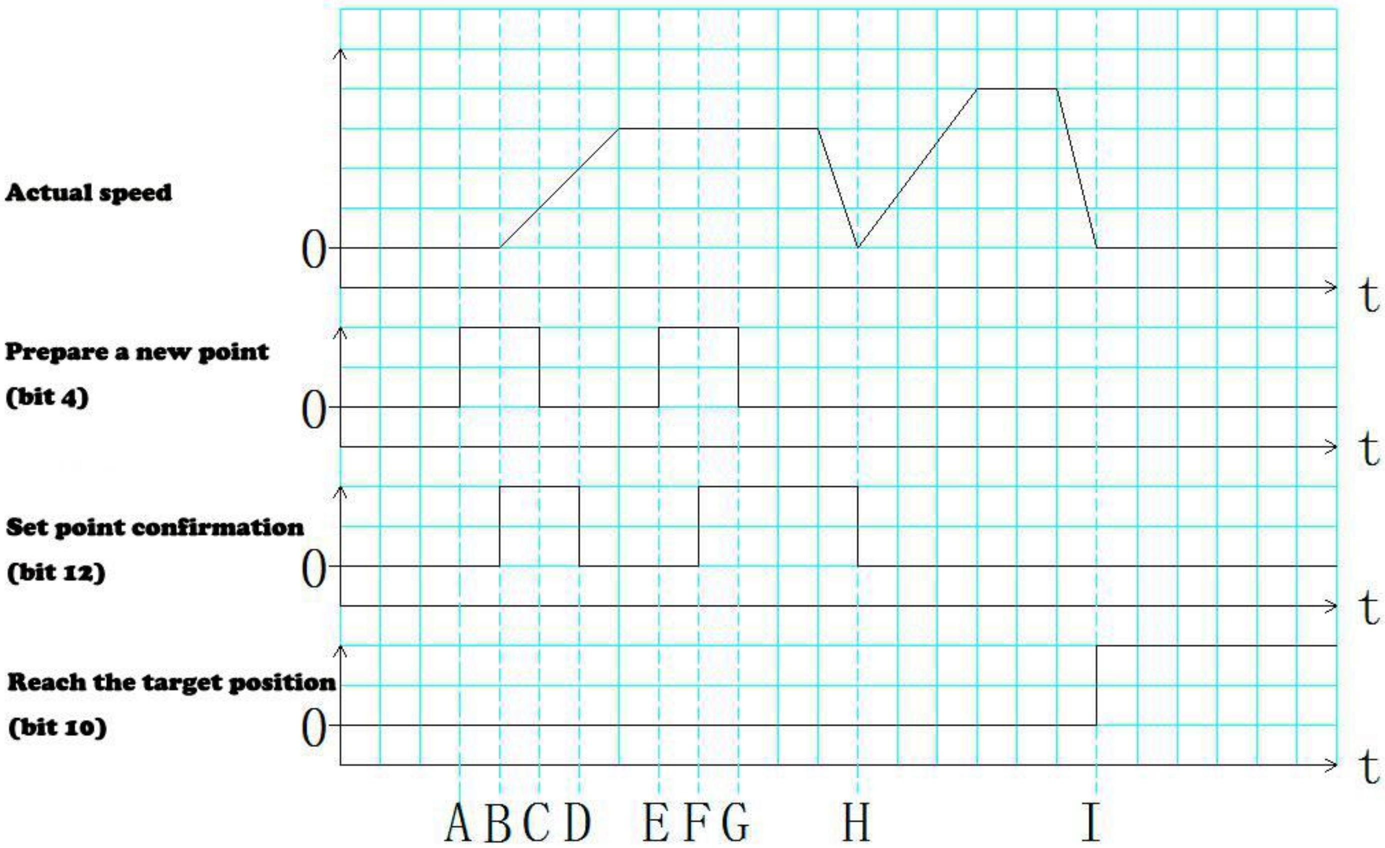


Figure 161 Multi-point motion, stop between positions

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

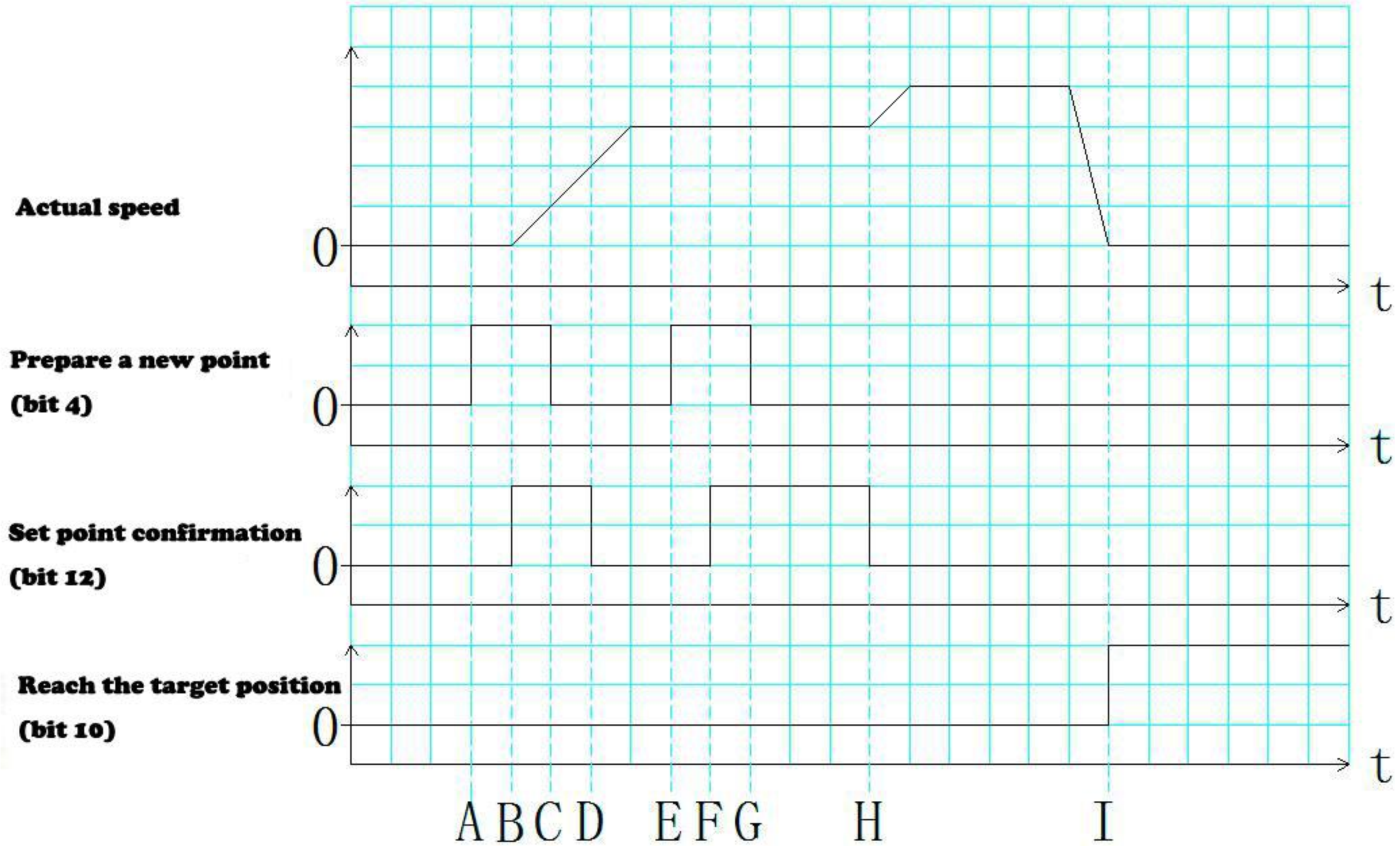


Fig. 162 Multi-point movement without stopping between points

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.

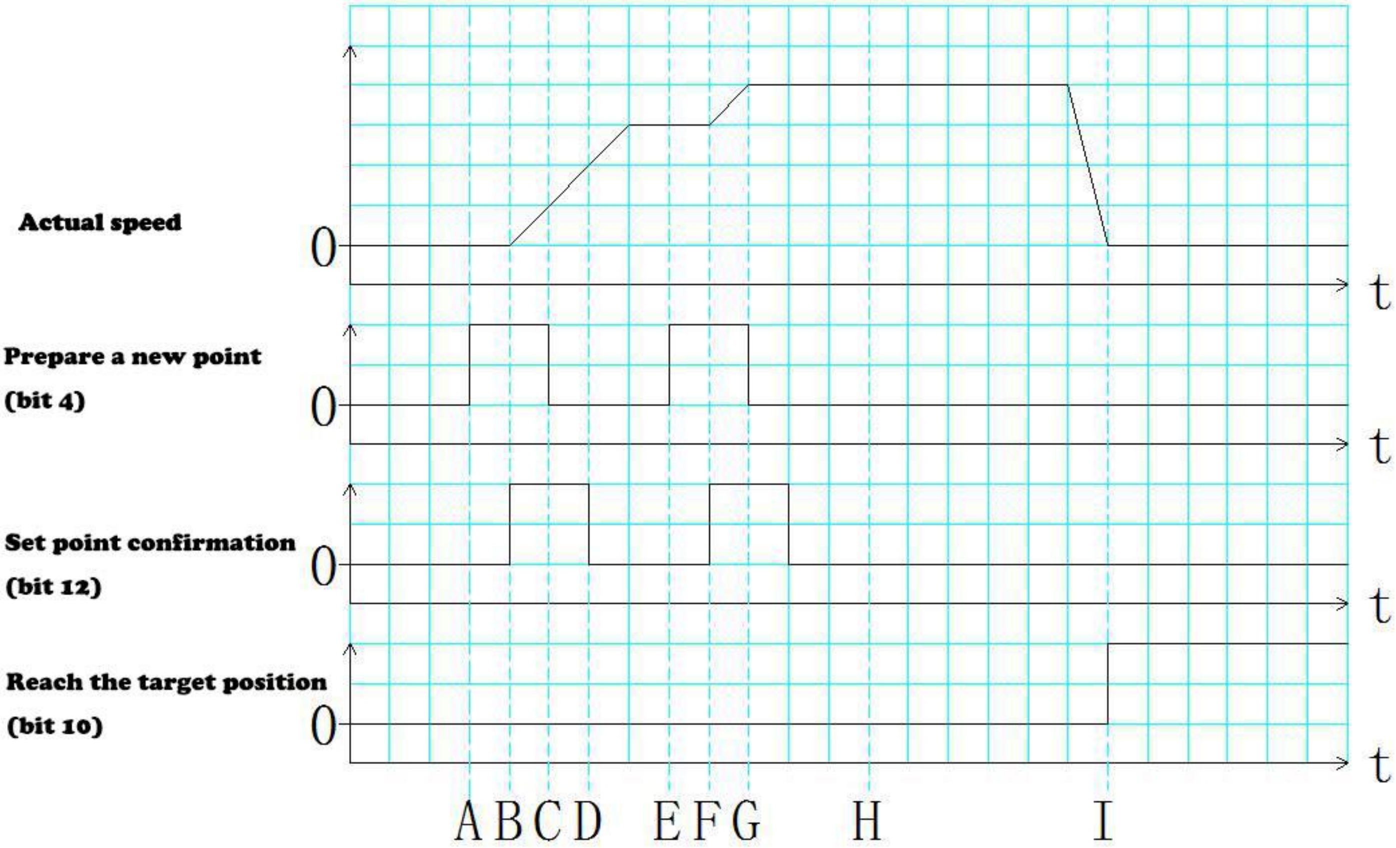


Figure 163 Multi-point motion, after setting the second point, switch directly to the speed of the second point

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 display	Optional

	60FDh: Digital input	Optional

4 Application process

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

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

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

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

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

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

➢ Contour speed mode (PV)

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

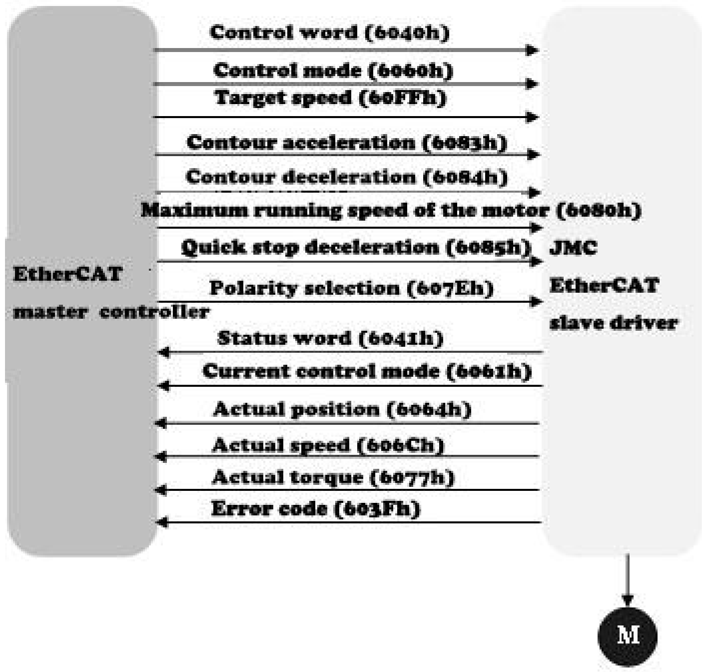


Figure 164 Contour speed mode control diagram

1 Related Object Dictionary Introduction

Table 261 Control word 6040h

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

Table 262 Control word 6040h bit definition in PV mode

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

Table 263 Status word 6041h

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

Table 264 Bit definition of status word 6041h in PV 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">Goal reached</td><td rowspan="2">0</td><td>When Bit8=0: the target speed is not reached</td></tr>
<tr><td>When Bit8=1: Decelerate</td></tr>
<tr><td rowspan="2">1</td><td>When Bit8=0: reaching the target speed</td></tr>
<tr><td>0 When Bit8=1: the speed is 0</td></tr>
<tr><td rowspan="2">12</td><td rowspan="2">Follow from the station</td><td colspan="2">0 0: Slave not running position command</td></tr>
<tr><td colspan="2">1: Slave is executing position command</td></tr>
<tr><td rowspan="2">13</td><td rowspan="2">Following error</td><td colspan="2">No excessive position deviation fault</td></tr>
<tr><td colspan="2">1: Fault due to excessive position deviation</td></tr>
</table>

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.

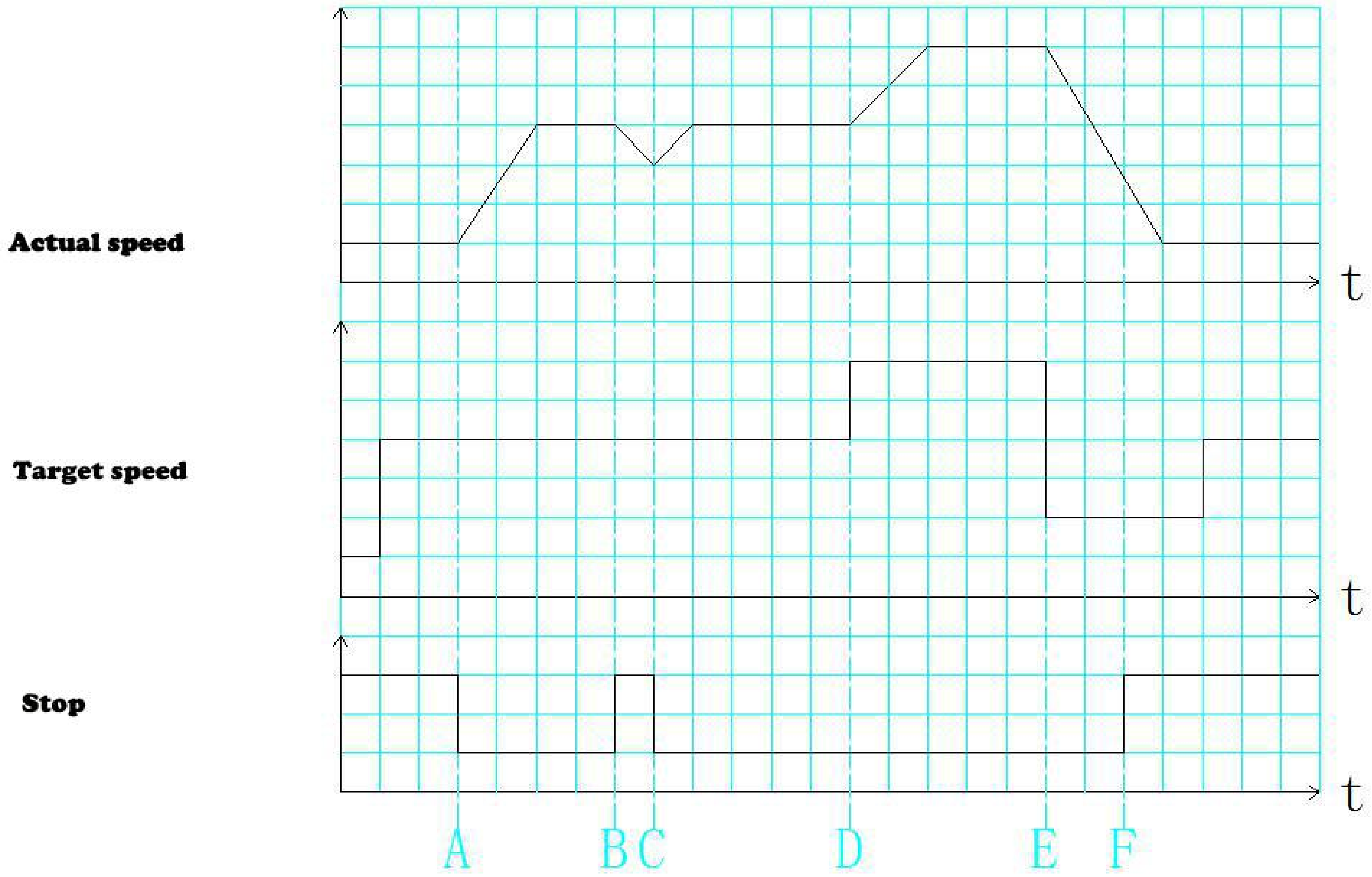
Table 269 Contour deceleration 6084h

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. PDO mapping is recommended for configuration

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.

➢ Homing model （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

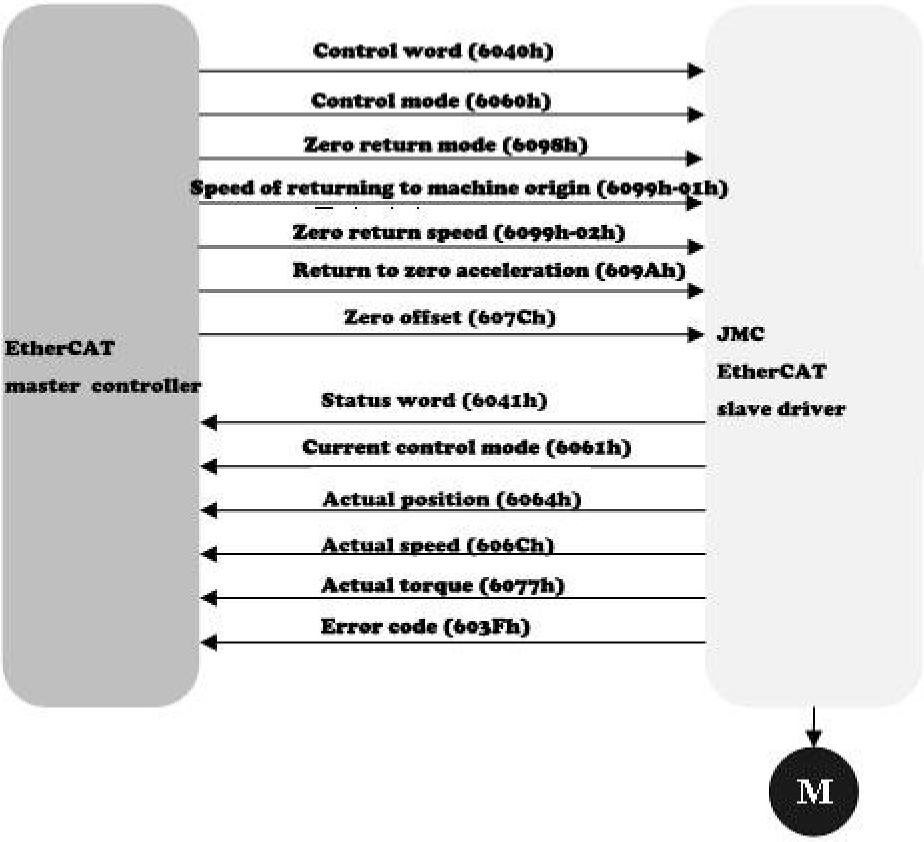


Figure 165 control chart of return to zero model

1. Introduction to the related object dictionary

Chart 270 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 271 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 272 state word 6041h

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

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

Bit	Bit definition		Description
10	Return to zero position	0	Bit8=0:Return to zero position not reached
			Bit8=1:Slow down
		1	Bit8=0:Return to zero position
			Bit8=1:Speed is 0
12	Zero return complete	0: Homing incomplete 1: Homing complete	
13	Return to zero error	0:Zero return without error 1:Over tolerance fault occurred in the process of returning to zero	

Chart 274 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 275 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 276 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 277 Return to zero mode 6098h

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

		return to zero					

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

Chart 278 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 279 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.

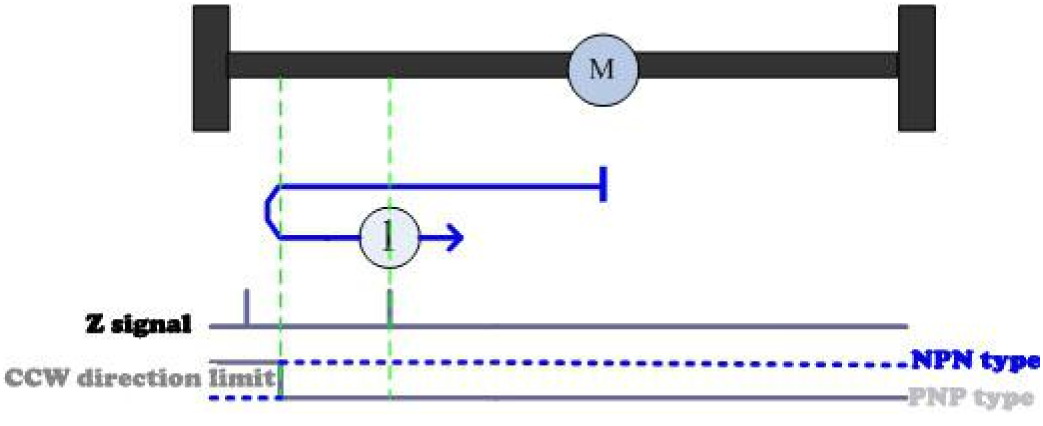


Fig. 166 schematic diagram of jemecon EtherCAT slave station return to zero mode 1

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.

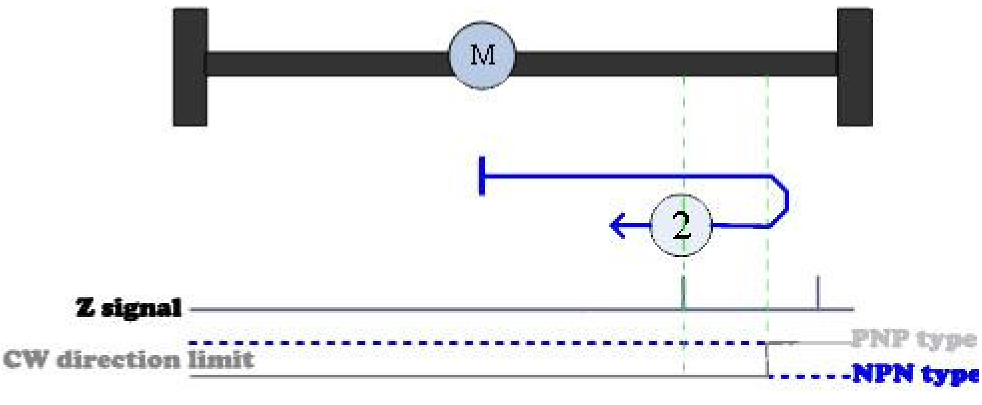


Figure 167 schematic diagram of jemecon EtherCAT slave station return to zero mode II

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.

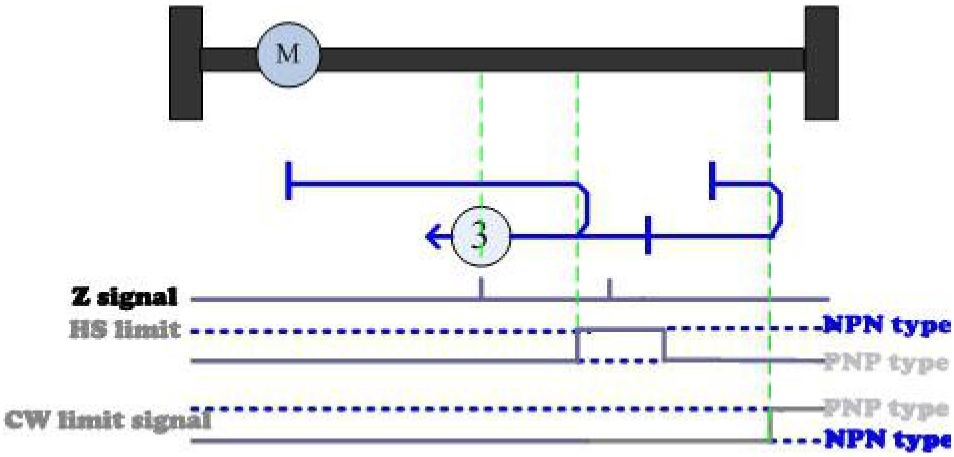


Figure 168 schematic diagram of JMC EtherCAT slave station return to zero mode 3

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;

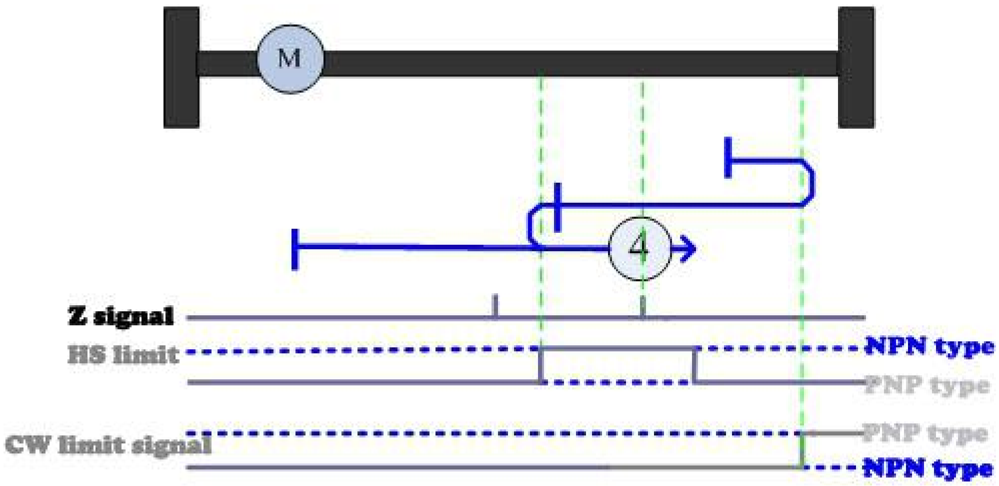


Fig. 169 schematic diagram of four track of JMC EtherCAT slave station returning to zero mode

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;

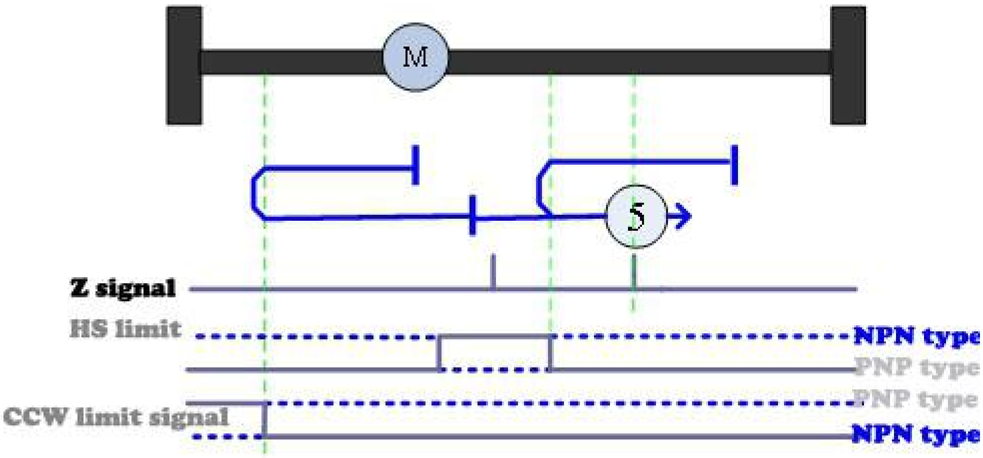


Fig. 169 schematic diagram of five track of JMC EtherCAT slave station returning to zero mode

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;

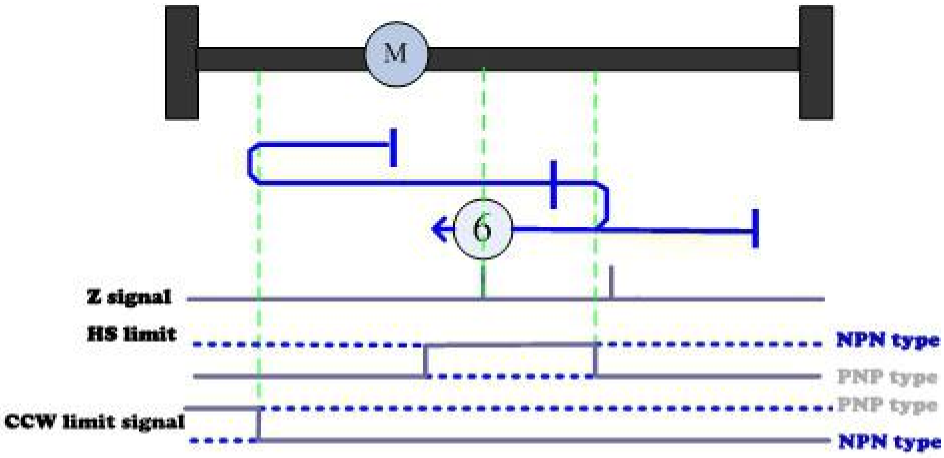


Figure 171 JMC EtherCAT Slave return to zero mode 6 trajectory diagram

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;

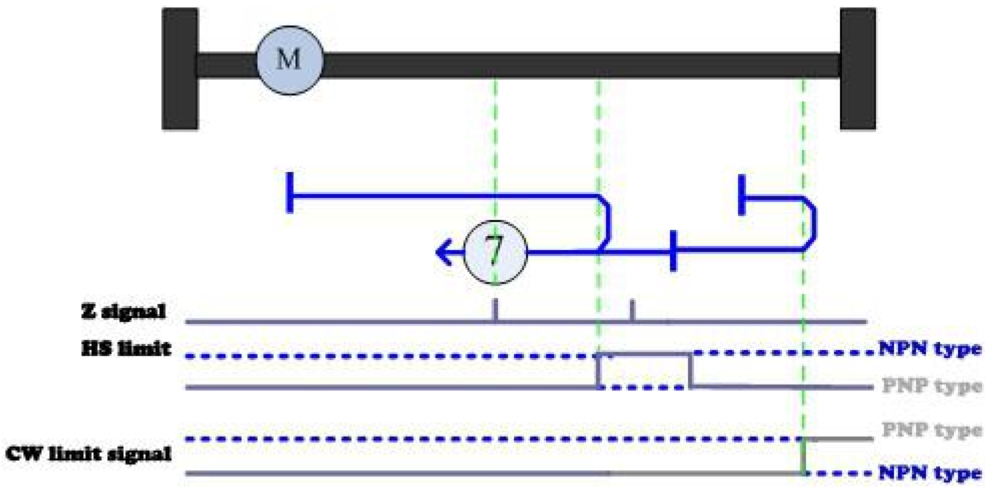


Figure 172 JMC EtherCAT Slave return to zero mode 7 trajectory diagram

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;

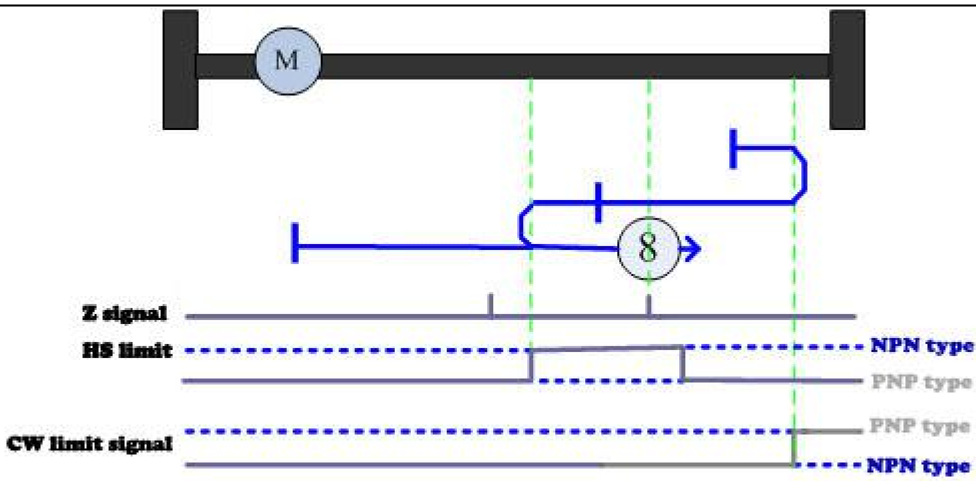


Figure 173 Schematic diagram of Eight trajectories for Domino EtherCAT back to zero from a station

2.9 Return to zero mode 9

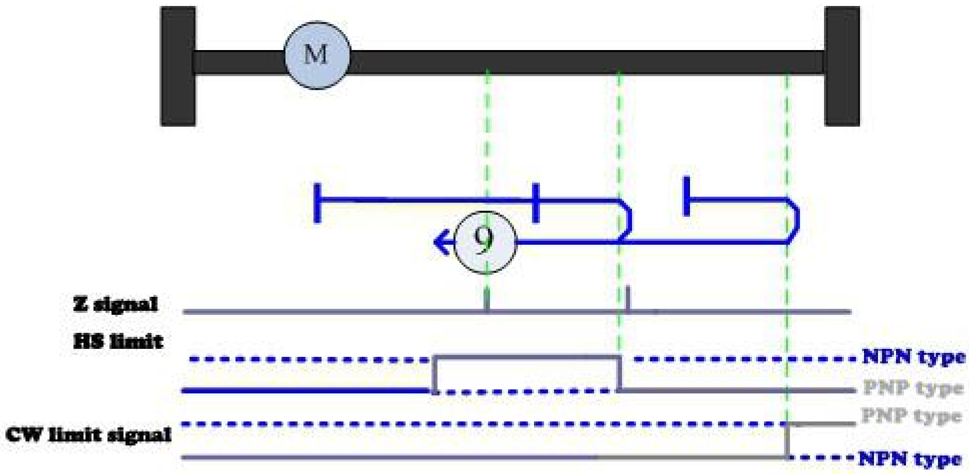


Figure 173 Schematic diagram of Eight trajectories for Domino EtherCAT back to zero from a station

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

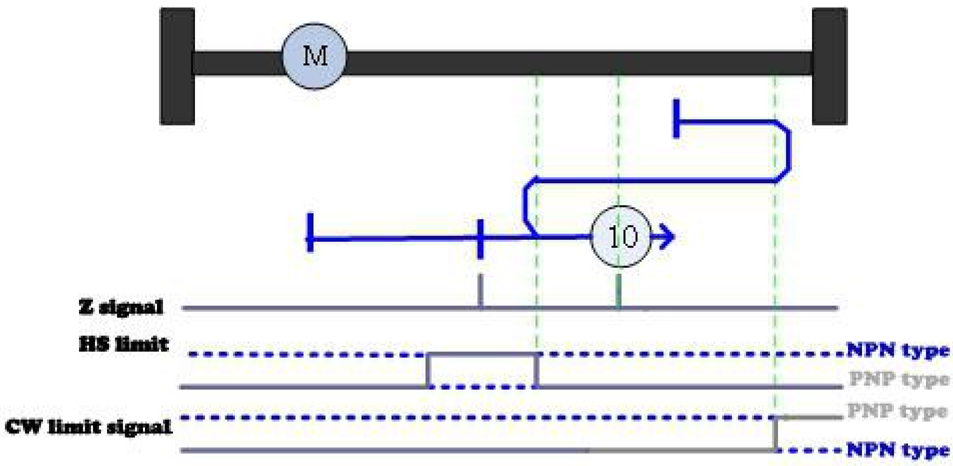


Fig. 175 schematic diagram of 10 track of JMC EtherCAT slave station returning to zero mode

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.

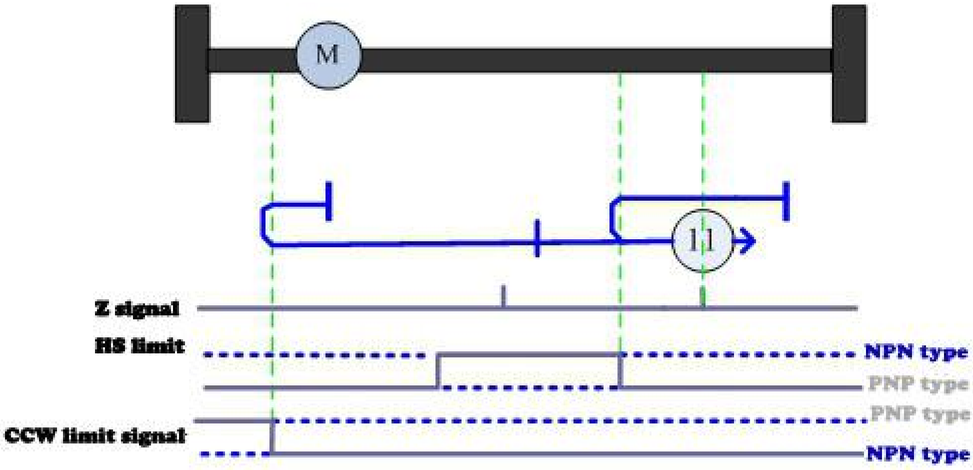


Figure 176 schematic diagram of return to zero mode 11 track of JMC EtherCAT slave station

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.

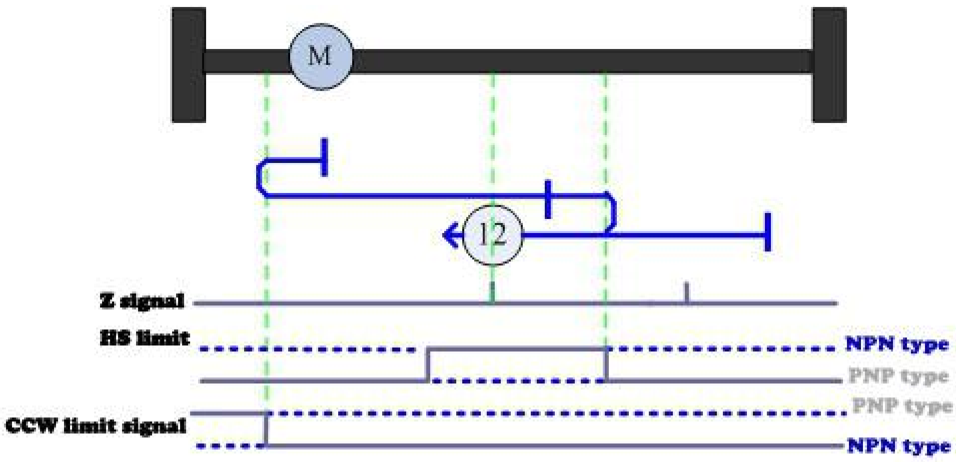


Figure 177 JMC EtherCAT Slave return to zero mode 12 trajectory diagram

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.

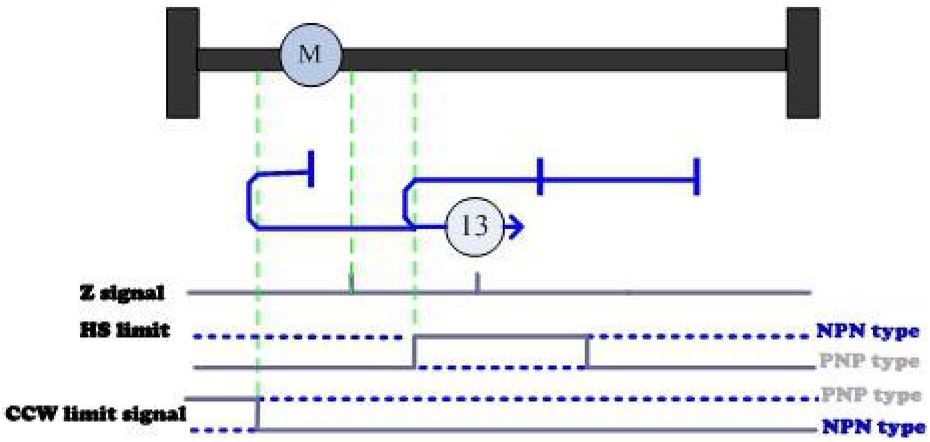


Fig. 178 schematic diagram of 13 track of JMC EtherCAT slave station return to zero mode

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.

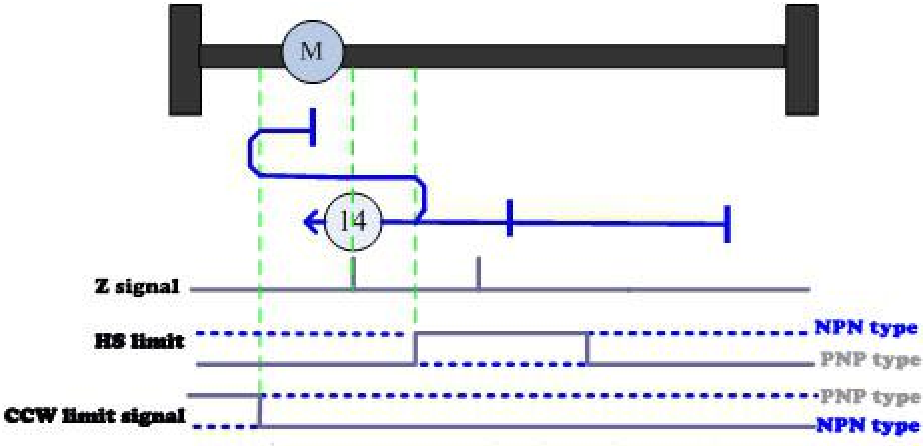


Figure 179 schematic diagram of 14 track in homing mode of JMC EtherCAT slave station

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;

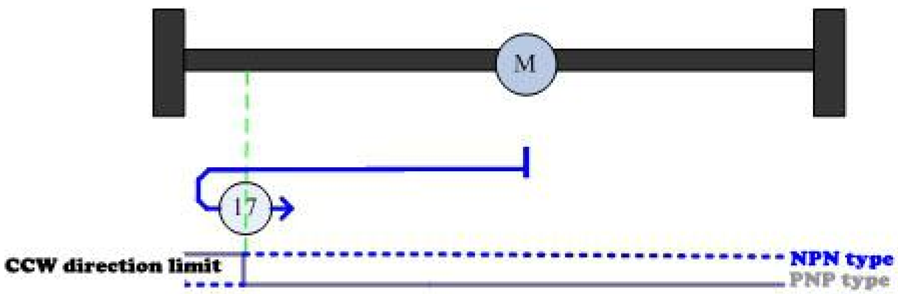


Fig. 180 17 trajectory diagram of EtherCAT slave return to zero mode

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;

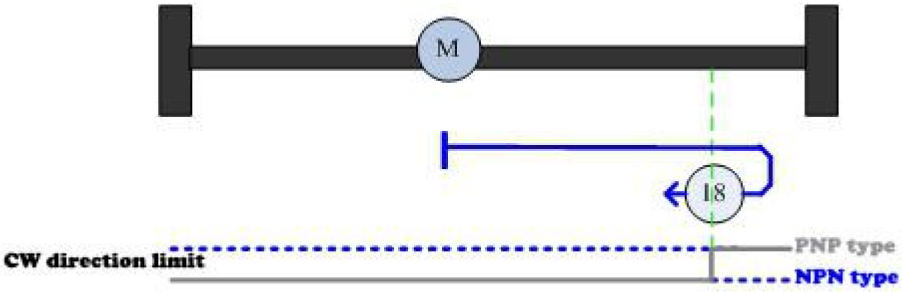


Fig. 181 18 trajectory diagram of EtherCAT slave return to zero mode

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。

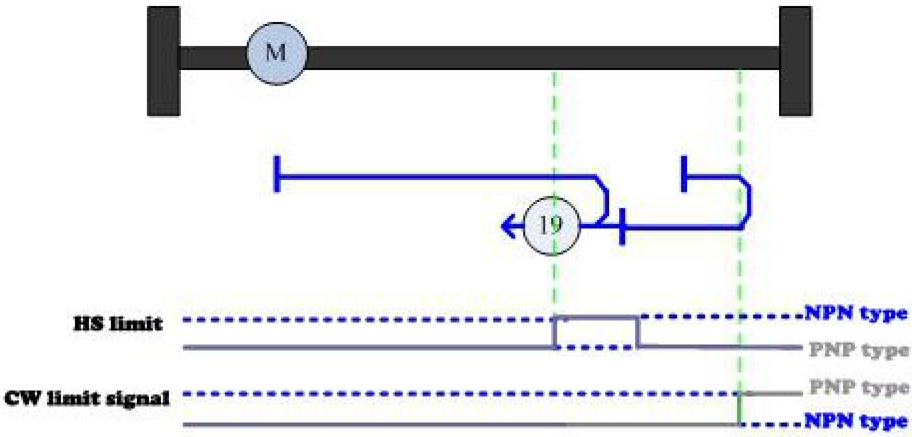


Fig. 182 19 trajectory diagram of EtherCAT slave return to zero mode

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;

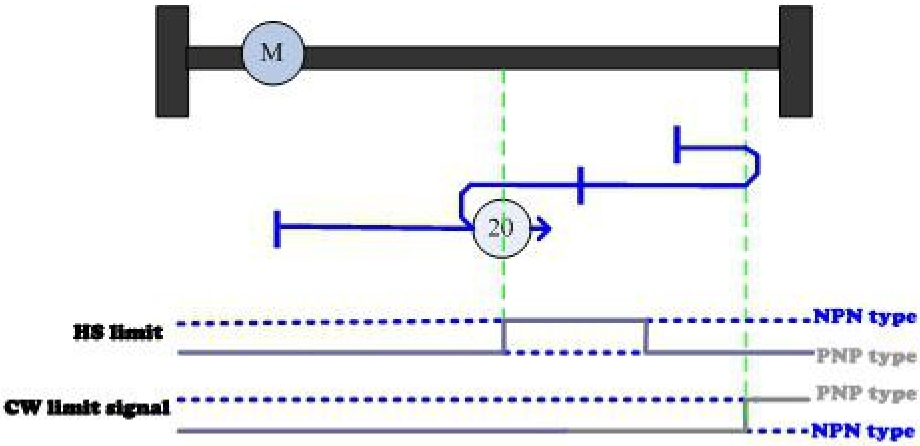


Figure 183 Schematic diagram of 20 trajectories for Domino EtherCAT returning from the station to zero mode

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;

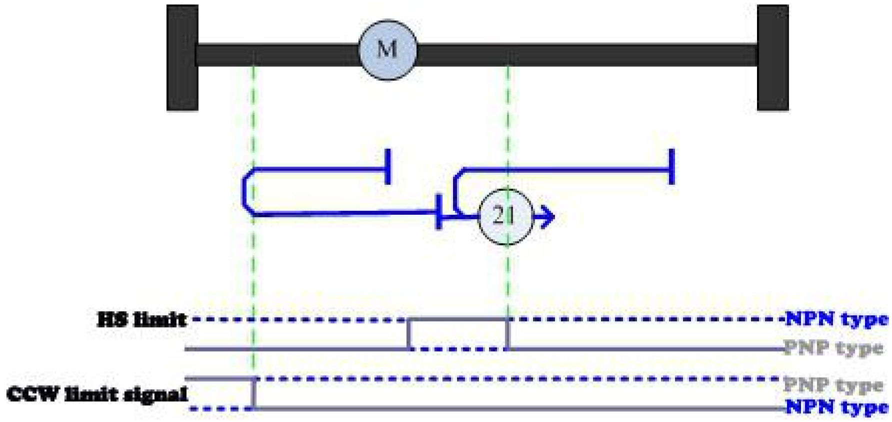


Fig. 184 21 trajectory diagram of EtherCAT slave return to zero mode

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.

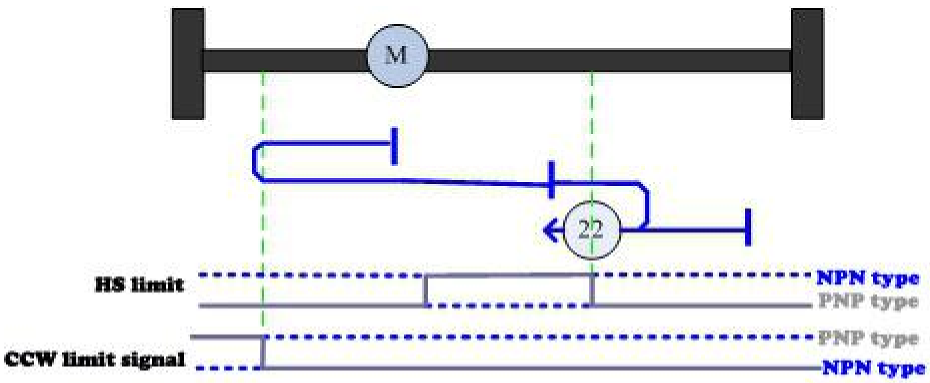


Fig. 185 schematic diagram of 22 track of jemecon EtherCAT slave station return to zero mode

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;

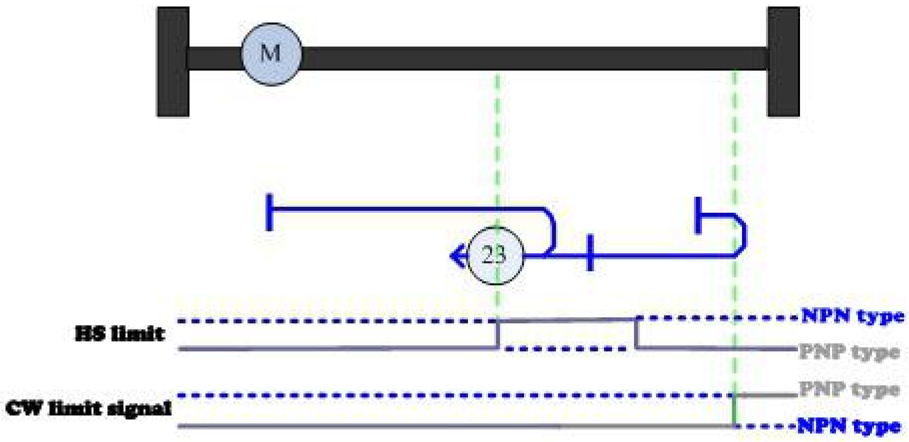


Fig. 186 23 trajectory diagram of EtherCAT slave return to zero mode

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;

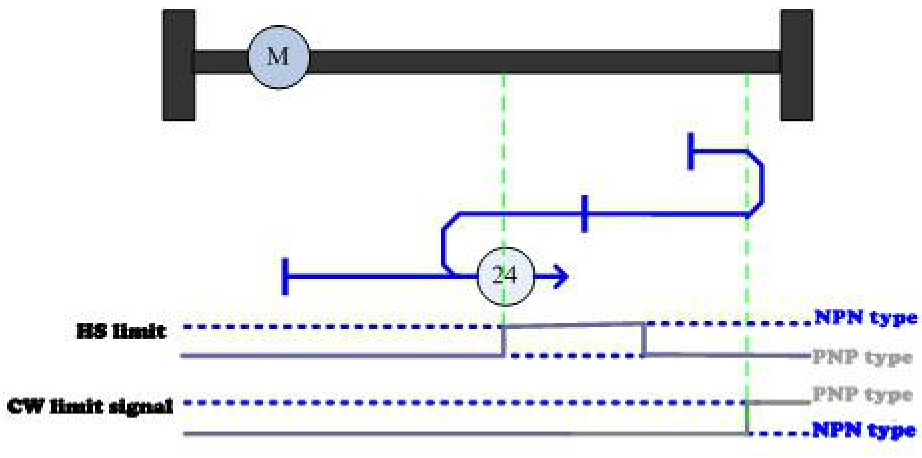


Fig. 187　　24 trajectory diagram of EtherCAT slave return to zero mode

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;

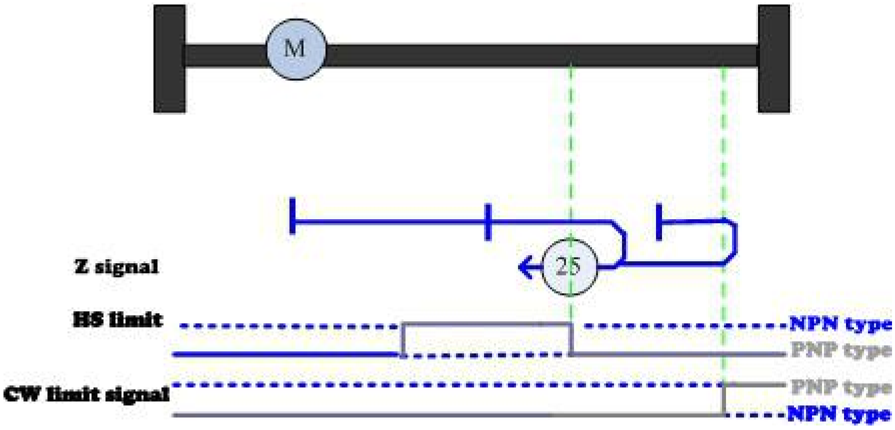


Fig. 188 25 trajectory diagram of EtherCAT slave return to zero mode

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;

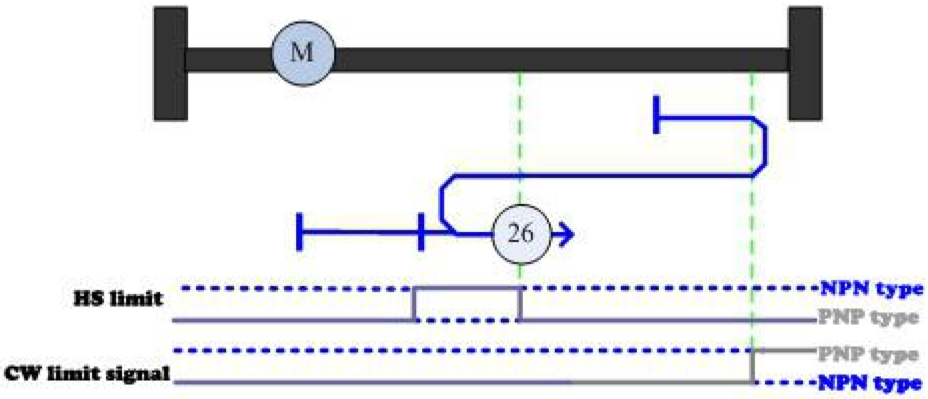


Fig. 189 26 trajectory diagram of EtherCAT slave return to zero mode

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;

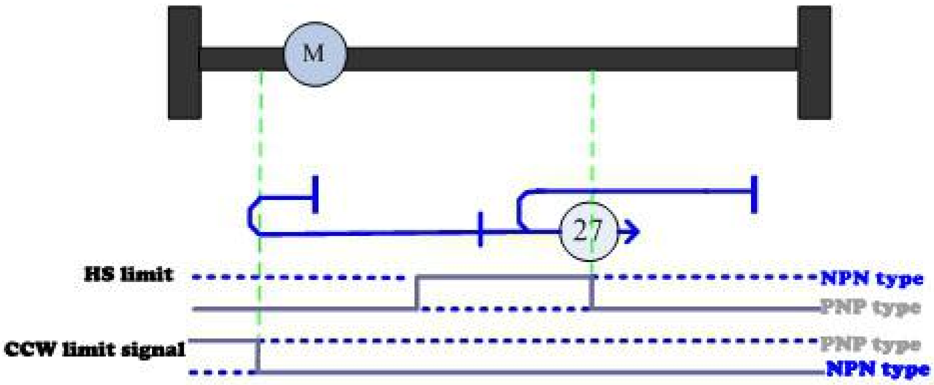


Fig. 190 27 trajectory diagram of EtherCAT slave return to zero mode

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;

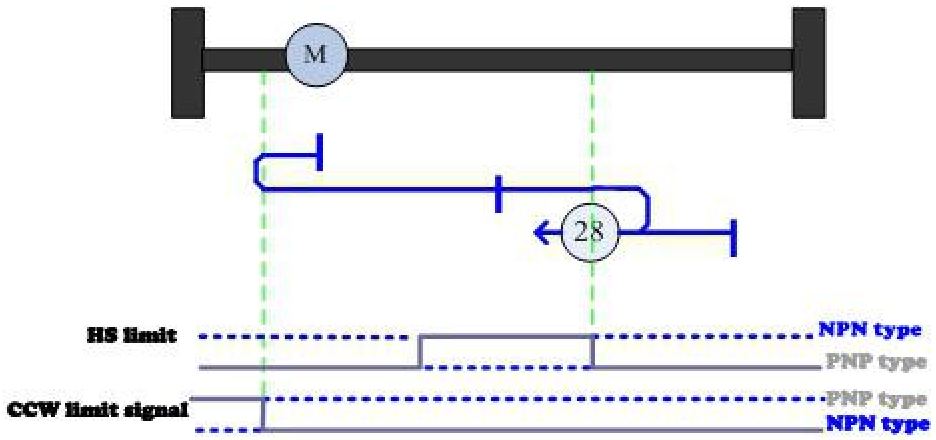


Figure 191 schematic diagram of 28 track in homing mode of JMC EtherCAT slave station

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;

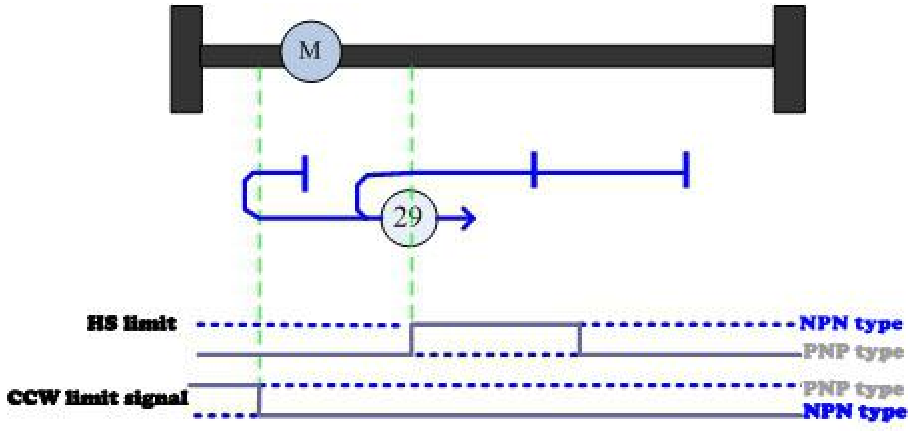


Fig. 192 29 trajectory diagram of EtherCAT slave return to zero mode

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;

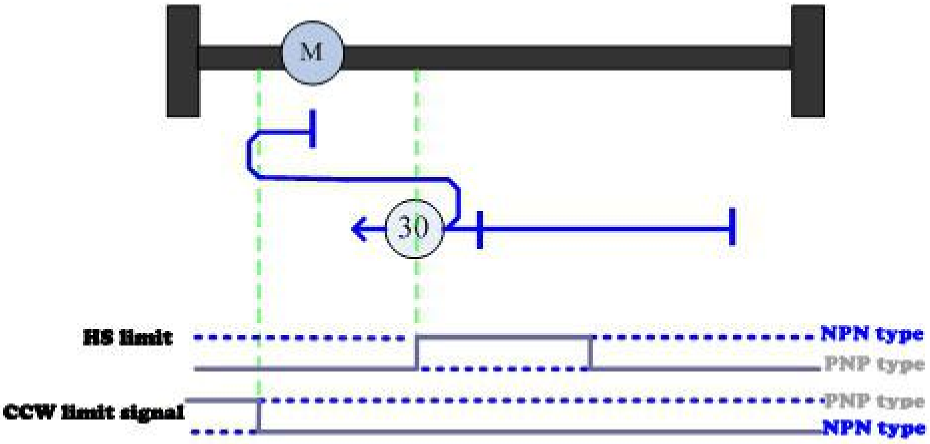


Fig. 193 30 trajectory diagram of EtherCAT slave return to zero mode

2.31 Return to zero mode 31

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.

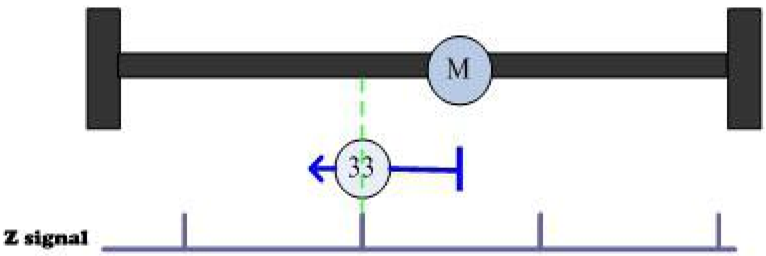


Fig. 194 33 trajectory diagram of EtherCAT slave return to zero mode

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

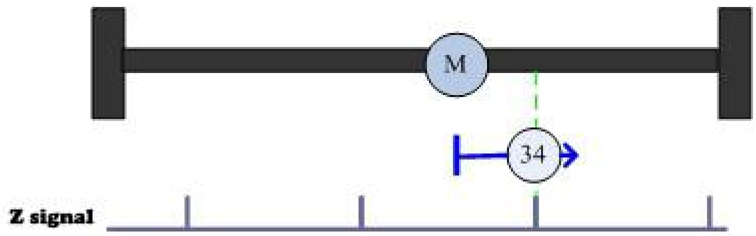


Fig. 195 34 trajectory diagram of EtherCAT slave return to zero mode

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 PDO Recommended 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 (JMC 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 Project

- Open the software through the icon in the task bar

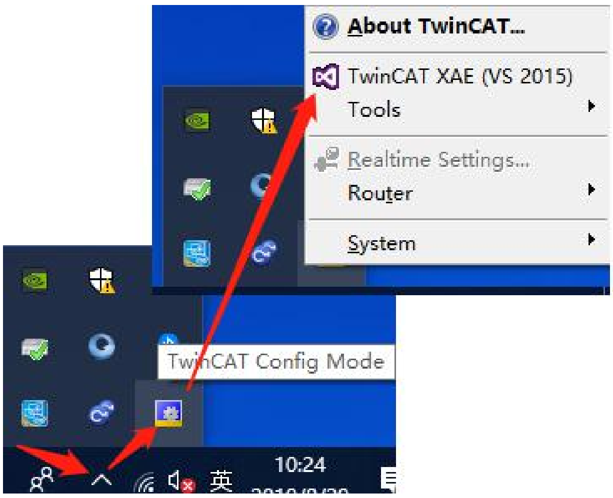


Figure 196 Running TwinCAT3

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

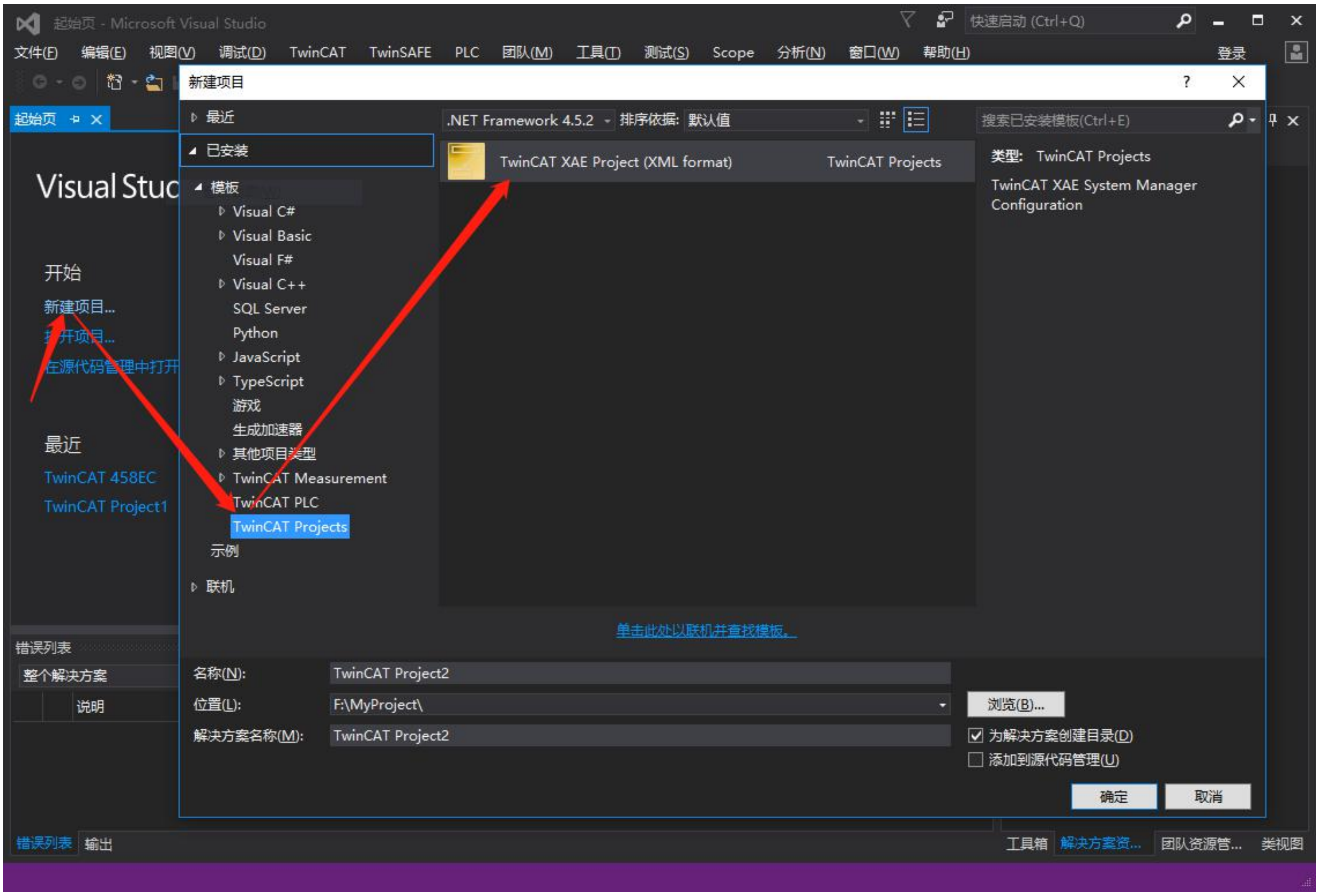


Fig. 197 New TwinCAT project

➢ Activate 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)

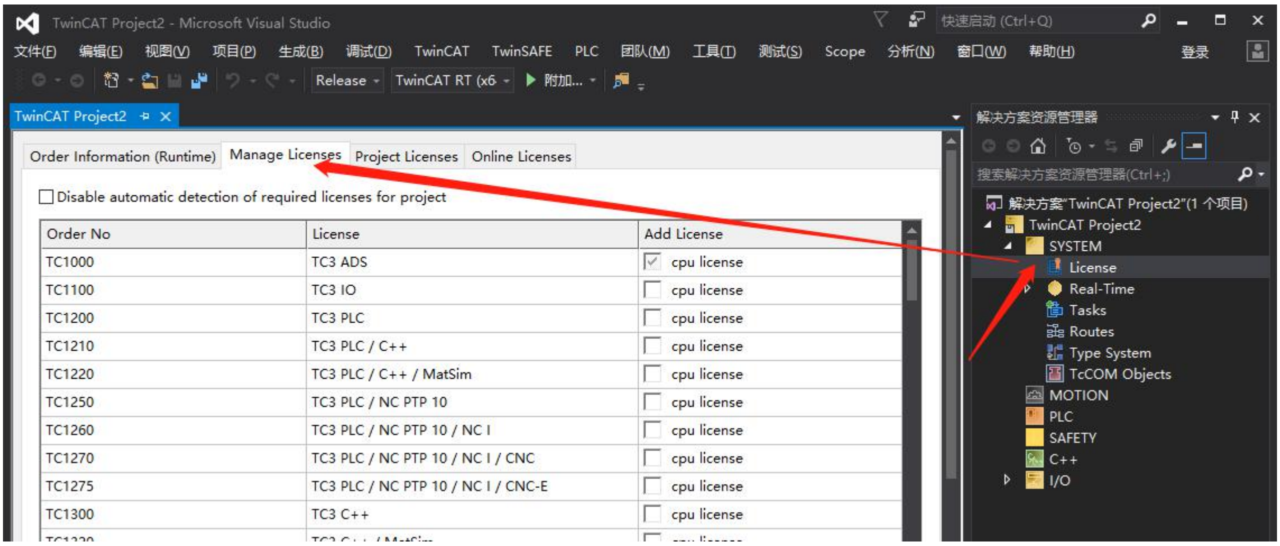


Figure 198 Activate license

- 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

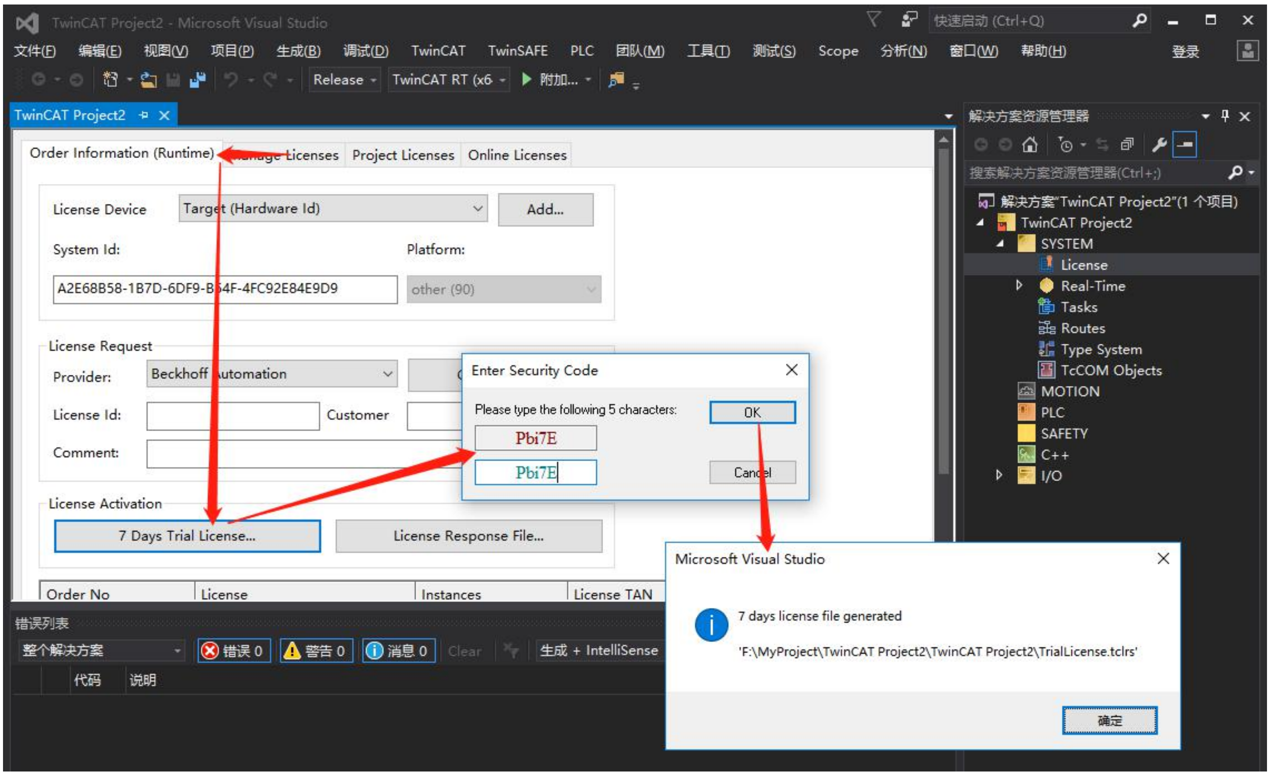


Figure 199 Enter confirmation code

➢ Network card configuration

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

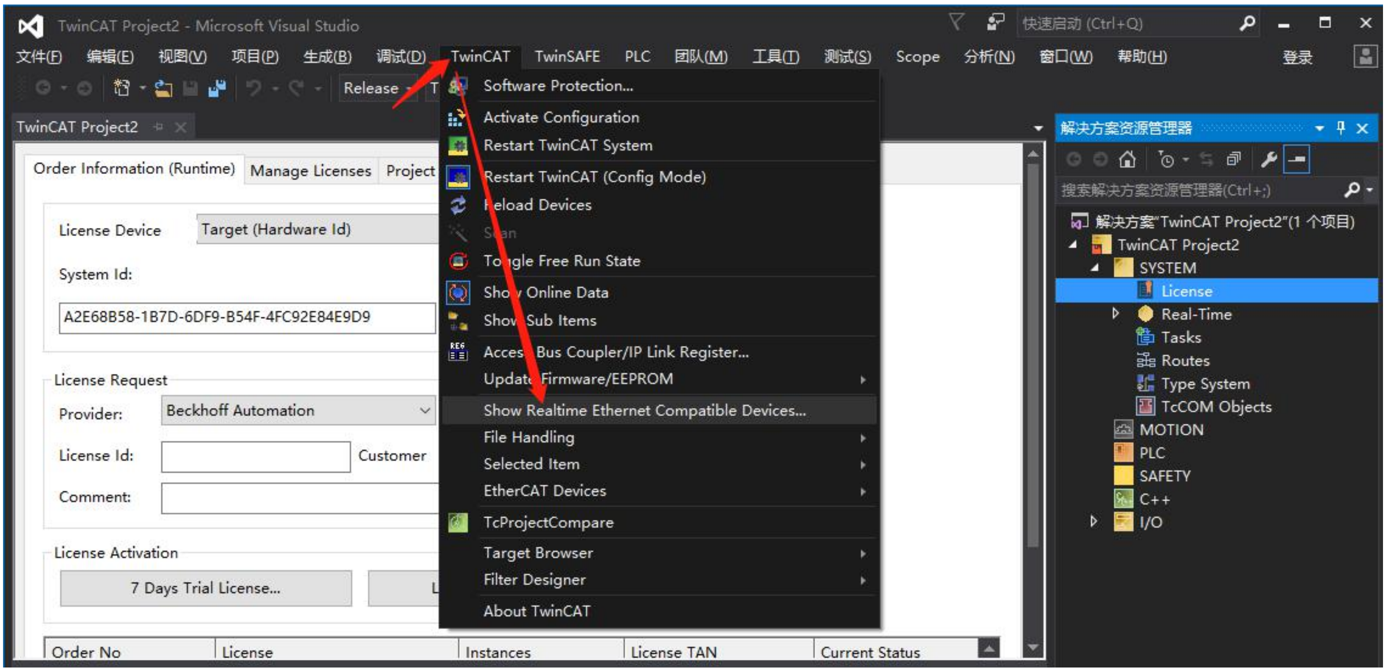


Figure 200 Open the list of compatible devices

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

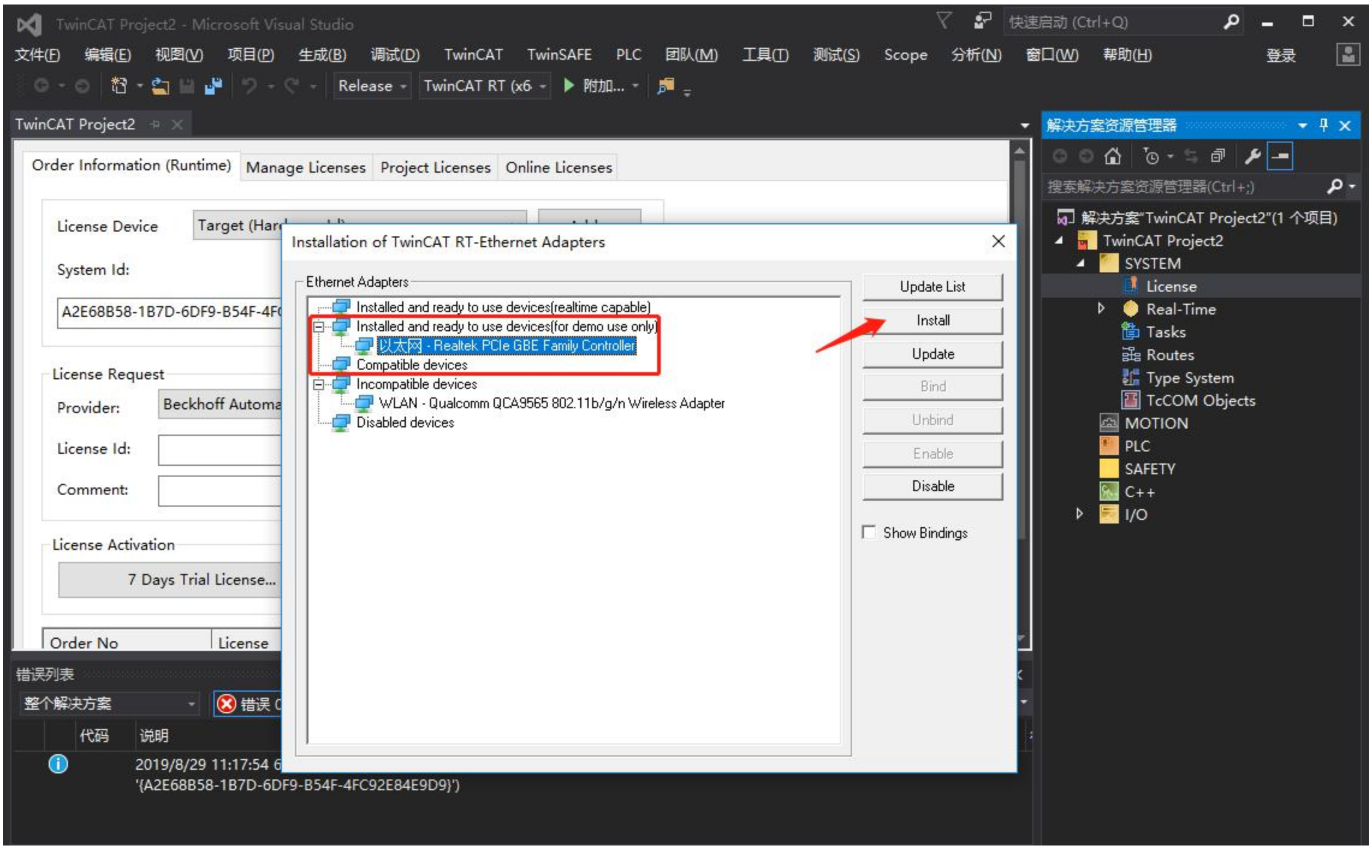


Figure 201　Click on compatible network card

➢ Configuration engineering

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

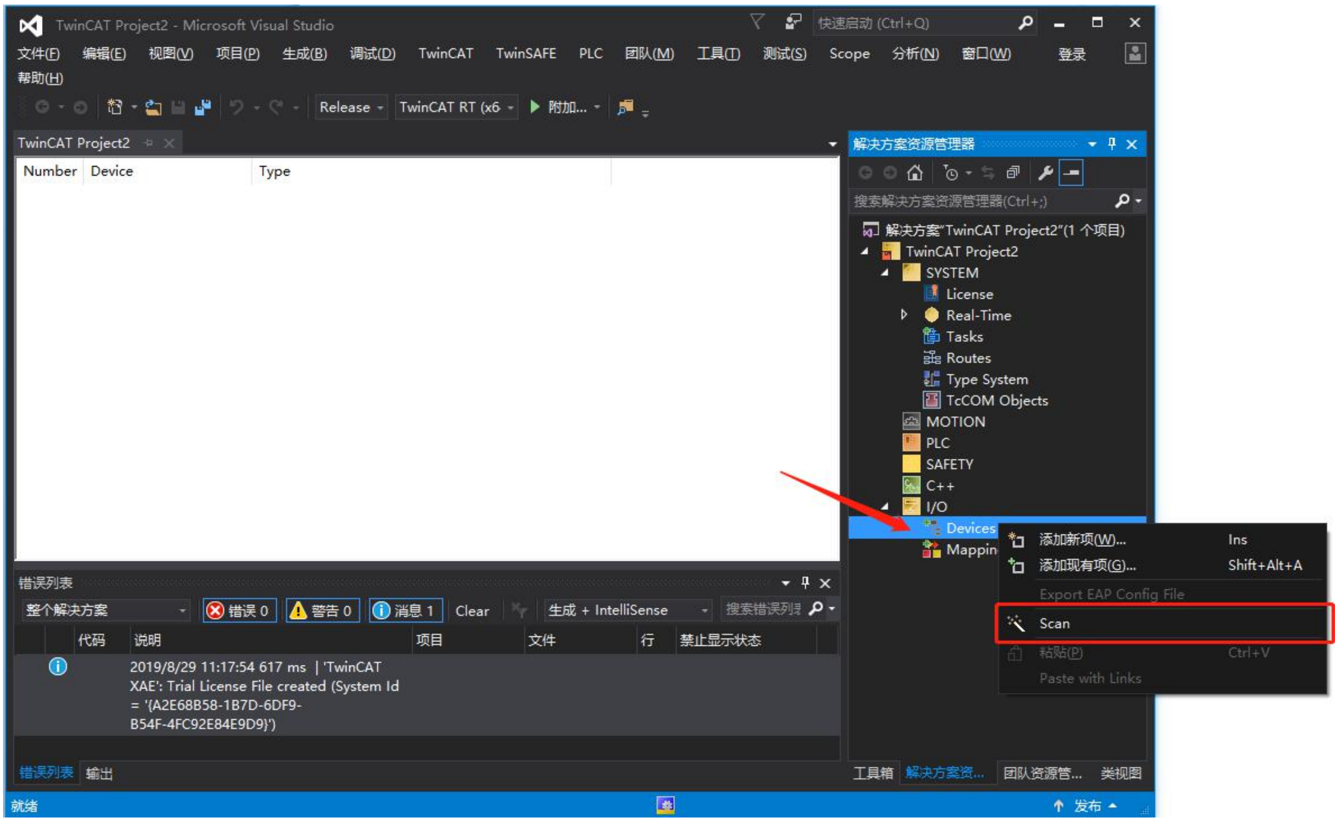


Figure 202 scanning equipment

- 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】

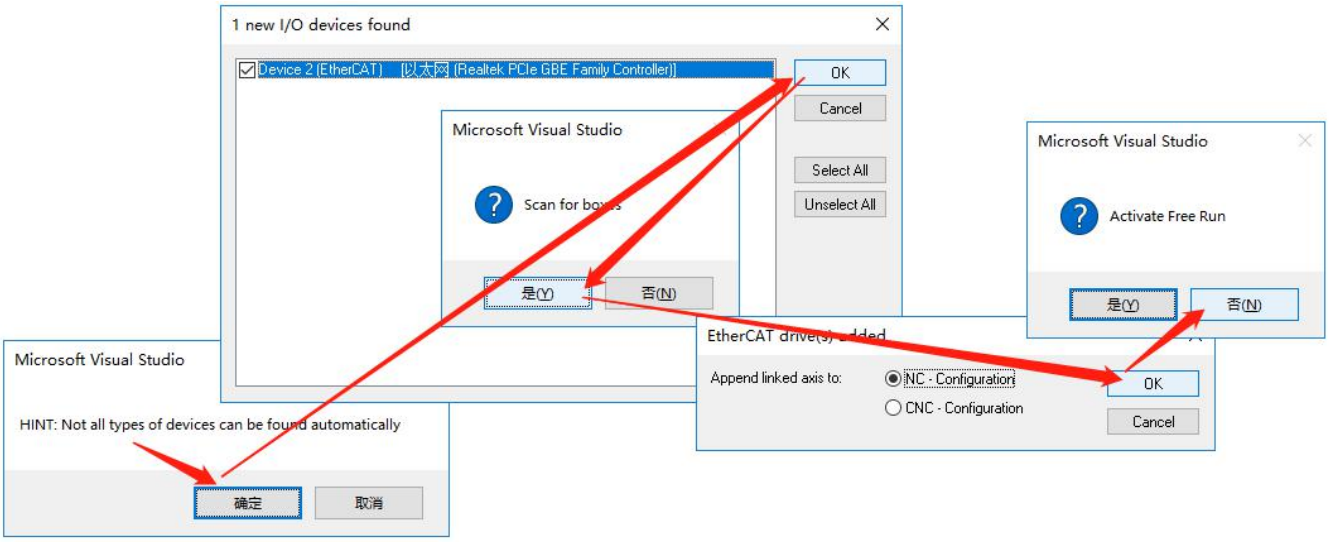


Figure 203 Add IO device

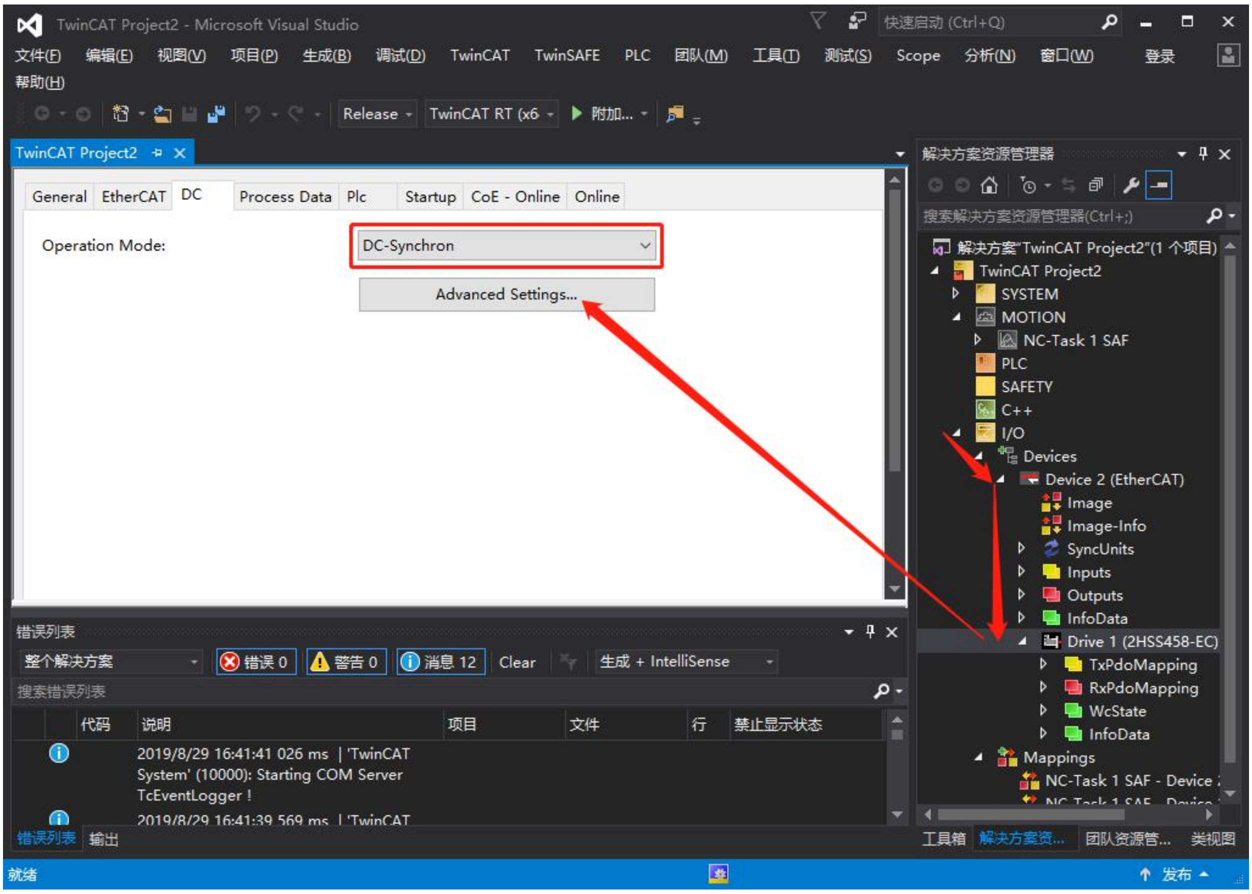


Figure 204 Set distributed clock

- 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

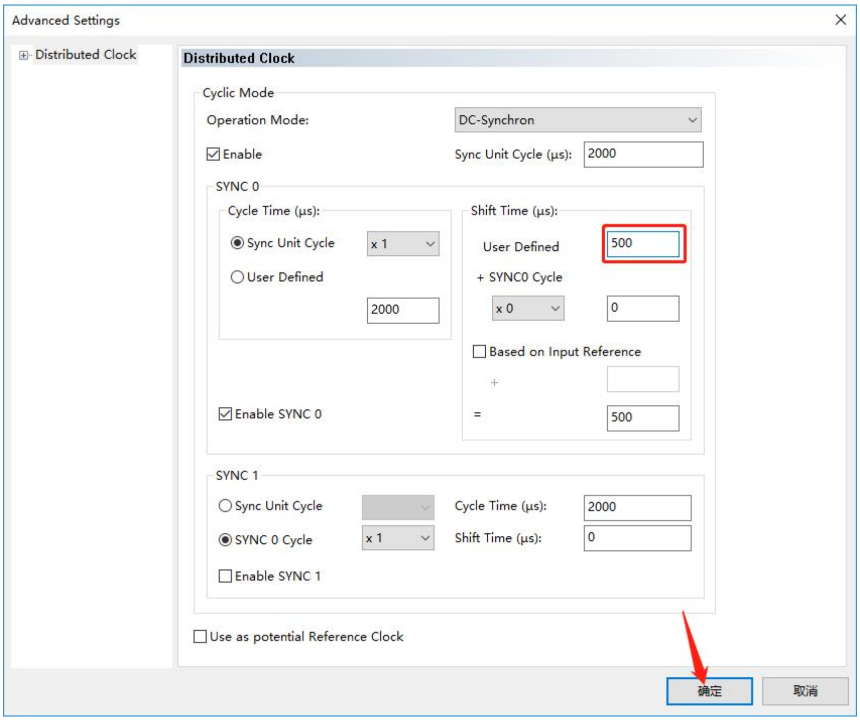


Figure 205 Set offset time

- 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.

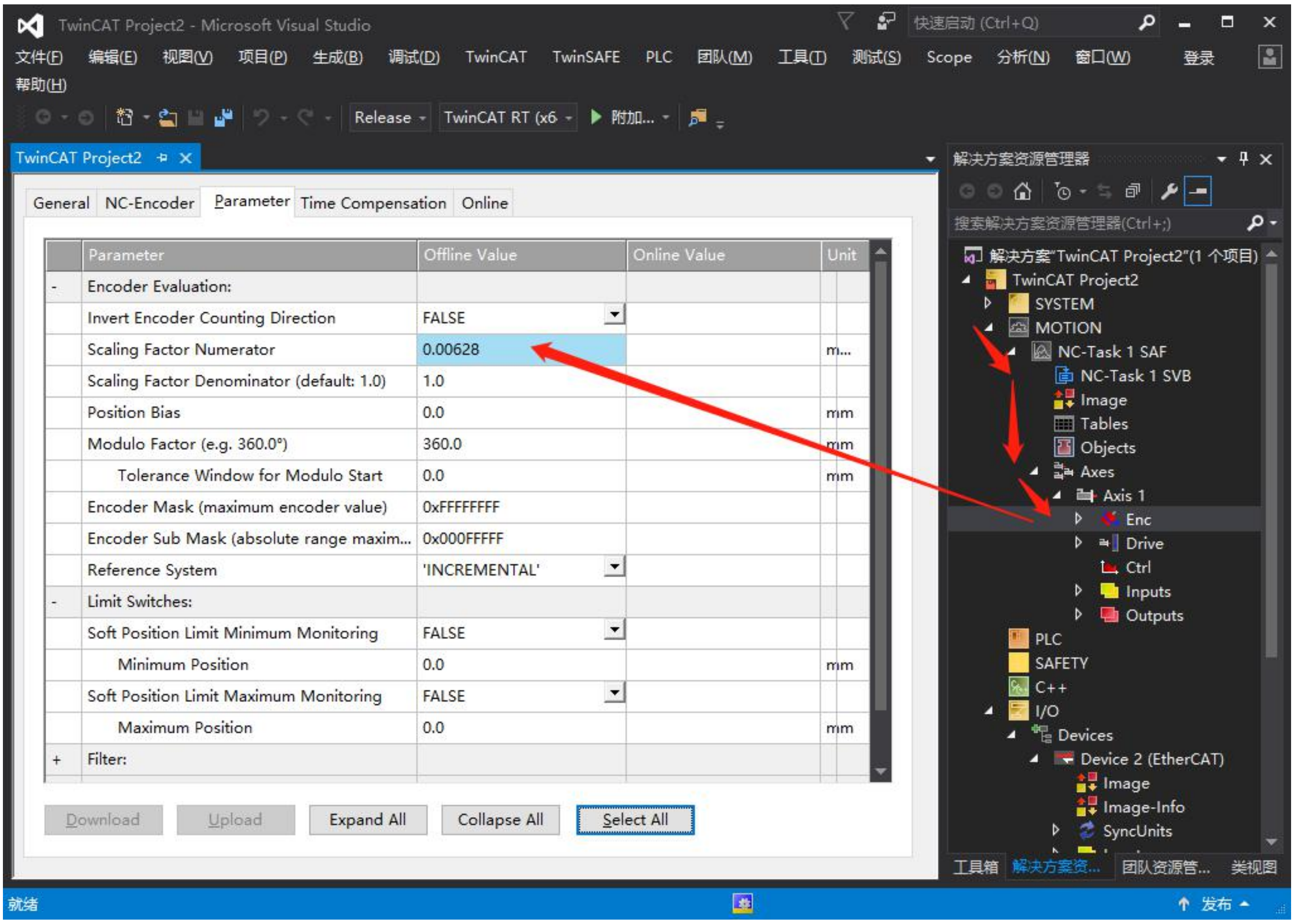


Figure 206 Setting the scale factor

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

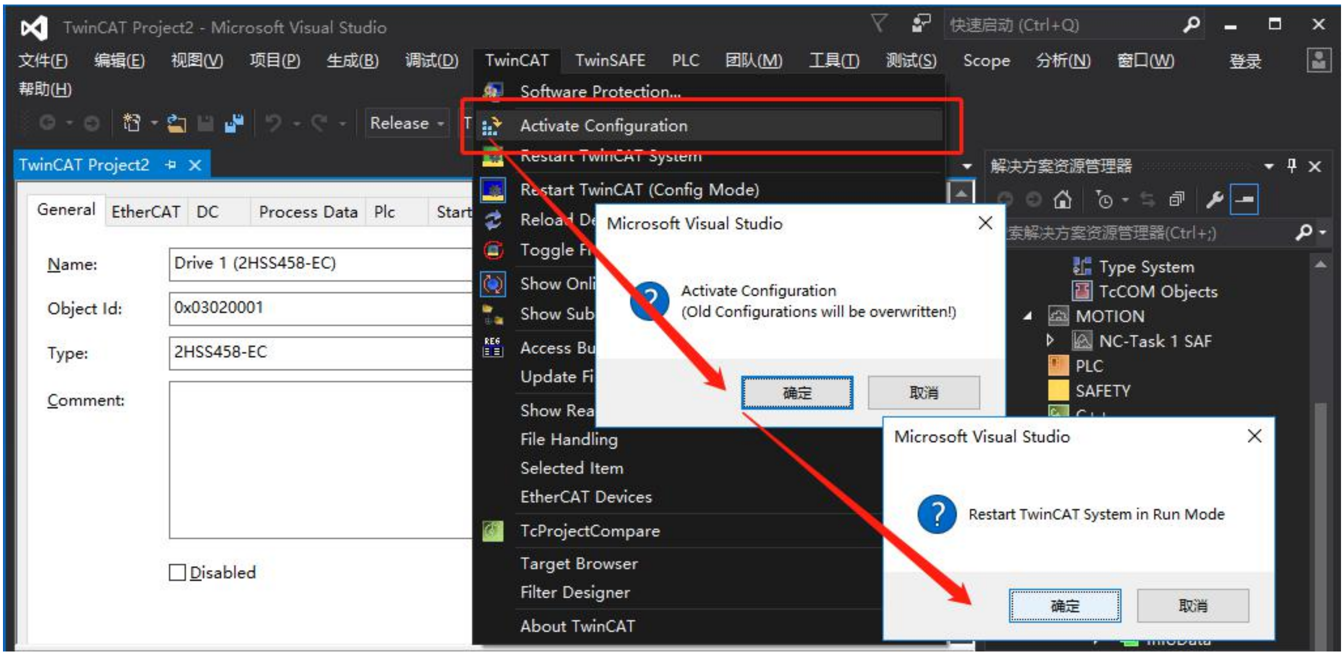


Figure 207 Restart the system

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

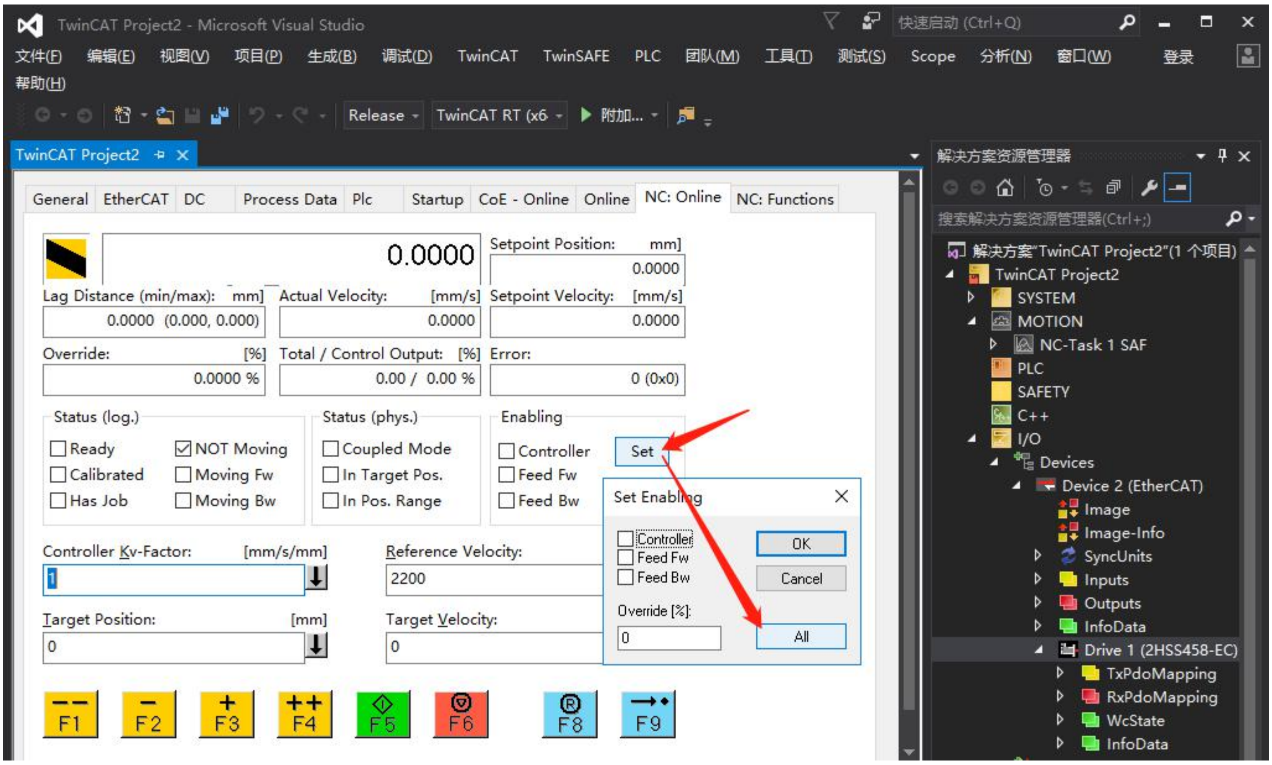
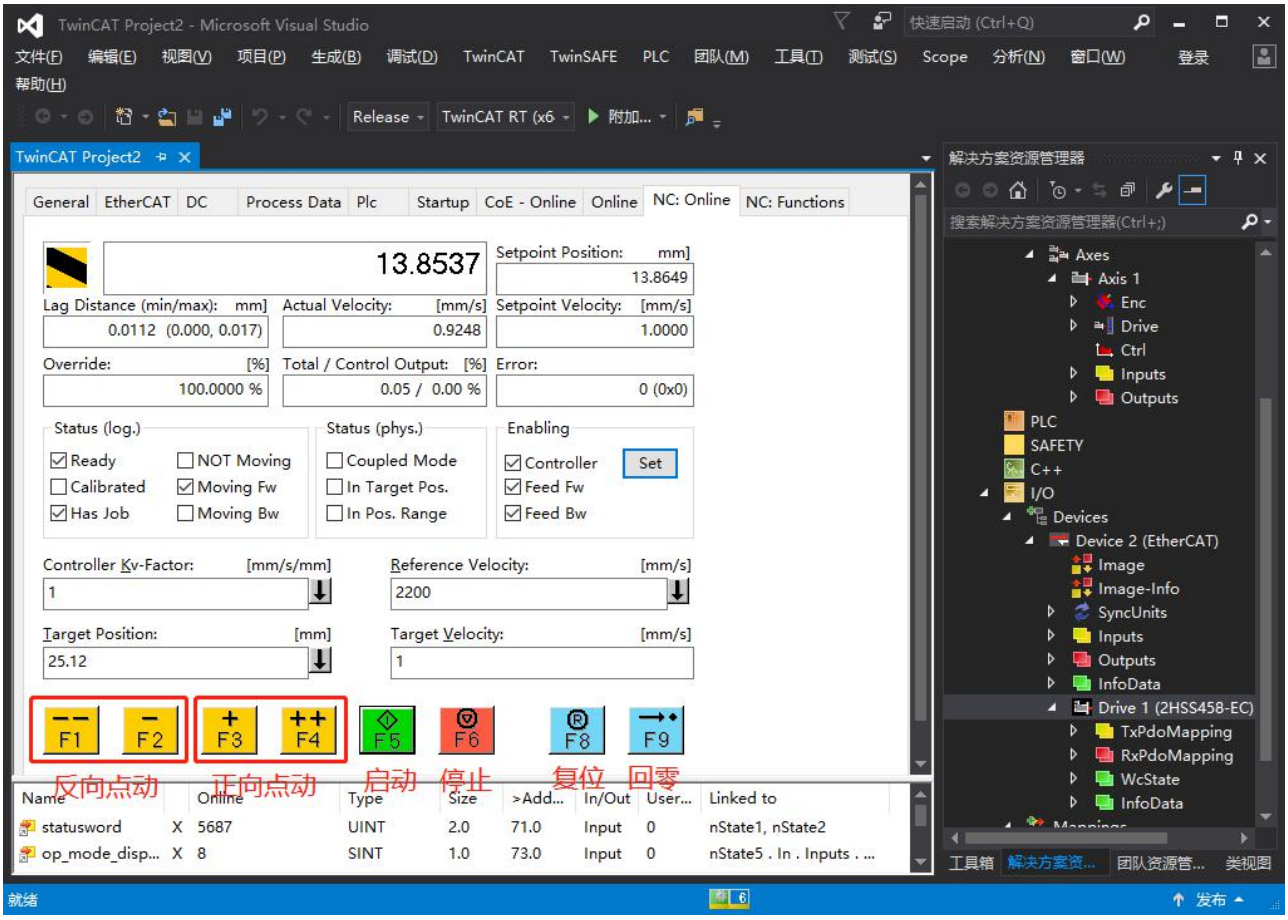


Fig 208 Enable equipment

- 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】

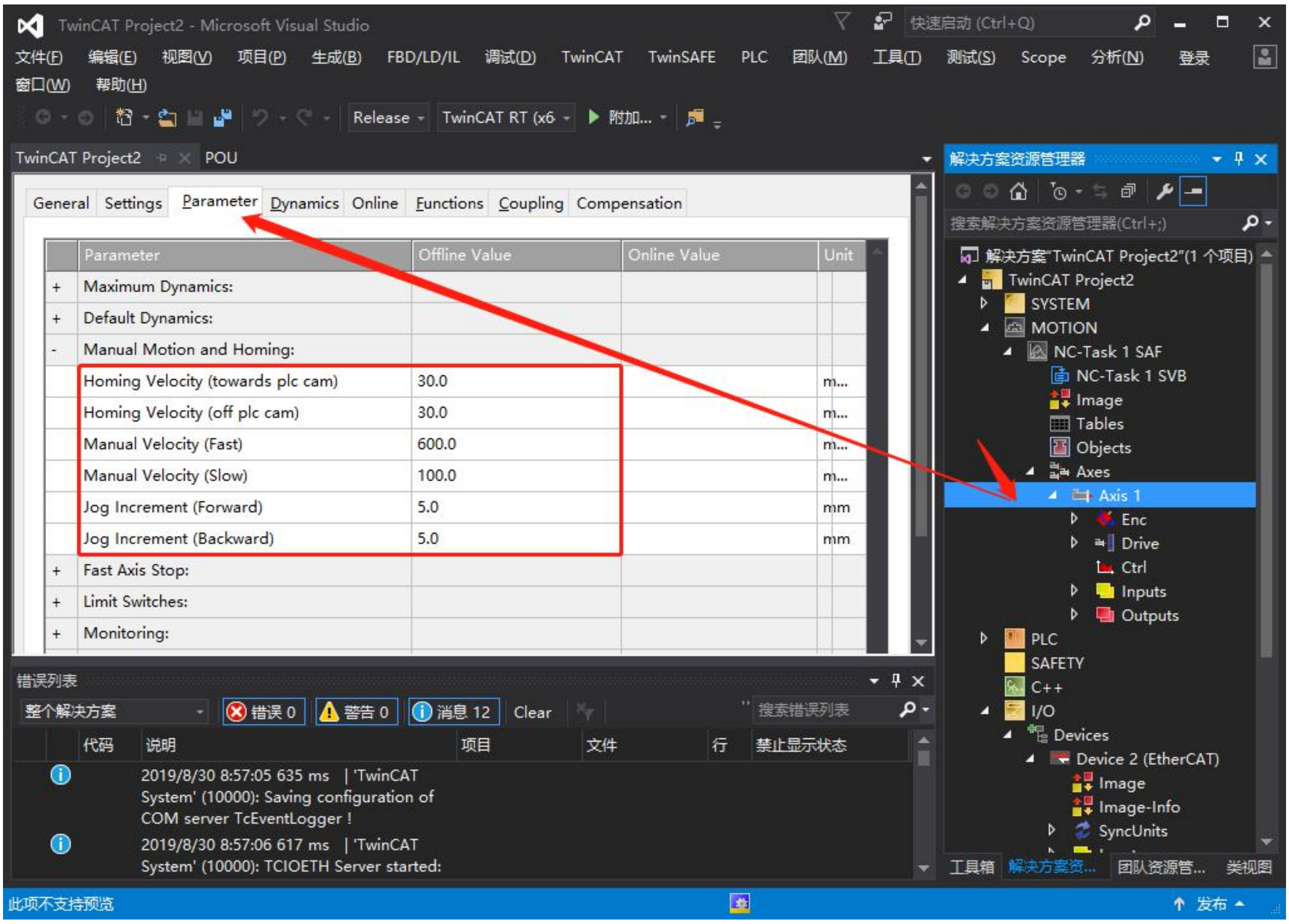


Figure 210 Setting manual control parameters

➢ PLC program creation

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

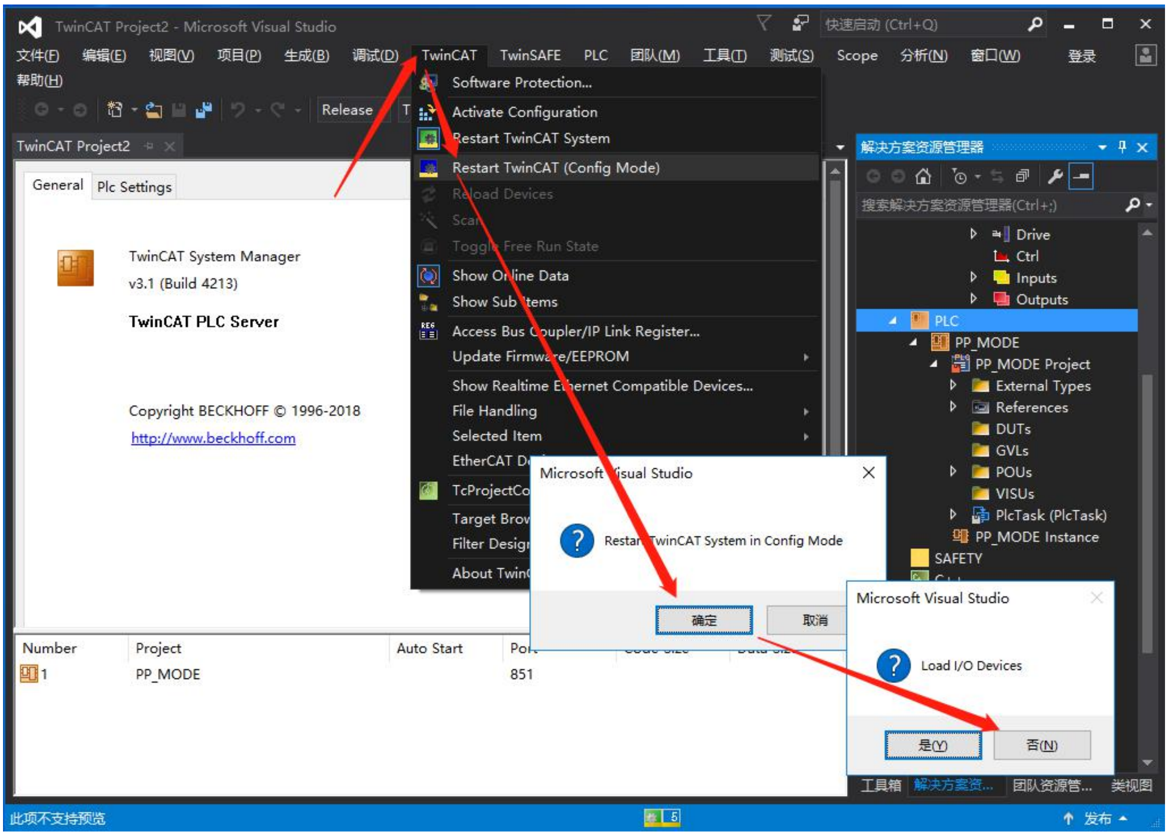


Figure 211 Enter configuration mode

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

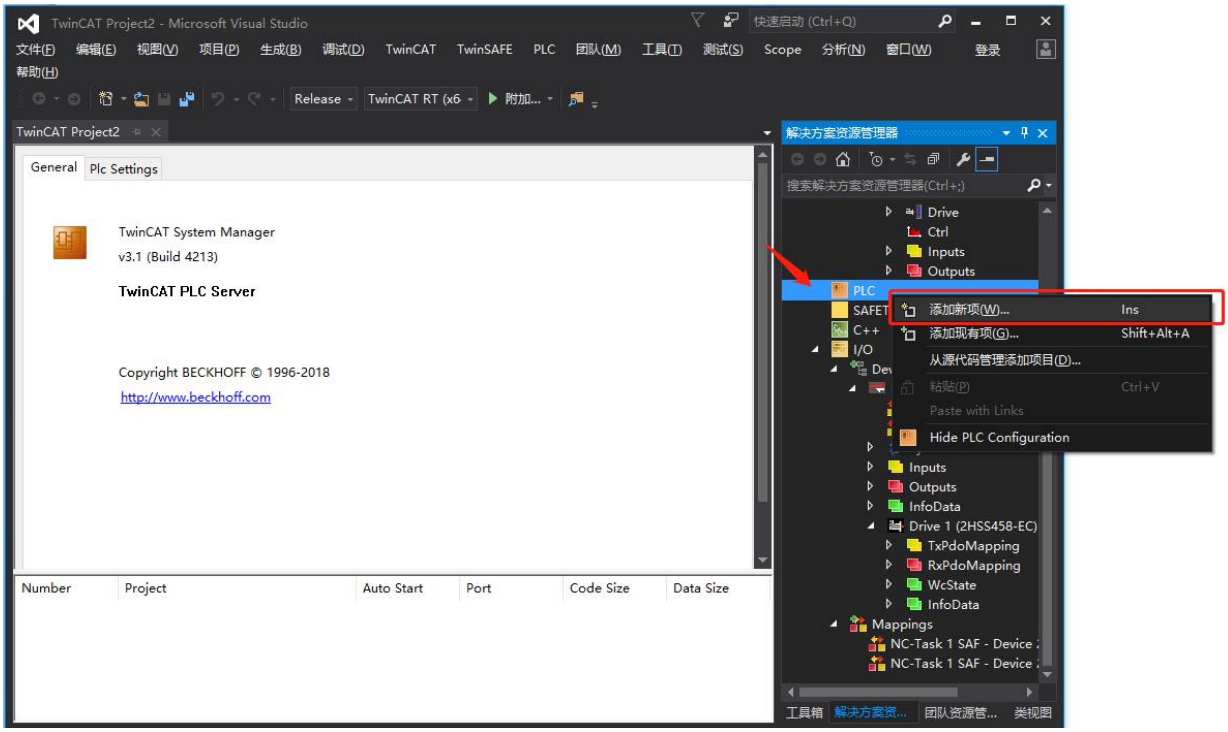


Figure 211 Enter configuration mode

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

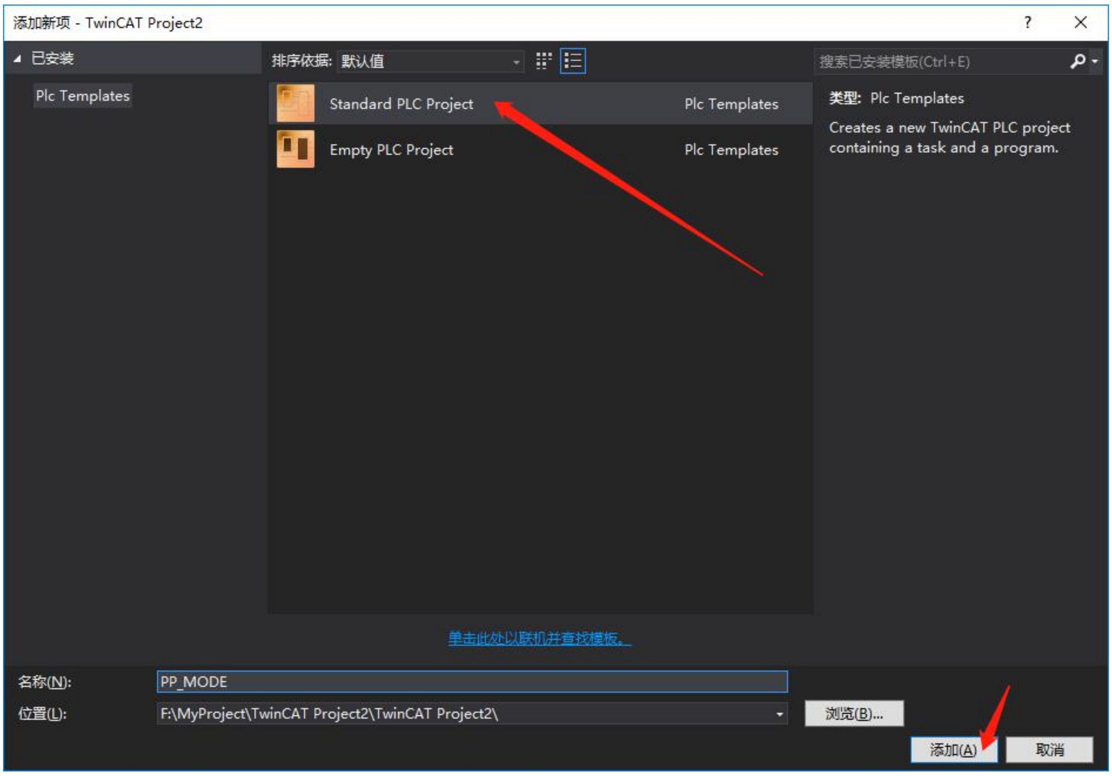


Figure 212 Add PLC project

- 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】

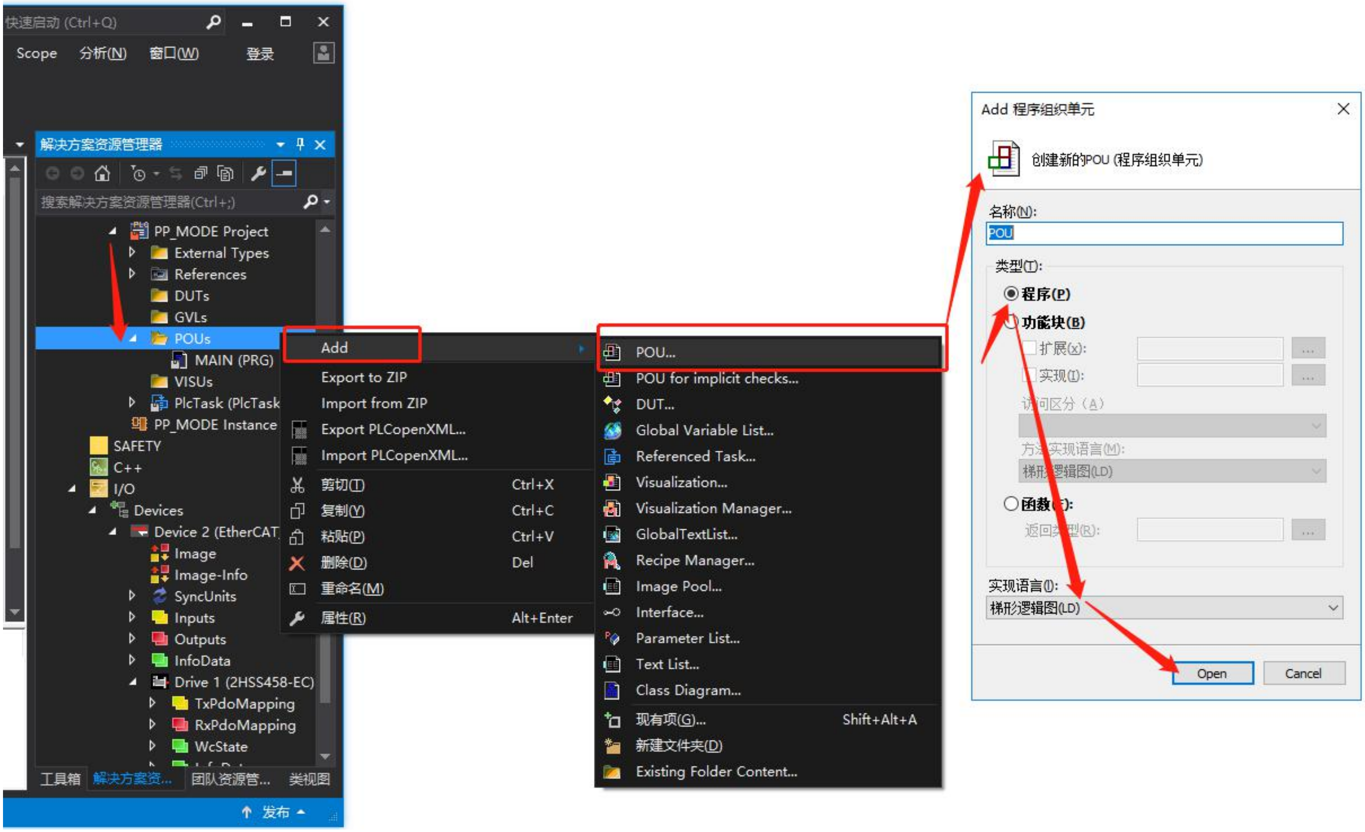


Figure 214 Add POU program

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

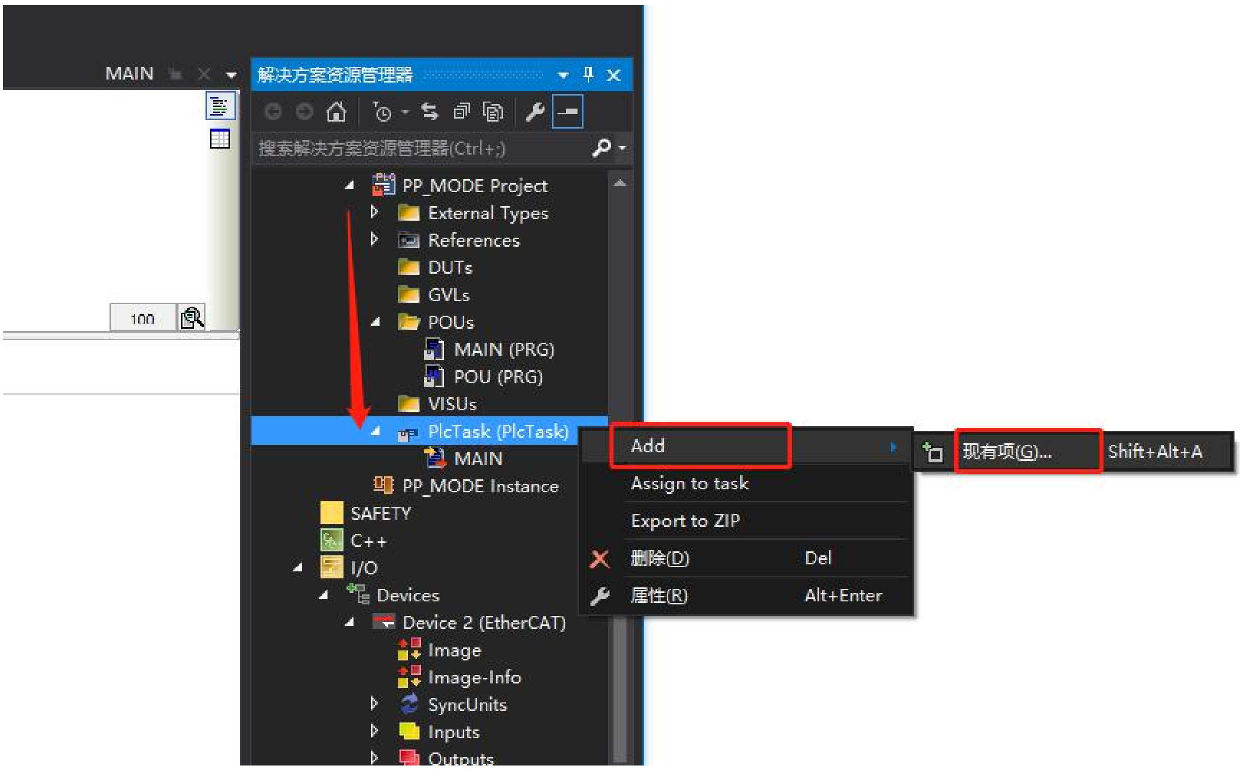


Fig 215 add PLC task

- Click 【Category】 → 【Programs】 → select the required program files under the

POUs in the current project → click【OK】

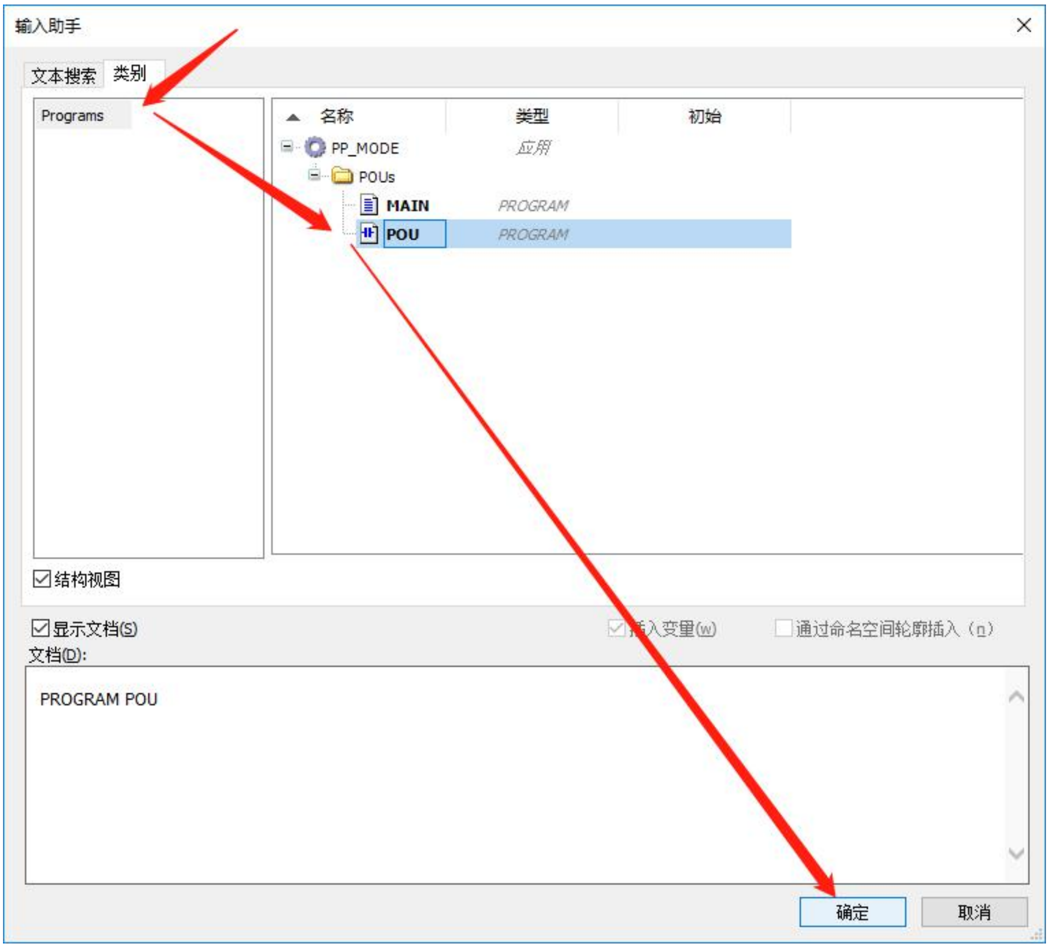
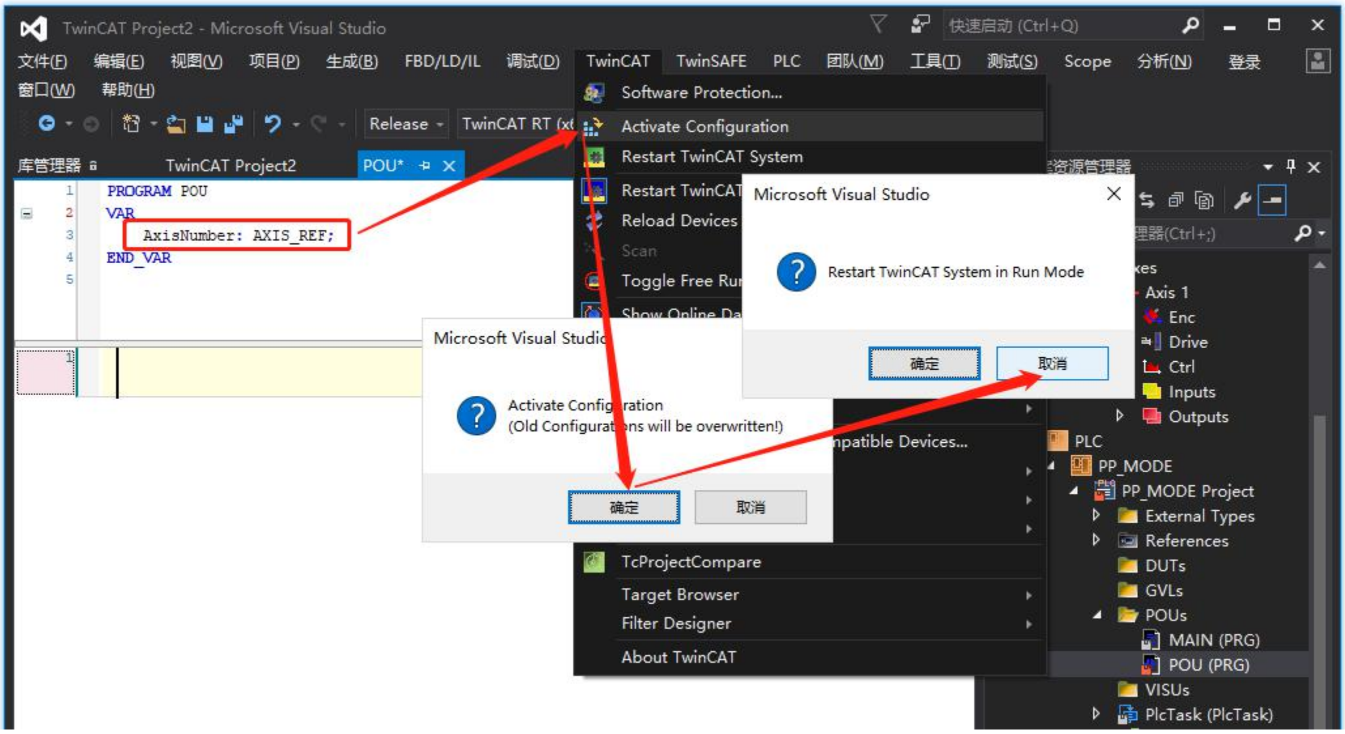


Figure 216 Select PLC task

- 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】

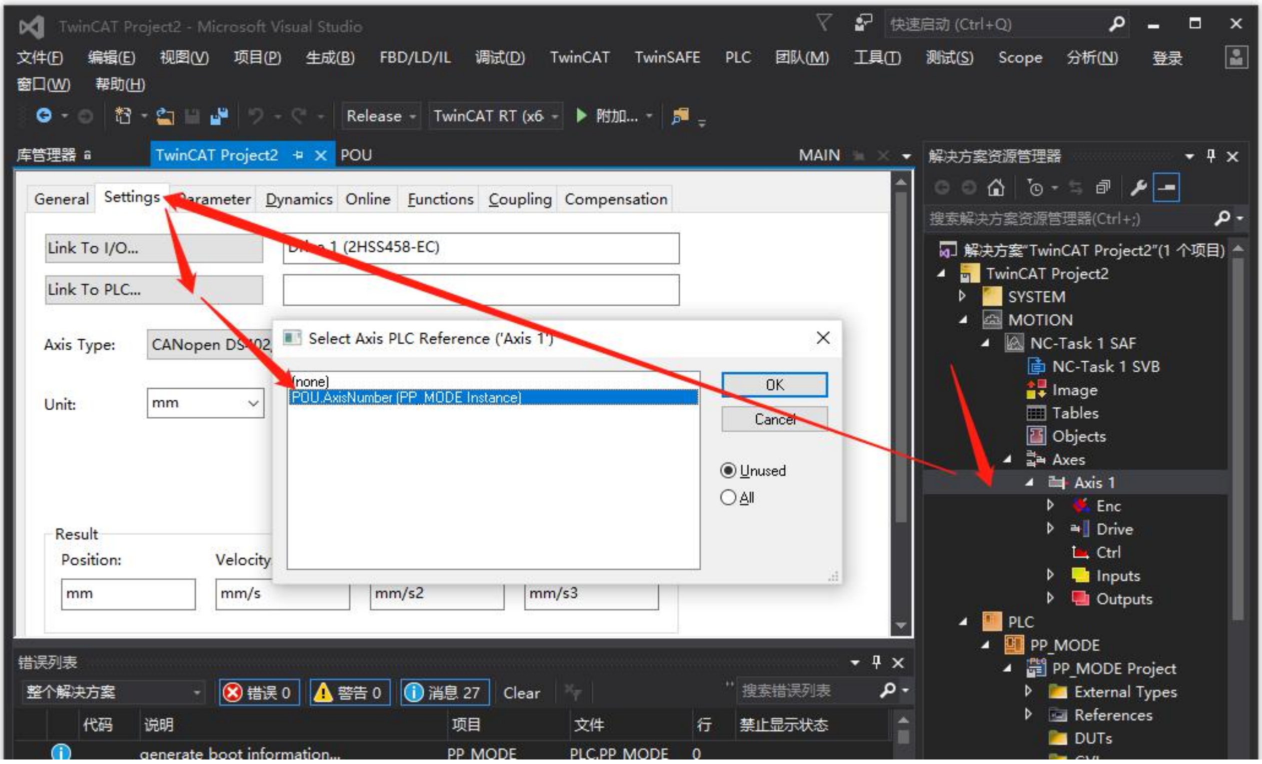


Figure 218. Link axis variables1 Control method I

- Because we will use the official motion control library, we need to add it to the project first.

- Right click【References】→click【Add library】

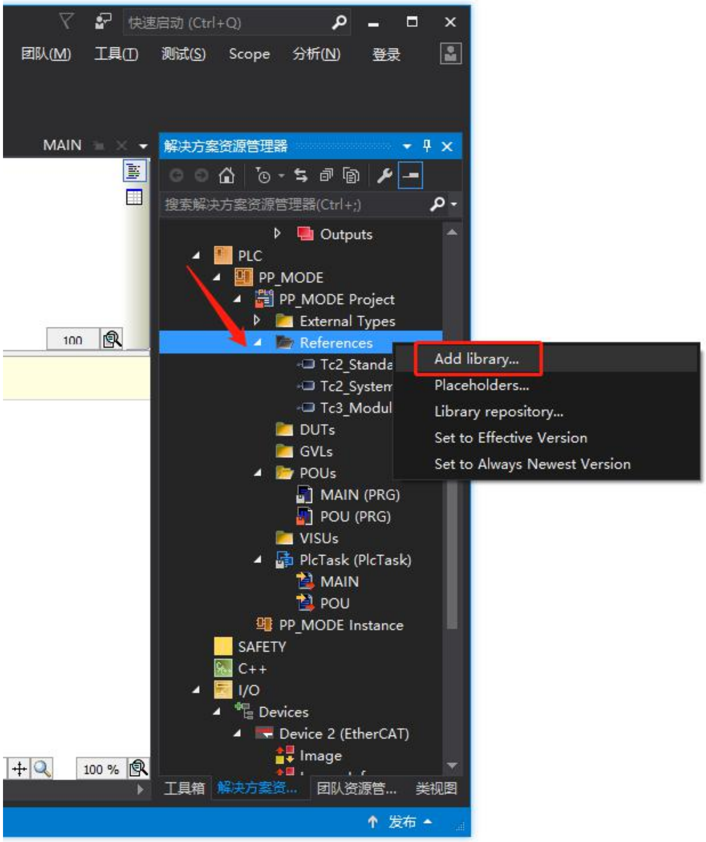


Figure 219 Add library

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

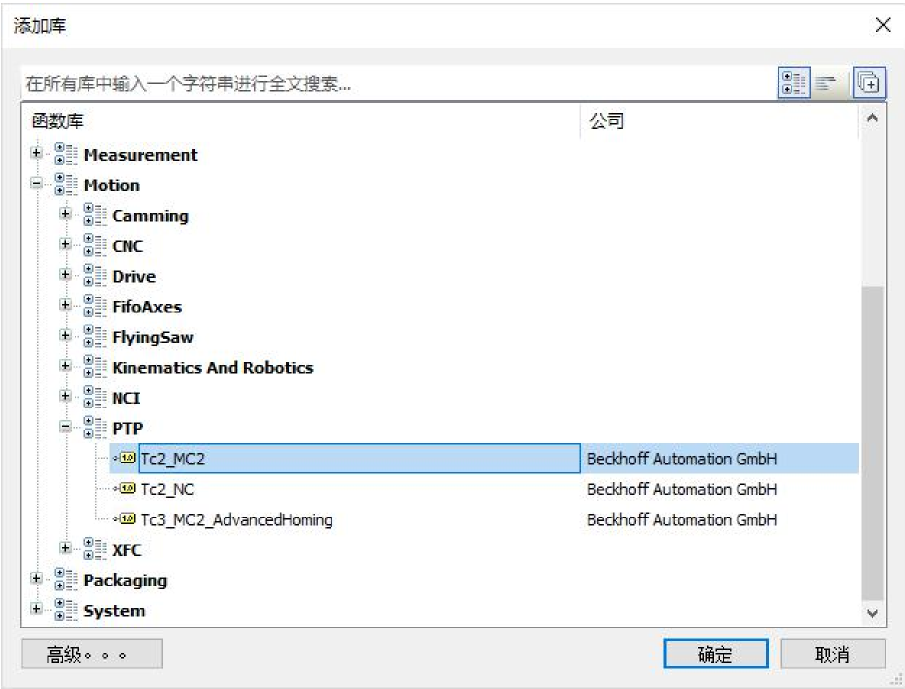


Figure 220 Select control motion library

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

Insert Operation Block

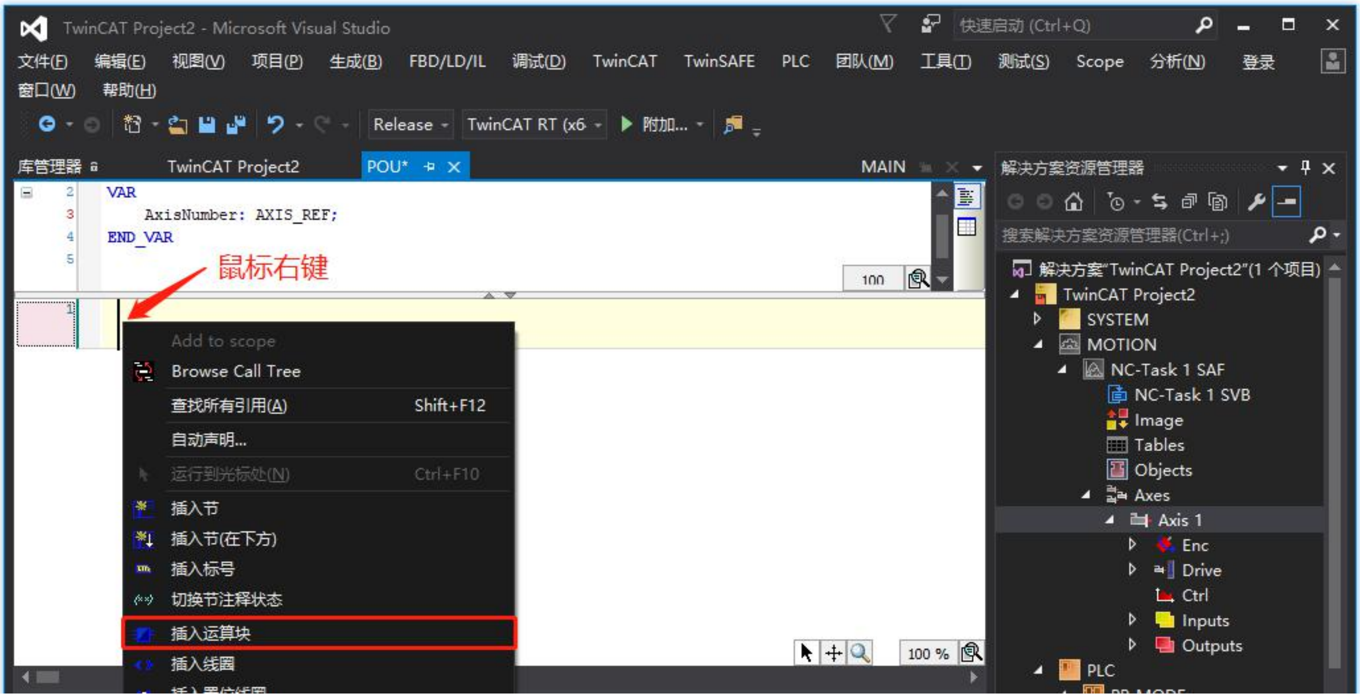


Fig. 221 Insert operation block

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

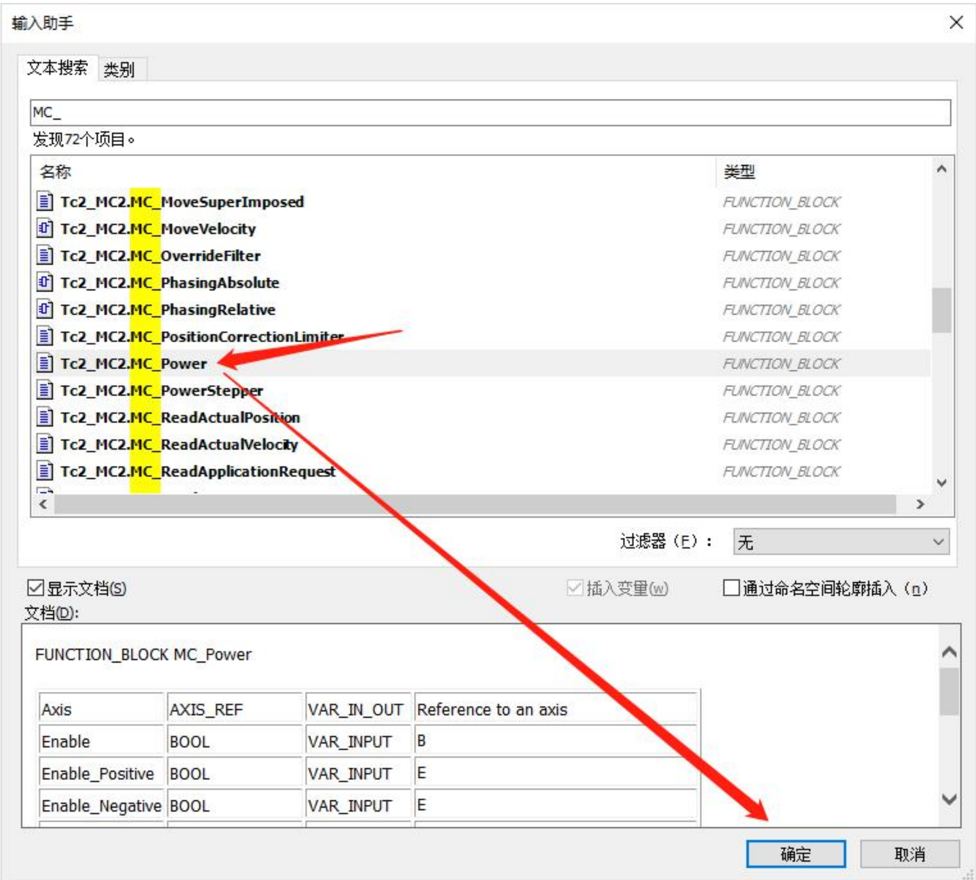


Fig 222 Select function block

- 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

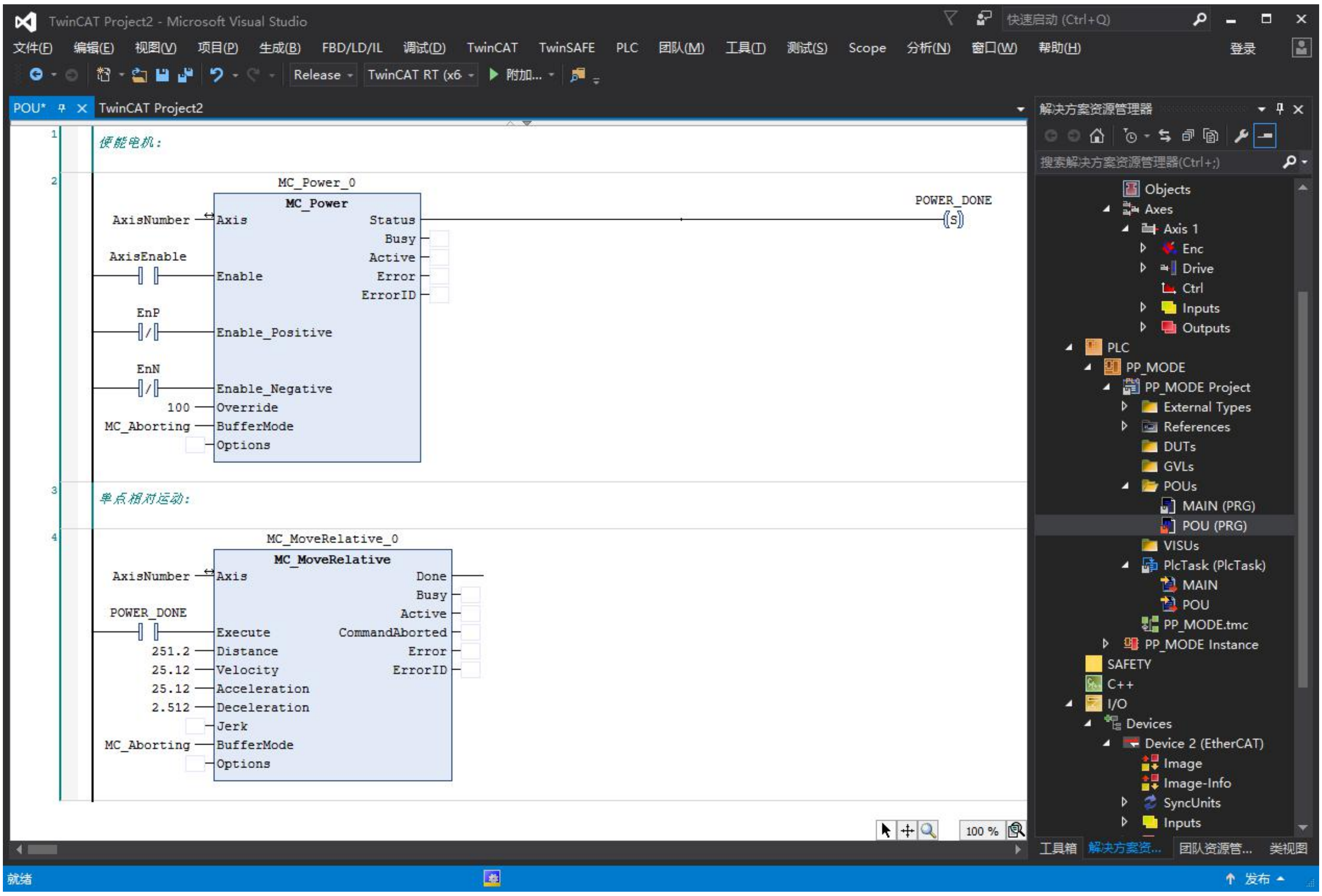


Figure 223 Point control routine

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

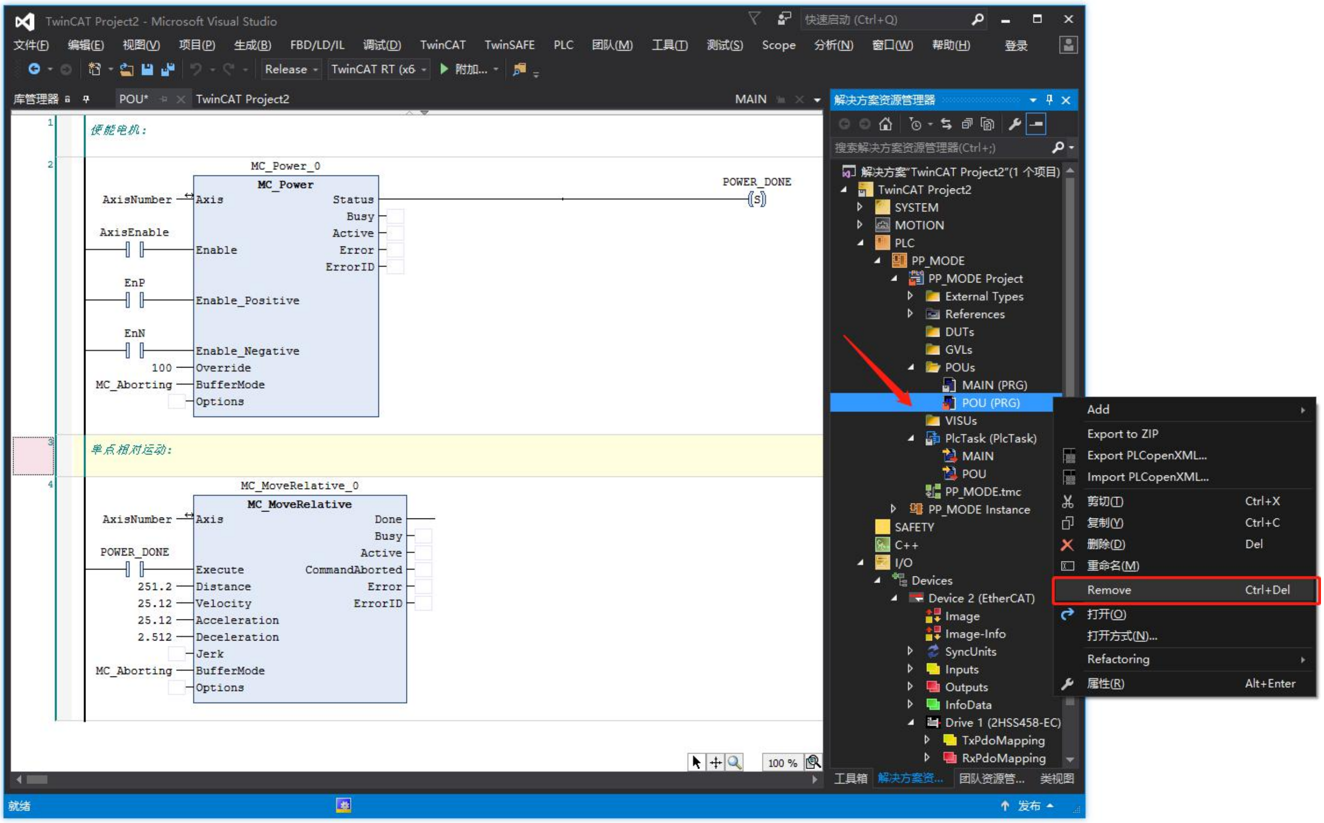


Figure 224 Removes the POU

- 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】

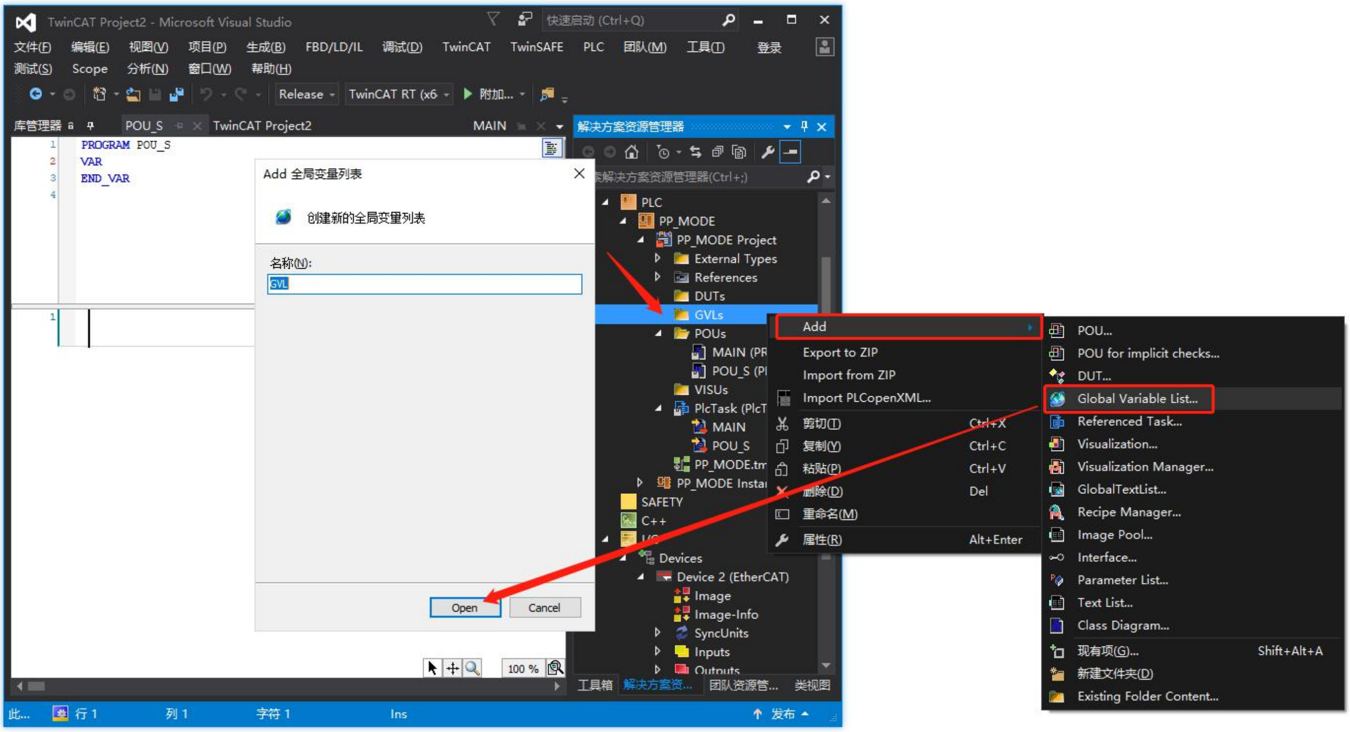


Figure 225 Add global variable list

- 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

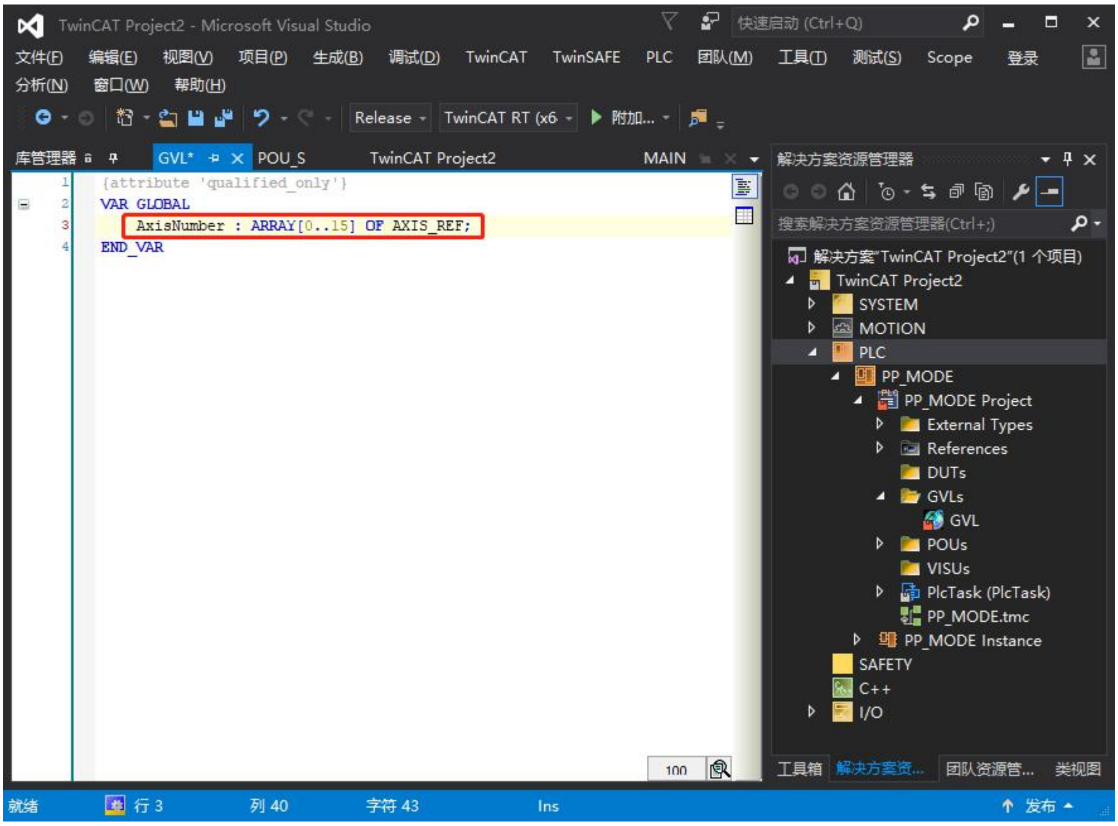


Figure 226 Add axis parameter group

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

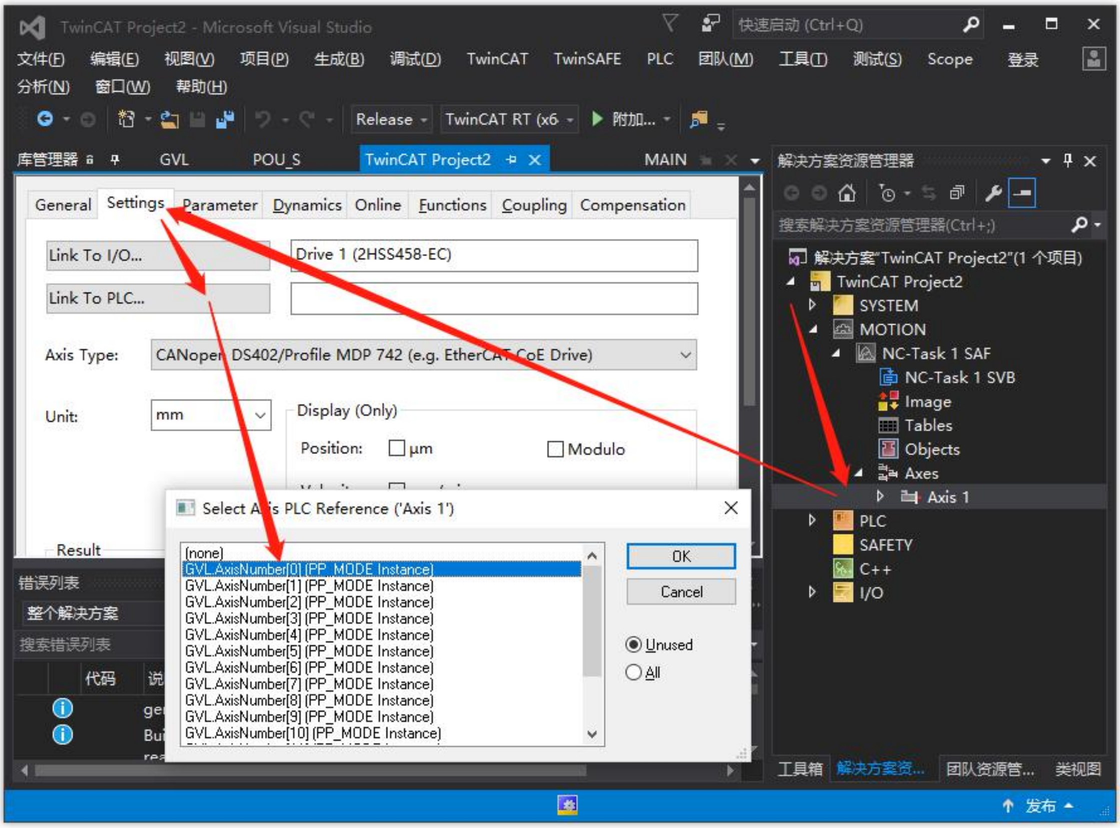


Figure 227 Link to corresponding axis number

- 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

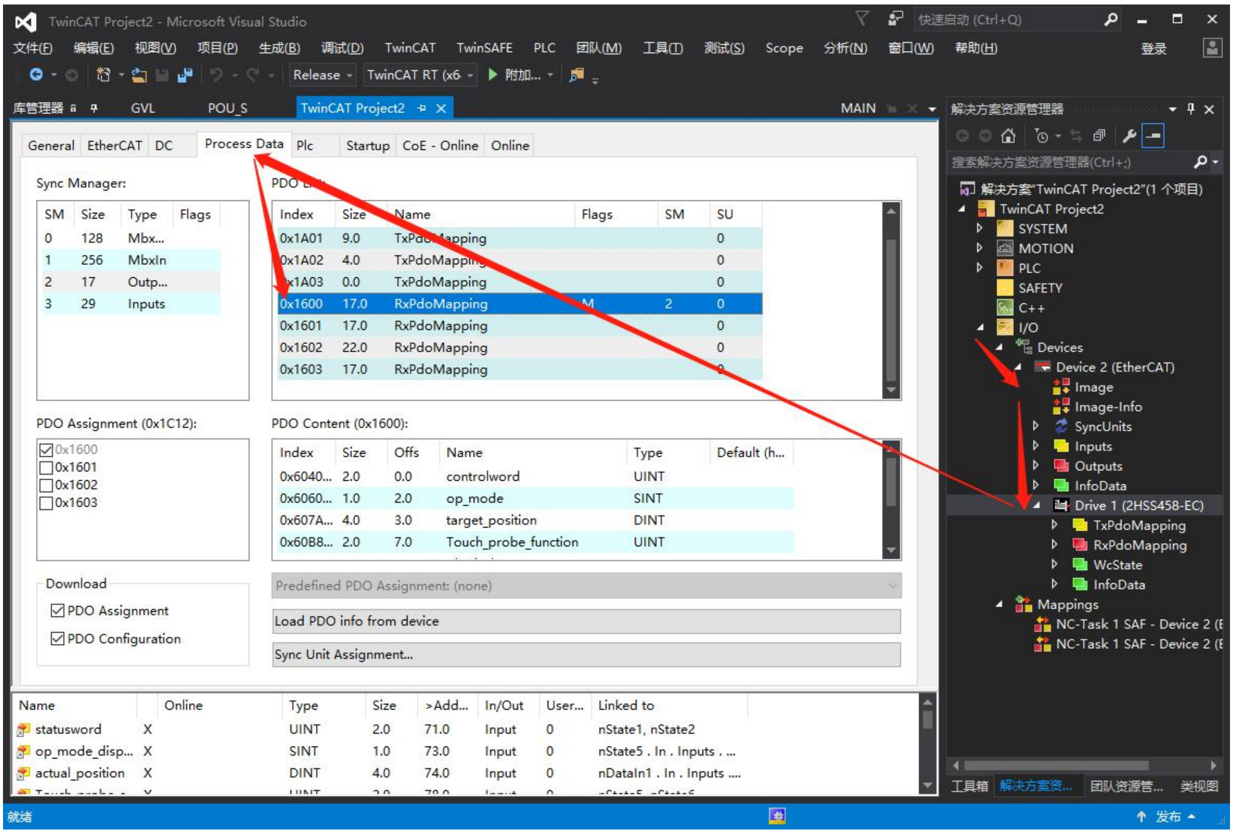


Figure 228 Modify PDO

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

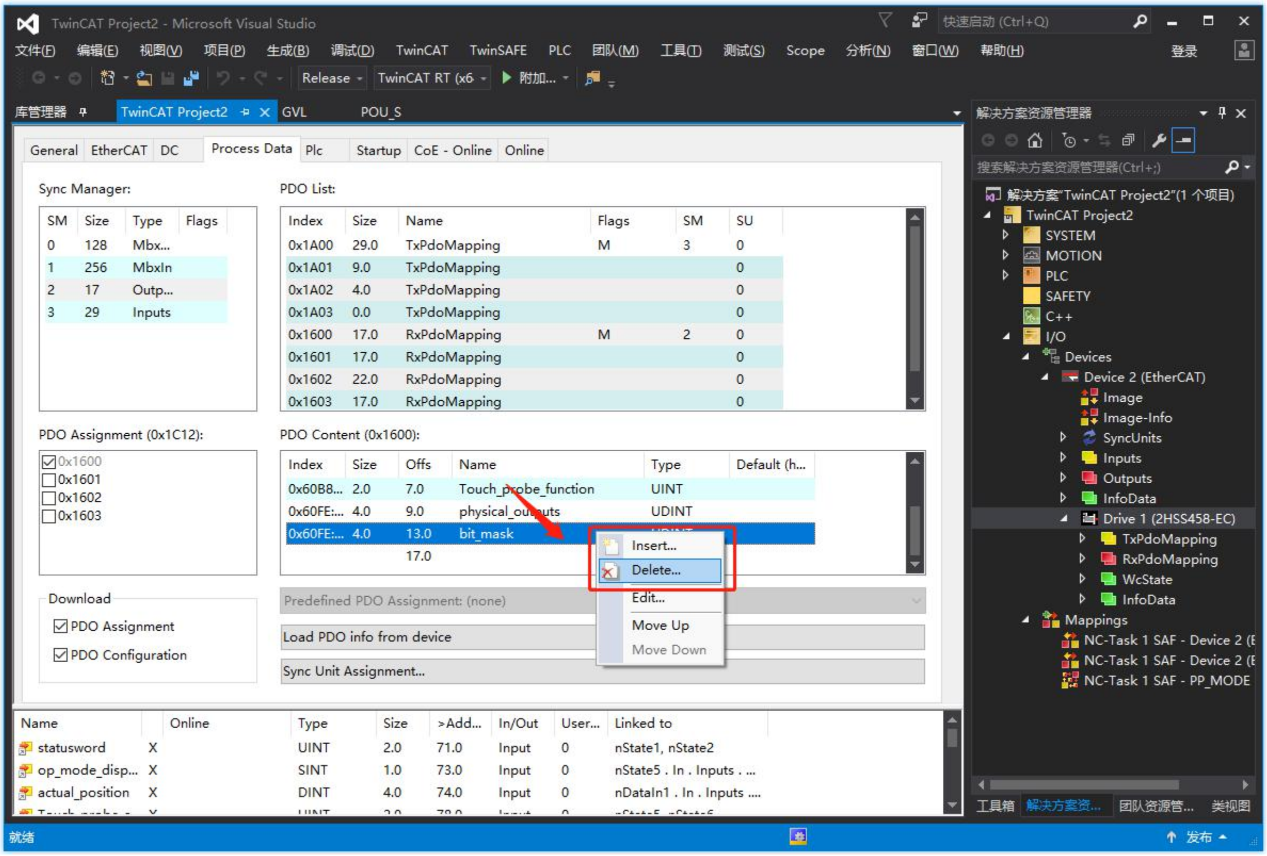


Figure 229 Modify PDO index

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

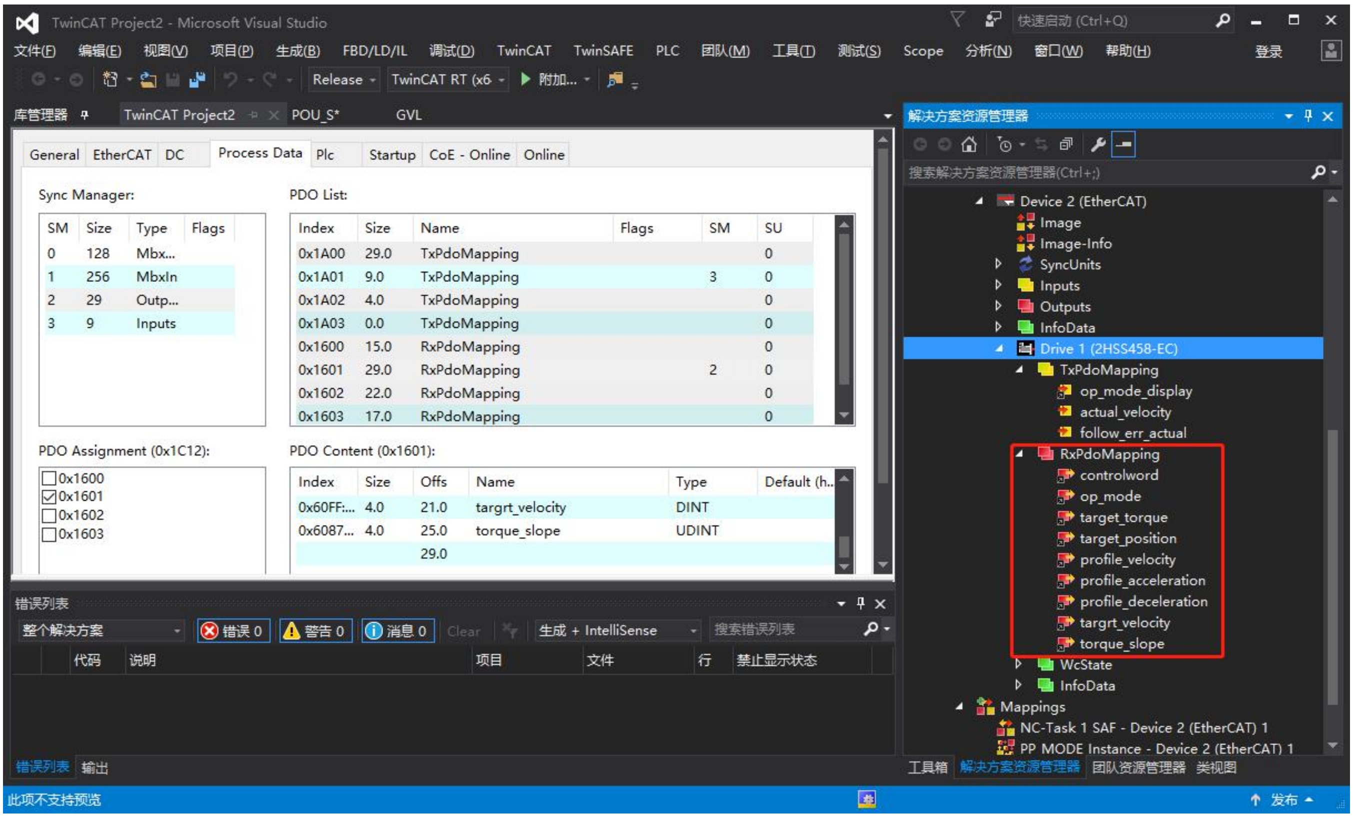


Fig 230 RxPDOMapping

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

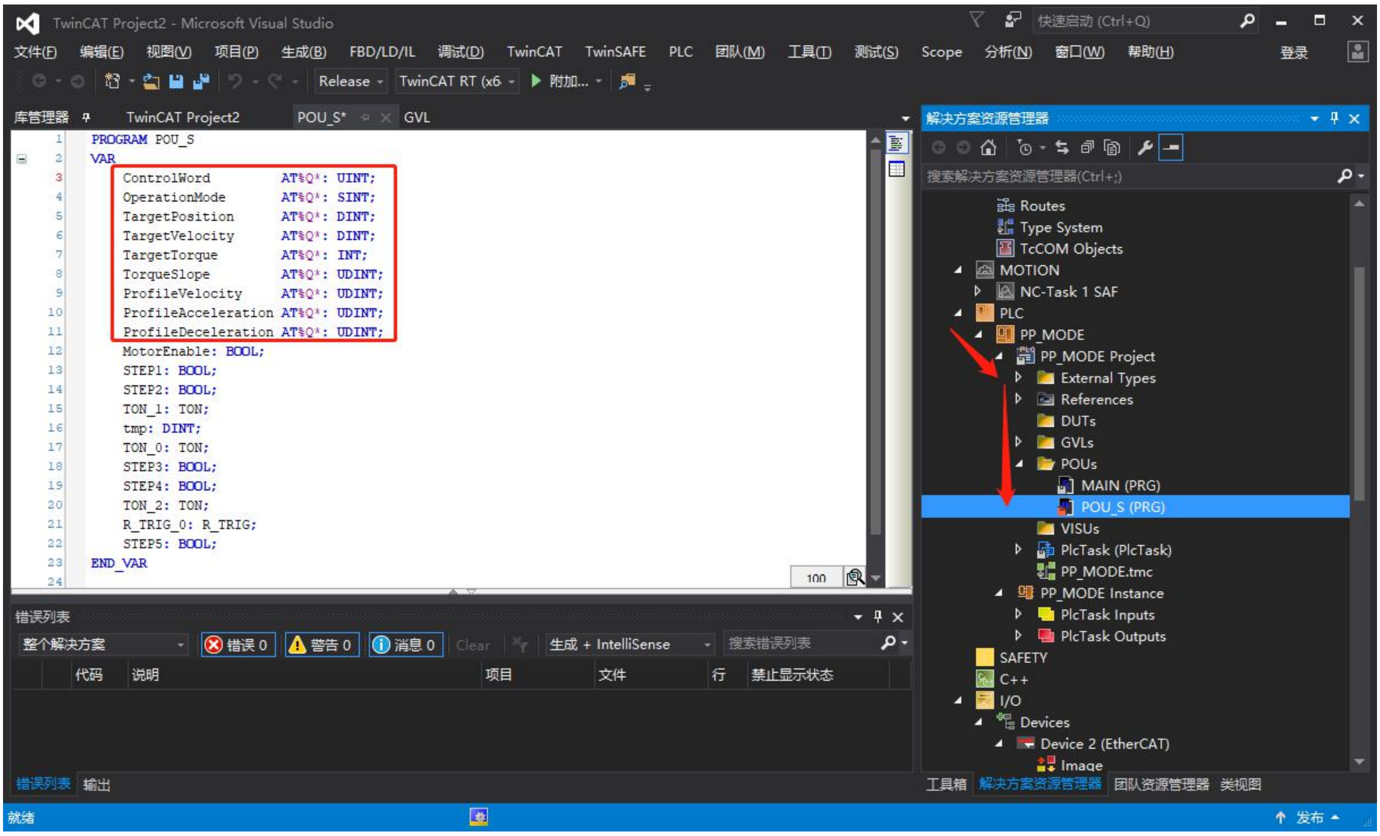


Figure 231 Add output variable

- 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】

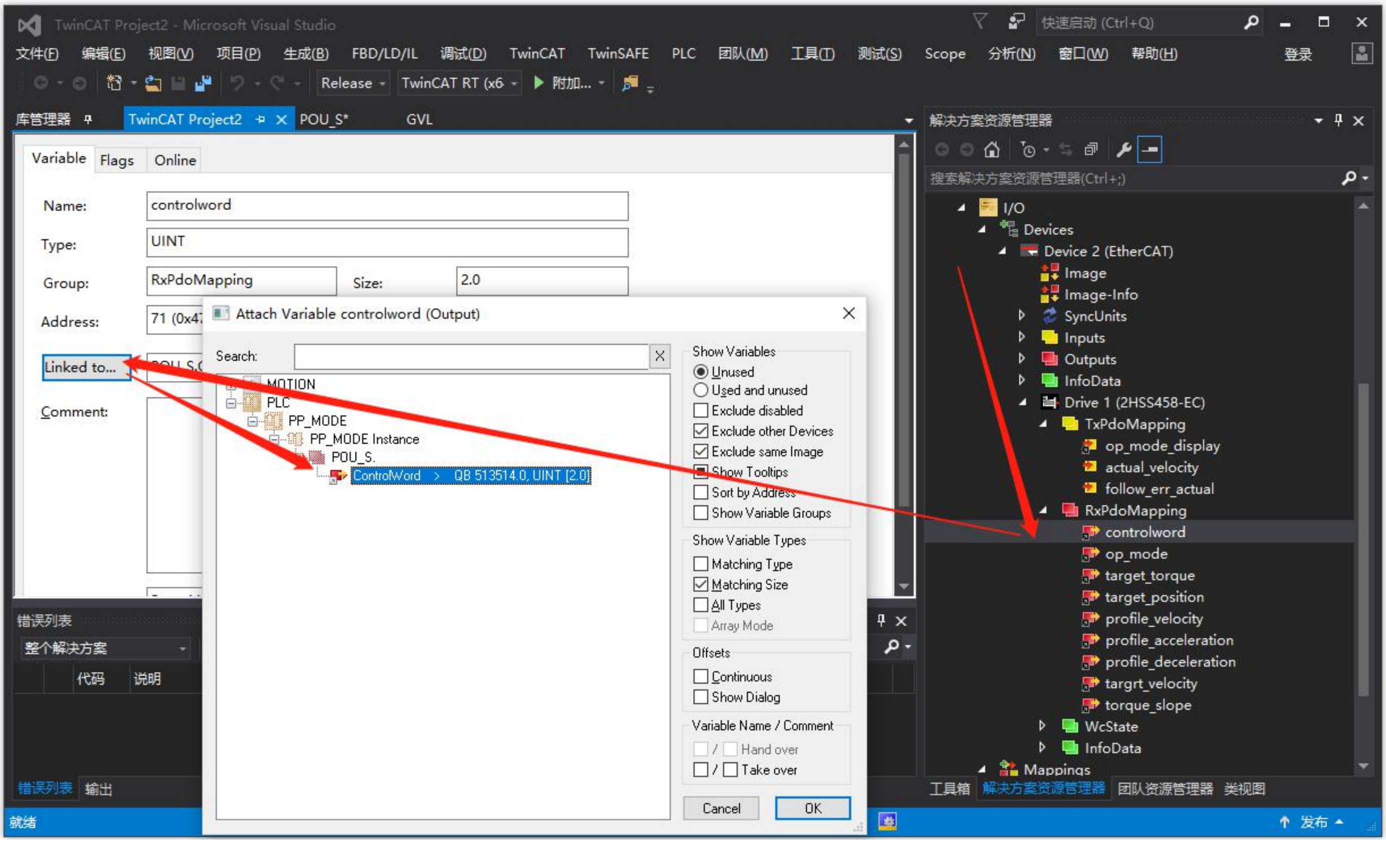


Figure 232 Link to output variable

- 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

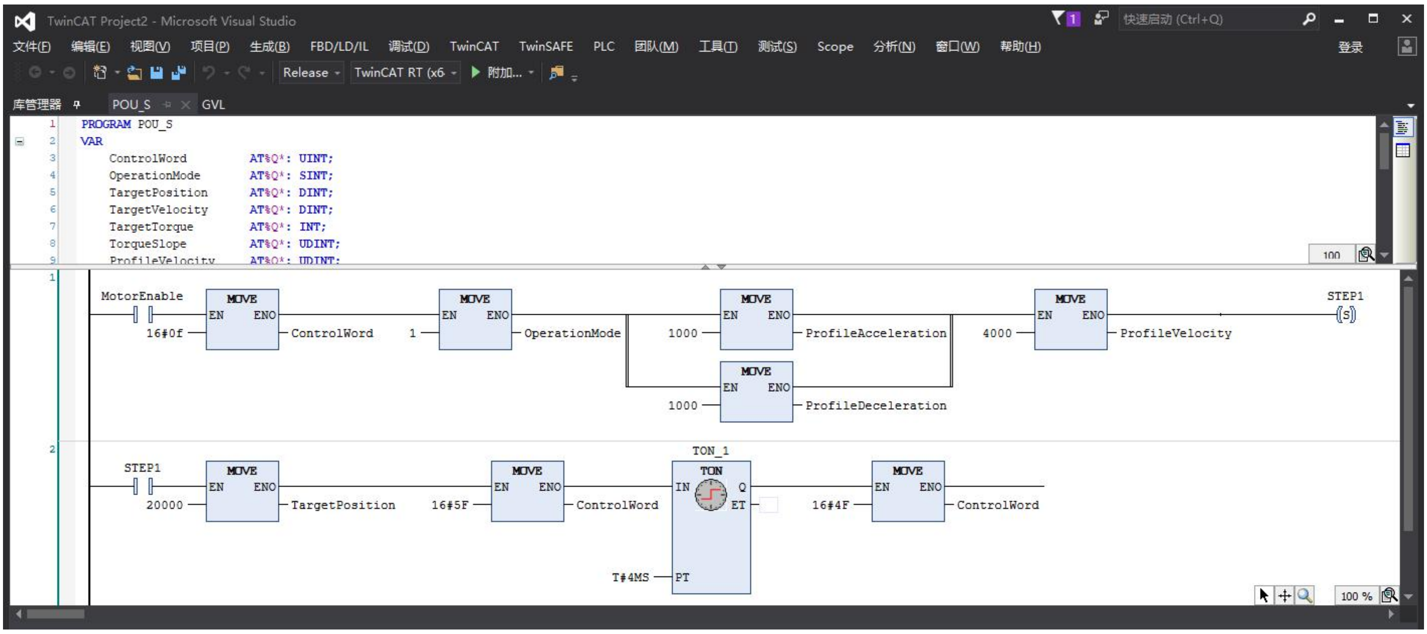


Fig. 233 Enter running mode

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

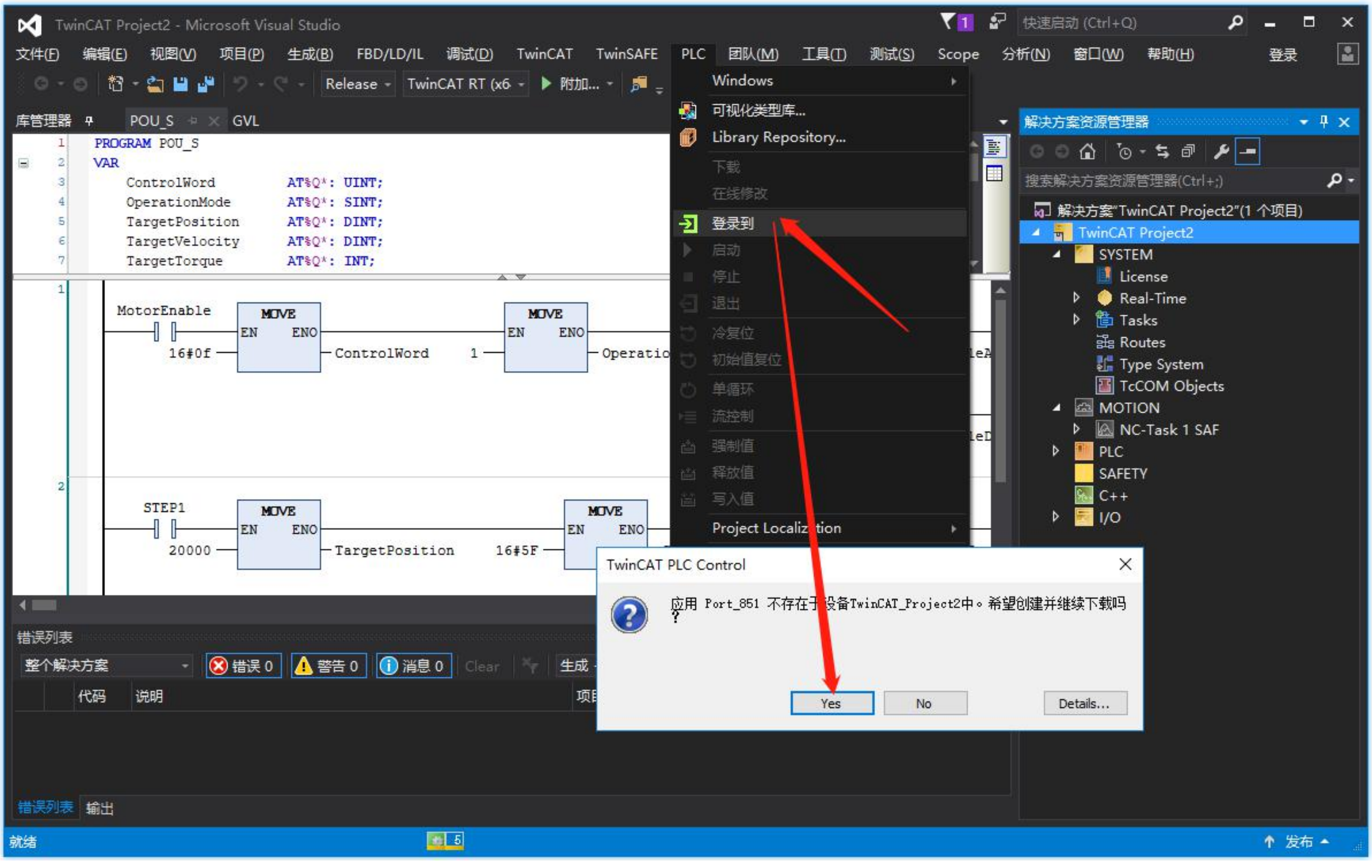


Figure 234 Confirm to continue downloading

- click【PLC】→select【start】

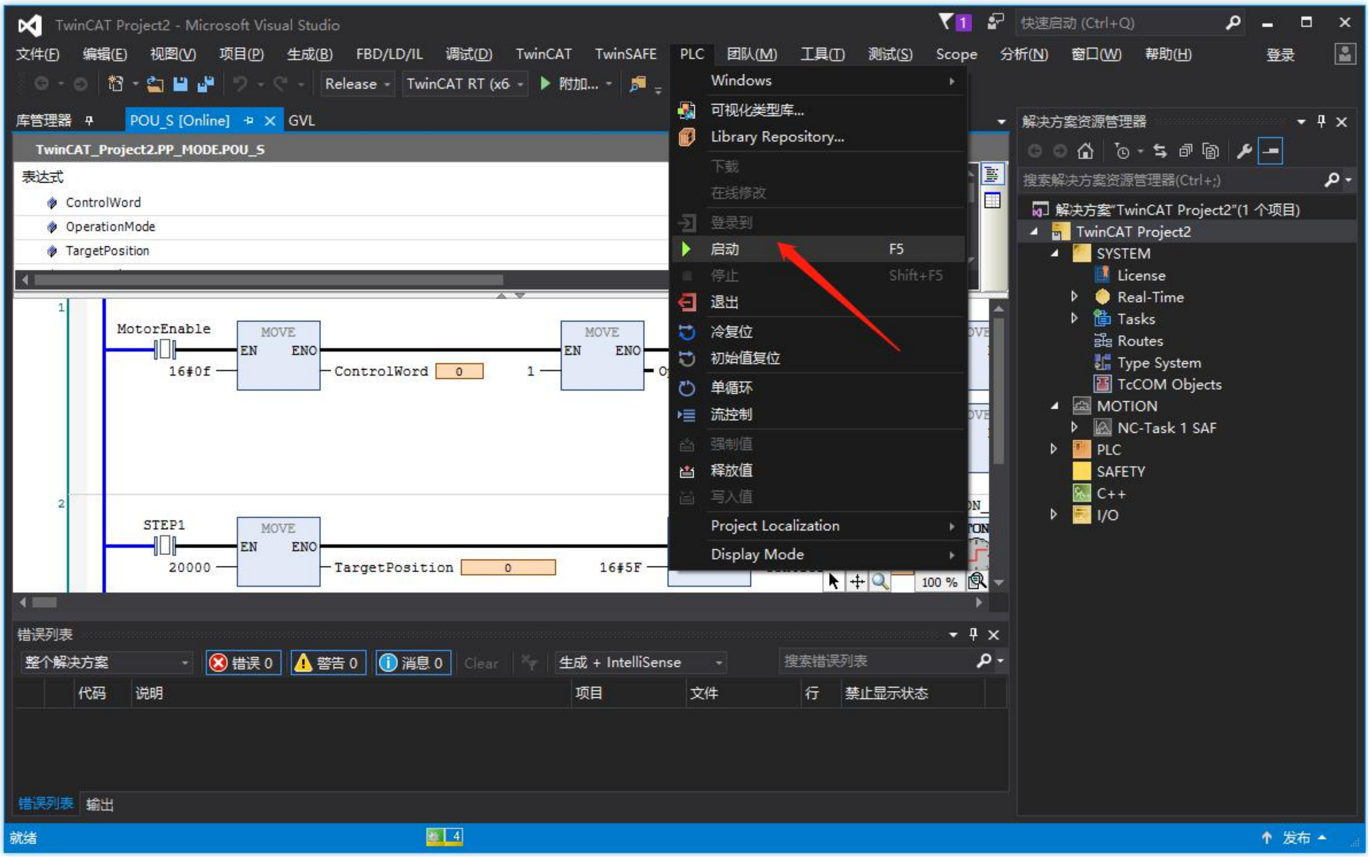


Fig. 235 Start PLC

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

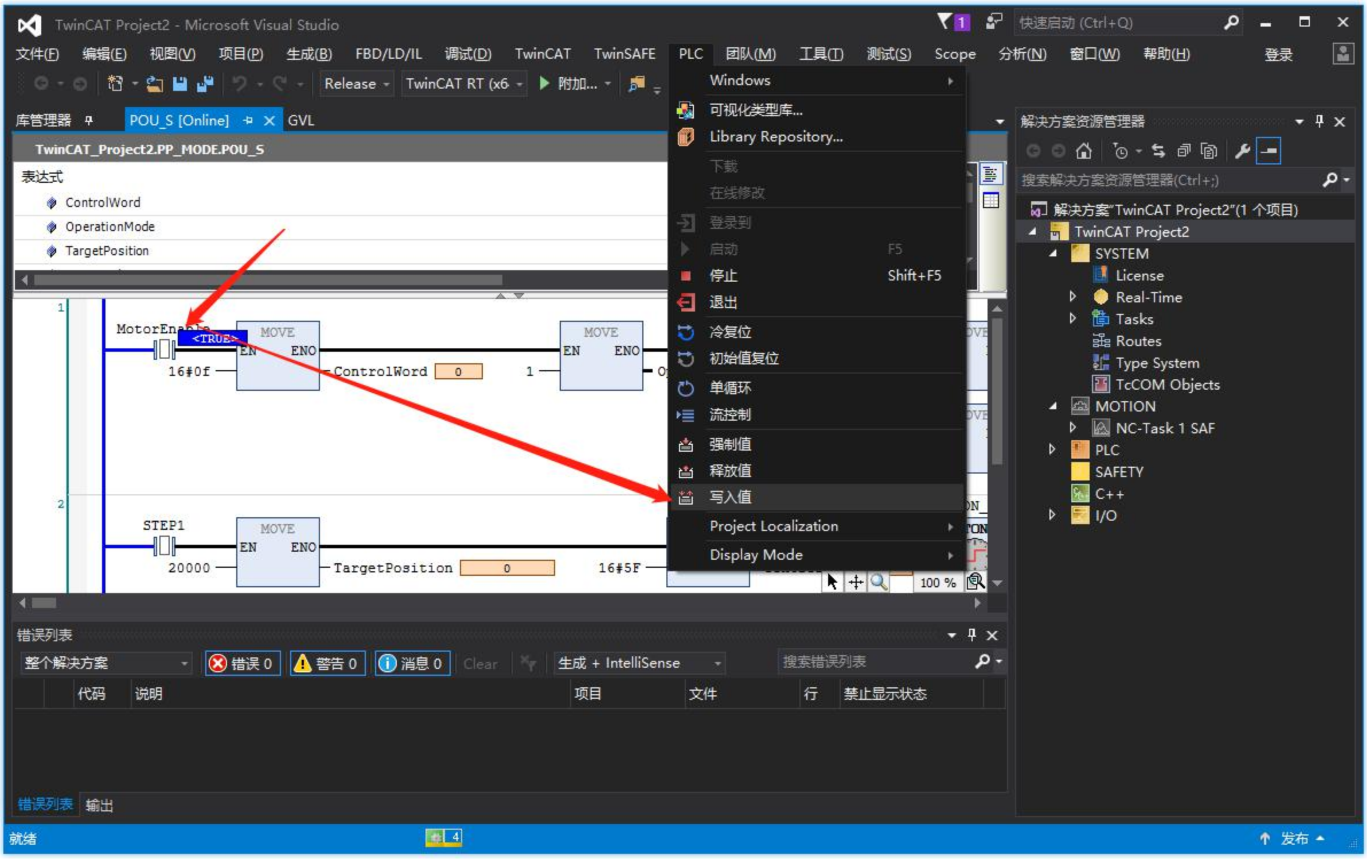


Figure 236 Running the program

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

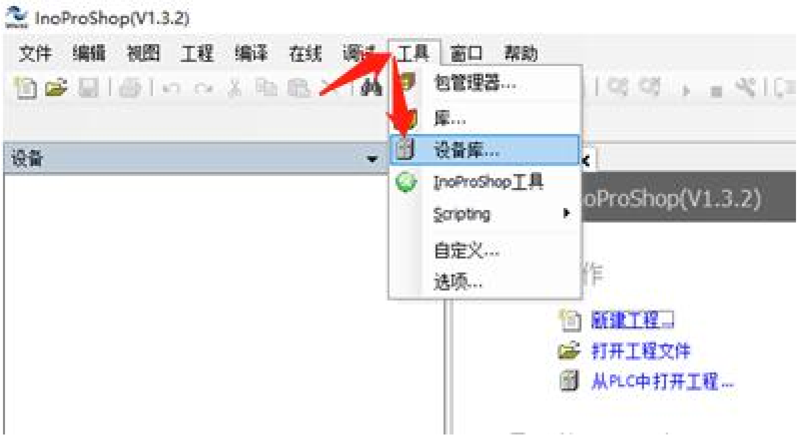


Figure 237 Open the device library

- Installation→Install slave device description file

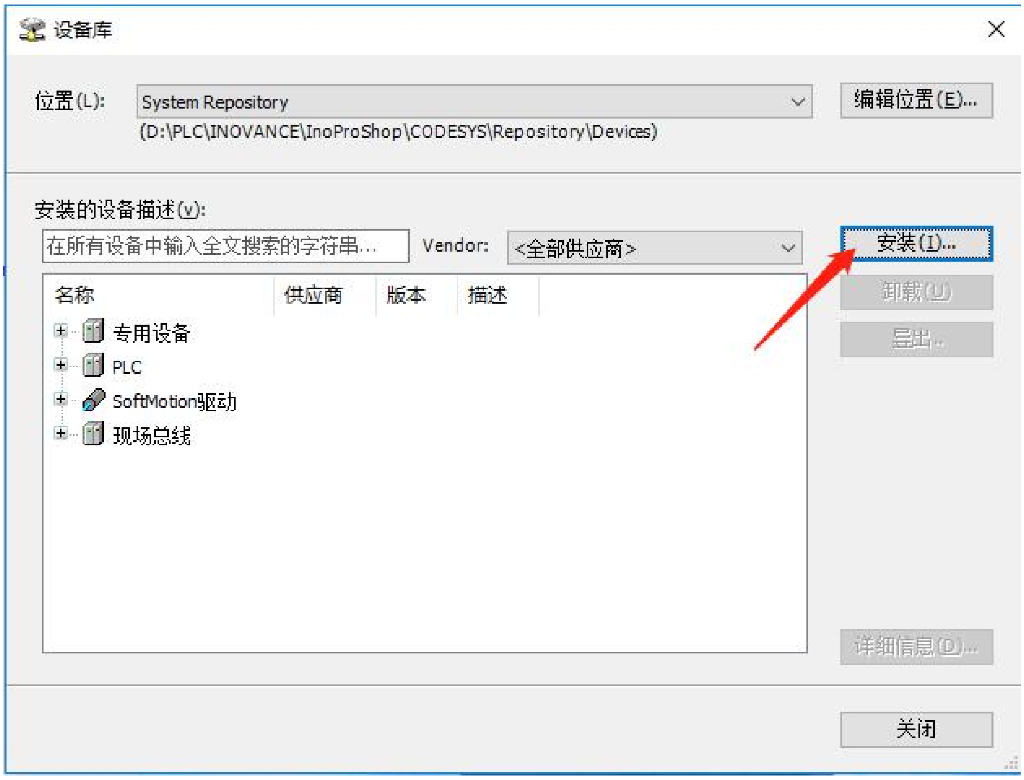


Figure 238 Install device description file

- Select XML file→Open

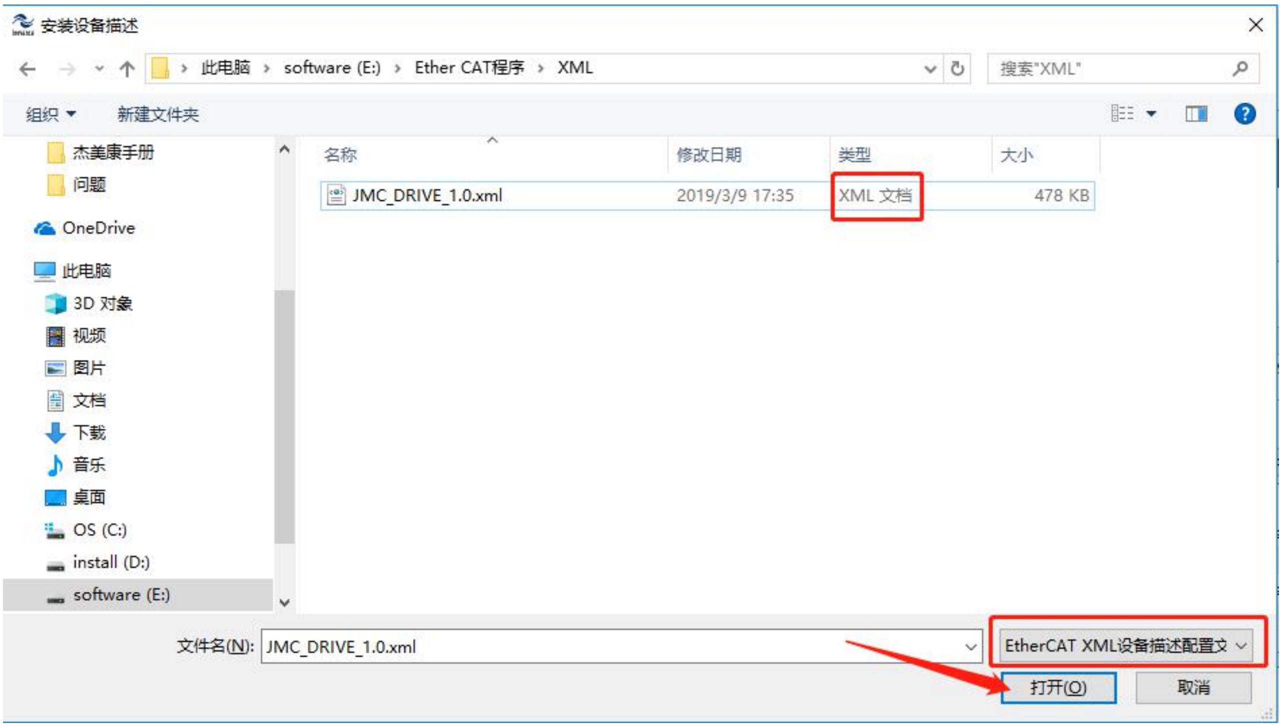


Figure 239 Select XML file

- After successful opening, the "Uninstall" button will no longer be dim

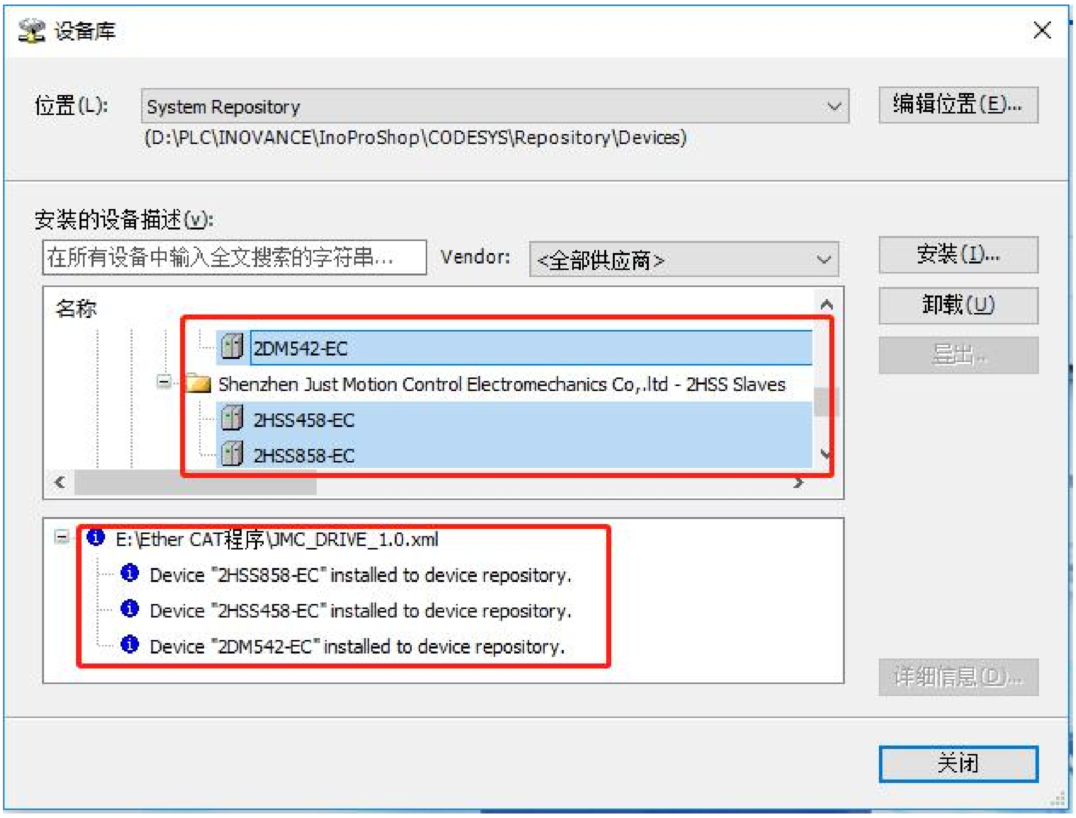


Figure 240 Successful installation

➢ Create a project

- Click New Project

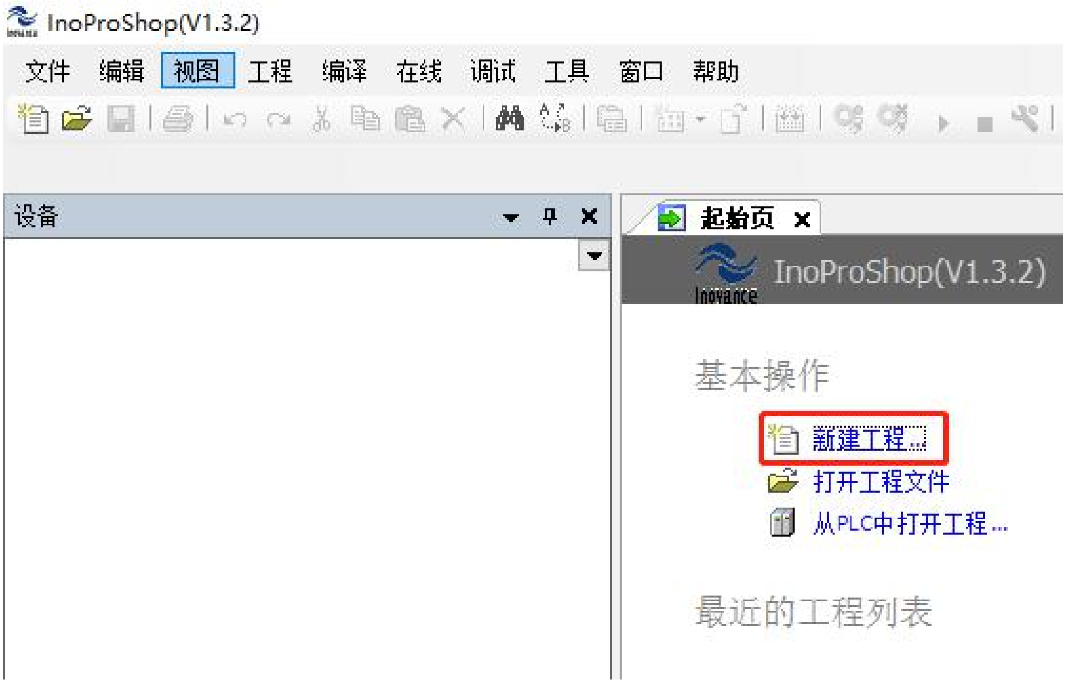


Figure 241　New InoProShop project

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

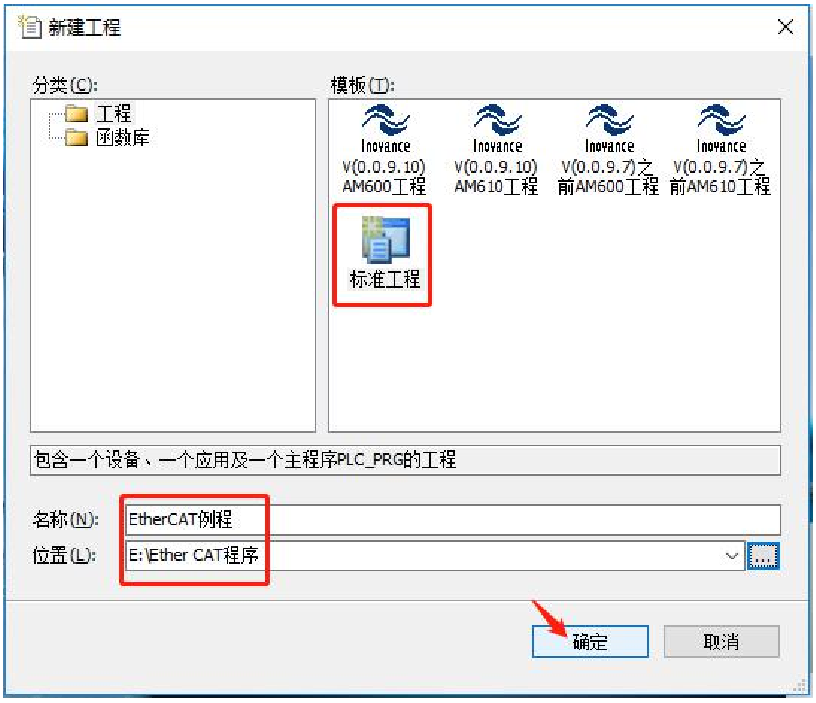


Figure 242 New standard project

- Select the device and programming language used, click OK

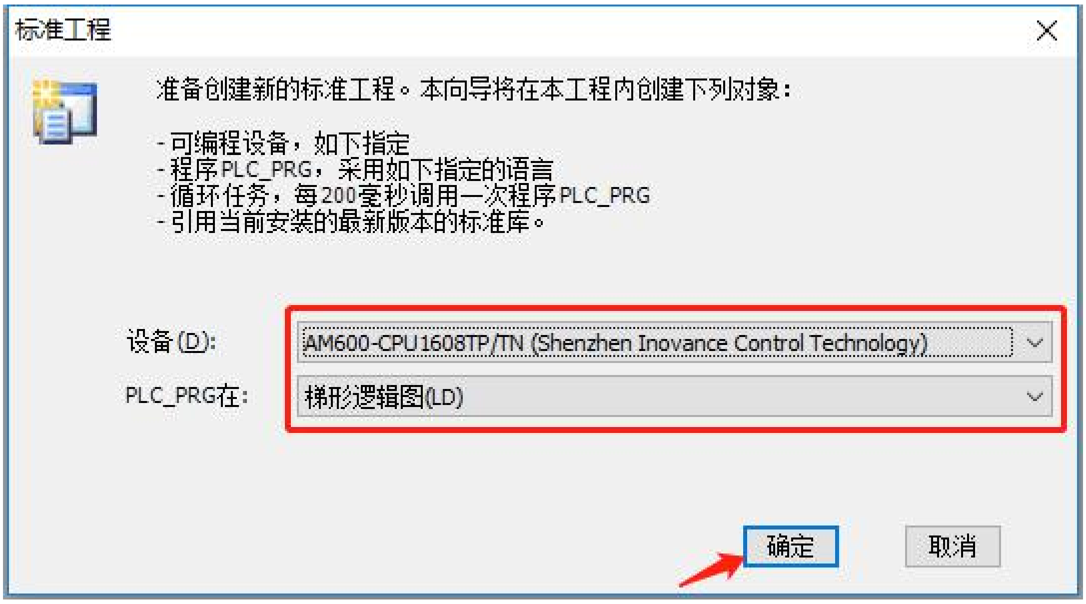


Figure 243 Determining the device and programming language

➢ Add device

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

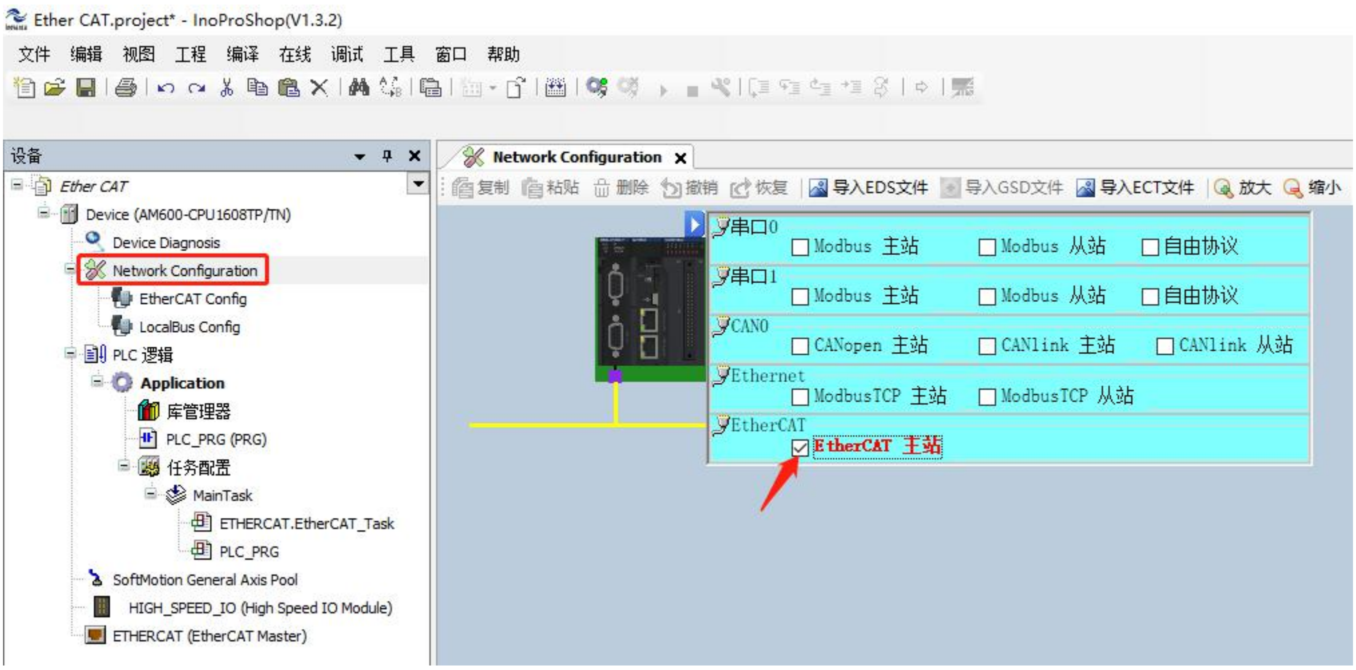
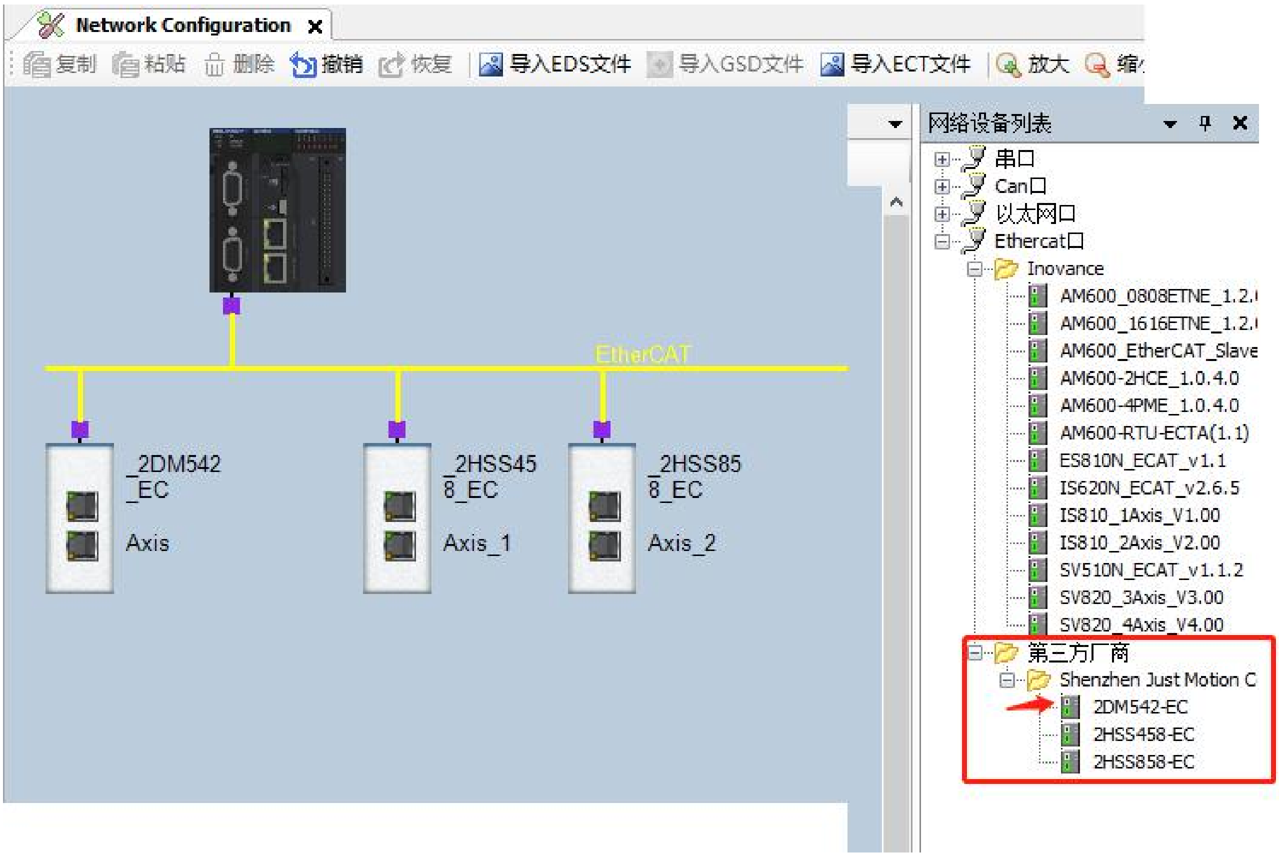


Figure 244 Add EtherCAT master

● 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

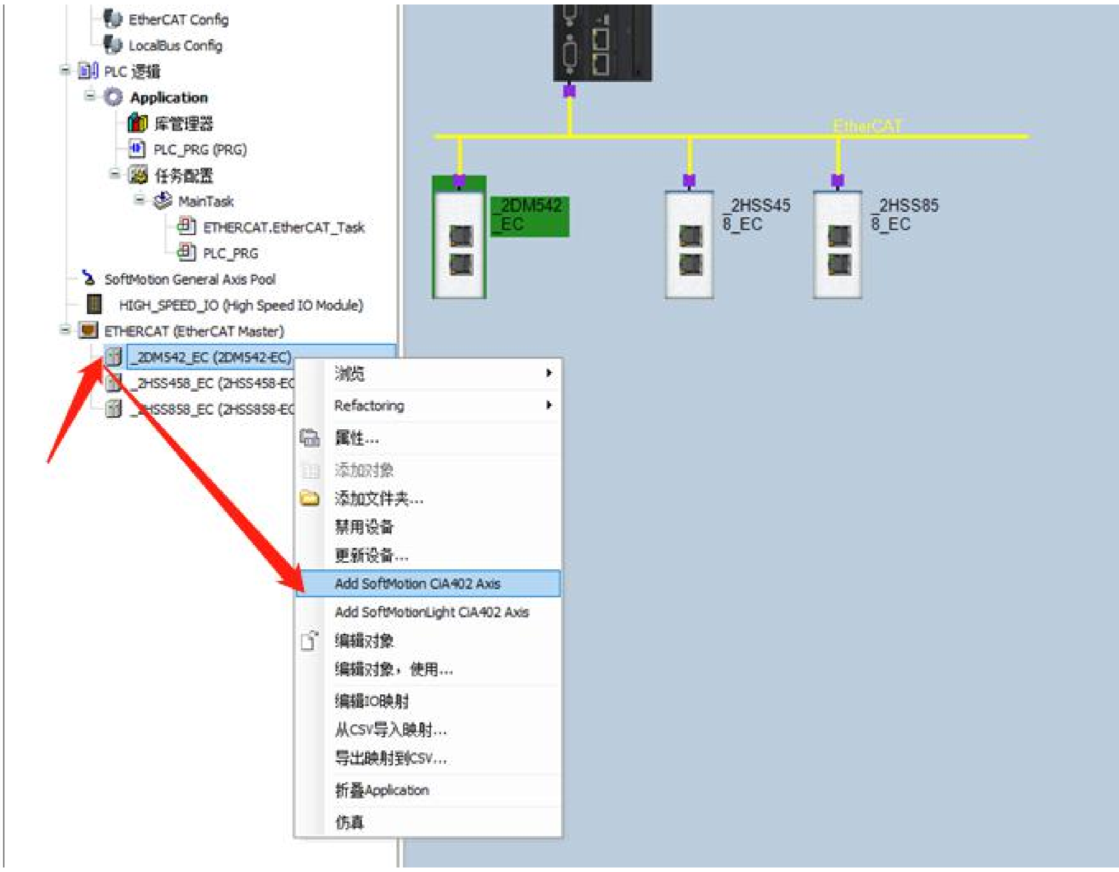


Figure 246 Add 402 axis

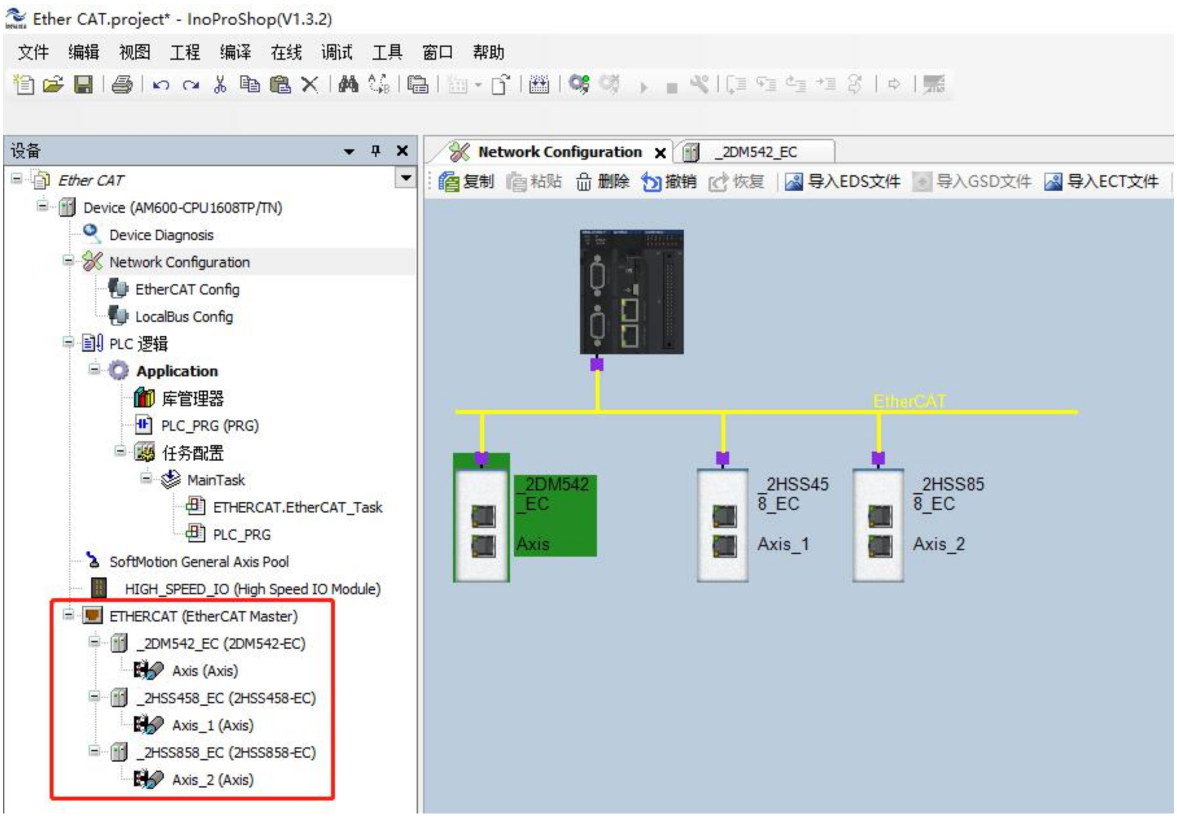


Figure 247 402 axis added

➢ Parameter setting

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

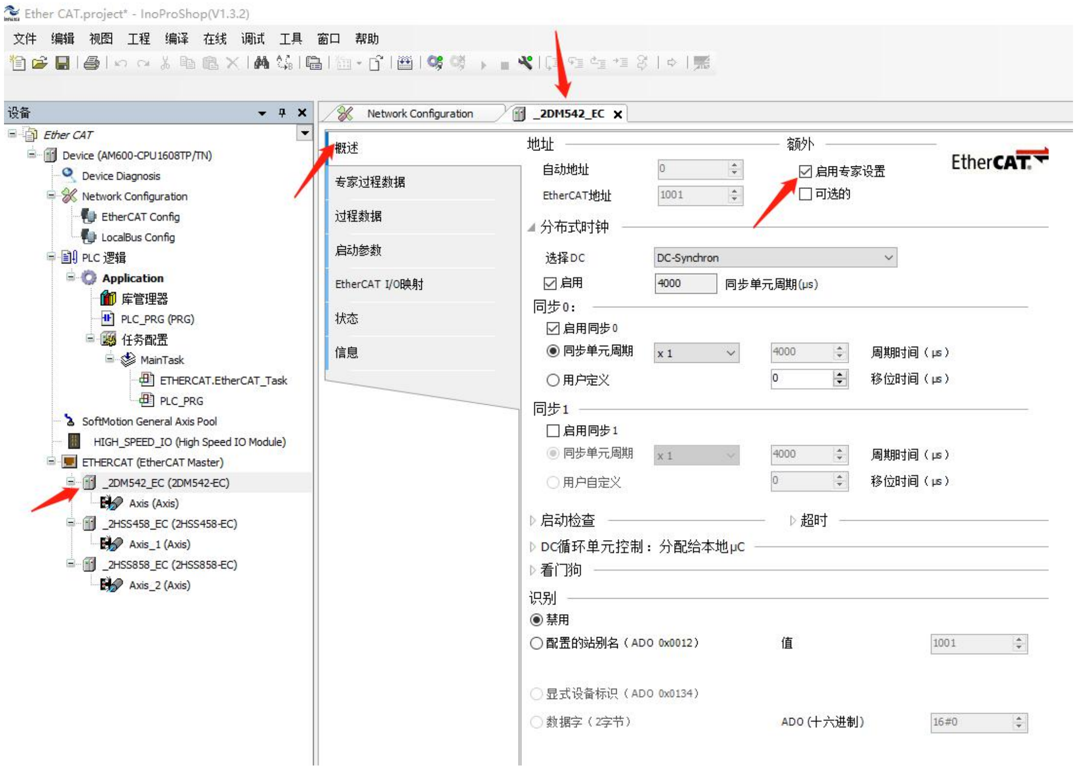


Figure 248 Enable expert settings

- Check PDO allocation and PDO configuration under expert process data

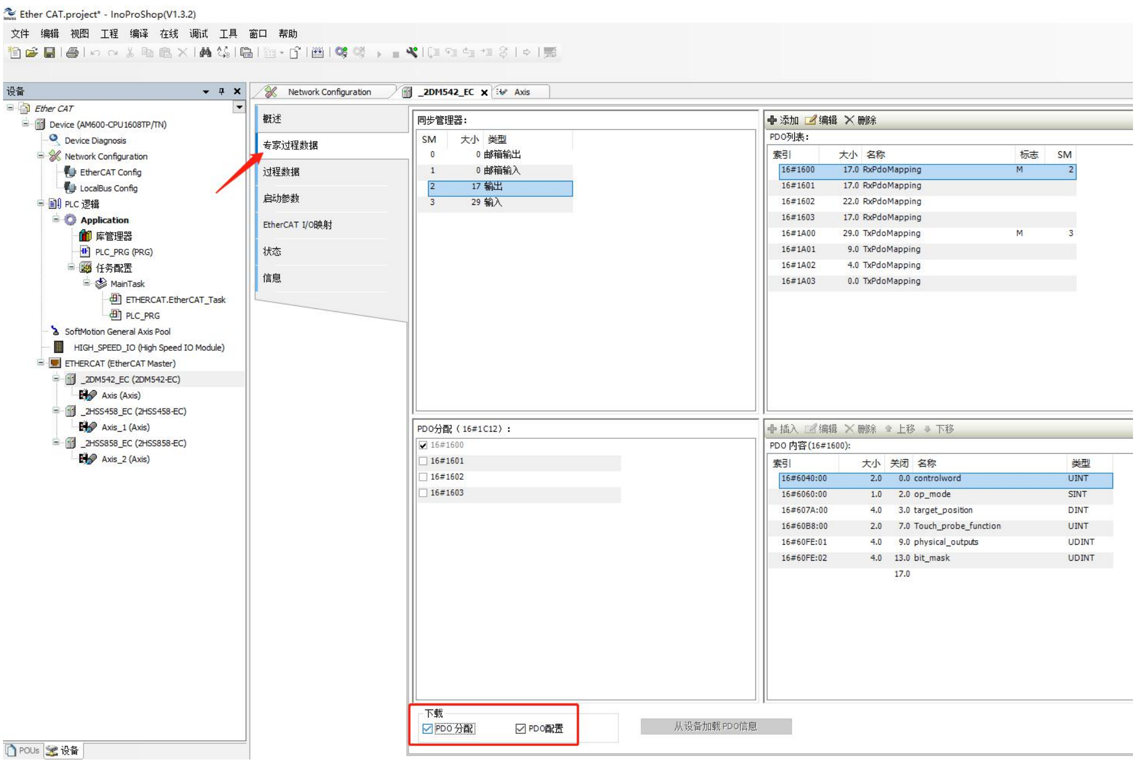


Figure 249 Check PDO configuration

- 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).

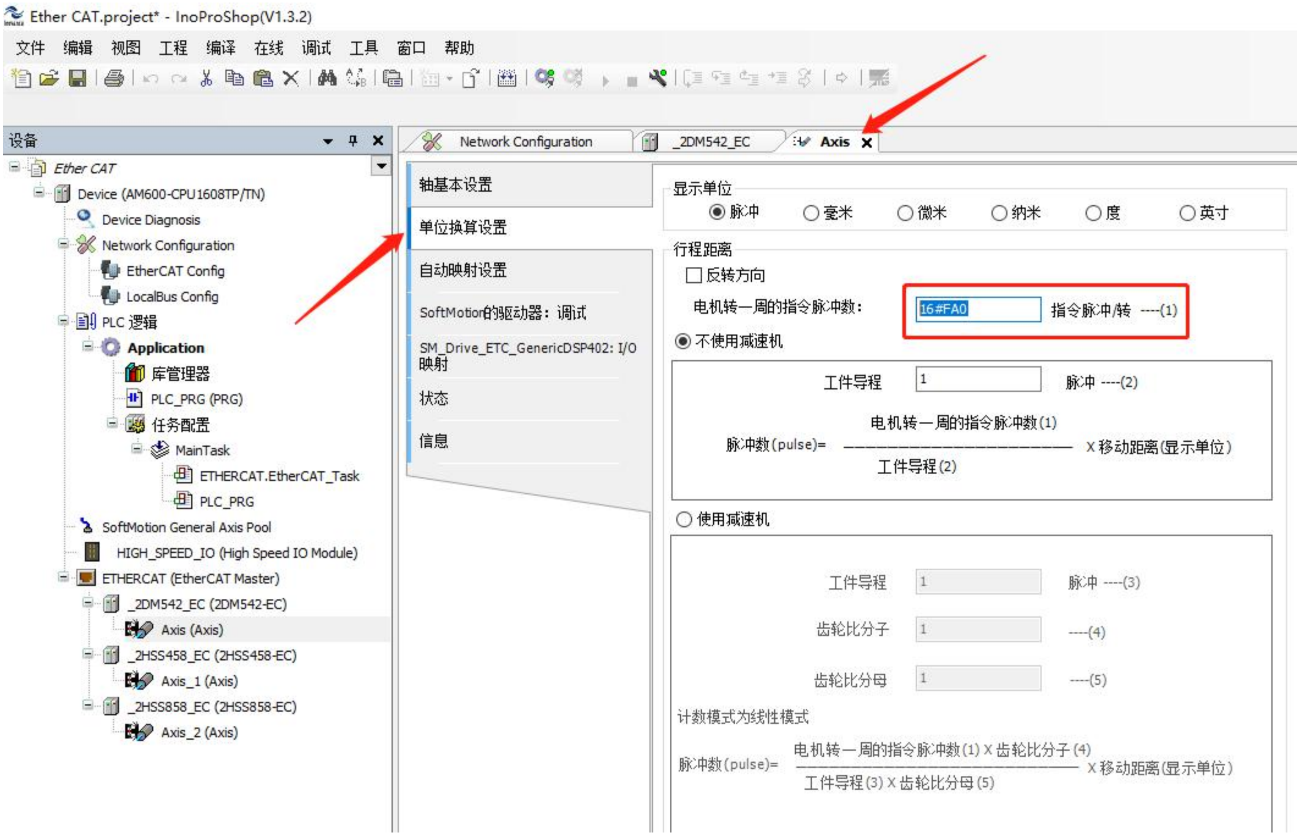


Figure 250 Setting the number of pulses for one revolution of the motor

- # Add parameter of return to zero parameter

- Startup parameter→click to add

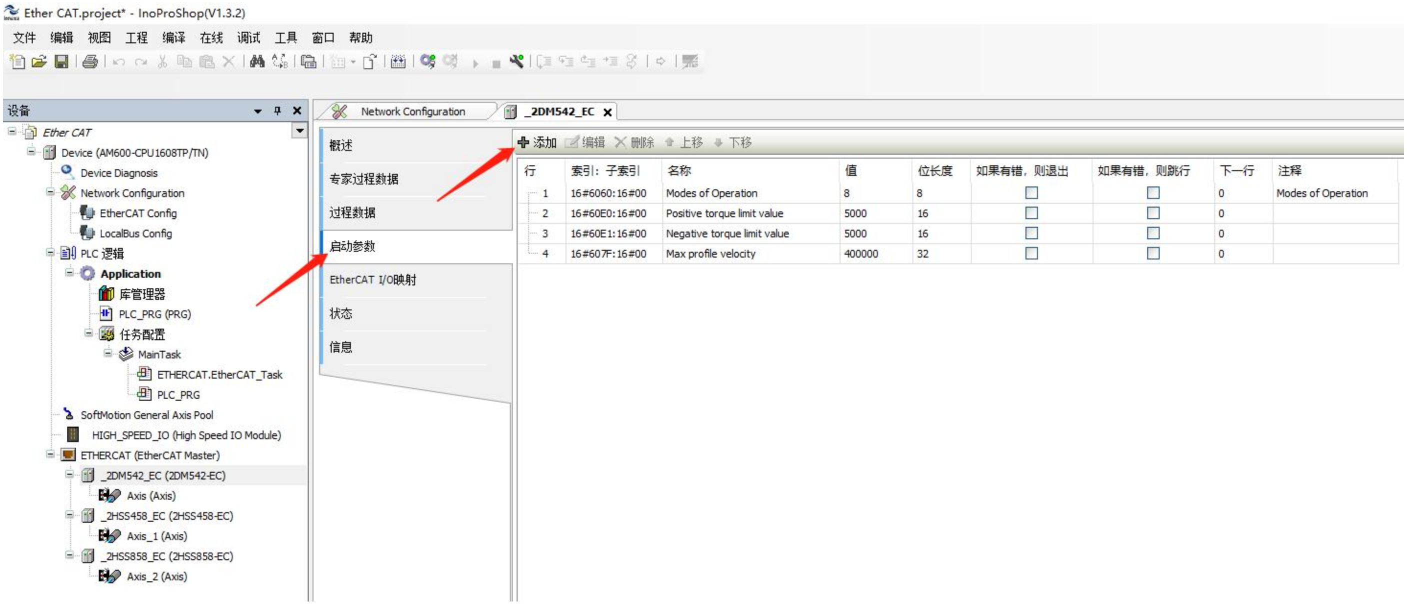


Figure 251 Add startup parameters

- 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

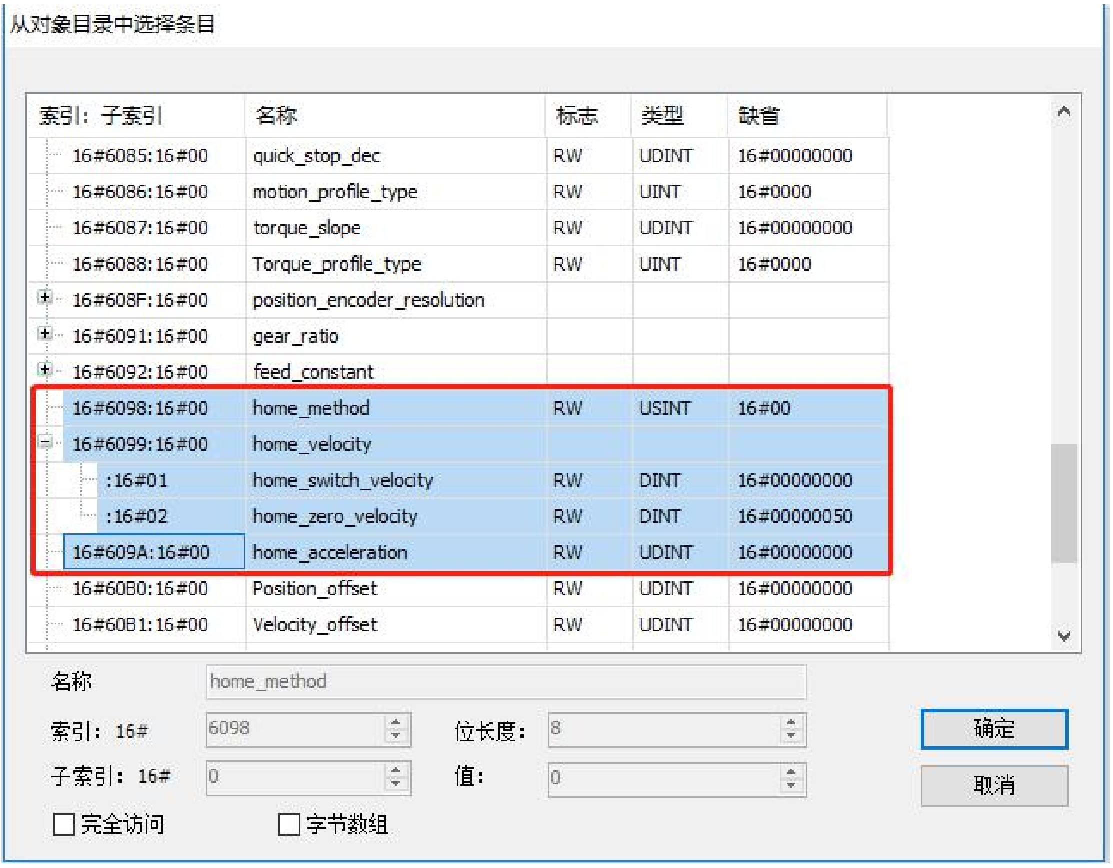


Figure 252 Selection object dictionary

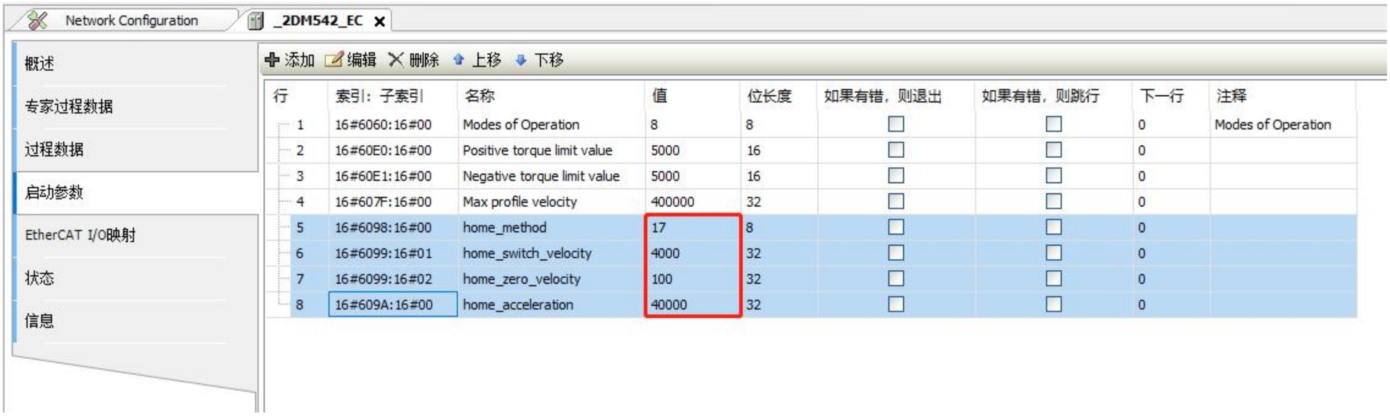
➢ Set parameter of zero return

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
-

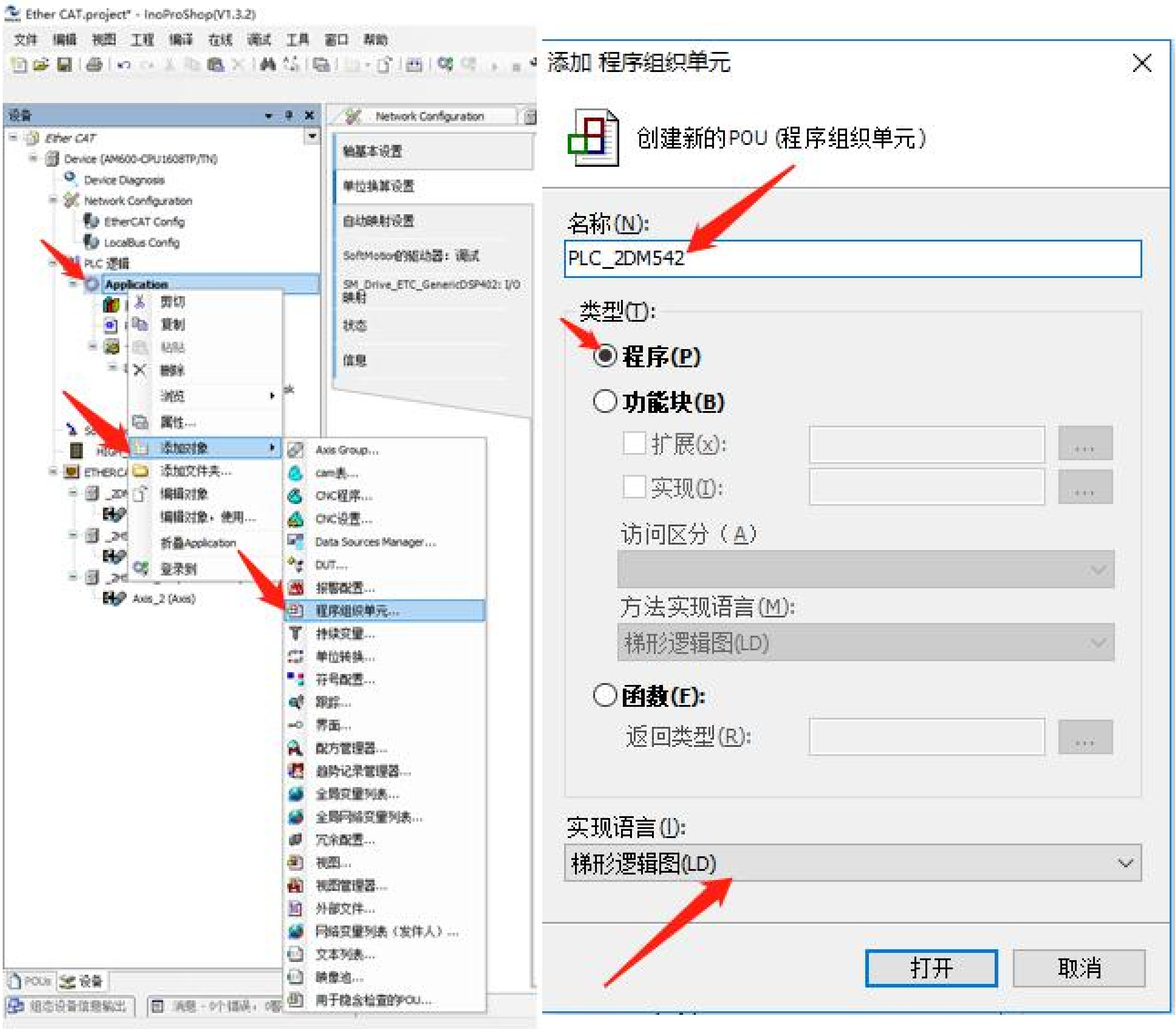


Figure 254 Create POU

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)")

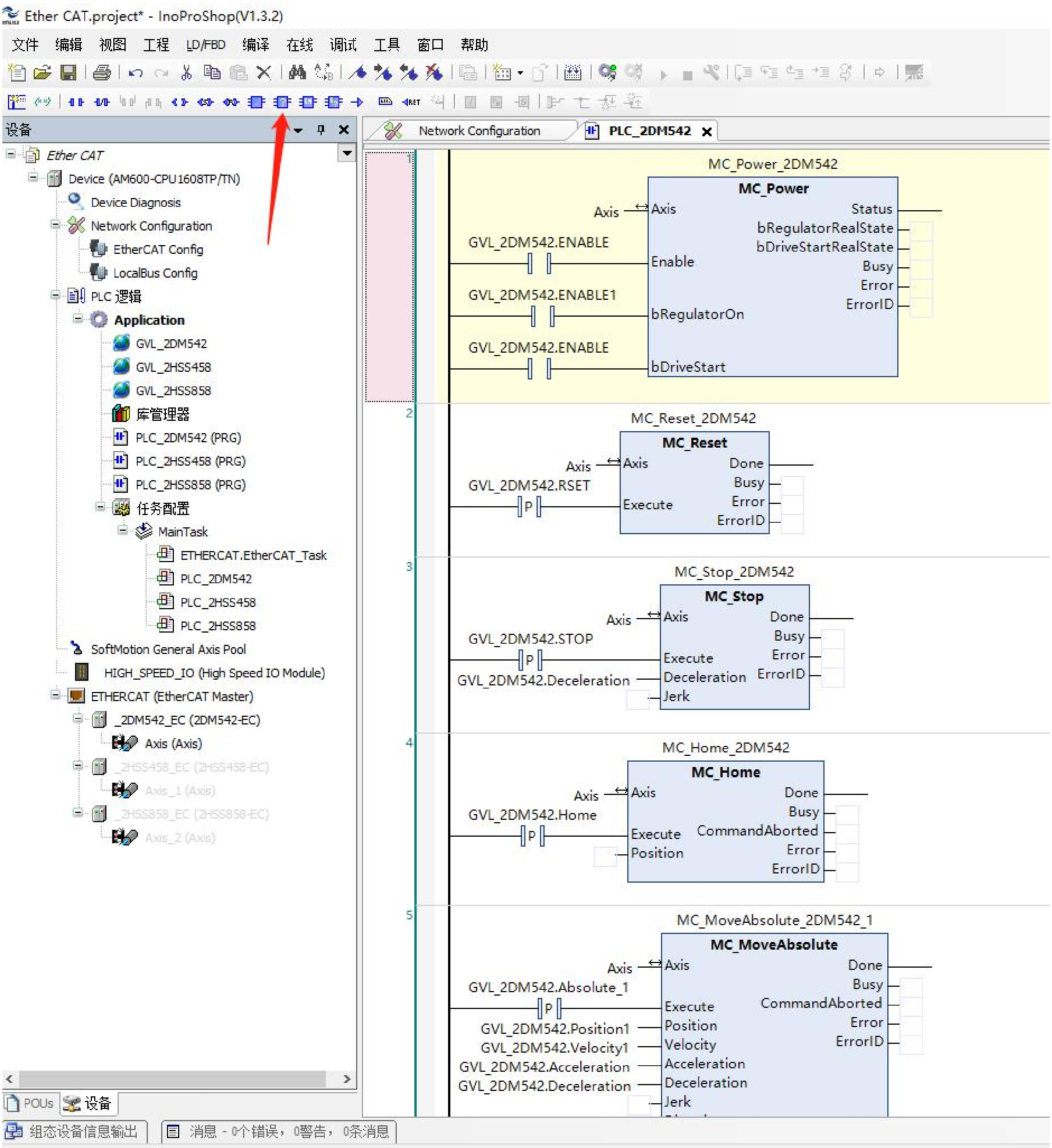


Figure 255 Motion control module

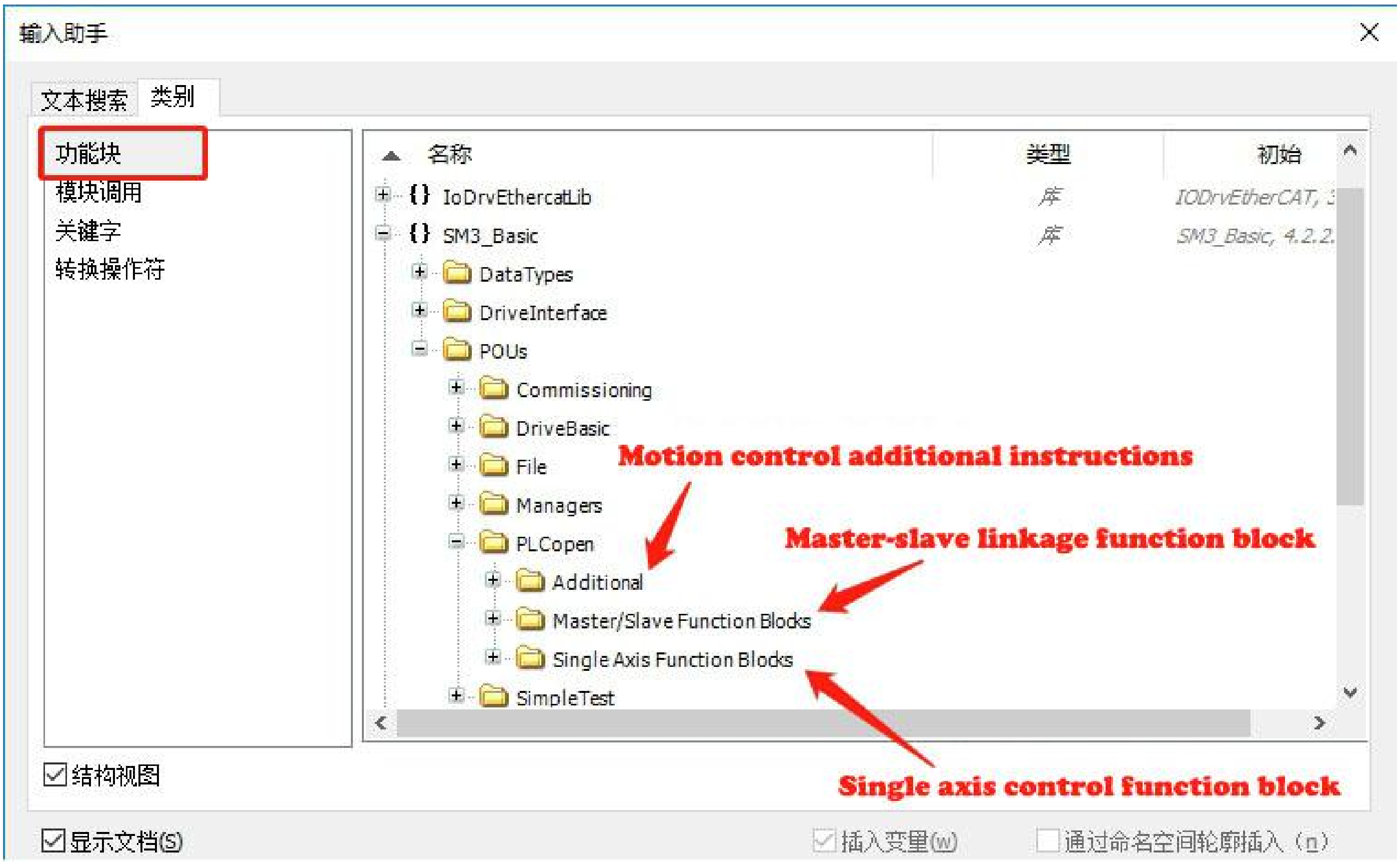
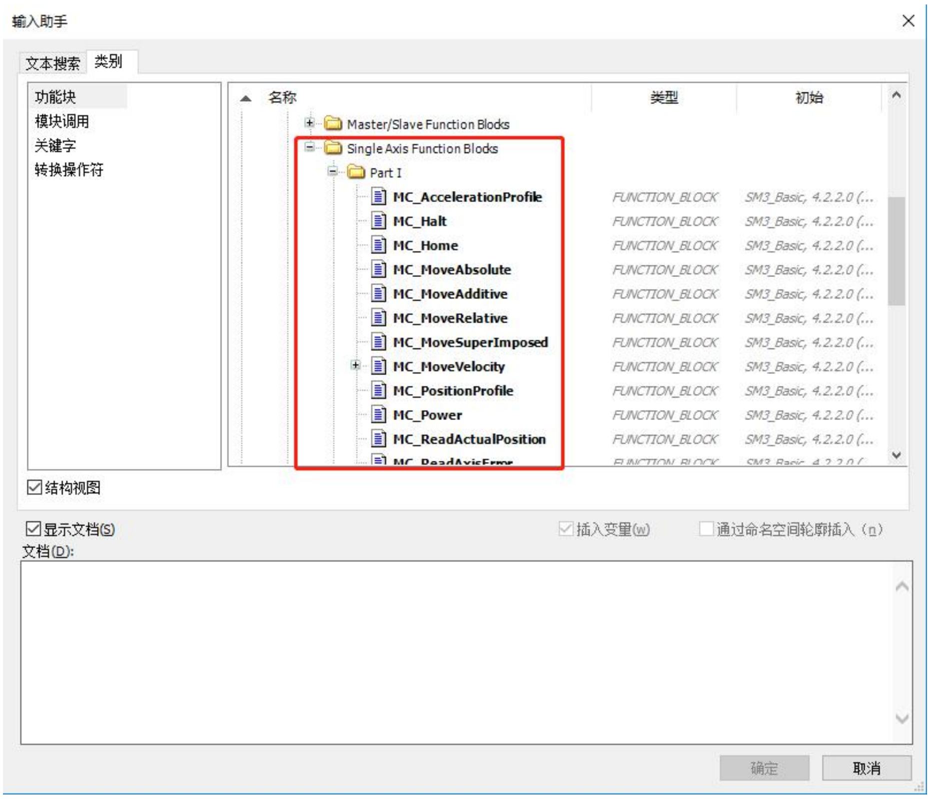


Figure 256 Function block

● The routine used is to control single-axis instructions



3 Add task configuration

- Double-click MainTask→Add Call

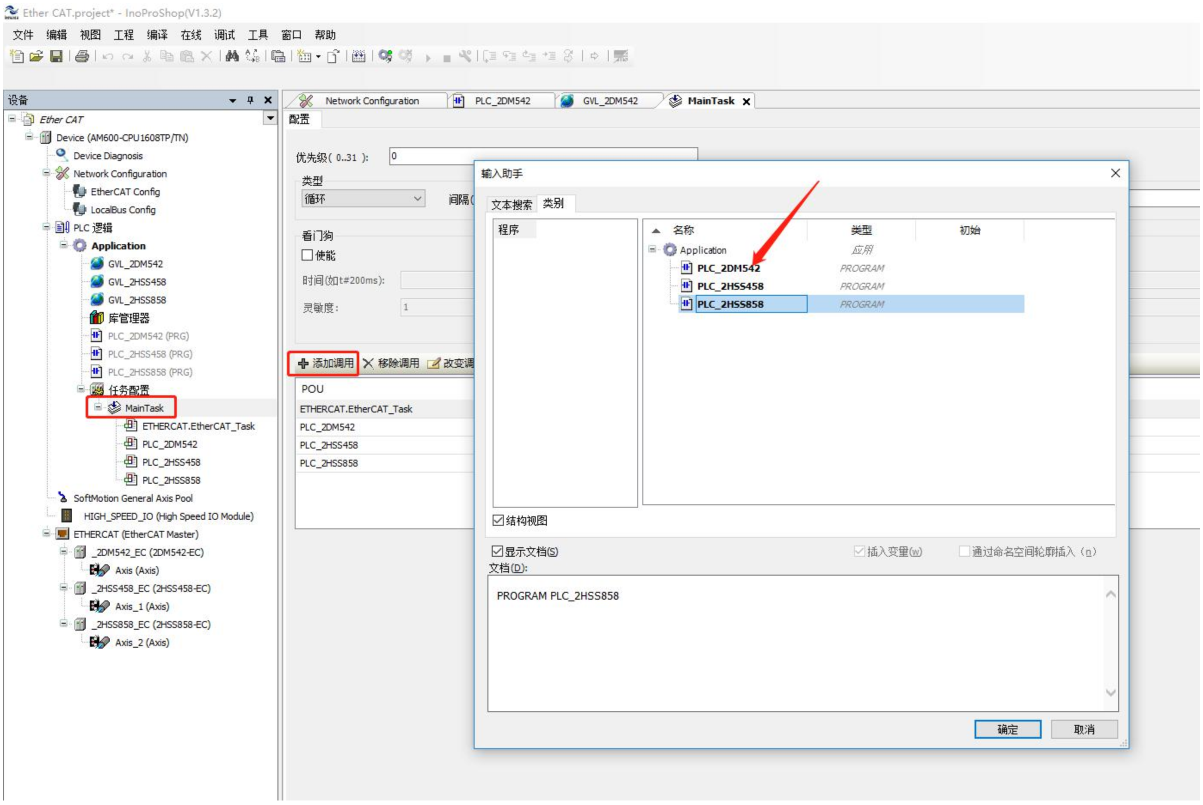


Figure 258 Add task configuration

4 Login to download and debug the program

- Scan the master device

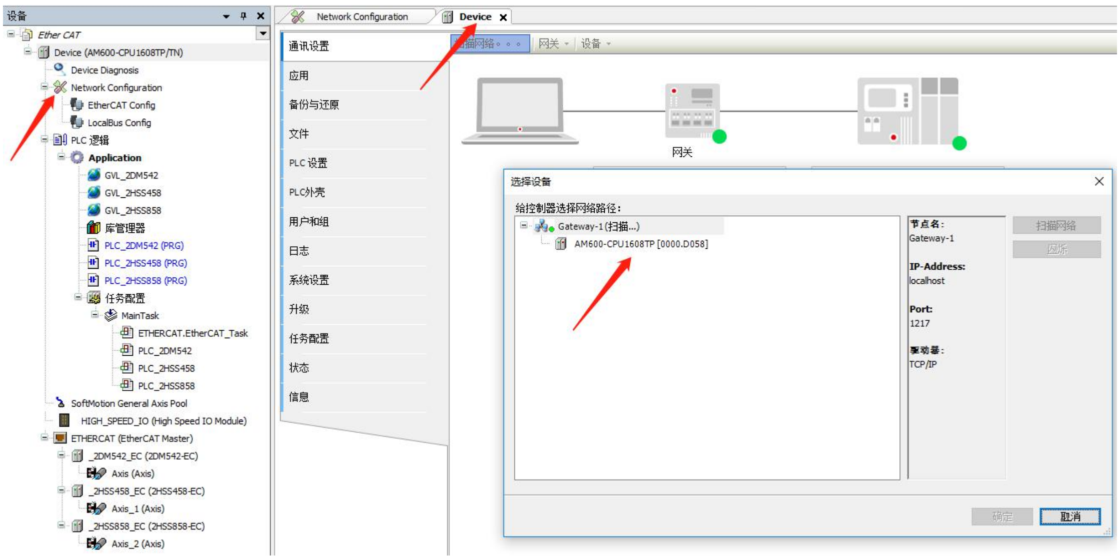
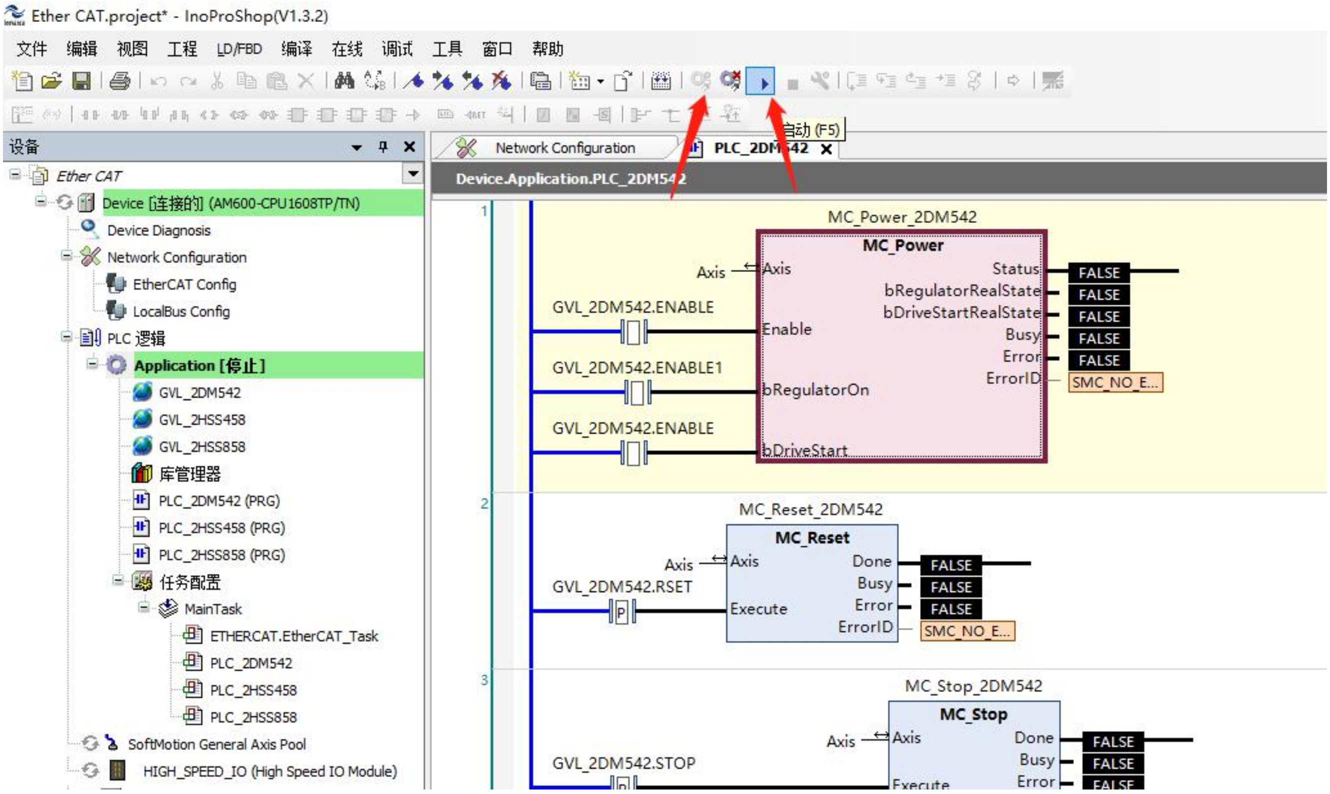


Figure 259 Scanning the master device

- Login→Start



- Figure 260 Log in to the device

- The connection status between the slave station and the master station

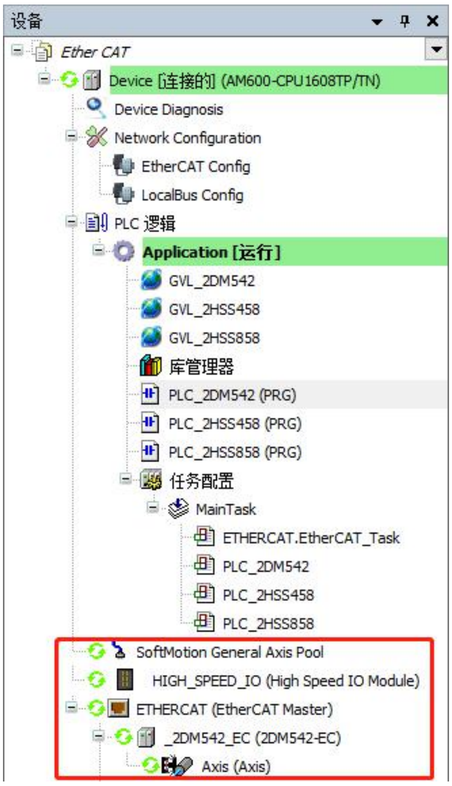


Figure 261 Master-slave connection status

5 Enable device

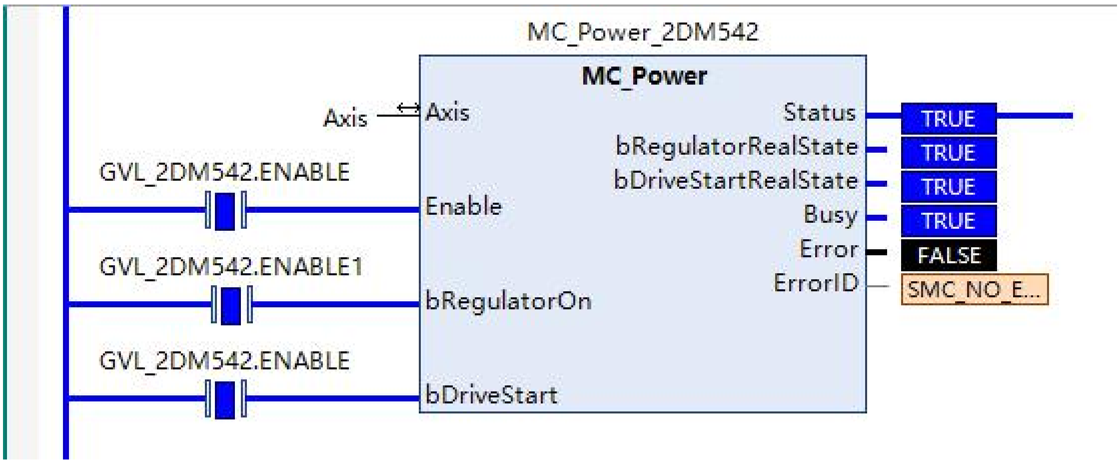


Figure 262 Enabling device

6 Back to zero mode

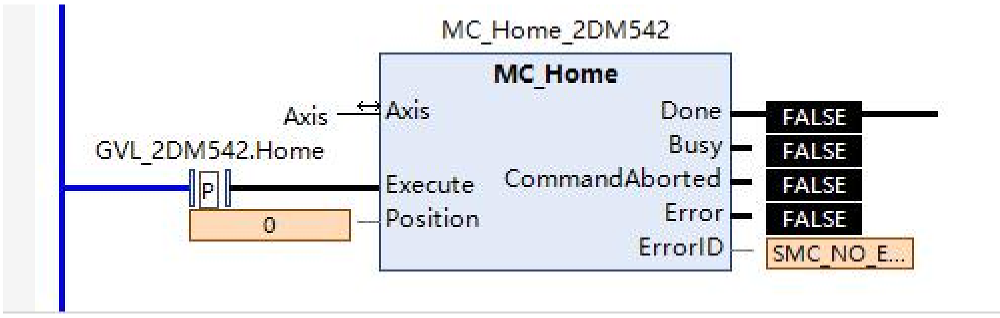


Figure 263 Back to zero mode

7 Position mode

- Absolute positioning

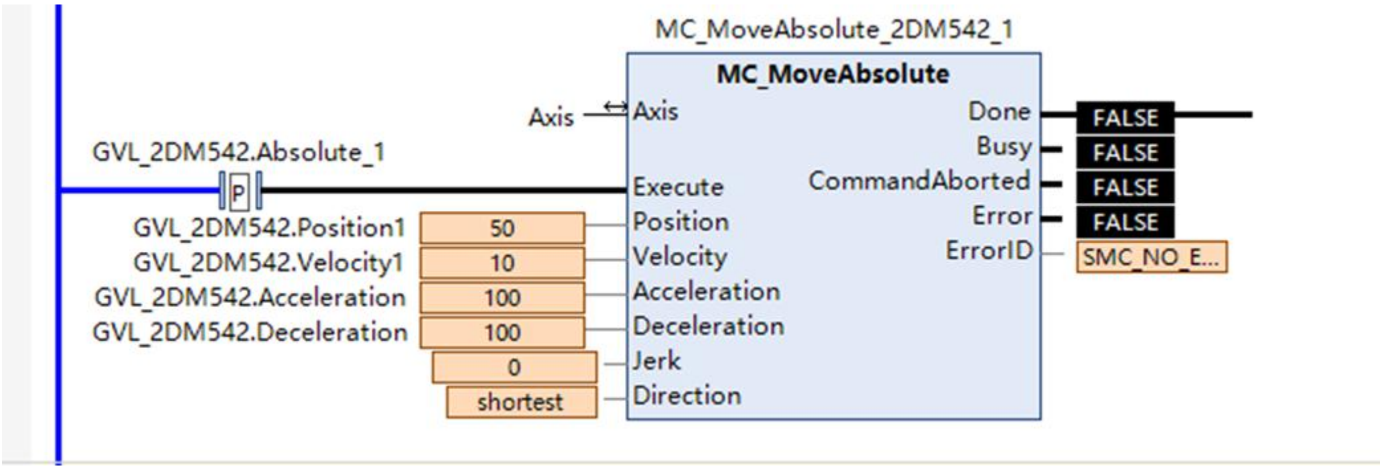
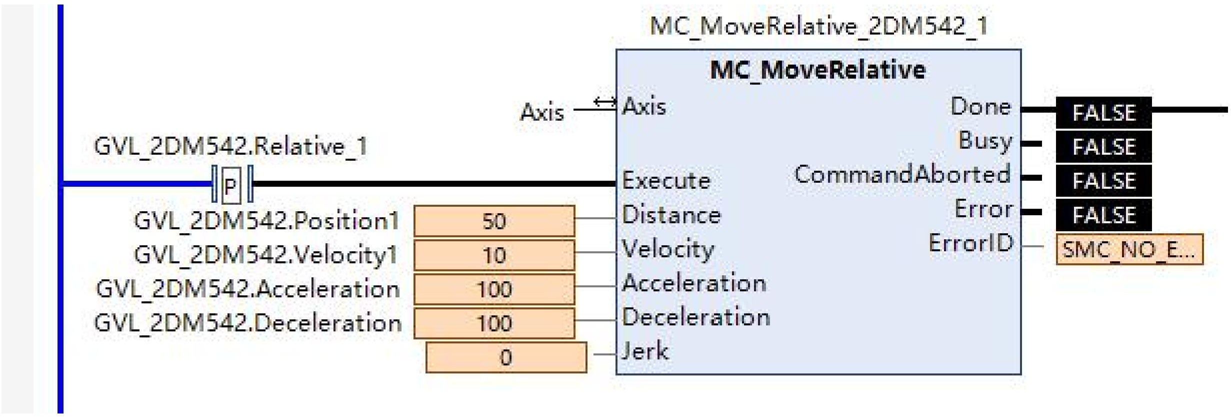


Figure 264 Position mode

- Relative positioning
-



- Figure 265 Relative positioning

8 Speed mode

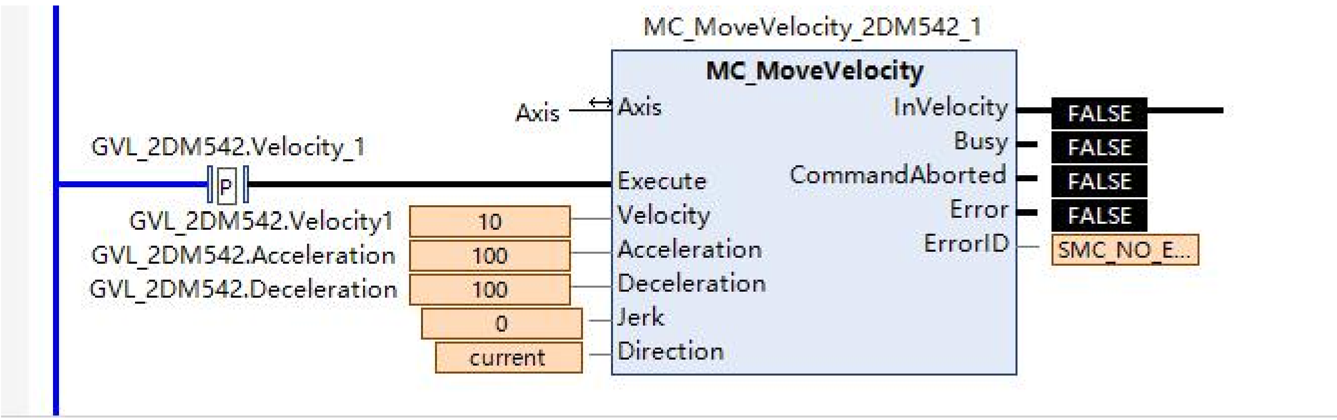


Figure 266 Speed mode

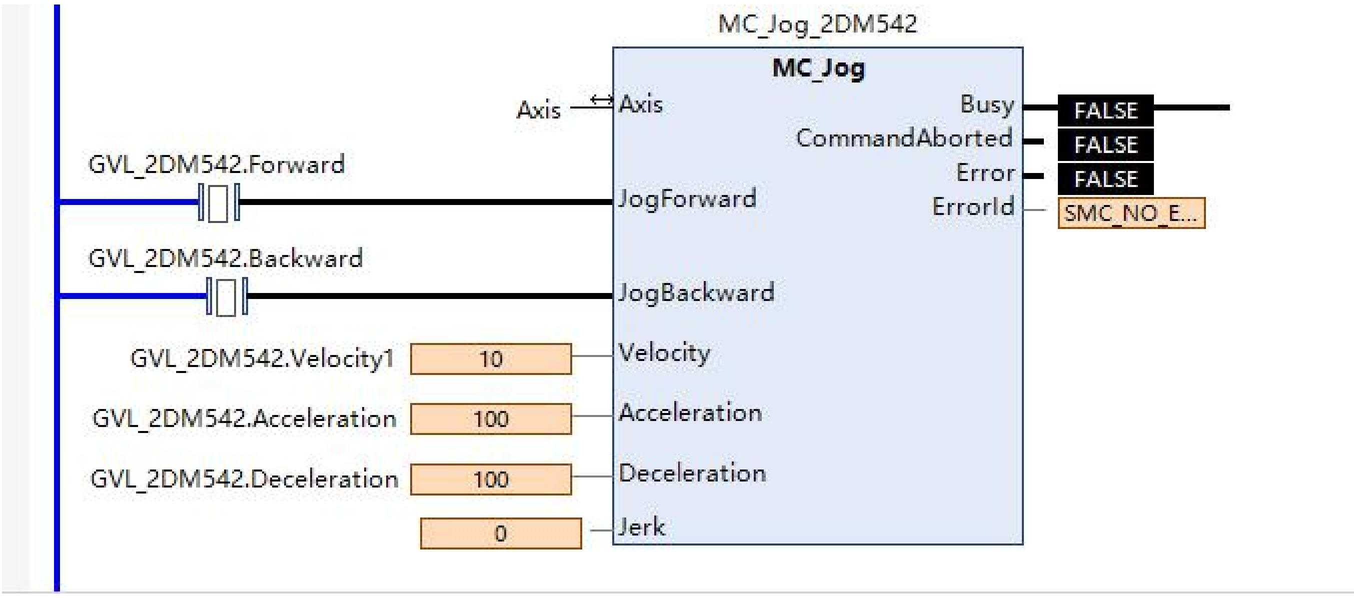


Figure 267 JOG mode

9 Alarm reset

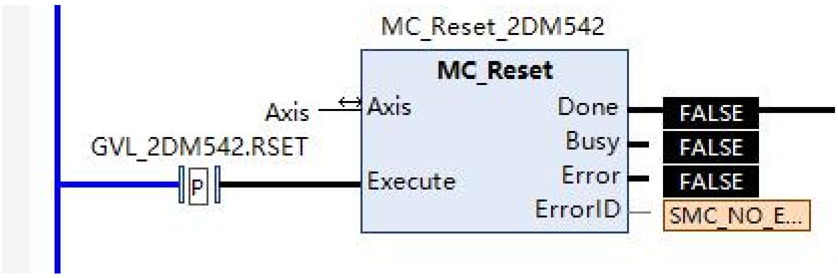


Figure 268 alarm reset

10 Stop the device

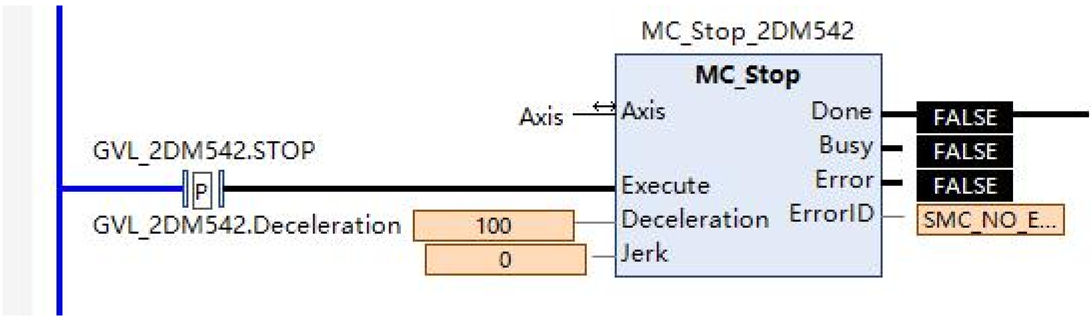


Figure 269 Stop device

EtherCAT communication operation routine based on Omron controller

Description file of installation equipment

Open Omron programming software Sysmac Studio→New Project→Create

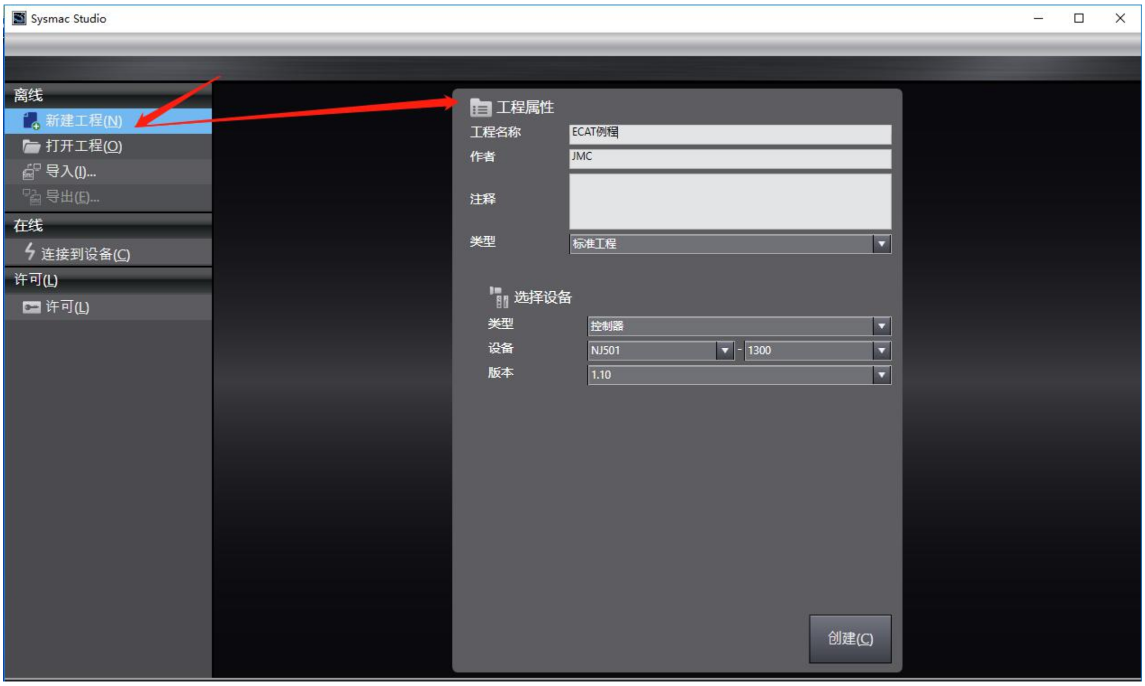


Figure 270 New Sysmac project

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

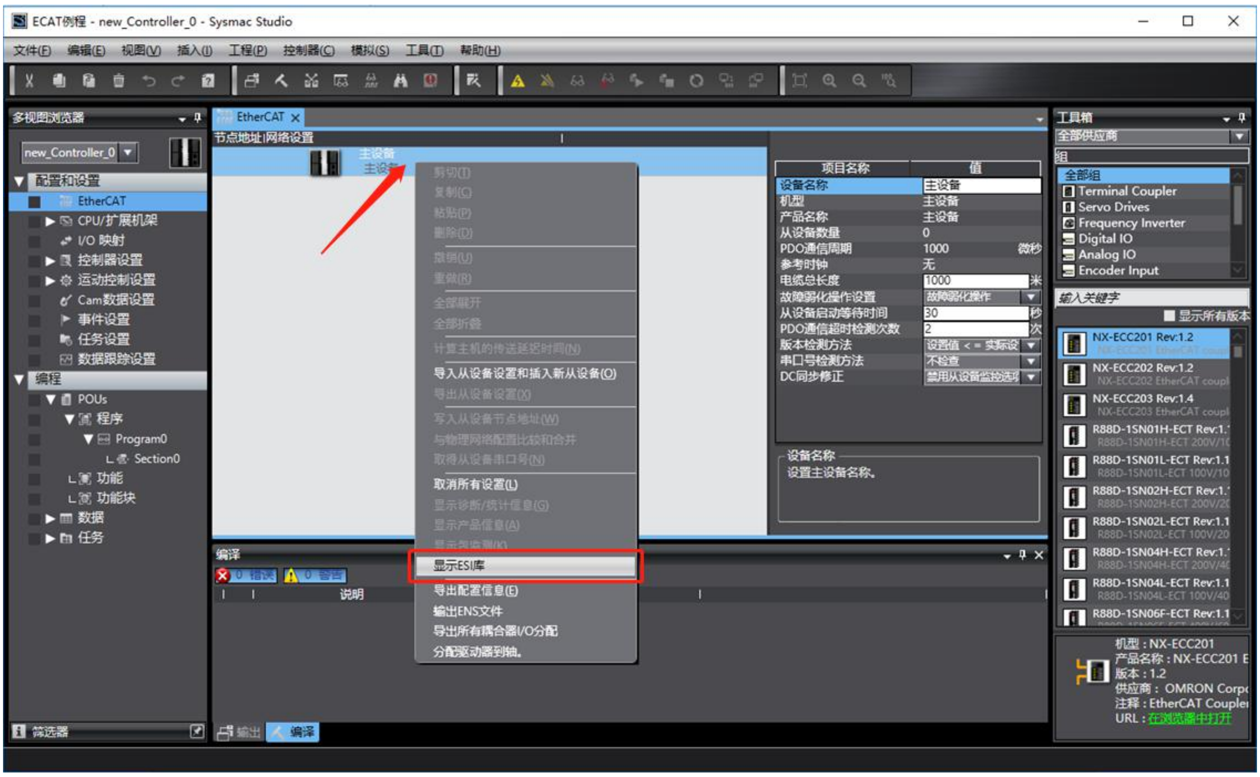


Figure 271 Open the ESI library

● Click on "This Folder"

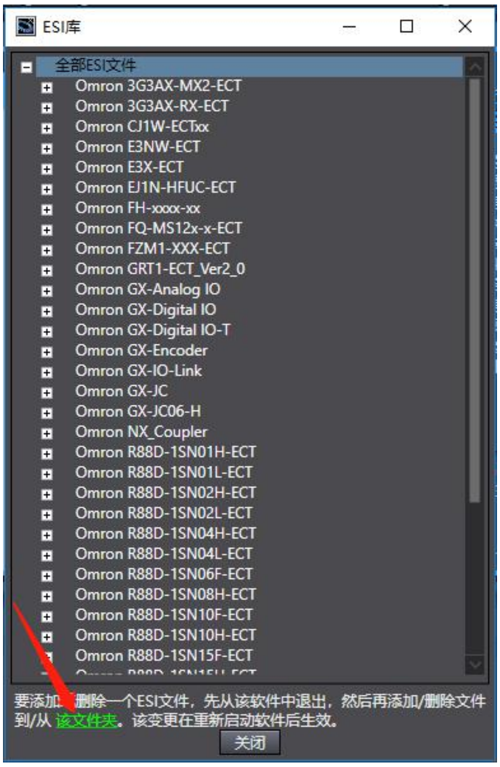


Fig. 272 Click "This Folder"

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

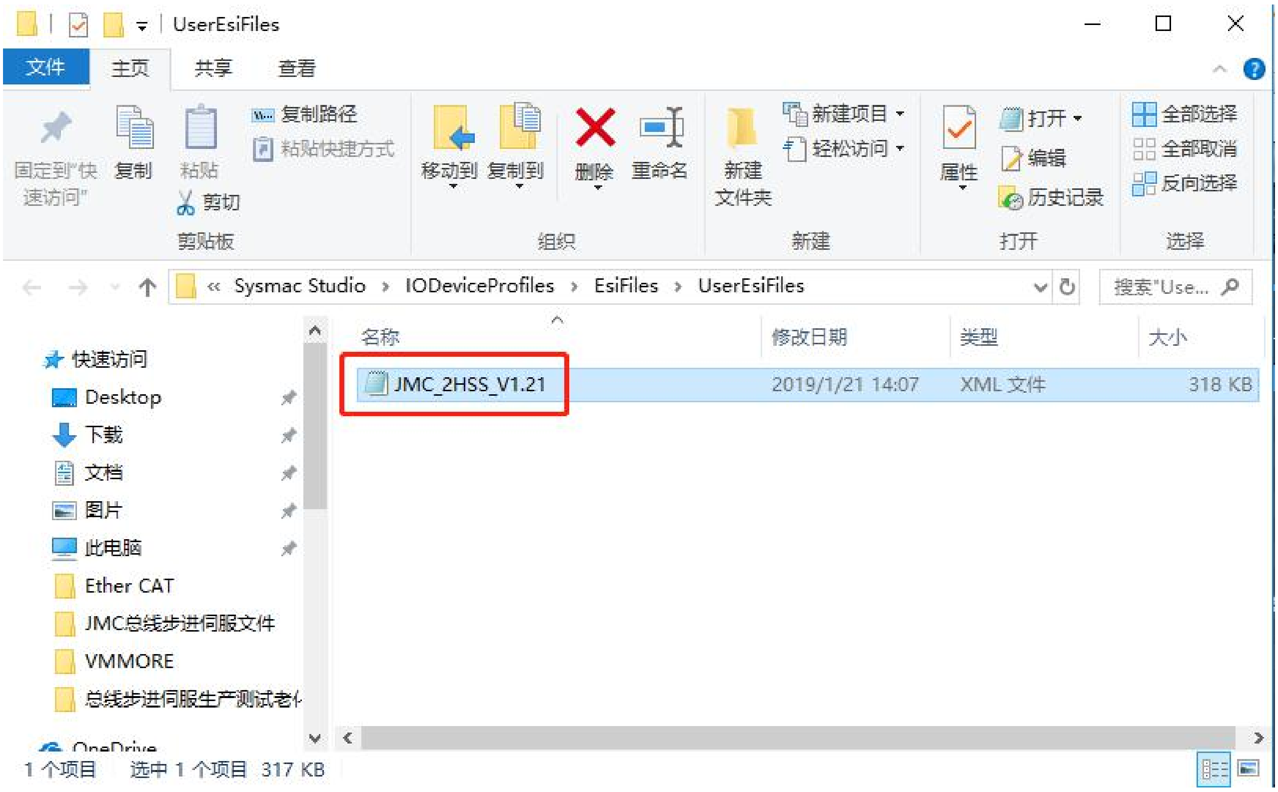


Figure 273 Select XML file

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

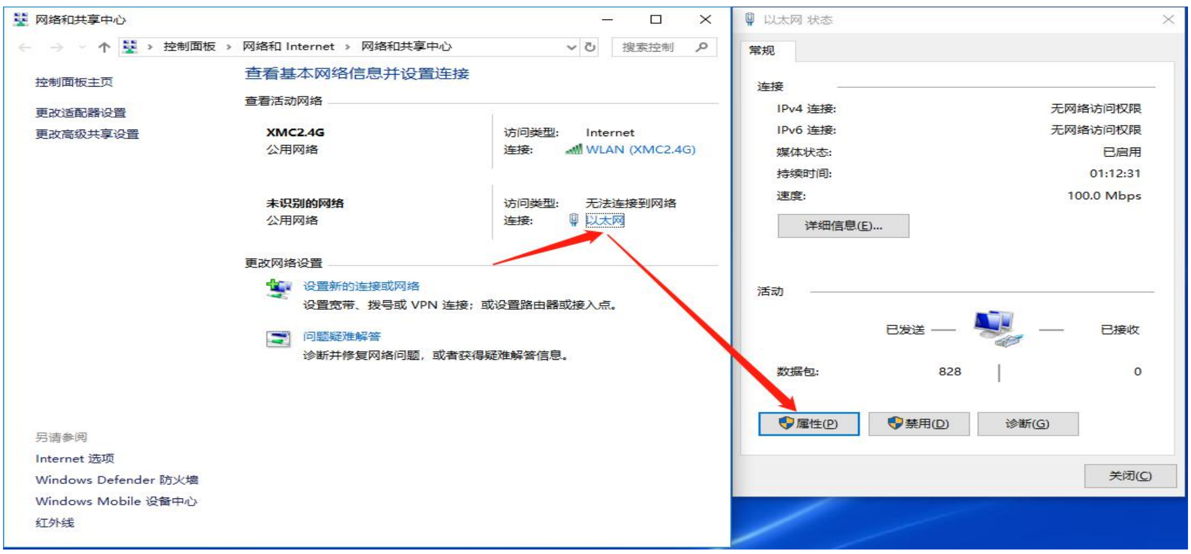


Figure 274 Configure TCP/IP

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

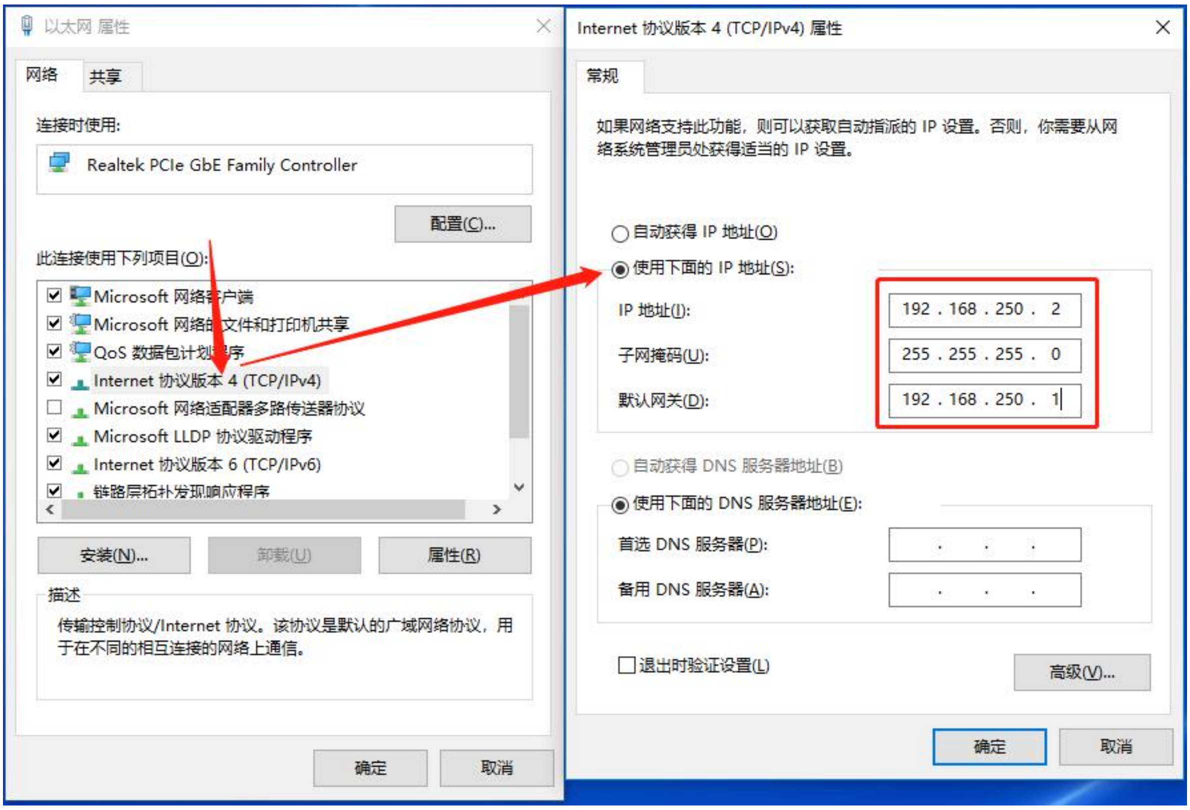


Figure 275 Set IP address

➢ Omron software configuration

1. Open project

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

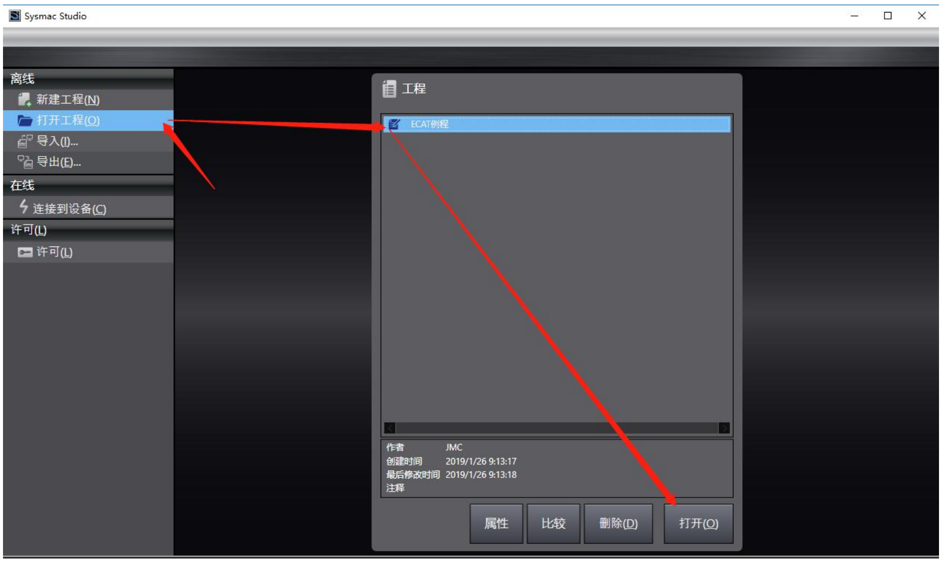


Figure 276 Open project

2 Communication settings

- Controller→Communication Settings

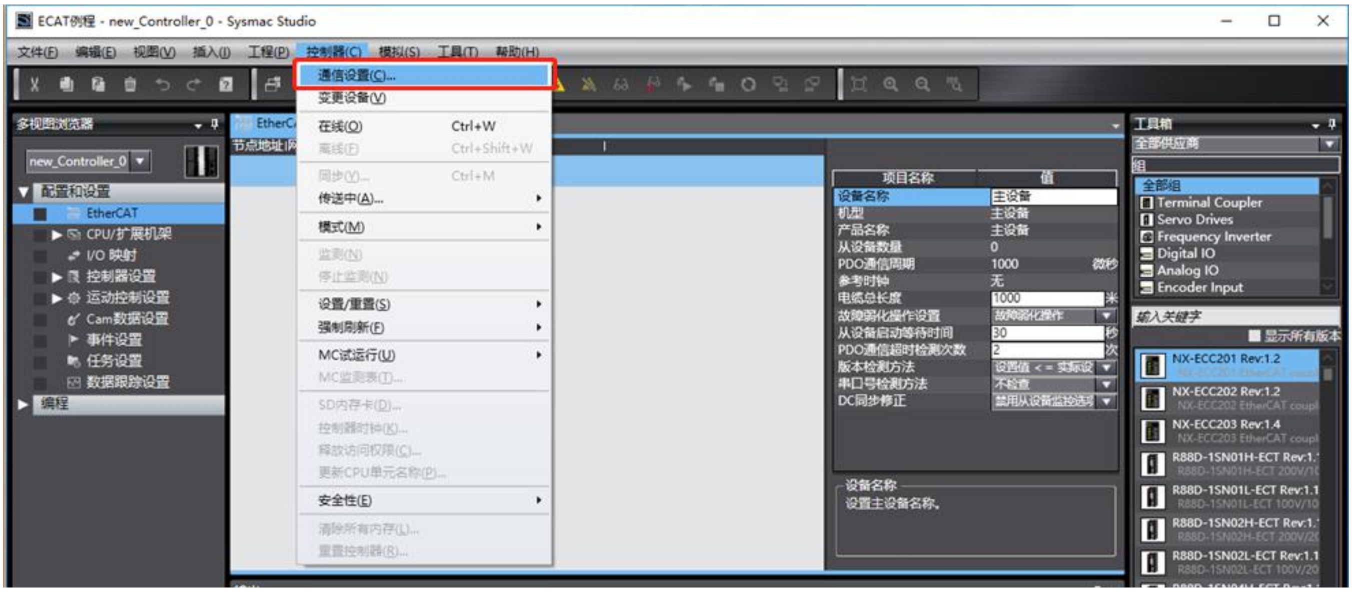


Figure 277 Communication settings

- Select Ethernet communication

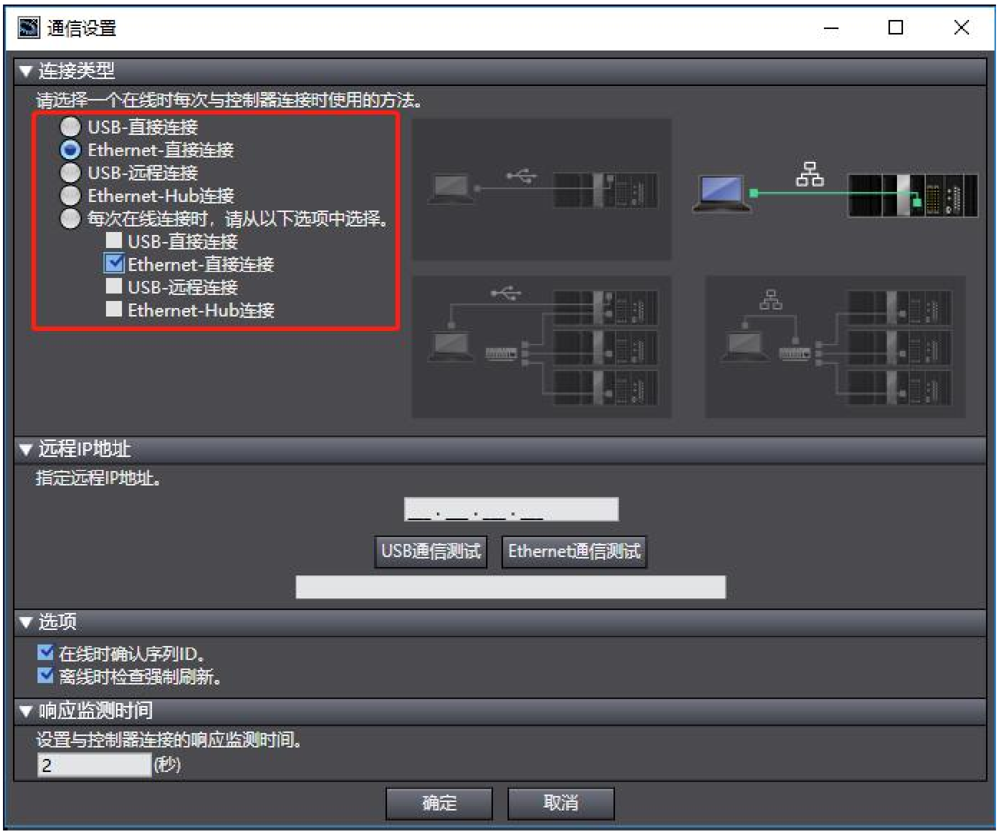


Figure 278 Select Ethernet communication

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

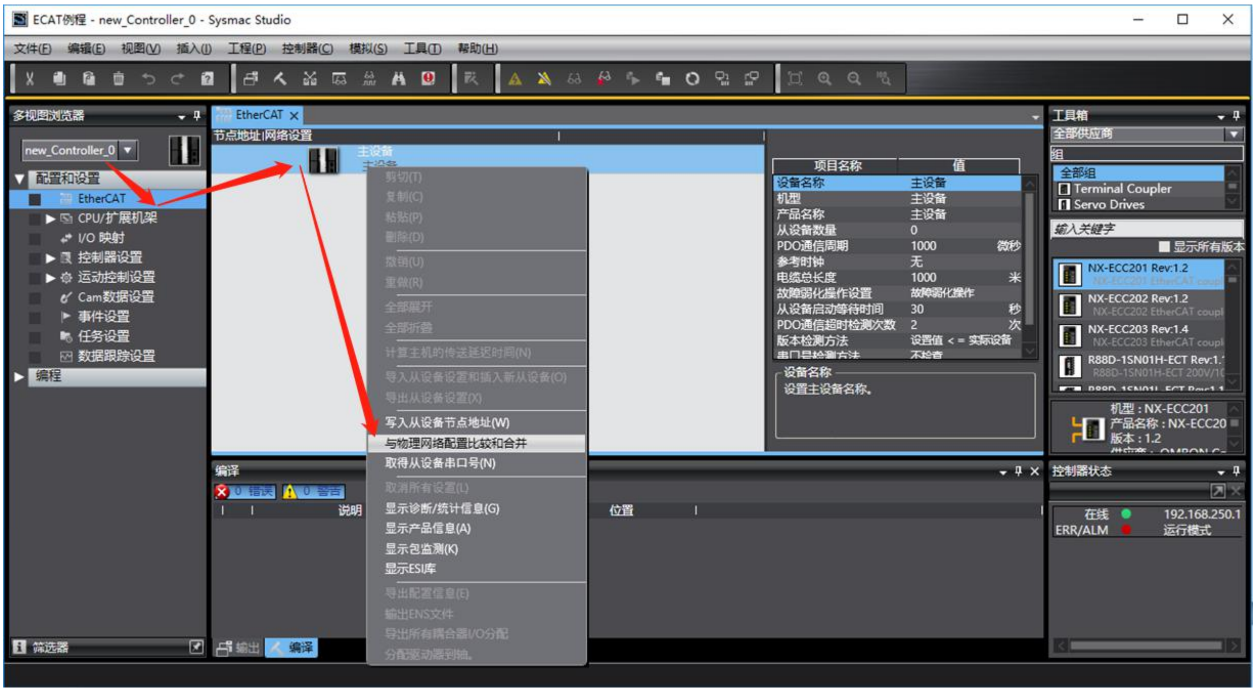


Figure 279 Comparison and merge with physical network configuration

- Apply physical network configuration

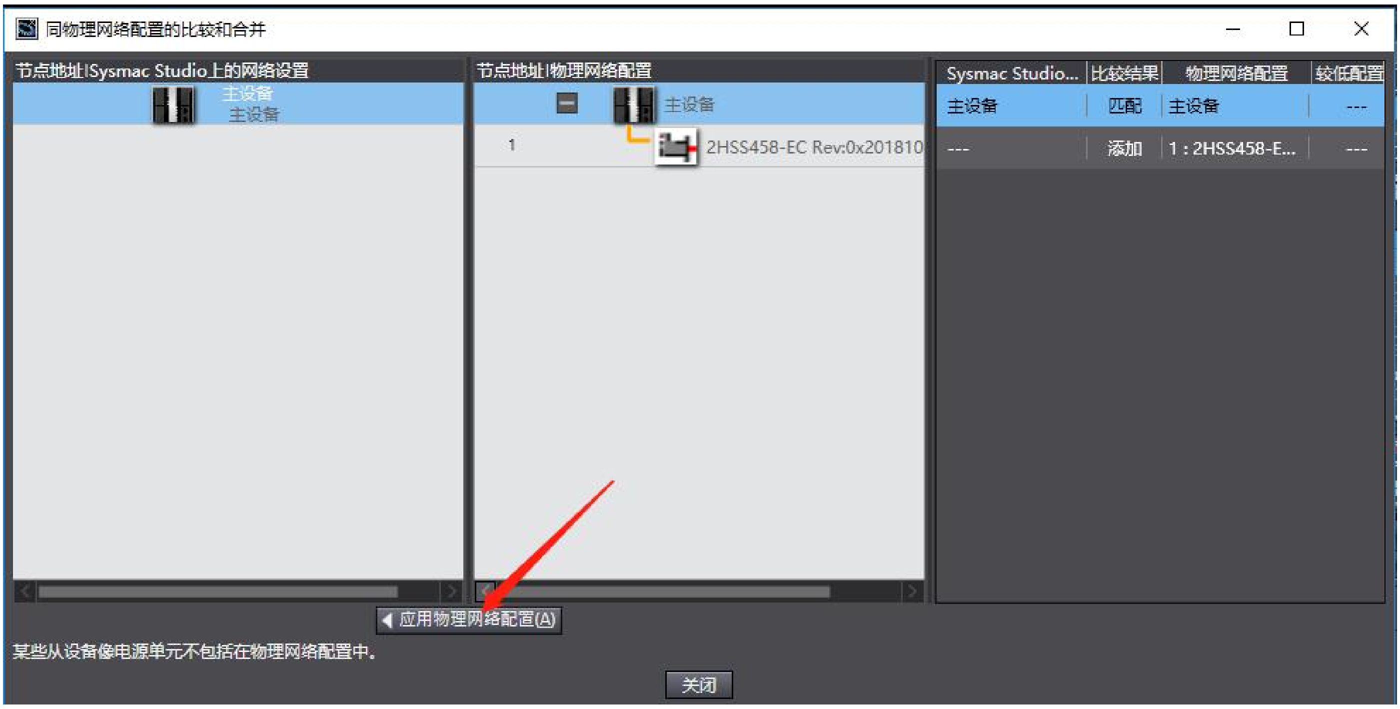


Figure 280 Applied physical network configuration

- Click Apply

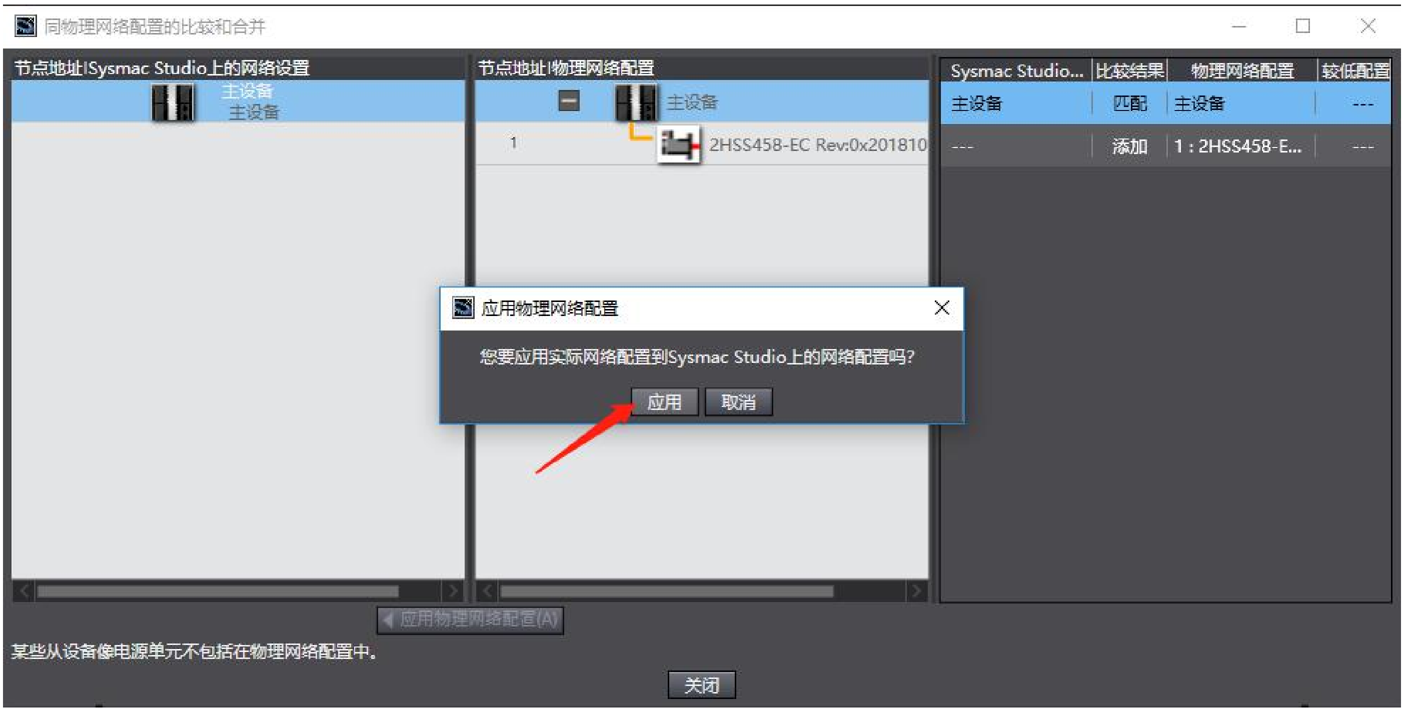


Figure 281 Click Apply

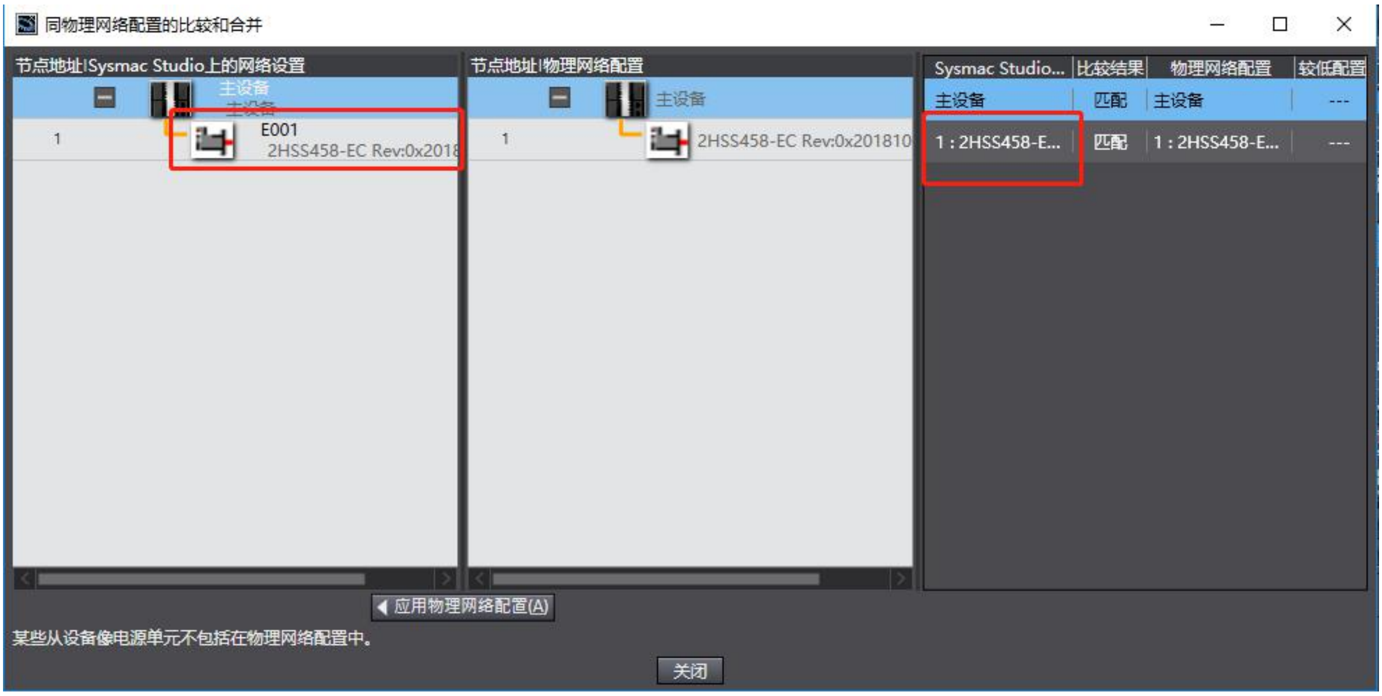


Figure 282 Application effect

4 Axis parameter setting

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

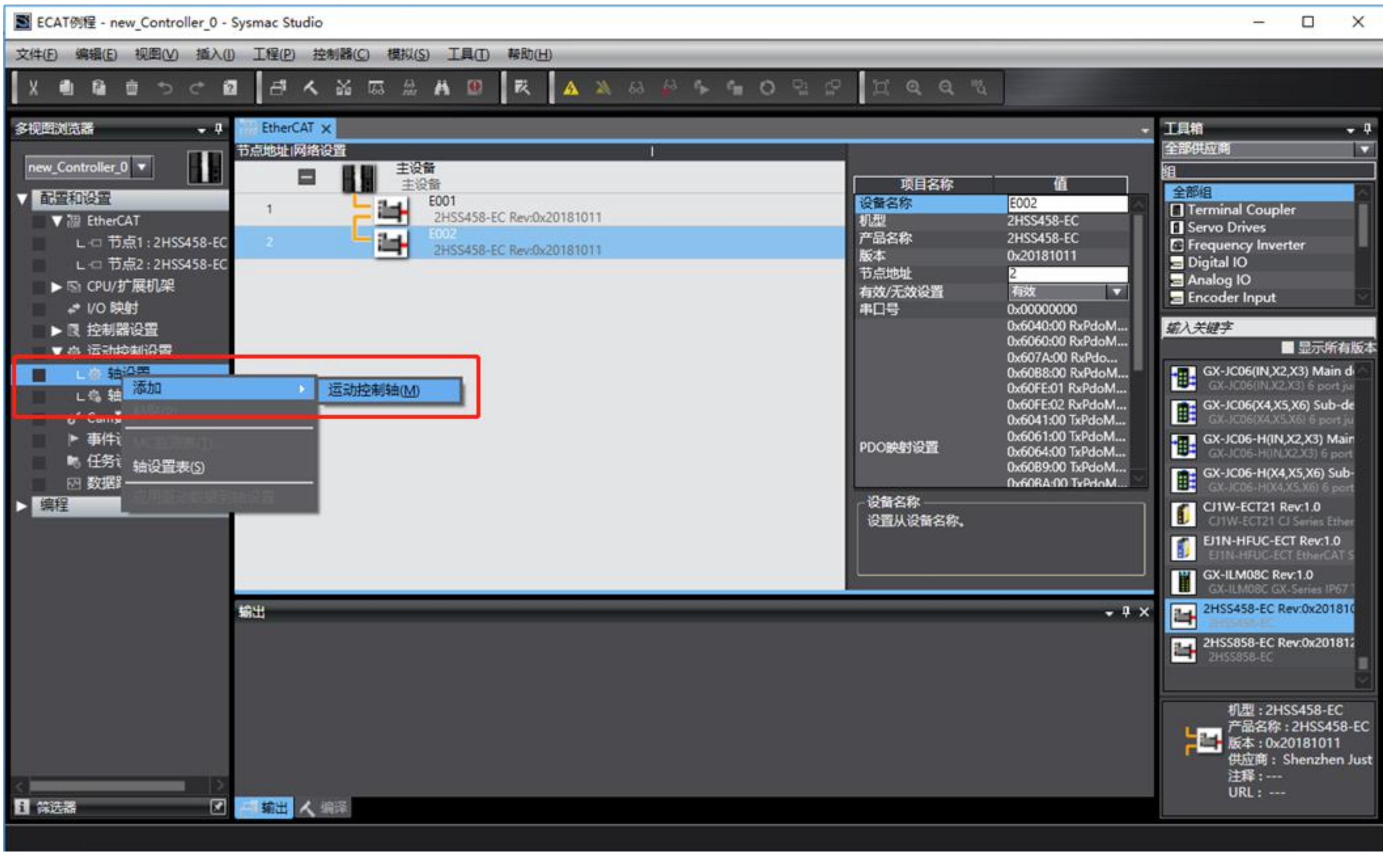


Figure 283 Add motion control axis

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

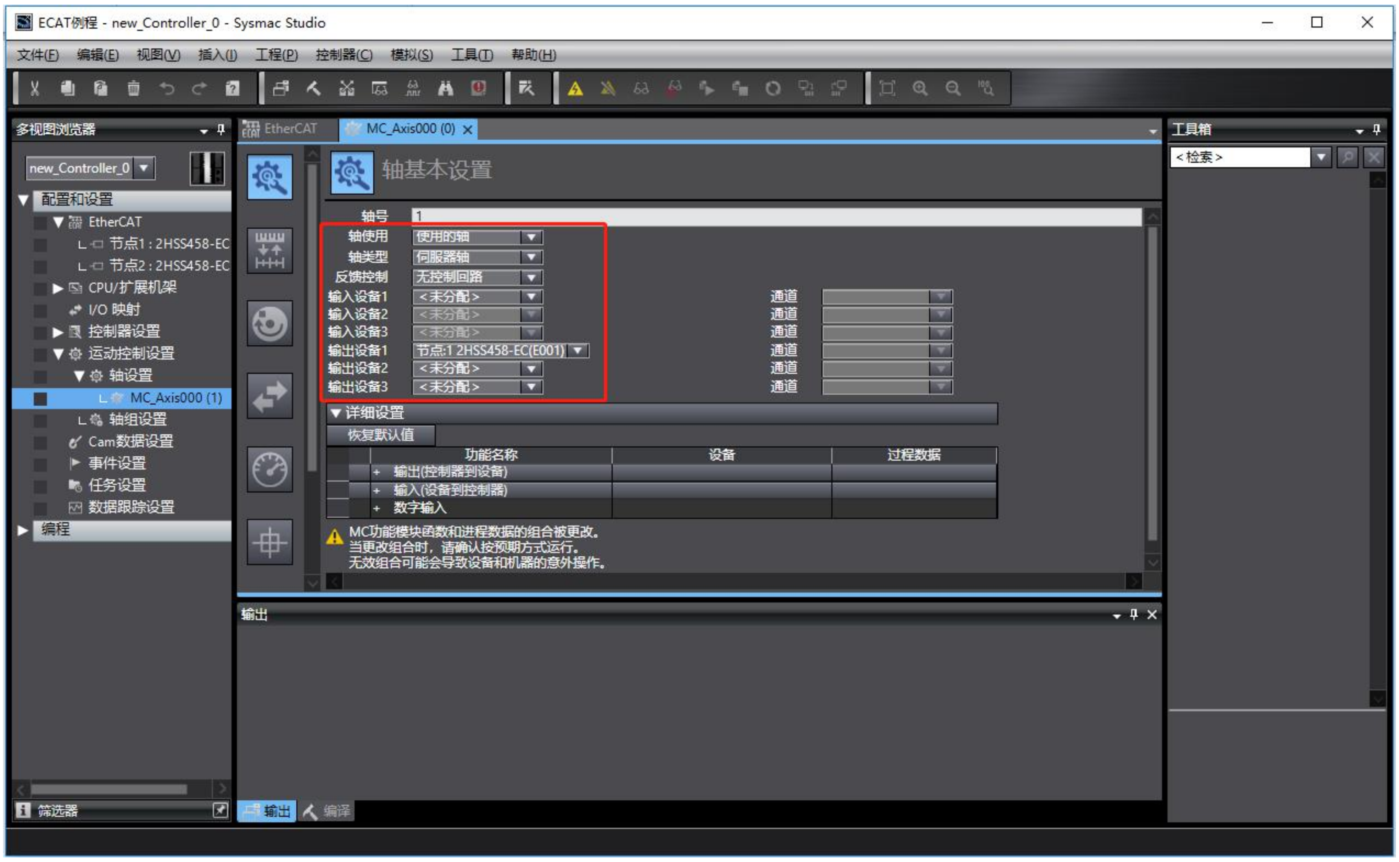


Figure 284 axis assignment

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.

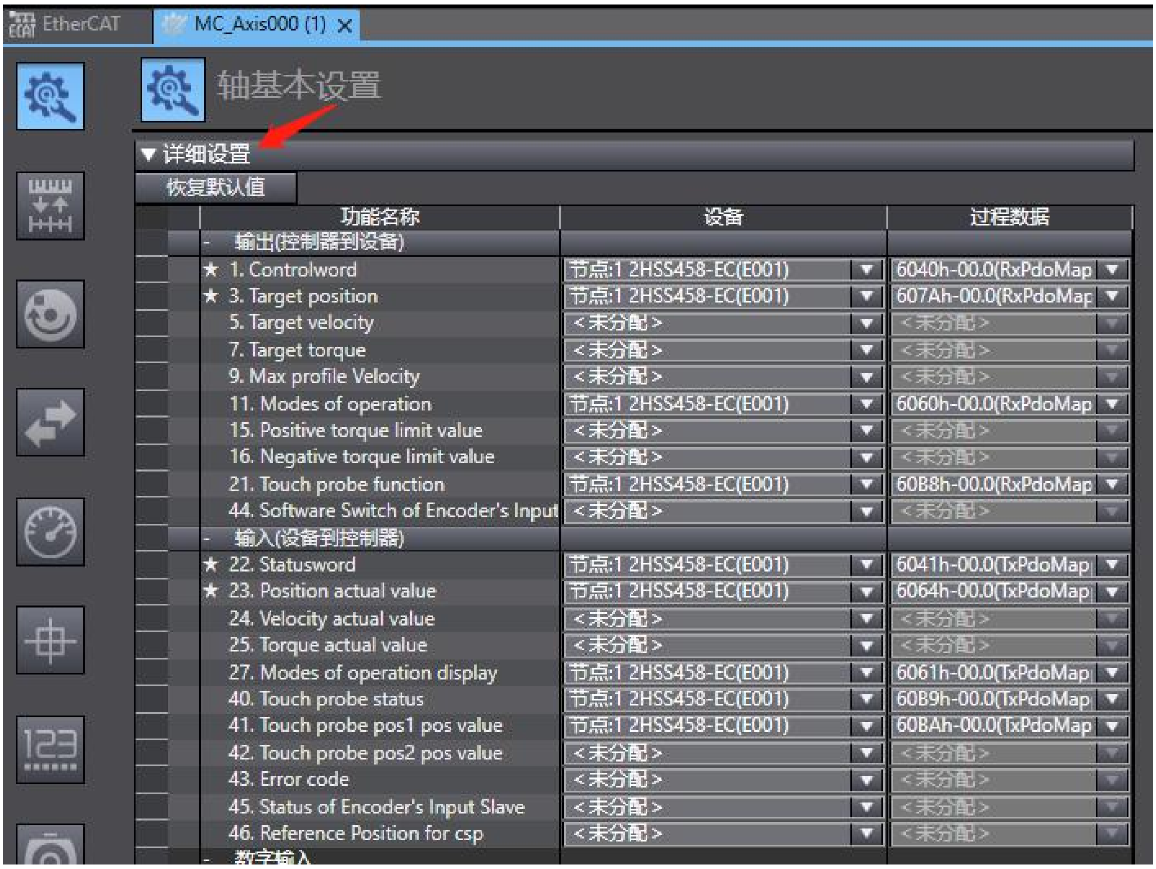


Fig 285 Axis basic setting

7 Unit conversion settings

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

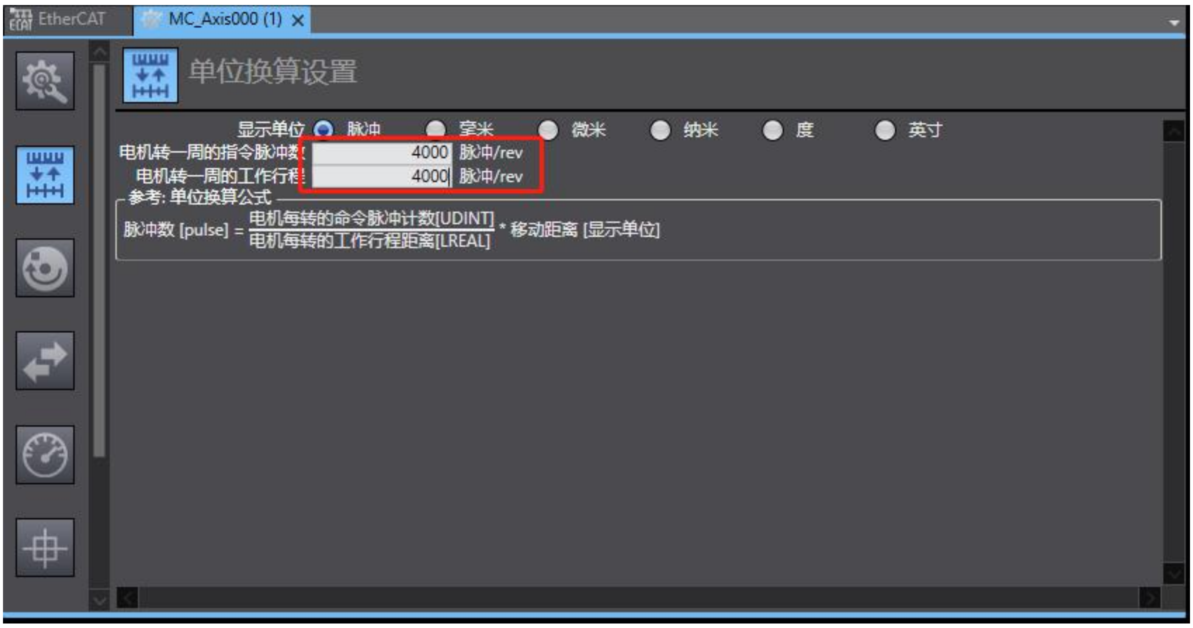


Fig 286 Unit conversion settings

8 Home 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.

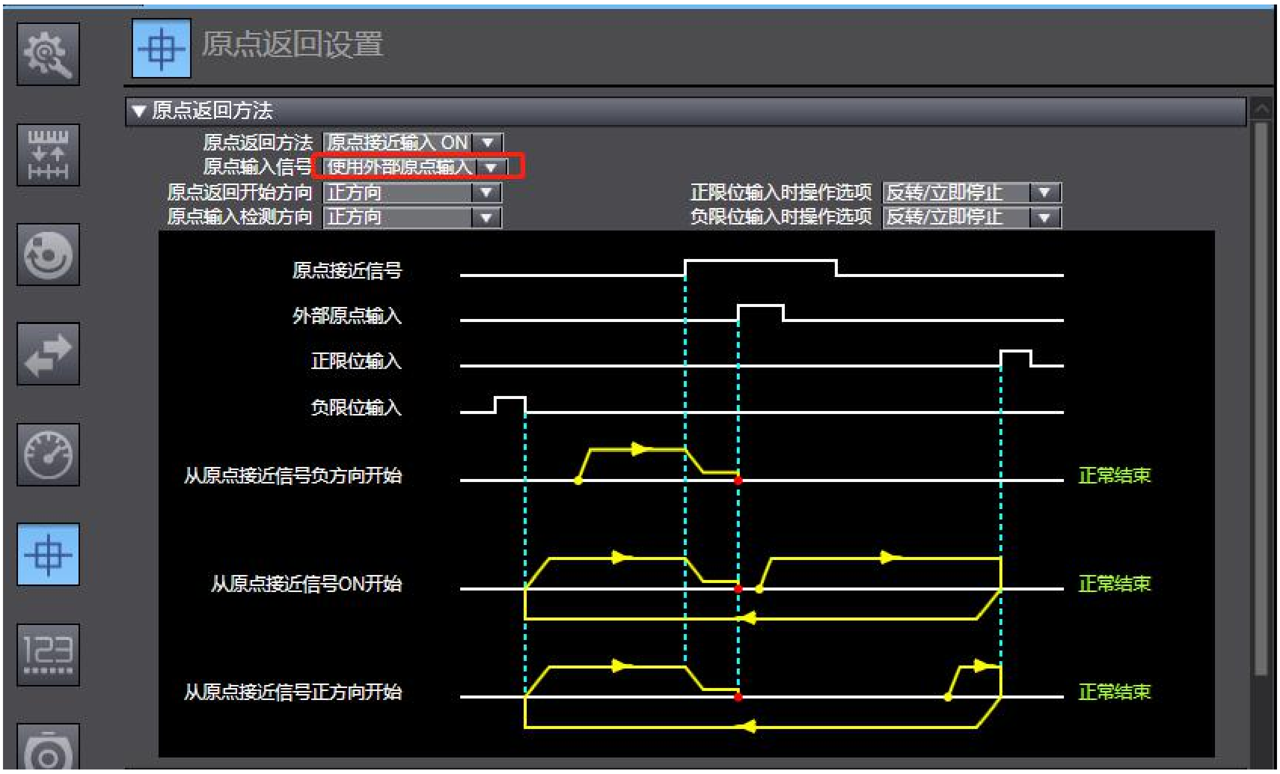


Figure 287 Origin return setting

➢ 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.

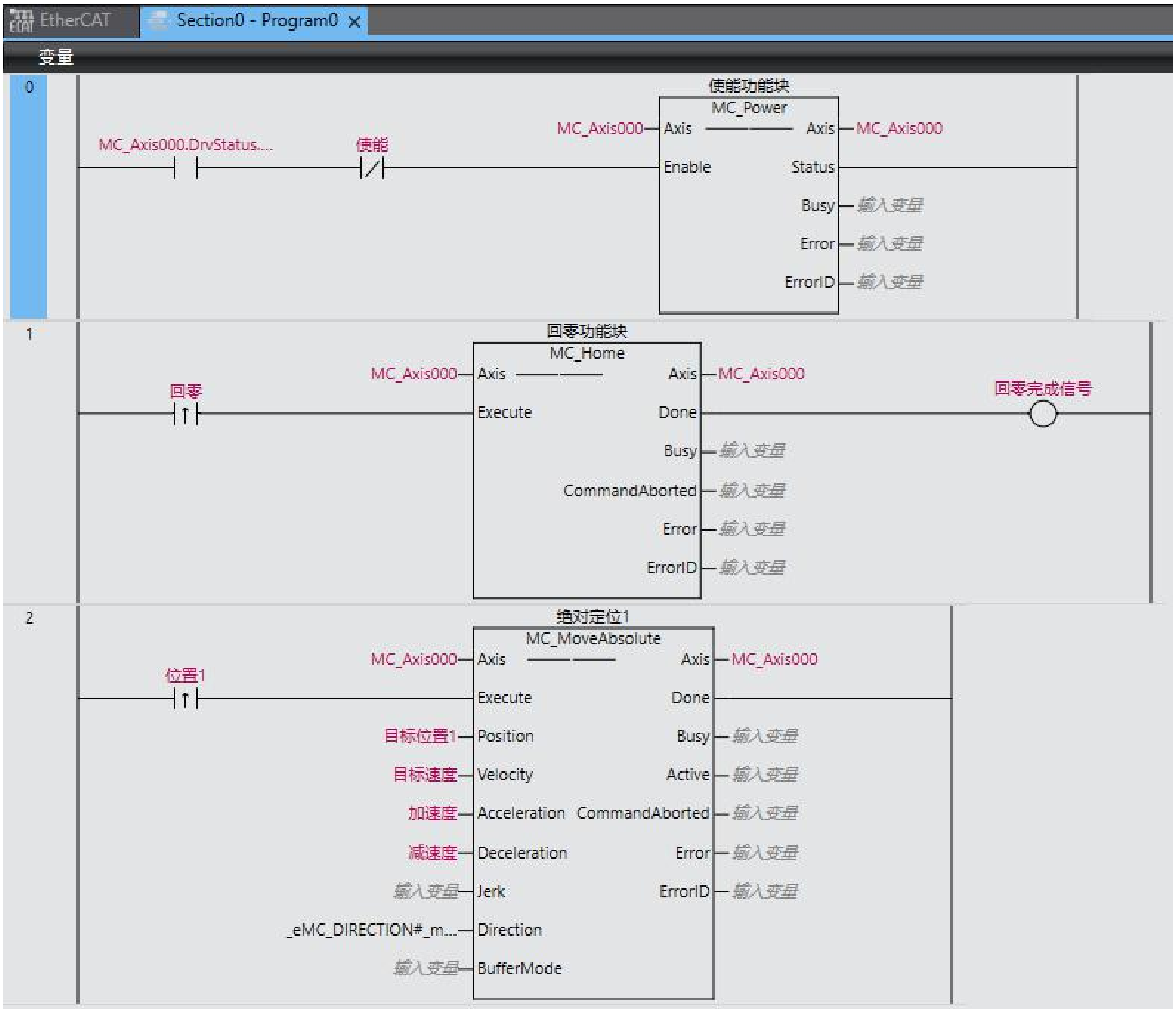


Figure 288 Program control

➢ 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

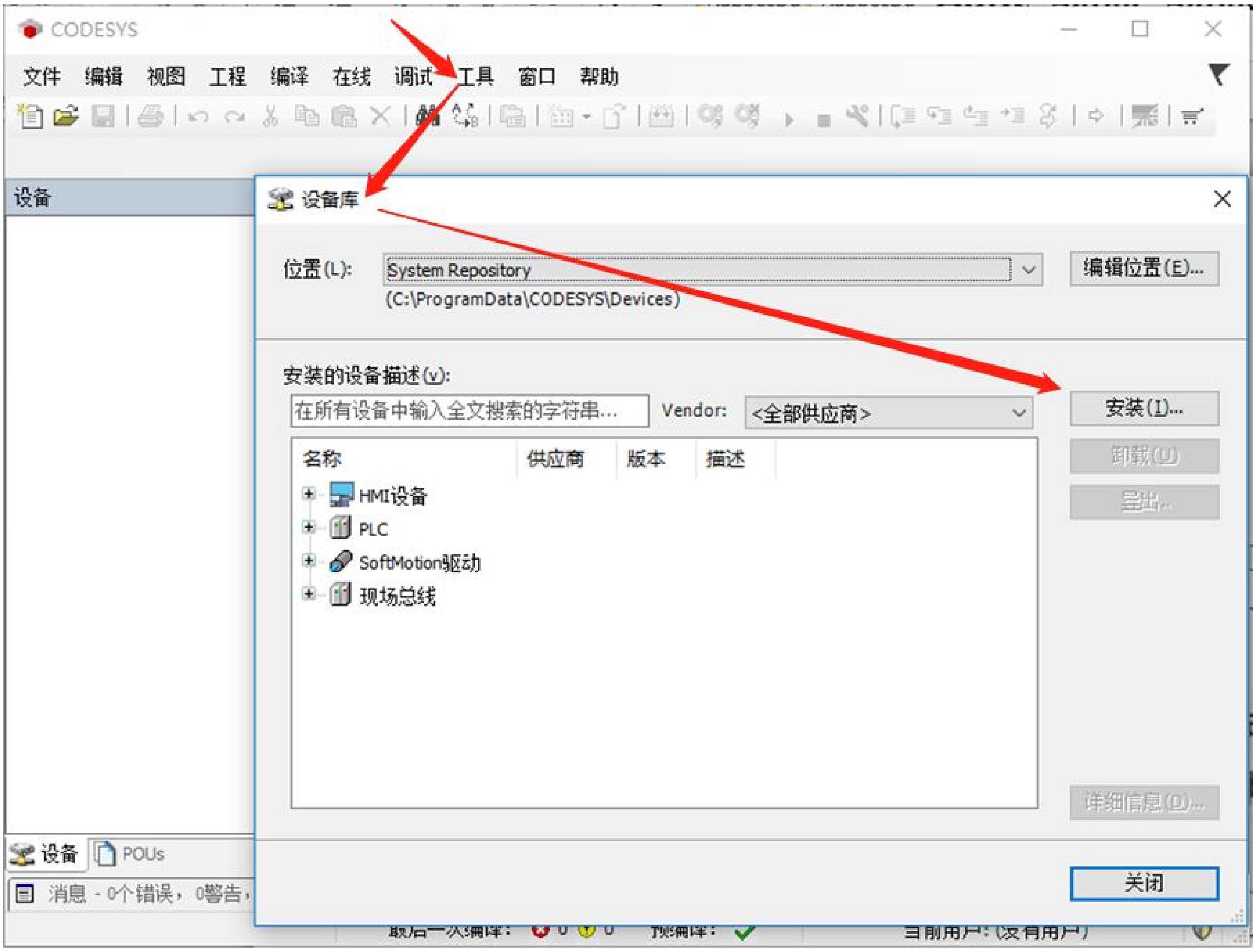


Figure 289 Install device description file

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

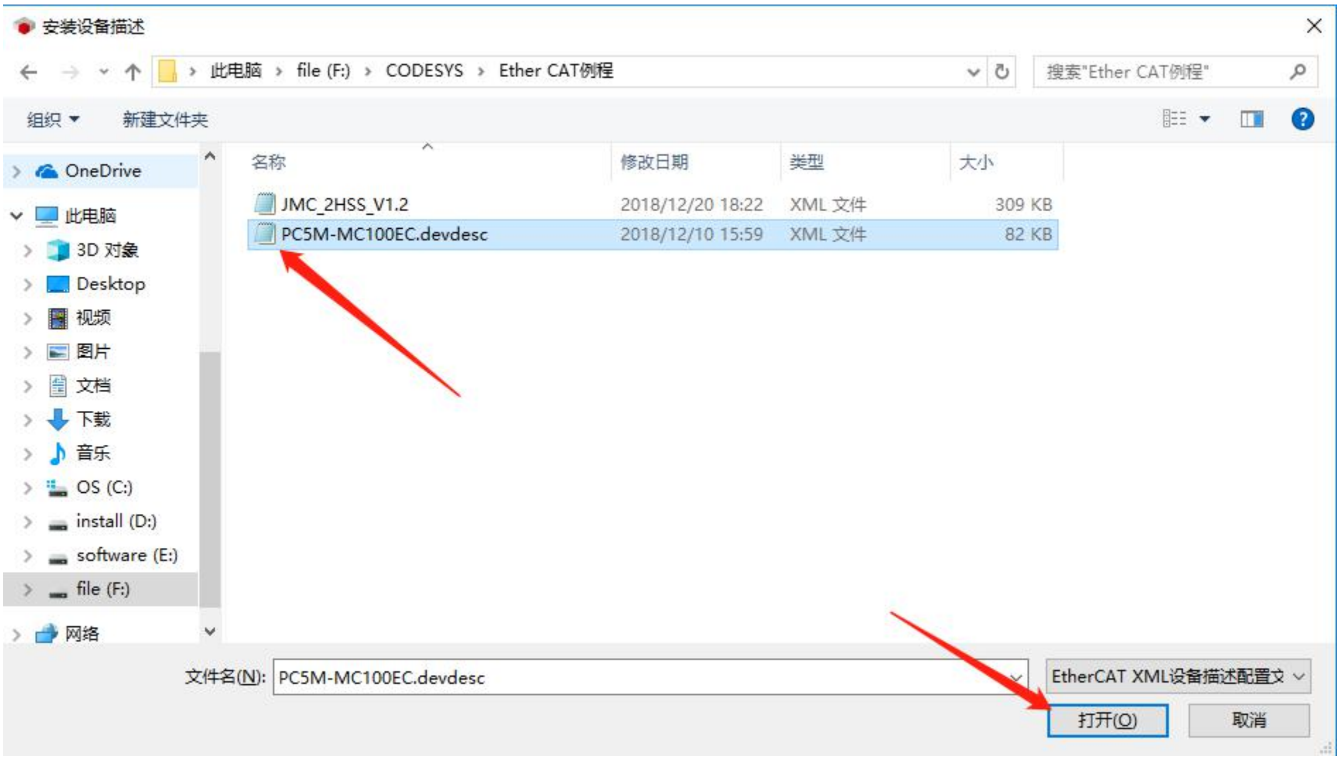


Figure 290 Install the master station and slave station device description files separately

● Waiting it’s installed automatically

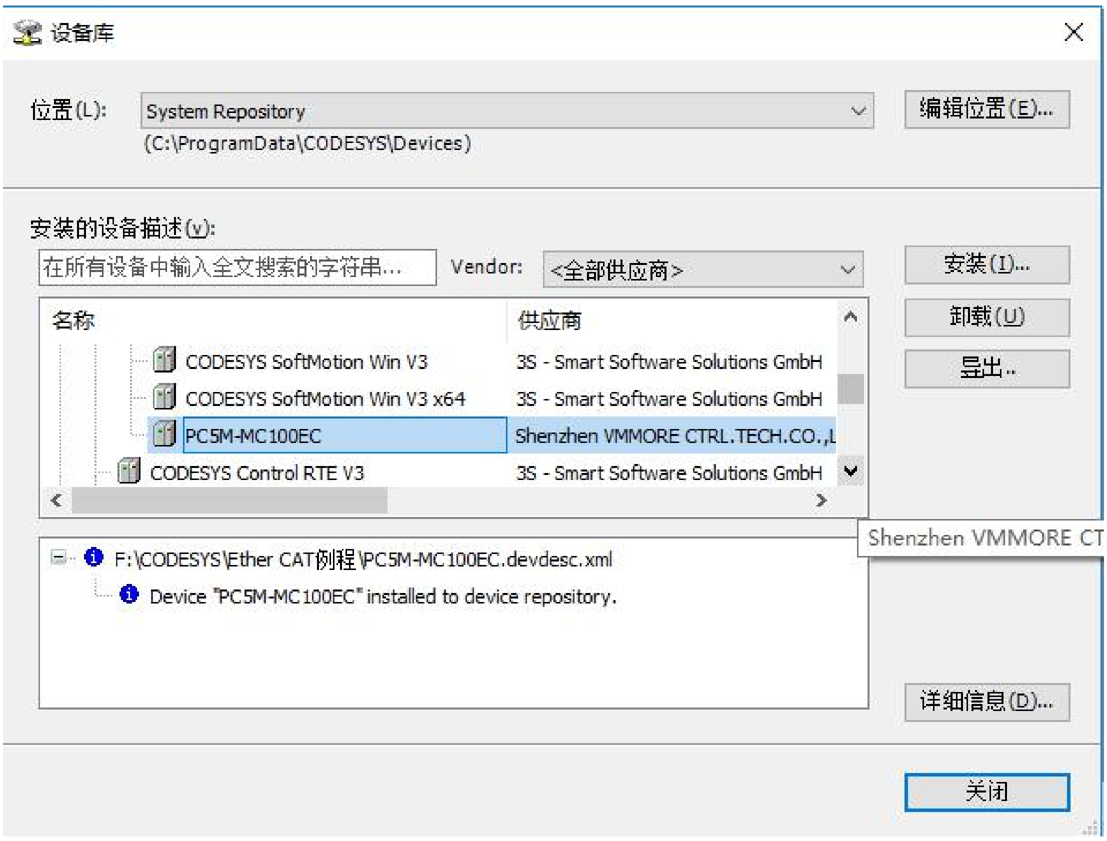


Figure 291 install automatically

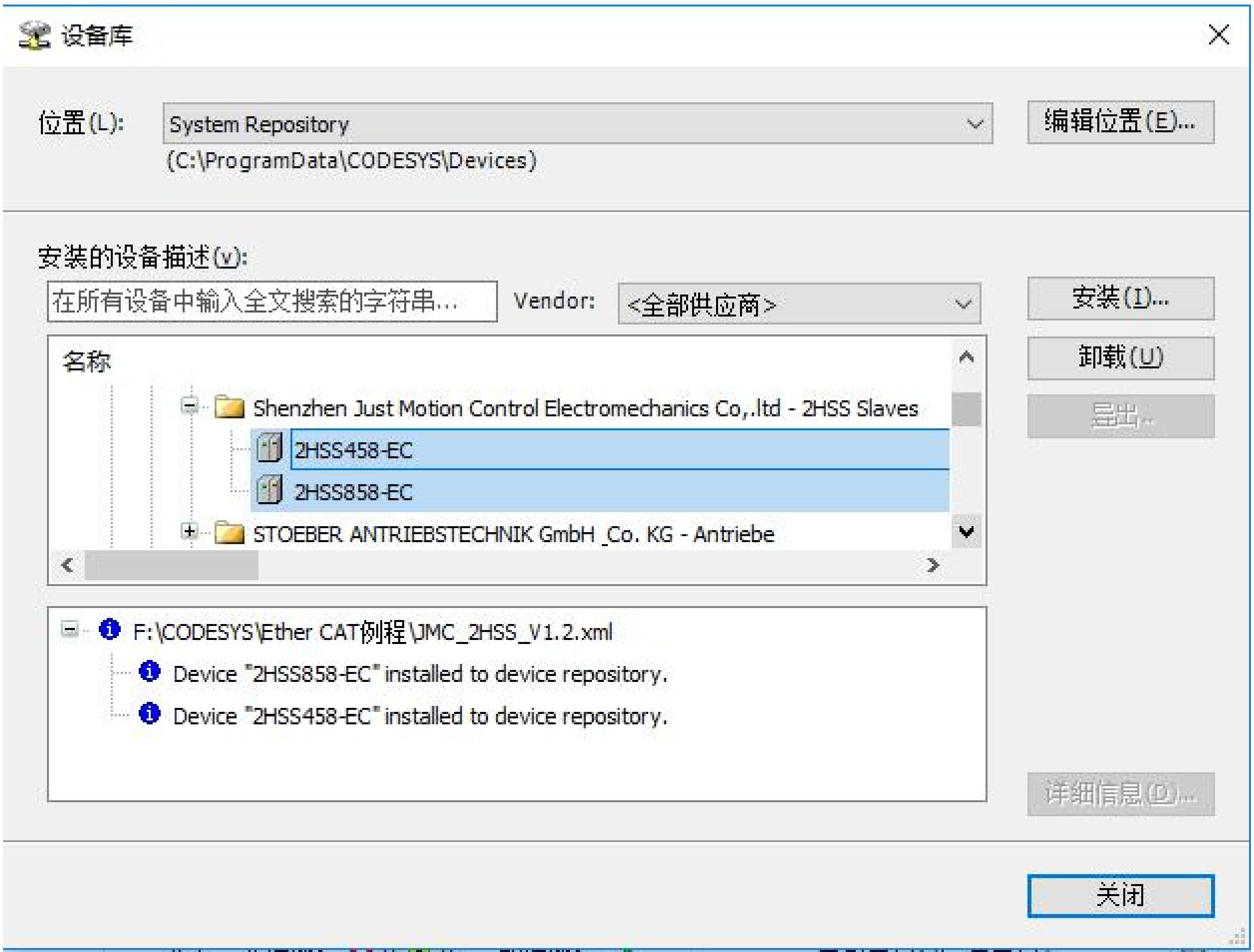


Figure 292 after installing

➢ Create a project

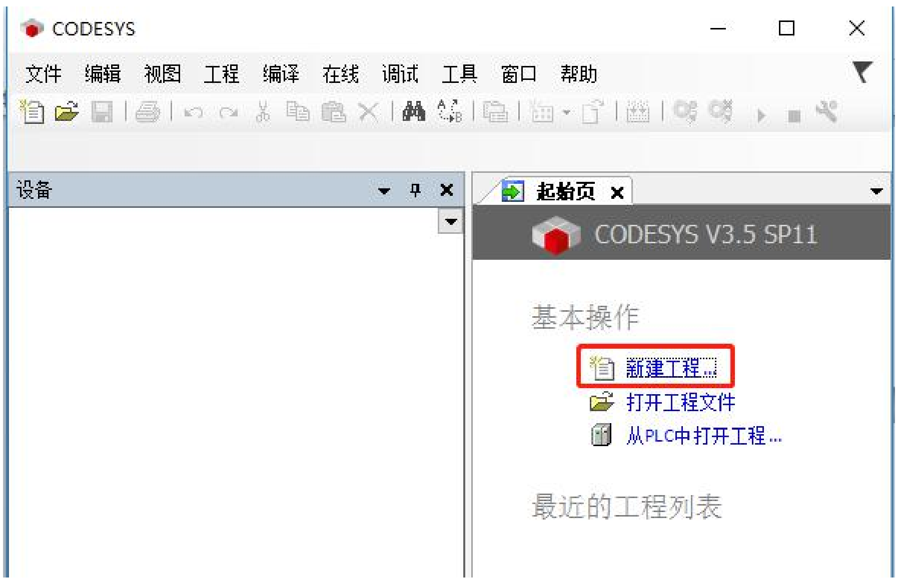


Fig 293 Create CODESYS project

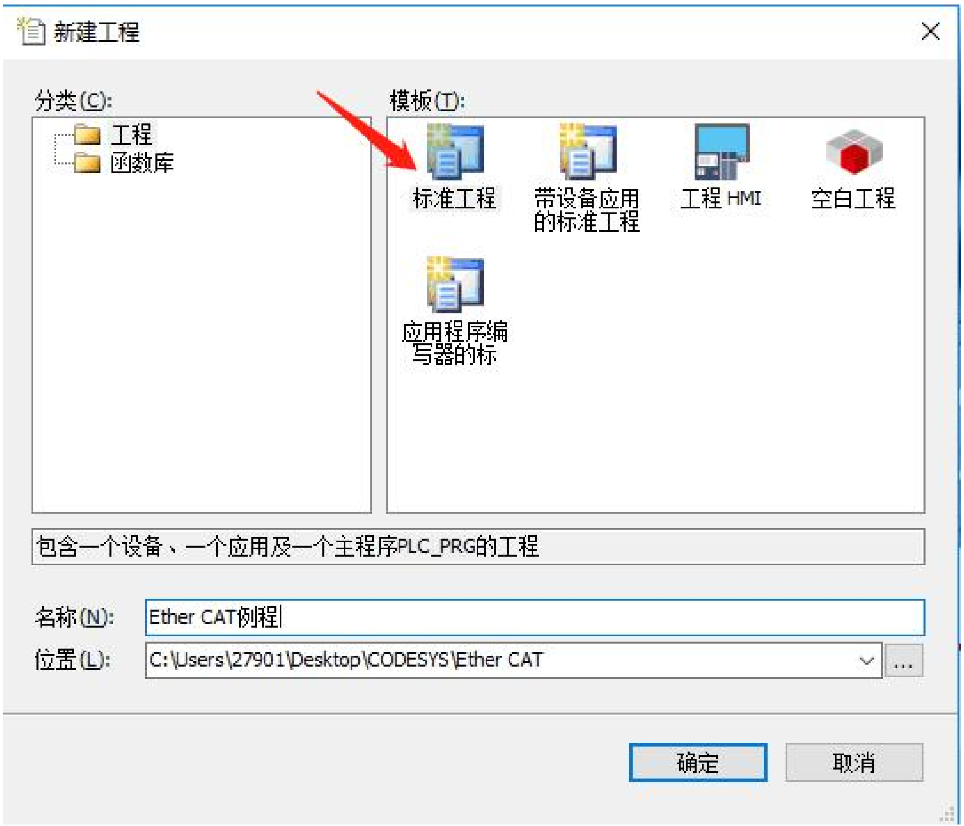


Figure 294 create a standard project

- 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

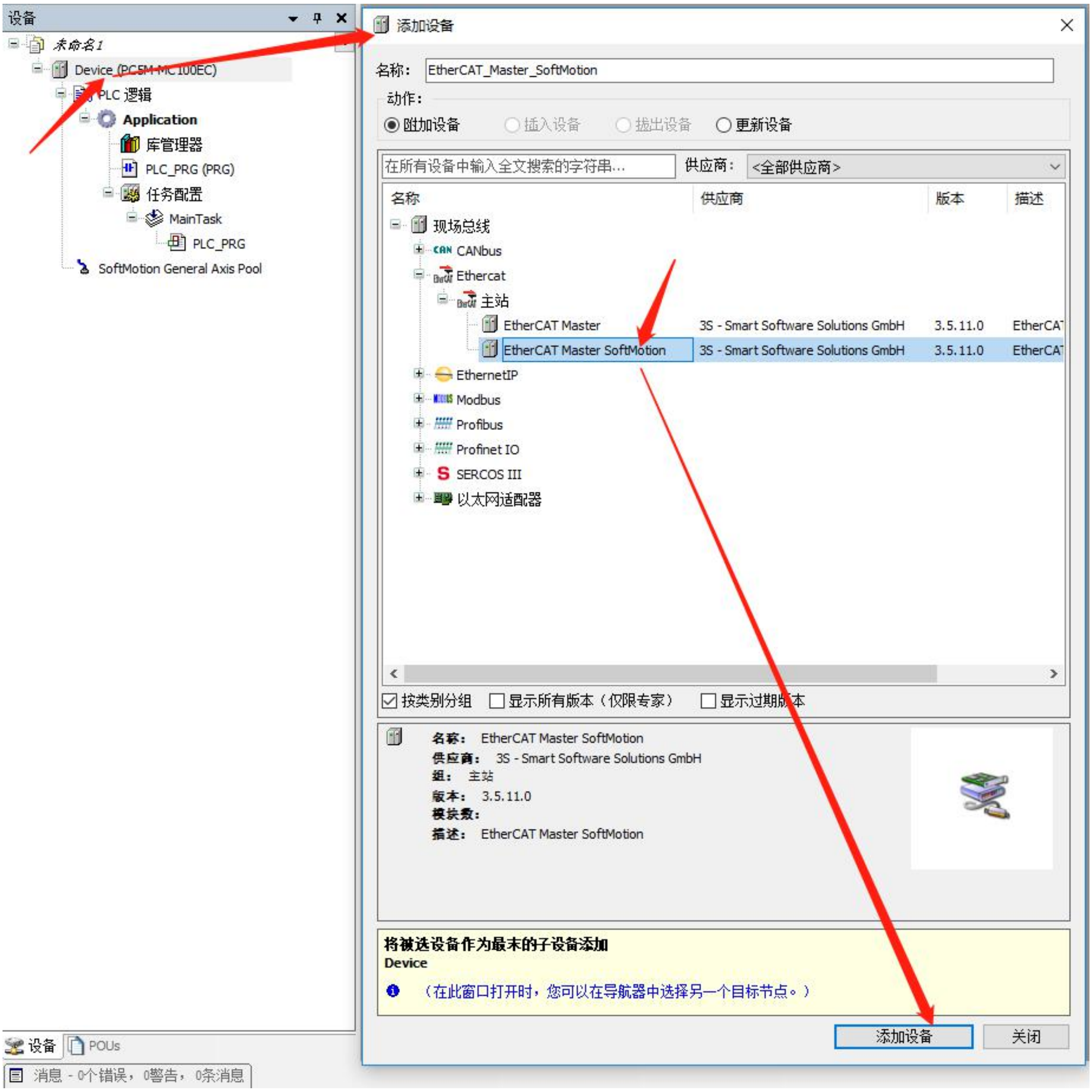


Figure 296 add device

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

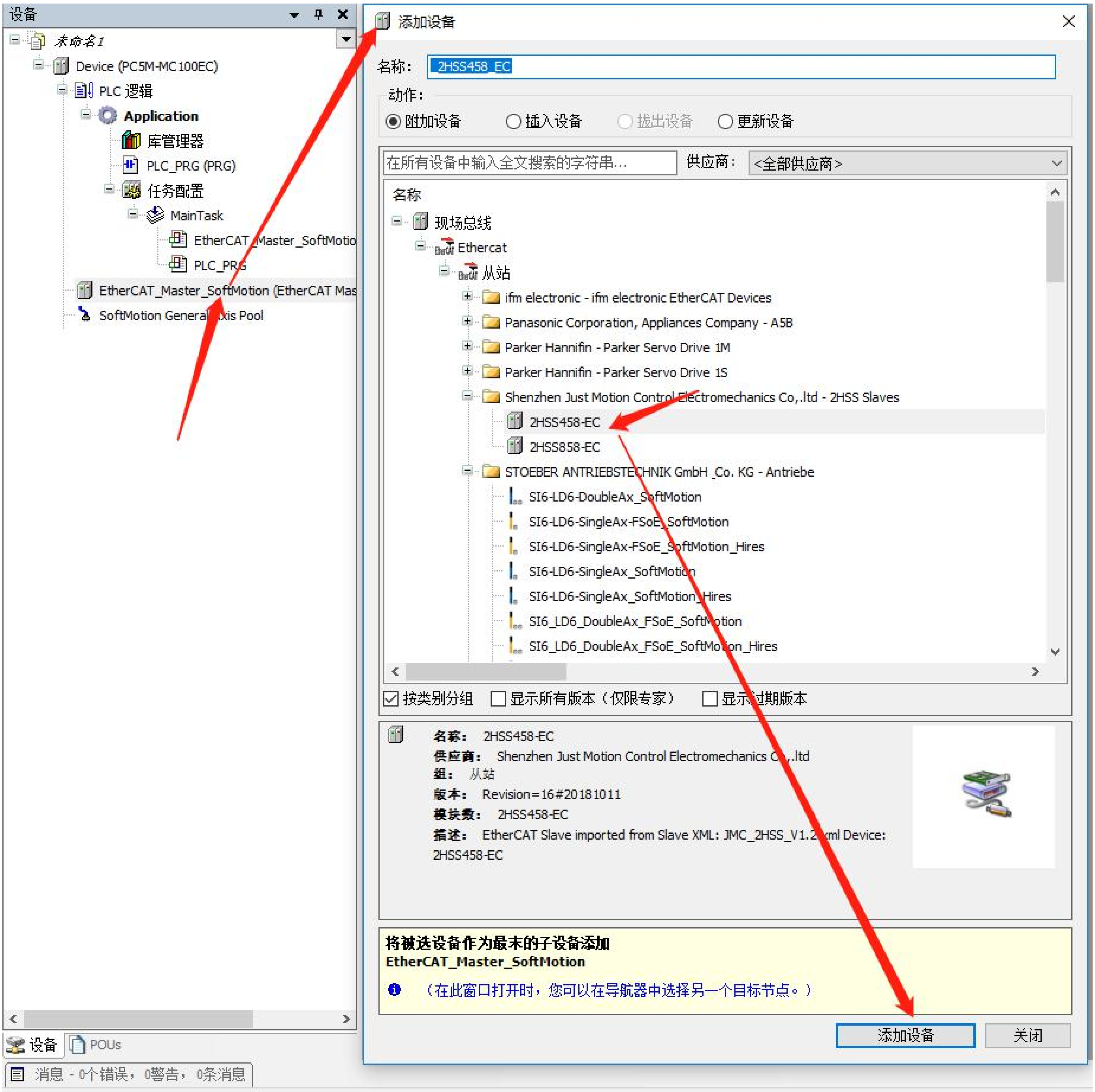


Figure 297 select device

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

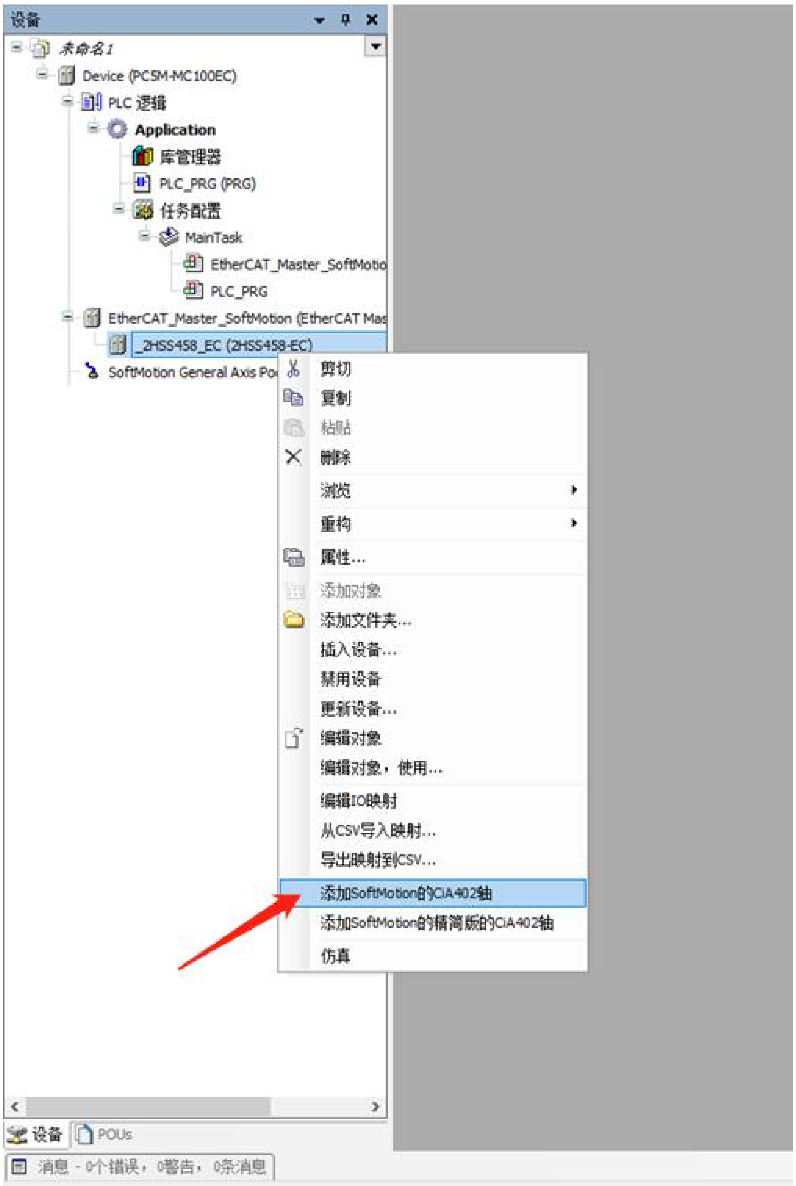


Figure 298 add CiA402 axis of SoftMotion

➤ Parameter setting

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

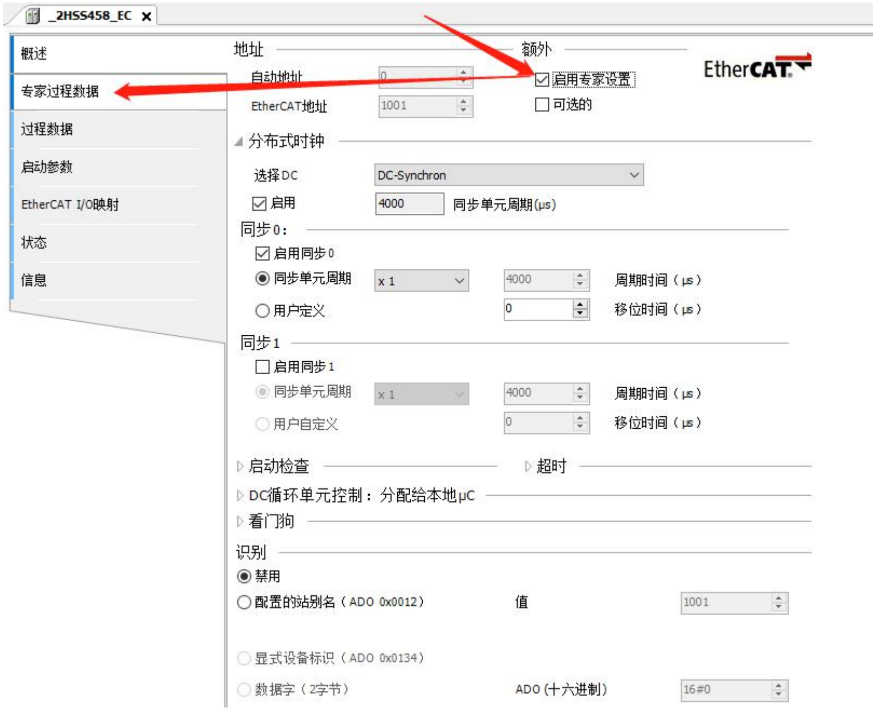


Figure 299 Enable expert settings

- Check the PDO allocation and PDO configuration in the download

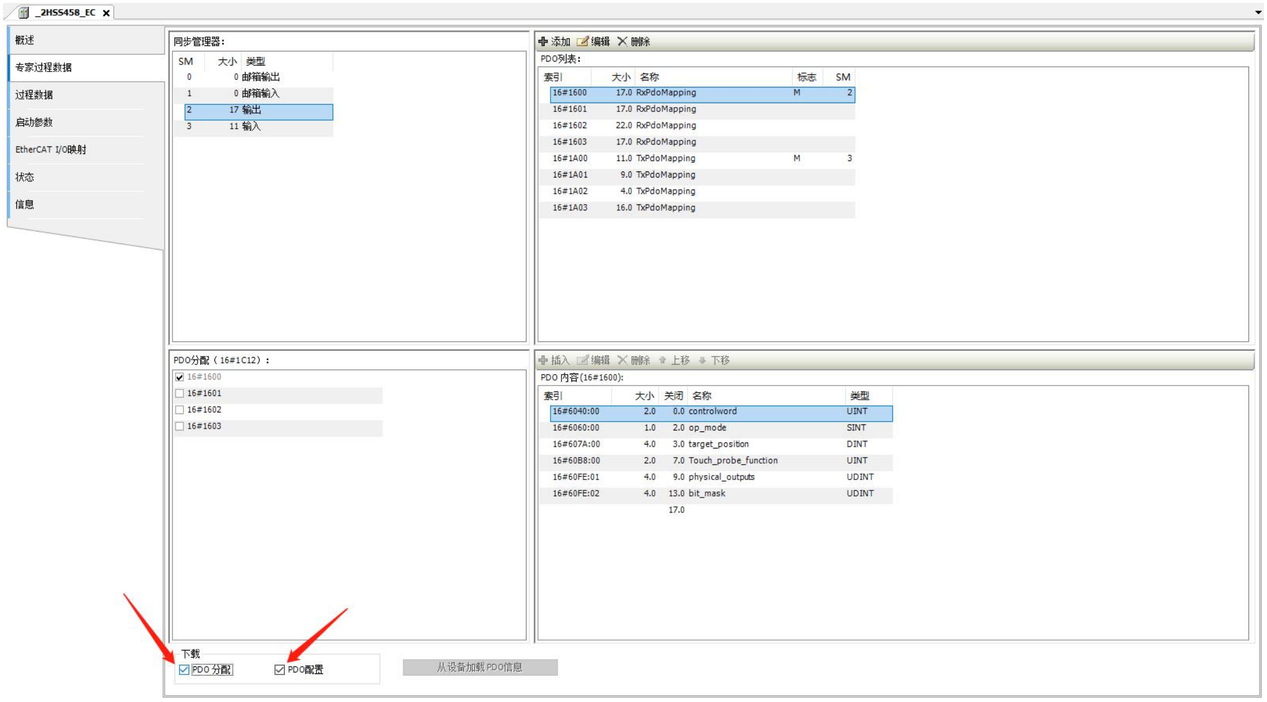


Figure 300 Expert process data

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

●

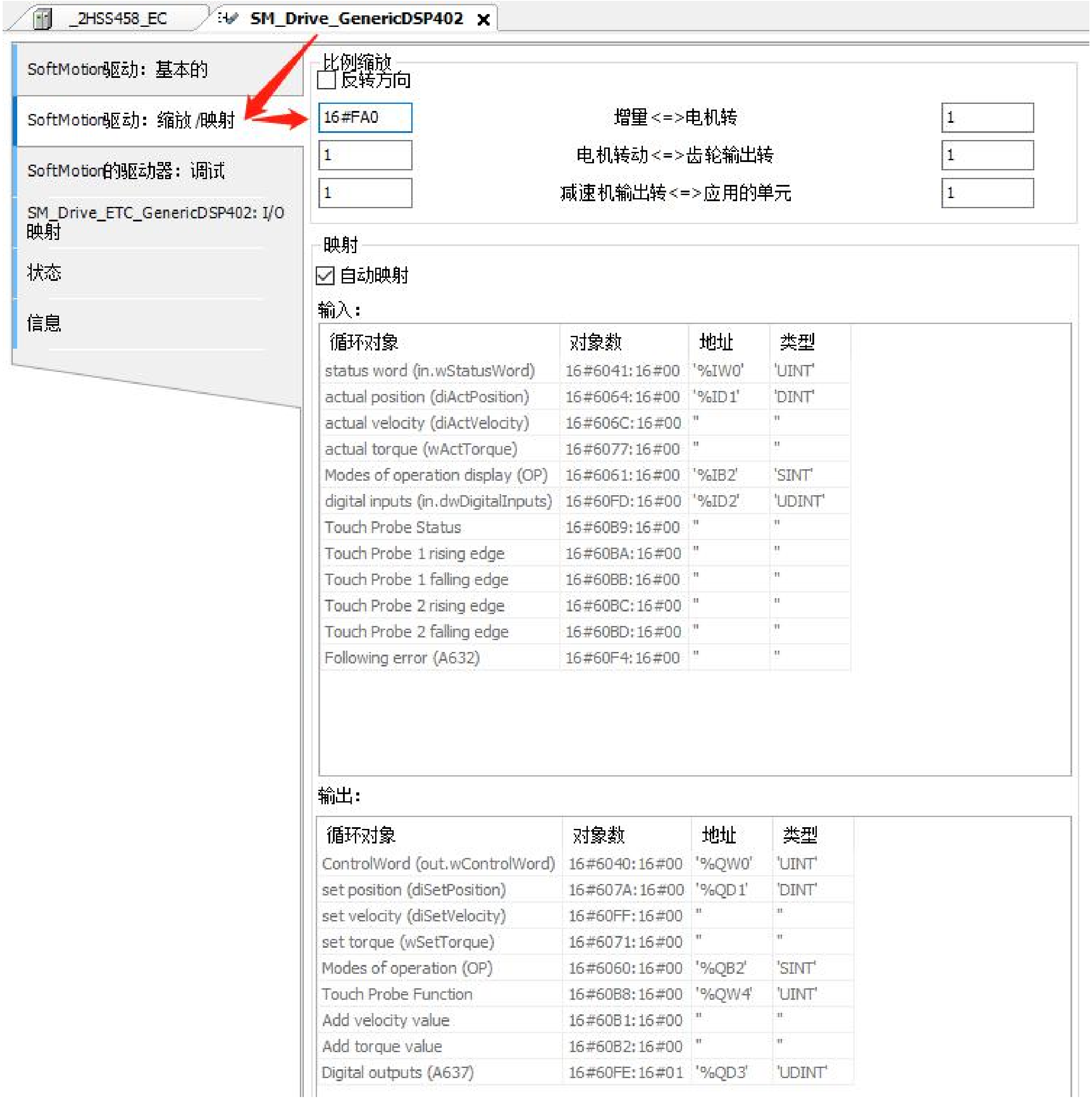


Figure 301 zoom/map

➢ Programming

1 Set homing parameter

- Double-click 2HSS458_EC→Startup parameter→Add

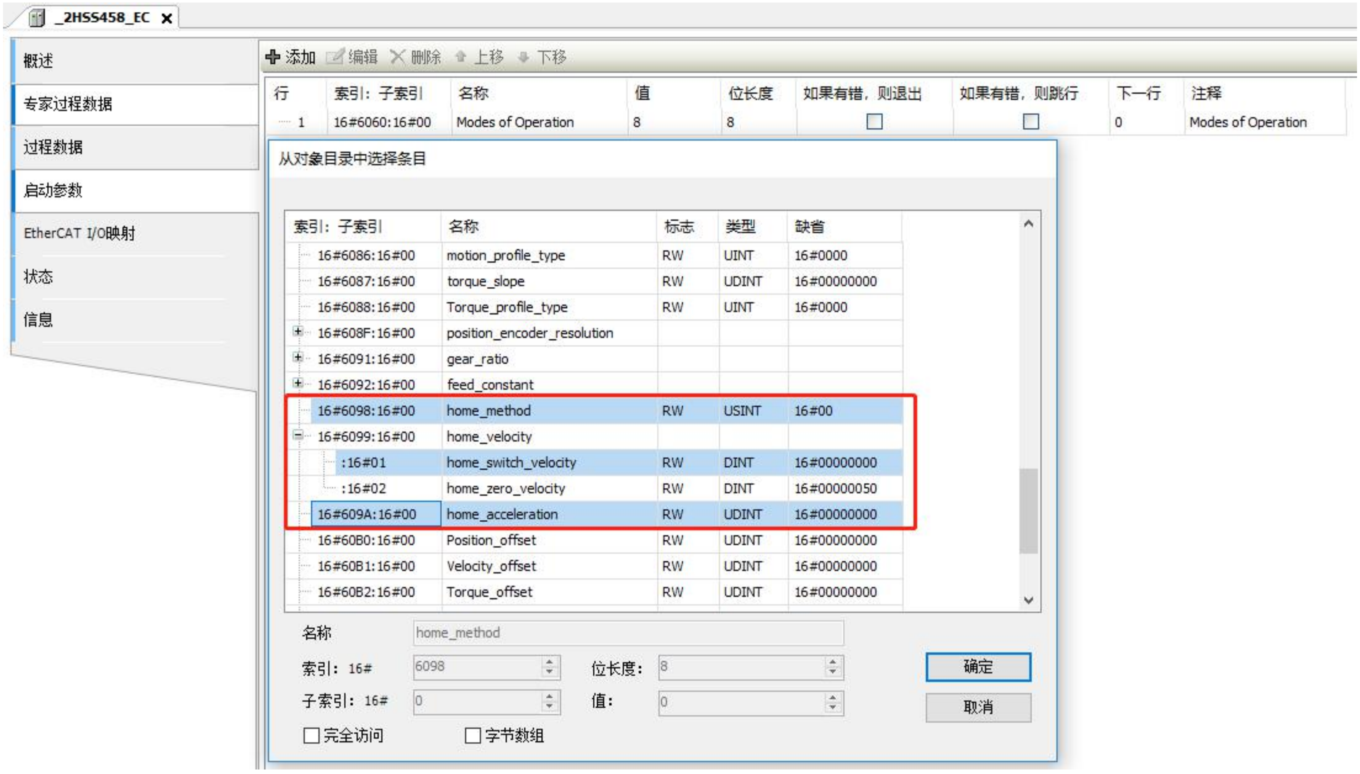


Fig 302 Add start parameter

Figure 303 Add object dictionary index

Add 60986099 [01], 609a → confirm

16#6098： homing type

16#6099 01： homing speed

16#609A： homing acc/dec velocity

Figure 304 After adding the index

Eg:

16#6098=1， select homing type 1

16#6099 01=4000 speed is 1rps

16#609A=40000 acc/dec velicty is 10rps

Because SoftMotion: scaling/mapping is 16#FA0=4000, so the motor needs 4000 pulses for one revolution

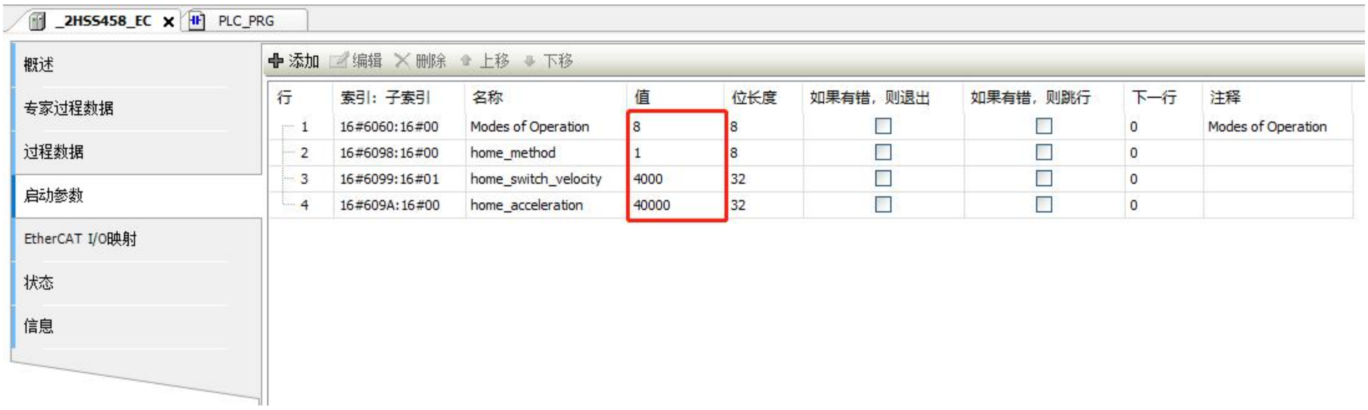


Figure 305 Modify the value of an object

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.

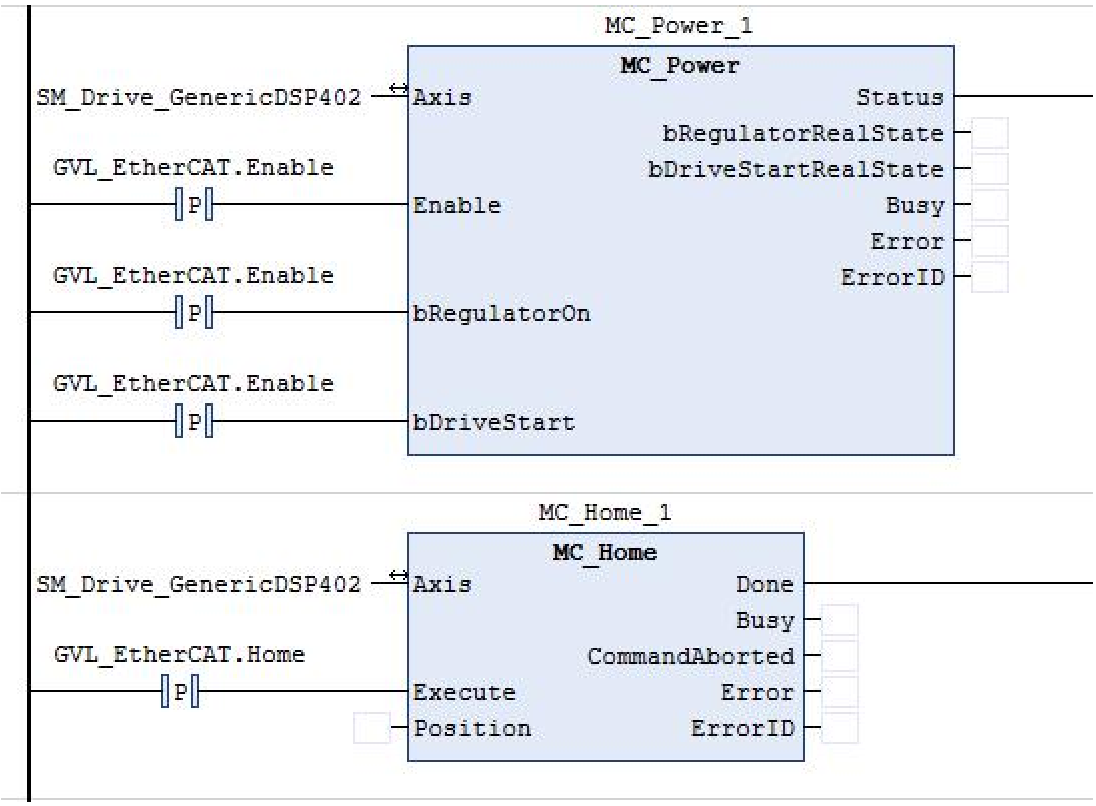


Figure 306 Homing procedure

➢ 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

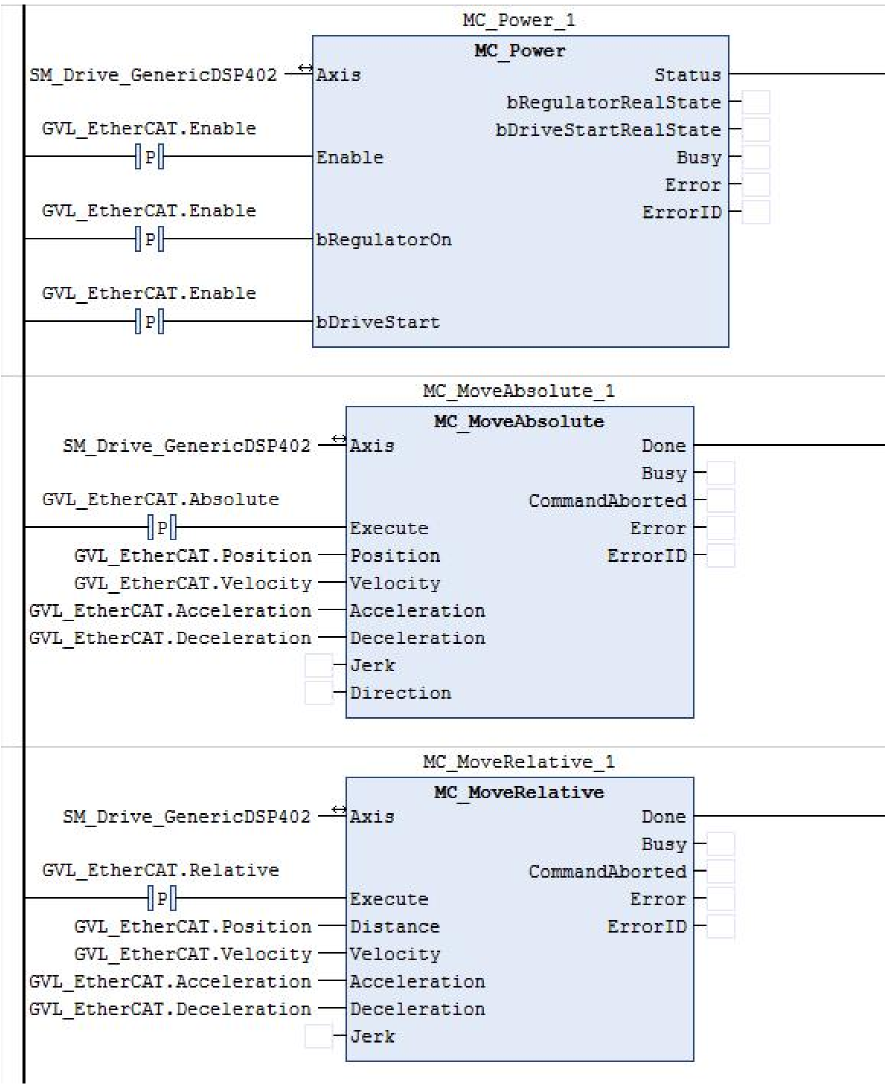
Distance: Relative motion position (unit: number of motor revolutions)

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 307 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.

➢

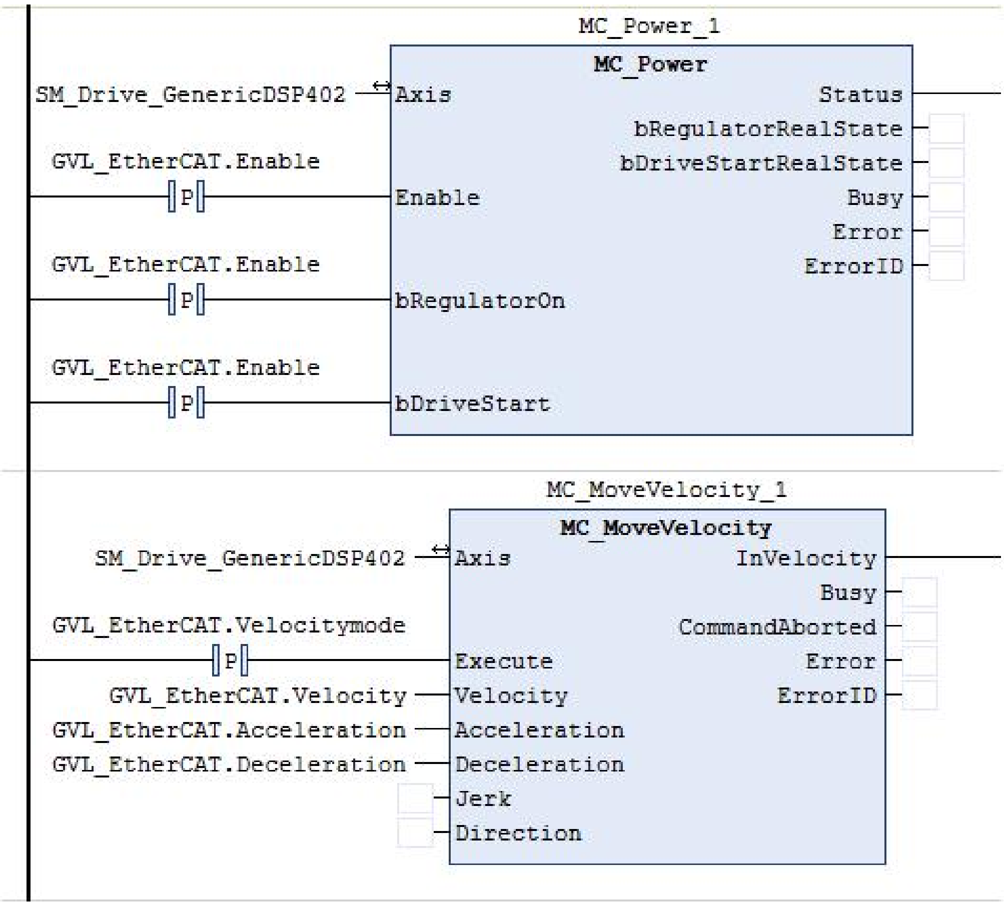


Fig 308 Speed mode

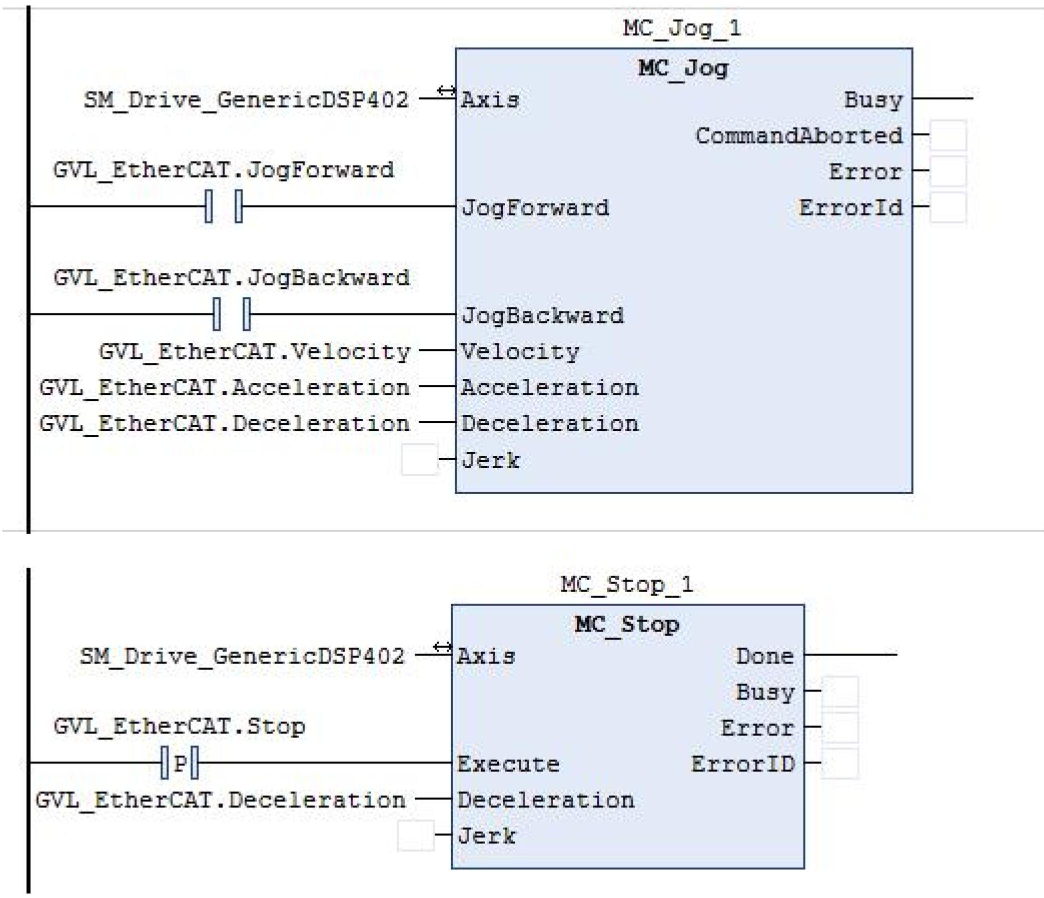


Fig 309 JOG mode

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

_2HSS458_EC | PLC_PRG | GVL_EtherCAT

```
{attribute 'qualified_only'}
VAR_GLOBAL
    Enable : BOOL :=FALSE;
    Home : BOOL :=FALSE;
    Absolute : BOOL :=FALSE;
    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

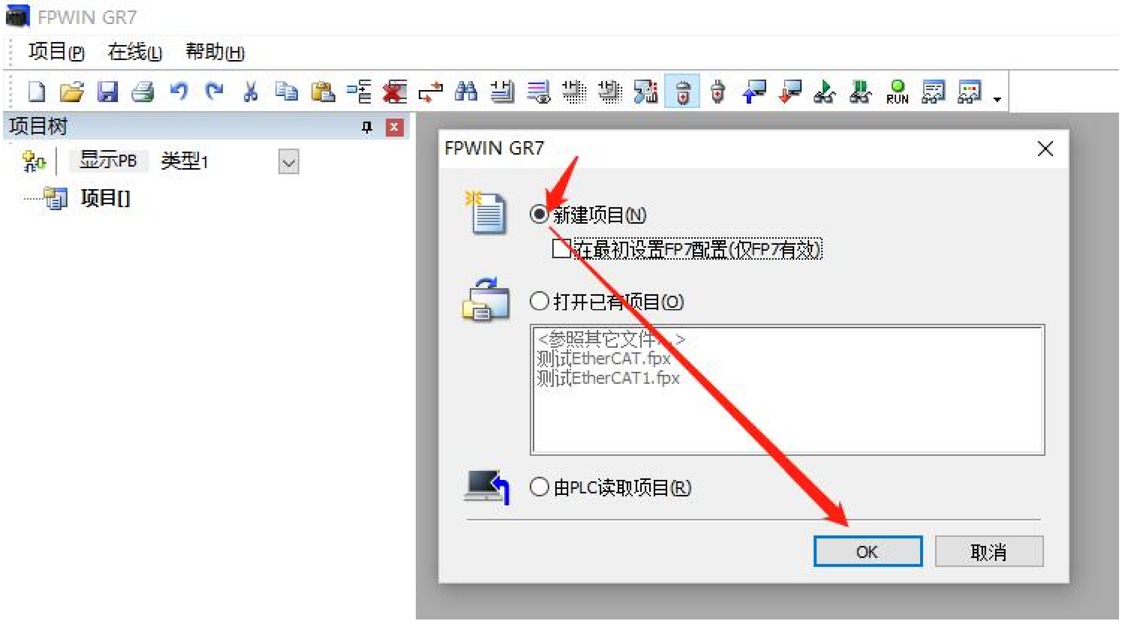


Fig 311 New FPWIN project

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

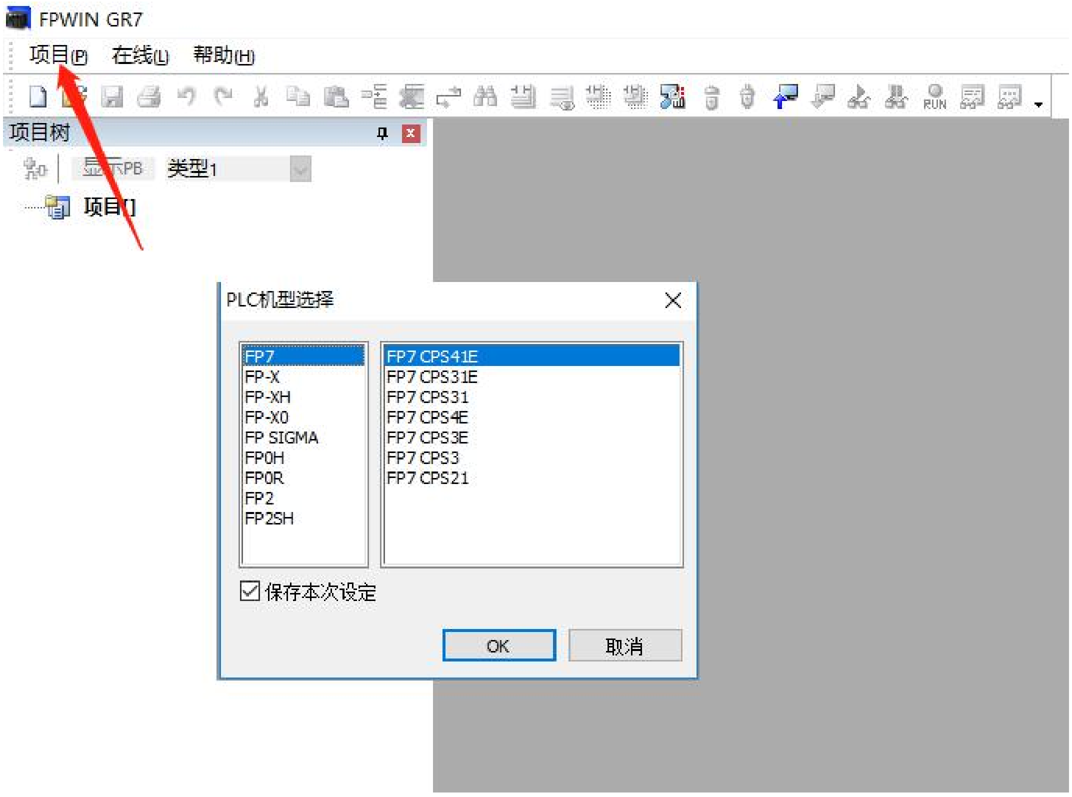


Fig 312 Select CPU unit and motion control unit

- Configure I/O mapping

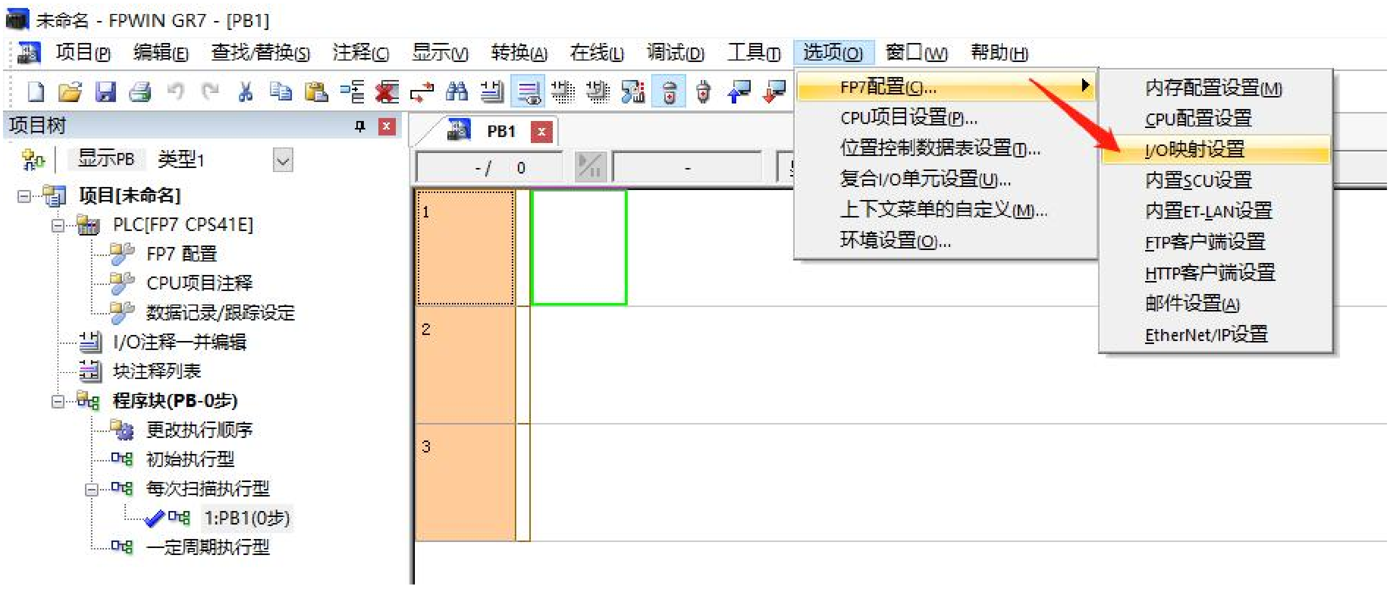


Fig 313 Configure I/O mapping

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

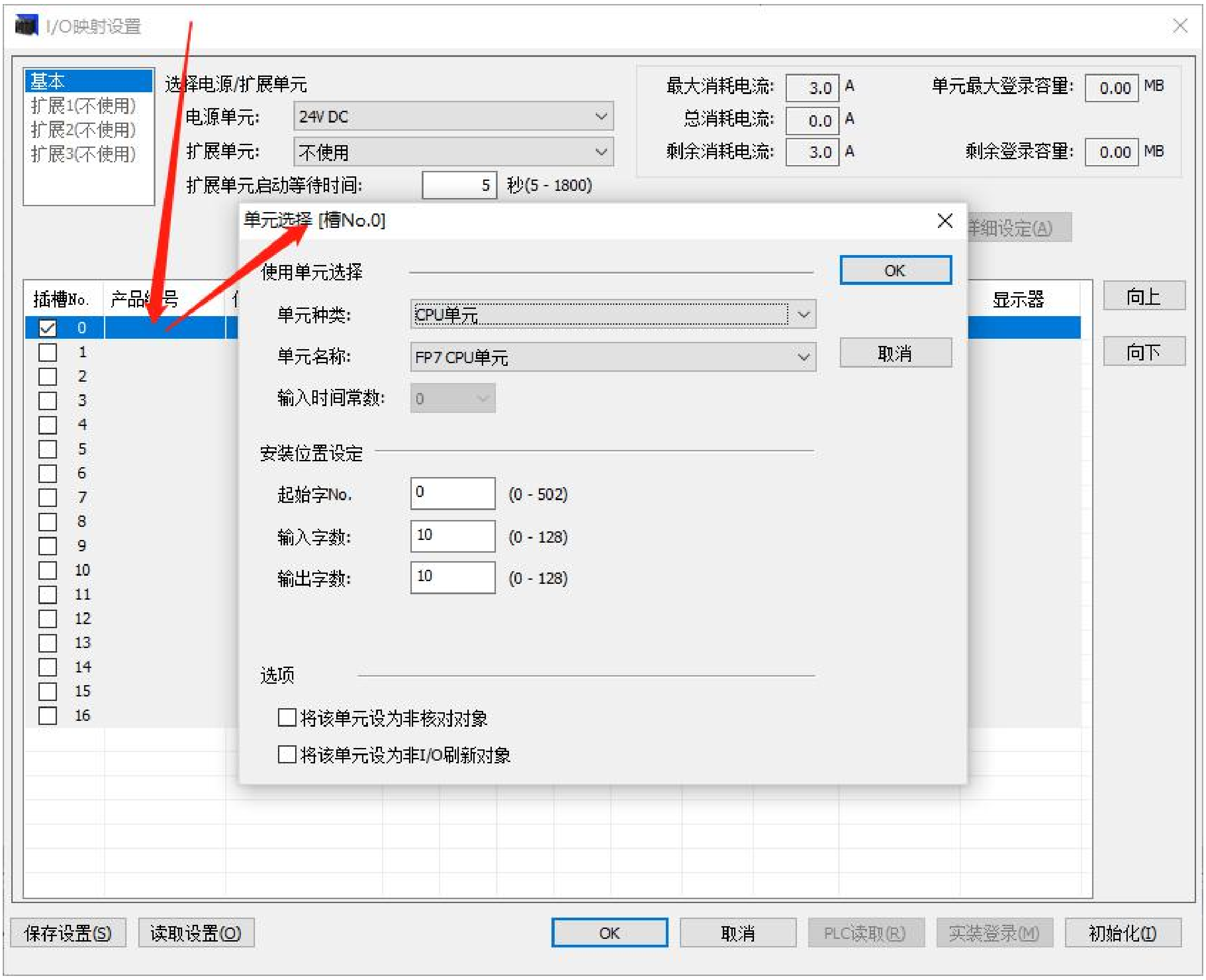


Figure 314 selecting unit type and unit name - slot No.0

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

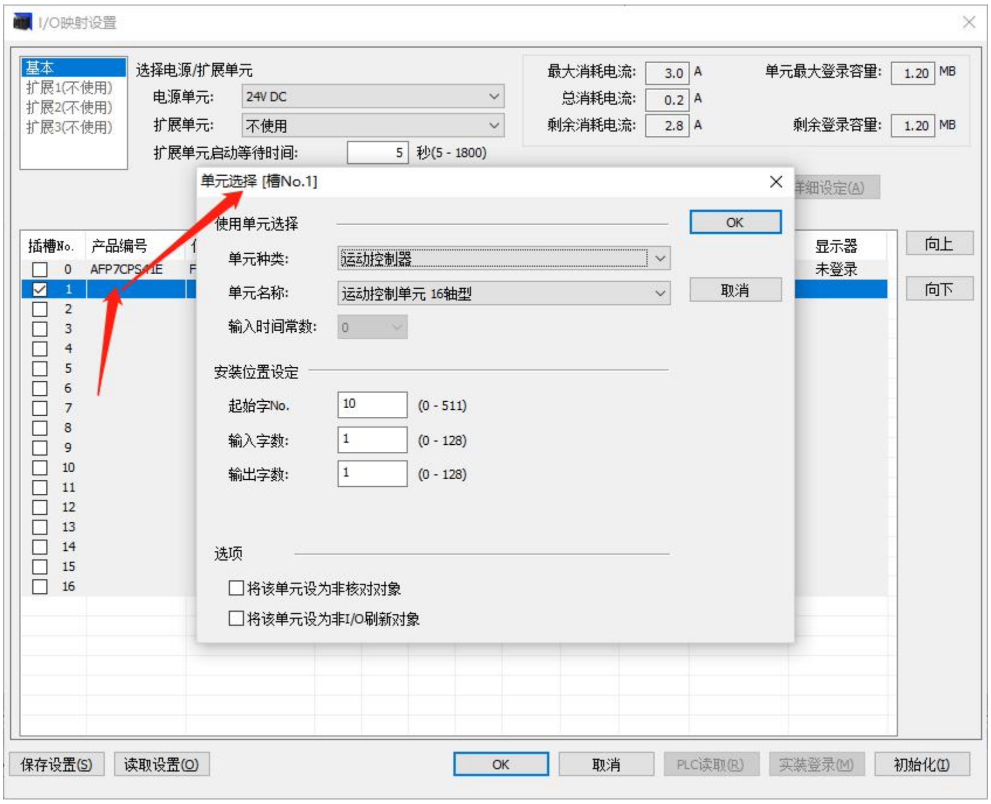


Fig 315. Select the unit type and unit name-Slot No. 1

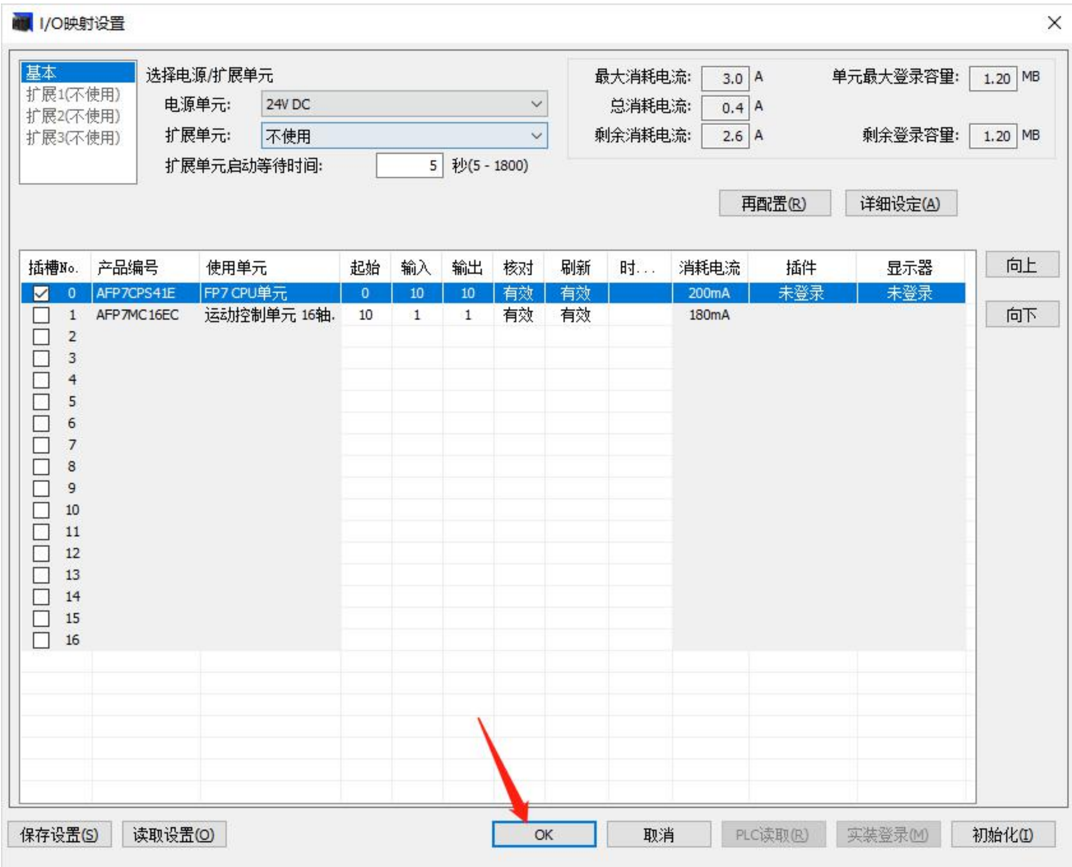


Fig 316 Select complete

Set the parameters of the shaft by CMI software

1 New Project

- Open the software ,Control Motion Integrator→new create

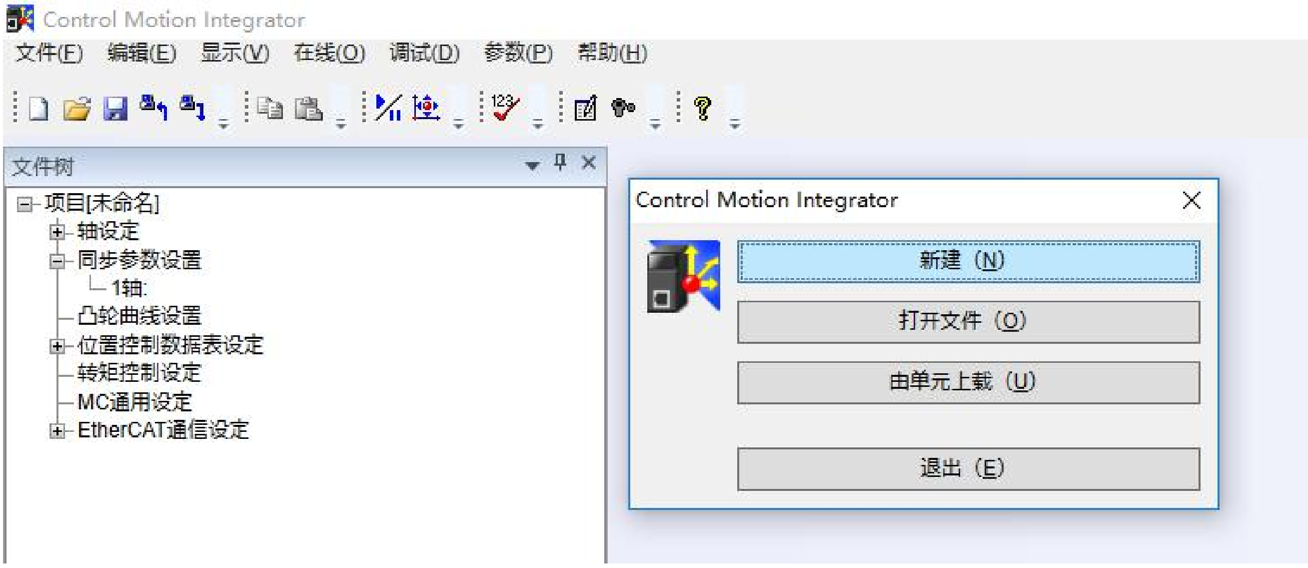


Fig 317 Create New CMI project

- 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
-

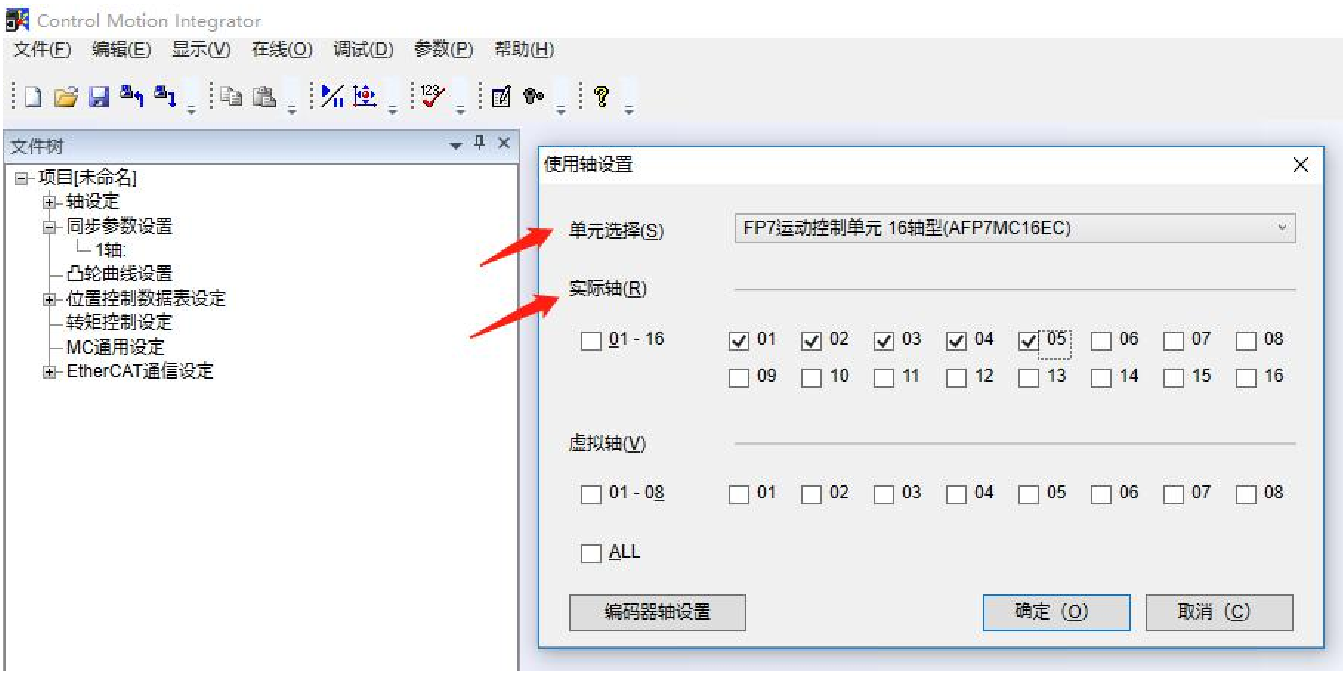


Fig 318 Select Motion Control Unit

- Whether the axis should be interpolated; if necessary, please add the axis to the interpolation group, if not, directly confirm
-

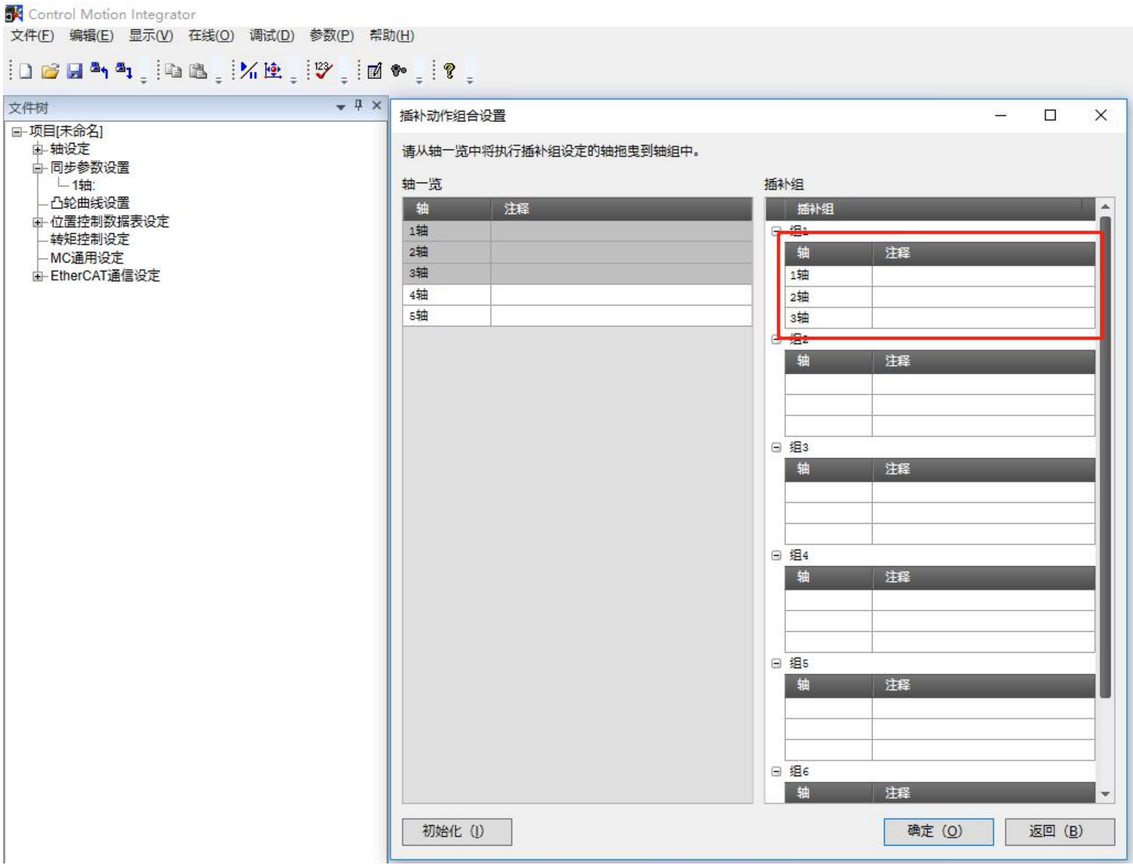


Fig 319 Interpolation group

2 Add ESI file

- Double-click EtherCAT communication settings

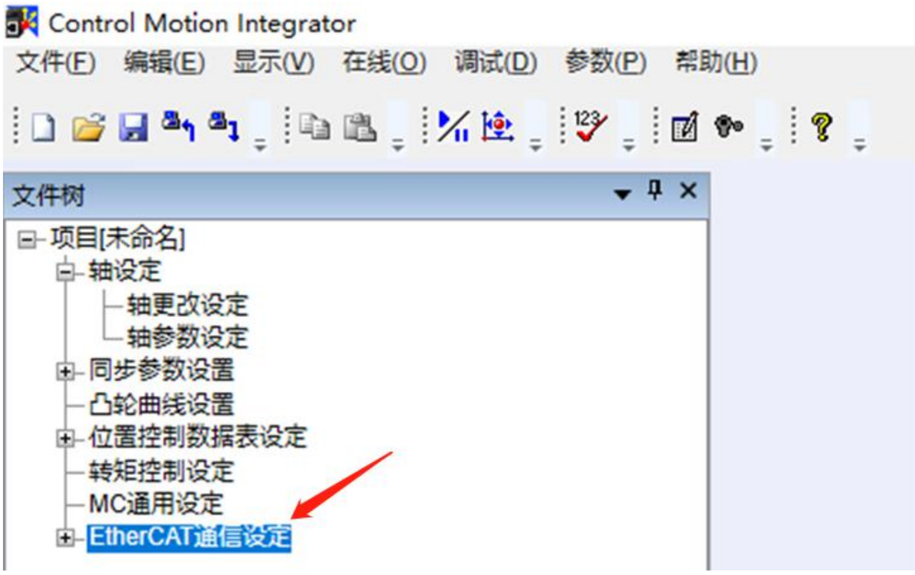


Fig 320 EtherCATCommunication settings

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

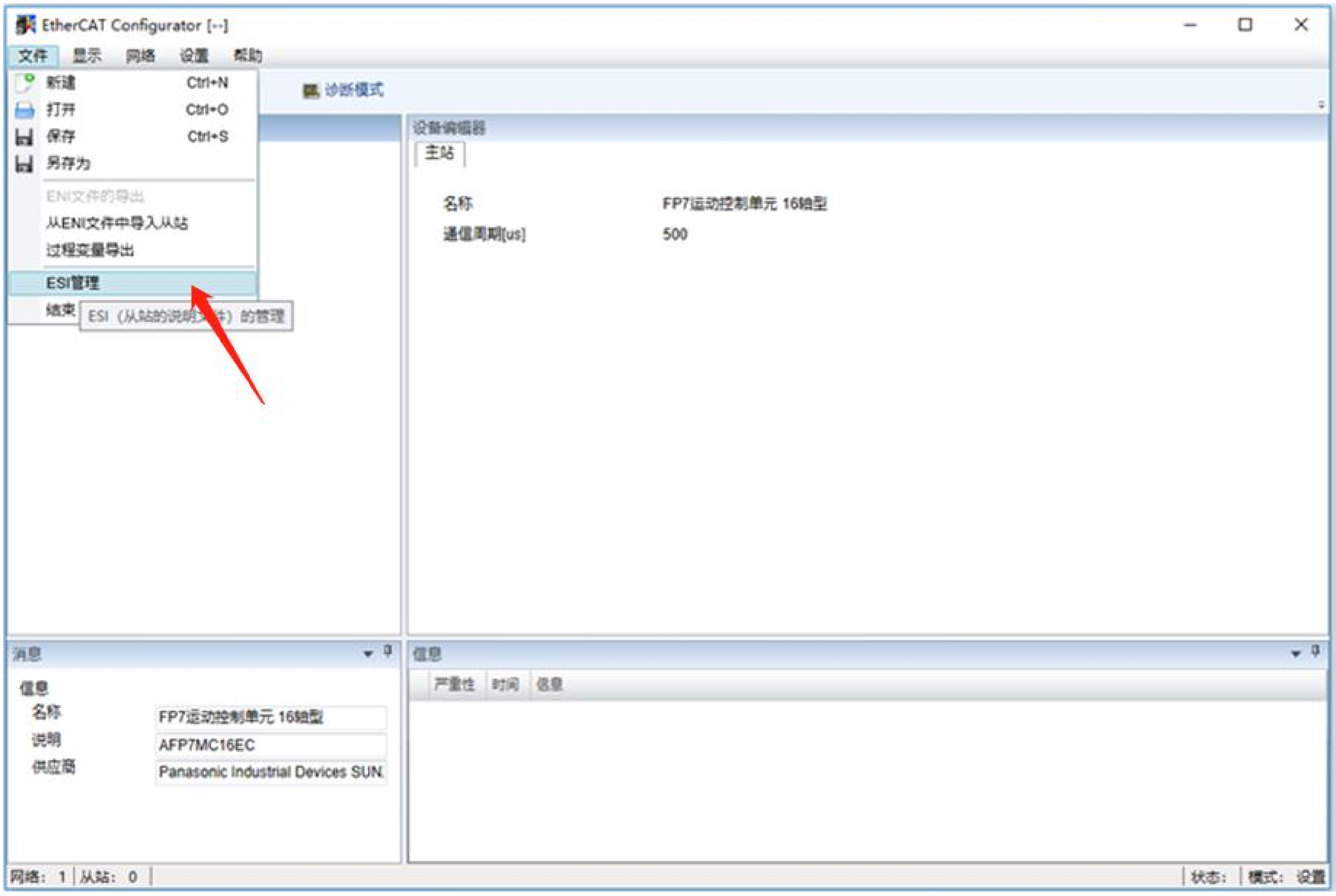


Fig 321 ESI manage

- Click the file to add

Fig 322 add ESI

Add ESI file→

Open

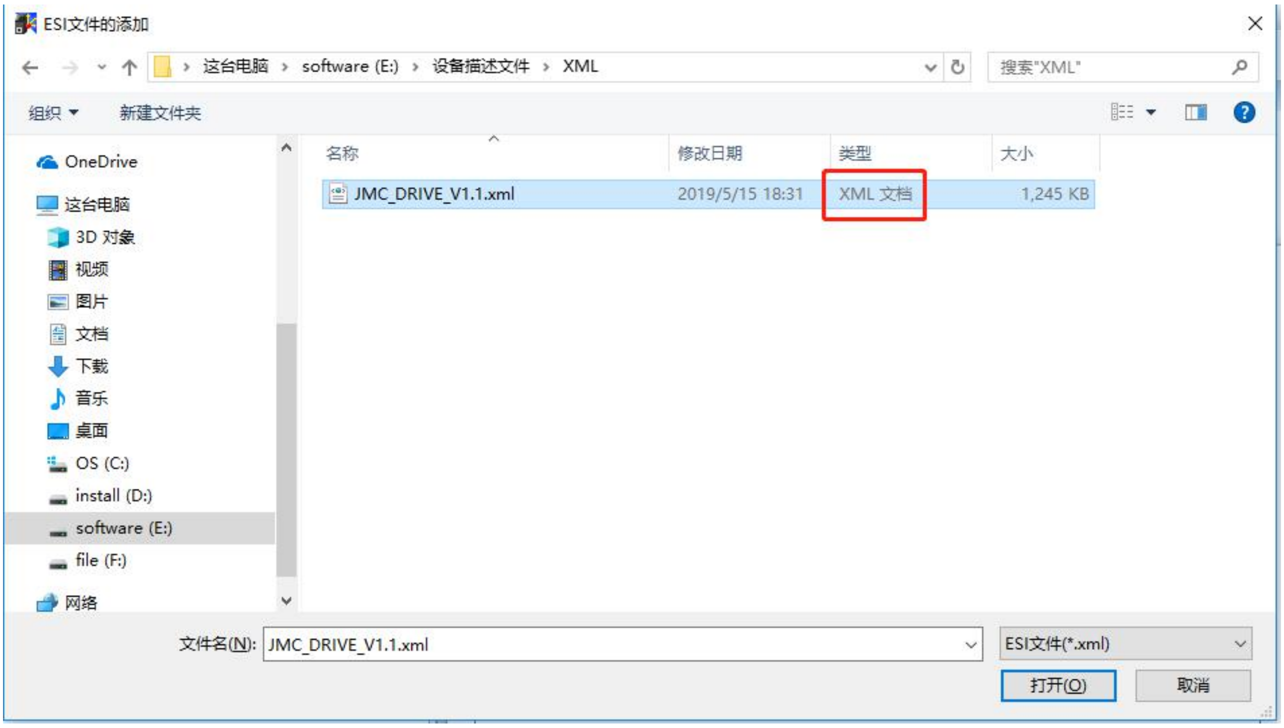


Fig 323 Open XML file

- Add successfully

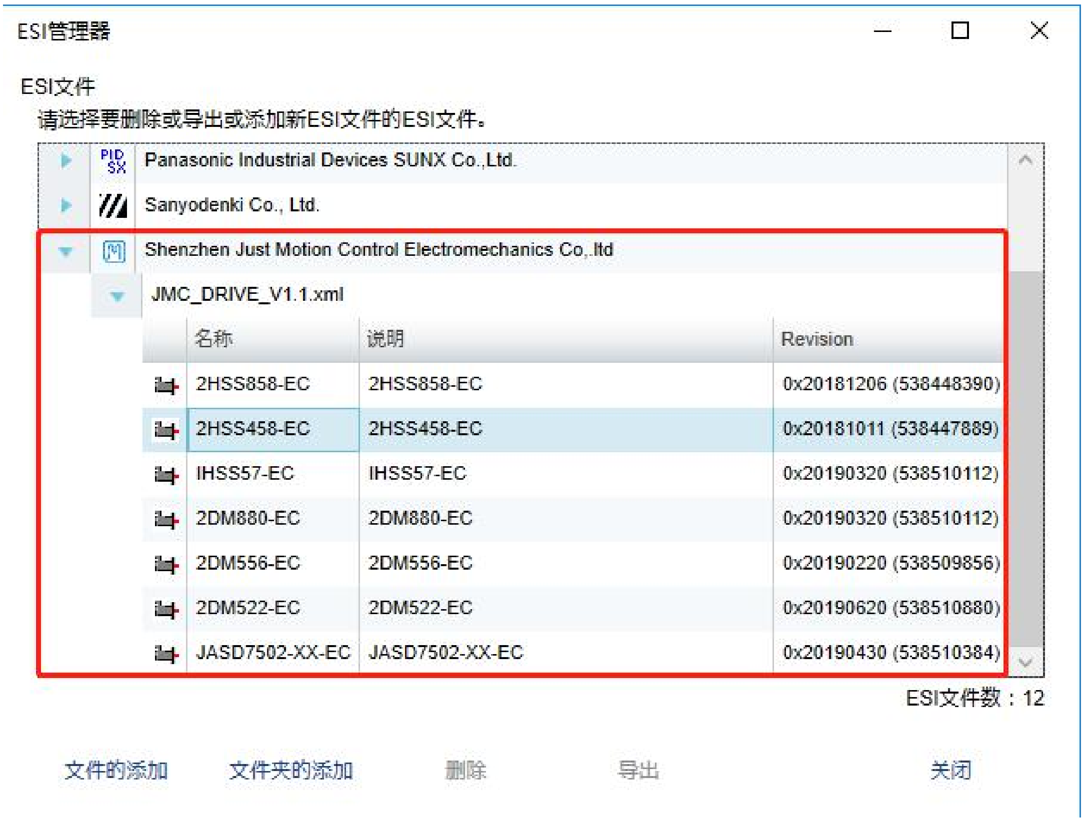


Fig 324 add XML succeed

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

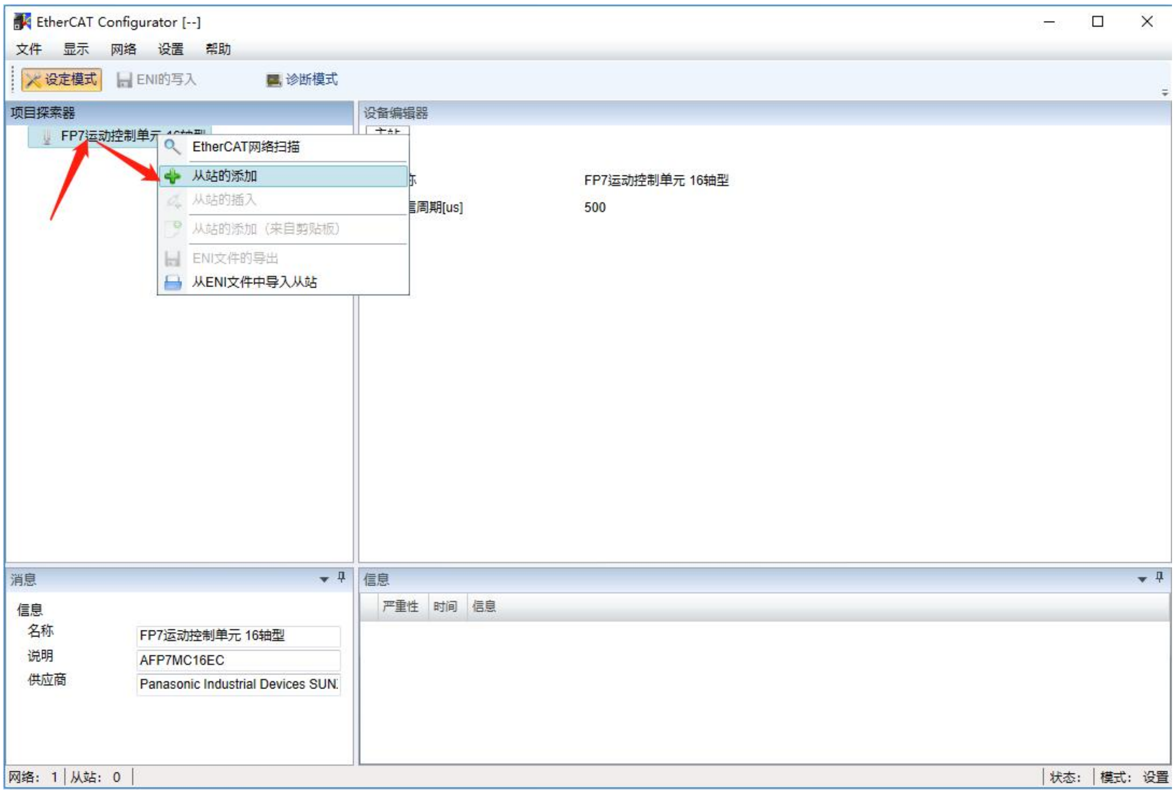


Fig 325 Select shaft model

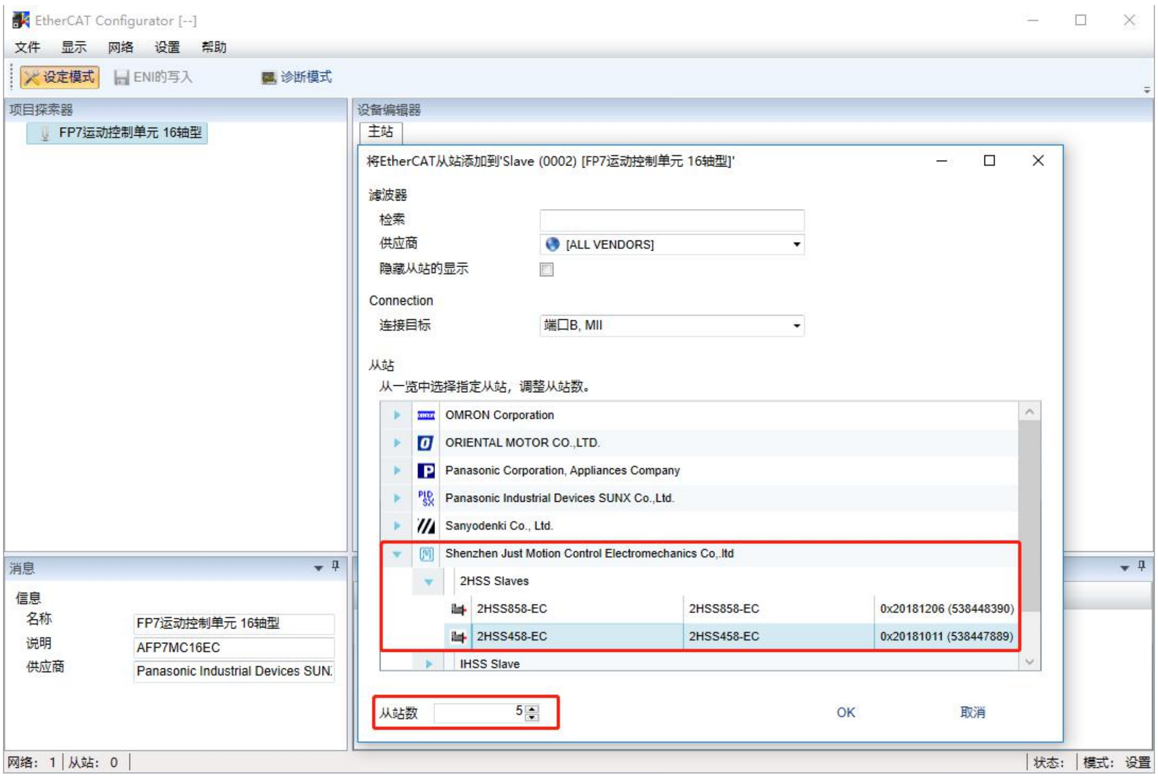


Fig 326 Set the number of slaves

- Add completed

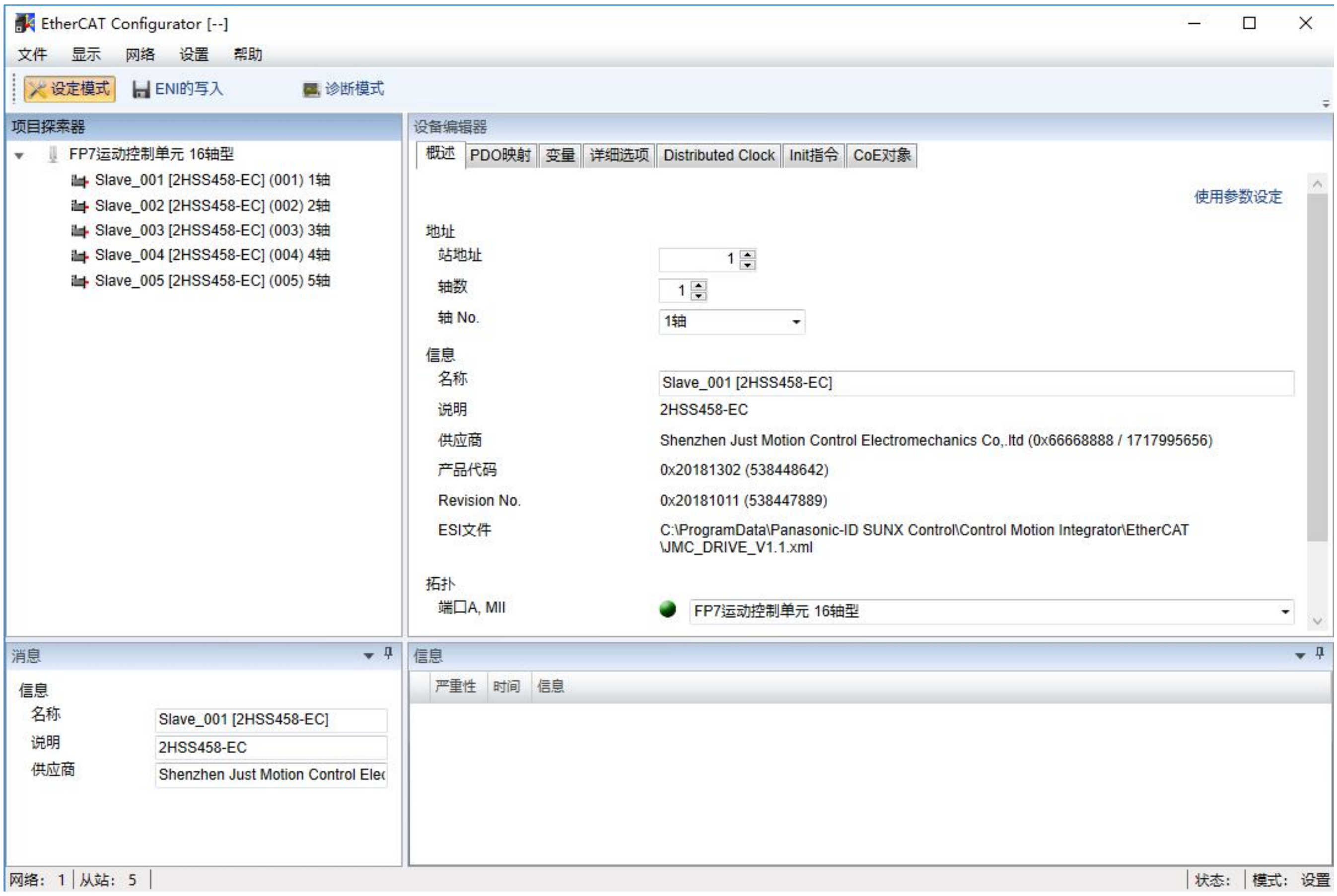


Fig 327 Add completed

4 Shaft parameters setting

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

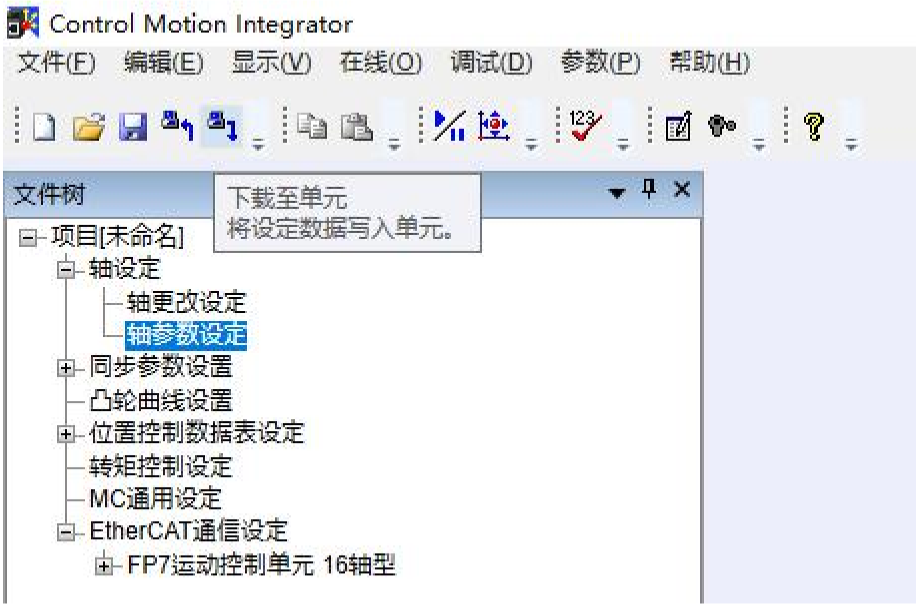
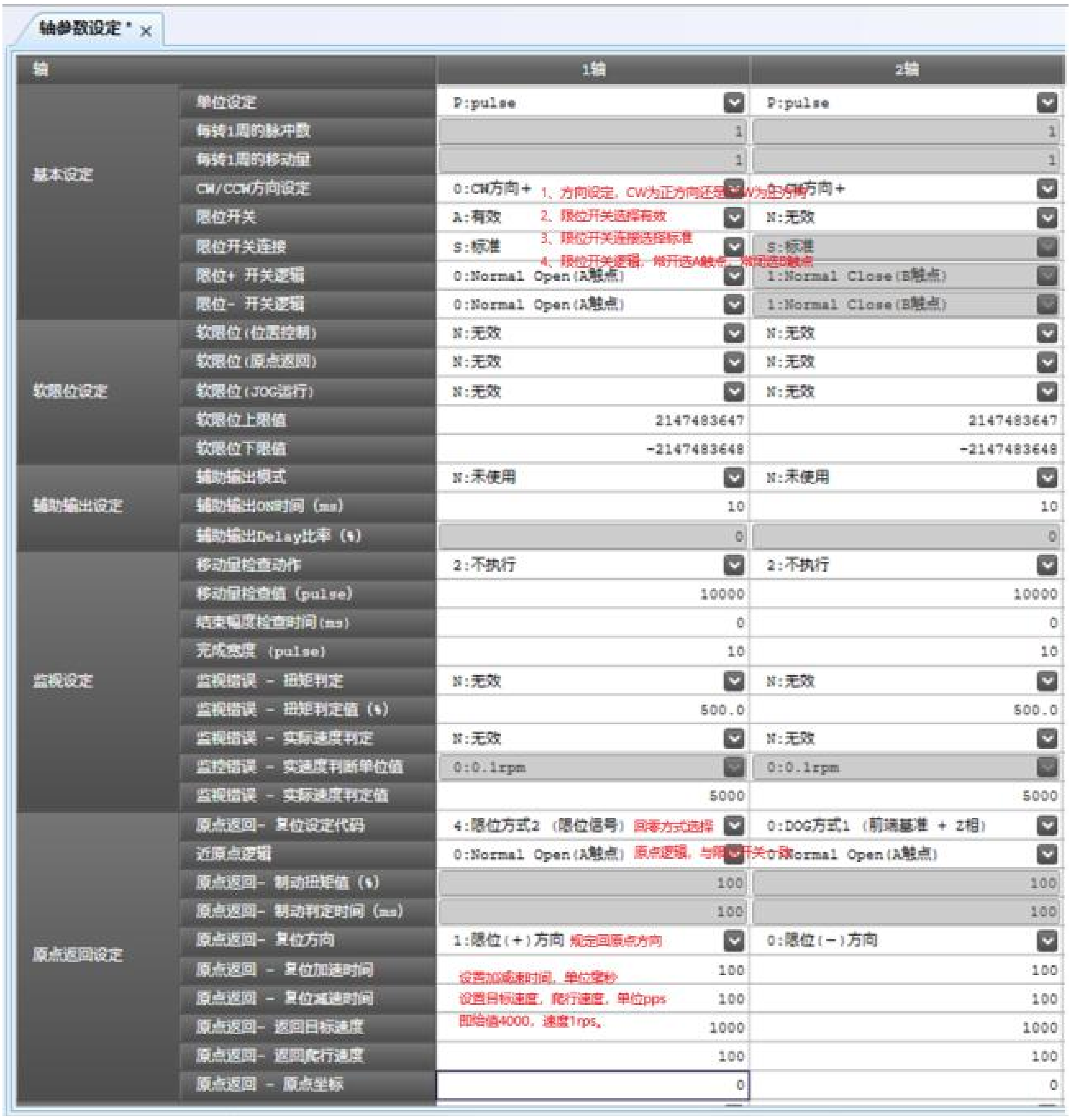


Fig 328 Axis parameter setting

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 *

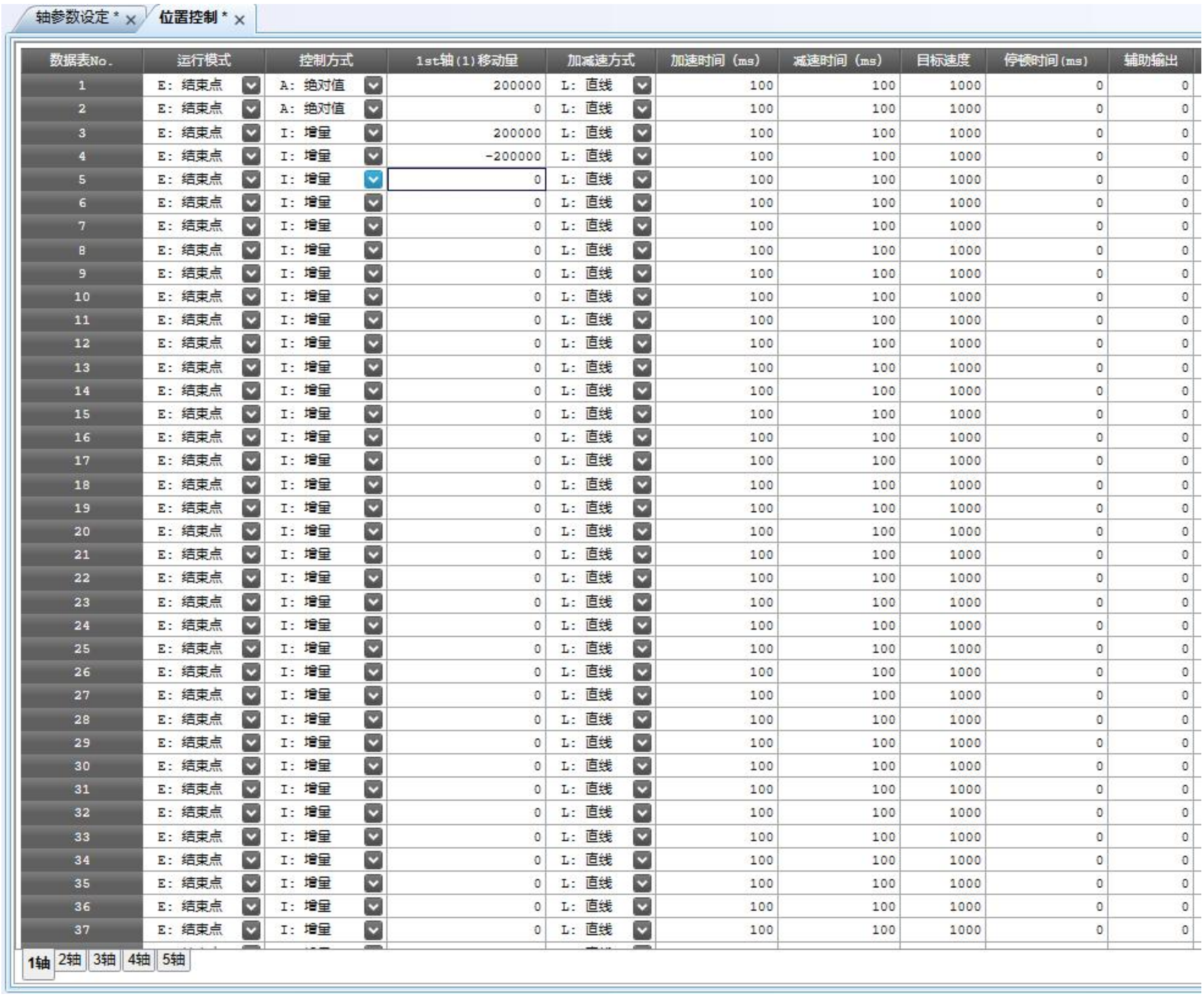
轴		1轴	2轴
基本设定	单位设定	P:pulse	P:pulse
	每转1周的脉冲数	1	1
	每转1周的移动量	1	1
	CW/CCW方向设定	0:CW方向+ 1、方向设定，CW为正方向还是CCW为正方向	0:CW方向+
	限位开关	A:有效 2、限位开关选择有效	N:无效
	限位开关连接	S:标准 3、限位开关连接选择标准	S:标准
	限位+ 开关逻辑	0:Normal Open(A触点) 4、限位开关逻辑，常开选A触点，常闭选B触点	1:Normal Close(B触点)
	限位- 开关逻辑	0:Normal Open(A触点)	1:Normal Close(B触点)
软限位设定	软限位(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) 回零方式选择	0:DOG方式1 (前端基准 + Z相)
	近原点逻辑	0:Normal Open(A触点) 原点逻辑，与限位开关一致	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 规定回原点方向	0:限位(-)方向
	原点返回 - 复位加速时间	设置加减速时间，单位毫秒 100	100
	原点返回 - 复位减速时间	设置目标速度，爬行速度，单位pps 100	100
	原点返回- 返回目标速度	即给值4000，速度1rps。 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 329 Setting example

5 Position parameter setting

- Double-click the position control setting in the file tree

Because our unit is set to pulse, the drive subdivision defaults to 4000, that is, the value 4000 is one lap, and 200000 is 50 laps. For operation mode and control method, please refer to Chapter 5.3 of FP7 Motion Control Unit User Manual



数据表No.	运行模式	控制方式	1st轴(1)移动量	加减速方式	加速时间 (ms)	减速时间 (ms)	目标速度	停顿时间(ms)	辅助输出
1	E: 结束点	A: 绝对值	200000	L: 直线	100	100	1000	0	0
2	E: 结束点	A: 绝对值	0	L: 直线	100	100	1000	0	0
3	E: 结束点	I: 增量	200000	L: 直线	100	100	1000	0	0
4	E: 结束点	I: 增量	-200000	L: 直线	100	100	1000	0	0
5	E: 结束点	I: 增量	0	L: 直线	100	100	1000	0	0
6	E: 结束点	I: 增量	0	L: 直线	100	100	1000	0	0
7	E: 结束点	I: 增量	0	L: 直线	100	100	1000	0	0
8	E: 结束点	I: 增量	0	L: 直线	100	100	1000	0	0
9	E: 结束点	I: 增量	0	L: 直线	100	100	1000	0	0
10	E: 结束点	I: 增量	0	L: 直线	100	100	1000	0	0
11	E: 结束点	I: 增量	0	L: 直线	100	100	1000	0	0
12	E: 结束点	I: 增量	0	L: 直线	100	100	1000	0	0
13	E: 结束点	I: 增量	0	L: 直线	100	100	1000	0	0
14	E: 结束点	I: 增量	0	L: 直线	100	100	1000	0	0
15	E: 结束点	I: 增量	0	L: 直线	100	100	1000	0	0
16	E: 结束点	I: 增量	0	L: 直线	100	100	1000	0	0
17	E: 结束点	I: 增量	0	L: 直线	100	100	1000	0	0
18	E: 结束点	I: 增量	0	L: 直线	100	100	1000	0	0
19	E: 结束点	I: 增量	0	L: 直线	100	100	1000	0	0
20	E: 结束点	I: 增量	0	L: 直线	100	100	1000	0	0
21	E: 结束点	I: 增量	0	L: 直线	100	100	1000	0	0
22	E: 结束点	I: 增量	0	L: 直线	100	100	1000	0	0
23	E: 结束点	I: 增量	0	L: 直线	100	100	1000	0	0
24	E: 结束点	I: 增量	0	L: 直线	100	100	1000	0	0
25	E: 结束点	I: 增量	0	L: 直线	100	100	1000	0	0
26	E: 结束点	I: 增量	0	L: 直线	100	100	1000	0	0
27	E: 结束点	I: 增量	0	L: 直线	100	100	1000	0	0
28	E: 结束点	I: 增量	0	L: 直线	100	100	1000	0	0
29	E: 结束点	I: 增量	0	L: 直线	100	100	1000	0	0
30	E: 结束点	I: 增量	0	L: 直线	100	100	1000	0	0
31	E: 结束点	I: 增量	0	L: 直线	100	100	1000	0	0
32	E: 结束点	I: 增量	0	L: 直线	100	100	1000	0	0
33	E: 结束点	I: 增量	0	L: 直线	100	100	1000	0	0
34	E: 结束点	I: 增量	0	L: 直线	100	100	1000	0	0
35	E: 结束点	I: 增量	0	L: 直线	100	100	1000	0	0
36	E: 结束点	I: 增量	0	L: 直线	100	100	1000	0	0
37	E: 结束点	I: 增量	0	L: 直线	100	100	1000	0	0

Fig 330　Position parameter setting

6　Download parameters

- Click to download to the unit

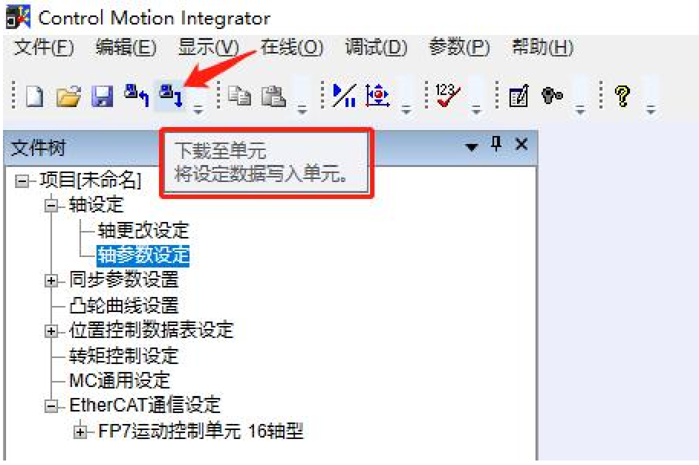


图 331 下载参数

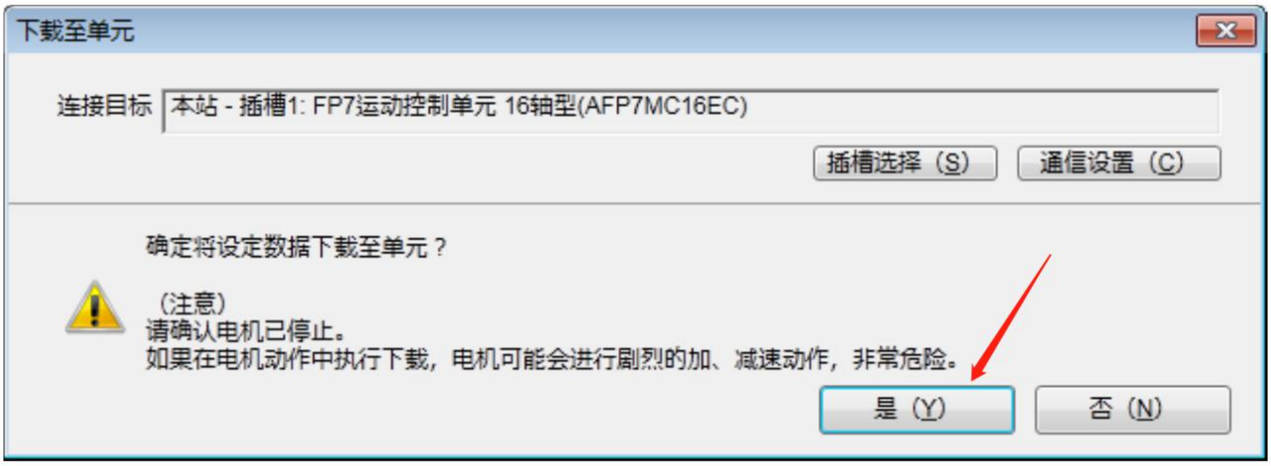


Figure 332 Download to unit

For specific programming code, refer to Panasonic's official "FP7 Motion Control Unit User Manual", which has detailed tutorials.

Contact us

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