RS EtherCAT Series Servo

User Manual

Preface

First of all, thank you for purchasing the RSE series V3.0 servo driver!

RSE series V3.0 servo driver is the third generation bus-type AC servo driver independently developed by Rtelligent. The power range of this series of products is 0.05～3KW, supports CoE (CANopen over EtherCAT), and can be networked. The driver also contains an internal PLC mode to facilitate customer customization.

The RSE series servo system is equipped with a standard 17～23-bit single-turn/multi-turn absolute encoder motor, and the frame below 80 adopts a full series of ultra-short high-density servo motors. It can achieve ultra-small installation size and high-speed precise positioning.

The RSE series servo system has the characteristics of fast positioning and good adaptability. The driver has seven basic control modes (CSP control, CSV control, CST control, PP control, PV control, PT control, HM control). In addition, more flexible application functions can be realized by using the driver's "internal PLC programming".

This manual is a comprehensive user manual of the RSE series V3.0 servo drive. Please read this manual carefully to confirm the relevant information before the formal power-on connection. If you have any doubts about product functions and performance, please consult our company's technical support. Due to the continuous improvement of servo drives, the information provided by our company is subject to change without notice.

Manual version change record

Date	Changed version	Changes
2020.10	V3.0	Version 1 product updates
2021.12	V3.1	1、Modify some errors 2、Add matching pictures

Contents

PREFACE I

MANUAL VERSION CHANGE RECORD II

CONTENTS 1

CHAPTER 1 SAFETY REMINDERS 6

1.1 SAFETY PRECAUTIONS 6

1.2 PRECAUTIONS WHEN CONFIRMING THE ARRIVAL OF THE PRODUCT 7

1.3 PACKING LIST 7

CHAPTER 2 PRODUCT INFORMATION AND INSTALLATION 8

2.1 DRIVER INTRODUCTION 8

2.1.1 *Nameplate and model description* 8

2.1.2 *Servo driver specifications* 8

2.1.3 *Driver installation* 9

2.2 SERVO MOTOR MODEL DESCRIPTION 11

2.2.1 *Motor naming* 11

2.2.2 *Motor specifications* 11

2.2.3 *Encoder type* 12

2.3 MOTOR INSTALLATION 13

2.3.1 *Servo motor use environment* 13

2.3.2 *Servo motor size* 13

2.3.3 *Precautions for motor installation* 16

2.4 SERVO SYSTEM CONFIGURATION LIST 16

2.5 MATCHING CABLE SPECIFICATIONS 18

2.5.1 *Motor and encoder wiring* 18

2.5.2 *Mini-USB debugging cable* 19

2.5.3 *EtherCAT communication cable* 20

2.5.4 *Instructions for braking resistor* 20

2.6 ACCESSORIES DESCRIPTION OF MULTITURN ABSOLUTE ENCODER 21

CHAPTER 3 SERVO DRIVER AND MOTOR WIRING 22

3.1 SERVO DRIVER INTERFACE DISTRIBUTION 22

3.2 SERVO DRIVER MAIN CIRCUIT CONNECTION 22

3.3 SERVO DRIVER ENCODER SIGNAL TERMINAL CN2 CONNECTION 23

3.4 THE CONNECTION OF THE CONTROL SIGNAL TERMINAL CN1 OF THE SERVO DRIVER 24

3.4.1 *CN1 pin definition* 24

3.4.2 *Universal input interface* 25

3.4.3 *Universal output interface* 28
3.5 THE CONNECTION OF THE DRIVER DEBUGGING COMMUNICATION TERMINAL CN3 30
3.6 CONNECTION OF DRIVER ETHERCAT COMMUNICATION TERMINALS CN4 AND CN5 30
3.7 EXAMPLE OF BRAKE CONTROL CONNECTION 30
3.8 ANTI-INTERFERENCE COUNTERMEASURES FOR ELECTRICAL WIRING 31

CHAPTER 4 PANEL DISPLAY AND OPERATION 32

4.1 PANEL DISPLAY OVERVIEW 32
4.1.1 *Panel composition introduction* 32
4.1.2 *Panel display content* 32
4.1.3 *Panel display operation method* 33
4.1.4 *Data display* 33
4.1.5 *Fault display* 35
4.1.6 *Monitor display* 35
4.2 PARAMETER SETTING 36
4.3 AUXILIARY FUNCTION 37
4.3.1 *Parameter management* 37
4.3.2 *Fault reset* 38
4.3.3 *Absolute value operation* 38
4.3.4 *Jog test machine* 39
4.3.5 *Open loop test* 39
4.3.6 *Encoder calibration* 39
4.3.7 *Jog operation* 39
4.3.8 *Fixed length/continuous operation* 40

CHAPTER 5 COMMUNICATION NETWORK CONFIGURATION 41

5.1 ETHERCAT PROTOCOL OVERVIEW 41
5.2 SYSTEM PARAMETER SETTING 41
5.3 ETHERCAT COMMUNICATION BASICS 42
5.3.1 *EtherCAT communication specification* 42
5.3.2 *Communications structure* 42
5.3.3 *State machine* 43
5.3.4 *Process Data PDO* 44
5.3.5 *Mailbox Data SDO* 46
5.3.6 *Distributed clock* 46
5.3.7 *Status indicators* 46
5.3.8 *Introduction to CIA 402 Control* 49
5.3.9 *Basic features* 51

CHAPTER 6 CONTROL MODE 53

6.1 BASIC SETTINGS 53

6.1.1 *Conversion factor setting* *53*

6.2 SERVO STATUS SETTING 54

6.2.1 *Control word 6040h* *57*

6.2.2 *Status word 6041h* *57*

6.3 SERVO MODE SETTING 58

6.3.1 *Introduction to servo mode* *58*

6.3.2 *Mode Switching* *59*

6.4 CYCLIC SYNCHRONOUS POSITION MODE (CSP) 59

6.4.1 *Related objects* *59*

6.4.2 *Related function settings* *61*

6.4.3 *Recommended configuration* *61*

6.5 CYCLIC SYNCHRONOUS VELOCITY MODE (CSV) 63

6.5.1 *Related objects* *63*

6.5.2 *Related function settings* *64*

6.5.3 *Recommended configuration* *64*

6.6 CYCLIC SYNCHRONOUS TORQUE MODE（CST） 64

6.6.1 *Related objects* *65*

6.6.2 *Related function settings* *66*

6.6.3 *Related function settings* *66*

6.7 PROFILE POSITION MODE (PP) 66

6.7.1 *Related objects* *66*

6.7.2 *Related function settings* *68*

6.7.3 *Position curve generator* *69*

6.7.4 *Recommended configuration* *70*

6.8 PROFILE VELOCITY MODE (PV) 71

6.8.1 *Related objects* *71*

6.8.2 *Related function settings* *72*

6.8.3 *Recommended configuration* *72*

6.9 PROFILE TORQUE MODE (PT) 72

6.9.1 *Related objects* *73*

6.9.2 *Related function settings* *74*

6.9.3 *Recommended configuration* *74*

6.10 HOMING MODE（HM） 74

6.10.1 *Related objects* *75*

6.10.2 *Introduction to Home pperation* *76*

6.10.3 *Recommended configuration* *82*
6.11 INTRODUCTION OF AUXILIARY FUNCTIONS 82
6.11.1 *Probe function* *82*
CHAPTER 7 DETAILED DESCRIPTION OF THE OBJECT DICTIONARY 85
7.1 OBJECT DICTIONARY CLASSIFICATION DESCRIPTION 85
7.2 DETAILED DESCRIPTION OF COMMUNICATION PARAMETERS (GROUP 1000H) 87
7.3 DETAILED DESCRIPTION OF MANUFACTURER-DEFINED PARAMETERS (GROUP 2000H) 93
7.3.1 *Servo motor parameters* *93*
7.3.2 *Driver parameters* *95*
7.3.3 *Encoder parameters* *95*
7.3.4 *Basic control parameters* *96*
7.3.5 *Input terminal parameters* *97*
7.3.6 *Output terminal parameters* *99*
7.3.7 *Position control parameters* *100*
7.3.8 *Speed control parameters* *101*
7.3.9 *Torque control parameters* *102*
7.3.10 *Gain parameters* *103*
7.3.11 *Self-tuning parameters* *104*
7.3.12 *Fault parameters* *106*
7.4 DETAILED DESCRIPTION OF SUB-PROTOCOL DEFINITION PARAMETERS (GROUP 6000H) 107
CHAPTER 8 APPLICATION CASES 117
8.1 COOPERATE WITH OMRON CONTROLLER OPERATION CASE 117
8.1.1 *Add device description fil* *117*
8.1.2 *New construction* *118*
8.1.3 *Add drive* *119*
8.1.4 *Add motion control axis* *120*
8.1.5 *Map axis and drive* *121*
8.1.6 *Write test code* *121*
8.1.7 *Connect the drive* *123*
8.1.8 *Assign drive address* *124*
8.1.9 *Program download* *125*
8.1.10 *Motion test* *125*
8.2 COOPERATE WITH BECKHOFF CONTROLLER OPERATION CASE 126
8.2.1 *Add device description file* *126*
8.2.2 *New Project* *126*
8.2.3 *Add master network card* *127*
8.2.4 *Install the network card driver* *128*

8.2.5 *Find drive* *128*
8.2.6 *Set electronic gear ratio* *130*
8.2.7 *Encoder settings* *130*
8.2.8 *Set motion parameters* *131*
8.2.9 *Activation* *131*
8.2.10 *Enable motor* *132*
8.2.11 *Motion test* *132*

CHAPTER 9 TROUBLESHOOTING **134**

9.1 ERROR CODE 134

CHAPTER 10 APPENDIX **138**

APPENDIX A LIST OF RELATIONSHIP BETWEEN DRIVE LED DISPLAY PARAMETERS AND OBJECT DICTIONARY 138
Group P00: *138*
Group P01: *139*
Group P02: *140*
Group P03: *141*
Group P04: *142*
Group P05: *144*
Group P06: *144*
Group P08: *145*
Group P12: *146*
Group P13: *146*

Chapter 1 Safety reminders

1.1 Safety precautions

- Please disconnect the power supply for more than 5 minutes before removing or disassembling the driver, otherwise it may cause electric shock due to residual voltage.
- Please never touch the inside of the servo driver, otherwise it may cause electric shock.
- Please insulate the connection part of the power supply terminal, otherwise it may cause
- electric shock.
- The ground terminal of the servo drive must be grounded, otherwise it may cause electric shock.
- Please do not damage or pull on the cable, subject the cable to excessive force, put it under heavy objects or clamp it. Doing so may result in electric shock, which may cause the product to stop or burn out.
- Unless designated personnel, please do not set up, disassemble or repair, otherwise it may
- cause electric shock or injury.
- Please do not remove the cover, cables, connectors and optional accessories while the
- power is on, otherwise it may cause electric shock and damage the driver.
- Please follow the steps required by this manual for trial operation.
- If an operation error occurs while the servo motor is connected to the machine, it will not only cause damage to the machine, but also sometimes cause personal accidents.
- Please do not change the maximum speed value, except for special purposes. Inadvertent change may damage the machine or cause injury.
- When the power is turned on and for a period of time after the power is cut off, the heat sink of the servo driver, the external braking resistor, and the servo motor may become hot. Please do not touch it, otherwise it may cause burns. To prevent accidental contact with hands or parts (cables, etc.), please take safety precautions such as installing an enclosure.
- Please do not touch the rotating part of the servo motor while it is running, as this may
- result in injury.
- If the servo motor is installed on the supporting machine and starts to run, make sure that
- the servo motor can be stopped at any time, otherwise you may get injured.
- Please install a stop device on the machine side to ensure safety.
- The brake of the servo motor with brake is not a stopping device to ensure safety. If a stop device is not provided, it may cause injury.
- If power is restored after a momentary power failure occurs during operation, the machine may restart suddenly, so please do not approach the machine.
- Please take measures to ensure that personal safety will not be endangered when restarting, otherwise it may cause injury.
- Please do not modify the product in any way, otherwise it may cause injury or mechanical damage.

- Please install the servo driver, servo motor, and external braking resistor on non-combustible materials, otherwise it may cause a fire.
- Between the power supply and the main circuit power supply of the servo driver (single-phase R, S, three-phase R, S, T), be sure to connect an electromagnetic contactor and a non-fuse circuit breaker. Otherwise, when the servo drive fails, the large current cannot be cut off, which may cause a fire.
- In the servo driver and servo motor, please do not mix oil, grease and other flammable foreign objects and screws, metal pieces and other conductive foreign objects, otherwise it may cause fire and other accidents.

1.2 Precautions when confirming the arrival of the product

Confirm item	Description
Does the delivered product match the model of the product you ordered?	The packaging box contains the products you ordered. Please confirm it with the nameplate model of the servo motor and servo driver.
Is there any damage to the product?	Please check the positive surface to see if the product is damaged during transportation. If any omission or damage is found, please contact our company or your supplier as soon as possible.
Is the servo motor rotating smoothly?	It is normal to be able to turn gently by hand. Except for servo motors with brakes.

1.3 Packing list

RS servo driver (including one DB44 terminal kit + one main circuit terminal) * one
RSM servo motor *1
Motor supporting power extension cable*1
Motor supporting encoder extension cable*1
Brake extension cable for brake motor*1 (special for motor with brake)
Driver debugging software communication cable (optional)*1

Chapter 2 Product information and installation

2.1 Driver introduction

2.1.1 Nameplate and model description

RS 400 C

Symbol	Description
RS	Rtelligent high voltage servo driver
400	Driver power 100 – 100W 200 – 200W 400 – 400W 750 – 750W 1000 – 1000W 1500 – 1500W 3000 – 3000W
C	Model type None - standard pulse type/RS485 fieldbus type driver E - EtherCAT fieldbus type driver C - Low cost pulse type driver

2.1.2 Servo driver specifications

1） Basic specifications

Driver model	RS100E	RS200E	RS400E	RS750E	RS1000E	RS1500E	RS3000E
Adapted power	100W	200W	400W	750W	1000W	1500W	3000W
Continuous current	3.0A	3.0A	3.0A	5.0A	7.0A	9.0A	12.0A
Maximum current	9.0A	9.0A	9.0A	15.0A	21.0A	27.0A	36.0A
Input power	Single phase 220AC			Single phase 220AC			Single phase / 3 phase 220AC
Size code	Type A			Type B			Type C
Size	178*160*41			178*160*51			203*178*70

2） Electrical parameters

Item	Content
Control method	IPM PWM control, SVPWM drive mode
Encoder type	Match 17 ~ 23Bit optical or magnetic encoder, support absolute encoder control
Universal input	8 channels, support 24V common anode or common cathode,
Universal output	2 single-ended + 2 differential outputs, single-ended (50mA) can be supported / differential (200mA) can be supported

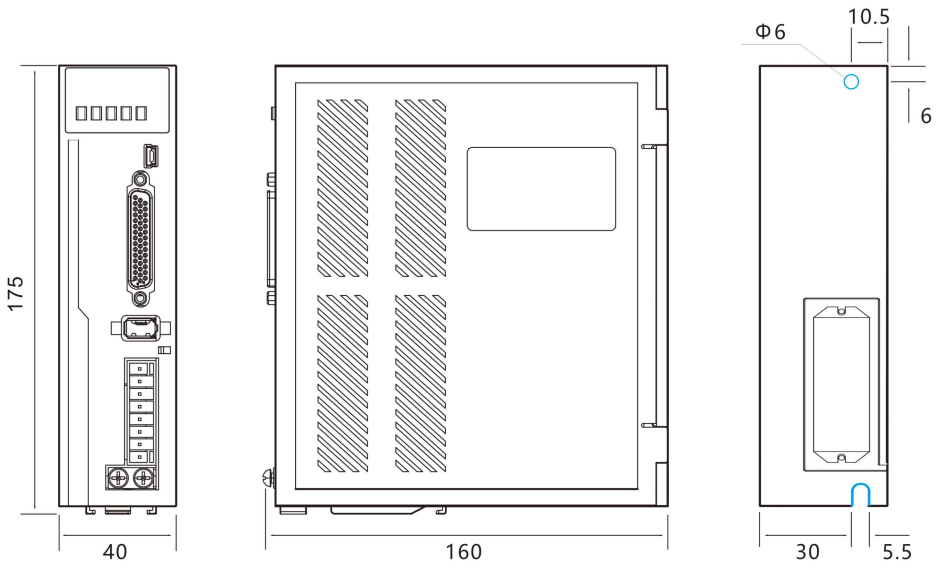
2.1.3 Driver installation

1） Driver environment

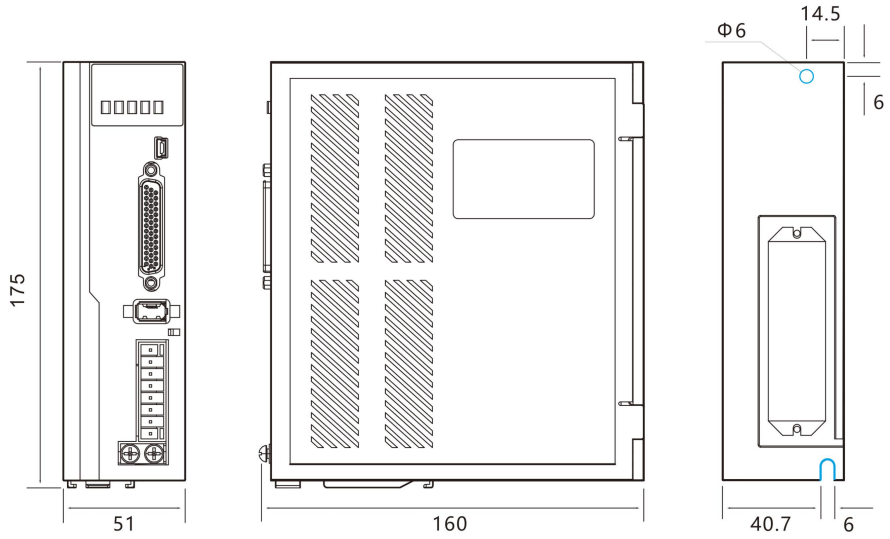
Item	Requirement
Ambient temperature	0～55°C (The average load rate should not exceed 80% when the ambient temperature is above 45°C)
Storage temperature	-20～85°C
Use/storage humidity	Below 90%RH (no condensation)
Vibration resistance/ impact resistance	4.9m/s2 /19.6m/s2
Protection level	IP10
Altitude	Less than 1000m

2） Driver size

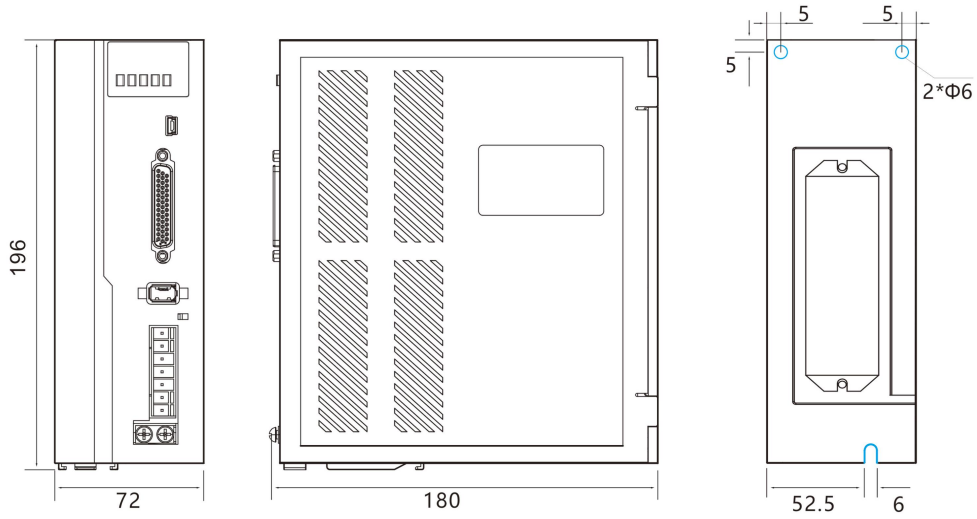
Size A - below 400W:



Size B - below 2000W:



Size C - below 3000W:



3） Precautions for driver installation

Please install the driver in an electrical cabinet free from sunlight and rain. Do not place the driver in a corrosive or other harmful environment.

Please ensure that the installation direction is perpendicular to the wall, and use natural air convection or a fan to cool the servo driver. Fix the servo driver firmly on the mounting surface through 2 to 4 mounting holes (the number of mounting holes varies according to the capacity). When installing, please face the front of the driver to the operator and make it perpendicular to the wall. Please pay attention to avoid drilling chips and other foreign matter from falling into the driver during installation, otherwise it may cause driver failure.

When multiple drivers are installed in the control cabinet, please note that sufficient space must be reserved for the placement position to achieve sufficient heat dissipation.

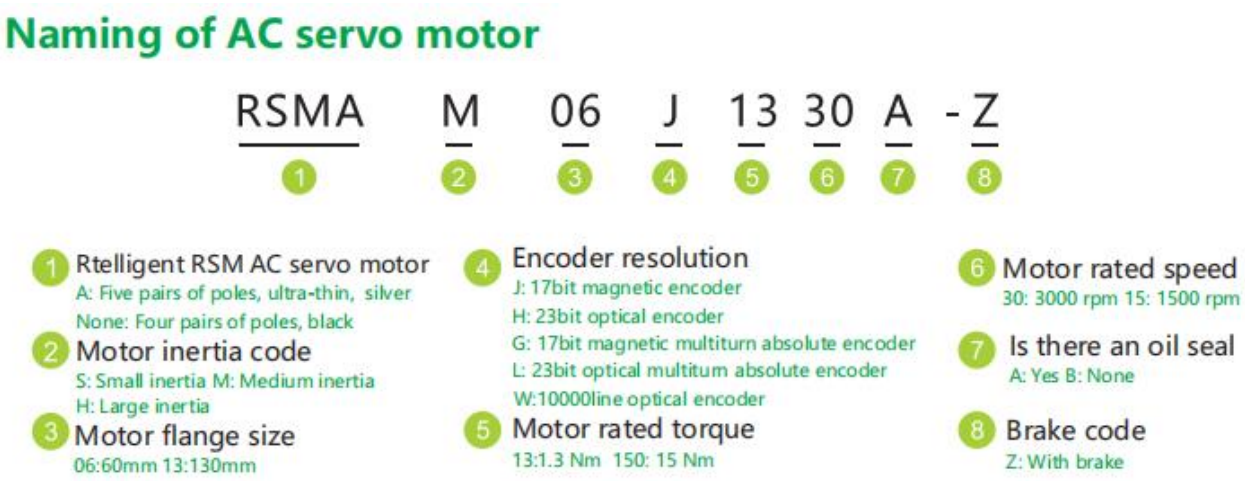
Be sure to connect the ground terminal to the ground, otherwise there may be a risk of electric shock or interference resulting in malfunction.

When there is a vibration source (punch) near the drive installation, if it is unavoidable, please use a vibration absorber or install an anti-vibration rubber gasket.

When there are noise interference sources such as large magnetic switches and fusion splicers near the driver, it is easy to cause the drive to be interfered by the outside and cause malfunction. At this time, a noise filter needs to be installed, but the noise filter will increase the leakage current, therefore, it is necessary to install an insulating transformer on the input end of the driver.

2.2 Servo motor model description

2.2.1 Motor naming



2.2.2 Motor specifications

1） Basic specifications

Size	Model	Power	Motor length	Motor length with brake
40	RSM-M04J0130A	50W	72	112
	RSM-M04J0330A	100W	80	120
60	RSMA-M06J0630A	200W	80	126
	RSMA-M06J1230A	400W	98	144
80	RSMA-M08J2430A	750W	113	153
	RSMA-M08J3230A	1000W	128	168
110	RSM-M11J4030A	1.2KW	189	245
	RSM-M11J5030A	1.5KW	204	260
	RSM-M11J6030A	1.8KW	219	275
130	RSM-M13J5025A	1.3KW	171	241
	RSM-M13J6025A	1.5KW	179	249

	RSM-M13J7725A	2.0KW	192	262
	RSM-M13J10015A	1.5KW	213	283
	RSM-M13J10025A	2.5KW	209	279
	RSM-M13J15015A	2.3KW	241	311
	RSM-M13J15025A	3.8KW	231	301

2） Electrical parameters

Item	Content
Rated voltage	220V
Encoder type	17bit magnetic encoder / 23bit optical encoder optional

2.2.3 Encoder type

Encoder selection specifications:

Encoder code	Description
J	17bit single-turn magnetic absolute encoder
H	23bit single-turn optical absolute encoder
G	17bit multiturn magnetic absolute encoder
L	23bit multiturn optical absolute encoder
W	10000 lines optical absolute encoder

Encoder performance selection instructions

The encoder is the position counting device of the servo motor, and the feedback of the motor position and speed information provides the most important basis for the control of the driver.

It is obvious that a high-resolution encoder can "cut" the movement of the motor in one revolution into smaller units, so a high-resolution encoder can provide higher precision information.

Absolute encoders can feed back the absolute number of turns of the encoder, and can be connected to an external battery to keep the position information of the motor even after the drive is powered off. It is generally used in some high-precision and precise positioning occasions.

Restricted by the encoder manufacturing process and servo drive acquisition capabilities, our company provides up to 23-bit photoelectric encoders with the highest resolution of 8388608. In actual use, because of the working conditions, we can choose a slightly lower resolution encoder to reduce the cost of the motor while ensuring a certain accuracy.

Therefore, please choose the encoder specification of the servo motor reasonably according to your actual situation.

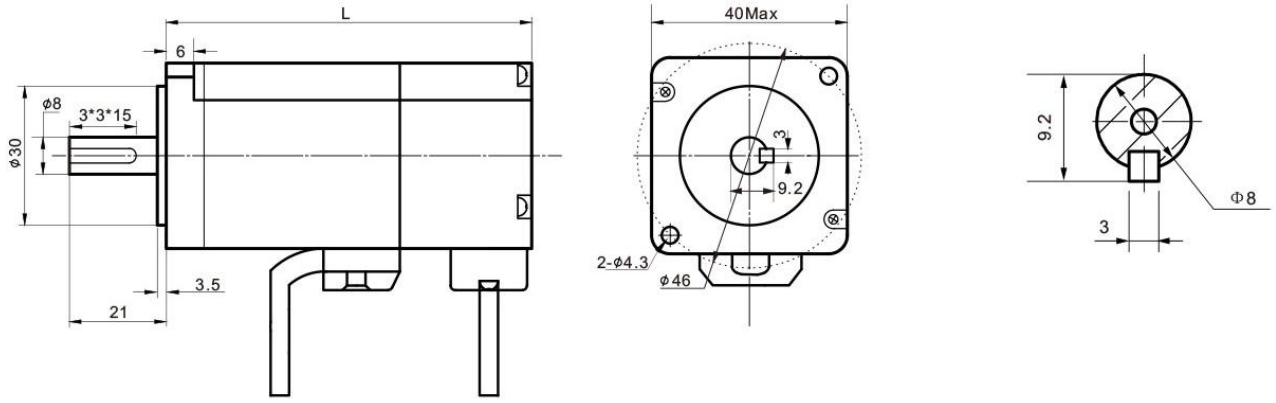
2.3 Motor installation

2.3.1 Servo motor use environment

Item	Requirement
Ambient temperature	0～40°C
Storage temperature	-20～60°C
Use/storage humidity	Below 90%RH (no condensation)
Vibration resistance/impact resistance	49m/s2 /196m/s2
Protection level	IP65
Altitude	Below 1000m

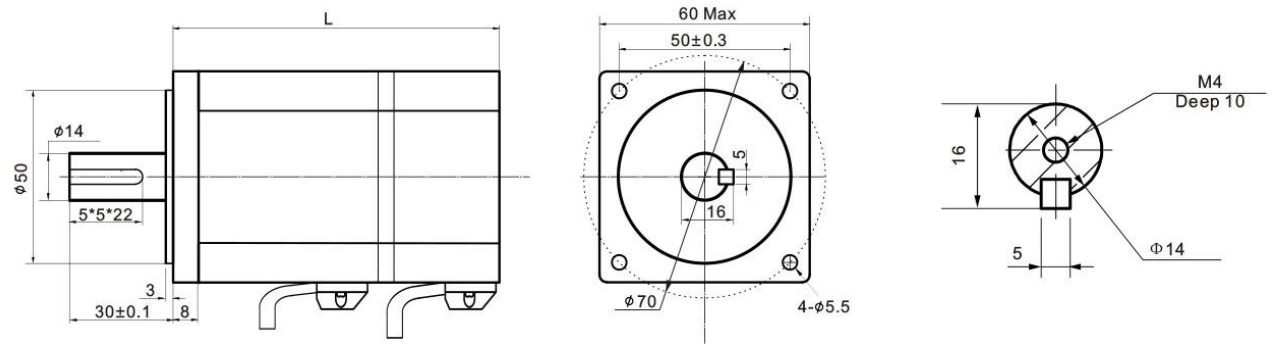
2.3.2 Servo motor size

1） Base 40 (AMP plug outlet*)



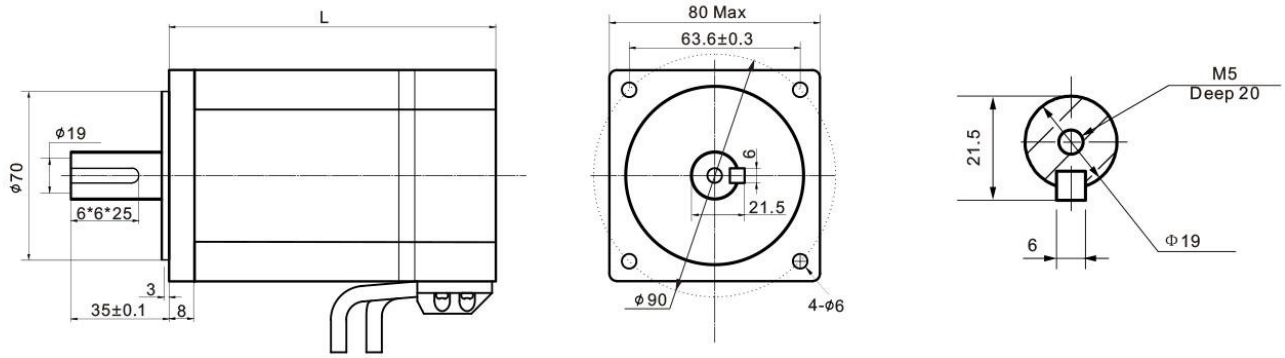
Description	Model	Motor length (mm)	Weight (kg)
50W	RSM-M04J0130A	72	0.3
100W	RSM-M04J0330A	80	0.45
50W with brake	RSM-M04J0130A-Z	112	0.5
100W with brake	RSM-M04J0330A-Z	120	0.62

2） Base 60 (AMP plug outlet*)



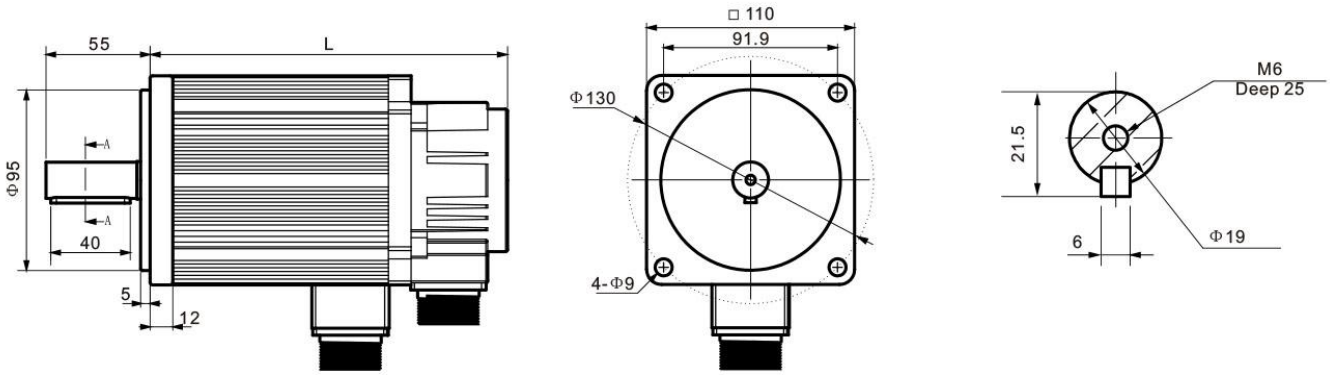
Description	Model	Motor length (mm)	Weight (kg)
200W	RSMA-M06J0630A	80	0.88
400W	RSMA-M06J1330A	98	1.26
200W with brake	RSMA-M06J0630A-Z	126	1.3
400W with brake	RSMA-M06J1330A-Z	144	1.7

3） Base 80 (AMP plug outlet*)



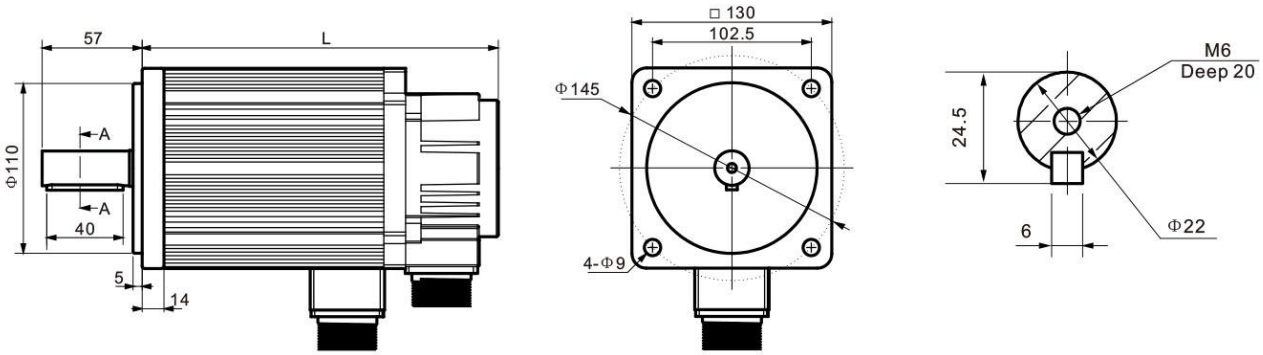
Description	Model	Motor length (mm)	Weight (kg)
750W	RSMA-M08J2430A	113	2.4
1000W	RSMA-M08J3230A	128	3.1
750W with brake	RSMA-M08J2330A-Z	163	3.1
1000W with brake	RSMA-M08J3230A-Z	188	3.8

4） Base 110 (Aviation plug outlet*)



Description	Model	Motor length (mm)	Weight (kg)
1.2KW	RSM-M11W4030A	189	6.0
1.5KW	RSM-M11W5030A	204	6.8
1.2KW	RSM-M11W6020A	219	7.9
1.8KW	RSM-M11W6030A	219	7.9
1.2KW with brake	RSM-M11W4030A-Z	245	7.1
1.5KW with brake	RSM-M11W5030A-Z	260	7.9
1.2KW with brake	RSM-M11W6020A-Z	275	9.0
1.8KW with brake	RSM-M11W6030A-Z	275	9.0

5） Base 130 (Aviation plug outlet*)



Description	Model	Motor length (mm)	Weight (kg)
1.3KW	RSM-M13W5025A	171	6.6
1.5KW	RSM-M13W6025A	179	7.4
2.0KW	RSM-M13W7725A	192	8.3
1.5KW	RSM-M13W10015A	213	9.8
2.5KW	RSM-M13W10025A	209	9.7
2.3KW	RSM-M13W15015A	241	12.6
3.8KW	RSM-M13W15025A	231	12.4
1.3KW with brake	RSM-M13W5025A-Z	241	7.7
1.5KW with brake	RSM-M13W6025A-Z	249	8.5
2.0KW with brake	RSM-M13W7725A-Z	262	9.4
1.5KW with brake	RSM-M13W10015A-Z	283	10.9
2.5KW with brake	RSM-M13W10025A-Z	279	10.8
2.3KW with brake	RSM-M13W15015A-Z	311	13.7

3.8KW with brake	RSM-M13W15025A-Z	301	13.5
1.2KW with brake	RSM-M11W6020A-Z	275	9.0
1.8KW with brake	RSM-M11W6030A-Z	275	9.0

***Remark:**

The AMP plug outlet specification is "4 holes motor wire + 9 holes encoder wire + 2 holes brake wire"

The aviation plug outlet specification is "4 holes motor wire + 7 holes encoder wire + 2 holes brake wire"

2.3.3 Precautions for motor installation

Please ensure that the installation direction is perpendicular to the wall, and use natural air convection or a fan to cool the servo drive. by2 to 4 mounting holes (the number of mounting holes varies according to the capacity), and the servo drive is firmly fixed on the mounting surface. When installing, please face the front of the driver to the operator and make it perpendicular to the wall. Please pay attention to avoid drilling chips and other foreign matter from falling into the drive during installation, otherwise it may cause driver failure.

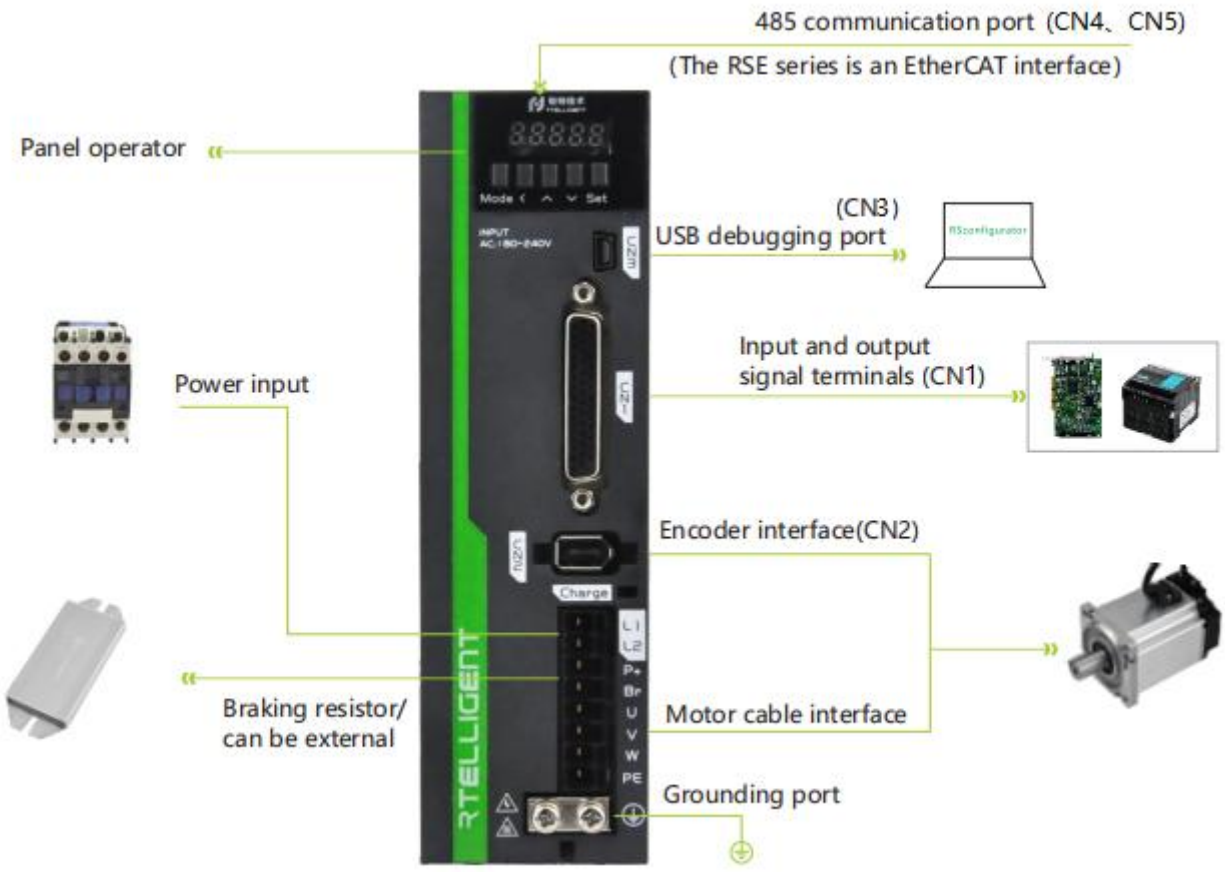
When multiple drivers are installed in the control cabinet, please note that sufficient space must be reserved for the placement position to achieve sufficient heat dissipation.

Be sure to connect the ground terminal to the ground, otherwise there may be a risk of electric shock or interference resulting in malfunction.

When there is a vibration source (punch) near the driver installation, if it is unavoidable, please use a vibration absorber or install an anti-vibration rubber gasket.

When there are noise interference sources such as large magnetic switches and fusion splicers near the driver, it is easy to cause the drive to be interfered by the outside and cause malfunction. At this time, a noise filter needs to be installed, but the noise filter will increase the leakage current, therefore, it is necessary to install an insulating transformer on the input end of the driver.

2.4 Servo system configuration list



List of standard model combinations					
Motor base	Model	Rated power	Matched driver	Encoder cable	Power cable
40	RSM-M04J0130A	50W	RS100(C/E)	SES4-030	SMS-030
	RSM-M04J0330A	100W	RS100(C/E)	SES4-030	SMS-030
60	RSMA-M06J0630A	200W	RS200(C/E)	SES4-030	SMS-030
	RSMA-M06J1330A	400W	RS400(C/E)	SES4-030	SMS-030
80	RSMA-M08J2430A	750W	RS750(C/E)	SES4-030	SMS-030
	RSMA-M08J3230A	1000W	RS1000(C/E)	SES4-030	SMS-030
110	RSM-M11J4030A	1200W	RS2000(C/E)	SEH4-030	SMH-030
	RSM-M11J5030A	1500W	RS2000(C/E)	SEH4-030	SMH-030
	RSM-M11J6020A	1200W	RS2000(C/E)	SEH4-030	SMH-030
	RSM-M11J6030A	1800W	RS2000(C/E)	SEH4-030	SMH-030
130	RSM-M13J5025A	1300W	RS2000(C/E)	SEH4-030	SMH-030

	RSM-M13J6025A	1500W	RS2000(C/E)	SEH4-030	SMH-030
	RSM-M13J7725A	2000W	RS2000(C/E)	SEH4-030	SMH-030
	RSM-M13J10025A	2500W	RS3000(C/E)	SEH4-030	SMH-030
	RSM-M13J15015A	2300W	RS3000(C/E)	SEH4-030	SMH-030
	RSM-M13J15025A	3800W	RS3000(C/E)	SEH4-030	SMH-030

Remarks: The wiring takes 3 meters as the standard configuration, other specifications please specify when ordering

2.5 Matching cable specifications

2.5.1 Motor and encoder wiring

Servo cable list

Naming of AC servo cables

S E S 4 -030

1 Cable series
S: 220V AC servo
H: 380V high-voltage servo
D: Low-voltage brushless servo

2 Cable category
E: Encoder cable
M: Power extension cable

3 Plug category
S: Plastic Amp Head
H: Aviation plugs

4 Number of cable cores
Power cable 4 cores can be omitted

5 Cable length
Cable length is 3 meters

Motor cable of 80mm and below

Motor cable SMS-030
Color definition:

U	V	W	PE
Red	White	Black	Yellow&green

Encoder cable SES4-030

Motor cable of 110mm/130mm

Motor cable SMH-030
Color definition:

U	V	W	PE
Brown	Blue	Black	Yellow&green

Encoder cable SEH4-030

Wiring matching table:

1） AMP plug type motor wiring (40/60/80 base)

Cable type	Cable length		
	3 meters	5 meters	8 meters
Motor cable	SMS-030	SMS-050	SMS-080
Encoder cable	SES4-030	SES4-050	SES4-080
Brake cable	SMBZ2-030	SMBZ2-050	SMBZ2-080
Multiturn absolute encoder cable	SES6-030	SES6-050	SES6-080

2） Aviation plug type motor wiring (110/130 base)

Cable type	Cable length		
	3 meters	5 meters	8 meters
Motor cable	SMH-030	SMH-050	SMH-050
Encoder cable	SEH4-030	SEH4-050	SEH4-050
Brake cable	HMBZ2-030	HMBZ2-050	HMBZ2-050
Multiturn absolute encoder cable	SEH6-030	SEH6-050	SEH6-050

Motor wiring requirements:

The motor power cable needs to meet certain current carrying requirements: Motors below 80mm base use wire diameter specifications above 0.5mm^2

For motors below 130mm base, the encoder cable of motors with wire diameters above 0.75mm^2 needs to meet the requirements of shielding isolation: standard configuration 0.14mm2 wire diameter, twisted pair, shielded cable.

Please also pay special attention to:

For drag chains or similar use environments, please be sure to use flexible cables that meet the requirements to ensure the normal operation of the servo system.

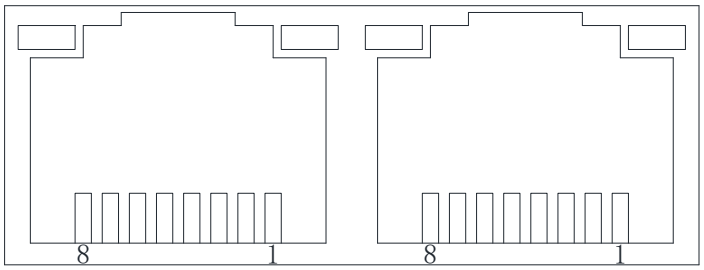
The cable installed in the drag chain needs to maintain a certain amount of space, and do not artificially increase the bending angle of the cable.

2.5.2 Mini-USB debugging cable

Please use Mini-USB cable with magnetic ring, please contact after-sales service or official website to download the driver

2.5.3 EtherCAT communication cable

The EtherCAT network cable is connected to the RJ45 terminal with a metal shield, and has input (IN/CN5) and output (OUT/CN4) interfaces. The electrical characteristics comply with IEEE802.3 and ISO8877 standards.



Pin	Definition	Description
1	TX+	Data sending+
2	TX-	Data sending-
3	RX+	Data reception+
4	NULL	null
5	NULL	null
6	RX-	Data reception-
7	NULL	null
8	NULL	null

2.5.4 Instructions for braking resistor

When the output torque of the motor and the rotation speed are in the opposite direction, it represents the energy transferred from the load end to the driver. This energy is fed back to the capacitor in the DC bus so that its voltage value rises. When it rises to a certain value, the capacitor cannot fully absorb the feedback energy, and a braking resistor is needed to dissipate it. The braking resistor is connected to the P+ and BR ports. The drive has its own braking resistor with a certain power. When the driver's built-in resistance is not enough to absorb braking energy consumption, the user can also connect a larger power braking resistor.

At this time, it is only necessary to replace the high-power braking resistor with the braking resistor of the driver. The following table shows the specifications of the built-in regenerative resistors provided by the RSE series:

Driver model	RS100E	RS400E	RS750E	RS1000E	RS2000E	RS3000E
Adapted motor power	100W	400W	750W	1000W	2000W	3000W
Continuous current	1.5A	2.8A	4.5A	6.0A	7.4A	10.1A
Maximum current	4.5A	8.4A	13.5A	18.0A	22.2A	30.3A
Built-in braking resistor	—	100Ω	50Ω		50Ω	

resistance and power	—	50W	75W	100W
Allowable braking power	—	25W	38W	50W
Minimum resistance of external braking resistor	—	50Ω	30Ω	20Ω

Configuration reference of braking resistor:

As mentioned in the above table, the braking energy of the drive returns to the DC bus first. When the feedback superimposed voltage exceeds the reference value set by the drive (that is, the maximum absorption capacity of the DC bus capacitor), the braking energy enters the braking resistor.

When the built-in braking resistor of the drive cannot meet the discharge requirements, it is necessary to replace the braking resistor with a larger specification.

The power of the braking resistor needs to be greater than the power of the drive's built-in braking resistor. The resistance of the braking resistor needs to meet certain requirements, and the minimum resistance should not be lower than the lower limit listed in the above table.

Generally speaking, the greater the load inertia and the shorter the acceleration and deceleration time, the greater the braking energy and the greater the braking resistor power required.

2.6 Accessories description of multiturn absolute encoder

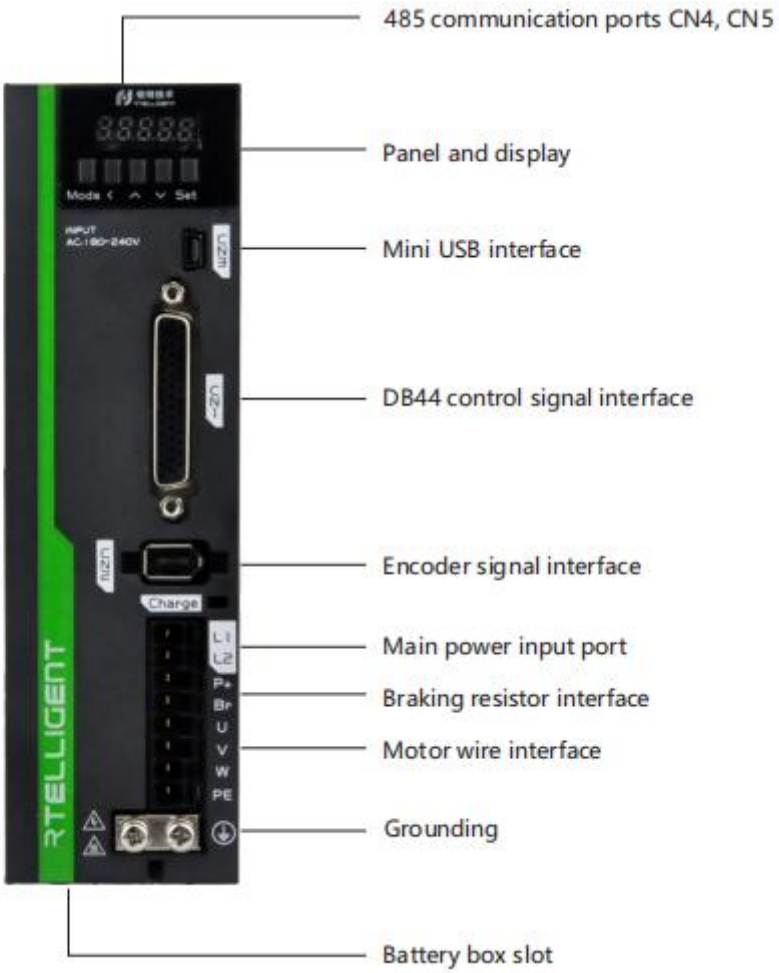
When using a servo motor with a multi-turn absolute encoder, you need to pay attention to selecting the corresponding encoder cable and the corresponding battery. At the bottom left of the drive is a dedicated card slot for the battery box. When leaving the factory, we are equipped with a battery and battery box of the corresponding specifications. When the battery is exhausted, the drive will prompt a related alarm. When replacing the battery, remove the battery box for replacement.

The standard battery specifications are: 3.6V, 2500mAh.

Chapter 3 Servo driver and motor wiring

3.1 Servo driver interface distribution

1） Size A, Size B driver interface distribution



3.2 Servo driver main circuit connection

Terminal symbol	Terminal name	Terminal function
L1、L2、L3	Power supply input terminal	Servo driver power supply input terminal, single-phase 220AC or three-phase 220VAC
P+、B+-	Braking resistor terminal	Connect to energy consumption braking resistor
U、V、W、PE	Servo motor connection terminal	Servo motor connection terminals, must be connected to the U, V, W, and PE terminals of the motor

Cautions for circuit wiring:

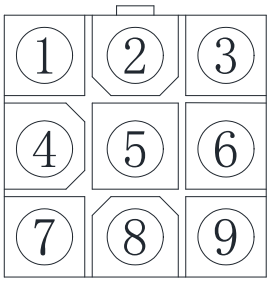
- Do not connect the input power cord to the output terminals U, V, W, otherwise the servo driver will be damaged.

- Do not pass the power cord and signal cord through the same pipe or bundle them together. To avoid interference, the distance between the two should be more than 30cm.
- Do not turn on/off the power frequently. When you need to repeatedly turn on/off the power continuously, please control it to less than once a minute. Since the power supply part of the servo driver has a capacitor, when the power is turned on, a relatively large charging current will flow (charging time 0.2s). Frequent ON/OFF of the power supply will cause the performance of the main circuit components inside the servo drive to degrade.
- Please connect the servo driver to the ground reliably, and use a PE wire with a large diameter as much as possible to ensure that the grounding resistance is less than 100 ohms.
- It is recommended that the power supply be supplied through a noise filter to improve the anti-interference ability.
- Please install a non-fuse type (NFB) circuit breaker so that the external power supply can be cut off in time when the driver fails.
- Do not power on and use the servo driver when the terminal screws or cables are loose, otherwise it may cause a fire.

3.3 Servo driver encoder signal terminal CN2 connection

Servo motor encoder output terminal signal definition: face up to the motor encoder output terminal, its terminal definition serial number is shown in the following diagram:

Schematic diagram of servo motor encoder outlet terminal

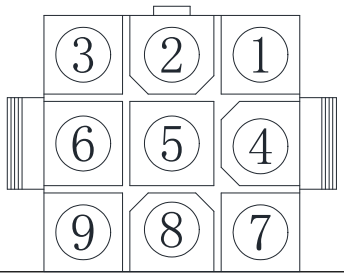


Signal name	Pin	Function
FG	1	Shield ground
+5V	2	Power input positive: +5V
GND	3	Power input negative: 0V
SD+	4	Encoder bus signal
SD-	5	
E+	6	Encoder battery
E-	7	

Servo encoder extension cable motor side terminal: face up to the servo encoder extension cord motor side terminal, the definition number of its terminal is shown in the following diagram:

Schematic diagram of motor side terminal of servo encoder extension cable

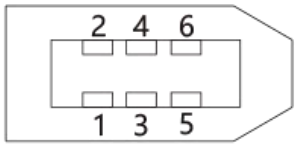
Signal name	Pin	Function
FG	1	Shield ground
+5V	2	Power output positive: +5V
GND	3	Power output negative: 0V



SD+	4	Encoder bus signal
SD-	5	
E+	6	Encoder battery
E-	7	

Servo encoder extension cord driver side terminal: The servo encoder extension cord driver side terminal is a welding pin, which is marked with a pin serial number, and the definition serial number of its terminal is shown in the following diagram:

Schematic diagram of motor side terminal of servo encoder extension cable



Signal name	Pin	Function
+5V	1	Power output positive: +5V
GND	2	Power output negative: 0V
BAT+	3	Encoder battery
BAT-	4	
SD+	5	Encoder bus signal
SD-	6	
FG	-	Terminal metal shell

Remarks:

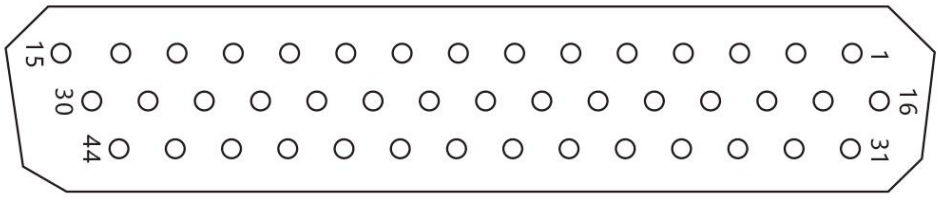
- Please purchase Rtelligent the SE series cables or cables with the same specifications and above.
- The encoder cable should be as far away as possible from other high-current loops of the equipment to prevent interference.
- Do not place the encoder connector in the drag chain to prevent poor connection at the connector. The absolute encoder wiring comes with two battery connectors. Please pay attention to the battery protection when purchasing.
- When cables are placed in the drag chain, attention should be paid to the distribution space to avoid excessive bending angles and the resulting reduction in cable life.

3.4 The connection of the control signal terminal CN1 of the servo driver

3.4.1 CN1 pin definition

CN1 is a 44-pin three-row DB connector, which is included with the driver when shipped. Please carefully confirm the pin definition and electrical specifications.

Driver control signal terminal CN1 pin diagram

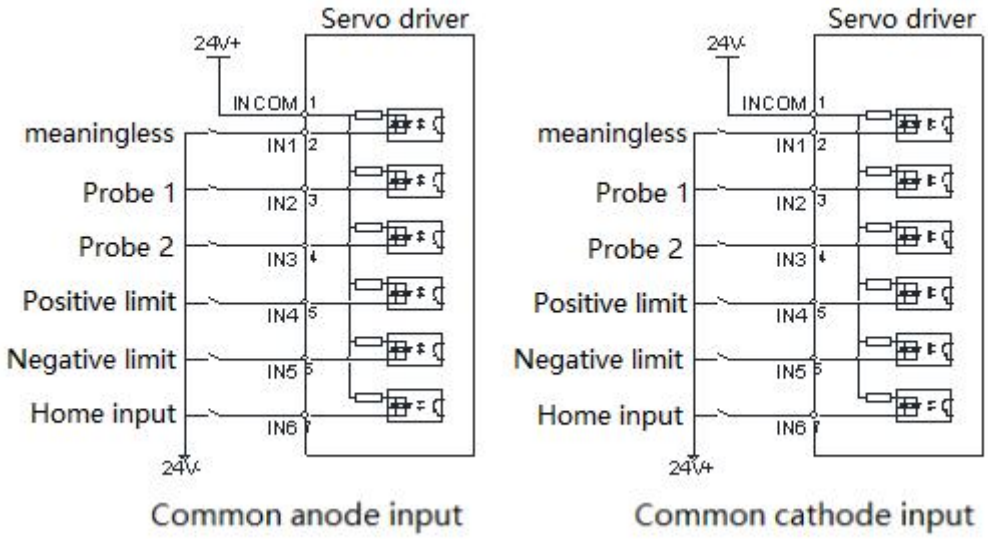


Signal name	Pin	Signal definition	Default function	Description
INCOM	1	Input common	-	● 24V signal input ● Support common anode or common cathode connection ● Does not support the mixed use of NPN and PNP
IN1	2	Input 1	Meaningless	
IN2	3	Input 2	Probe 1	
IN3	4	Input 3	Probe 2	
IN4	5	Input 4	Positive limit	
IN5	6	Input 5	Negative limit	
IN6	7	Input 6	Origin signal	
IN7_24V+	16	Input 7	Meaningless	Differential input terminal: ● 24V signal is connected to IN7_24V and IN7- terminals ● 5V signal is connected to IN7_5V+ and IN7- terminals
IN7_5V+	17			
IN7-	18			
IN8_24V+	19	Input 8	Emergency stop	Differential input terminal: ● 24V signal is connected to IN8_24V and IN8- terminals ● 5V signal is connected to IN8_5V+ and IN8- terminals
IN8_5V+	20			
IN8-	21			
OUTCOM-	31	Output common	-	● Common cathode output ● Current does not exceed 50mA
OUT1	32	Output 1	Servo ready	
OUT2	33	Output 2	Alarm output	
OUT3+	34	Output 3	Position reached	● Differential output ● Current does not exceed 200mA
OUT3-	35			
OUT4+	36	Output 4	Brake output	
OUT4-	37			

3.4.2 Universal input interface

Signal name	Pin	Signal definition	Default function	Description
INCOM	1	Input common	-	● 24V signal input ● Support common anode or common cathode connection ● Does not support the mixed use of NPN and PNP
IN1	2	Input 1	Meaningless	
IN2	3	Input 2	Probe 1	
IN3	4	Input 3	Probe 2	
IN4	5	Input 4	Positive limit	
IN5	6	Input 5	Negative limit	

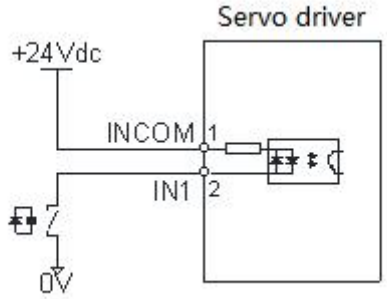
IN6	7	Input 6	Origin signal	
IN7_24V+	16	Input 7	Meaningless	Differential input terminal: ● 24V signal is connected to IN7_24V and IN7- terminals ● 5V signal is connected to IN7_5V+ and IN7- terminals
IN7_5V+	17			
IN7-	18			
IN8_24V+	19	Input 8	Emergency stop	Differential input terminal: ● 24V signal is connected to IN8_24V and IN8- terminals ● 5V signal is connected to IN8_5V+ and IN8- terminals
IN8_5V+	20			
IN8-	21			



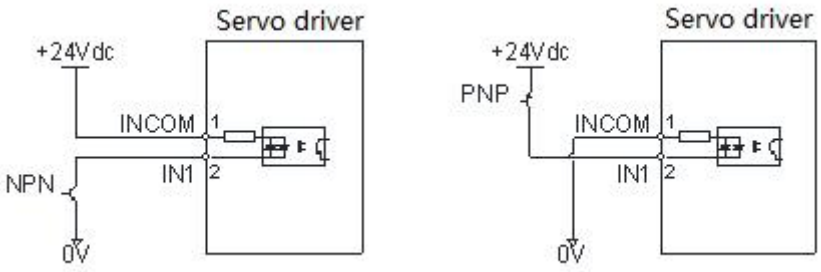
The driver has a total of 8 input ports, and the function can be selected and set according to P02.00～P02.17 (refer to the parameter chapter).

The circuits of IN1～IN6 are the same. Taking IN1 as an example, the wiring example is as follows:

1） When the upper computer device is a relay output:



2） When the upper computer device is open-collector output:

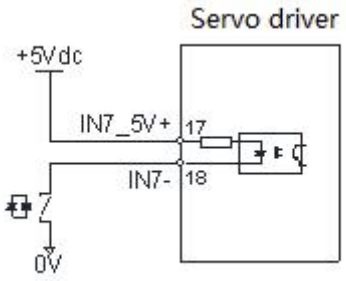


Note: Mixing of NPN and PNP is not supported

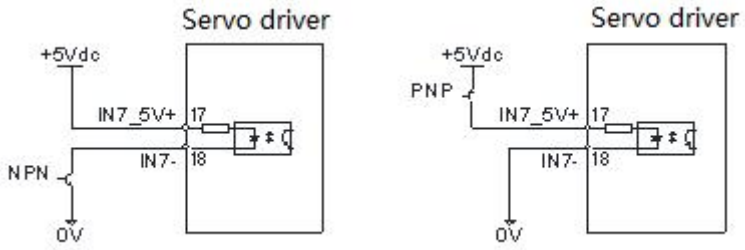
The IN7 and IN8 circuits are the same, the following takes IN8 as an example for description:

When the signal voltage is 5V:

1） When the upper computer device is a relay output:

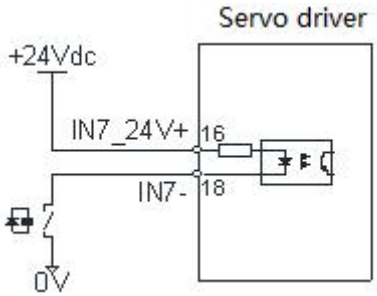


2） When the upper computer device is open-collector output:

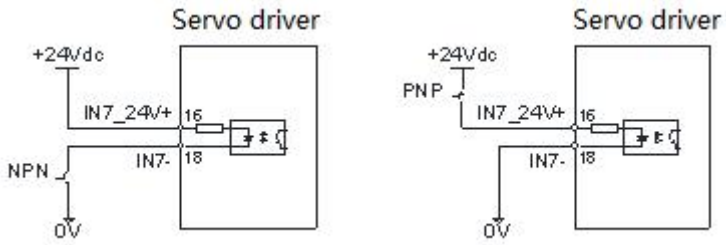


When the signal voltage is 24V:

1） When the upper computer device is a relay output:



2） When the upper computer device is open-collector output:



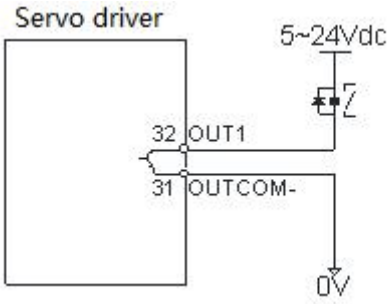
3.4.3 Universal output interface

Signal name	Pin	Signal definition	Default function	Description
OUTCOM-	31	Output common	-	● Common cathode output ● Current does not exceed 50mA
OUT1	32	Output 1	Servo ready	
OUT2	33	Output 2	Alarm output	
OUT3+	34	Output 3	Position reached	● Differential output ● Current does not exceed 200mA
OUT3-	35			
OUT4+	36	Output 4	Brake output	
OUT4-	37			

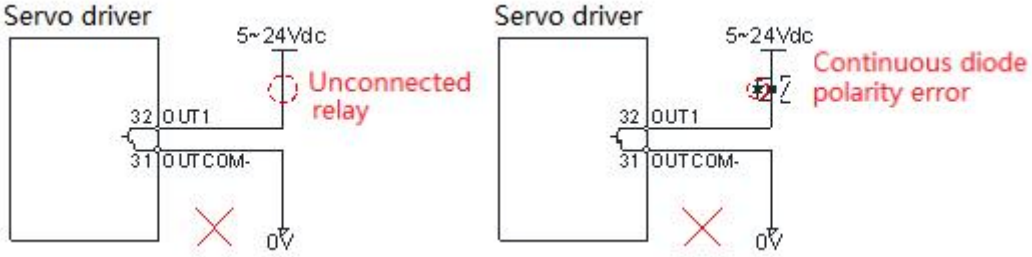
The driver has a total of 4 output ports, the common cathode output terminal drive current is 50mA, which can be used for small current output; the maximum drive current of the differential output terminal is 200mA, which can be used to drive the relay type output.

The OUT1～OUT2 interface circuits are the same. Take OUT1 as an example.

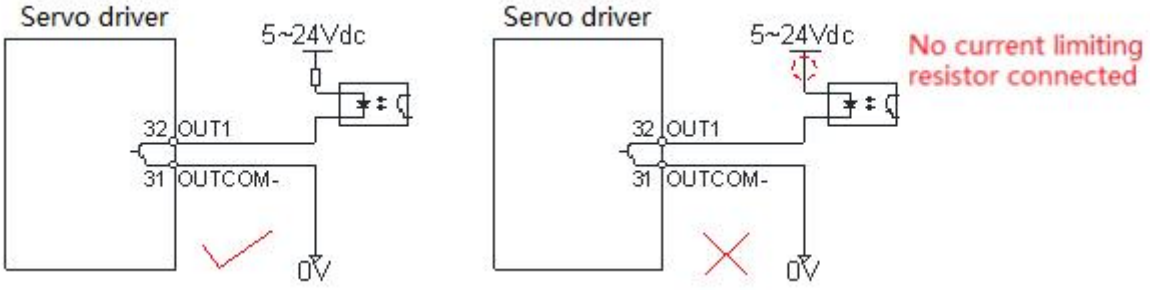
1） When the upper device is a relay input:



The following is the wrong wiring method:

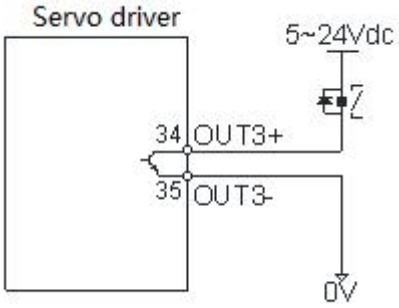


2） When the upper device is optocoupler input:

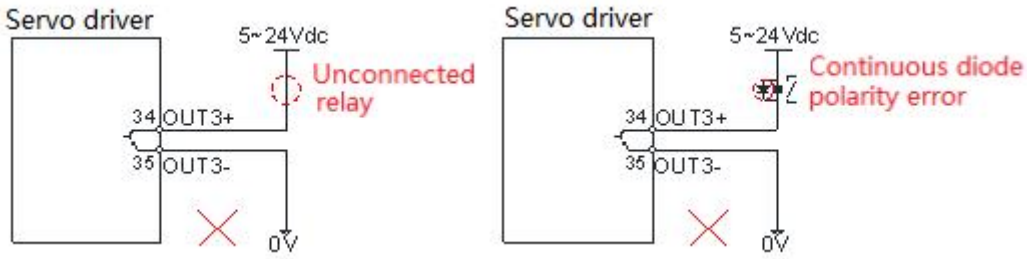


The OUT3～OUT4 interface circuits are the same. Take OUT3 as an example.

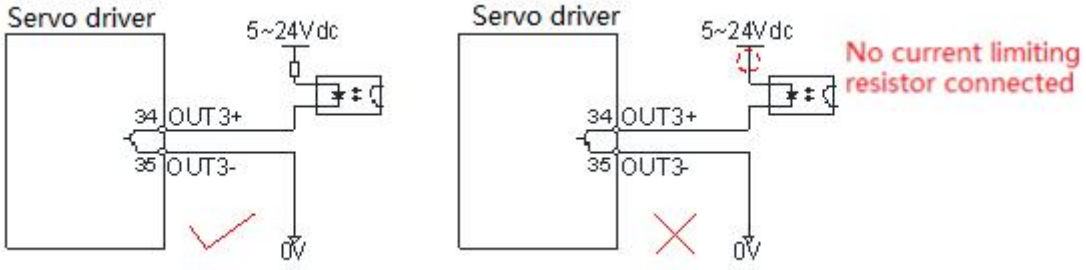
1） When the upper device is a relay input:



The following is the wrong wiring method



2） When the upper device is optocoupler input:

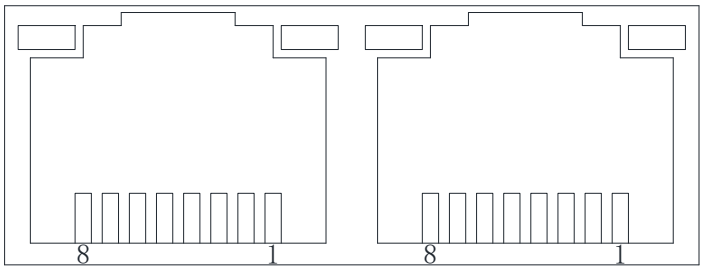


3.5 The connection of the driver debugging communication terminal CN3

The CN3 interface is a standard mini-USB interface, which is used to connect to the computer's USB port for debugging software communication. When you need to use it, please purchase from the manufacturer or bring your own cables of the same specification.

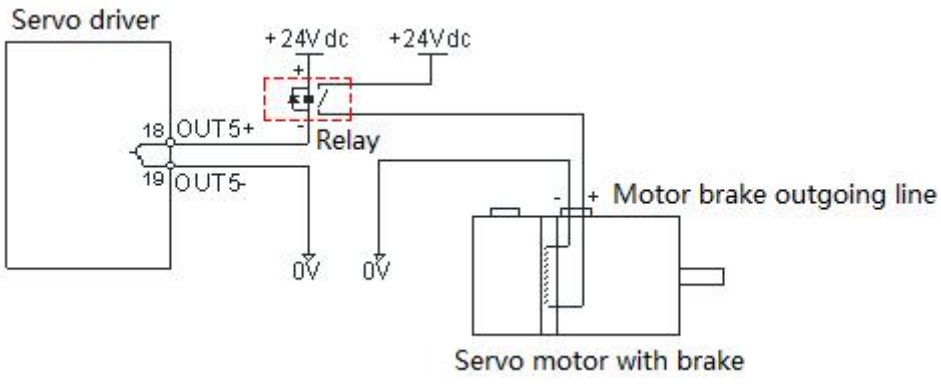
3.6 Connection of driver EtherCAT communication terminals CN4 and CN5

The EtherCAT network cable is connected to the RJ45 terminal with a metal shield, and has input (IN/CN5) and output (OUT/CN4) interfaces. The electrical characteristics comply with IEEE802.3 and ISO8877 standards.



Pin	Definition	Description
1	TX+	Data sending+
2	TX-	Data sending-
3	RX+	Data reception+
4	NULL	null
5	NULL	null
6	RX-	Data reception-
7	NULL	null
8	NULL	null

3.7 Example of brake control connection



3.8 Anti-interference countermeasures for electrical wiring

To suppress interference, please take the following measures:

- The length of the command input cable should be less than 3m, and the encoder cable should be less than 20m.
- Use thick wires as much as possible for the grounding wiring. (Above 2.0mm^2)
- Please use a noise filter to prevent radio frequency interference. When using in a civil environment where the power supply interference noise is strong, please install a noise filter on the input side of the power cord.
- In order to prevent the malfunction caused by electromagnetic interference, the following treatment methods can be used:

① Install the host computer device and noise filter near the servo driver as much as possible.

② Install surge suppressors on the coils of relays, screw tubes, and electromagnetic contactors.

③ When wiring, please lay the strong current lines separately from the weak current lines, and keep an interval of more than 30cm. Do not put them in the same pipe or bundle them together.

④ Do not share power supply with electric welders, electrical discharge processing equipment, etc. When there is a high-frequency generator nearby, install a noise filter on the input side of the power cord

Chapter 4 Panel display and operation

4.1 Panel display overview

4.1.1 Panel composition introduction

The display panel of the servo drive is composed of 5 keys and a 5-digit LED digital tube display, which is used to realize various status information display, trial operation, parameter management and other functions. The 5 keys are identified as follows:

Functions	Symbol	Description	Icon
Mode/return	MODE	Mode switch	
Shift key		Shift left	
Increase		Switch up selection/increase value	
Decrease		Switch down selection/decrease value	
Confirm	SET	Confirm operation	

4.1.2 Panel display content

When the servo driver is running, the LED display can be used for servo monitoring display, parameter display, function display, parameter management, encoder adjustment, and open loop operation.

- Monitoring display: display the current running status of the servo;
- Parameter display: display the set value of servo control parameters;
- Function display: internal test run operation;
- Parameter management: used to manage servo control parameters;
- Encoder adjustment, open loop operation: the manufacturer reserves the use function.

4.1.3 Panel display operation method

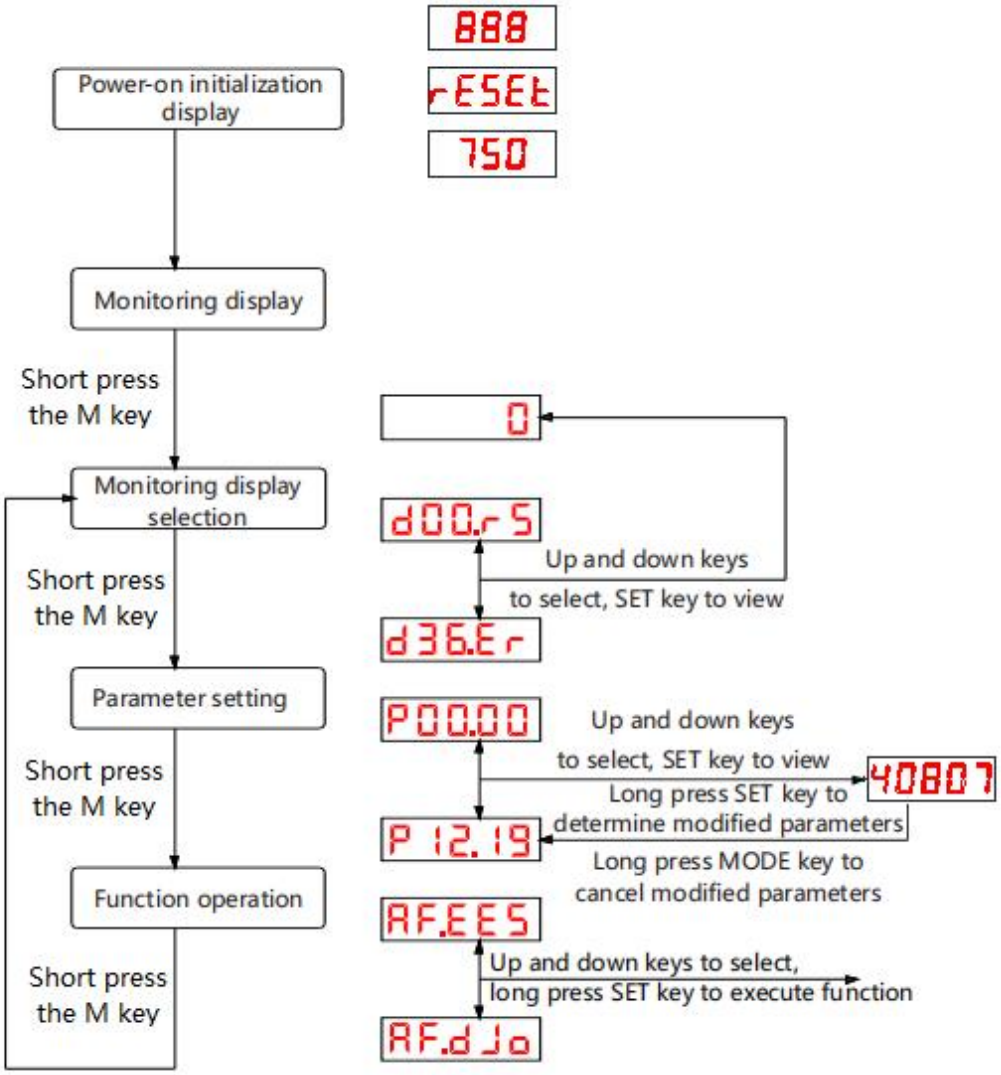


Figure 4-1 Schematic diagram of the operation of the servo driver panel

- After the power is turned on and the initialization of the servo drive is completed, the panel display immediately enters the monitor display mode. The target parameter of pre-monitoring can be selected through parameter P13.00;
- Long press the "MODE" key to switch between different display modes;
- Once a fault occurs, the servo drive automatically displays the fault monitoring code.

4.1.4 Data display

Different data length and negative number display description:

a) 4 or less signed numbers or 5 or less unsigned numbers:

A single-page digital tube (5 digits) is used for display. For signed numbers, the highest bit of the data "-" indicates a negative sign.

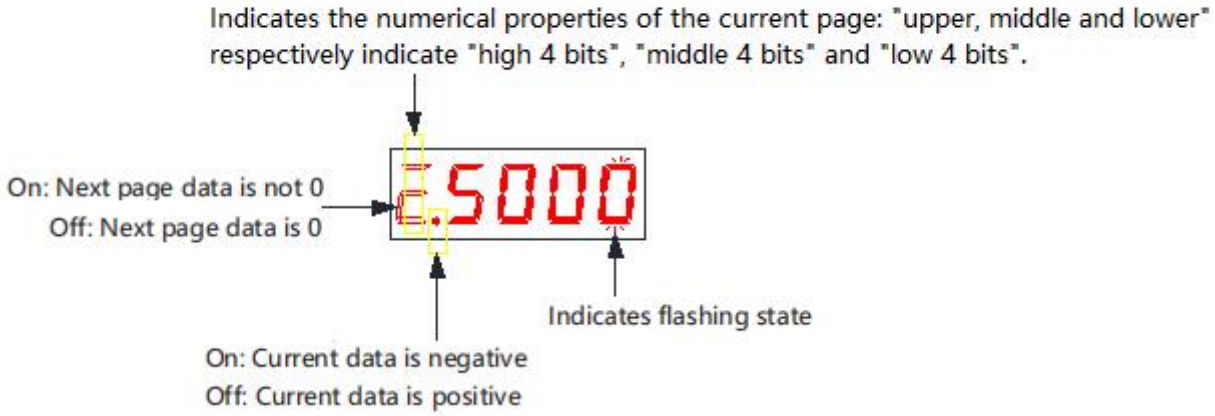
Display example: -6666 is displayed as follows:

Display example: 65535 is displayed as follows:

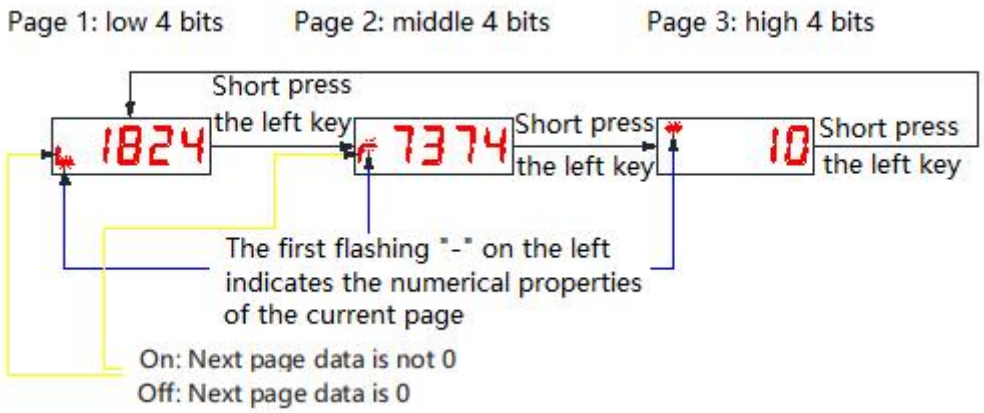
b) 4 or more signed numbers or 5 or more unsigned numbers

Display in pages from low to high by digits, each 4 digits is a page, display method: current page + current page value, switch the current page by long pressing the M key.

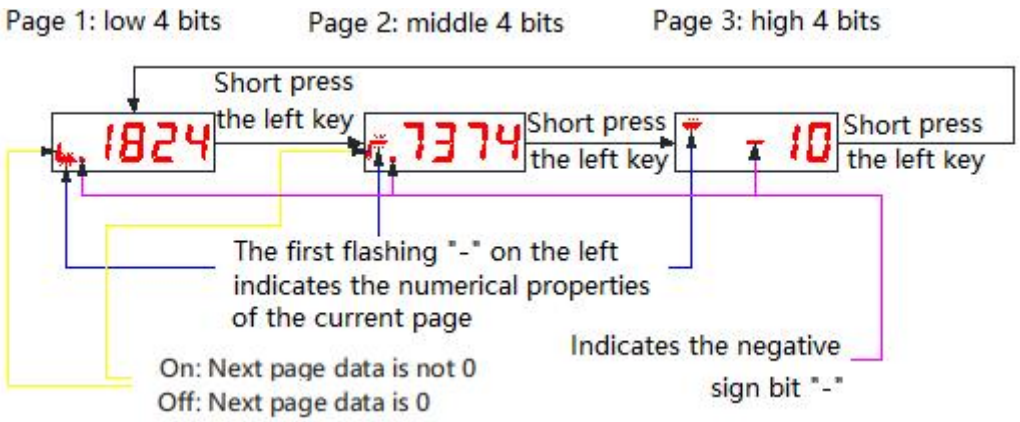
Note: The drive displays a maximum of 12 digits. Three pages are required to represent the "high 4 bits", "middle 4 bits" and "low 4 bits" of the 12 digits.



Display example: 1073741824 is displayed as follows:

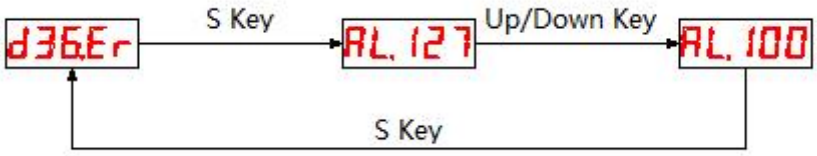


Display example: -1073741824 is displayed as follows:



4.1.5 Fault display

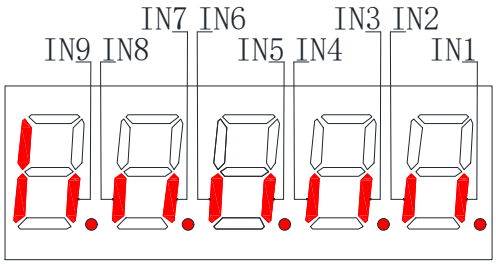
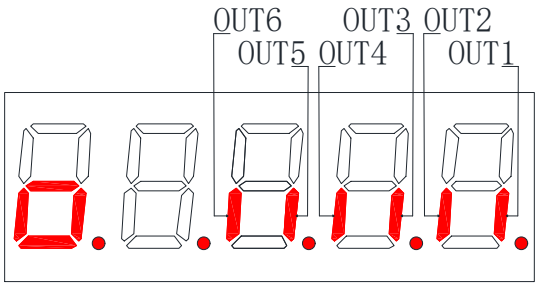
- When the driver is in an error state, the LED panel can display related failure information. If the driver generates multiple fault alarms at the same time, the drive panel will jump to display each alarm in turn, or you can view it through the "up and down keys" on the debugging panel.
- For specific troubleshooting, please refer to the relevant content in section 4.6.



4.1.6 Monitor display

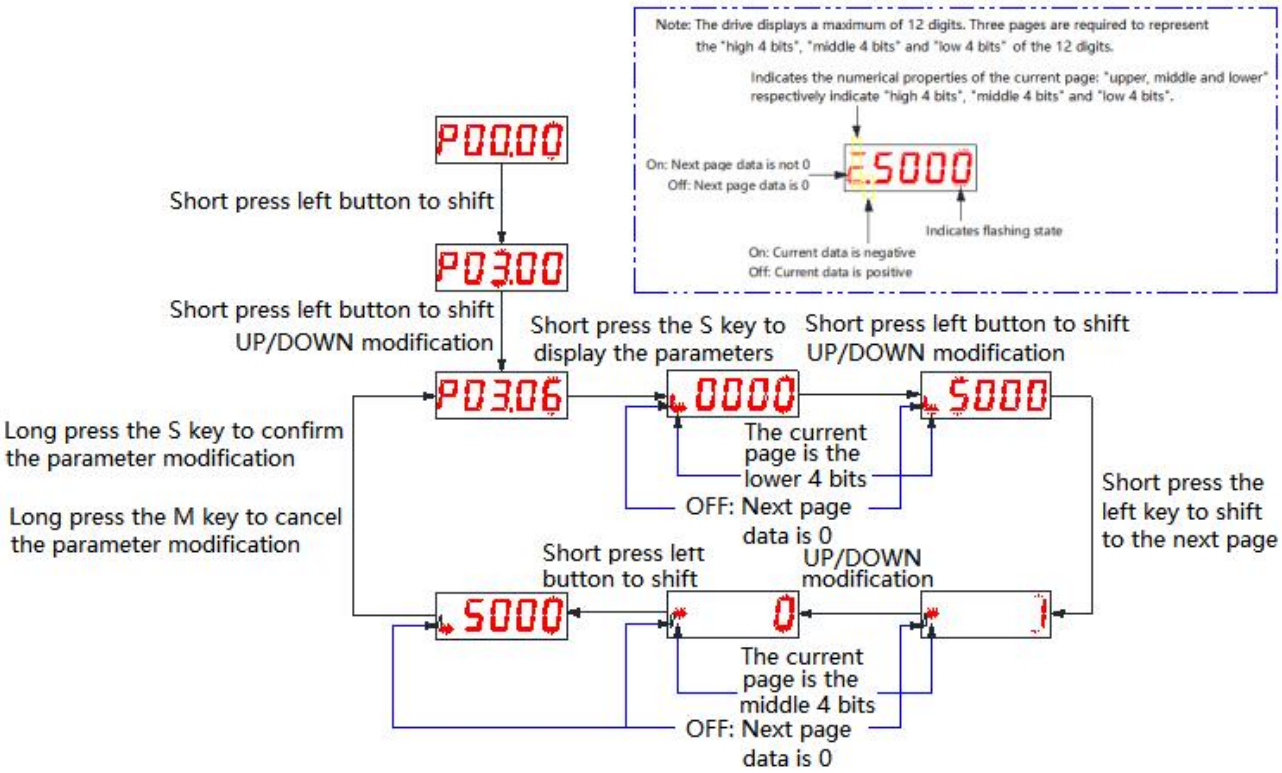
The monitor display is used to monitor the running status of the servo driver. By setting the parameter code P13.00 (the panel default monitoring object), when the servo drive is powered on and initialized, the display will show the monitoring value of the object. The detailed description of the monitoring display is as follows:

Display state	Meaning	Unit
d00.rS	Operating status	-
d01.SF	Motor speed	rpm
d02.SC	Speed command	rpm
d03.tF	Motor torque	%
d04.tC	Torque command	%
d07.PC	Position command counter	Command unit
d09.PC	Position feedback counter	Encoder unit
d11.PF	Feedback pulse counter	Encoder unit
d13.PE	Position error	Command unit
d15.PE	Position error	Encoder unit

d17.FS	Pulse command speed	rpm
d18.Fr	Pulse command frequency	KHz
d19.15	Indicates the status of the current driver input port, The corresponding LED segment code is "on", indicating that the port has signal input The corresponding LED segment code is "off", indicating that the port has no signal input 	-
d20.o5	Indicate the current status of the driver output port The corresponding LED segment code is "on", indicating that the port signal output is valid The corresponding LED segment code is "off", indicating that the port signal output is invalid 	-
d21.nA	Motor mechanical angle	Encoder unit
d22.EA	Motor electrical angle	°
d23.Ub	Driver bus voltage	V
d24.ES	Encoder status	-
d25.Eo	Encoder single-turn value	Encoder unit
d26.EN	Encoder multi-turn value	Circle
d27.Er	Encoder offset	Encoder unit
d28.PF	Feedback pulse counter	Command unit
d29.CS	Status indication	-
d36.Er	Alarm code	-

4.2 Parameter setting

Use the panel of the servo driver to set the parameters. For parameter details, please read “Chapter 10 Appendix A”. Take the LED display panel display parameter menu as an example, change the servo drive P03.06 (the number of command pulses for one revolution of the motor) from the default value of 10000 to 5000 as an example, and proceed with the operation instructions:



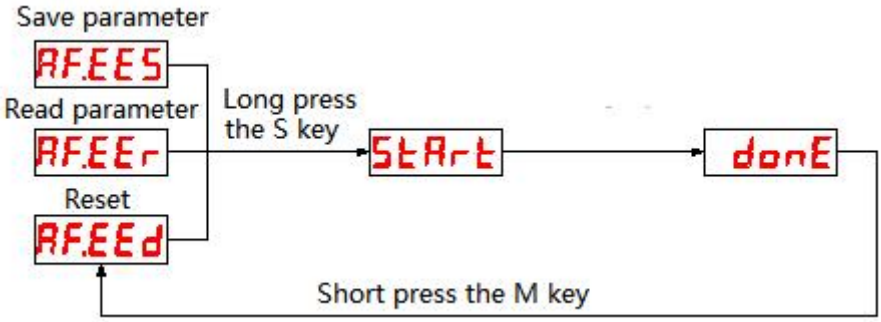
- **Note: The modified parameters are only sent to the RAM area of the driver, and the value before the modification will be restored after the driver is powered off and restarted. After confirming the correctness of the parameter, if you need to save the parameter value permanently, you need to perform the "parameter save" operation on the auxiliary function operation interface.**

4.3 Auxiliary function

4.3.1 Parameter management

- Save parameters: The parameters modified by the user through the "parameter setting" interface or the upper computer are only changed in the memory and will be lost after power off. If you want to change the parameters permanently, you need to execute the "save parameters" operation to write the internal parameters of the chip into the EEPROM inside the servo drive, and the modified parameter values will be used after power-on.
- Read parameters: Read the parameters stored in EEPROM into the chip memory. This parameter is automatically executed once when the drive is powered on. Therefore, the parameter value in the chip memory is the same as the parameter value in the EEPROM at the beginning of power-on. When the user is not satisfied with the modified parameters or the parameters are adjusted disorderly, execute this operation to read the parameters in the EEPROM into the chip memory and restore the parameters at the time of power-on.
- The factory default values of all parameters are read into the chip memory and written into the EEPROM. The default parameter values will be used next time the power is turned on. When the user

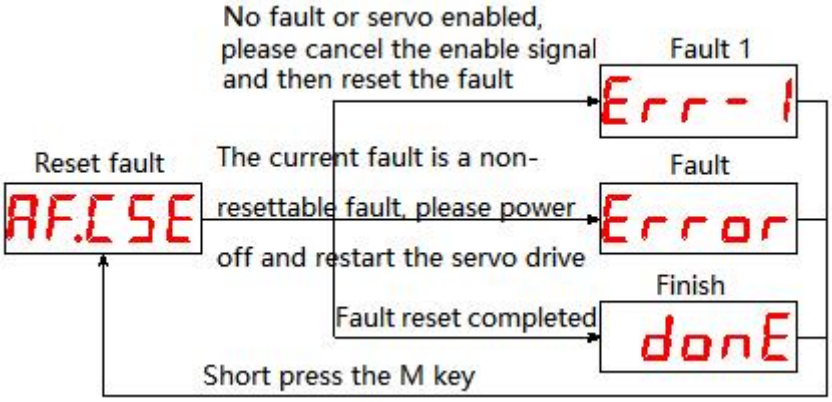
parameters are disordered and the servo drive cannot work normally, all parameters can be restored to the factory default values through this operation.



4.3.2 Fault reset

When a resettable fault or warning occurs to the servo driver, the fault information of the servo drive can be reset without power failure, so that the servo drive can resume normal working mode.

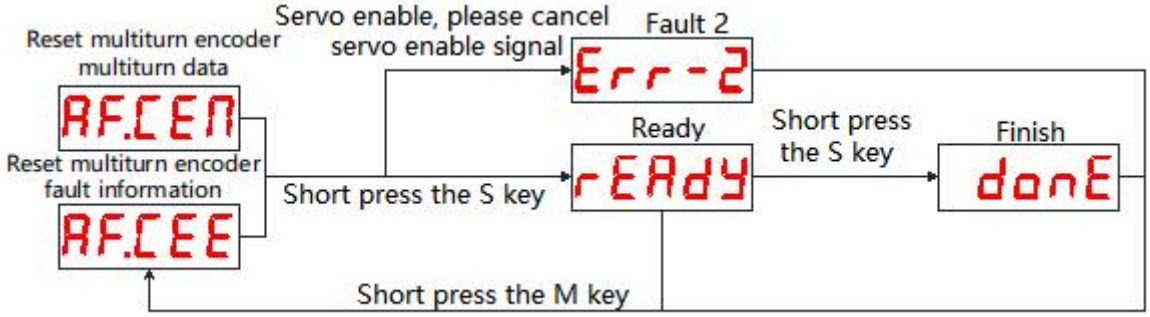
◆ Note: When using this operation, please disable the servo enable signal, otherwise the fault information cannot be reset.



4.3.3 Absolute value operation

This auxiliary function can be used to complete the task when a multi-turn encoder failure occurs or the multi-turn data of the absolute encoder needs to be cleared.

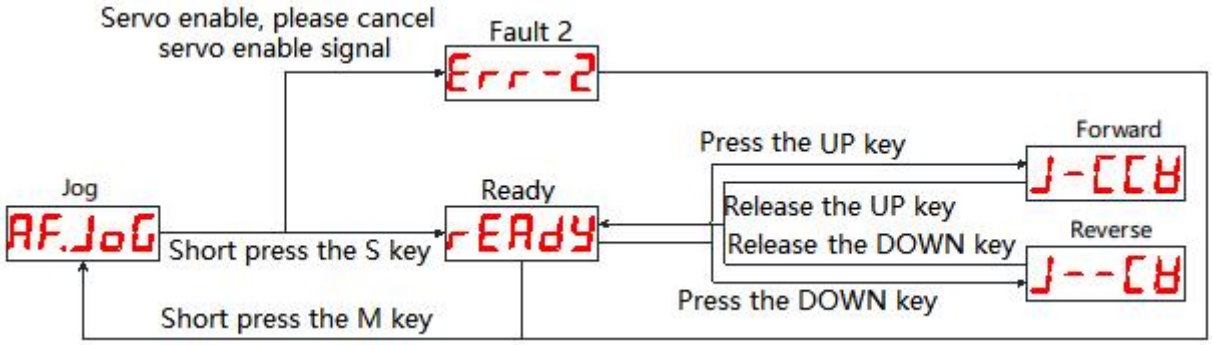
◆ Note: When using this operation, please disable the servo enable signal, otherwise the fault information cannot be reset.



4.3.4 Jog test machine

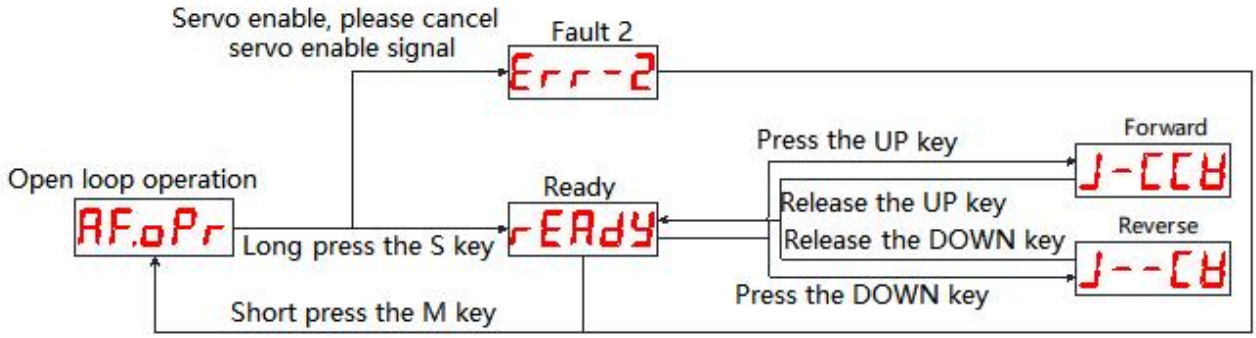
Through this operation, the servo driver can be tested.

◆ Note: When using this operation, please disable the servo enable signal.



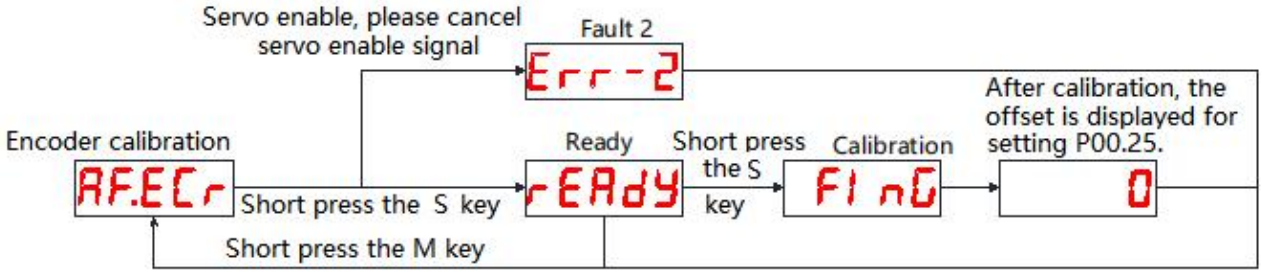
4.3.5 Open loop test

This function is only used for manufacturer testing, please do not operate.



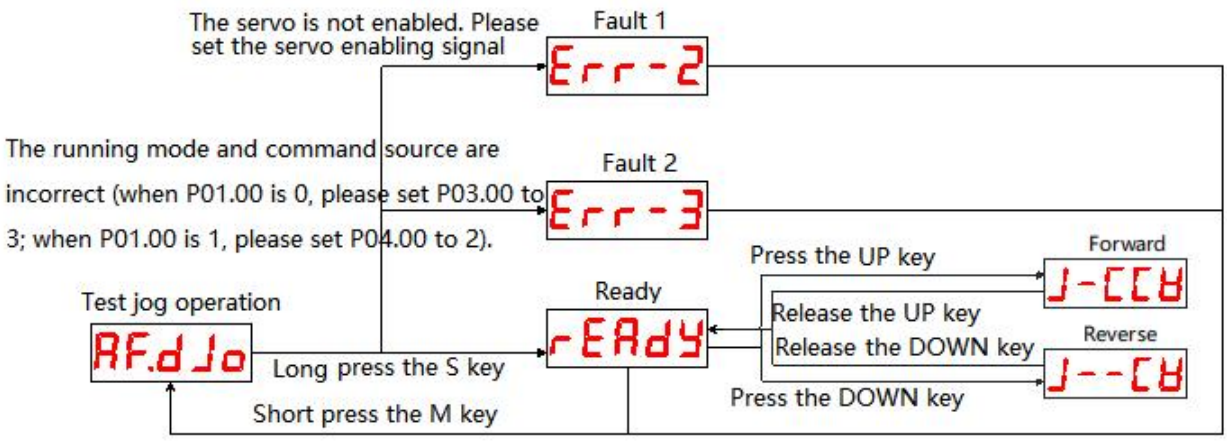
4.3.6 Encoder calibration

This function is only used for manufacturer testing, please do not operate.



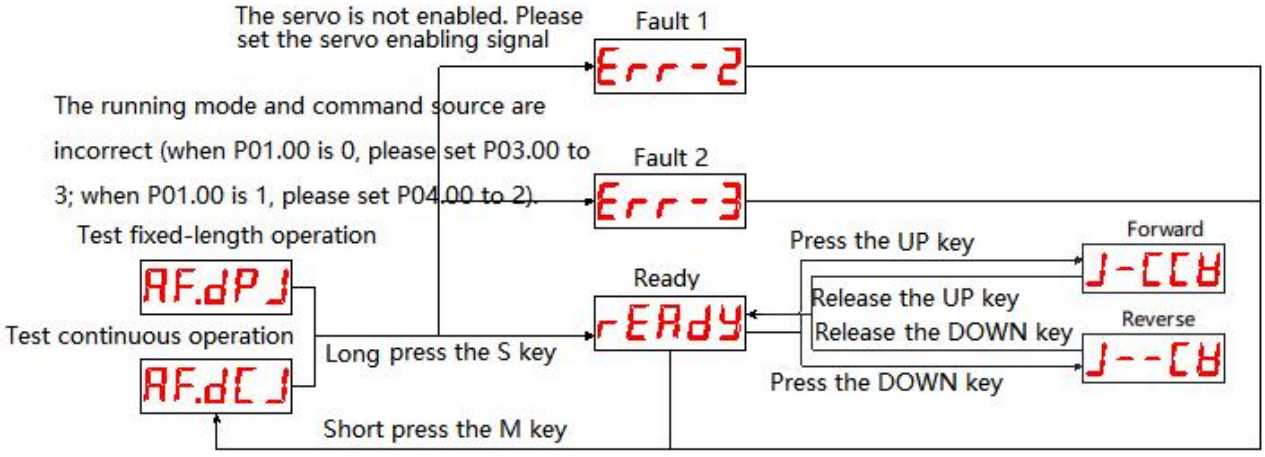
4.3.7 Jog operation

Control the mode and speed of test operation by setting parameters P01.00 (control mode), P04.62 (test operation speed), P04.63 (test operation acceleration time), P04.64 (test operation deceleration time).



4.3.8 Fixed length/continuous operation

By setting parameters P01.00 (control mode), P04.60/P04.61 (test command pulse number), P04.62 (test running speed), P04.63 (test running acceleration time), P04.64 (test running deceleration time) to control the mode, speed, and stroke of the test operation.



Chapter 5 Communication network configuration

5.1 EtherCAT protocol overview

EtherCAT is an industrial Ethernet technology with high performance, low cost, simple application and flexible topology. It can be used in industrial field-level ultra-high-speed I/O network, using standard Ethernet physical layer, transmission media twisted pair or optical fiber (100Base-TX or 100Base-FX). The EtherCAT system consists of a master station and a slave station. The master station only needs an ordinary network card, and the slave station needs a dedicated slave station control chip, such as: ET1100, ET1200, FPGA, etc.

EtherCAT one network to the end, protocol processing directly to the I/O layer:

- No need for any lower sub-bus
- No gateway delay
- A single system can cover all devices: input and output, sensors, actuators, drives, displays...
- Transmission rate: 2 x 100Mbit/s (fast Ethernet, full duplex mode)
- Synchronization: The distance between the two devices is 300 nodes, the cable length is 120 meters, and the synchronization jitter is less than 1us
- Refresh time:
  - 256 digital I/O: 11us
  - 1000 switch I/O distributed in 100 nodes: 30us
  - 200 analog I/O (16bit): 50us
  - 100 servo axes (each 8 Byte IN+OUT): 100us
  - 12000 digital I/O: 350us

In order to support more types of devices and a wider range of application layers, EtherCAT has established the following application protocols:

- CoE (CAN application protocol based on EtherCAT)
- SoE (Servo driver profile conforming to IEC61800-7-204 standard)
- EoE (EtherCAT realizes Ethernet)
- FoE (EtherCAT realizes file reading)

The slave device does not need to support all communication protocols. On the contrary, it only needs to select the communication protocol that is most suitable for its application.

5.2 System parameter setting

Object dictionary	Subindex	Name	Setting range	Default value
0x2003	01h	Control mode selection	0: Position mode 1: Speed mode 2: Torque mode 3: EtherCAT mode	3

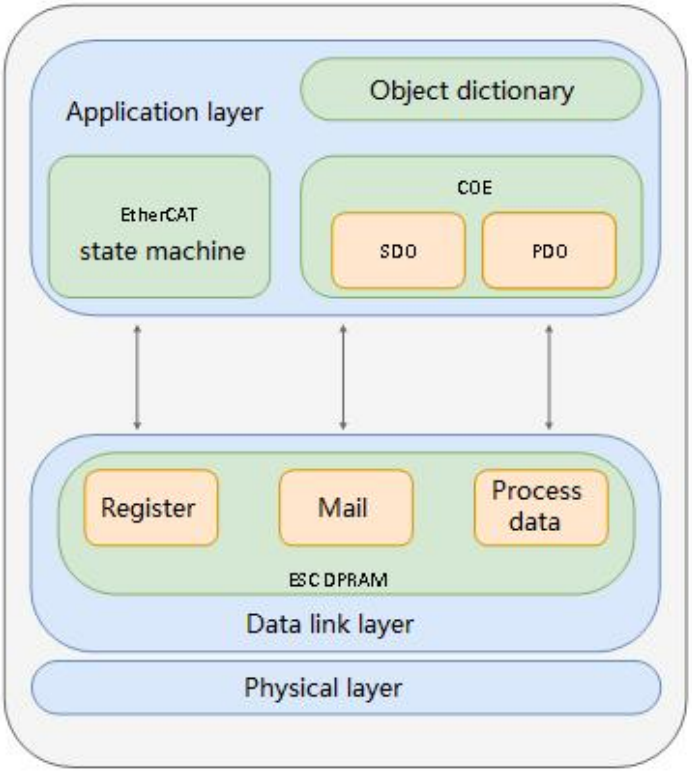
5.3 EtherCAT communication basics

5.3.1 EtherCAT communication specification

item		specifications
communication protocol		IEC 61158 Type 12, IEC 61800-7 CIA402 Driver Profile
application layer	SDO	SDO request, SDO answer
	PDO	Variable PDO Mapping
	CIA402	Profile Position Mode (PP) Profile Velocity Mode (PV) Profile Torque Mode (PT) Homing mode (HM) Cyclic Synchronous Position Mode (CSP) Cyclic Synchronous Velocity mode (CSV) Cyclic Synchronous Torque Mode (CST)
physical layer	transfer protocol	100BASE-TX（IEEE802.3）
	maximum distance	100M
	interface	RT45*2（IN、OUT）

5.3.2 Communications structure

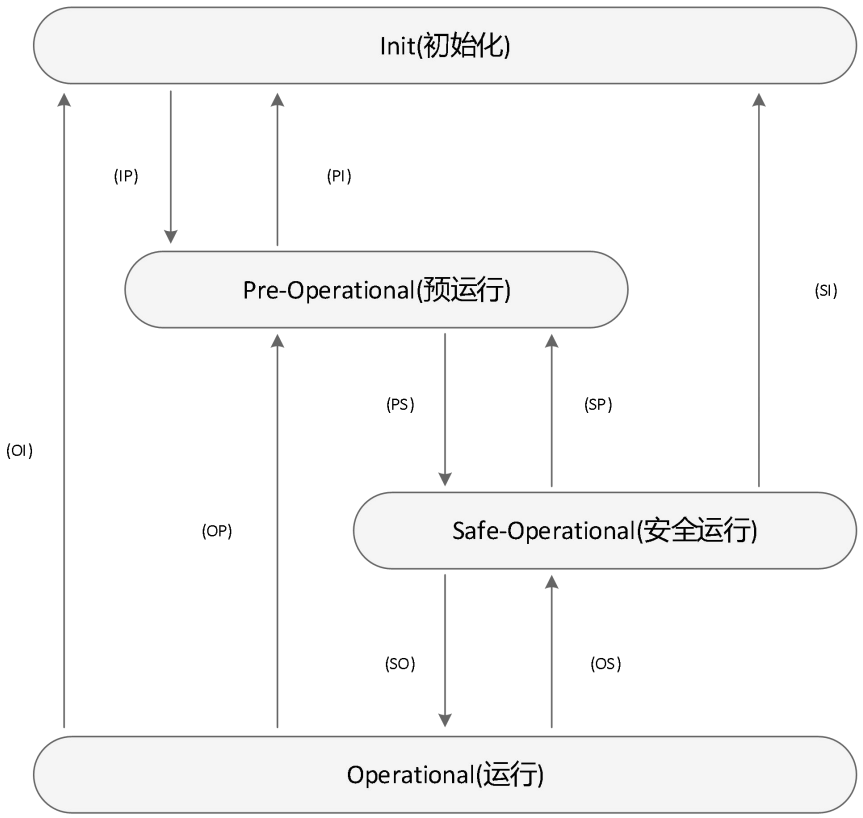
There are a variety of application layer protocols using EtherCAT communication. In the RS EtherCAT series servo drives, the IEC61800-7 (CIA402)-CANOpen motion control sub-protocol is used.
The figure below is the EtherCAT communication structure based on the CANOpen application layer.



In the structure diagram, the application layer object dictionary contains: communication parameters, application program data, and PDO mapping data. The PDO process data object contains real-time data during the operation of the servo drive, and is accessed periodically for reading and writing. To communicate with the DSO mailbox, some communication parameter objects and PDO process data objects are accessed and modified non-periodically.

5.3.3 State machine

The following block diagram shows the EtherCAT state transition:



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

Init: initialization, abbreviated as I

Pre-Operational: Pre-running, abbreviated as

Safe-Operational: safe operation, abbreviated as S

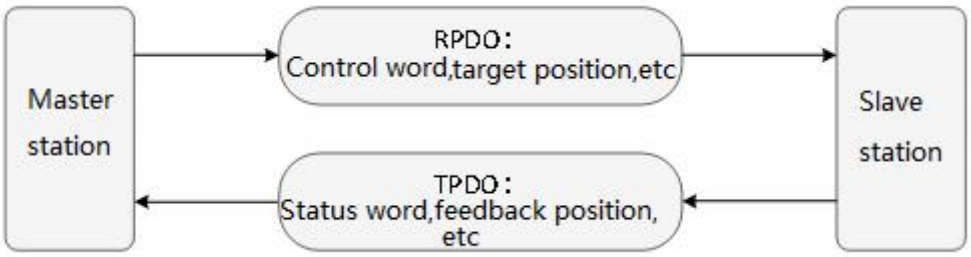
When transitioning from the initialization state to the running state, it must be transformed in the order of "initialization→pre-operation→safe operation→operation", and no leapfrogging is allowed. You can skip the conversion when returning from the running state. The state conversion operation and initialization process are as follows:

State and state transformation	operations
Initialization（I）	There is no communication at the application layer, the master can only read and write ESC registers

IP	Master configuration slave site address Configuring mailbox channels Configuring the DC Division Clock Requesting "Pre-Operational" status
Pre-Operational（P）	Application layer mailbox data communication (SDO)
PS	Master uses mailbox initialization process data mapping SM channel used for master configuration process data communication Master configuration FMMU Requesting "Safe operational"
Safe-Operational（S）	Process data communication is available, but only read input data is allowed, no output signals are generated (SDO, TPDO)
SO	Master sends valid output data Request "operational status"
Operational status （O）	Inputs and outputs all valid (TPDO, RPDO) Mailbox communication (SDO) is still available

5.3.4 Process Data PDO

The transmission of PDO real-time process data follows the producer-consumer model. PDO can be divided into RPDO (Reception PDO), the slave station receives the command of the master station through RPDO; and TPDO (Transmission PDO), the slave station feedbacks its own state through TPDO.



1） PDO mapping parameters

PDO mapping is used to establish the mapping relationship with PDO in the object dictionary. 1600h to 17FFh is RPDO and 1A00h to 1BFFh is TPDO. 3 RPDO and 3 TPDO are available in RS series EtherCAT servo drivers as shown in the following table:

PDO	index	maximum number of maps	longest byte	default mapping object
RPDO	1600h	12	48	6040 (control word) 607A (target position) 60B8 (probe function)
RPDO1	1601h	12	48	6040 (control word) 607A (target position) 6081 (profile speed) 6083 (profile acceleration)

				6084 (profile deceleration) 6060 (mode selection)
RPDO2	1602h	12	48	6040 (control word) 6083 (profile acceleration) 6084 (profile deceleration) 60FF (target speed) 6060 (mode selection)
TPDO0	1A00h	12	48	603F (error code) 6041 (status word) 6061 (mode display) 6064 (position feedback) 60B9 (probe status) 60BA (probe 1 rising edge position feedback) 60FD (DI status)
TPDO1	1A01h	12	48	6041 (status word) 6061 (mode display) 606C (speed feedback) 60FD (DI status)
TPDO2	1A02h	12	48	6041 (status word) 6064 (position feedback)

2） Synchronization manager PDO allocation settings

In EtherCAT periodic data communication, the process data can contain multiple PDO mapping data objects. The data objects 0x1C10～0x1C2F used by the CoE protocol define the corresponding SM (synchronous management channel) PDO mapping object list. Multiple PDO can be mapped in different sub-index.

In DRV series EtherCAT servo drivers, 1 RPDO frequency division and 1 TPDO frequency division are supported, as shown in the following table:

index	subindex	elements
0x1C12	01h	Choose to use one of 0x1600, 0x1601, 0x1602 as the actual RPDO used
0x1C13	01h	Choose to use one of 0x1A00, 0x1A01, 0x1A02 as the actual TPDO used

3） PDO Configuration

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

number of digits	31	……	16	15	……	8	7	……	0
connotation	index			subindex			object length		

The index and sub-index jointly determine the position of the object in the object dictionary. The length of the object indicates the specific bit length of the object, expressed in hexadecimal, namely:

Object length	Bit length
08h	8-bit
10h	16-bit
20h	32-bit

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

5.3.5 Mailbox Data SDO

EtherCAT mailbox data SDO is used to transmit non-periodic data, such as the configuration of communication parameters, the configuration of servo drive operating parameters, etc. EtherCAT's CoE service types include: 1. Emergency information; 2. SDO request; 3. SDO response; 4. TXPDO; 5. RXPDO; 6. Remote TXPDO sending request; 7. Remote RXPDO sending request; 8. SDO information.

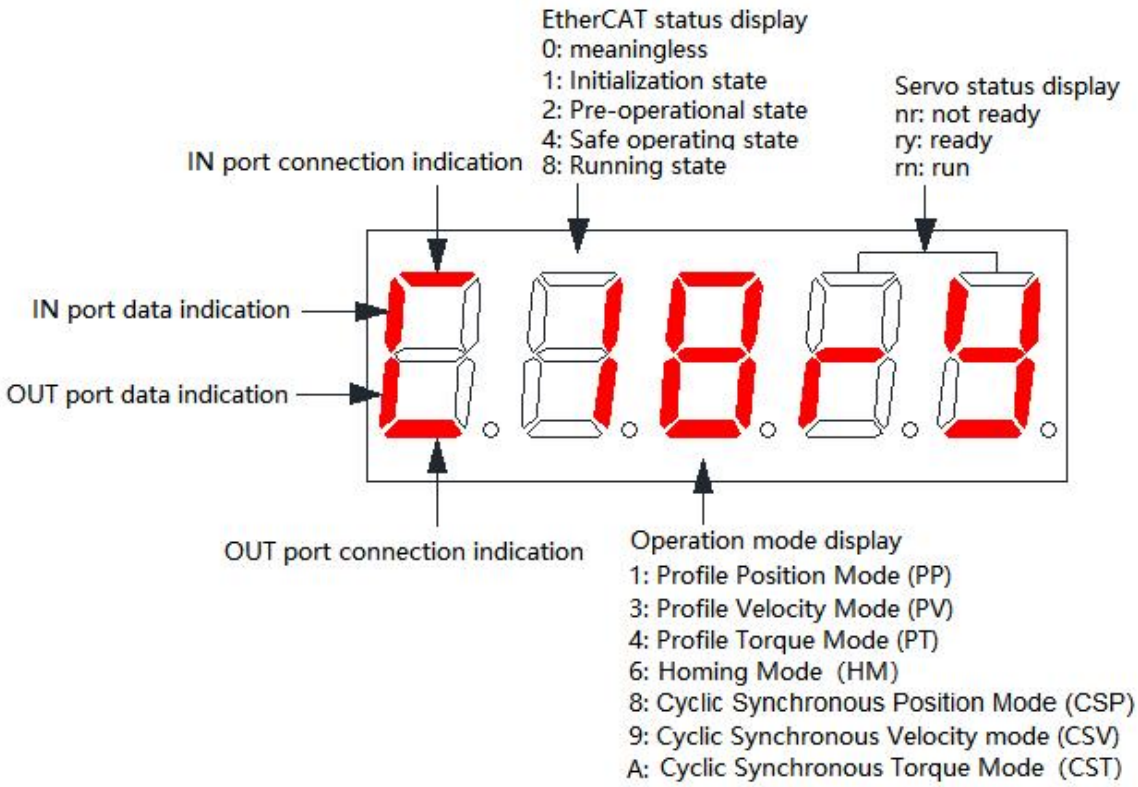
5.3.6 Distributed clock

The distributed clock can make all EtherCAT devices use the same system time, thereby controlling the synchronous execution of the tasks of each device. The slave device can generate synchronization signals based on synchronized system events. DRV series EtherCAT drivers support SM synchronization mode and DC synchronization mode. The synchronization cycle is controlled by SYNC0, and the cycle range varies according to different motion modes.

5.3.7 Status indicators

The object can be monitored by the driver LED:

Monitor the current status of the driveR, and the description of the monitored values is shown in the figure below:



1） Communication connection status

The RS EtherCAT servo driver uses the upper and lower "-" of the first digital tube from the left in the 5-digit LED indicator on the panel to reflect the connection status of the two RJ45 ports: upper "-" (IN port), lower "-" (OUT port)

Long dark: The physical layer does not detect the communication connection

Steady on: The physical layer has established a communication connection

2） Data transfer status

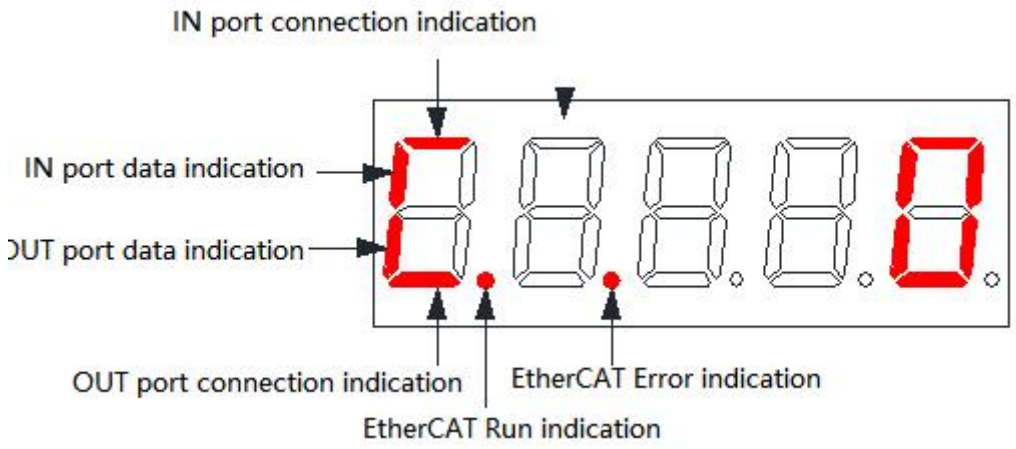
The RS EtherCAT servo driver uses the upper and lower "｜" of the first digital tube from the left in the 5-digit LED indicator on the panel to reflect the data transmission status of the two RJ45 ports: the upper "｜" (IN port), the lower "｜" (OUT port)

Flashing: data is being transferred

3） Communication operating status

The communication and servo status and the communication connection status are displayed on the same interface. The second digit from the left of the 5-digit LED indicator on the panel displays the status of the slave station's EtherCAT state machine in character form.

Or under the LED speed monitoring interface: The decimal point of the first digit from the left in the 5-digit LED indicator on the panel indicates the running status of EtherCAT, which is defined as follows:



LED	statuses	description
EtherCAT Run indicators	not bright	Initialization
	slow flash	Pre-Operational
	single flash	Safe-Operational
	always bright	Operational status (Operational)
EtherCAT Error indicators	not bright	No errors
	slow flash	General errors
	single flash	Synchronization error
	double flash	Watchdog error

- **Remarks：**

Fast flash: 50ms on, 50ms off (10Hz)

Slow flash: 200ms on, 200ms off (2.5Hz)

Single flash: 200ms on, 1000ms off

Double flash: 200ms on, 200ms off, 200ms on, 1000ms off

4） Servo mode display

The communication and servo status and the communication connection status are displayed on the same interface. The third digital tube from the left in the 5-digit LED indicator on the panel displays the current servo operating mode in the form of hexadecimal numbers.

Servo operation mode includes the following:

Servo operation mode display 6060h	Panel display
1: Profile position mode	1
3: Profile velocity mode	3
4: Profile torque mode	4
6: Homing mode	6
8: Cyclic synchronous position mode	8
9: Cyclic synchronous velocity mode	9
10: Cyclic synchronous torque mode	A

5） Servo status display

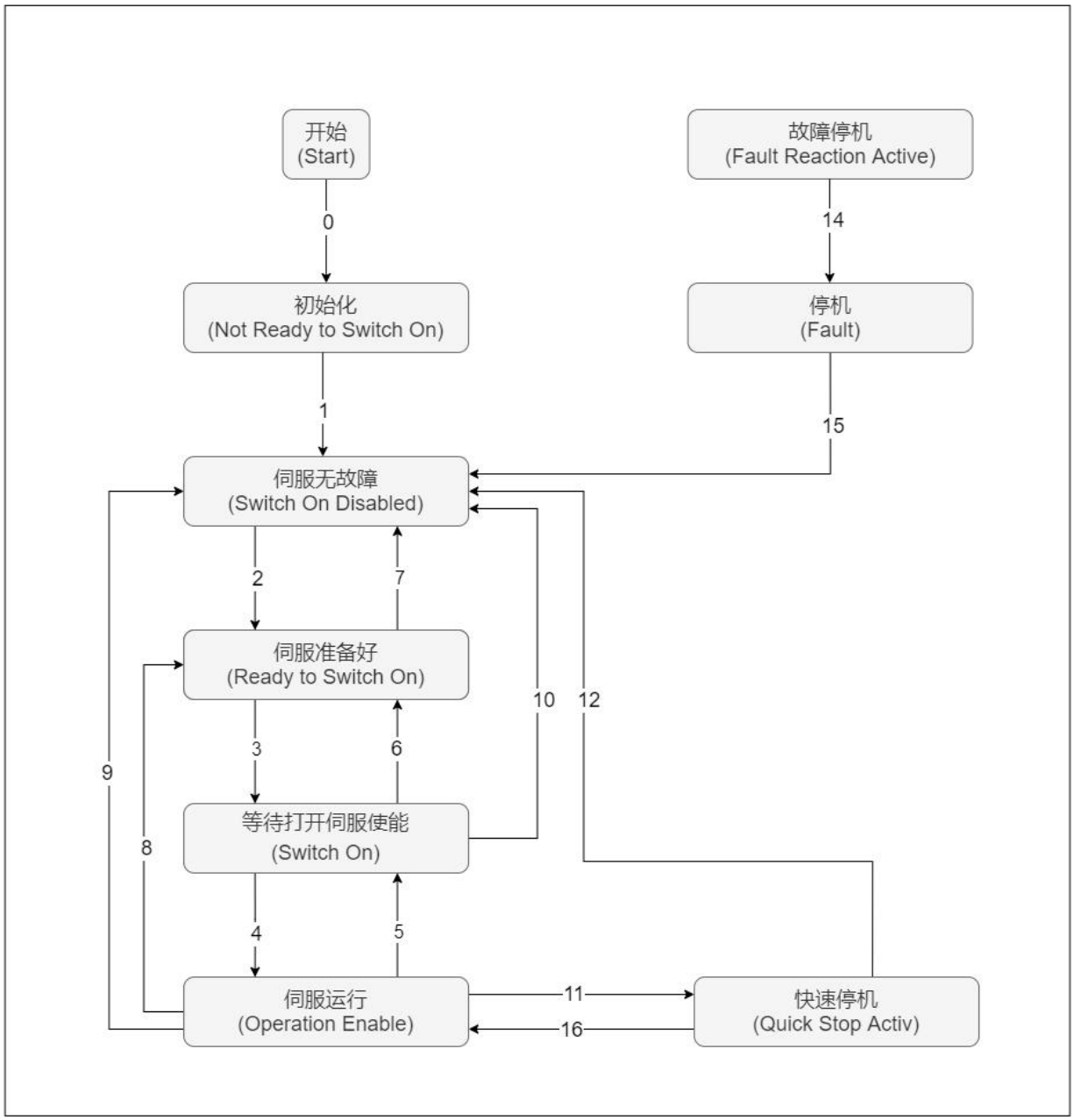
The communication and servo status and the communication connection status are displayed on the same interface. The 4th to 5th digits from the left of the 5-digit LED indicator on the panel display the slave's servo status in characters.

The servo status includes the following:

Status	Description	Panel display
Reset	Servo drive is powering on and initializing	-
Not ready	The initialization has been completed, the power is not connected or the servo is faulty Not Ready	nr
Get ready	The power supply has been connected, and the servo enable is invalid. Ready	ry
Running servo	Servo enable is valid, and the motor is running while energized. Run	rn

5.3.8 Introduction to CIA 402 Control

To use RS EtherCAT driver, the servo driver must be guided in accordance with the process specified in the standard CiA402 protocol, so that the servo drive can run in the specified state.



The description of each state is as follows:

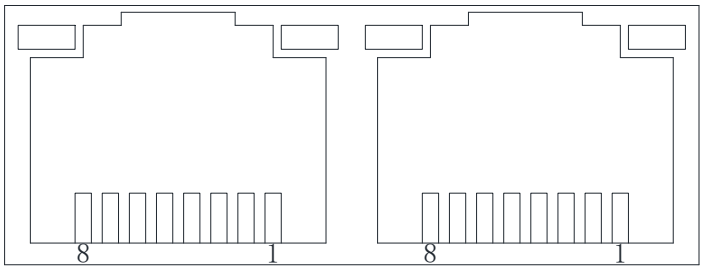
Initialization	Driver initialization and internal self-check have been completed The parameters of the driver cannot be set, nor can the driver function be executed
Servo without failure	The servo driver has no fault or the error has been eliminated Driver parameters can be set
Servo ready	Servo driver is ready Driver parameters can be set
Waiting to turn on servo enable	The servo driver is waiting to turn on the servo enable Driver parameters can be set
Servo operation	The driver is operating normally, a certain servo operation mode has been enabled, the motor has been energized, and when the command is not 0, the motor will rotate

	The drive parameter attribute can be set as "operational change", otherwise it cannot be set.
Quick stop	The quick stop function is activated, and the driver is executing the quick stop function The driver parameter attribute can be set as "operational change", otherwise it cannot be set
Fault shutdown	The driver has failed and is in the process of shutdown. The driver parameter attribute can be set as "operational change", otherwise it cannot be set
Faults	When the fault stop is completed, all driver functions are prohibited, and the driver parameters are allowed to be changed in order to eliminate the fault.

5.3.9 Basic features

1） Interface Information

The EtherCAT network cable is connected to RJ45 terminals with metal shield and is divided into input (IN/CN5) and output (OUT/CN4) interfaces. The electrical characteristics are in accordance with IEEE802.3, ISO8877.

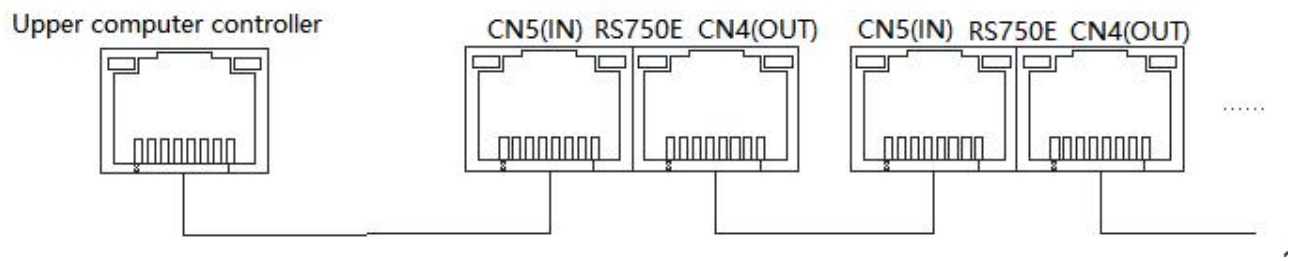


pin	meaning	description
1	TX+	Data sending+
2	TX-	Data sending-
3	RX+	Data reception+
4	NULL	none
5	NULL	none
6	RX-	Data reception-
7	NULL	none
8	NULL	none

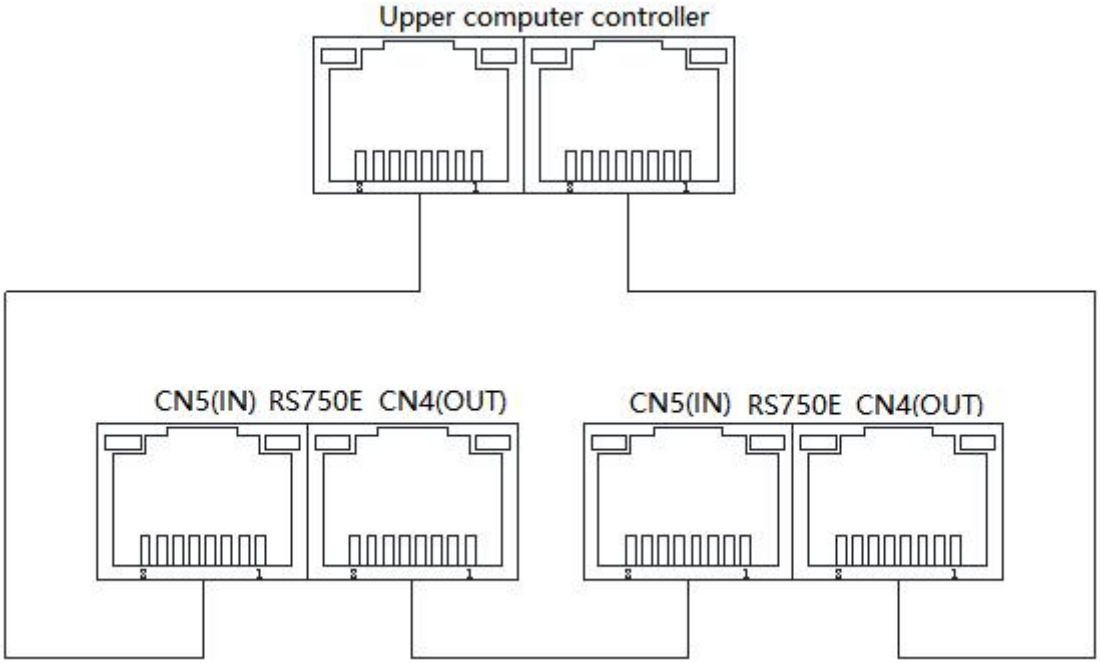
2） Topological connection

The EtherCAT communication topology is flexible in connection and has basically no restrictions. This servo has IN (CN5) and OUT (CN4) interfaces and the topology is connected as follows.

Linear connection:



Redundant ring connections:



3） Communication cable

Ethernet Category 5 (100BASE-TX) network cables or high-strength shielded network cables are used for EtherCAT communication. When using servo drives, a shielded network cable with a length of up to 100 M is also required. shielded network cables increase the immunity of the system.

Chapter 6 Control mode

6.1 Basic settings

6.1.1 Conversion factor setting

Object 6091h is used to set the electronic gear ratio of the servo driver:

The essential meaning of gear ratio is: when the load shaft is displaced by one command unit, the corresponding motor displacement (unit: encoder unit). The gear ratio is composed of the numerator 6091-01h and the denominator 6091-02. Through the gear ratio, the proportional relationship between the displacement of the load shaft (command unit) and the displacement of the motor (encoder unit) can be established:

Motor displacement = load shaft displacement x gear ratio

The motor and the load are connected with other mechanical transmission mechanisms through a reducer. Therefore, the gear ratio is related to the mechanical reduction ratio, mechanical size-related parameters, and motor resolution. The calculation method is as follows:

$$\text{gear ratio} = \frac{\text{motor resolution}}{\text{load shaft resolution}}$$

Index 6091h	Name	Gear ratio					Data structure	ARR	Data type	Uint32
	Data range	OD data range	Factory setting	OD default	Accessibility	-	Related models	PP/PV/CSP/CSV/HM	Map	YES

The gear ratio is used to establish a user-specified proportional relationship between the load shaft displacement and the motor shaft displacement.

1）、motor feedback position (encoder unit) and load axis position feedback (command unit relationship:

$$\text{motor feedback position} = \text{load shaft feedback position} \times \text{gear ratio}$$

2）、Motor speed (rpm) versus load shaft speed (command unit/s):

$$\text{motor spees(rpm)} = \frac{\text{load shaft speed} \times \text{gear ratio}}{\text{encoder resolution}} \times 60$$

3）、Motor acceleration (rpm/ms) versus load speed (command unit/s ^{2}):

$$\text{motor acceleration} = \frac{\text{load shaft acceleration} \times \text{gear ratio}}{\text{encoder resolution}} \times \frac{1000}{60}$$

Subindex 00h	Name	Maximum subindex number of the gear ratio					Data structure	-	Data type	Uint8
	Data range	-	Factory setting	2	Accessibility	RO	Related models	-	Map	NO

Subindex 01h	Name	Gear ratio numerator					Data structure	VAR	Data type	Int32
	Data range	1～(2^{31}-1)	Factory setting	1	Accessibility	RW	Related models	-	Map	RPDO

Subindex 02h	Name	Gear ratio denominator					Data structure	VAR	Data type	Int32
	Data range	1～(2^{31}-1)	Factory setting	1	Accessibility	RW	Related models	-	Map	RPDO

- Take a ball screw as an example:

Minimum unit of command fc = 1mm

Lead screw PB = 10mm/r

Deceleration ratio n = 5:1

ncoder resolution for motor model RSMA-M08J2430A is P = 131072 (p/r)

Therefore, the location factor is calculated as follows:

$$location\ factor = \frac{P \times n}{PB} = \frac{131072 \times 5}{10} = \frac{65536}{1}$$

Therefore:

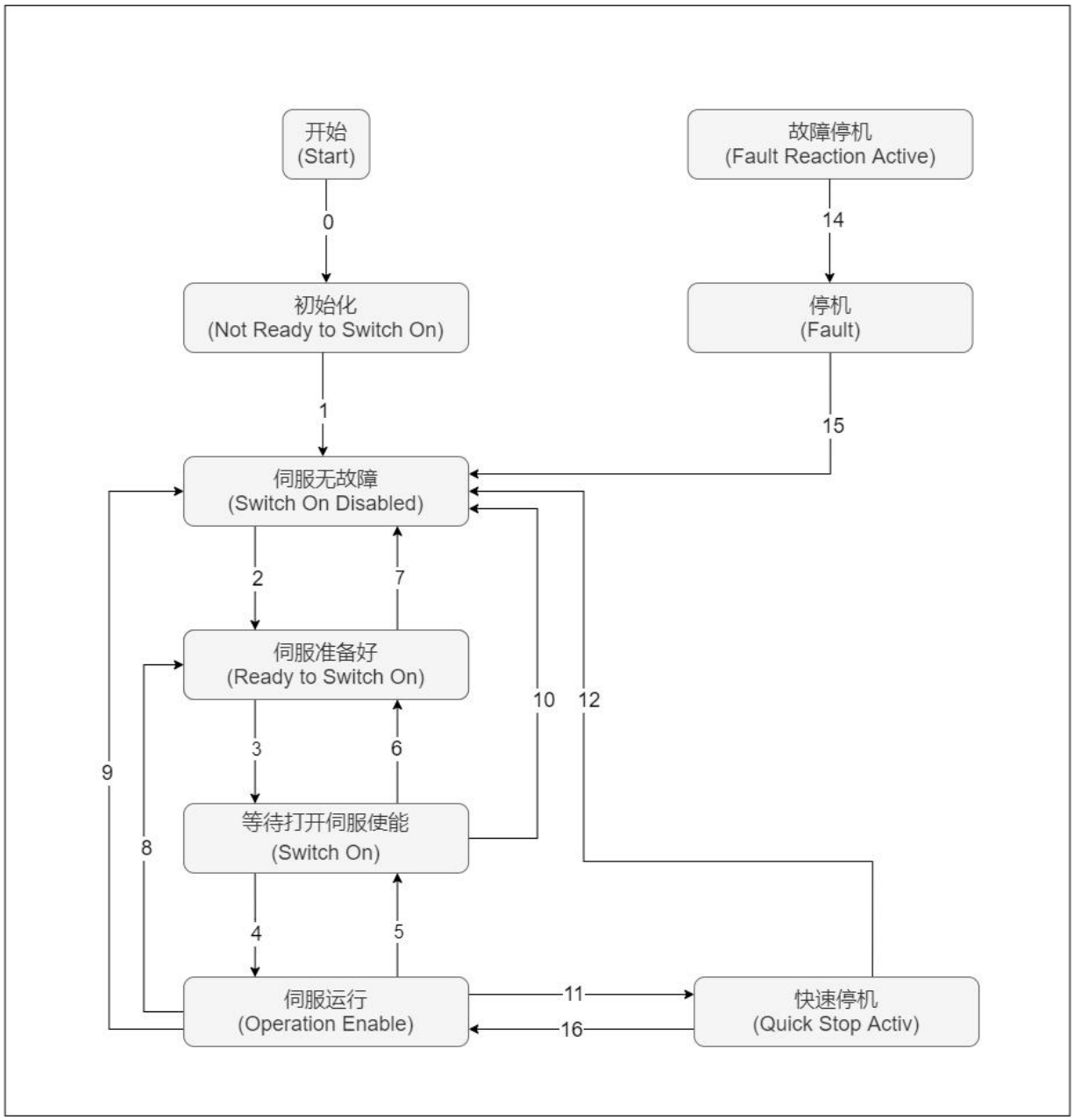
6091-01h = 65536

6091-02h = 1

Its essential meaning is: when the load displacement is 1mm, the motor displacement is 65536 strokes (encoder unit)

6.2 **Servo status setting**

The servo driver must be guided in accordance with the process specified in the standard CiA402 protocol for the Servo Drive to operate in the specified state.



Initialization	Driver initialization and internal self-check have been completed The parameters of the driver cannot be set, nor can the driver function be executed
Servo without failure	The servo driver has no fault or the error has been eliminated Driver parameters can be set
Servo ready	Servo driver is ready Driver parameters can be set
Waiting to turn on servo enable	The servo driver is waiting to turn on the servo enable Driver parameters can be set
Servo operation	The driver is operating normally, a certain servo operation mode has been enabled, the motor has been energized, and when the command is not 0, the motor will rotate The drive parameter attribute can be set as "operational change", otherwise it cannot be set.

Quick stop	The quick stop function is activated, and the driver is executing the quick stop function The driver parameter attribute can be set as "operational change", otherwise it cannot be set
Fault shutdown	The driver has failed and is in the process of shutdown. The driver parameter attribute can be set as "operational change", otherwise it cannot be set
Faults	When the fault stop is completed, all driver functions are prohibited, and the driver parameters are allowed to be changed in order to eliminate the fault.

Control commands and status switching:

CiA402 state switching		Control word 6040h	Bit0 to Bit9 of status word 6041h
0	Power on → Initialization	Natural transition, no control commands required	0x0000
1	Initialization → No servo failure	Natural transition, no control commands required	0x0250
2	Servo is fault-free → Servo is ready	0x0006	0x0231
3	Servo ready → Wait to turn on servo enable	0x0007	0x0233
4	Wait to turn on servo enable → Servo operation	0x000F	0x0237
5	Servo operation → Wait to turn on servo enable	0x007	0x0233
6	Wait to turn on servo enable → Servo ready	0x006	0x0231
7	Servo ready → No servo failure	0x0000	0x0250
8	Servo running → Servo ready	0x0006	0x0231
9	Servo operation → No servo failure	0x0000	0x0250
10	Wait to turn on servo enable → No servo failure	0x0000	0x0250
11	Servo operation → Quick stop	0x0002	0x217
12	Quick stop → servo-free	Natural transition after shutdown is complete, no control commands required	0x0250
13	→ Failure to stop	If the servo driver fails in any state other than "fault", it will automatically switch to the fault stop state without command control.	0x021F
14	Failure to stop → Failure	Natural transition after the fault stop is done, no control commands required	0x0218
15	Fault → Servo without fault	0x80	0x0250
16	Quick stop → servo operation	When the shutdown is complete, send 0x0F	0x0237

6.2.1 Control word 6040h

Index 6040h	名称	控制字					数据结构	VAR	数据类型	Uint16
	数据范围	0～65535	出厂设定	0	可访问性	RW	相关模式	ALL	能否映射	RPDO

Set control commands:

Bit	Name		description
0	可以开启伺服运行	Switch on	0: invalid, 1: valid
1	接通主回路电	Enable voltage	0: invalid, 1: valid
2	快速停机	Quick stop	0: invalid, 1: valid
3	伺服运行	Enable operation	0: invalid, 1: valid
4～6	运行模式相关	Operation mode specific	Related to servo operation mode
7	故障复位	Fault reset	For resettable faults and warnings, perform fault reset function The rising edge of Bit7 is valid; Bit7 remains at 1, other control commands are invalid
8	暂停	Halt	Please consult the object dictionary 605Dh for the pause method in each mode
9	运行模式相关	Operation mode specific	Related to each servo operation mode
10	保留	Reverse	undefined
11～15	厂家自定义	Manufacturer-specific	Manufacturer customization

◆ Note：

1)、Each Bit of the control word is meaningless when assigned individually, and must be used with other bits that do not form part of a control command；

2)、Bit0 to Bit3 and Bit7 have the same meaning in each servo mode, and commands must be sent in sequence to direct the servo driver into the expected state according to the CiA402 state machine switching process, with each command corresponding to a defined state.；

3)、Bit4 to Bit6 are related to each servo mode, please check the control commands in different modes；

4)、Bit9 undefined function

6.2.2 Status word 6041h

Index 6041h	Name	status word					Data structure	VAR	Data type	Uint16
	Data range	0～65535	Factory setting	0	Accessibility	RO	Related models	ALL	Map	TPDO

Reflect the current running status of the servo driver：

Bit	Name		description
0	伺服准备好	Ready to switch on	0: invalid, 1: valid
1	可以开启伺服运行	Switch on	0: invalid, 1: valid
2	伺服运行	Operation enabled	0: invalid, 1: valid
3	故障	Fault	0: invalid, 1: valid
4	主电路电接通	Voltage enabled	0: invalid, 1: valid
5	快速停机	Quick stop	0: invalid, 1: valid
6	伺服不可运行	Switch on disabled	0: invalid, 1: valid
7	警告	Waming	0: invalid, 1: valid
8	厂家自定义	Manufacturer specific	undefined
9	远程控制	Remote	0: invalid, 1: valid (control word in effect)
10	目标到达	Target reach	0: invalid, 1: valid
11	内部限制有效	Internal limit active	0: invalid, 1: valid
12～13	运行模式相关	Operation limit active	Related to each servo operation mode
14	厂家自定义	Manufacturer specific	undefined
15	原点已找到	Home find	0: invalid, 1: valid

Displayed value (binary value)	description
xxxx xxxx x0xx 0000	未准备好（Not ready to switch on）
xxxx xxxx x1xx 0000	启动失效（Switch on disabled）
xxxx xxxx x01x 0001	准备好（Ready to switch on）
xxxx xxxx x01x 0011	启动（Switch on）

xxxx xxxx x01x 0111	操作使能（Operation enabled）
xxxx xxxx x00x 0111	快速停机有效（Quick stop active）
xxxx xxxx x0xx 1111	故障反应有效（Fault reaction active）
xxxx xxxx x0xx 1000	故障（Fault）

◆ Note：
1)、Bit0 to Bit9 have the same meaning in each servo mode. After the control word 6040h sends the command in sequence, the servo feeds back a determined state.
2)、Bit12 to Bit13 are related to each servo mode (please check the control commands in different modes)
3)、Bit10, Bit11, Bit15 have the same meaning in each servo mode, feedback the state of the servo after executing a certain servo mode.

6.3 Servo mode setting

6.3.1 Introduction to servo mode

Index 60FFh	Name	Supports servo operation mode					Data structure	VAR	Data type	Uint32
	Data range	-	Factory setting	941	Accessibility	RO	Related models	-	Map	NO

Reflect the servo operation mode supported by the drive:

Bit	description	Support or not (0: not support, 1: support)
0	轮廓位置模式（PP）	1
1	变频调速模式（VL）	0
2	轮廓速度模式（PV）	1
3	轮廓转矩模式（PT）	1
4	NA	0
5	回零模式（HM）	1
6	插补模式（IP）	0
7	周期同步位置模式（CSP）	1
8	周期同步速度模式（CSV）	1
9	周期同步转矩模式（CST）	1
10～31	NA	0

Index 6060h	Name	Mode selection					Data structure	VAR	Data type	Int16
	Data range	0～10	Factory setting	8	Accessibility	RW	Related models	ALL	Map	RPDO

Select the servo operation mode:

Set value	Servo mode
0/2/5	NA
1	轮廓位置模式（PP）
3	轮廓速度模式（PV）
4	轮廓转矩模式（PT）

6	回零模式（HM）
7	插补模式（IP）
8	周期同步位置模式（CSP）
9	周期同步速度模式（CSV）
10	周期同步转矩模式（CST）

Index 6061h	Name	Operation mode display					Data structure	VAR	Data type	Int16
	Data range	0～10	Factory setting	8	Accessibility	RO	Related models	ALL	Map	TPDO

Select the current operating mode of the servo driver：

Set value	Servo mode
0/2/5	NA
1	轮廓位置模式（PP）
3	轮廓速度模式（PV）
4	轮廓转矩模式（PT）
6	回零模式（HM）
7	插补模式（IP）
8	周期同步位置模式（CSP）
9	周期同步速度模式（CSV）
10	周期同步转矩模式（CST）

6.3.2 Mode Switching

Precautions for the use of servo operation status switching:

1） When the servo drive is in any state, after switching from the profile position mode or the cyclic synchronous position mode to other modes, the unexecuted position commands will be discarded.

2） When switching from other modes to running in cyclic synchronization mode, please send the command at least 5ms apart, otherwise command loss or error will occur.

6.4 Cyclic Synchronous Position Mode (CSP)

In the cyclic synchronous position mode, the host computer performs position command planning, and then sends the planned target position 607Ah to the servo drive in a cyclic synchronous manner, and the position, speed and torque control is done internally by the servo drive.

6.4.1 Related objects

Control word 6040h		
Bit	Name	Description
0	伺服准备好(Switch On)	When the value of Bit0 to Bit3 is 1, the motor is enabled
1	接通主回路电(Enable Voltage)	
2	快速停机(Quick Stop)	
3	伺服运行(Enable Operation)	
7	复位故障(Reset Fault)	0: no effect 1: Reset drive failure

Status word 6041h		
Bit	Name	Description
10	目标到达 Target Reached	0: target position not reached 1: target position reached
11	软件内部位置超限 Internal Limit Active	0: Neither the position command nor the position feedback exceeds the limit 1: Position command or position feedback overrun
12	从站跟随指令 Driver Follow the Command	0: Slave not following command 1: Slave follow command
13	跟随错误 Following Error	0: No excessive position deviation fault 1: Excessive position deviation fault occurs
15	原点回零完成 Home Find	0: Home not completed 1: Home completed

Index (Hex)	Subindex (Hex)	Name	Data type	Setting range	Accessibility	Default value
603F	00	error code	Uint16	-	RO	0
6040	00	control word	Uint16	0～65535	RW	0
6041	00	status word	Uint16	-	RO	0
6060	00	operating mode	Int16	0～10	RW	8
6061	00	mode display	Int16	-	RO	8
6062	00	position command (unit: command unit)	Int32	-	RO	-
6063	00	position feedback (unit: encoder unit)	Int32	-	RO	-
6064	00	position feedback (unit: command unit)	Int32	-	RO	-
6065	00	position deviation excess Threshold (unit: command unit)	Uint32	$0～2^{32}-1$	RW	393216
6067	00	position reach threshold (unit: encoder unit)	Uint32	0～65535	RW	92
6068	00	position arrival time window (unit: ms)	Uint16	0～65535	RW	10
606C	00	actual speed (unit: command unit/s)	Int32	-	RO	-
6072	00	maximum torque (unit: 0.1%)	Uint16	0～3000	RW	3000
6077	00	actual torque (unit: 0.1%)	Int16	-5000～5000	RO	-
607A	00	target position (unit: command unit)	Int32	$-2^{31}～2^{31}-1$	RW	0
6091	01	gear ratio numerator	Uint32	$1～2^{32}-1$	RW	1
	02	gear ratio denominator	Uint32	$1～2^{32}-1$	RW	1
60F4	00	position deviation (unit: command units)	Int32	-	RO	-

60FC	00	position command (unit: encoder unit)	Int32	-	RO	-
2009	01	speed loop gain	Uint16	0～50000	RW	4000
	02	speed loop integration time	Uint16	1～30000	RW	1500
	03	position loop gain	Uint16	0～50000	RW	800
	0F	torque loop gain	Uint16	0～50000	RW	800
	10	torque loop integration time	Uint16	1～10000	RW	500

6.4.2 Related function settings

1） Positioning completion signal

Index (Hex)	Subindex (Hex)	Name	Description
2006	07	Position arrival threshold unit selection	Set the unit for 6067h. 0: command unit 1: encoder unit
6067	00	Position reaches threshold	If the absolute value of position deviation is within 6067h and the time reaches 6068h, the DO signal of position completion is valid and 6041h. Bit10 is set to 1. If either of these conditions is not met, the position arrival is invalid.
6068	00	Position arrival time window	

2） Position deviation excess threshold

Index (Hex)	Subindex (Hex)	Name	Description
6065	00	Position deviation excess threshold	When the absolute value of the position deviation is greater than the set value, an excessive position deviation fault occurs, the drive LED panel will display AL.240, and the status word 6041h4.Bit13 will be set to 1. When the set value is 0xFFFFFFFF, the drive will not detect excessive position deviation

6.4.3 Recommended configuration

RPDO	TPDO	Description
6040h：控制字(Control Word)	6041h：状态字(Status Word)	necessary
607Ah：目标位置(Target Position)	6064h：位置反馈(Position Actual Value)	necessary
6060h：模式选择(Modes of Operation)	6061h：运行模式(Modes of Operation Display)	optional
	603Fh：错误代码(Error Code)	optional
	60FDh：数字输入(Digital Inputs)	optional

6.5 Cyclic Synchronous Velocity mode (CSV)

In the cyclic synchronous velocity mode, the host computer sends the planned target speed of 60FFh to the servo drive in a cyclic synchronous manner, and the speed and torque control is done internally by the servo drive.

6.5.1 Related objects

Control word 6040h		
Bit	Name	Description
0	伺服准备好(Switch On)	When the value of Bit0 to Bit3 is 1, the motor is enabled
1	接通主回路电(Enable Voltage)	
2	快速停机(Quick Stop)	
3	伺服运行(Enable Operation)	
7	复位故障(Reset Fault)	0: no effect 1: Reset drive failure

Status word 6041h		
Bit	Name	Description
10	目标到达 Target Reached	0: Target speed not reached 1: Target speed reached
11	软件内部位置超限 Internal Limit Active	0: Neither the position command nor the position feedback exceeds the limit 1: Position command or position feedback overrun
12	从站跟随指令 Driver Follow the Command	0: Slave not following command 1: Slave follow command
15	原点回零完成 Home Find	0: Home not completed 1: Home completed

Index (Hex)	Subindex (Hex)	Name	Data type	Setting range	Accessibility	Default value
6040	00	control word	Uint16	0～65535	RW	0
6041	00	status word	Uint16	-	RO	0
6060	00	operating mode	Int16	0～10	RW	8
6061	00	mode display	Int16	-	RO	8
6063	00	position feedback (unit: encoder unit)	Int32	-	RO	-
6064	00	position feedback (unit: command unit)	Int32	-	RO	-
606C	00	actual speed (unit: command unit/s)	Int32	-	RO	-
6072	00	maximum torque	Uint16	0～3000	RW	3000

		(unit: 0.1%)				
6077	00	actual torque (unit: 0.1%)	Int16	-5000～5000	RO	-
6091	01	gear ratio numerator	Uint32	1～2^{31}-1	RW	1
	02	gear ratio denominator	Uint32	1～2^{31}-1	RW	1
60FF	00	target speed (unit: command unit/s)	Int32	-2^{31}～2^{31}-1	RW	0
2009	01	speed loop gain	Uint16	0～50000	RW	4000
	02	speed loop integration time	Uint16	1～30000	RW	1500
	0F	torque loop gain	Uint16	0～50000	RW	800
	10	torque loop integration time	Uint16	1～10000	RW	500

6.5.2 Related function settings

1） Speed reach output function

Index (Hex)	Subindex (Hex)	Name	Description
606D	00	Speed reaching threshold	When the absolute value of the difference between the target speed 60FF (converted into the motor speed in rpm unit) and the actual motor speed is within 606Dh, and the time set by 606Eh is maintained, the status word 6041h.bit10 is set to 1, and the speed reaches the DO function is valid
606E	00	Speed arrival time window	

6.5.3 Recommended configuration

RPDO	TPDO	Description
6040h：控制字(Control Word)	6041h：状态字(Status Word)	necessary
6060h：模式选择(Modes of Operation)	6061h：运行模式(Modes of Operation Display)	optional
60FFh：目标速度(Target Velocity)		necessary
	6064h：位置反馈(Position Actual Value)	optional
	606Ch：速度反馈(Velocity Actual Value)	optional
	603Fh：错误代码(Error Code)	optional
	60FDh：数字输入(Digital Inputs)	optional

6.6 Cyclic Synchronous Torque Mode（CST）

In this mode, the host computer sends the calculated target torque 6071h to the servo drive periodically and synchronously, and the torque adjustment is executed internally by the servo drive. When the motor speed reaches the limit value, it will enter the speed regulation stage.

6.6.1 Related objects

Control word 6040h		
Bit	Name	Description
0	伺服准备好(Switch On)	When the value of Bit0 to Bit3 is 1, the motor is enabled
1	接通主回路电(Enable Voltage)	
2	快速停机(Quick Stop)	
3	伺服运行(Enable Operation)	
7	复位故障(Reset Fault)	0: no effect 1: Reset drive failure

Status word 6041h		
Bit	Name	Description
10	目标到达 Target Reached	0: Target torque not reached 1: Target torque reached
11	软件内部位置超限 Internal Limit Active	0: Neither the position command nor the position feedback exceeds the limit 1: Position command or position feedback overrun
12	从站跟随指令 Driver Follow the Command	0: Slave not following command 1: Slave follow command
15	原点回零完成 Home Find	0: Home not completed 1: Home completed

Index (Hex)	Subindex (Hex)	Name	Data type	Setting range	Accessibility	Default value
6040	00	control word	Uint16	0～65535	RW	0
6041	00	status word	Uint16	-	RO	0
6060	00	operating mode	Int16	0～10	RW	8
6061	00	mode display	Int16	-	RO	8
6063	00	position feedback (unit: encoder unit)	Int32	-	RO	-
6064	00	position feedback (unit: command unit)	Int32	-	RO	-
606C	00	actual speed (unit: command unit/s)	Int32	-	RO	-
6071	00	target torque (unit: 0.1%)	Int16	-3000～3000	RW	0
6072	00	maximum torque (unit: 0.1%)	Uint16	0～3000	RW	3000
6074	00	torque command (unit: 0.1%)	Int16	-5000～5000-	RO	-
6077	00	actual torque (unit: 0.1%)	Int16	-5000～5000	RO	-
2009	01	speed loop gain	Uint16	0～50000	RW	4000
	02	speed loop integration time	Uint16	1～30000	RW	1500
	0F	torque loop gain	Uint16	0～50000	RW	800
	10	torque loop integration time	Uint16	1～10000	RW	500

6.6.2 Related function settings

1） Torque reach output setting

Index (Hex)	Subindex (Hex)	Name	Description
2008	0A	Torque reaches reference value	Torque reaches reference value: A Torque reaches effective value: B Torque reaches invalid value: C ● When: |torque actual value|> |A + B|, the torque reaches DO is valid, and the status word 6041h.bit10 is set to 1. ● When: |torque actual value| <|A + C|, the torque reaches DO is invalid, and the status word 6041h.bit10 is cleared
2008	0B	Torque reaches effective value	
2008	0C	Torque reaches invalid value	

6.6.3 Related function settings

RPDO	TPDO	Description
6040h：控制字(Control Word)	6041h：状态字(Status Word)	necessary
6060h：模式选择(Modes of Operation)	6061h：运行模式(Modes of Operation Display)	optional
6071h：目标转矩(Target Torque)		necessary
	6064h：位置反馈(Position Actual Value)	optional
	606Ch：速度反馈(Velocity Actual Value)	optional
	6077h：转矩反馈(Torque Actual Value)	optional
	603Fh：错误代码(Error Code)	optional
	60FDh：数字输入(Digital Inputs)	optional

6.7 Profile Position Mode (PP)

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

6.7.1 Related objects

Control word 6040h		
Bit	Name	Description
0	伺服准备好(Switch On)	When the value of Bit0 to Bit3 is 1, the motor is enabled
1	接通主回路电(Enable Voltage)	
2	快速停机(Quick Stop)	
3	伺服运行(Enable Operation)	

4	新目标位置(New Set-Point)	This is the rising edge from 0 to 1 indicates the pre-triggered new target position 607Ah, profile velocity 6081h, acceleration 6083h, deceleration 6084h given
5	立即更新(Change Set Immediately)	0: Not immediately updated 1: Update immediately
6	绝对位置/相位位置(Absolute/Relative)	0: The target position is an absolute position command 1: The target position is a relative position command
7	复位故障(Reset Fault)	0: no effect 1: Reset drive failure
8	暂停 Halt	0: Servo is set according to Bit0～Bit3 1: Servo pauses according to 605Dh setting

Status word 6041h		
Bit	Name	Description
10	目标到达 Target Reached	0: target position not reached 1: target position reached
11	软件内部位置超限 Internal Limit Active	0: Neither the position command nor the position feedback exceeds the limit 1: Position command or position feedback overrun
12	目标位置更新 Set-Point Acknowledge	0: Slave not following command 1: Slave follow command
13	跟随错误 Following Error	0: No excessive position deviation fault 1: Excessive position deviation fault occurs
15	原点回零完成 Home Find	0: Home not completed 1: Home completed

Index (Hex)	Subindex (Hex)	Name	Data type	Setting range	Accessibility	Default value
6040	00	control word	Uint16	0～65535	RW	0
6041	00	status word	Uint16	-	RO	0
6060	00	operating mode	Int16	0～10	RW	8
6061	00	mode display	Int16	-	RO	8
6062	00	position command (unit: command unit)	Int32	-	RO	-
6063	00	position feedback (unit: encoder unit)	Int32	-	RO	-
6064	00	position feedback (unit: command unit)	Int32	-	RO	-
6065	00	position deviation excess Threshold (unit: command unit)	Uint32	$0～2^{32}-1$	RW	393216
6067	00	position reach threshold (unit:	Uint32	0～65535	RW	92

		encoder unit)				
6068	00	position arrival time window (unit: ms)	Uint16	0～65535	RW	10
606C	00	actual speed (unit: command unit/s)	Int32	-	RO	-
6072	00	maximum torque (unit: 0.1%)	Uint16	0～3000	RW	3000
6077	00	actual torque (unit: 0.1%)	Int16	-5000～5000	RO	-
607A	00	target position (unit: command unit)	Int32	-2^{31}～2^{31}-1	RW	0
6081	00	profile speed (unit: command pulse/s)	Uint32	0～2^{32}-1		10000
6083	00	profile acceleration (unit: command pulse/s ^{2})	Uint32	0～2^{32}-1		10000
6084	00	profile deceleration (unit: command pulse/s ^{2})	Uint32	0～2^{32}-1		10000
6091	01	gear ratio numerator	Uint32	1～2^{31}-1	RW	1
	02	gear ratio denominator	Uint32	1～2^{31}-1	RW	1
60F4	00	position deviation (unit: command units)	Int32	-	RO	-
60FC	00	position command (unit: encoder unit)	Int32	-	RO	-
2009	01	speed loop gain	Uint16	0～50000	RW	4000
	02	speed loop integration time	Uint16	1～30000	RW	1500
	03	position loop gain	Uint16	0～50000	RW	800
	0F	torque loop gain	Uint16	0～50000	RW	800
	10	torque loop integration time	Uint16	1～10000	RW	500

6.7.2 Related function settings

1） Positioning completion signal

Index (Hex)	Subindex (Hex)	Name	Description
2006	07	Position arrival threshold unit selection	Set the unit for 6067h. 0: command unit 1: encoder unit
6067	00	Position reaches threshold	If the absolute value of position deviation is within 6067h and the time reaches 6068h, the DO signal of position completion is valid and 6041h. Bit10 is set to 1. If either of these conditions is not met, the position arrival is invalid.
6068	00	Position arrival time window	

2） Position deviation excess threshold

Index (Hex)	Subindex (Hex)	Name	Description
6065	00	Position deviation excess	When the absolute value of the position deviation is greater than the set value, an excessive position deviation fault occurs, the

		threshold	drive LED panel will display AL.240, and the status word 6041h4.Bit13 will be set to 1. When the set value is 0xFFFFFFFF, the drive will not detect excessive position deviation

6.7.3 Position curve generator

1）Update immediately

a）The upper computer first updates and modifies other attributes of the displacement command as needed (acceleration time 6083h, deceleration time 6084h, contour speed 6081h, target displacement 607Ah)

b）The host computer sets the bit4 of 6040h from 0 to 1, indicating that the slave station has a new displacement command that needs to be enabled

c）After receiving the rising edge of bit 4 of 6040h, the slave station judges whether the new displacement command can be received:

If the initial state of bit 5 of 6040 is 0, and bit 12 of 6041h is 0 at this time, it indicates that the slave station can receive a new displacement command①; after receiving the new displacement command, the slave station sets bit 12 of 6041 from 0 to 1, indicating the new displacement command ① has been received, and the current slave station is in a state where it cannot continue to receive new displacement commands.

In immediate update mode, once a new displacement command is received (biyt12 of 6041h changes from 0 to 1), the servo will immediately execute the displacement command.

d）After the upper computer receives the bit12 of the status word 6041h of the slave station becomes 1, it can release the displacement command data, and set the bit4 of the control word 6040h from 1 to 0, indicating that there is no new position command at present.

Because bit4 of 6040h is valid for edge change, this operation will not interrupt the displacement command being executed.

e）When the slave station detects that the bit4 of the control word 6040h changes from 1 to 0, it can set the bit12 of the status word 6041h from 1 to 0, indicating that the slave station is ready to receive a new displacement command.

In immediate update mode, when the slave detects that bit 4 of the control word 6040h changes from 1 to 0, it will always clear bit 12 of 6041h.

In immediate update mode, during the execution of the current displacement command ①, a new displacement command ② is received, and the unexecuted displacement command in ① is not discarded. For the relative position command, after the positioning of the second displacement command is completed, the total displacement increment = target position increment 607Ah of ①+ target position

increment 607Ah of ②, for the absolute position command, after the second stage of displacement command positioning is completed, the user's absolute position = target position 607Ah of ②.

2）Non-immediate update

a）The upper computer first updates and modifies other attributes of the displacement command as needed (acceleration time 6083h, deceleration time 6084h, contour speed 6081h, target displacement 607Ah)

b）The host computer sets the bit4 of 6040h from 0 to 1, indicating that the slave station has a new displacement instruction that needs to be enabled

c）After receiving the rising edge of bit 4 of 6040h, the slave station judges whether the new displacement command can be received:

If the initial state of bit 5 of 6040 is 0, and bit 12 of 6041h is 0 at this time, it indicates that the slave station can receive a new displacement command①; after receiving the new displacement command, the slave station sets bit 12 of 6041 from 0 to 1, indicating the new displacement command ① has been received, and the current slave station is in a state where it cannot continue to receive new displacement commands.

d）After the upper computer receives the bit12 of the status word 6041h of the slave station becomes 1, it can release the displacement command data, and set the bit4 of the control word 6040h from 1 to 0, indicating that there is no new position command at present.。

Because bit4 of 6040h is valid for edge change, this operation will not interrupt the displacement command being executed.

e）The slave station detects that the bit 4 of the control word 6040 changes from 1 to 0, and releases the bit 12 of 6041 after the current segment positioning is completed, indicating that the slave station is ready to receive a new displacement command. In non-immediate update mode, while the current segment is running, the servo cannot receive a new displacement command. After the current segment positioning is completed, the servo can receive a new displacement command. Once received (bit12 of 6041 changes from 0 to 1), the servo executes the displacement command immediately.

6.7.4 Recommended configuration

RPDO	TPDO	Description
6040h：控制字(Control Word)	6041h：状态字(Status Word)	necessary
607Ah：目标位置(Target Position)	6064h：位置反馈(Position Actual Value)	necessary
6060h：模式选择(Modes of Operation)	6061h：运行模式(Modes of Operation Display)	optional
6081h：轮廓速度(Profile Velocity)		necessary
6083h：轮廓加速度(Profile Acceleration)		optional
6084h：轮廓减速度(Profile Deceleration)		optional

6.8 Profile Velocity Mode (PV)

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

6.8.1 Related objects

Control word 6040h		
Bit	Name	Description
0	伺服准备好(Switch On)	When the value of Bit0 to Bit3 is 1, the motor is enabled
1	接通主回路电(Enable Voltage)	
2	快速停机(Quick Stop)	
3	伺服运行(Enable Operation)	
4	新目标位置(New Set-Point)	This is the rising edge from 0 to 1 indicates the pre-triggered new target position 607Ah, profile velocity 6081h, acceleration 6083h, deceleration 6084h given
5	立即更新(Change Set Immediately)	0: Not immediately updated 1: Update immediately
6	绝对位置/相位位置(Absolute/Relative)	0: The target position is an absolute position command 1: The target position is a relative position command
7	复位故障(Reset Fault)	0: no effect 1: Reset drive failure
8	暂停 Halt	0: Servo is set according to Bit0～Bit3 1: Servo pauses according to 605Dh setting

Status word 6041h		
Bit	Name	Description
10	目标到达 Target Reached	0: Target speed not reached 1: Target speed reached
11	软件内部位置超限 Internal Limit Active	0: Neither the position command nor the position feedback exceeds the limit 1: Position command or position feedback overrun
15	原点回零完成 Home Find	0: Home not completed 1: Home completed

Index (Hex)	Subindex (Hex)	Name	Data type	Setting range	Accessibility	Default value
6040	00	control word	Uint16	0～65535	RW	0
6041	00	status word	Uint16	-	RO	0
6060	00	operating mode	Int16	0～10	RW	8
6061	00	mode display	Int16	-	RO	8
6063	00	position feedback (unit: encoder unit)	Int32	-	RO	-

6064	00	position feedback (unit: command unit)	Int32	-	RO	-
606C	00	actual speed (unit: command unit/s)	Int32	-	RO	-
6072	00	maximum torque (unit: 0.1%)	Uint16	0～3000	RW	3000
6077	00	actual torque (unit: 0.1%)	Int16	-5000～5000	RO	-
60FF	00	profile speed (unit: command pulse/s)	Uint32	$0～2^{32}-1$	RW	0
6091	01	gear ratio numerator	Uint32	$1～2^{31}-1$	RW	1
	02	gear ratio denominator	Uint32	$1～2^{31}-1$	RW	1
2009	01	speed loop gain	Uint16	0～50000	RW	4000
	02	speed loop integration time	Uint16	1～30000	RW	1500
	0F	torque loop gain	Uint16	0～50000	RW	800
	10	torque loop integration time	Uint16	1～10000	RW	500

6.8.2 Related function settings

1） Speed reach output function

Index (Hex)	Subindex (Hex)	Name	Description
606D	00	Speed reaching threshold	When the absolute value of the difference between the target speed 60FF (converted into the motor speed in rpm unit) and the actual motor speed is within 606Dh, and the time set by 606Eh is maintained, the status word 6041h.bit10 is set to 1, and the speed reaches the DO function is valid
606E	00	Speed arrival time window	

6.8.3 Recommended configuration

RPDO	TPDO	Description
6040h：控制字(Control Word)	6041h：状态字(Status Word)	necessary
6060h：模式选择(Modes of Operation)	6061h：运行模式(Modes of Operation Display)	optional
60FFh：目标速度(Target Velocity)		necessary
6083h：轮廓加速度(Profile Acceleration)	6064h：位置反馈(Position Actual Value)	optional
6084h：轮廓减速度(Profile Deceleration)	606Ch：速度反馈(Velocity Actual Value)	optional
	603Fh：错误代码(Error Code)	optional
	60FDh：数字输入(Digital Inputs)	optional

6.9 Profile Torque Mode (PT)

In this mode, the host computer sends the target torque 6071h and the torque ramp constant 6087h to the servo drive, and the torque regulation is performed internally by the servo drive. When the speed of the motor reaches the limit value it will enter the speed regulation stage.

6.9.1 Related objects

Control word 6040h		
Bit	Name	Description
0	伺服准备好(Switch On)	When the value of Bit0 to Bit3 is 1, the motor is enabled
1	接通主回路电(Enable Voltage)	
2	快速停机(Quick Stop)	
3	伺服运行(Enable Operation)	
7	复位故障(Reset Fault)	0: no effect 1: Reset drive failure

Status word 6041h		
Bit	Name	Description
10	目标到达 Target Reached	0: Target torque not reached 1: Target torque reached
11	软件内部位置超限 Internal Limit Active	0: Neither the position command nor the position feedback exceeds the limit 1: Position command or position feedback overrun
15	原点回零完成 Home Find	0: Home not completed 1: Home completed

Index (Hex)	Subindex (Hex)	Name	Data type	Setting range	Accessibility	Default value
6040	00	control word	Uint16	0～65535	RW	0
6041	00	status word	Uint16	-	RO	0
6060	00	operating mode	Int16	0～10	RW	8
6061	00	mode display	Int16	-	RO	8
6063	00	position feedback (unit: encoder unit)	Int32	-	RO	-
6064	00	position feedback (unit: command unit)	Int32	-	RO	-
606C	00	actual speed (unit: command unit/s)	Int32	-	RO	-
6071	00	target torque (unit: 0.1%)	Int16	-3000～3000	RW	0
6072	00	maximum torque (unit: 0.1%)	Uint16	0～3000	RW	3000
6074	00	torque command (unit: 0.1%)	Int16	-5000～5000-	RO	-
6077	00	actual torque (unit: 0.1%)	Int16	-5000～5000	RO	-
60FF	00	profile speed (unit: command pulse/s)	Uint32	$0～2^{32}-1$	RW	0
6087	00	Torque ramp (unit: 0.1%/s)	Uint32	$0～2^{32}-1$	RW	3000
2009	01	speed loop gain	Uint16	0～50000	RW	4000
	02	speed loop integration time	Uint16	1～30000	RW	1500

	0F	torque loop gain	Uint16	0～50000	RW	800
	10	torque loop integration time	Uint16	1～10000	RW	500

6.9.2 Related function settings

1） Torque reach output setting

Index (Hex)	Subindex (Hex)	Name	Description
2008	0A	Torque reaches reference value	Torque reaches reference value: A Torque reaches effective value: B Torque reaches invalid value: C ● When: |torque actual value|> |A + B|, the torque reaches DO is valid, and the status word 6041h.bit10 is set to 1. ● When: |torque actual value| <|A + C|, the torque reaches DO is invalid, and the status word 6041h.bit10 is cleared
2008	0B	Torque reaches effective value	
2008	0C	Torque reaches invalid value	

6.9.3 Recommended configuration

RPDO	TPDO	Description
6040h：控制字(Control Word)	6041h：状态字(Status Word)	necessary
6060h：模式选择(Modes of Operation)	6061h：运行模式(Modes of Operation Display)	optional
6071h：目标转矩(Target Torque)		necessary
6087h：转矩斜坡(Torque Slope)	6064h：位置反馈(Position Actual Value)	optional
607Fh：最大轮廓速度(Profile Velocity)	606Ch：速度反馈(Velocity Actual Value)	optional
	6077h：转矩反馈(Torque Actual Value)	optional
	603Fh：错误代码(Error Code)	optional
	60FDh：数字输入(Digital Inputs)	optional

6.10 Homing Mode（HM）

The homing mode is used to find the mechanical origin and locate the positional relationship between the mechanical origin and the mechanical zero point.

Mechanical origin: A fixed position on the machine can correspond to a certain origin switch or motor Z-phase signal.

Mechanical zero point: absolute zero position on the machine.

After the homing is completed, the stop position of the motor is the mechanical origin. By setting 607Ch, the relationship between the mechanical origin and the mechanical zero can be set:

Mechanical origin = mechanical zero + 607Ch (origin offset)

When 607Ch = 0, the mechanical origin coincides with the mechanical zero point.

6.10.1 Related objects

Control word 6040h		
Bit	Name	Description
0	伺服准备好(Switch On)	When the value of Bit0 to Bit3 is 1, the motor is enabled
1	接通主回路电(Enable Voltage)	
2	快速停机(Quick Stop)	
3	伺服运行(Enable Operation)	
4	启动回零(Home Start)	0 -> 1: Start home 1: Homing 1 -> 0: End home
7	复位故障(Reset Fault)	0: no effect 1: Reset drive failure
8	暂停 Halt	0: The servo determines whether to start home according to Bit4 setting 1: Servo pauses according to 605Dh setting

Status word 6041h		
Bit	Name	Description
10	目标到达 Target Reached	0: target position not reached 1: target position reached
11	软件内部位置超限 Internal Limit Active	0: Neither the position command nor the position feedback exceeds the limit 1: Position command or position feedback overrun
12	回零 Homing Attained	0: Home unsuccessful 1: Home success, this flag is valid after the servo in homing mode operation (target reach signal) is set
13	回零错误 Homing Error	0: Home no error occurred 1: Home error occurred
15	原点回零完成 Home Find	0: Home not completed 1: Home completed

Index (Hex)	Subindex (Hex)	Name	Data type	Setting range	Accessibility	Default value
6040	00	control word	Uint16	0～65535	RW	0
6041	00	status word	Uint16	-	RO	0
6060	00	operating mode	Int16	0～10	RW	8
6061	00	mode display	Int16	-	RO	8
6062	00	position command (unit: command unit)	Int32	-	RO	-
6063	00	position feedback (unit: encoder unit)	Int32	-	RO	-

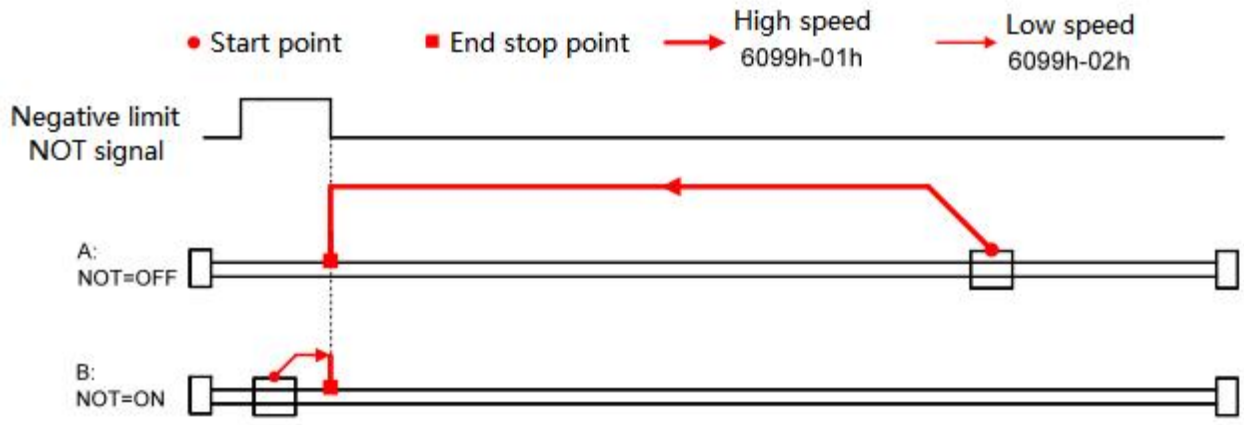
6064	00	position feedback (unit: command unit)	Int32	-	RO	-
6065	00	position deviation excess threshold (unit: command units)	Uint32	0～2^{32}-1	RW	393216
6067	00	position reach threshold (unit: encoder units)	Uint32	0～65535	RW	92
6068	00	position arrival time window (unit: ms)	Uint16	0～65535	RW	10
606C	00	actual speed (unit: command unit/s)	Int32	-	RO	-
6072	00	maximum torque (unit: 0.1%)	Uint16	0～3000	RW	3000
6077	00	actual torque (unit: 0.1%)	Int16	-5000～5000	RO	-
6091	01	gear ratio numerator	Uint32	1～2^{31}-1	RW	1
	02	gear ratio denominator	Uint32	1～2^{31}-1	RW	1
6099	01	Search deceleration point signal speed (unit: command unit/s)	Uint32	1～2^{31}-1	RW	10000
	02	Search origin signal speed (unit: command unit/s)	Uint32	1～2^{31}-1	RW	2000
609A	00	acceleration (unit: command unit/s ^{2})	Uint32	0～2^{32}-1	RW	100000
60F4	00	position deviation (unit: command units)	Int32	-	RO	-
2009	01	speed loop gain	Uint16	0～50000	RW	4000
	02	speed loop integration time	Uint16	1～30000	RW	1500
	03	position loop gain	Uint16	0～50000	RW	800
	0F	torque loop gain	Uint16	0～50000	RW	800
	10	torque loop integration time	Uint16	1～10000	RW	500

6.10.2 Introduction to Home pperation

1） Object 6098h = 17

Origin: reverse limit switch

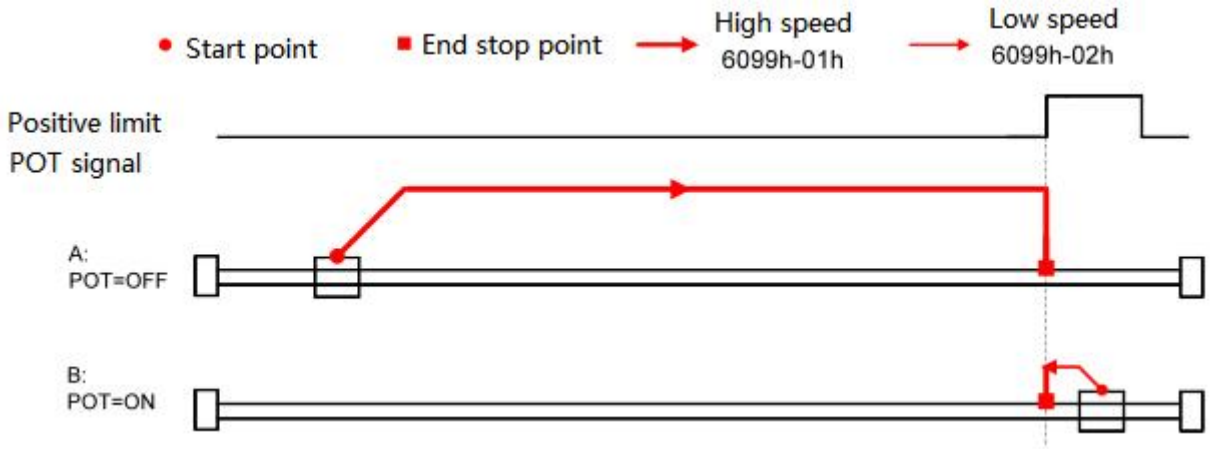
Deceleration point: reverse limit switch



2） Object 6098h = 18

Origin: positive limit switch

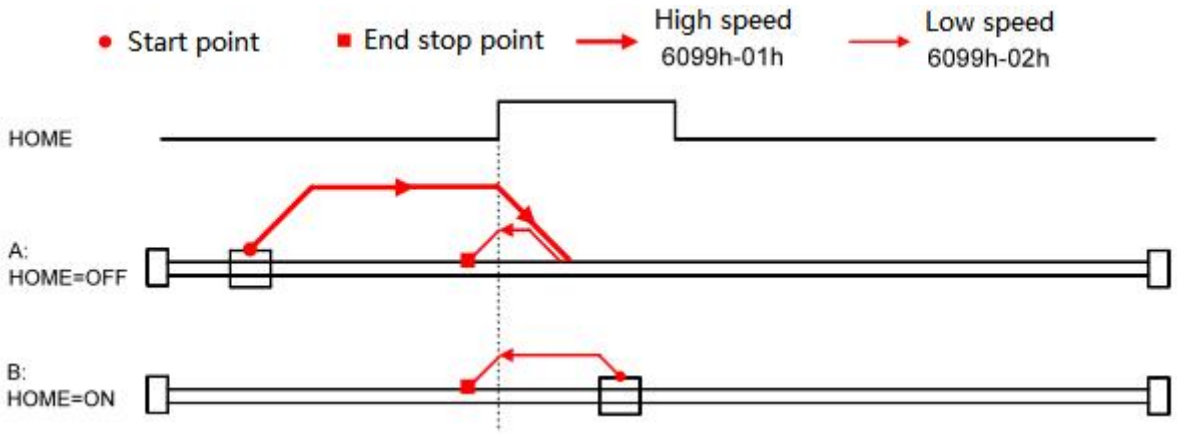
Deceleration point: positive limit switch



3） Object 6098h = 19

Origin: origin switch

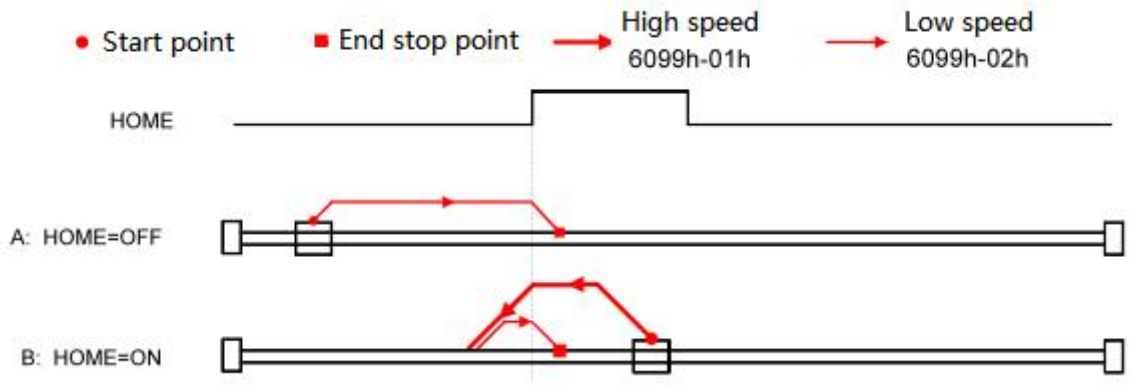
Deceleration point: origin switch



4） Object 6098h = 20

Origin: origin switch

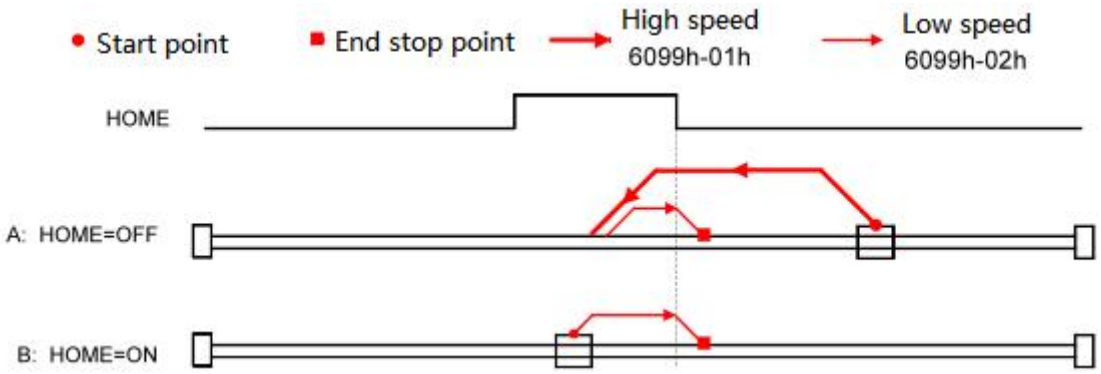
Deceleration point: origin switch



5） Object 6098h = 21

Origin: origin switch

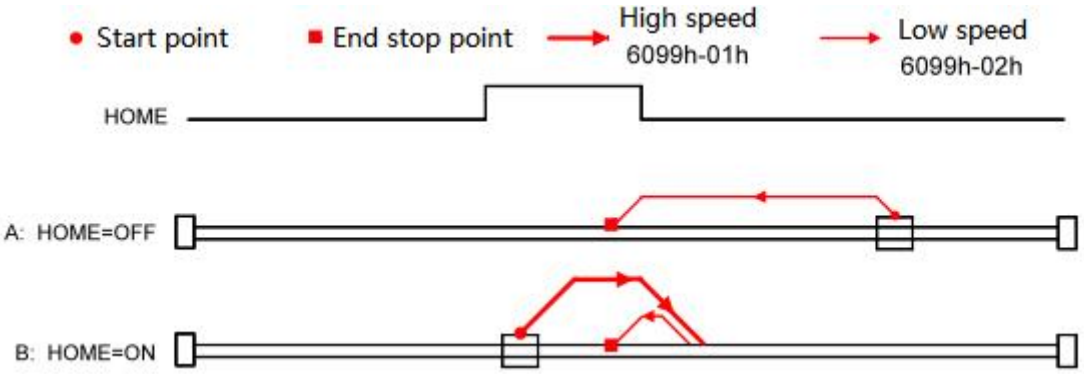
Deceleration point: origin switch



6） Object 6098h = 22

Origin: origin switch

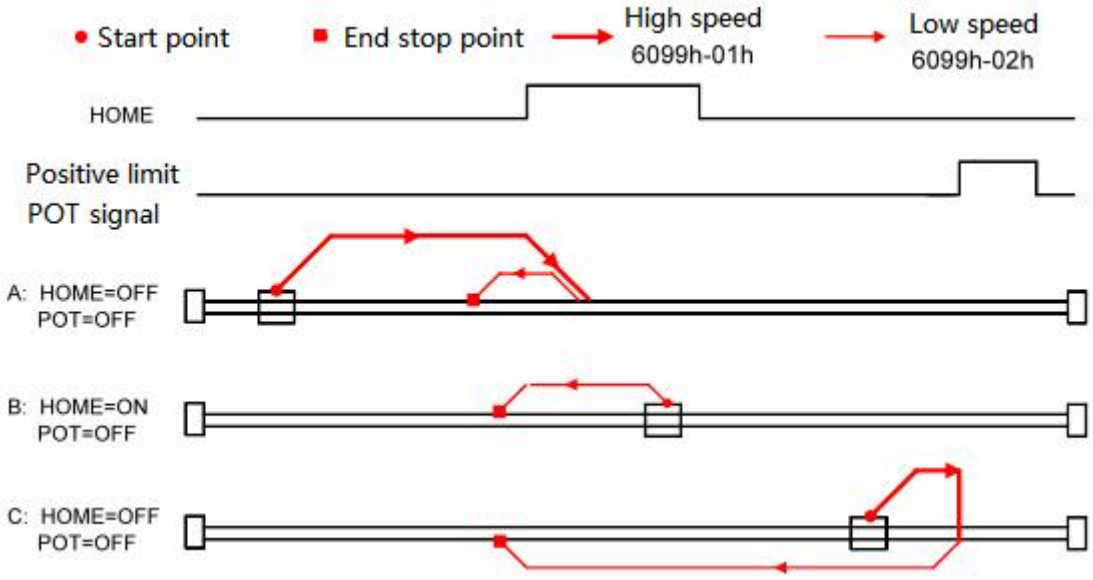
Deceleration point: origin switch



7） Object 6098h = 23

Origin: origin switch

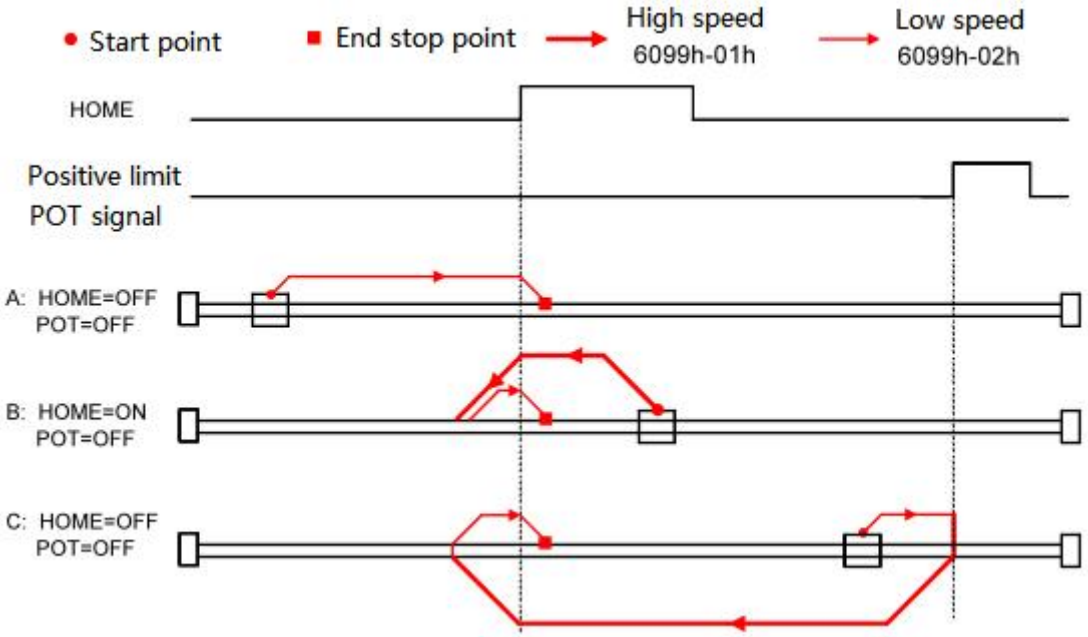
Deceleration point: origin switch



8） Object 6098h = 24

Origin: origin switch

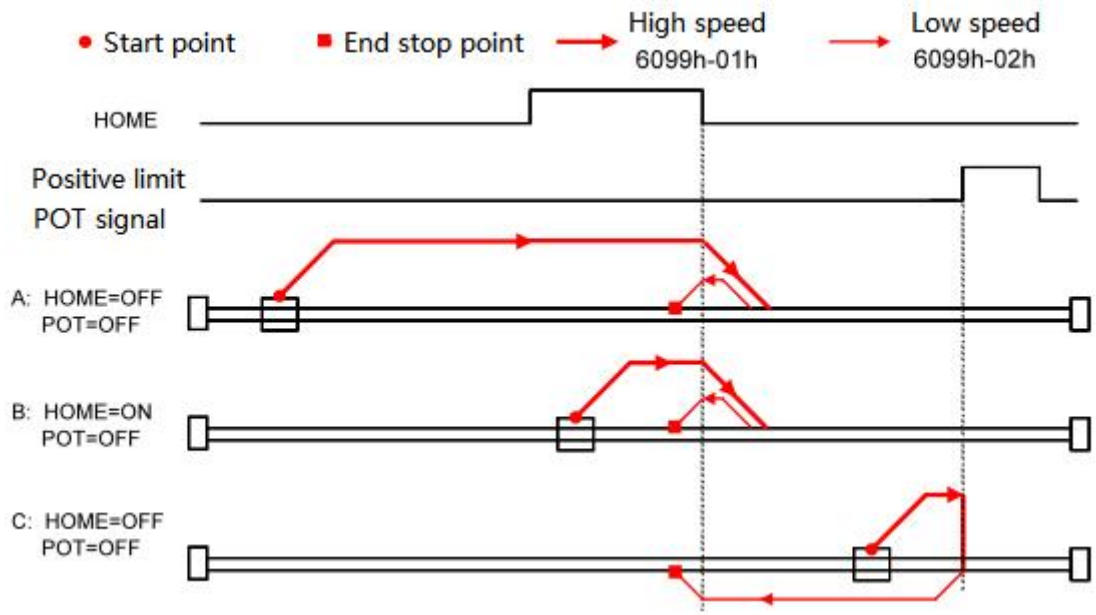
Deceleration point: origin switch



9） Object 6098h = 25

Origin: origin switch

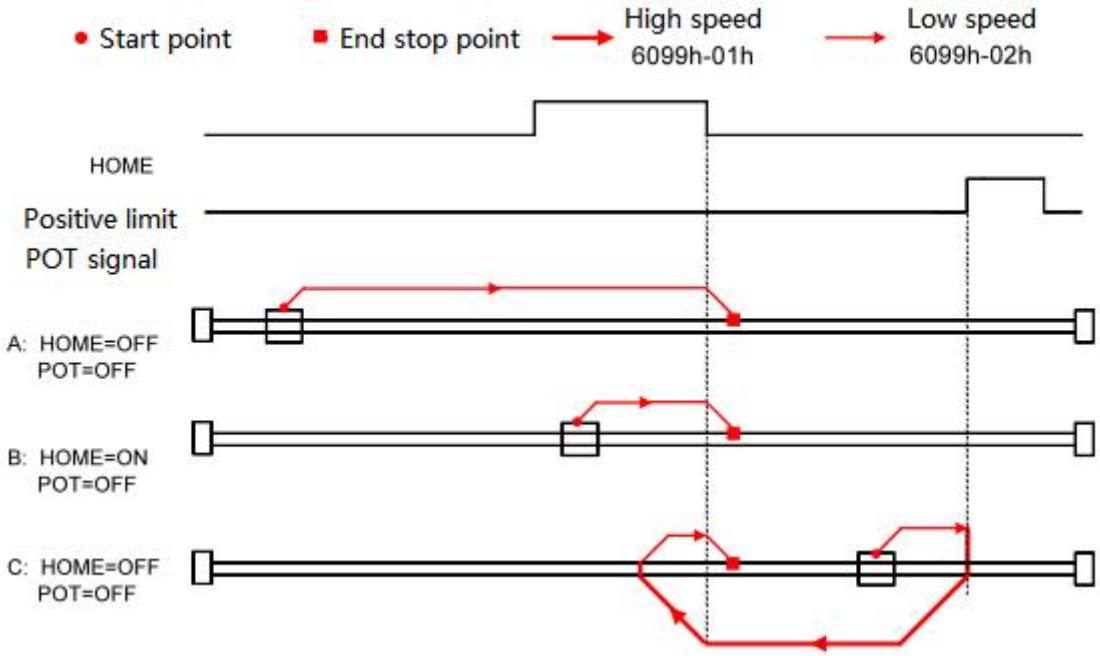
Deceleration point: origin switch



10） Object 6098h = 26

Origin: origin switch

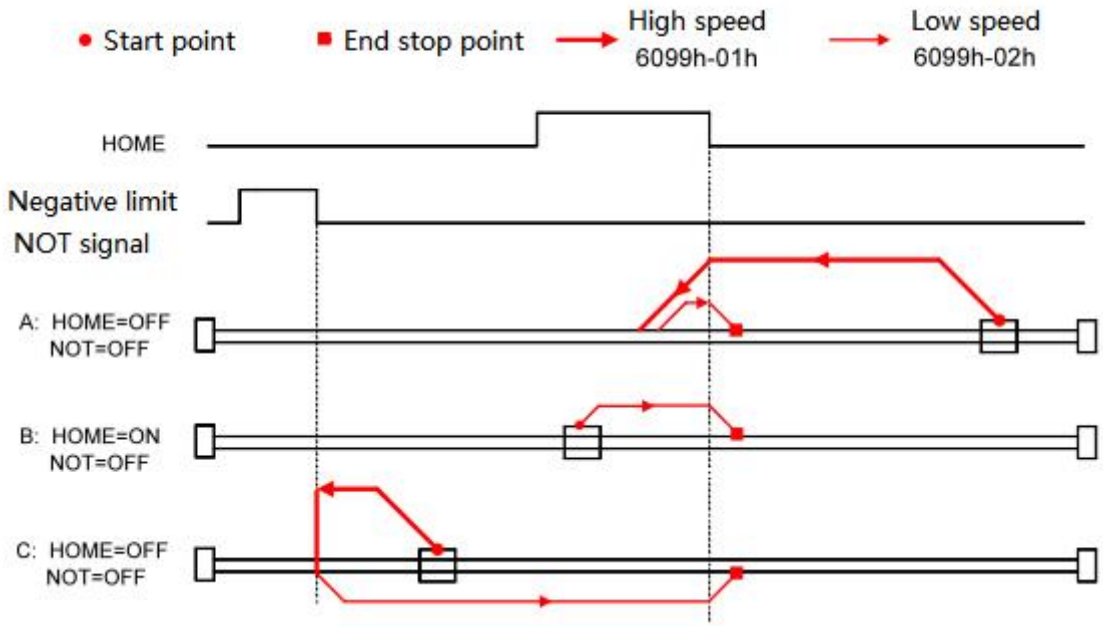
Deceleration point: origin switch



11） Object 6098h = 27

Origin: origin switch

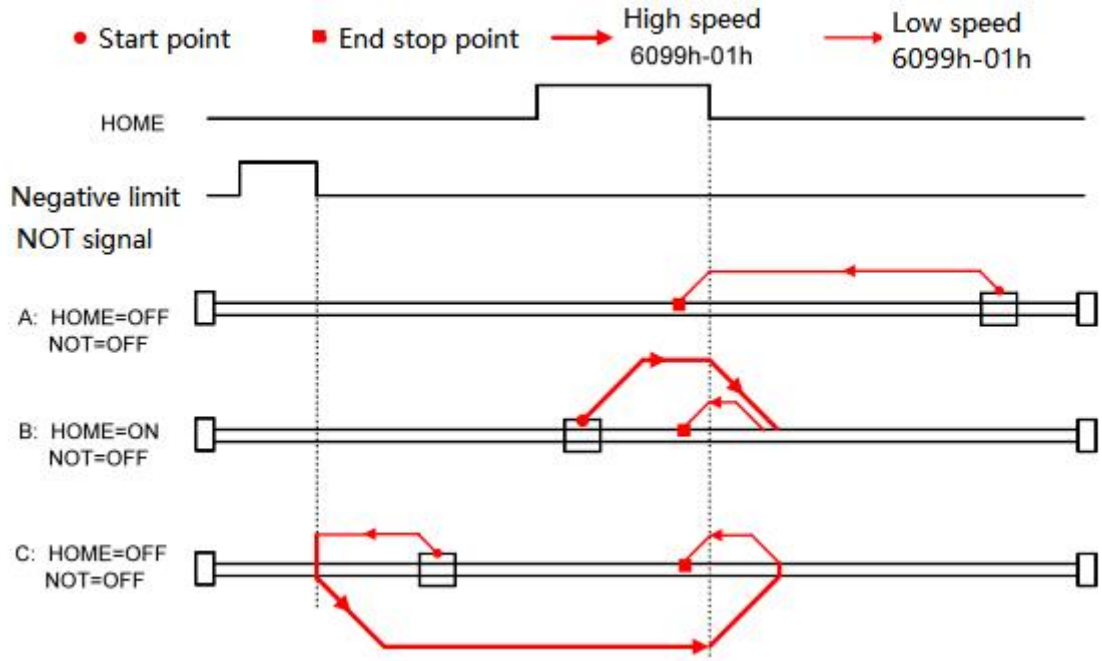
Deceleration point: origin switch



12） Object 6098h = 28

Origin: origin switch

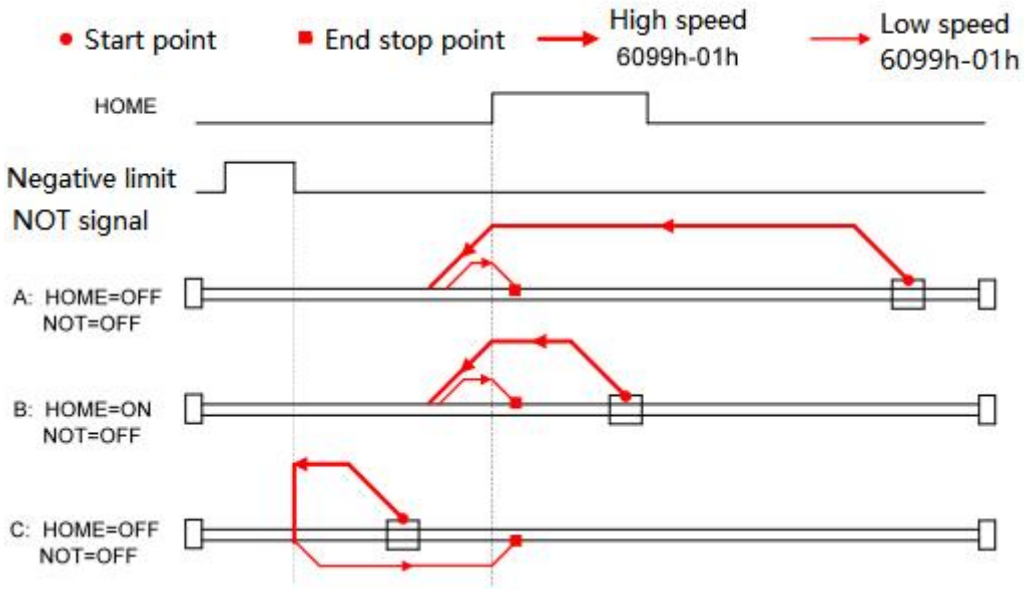
Deceleration point: origin switch



13） Object 6098h = 29

Origin: origin switch

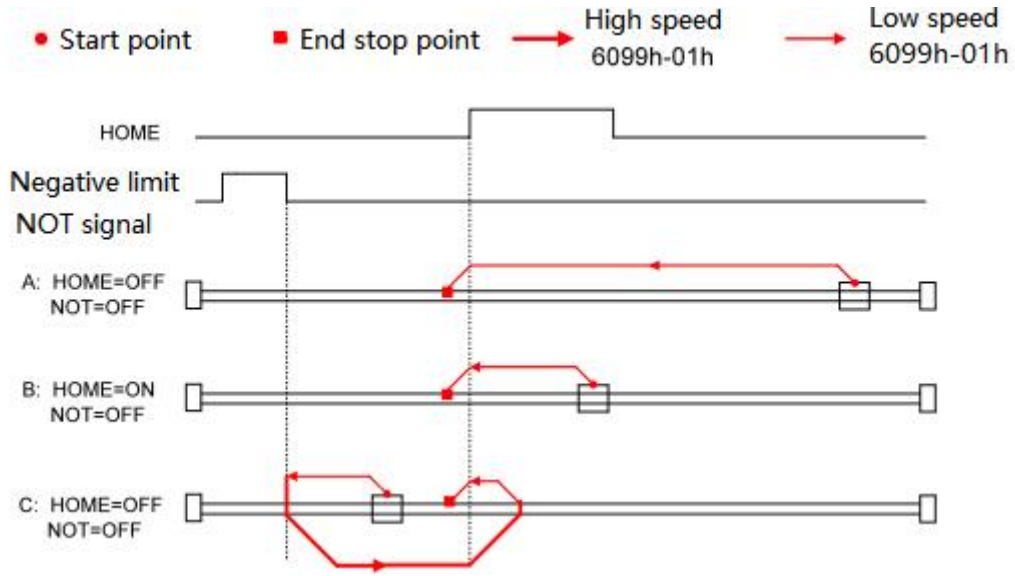
Deceleration point: origin switch



14） Object 6098h = 30

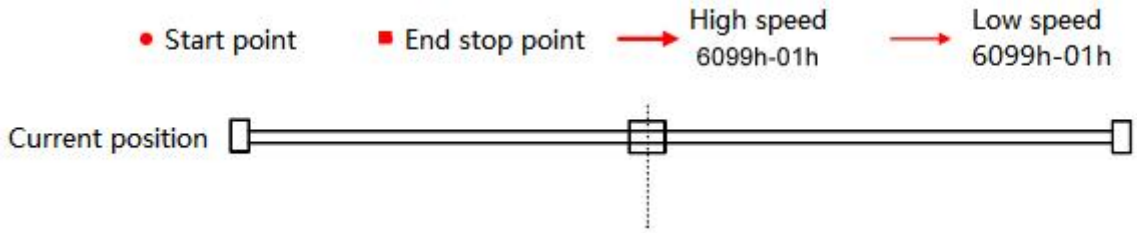
Origin: origin switch

Deceleration point: origin switch



15） Object 6098h = 35

Taking the current position as the mechanical origin, after triggering the origin return to zero (6040h control word: 0x0F -> 0x1F), the position feedback 6064h is set to the origin offset 607Ch.



6.10.3 Recommended configuration

RPDO	TPDO	Description
6040h：Control Word	6041h：状态字(Status Word)	necessary
6060h：Modes of Operation	6061h：运行模式(Modes of Operation Display)	optional
6098h: Homing Method		optional
6099-01h：Speed during search for switch		optional
6099-02h：Speed during search for zero	603Fh：错误代码(Error Code)	optional
609Ah：Homing acceleration	60FDh：数字输入(Digital Inputs)	optional

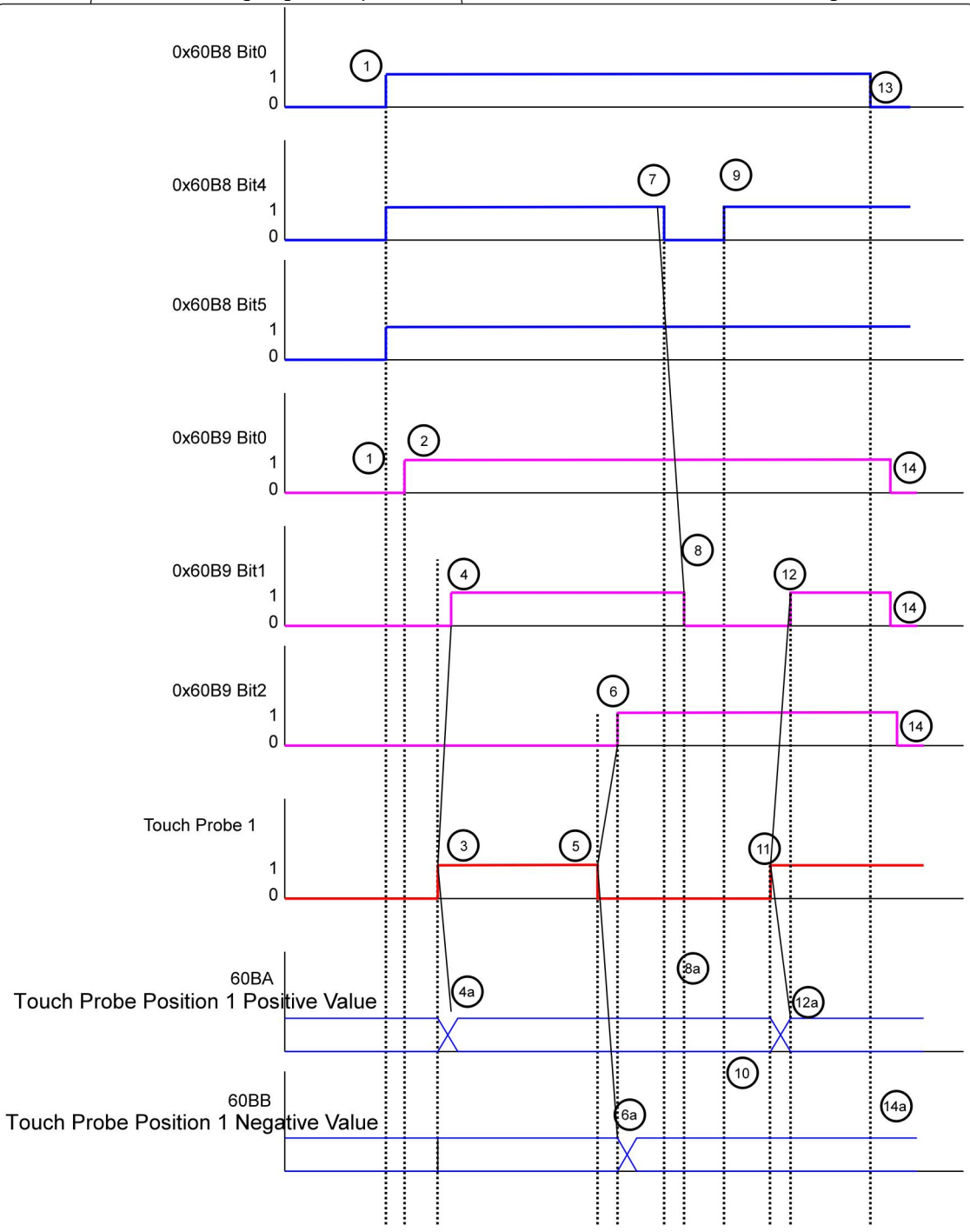
6.11 Introduction of auxiliary functions

6.11.1 Probe function

The probe function latches the motor position information through the digital input port. The function and polarity of the digital input port of RS EtherCAT driver can be defined by index 0x2004.

The relevant object dictionary of the probe function is as follows:

Index	Object description	Description
0x60B8	Probe function setting	Touch Probe Function
0x60B9	Probe status	Touch Probe Status
0x60BA	Probe 1 rising edge latch position	Touch Probe Position 1 Positive Value
0x60BB	Probe 1 falling edge latch position	Touch Probe Position 1 Negative Value
0x60BC	Probe 2 rising edge latch position	Touch Probe Position 2 Positive Value
0x60BD	Probe 2 falling edge latch position	Touch Probe Position 2 Negative Value



probe timing diagram

No.	Register Changes	Probe action
1	60B8 Bit 0 = 1 60B8 Bit 1,4,5	Enable Probe 1 Configure enable probe rising and falling edges
2	-> 60B9 Bit 0 = 1	Status "Probe 1 Enable" is set
3	External Probe Signal Rising Edge	
4	-> 60B9 Bit 1 = 1	Status "Probe 1 rising edge latch" is set
4a	-> 60BA	Probe 1 positive position is latched
5	External Probe Signal Falling Edge	
6	-> 60B9 Bit 2 = 1	Status "Probe 1 falling edge latch" is set
6a	-> 60BB	Probe 1 negative position is latched
7	-> 60B8 Bit：4	Rising edge latching function: disabled
8	-> 60B9 Bit 0 = 0	Status "Probe 1 rising edge latch" is cleared
8a	-> 60BA	Probe 1 positive position, no change in latch position
9	-> 60B8 Bit 4 = 1	Rising edge latching function: Enabled
10	-> 60BA	Probe 1 positive position, no change in latch position
11	External Probe Signal Rising Edge	
12	-> 60B9 Bit 1 = 1	Status "Probe 1 rising edge latch" is set
12a	-> 60BA	Probe 1 positive position is latched
13	-> 60B8 Bit 0 = 0	Probe 1 function: disabled
14	-> 60B9 Bit 0,1,2 = 0	Status bits are cleared
14a	-> 60BA,60BB	No change in Probe 1 positive/negative latch position

probe timing description

Chapter 7 Detailed description of the object dictionary

7.1 Object dictionary classification description

The object dictionary is the most important part of the device specification. It is an ordered collection of a set of parameters and variables, including all parameters of device description and device network status, and a set of objects that can be accessed through the network in an orderly and predefined manner.
The CANopen protocol uses an object dictionary with a 16-bit index and an 8-bit sub-index. The structure of the object dictionary is shown in the following table.

Index	Object
0000h	Unused
0001h～001Fh	Static data types (standard data types, such as Boolean, Integer16)
0020h～003Fh	Complex data types (predefined structures composed of simple types such as PDOCommPar, SDOParmeter)
0040h～005Fh	Complex data types specified by the manufacturer
0060h～007Fh	Static data type specified by the device sub-protocol
0080h～009Fh	Complex data types specified in the device sub-protocol
00A0h～0FFFh	Reserve
1000h～1FFFh	Communication sub-protocol area (e.g. device type, error register, number of supported PDOs)
2000h～5FFFh	Manufacturer-specific sub-protocol area (e.g. function code mapping)
6000h～9FFFh	Standard equipment sub-protocol area (e.g. DSP-402 protocol)
A000h～FFFFh	Reserve

The object in RS EtherCAT contains the following attributes:

- Index
- Subindex
- Data structure
- Data type
- Accessibility
- Map
- Setting effective
- Related models
- Data range
- Factory setting

■ Noun Interpretation

The position of the object dictionary in the parameter table is specified by "index" and "subindex".

"Index": Specify the position of the same type of object in the object dictionary, expressed in hexadecimal.
"Subindex": Under the same index, it contains multiple objects, and the offset of each object under this category

The description of each object in the object dictionary is described by category. For example, there is an object 6091h for electronic gear ratio setting in the object dictionary, which respectively describes the numerator and denominator of the electronic gear ratio. The objects are defined as follows:

Index	Subindex	Name	Meaning
6091h	00h	Number of elements	The number of object data, not including itself
6091h	01h	Index 1	Electronic gear ratio numerator
6091h	02h	Index 2	Electronic gear ratio denominator

“Data structure”:

Category	Meaning	DS301 value
VAR	A single simple value, including data types Int8, Uint16, String, etc.	7
ARR	Have same types of data blocks	8
REC	Have different types of data blocks	9

“Data type”:

Data type	Value range	Data length	DS301 value
Int8	-128～+127	1 byte	0002
Int16	-32768～+32767	2 bytes	0003
Int32	-2147483648～+2147483647	4 bytes	0004
Uint8	0～255	1 byte	0005
Uint16	0～65535	2 bytes	0006
Uint32	0～4294967295	4 bytes	0007
String	ASCII	-	0009

“Accessibility”:

Accessibility	Description
RW	Can read and write
WO	Write only
RO	Read only

“Map”:

Map	Description
NO	Can not be mapped in PDO
RPDO	Can be used as RPDO
TPDO	Can be used as TPDO

“Related models”:

Related models	Description
-	Parameters are independent of control mode
ALL	Parameters are related to all control modes
PP/PV/PT/HM/CSP/CSV/CST	Parameters are related in the corresponding mode

“Data range”: Data upper and lower limits of parameters with writable attributes

“Factory setting”: Parameter default value

7.2 Detailed description of communication parameters (group 1000h)

Index 1000h	Name	Equipment type					Data structure	VAR	Data type	Uint32
	Data range	-	Factory setting	0x00020192	Accessibility	RO	Related models	-	Map	NO

Description of the CoE device sub-protocol type

Bit	Name	Description
0～15	device sub-protocol	402（192h: device sub-protocol
16～23	type	02: servo driver
25～31	mode	manufacturer customization

Index 1008h	Name	Manufacturer equipment name					Data structure	-	Data type	-
	Data range	-	Factory setting	Determined by model	Accessibility	RO	Related models	-	Map	NO

Index 1009h	Name	Manufacturer hardware version					Data structure	-	Data type	-
	Data range	-	Factory setting	Determined by version	Accessibility	RO	Related models	-	Map	NO

Index 100Ah	Name	Manufacturer software version					Data structure	-	Data type	-
	Data range	-	Factory setting	Determined by version	Accessibility	RO	Related models	-	Map	NO

Index 1018h	Name	ID object					Data structure	REC	Data type	OD type
	Data range	ODData range	Factory setting	OD default value	Accessibility	RO	Related models	-	Map	NO

Subindex 00h	Name	The largest subindex number contained in the ID object					Data structure	-	Data type	Uint8
	Data range	4	Factory setting	4	Accessibility	RO	Related models	-	Map	NO

Subindex 01h	Name	Manufacturer ID					Data structure	-	Data type	Uint32
	Data range	-	Factory setting	0x0A880000	Accessibility	RO	Related models	-	Map	NO

Subindex 02h	Name	Product code					Data structure	-	Data type	Uint32
	Data range	-	Factory setting	0x00100000	Accessibility	RO	Related models	-	Map	NO

Subindex 03h	Name	Revision number				Data structure	-	Data type	Uint32
	Data range	-	Factory setting	0x00010A88	Accessibility	RO	Related models	-	Map	NO

Subindex 04h	Name	Product serial number				Data structure	-	Data type	Uint32
	Data range	-	Factory setting	0x00000000	Accessibility	RO	Related models	-	Map	NO

Index 1600h	Name	RPDO1 mapping object				Data structure	REC	Data type	Uint8
	Data range	ODData range	Factory setting	OD default value	Accessibility	RW	Related models	ALL	Map	NO

Subindex 00h	Name	Number of mapping objects supported by RPDO1				Data structure	-	Data type	Uint8
	Data range	0～12	Factory setting	3	Accessibility	RW	Related models	ALL	Map	NO

Subindex 01h	Name	The first mapping object				Data structure	-	Data type	Uint8
	Data range	0～4294967295	Factory setting	0x60400010	Accessibility	RW	Related models	ALL	Map	NO

Subindex 02h	Name	The second mapping object				Data structure	-	Data type	Uint8
	Data range	0～4294967295	Factory setting	0x607A0020	Accessibility	RW	Related models	ALL	Map	NO

Subindex 03h	Name	The third mapped object				Data structure	-	Data type	Uint8
	Data range	0～4294967295	Factory setting	0x60B80010	Accessibility	RW	Related models	ALL	Map	NO

Subindex 04～0Ch	Name	The 4th to 12th mapping objects				Data structure	-	Data type	Uint8
	Data range	0～4294967295	Factory setting	-	Accessibility	RW	Related models	ALL	Map	NO

Index 1601h	Name	RPDO2 mapping object				Data structure	REC	Data type	Uint32
	Data range	ODData range	Factory setting	OD default value	Accessibility	RW	Related models	ALL	Map	NO

Subindex 00h	Name	Number of mapping objects supported by RPDO2				Data structure	-	Data type	Uint8
	Data range	0～12	Factory setting	6	Accessibility	RW	Related models	ALL	Map	NO

Subindex 01h	Name	The first mapping object				Data structure	-	Data type	Uint32
	Data range	0～4294967295	Factory setting	0x60400010	Accessibility	RW	Related models	ALL	Map	NO

Subindex 02h	Name	The second mapping object				Data structure	-	Data type	Uint32
	Data range	0～4294967295	Factory setting	0x607A0020	Accessibility	RW	Related models	ALL	Map	NO

Subindex 03h	Name	The third mapping object				Data structure	-	Data type	Uint32
	Data range	0～4294967295	Factory setting	0x60810020	Accessibility	RW	Related models	ALL	Map	NO

Subindex 04h	Name	The fourth mapping object				Data structure	-	Data type	Uint32
	Data range	0～4294967295	Factory setting	0x60830020	Accessibility	RW	Related models	ALL	Map	NO

Subindex 05h	Name	The fifth mapping object					Data structure	-	Data type	Uint32
	Data range	0～4294967295	Factory setting	0x60840020	Accessibility	RW	Related models	ALL	Map	NO

Subindex 06h	Name	The sixth mapping object					Data structure	-	Data type	Uint32
	Data range	0～4294967295	Factory setting	0x60600008	Accessibility	RW	Related models	ALL	Map	NO

Subindex 07～0Ch	Name	The 7th to 12th mapping objects					Data structure	-	Data type	Uint32
	Data range	0～4294967295	Factory setting	-	Accessibility	RW	Related models	ALL	Map	NO

Index 1602h	Name	RPDO3 mapping object					Data structure	REC	Data type	Uint32
	Data range	ODData range	Factory setting	OD default value	Accessibility	RW	Related models	ALL	Map	NO

Subindex 00h	Name	Number of mapping objects supported by RPDO3					Data structure	-	Data type	Uint8
	Data range	0～12	Factory setting	5	Accessibility	RW	Related models	ALL	Map	NO

Subindex 01h	Name	The first mapping object					Data structure	-	Data type	Uint32
	Data range	0～4294967295	Factory setting	0x60400010	Accessibility	RW	Related models	ALL	Map	NO

Subindex 02h	Name	The second mapping object					Data structure	-	Data type	Uint32
	Data range	0～4294967295	Factory setting	0x60830020	Accessibility	RW	Related models	ALL	Map	NO

Subindex 03h	Name	The third mapping object					Data structure	-	Data type	Uint32
	Data range	0～4294967295	Factory setting	0x60840020	Accessibility	RW	Related models	ALL	Map	NO

Subindex 04h	Name	The fourth mapping object					Data structure	-	Data type	Uint32
	Data range	0～4294967295	Factory setting	0x60FF0020	Accessibility	RW	Related models	ALL	Map	NO

Subindex 05h	Name	The fifth mapping object					Data structure	-	Data type	Uint32
	Data range	0～4294967295	Factory setting	0x60600008	Accessibility	RW	Related models	ALL	Map	NO

Subindex 06～0Ch	Name	The 6th to 12th mapping objects					Data structure	-	Data type	Uint32
	Data range	0～4294967295	Factory setting	-	Accessibility	RW	Related models	ALL	Map	NO

Index 1A00h	Name	TPDO1 mapping object					Data structure	REC	Data type	Uint32
	Data range	ODData range	Factory setting	OD default value	Accessibility	RW	Related models	ALL	Map	NO

Subindex 00h	Name	Number of mapping objects supported by TPDO1					Data structure	-	Data type	Uint8
	Data range	0～12	Factory setting	7	Accessibility	RW	Related models	ALL	Map	NO

Subindex 01h	Name	The first mapping object					Data structure	-	Data type	Uint32
	Data range	0～4294967295	Factory setting	0x603F0010	Accessibility	RW	Related models	ALL	Map	NO

Subindex 02h	Name	The second mapping object					Data structure	-	Data type	Uint32
	Data range	0～4294967295	Factory setting	0x60410010	Accessibility	RW	Related models	ALL	Map	NO

Subindex 03h	Name	The third mapping object					Data structure	-	Data type	Uint32
	Data range	0～4294967295	Factory setting	0x60610008	Accessibility	RW	Related models	ALL	Map	NO

Subindex 04h	Name	The fourth mapping object					Data structure	-	Data type	Uint32
	Data range	0～4294967295	Factory setting	0x60640020	Accessibility	RW	Related models	ALL	Map	NO

Subindex 05h	Name	The fifth mapping object					Data structure	-	Data type	Uint32
	Data range	0～4294967295	Factory setting	0x60B90010	Accessibility	RW	Related models	ALL	Map	NO

Subindex 06h	Name	The sixth mapping object					Data structure	-	Data type	Uint32
	Data range	0～4294967295	Factory setting	0x60BA0020	Accessibility	RW	Related models	ALL	Map	NO

Subindex 07h	Name	The seventh mapping object					Data structure	-	Data type	Uint32
	Data range	0～4294967295	Factory setting	0x60FD0020	Accessibility	RW	Related models	ALL	Map	NO

Subindex 08～0Ch	Name	The 8th to 12th mapping objects					Data structure	-	Data type	Uint32
	Data range	0～4294967295	Factory setting	-	Accessibility	RW	Related models	ALL	Map	NO

Index 1A00h	Name	TPDO2 mapping object					Data structure	REC	Data type	Uint32
	Data range	ODData range	Factory setting	OD default value	Accessibility	RW	Related models	ALL	Map	NO

Subindex 00h	Name	Number of mapping objects supported by TPDO2					Data structure	-	Data type	Uint8
	Data range	0～12	Factory setting	4	Accessibility	RW	Related models	ALL	Map	NO

Subindex 01h	Name	The first mapping object					Data structure	-	Data type	Uint32
	Data range	0～4294967295	Factory setting	0x60410010	Accessibility	RW	Related models	ALL	Map	NO

Subindex 02h	Name	The second mapping object					Data structure	-	Data type	Uint32
	Data range	0～4294967295	Factory setting	0x60610008	Accessibility	RW	Related models	ALL	Map	NO

Subindex 03h	Name	The third mapping object					Data structure	-	Data type	Uint32
	Data range	0～4294967295	Factory setting	0x606C0020	Accessibility	RW	Related models	ALL	Map	NO

Subindex 04h	Name	The fourth mapping object					Data structure	-	Data type	Uint32
	Data range	0～4294967295	Factory setting	0x60FD0020	Accessibility	RW	Related models	ALL	Map	NO

Subindex 05～0Ch	Name	The 5th to 12th mapping objects					Data structure	-	Data type	Uint32
	Data range	0～4294967295	Factory setting	-	Accessibility	RW	Related models	ALL	Map	NO

Index 1A00h	Name	TPDO3 mapping object					Data structure	REC	Data type	Uint32
	Data range	ODData range	Factory setting	OD default value	Accessibility	RW	Related models	ALL	Map	NO

Subindex 00h	Name	Number of mapping objects supported by TPDO3					Data structure	-	Data type	Uint8
	Data range	0～12	Factory setting	0	Accessibility	RW	Related models	ALL	Map	NO

Subindex 00～0Ch	Name	The 1st to 12th mapping objects					Data structure	-	Data type	Uint32
	Data range	0～4294967295	Factory setting	-	Accessibility	RW	Related models	ALL	Map	NO

Index 1C00h	Name	Synchronous management communication type					Data structure	REC	Data type	OD type
	Setting range	OD Data range	Factory setting	OD default value	Accessibility	RO	Related models	-	Map	NO

Subindex 00h	Name	The largest subindex number of the synchronous management communication type					Data structure	-	Data type	Uint8
	Data range	-	Factory setting	4	Accessibility	RO	Related models	-	Map	NO

Subindex 01h	Name	SM0 communication type					Data structure	-	Data type	Uint8
	Data range	-	Factory setting	0x01	Accessibility	RO	Related models	-	Map	NO
SM0 communication type: receiving mailbox										

Subindex 02h	Name	SM1 communication type					Data structure	-	Data type	Uint8
	Data range	-	Factory setting	0x02	Accessibility	RO	Related models	-	Map	NO
SM1 communication type: send mailbox										

Subindex 03h	Name	SM2 communication type					Data structure	-	Data type	Uint8
	Data range	-	Factory setting	0x03	Accessibility	RO	Related models	-	Map	NO
SM2 communication type: process data output										

Subindex 04h	Name	SM3 communication type					Data structure	-	Data type	Uint8
	Data range	-	Factory setting	0x04	Accessibility	RO	Related models	-	Map	NO
SM3 communication type: process data input										

Index 1C12h	Name	Synchronization manager 2 RPDO allocation					Data structure	ARR	Data type	Uint16
	Data range	OD Data range	Factory setting	OD default value	Accessibility	RW	Related models	-	Map	NO
Set the assigned object index of RPDO										

Subindex 00h	Name	Synchronization manager 2 RPDO assigns the largest subindex number					Data structure	-	Data type	Uint8
	Data range	0～1	Factory setting	1	Accessibility	RW	Related models	ALL	Map	NO

Subindex 01h	Name	Index of the object allocated by RPDO					Data structure	-	Data type	Uint16
	Data range	0～65535	Factory setting	0x1600	Accessibility	RW	Related models	-	Map	NO

Set the index of the RPDO allocation object

Index 1C13h	Name	Synchronization manager 3 TPDO allocation					Data structure	ARR	Data type	Uint16
	Data range	OD Data range	Factory setting	OD default value	Accessibility	RW	Related models	-	Map	NO
Set the assigned object index of RPDO										

Subindex 00h	Name	Synchronization manager 3 TPDO assigns the largest subindex number					Data structure	-	Data type	Uint8
	Data range	0～1	Factory setting	1	Accessibility	RW	Related models	ALL	Map	NO

Subindex 01h	Name	Index of the object allocated by TPDO					Data structure	-	Data type	Uint16
	Data range	0～65535	Factory setting	0x1A00	Accessibility	RW	Related models	-	Map	NO
Set the index of the RPDO allocation object										

Index 1C32h	Name	Synchronization manager 2 synchronization output parameters					Data structure	REC	Data type	Uint16
	Data range	OD Data range	Factory setting	OD default value	Accessibility	RO	Related models	-	Map	NO
Describe the output parameters of SM2										

Subindex 00h	Name	The maximum subindex number of the synchronization output parameter of the synchronization manager 2					Data structure	-	Data type	Uint8
	Data range	-	Factory setting	32	Accessibility	RO	Related models	-	Map	NO

Subindex 01h	Name	Synchronization type					Data structure	-	Data type	Uint16
	Data range	-	Factory setting	2	Accessibility	RO	Related models	-	Map	NO
0x0002 indicates that the synchronization type of SM2 is distributed clock synchronization 0 mode (DC SYNC Mode)										

Subindex 02h	Name	Cycle time (unit: ns)					Data structure	-	Data type	Uint32
	Data range	-	Factory setting	0x003D0900	Accessibility	RO	Related models	-	Map	NO
Reflect the cycle of DC SYNC 0										

Subindex 04h	Name	Supported synchronization types					Data structure	-	Data type	Uint16
	Data range	-	Factory setting	0x401F	Accessibility	RO	Related models	-	Map	NO
Reflect the type of distributed clock 0x0004 represents the distributed clock synchronization 0 mode (DC SYNC 0 Mode)										

Subindex 05h	Name	Minimum cycle time (unit: ns)					Data structure	-	Data type	Uint32
	Data range	-	Factory setting	0xE8480000	Accessibility	RO	Related models	-	Map	NO

Subindex 06h	Name	Calculation and replication time (unit: ns)					Data structure	-	Data type	Uint32
	Data range	-	Factory setting	0	Accessibility	RO	Related models	-	Map	NO
Reflects the time when the microprocessor copies data from the synchronization manager to the local.										

Subindex 09h	Name	Delay time (unit: ns)					Data structure	-	Data type	Uint32
	Data range	-	Factory setting	0	Accessibility	RO	Related models	-	Map	NO

Subindex 20h	Name	Sync error					Data structure	-	Data type	Bool
	Data range	-	Factory setting	0	Accessibility	RO	Related models	-	Map	NO
Reflect whether a synchronization error occurs currently: TRUE: synchronization is activated and no synchronization error occurs FALSE: Synchronization is not activated or a synchronization error has occu										

Index 1C33h	Name	Synchronization management 3 synchronization input parameters					Data structure	REC	Data type	OD type
	Data range	OD Data range	Factory setting	-	Accessibility	RO	Related models	-	Map	NO
Describe the input parameters of SM3										

Subindex 00h	Name	The maximum subindex number of the synchronization input parameter of the synchronization manager 3					Data structure	-	Data type	Uint8
	Data range	-	Factory setting	32	Accessibility	RO	Related models	-	Map	NO

Subindex 01h	Name	Synchronization type					Data structure	-	Data type	Uint16
	Data range	-	Factory setting	2	Accessibility	RO	Related models	-	Map	NO
0x0002 indicates that the synchronization type of SM2 is distributed clock synchronization 0 mode (DC SYNC Mode)										

Subindex 01h	Name	Cycle time (unit: ns)					Data structure	-	Data type	Uint32
	Data range	-	Factory setting	0x003D0900	Accessibility	RO	Related models	-	Map	NO

Subindex 04h	Name	Supported synchronization types					Data structure	-	Data type	Uint16
	Data range	-	Factory setting	0x401F	Accessibility	RO	Related models	-	Map	NO
Reflect the type of distributed clock 0x0004 represents the distributed clock synchronization 0 mode (DC SYNC 0 Mode)										

Subindex 05h	Name	Minimum cycle time (unit: ns)					Data structure	-	Data type	Uint32
	Data range	-	Factory setting	0xE8480000	Accessibility	RO	Related models	-	Map	NO

Subindex 06h	Name	Calculation and replication time (unit: ns)					Data structure	-	Data type	Uint32
	Data range	-	Factory setting	0x00000001	Accessibility	RO	Related models	-	Map	NO

Subindex 09h	Name	Delay time (unit: ns)					Data structure	-	Data type	Uint32
	Data range	-	Factory setting	0x0000	Accessibility	RO	Related models	-	Map	NO

Subindex 20h	Name	Sync error					Data structure	-	Data type	Bool
	Data range	-	Factory setting	-	Accessibility	RO	Related models	-	Map	NO

7.3 Detailed description of manufacturer-defined parameters (group 2000h)

7.3.1 Servo motor parameters

Index	Name	Servo motor parameter			Data	ARR	Data type	Uint16

2000h							structure			
	Data range	OD Data range	Factory setting	OD default value	Accessibility	-	Related models	-	Map	NO

Subindex 00h	Name	Maximum subindex number					Data structure	-	Data type	Uint8
	Data range	-	Factory setting	14	Accessibility	RO	Related models	-	Map	NO

Subindex 01h	Name	Motor ID					Data structure	-	Data type	Uint16
	Data range	0～65535	Factory setting	Determined by model	Accessibility	RW	Related models	-	Map	NO

Subindex 02h	Name	Motor rated power (unit: 0.01KW)					Data structure	-	Data type	Uint16
	Data range	0～65535	Factory setting	Determined by model	Accessibility	RW	Related models	-	Map	NO

Subindex 03h	Name	Motor rated voltage (unit: V)					Data structure	-	Data type	Uint16
	Data range	0～65535	Factory setting	Determined by model	Accessibility	RW	Related models	-	Map	NO

Subindex 04h	Name	Motor rated current (unit: 0.1A)					Data structure	-	Data type	Uint16
	Data range	0～65535	Factory setting	Determined by model	Accessibility	RW	Related models	-	Map	NO

Subindex 05h	Name	Motor rated speed (unit: rpm)					Data structure	-	Data type	Uint16
	Data range	0～65535	Factory setting	Determined by model	Accessibility	RW	Related models	-	Map	NO

Subindex 06h	Name	Motor max speed (unit: rpm）					Data structure	-	Data type	Uint16
	Data range	0～65535	Factory setting	Determined by model	Accessibility	RW	Related models	-	Map	NO

Subindex 07h	Name	Motor rated torque (unit: 0.01Nm)					Data structure	-	Data type	Uint16
	Data range	0～65535	Factory setting	Determined by model	Accessibility	RW	Related models	-	Map	NO

Subindex 08h	Name	Motor max torque (unit: 0.01Nm)					Data structure	-	Data type	Uint16
	Data range	0～65535	Factory setting	Determined by model	Accessibility	RW	Related models	-	Map	NO

Subindex 09h	Name	Motor moment of inertia (unit: 0.01Kg.cm)					Data structure	-	Data type	Uint16
	Data range	0～65535	Factory setting	Determined by model	Accessibility	RW	Related models	-	Map	NO

Subindex 0Ah	Name	Number of motor pole pairs (unit: pole pairs)					Data structure	-	Data type	Uint16
	Data range	0～65535	Factory setting	Determined by model	Accessibility	RW	Related models	-	Map	NO

Subindex 0Bh	Name	Motor wire resistance (unit: 0.001Ω)					Data structure	-	Data type	Uint16
	Data range	0～65535	Factory setting	Determined by model	Accessibility	RW	Related models	-	Map	NO

Subindex 0Ch	Name	Motor Q-axis inductance (unit: 0.01mH)					Data structure	-	Data type	Uint16
	Data range	0～65535	Factory setting	Determined by model	Accessibility	RW	Related models	-	Map	NO

Subindex 0Dh	Name	Motor D-axis inductance (unit: 0.01mH)					Data structure	-	Data type	Uint16
	Data range	0～65535	Factory setting	Determined by model	Accessibility	RW	Related models	-	Map	NO

Subind	Name	Motor torque constant (unit: 0.01Nm/A)	Data structure	-	Data type	Uint16

ex 0Eh	Data range	0～65535	Factory setting	Determined by model	Accessibility	RW	Related models	-	Map	NO

7.3.2 Driver parameters

Index 2001h	Name	Drive parameters					Data structure	ARR	Data type	Uint16
	Data range	OD Data range	Factory setting	OD default value	Accessibility	-	Related models	-	Map	NO

Subindex 00h	Name	Maximum subindex number					Data structure	-	Data type	Uint8
	Data range	-	Factory setting	3	Accessibility	RO	Related models	-	Map	NO

Subindex 01h	Name	MCU software version number					Data structure	-	Data type	Uint16
	Data range	-	Factory setting	-	Accessibility	RO	Related models	-	Map	NO

Subindex 02h	Name	FPGA software version number					Data structure	-	Data type	Uint16
	Data range	-	Factory setting	-	Accessibility	RO	Related models	-	Map	NO

Subindex 03h	Name	EtherCAT software version number					Data structure	-	Data type	Uint16
	Data range	-	Factory setting	-	Accessibility	RO	Related models	-	Map	NO

7.3.3 Encoder parameters

Index 2002h	Name	Encoder parameters					Data structure	ARR	Data type	Uint16
	Data range	OD Data range	Factory setting	OD default value	Accessibility	-	Related models	-	Map	NO

Subindex 00h	Name	Maximum subindex number					Data structure	-	Data type	Uint8
	Data range	-	Factory setting	10	Accessibility	RO	Related models	-	Map	NO

Subindex 01h	Name	Encoder type					Data structure	-	Data type	Uint16
	Data range	0～2	Factory setting	2	Accessibility	RW	Related models	-	Map	NO
Set the encoder type: 0: Reserved 1: Multiturn absolute encoder 2: Single-turn absolute encoder										

Subindex 02h	Name	Motor encoder zero offset					Data structure	-	Data type	Uint32
	Data range	0～2^{32}-1	Factory setting	0	Accessibility	RW	Related models	-	Map	NO

Subindex 03h	Name	Encoder resolution (unit: bit)					Data structure	-	Data type	Uint16
	Data range	0～23	Factory setting	17	Accessibility	RW	Related models	-	Map	NO

Subindex 04h	Name	Prohibit multiturn absolute encoder battery failure alarm					Data structure	-	Data type	Uint16
	Data range	0～1	Factory setting	0	Accessibility	RW	Related models	-	Map	NO

Subindex 05h	Name	Resolution of multiturn absolute encoder (unit: bit)					Data structure	-	Data type	Uint16
	Data range	0～23	Factory setting	16	Accessibility	RW	Related models	-	Map	NO

Subindex 06h	Name	Motor power-on and lock shaft torque (unit: %)					Data structure	-	Data type	Uint16
	Data range	0～300	Factory setting	90	Accessibility	RW	Related models	-	Map	NO

Subindex 07h	Name	Set the current position of the multiturn absolute encoder as zero					Data structure	-	Data type	Uint16
	Data range	0～1	Factory setting	0	Accessibility	RW	Related models	-	Map	NO

Subindex 08h	Name	Multiturn absolute encoder zero point single-turn offset					Data structure	-	Data type	Uint32
	Data range	0～8388607	Factory setting	0	Accessibility	RW	Related models	-	Map	NO

Subindex 09h	Name	Multiturn absolute encoder zero point multiturn offset					Data structure	-	Data type	Int32
	Data range	-32768～32767	Factory setting	0	Accessibility	RW	Related models	-	Map	NO

Subindex 0Ah	Name	Prohibit the encoder position to update the current position command					Data structure	-	Data type	Uint16
	Data range	0～1	Factory setting	0	Accessibility	RW	Related models	-	Map	NO

7.3.4 Basic control parameters

Index 2003h	Name	Basic control parameters					Data structure	ARR	Data type	Uint16
	Data range	OD Data range	Factory setting	OD default value	Accessibility	-	Related models	ALL	Map	NO

Subindex 00h	Name	Maximum subindex number					Data structure	-	Data type	Uint8
	Data range	-	Factory setting	16	Accessibility	RO	Related models	-	Map	NO

Subindex 01h	Name	Control mode					Data structure	-	Data type	Uint16
	Data range	0～7	Factory setting	3	Accessibility	RW	Related models	ALL	Map	NO

Set the drive control mode:
0: Position control mode
1: Speed control mode
2: Torque control mode
3: EtherCAT control mode
4: Speed mode - Torque mode (reserved)
5: Position Mode - Speed Mode (reserved)
6: Position mode - Torque mode (reserved)
7: Position mode - Speed mode - Torque mode (reserved)

Subindex 02h	Name	Operation direction selection					Data structure	-	Data type	Uint16
	Data range	0～1	Factory setting	0	Accessibility	RW	Related models	ALL	Map	NO

Set the positive direction of the motor:
0: Regard the CCW direction as the forward rotation direction (when the forward direction is commanded, from the side of the motor shaft, the motor rotation direction is the CCW direction, that is, counterclockwise rotation)
1: Regard the CW direction as the forward rotation direction (when the forward direction is commanded, from the side of the motor shaft, the motor rotation direction is the CW direction, that is, clockwise rotation)

Subindex 03h	Name	Minimum value of braking resistance allowed for the drive (unit: Ω)					Data structure	-	Data type	Uint16
	Data range	-	Factory setting	-	Accessibility	RO	Related models	-	Map	NO

Subindex 04h	Name	Built-in braking resistor power (unit: W)					Data structure	-	Data type	Uint16
	Data range	-	Factory setting	-	Accessibility	RO	Related models	-	Map	NO

Subindex	Name	Built-in braking resistor resistance value (unit: Ω)	Data structure	-	Data type	Uint16

05h	Data range	-	Factory setting	-	Accessibility	RO	Related models	-	Map	NO

Subindex 06h	Name	Brake resistor heat dissipation coefficient (unit: %)					Data structure	-	Data type	Uint16
	Data range	0～100	Factory setting	20	Accessibility	RW	Related models	-	Map	NO

Subindex 07h	Name	Braking resistor setting					Data structure	-	Data type	Uint16
	Data range	0～1	Factory setting	0	Accessibility	RW	Related models	-	Map	NO
0: Use built-in resistor 1: Use external resistor										

Subindex 08h	Name	External braking resistor power (unit: W)					Data structure	-	Data type	Uint16
	Data range	0～65535	Factory setting	50	Accessibility	RW	Related models	-	Map	NO

Subindex 09h	Name	External braking resistor resistance value (unit: Ω)					Data structure	-	Data type	Uint16
	Data range	0～65535	Factory setting	10	Accessibility	RW	Related models	-	Map	NO

Subindex 0Ah	Name	Braking start voltage threshold (unit: V)					Data structure	-	Data type	Uint16
	Data range	150～390	Factory setting	75	Accessibility	RW	Related models	-	Map	NO

Subindex 0Bh	Name	Disable brake feedback detection mode					Data structure	-	Data type	Uint16
	Data range	0～1	Factory setting	1	Accessibility	RW	Related models	-	Map	NO

Subindex 0Ch	Name	Maximum continuous braking time (unit: ms)					Data structure	-	Data type	Uint16
	Data range	0～65535	Factory setting	3000	Accessibility	RW	Related models	-	Map	NO

Subindex 0Dh	Name	Reserve					Data structure	-	Data type	Uint16
	Data range	-	Factory setting	-	Accessibility	RO	Related models	-	Map	NO

Subindex 0Eh	Name	Reserve					Data structure	-	Data type	Uint16
	Data range	-	Factory setting	-	Accessibility	RO	Related models	-	Map	NO

Subindex 0Fh	Name	The delay time from when the brake output is OFF to when the motor is not energized (unit: ms)					Data structure	-	Data type	Uint16
	Data range	0～65535	Factory setting	50	Accessibility	RW	Related models	-	Map	NO

Subindex 10h	Name	Reserve					Data structure	-	Data type	Uint16
	Data range	-	Factory setting	-	Accessibility	RO	Related models	-	Map	NO

7.3.5 Input terminal parameters

Index 2004h	Name	Input terminal parameters					Data structure	ARR	Data type	Uint16
	Data range	OD Data range	Factory setting	OD default value	Accessibility	-	Related models	-	Map	YES

Subindex 00h	Name	Maximum subindex number					Data structure	-	Data type	Uint8
	Data range	-	Factory setting	16	Accessibility	RO	Related models	-	Map	NO

Subindex 01h	Name	IN1 terminal function selection					Data structure	-	Data type	Uint16
	Data	0～31	Factory	5	Accessib	RW	Related	-	Map	YES

	range		setting		ility		models			

Set the function of the digital input terminal 1 of the drive.

Set value	IN terminal function	Set value	IN terminal function
0	FunIN.0: Normal input	16	FunIN.16: Multi-segment run command switching 3
1	FunIN.1: Servo enable	17	FunIN.17: Multi-segment run command switching4
2	FunIN. 2: Alarm clear	18	FunIN.18: Torque command direction setting
3	FunIN. 3: Pulse command prohibition	19	FunIN.19: Speed command direction setting
4	FunIN. 4: Clear position deviation	20	FunIN. 20: Position command direction setting
5	FunIN. 5: Positive limit signal	21	FunIN. 21: Multi-segment position command enable
6	FunIN. 6: Negative limit signal	22	FunIN.22: Back to home input
7	FunIN. 7: Gain switching	23	FunIN. 23: Home switch signal
8	FunIN. 8: Electronic gear ratio switching	24	FunIN.24：USER1
9	FunIN. 9: Zero-speed clamp	25	FunIN.25：USER2
10	FunIN.10: Control mode selection 1	26	FunIN.26：USER3
11	FunIN.11: Emergency stop	27	FunIN.27：USER4
12	FunIN.12: Position command prohibition	28	FunIN.28：USER5
13	FunIN.13: Step Position Trigger	29	FunIN.29: Control mode selection 2
14	FunIN.14: Multi-segment run command switching 1	30	FunIN.30: Probe 1
15	FunIN.15: Multi-segment run command switching 2	31	FunIN. 31: Probe 2

Subindex 02h	Name	IN1 terminal logic selection					Data structure	-	Data type	Uint16
	Data range	0～1	Factory setting	0	Accessibility	RW	Related models	-	Map	YES

Set the level logic of the hardware IN1 terminal when the IN function selected by IN1 is valid. Please set the effective level logic correctly according to the host computer and peripheral circuit.

Set value	IN terminal logic when IN function is valid
0	Low level
1	High level

Subindex 03h	Name	IN2 terminal function selection					Data structure	-	Data type	Uint16
	Data range	0～31	Factory setting	6	Accessibility	RW	Related models	-	Map	YES

Subindex 04h	Name	IN2 terminal logic selection					Data structure	-	Data type	Uint16
	Data range	0～1	Factory setting	0	Accessibility	RW	Related models	-	Map	YES

Subindex 05h	Name	IN3 terminal function selection					Data structure	-	Data type	Uint16
	Data range	0～31	Factory setting	23	Accessibility	RW	Related models	-	Map	YES

Subindex 06h	Name	IN3 terminal logic selection					Data structure	-	Data type	Uint16
	Data range	0～1	Factory setting	0	Accessibility	RW	Related models	-	Map	YES

Subindex 07h	Name	IN4 terminal function selection					Data structure	-	Data type	Uint16
	Data range	0～31	Factory setting	30	Accessibility	RW	Related models	-	Map	YES

Subindex 08h	Name	IN4 terminal logic selection					Data structure	-	Data type	Uint16
	Data range	0～1	Factory setting	0	Accessibility	RW	Related models	-	Map	YES

Subindex 09h	Name	IN5 terminal function selection					Data structure	-	Data type	Uint16
	Data range	0～31	Factory setting	6	Accessibility	RW	Related models	-	Map	YES

Subindex 0Ah	Name	IN5 terminal logic selection					Data structure	-	Data type	Uint16
	Data range	0～1	Factory setting	31	Accessibility	RW	Related models	-	Map	YES

Subindex 0Bh	Name	IN6 terminal function selection					Data structure	-	Data type	Uint16
	Data range	0～31	Factory setting	0	Accessibility	RW	Related models	-	Map	YES

Subindex 0Ch	Name	IN6 terminal logic selection					Data structure	-	Data type	Uint16
	Data range	0～1	Factory setting	0	Accessibility	RW	Related models	-	Map	YES

Subindex 0Dh	Name	IN7 terminal function selection					Data structure	-	Data type	Uint16
	Data range	0～31	Factory setting	0	Accessibility	RW	Related models	-	Map	YES

Subindex 0Eh	Name	IN7 terminal logic selection					Data structure	-	Data type	Uint16
	Data range	0～1	Factory setting	0	Accessibility	RW	Related models	-	Map	YES

Subindex 0Fh	Name	IN8 terminal function selection					Data structure	-	Data type	Uint16
	Data range	0～31	Factory setting	0	Accessibility	RW	Related models	-	Map	YES

Subindex 10h	Name	IN8 terminal logic selection					Data structure	-	Data type	Uint16
	Data range	0～1	Factory setting	0	Accessibility	RW	Related models	-	Map	YES

7.3.6 Output terminal parameters

Index 2005h	Name	Output terminal parameters					Data structure	ARR	Data type	Uint16
	Data range	OD Data range	Factory setting	OD default value	Accessibility	-	Related models	-	Map	YES

Subindex 00h	Name	Maximum subindex number					Data structure	-	Data type	Uint8
	Data range	-	Factory setting	8	Accessibility	RO	Related models	-	Map	NO

Subindex 01h	Name	OUT1 terminal function selection					Data structure	-	Data type	Uint16
	Data range	0～31	Factory setting	1	Accessibility	RW	Related models	-	Map	YES

Set the OUT function corresponding to the hardware OUT1 terminal. Please refer to the table below for parameter value setting.

Set value	OUT terminal function	Set value	OUT terminal function
0	FunOUT.0: Holding brake	9	FunOUT.9: USER3
1	FunOUT.1: Alarm	10	FunOUT.10: USER4
2	FunOUT.2: position arrival	11	FunOUT.11: USER5
3	FunOUT.3: Speed arrival	12	FunOUT.12: USER6
4	FunOUT.4: Servo ready	13	FunOUT.13: Torque arrival
5	FunOUT.5: Internal position command shutdown	14	FunOUT.14: Out of tolerance output
6	FunOUT.6: Back to origin completed	15～30	Reserve
7	FunOUT.7: USER1	31	Universal output
8	FunOUT.8: USER2		

Subindex 02h	Name	OUT1 terminal logic selection					Data structure	-	Data type	Uint16
	Data range	0～1	Factory setting	0	Accessibility	RW	Related models	-	Map	YES

Set the output level logic of the hardware OUT1 terminal when the OUT function selected by OUT1 is valid

Set value	OUT1 terminal logic when OUT function is valid	Transistor status
0	Low level	ON
1	High level	OFF

Subindex 03h	Name	OUT2 terminal function selection					Data structure	-	Data type	Uint16
	Data range	0～31	Factory setting	6	Accessibility	RW	Related models	-	Map	YES

Subindex 04h	Name	OUT2 terminal logic selection					Data structure	-	Data type	Uint16
	Data range	0～1	Factory setting	0	Accessibility	RW	Related models	-	Map	YES

Subindex 05h	Name	OUT3 terminal function selection					Data structure	-	Data type	Uint16
	Data range	0～31	Factory setting	0	Accessibility	RW	Related models	-	Map	YES

Subindex 06h	Name	OUT3 terminal logic selection					Data structure	-	Data type	Uint16
	Data range	0～1	Factory setting	0	Accessibility	RW	Related models	-	Map	YES

Subindex 07h	Name	OUT4 terminal function selection					Data structure	-	Data type	Uint16
	Data range	0～31	Factory setting	31	Accessibility	RW	Related models	-	Map	YES

Subindex 08h	Name	OUT4 terminal logic selection					Data structure	-	Data type	Uint16
	Data range	0～1	Factory setting	0	Accessibility	RW	Related models	-	Map	YES

7.3.7 Position control parameters

Index 2006h	Name	Position control parameters					Data structure	ARR	Data type	Uint16
	Data range	OD Data range	Factory setting	OD default value	Accessibility	-	Related models	-	Map	YES

Subind	Name	Maximum subindex number	Data	-	Data type	Uint8

ex 00h						structure			
	Data range	-	Factory setting	8	Accessibility	RO	Related models	-	Map	NO

Subindex 01h	Name	Position command clear setting				Data structure	-	Data type	Uint16
	Data range	0～1	Factory setting	0	Accessibility	RW	Related models	-	Map	YES
Set the clear operation mode of the position command counter when the motor is not enabled: 0: Position command is cleared 1: Position command is not cleared									

Subindex 02h	Name	Reserve				Data structure	-	Data type	Uint16
	Data range	-	Factory setting	-	Accessibility	RO	Related models	-	Map	NO

Subindex 03h	Name	Reserve				Data structure	-	Data type	Uint16
	Data range	-	Factory setting	-	Accessibility	RO	Related models	-	Map	NO

Subindex 04h	Name	Reserve				Data structure	-	Data type	Uint16
	Data range	-	Factory setting	-	Accessibility	RO	Related models	-	Map	NO

Subindex 05h	Name	Reserve				Data structure	-	Data type	Uint16
	Data range	-	Factory setting	-	Accessibility	RO	Related models	-	Map	NO

Subindex 06h	Name	Reserve				Data structure	-	Data type	Uint16
	Data range	-	Factory setting	-	Accessibility	RO	Related models	-	Map	NO

Subindex 07h	Name	Positioning completion threshold unit setting				Data structure	-	Data type	Uint16
	Data range	0～1	Factory setting	0	Accessibility	RW	Related models	-	Map	NO
Set the unit of positioning completion threshold 0: Command unit 1: Encoder unit									

Subindex 08h	Name	-				Data structure	-	Data type	Uint16
	Data range	-	Factory setting	-	Accessibility	RO	Related models	-	Map	NO

7.3.8 Speed control parameters

Index 2007h	Name	Speed control parameters				Data structure	ARR	Data type	Uint16
	Data range	OD Data range	Factory setting	OD default value	Accessibility	-	Related models	-	Map	YES

Subindex 00h	Name	Maximum subindex number				Data structure	-	Data type	Uint8
	Data range	-	Factory setting	3	Accessibility	RO	Related models	-	Map	NO

Subindex 01h	Name	Jog speed (unit: rpm)				Data structure	-	Data type	Uint16
	Data range	0～3000	Factory setting	100	Accessibility	RW	Related models	-	Map	YES

Subindex 02h	Name	Reserve				Data structure	-	Data type	Uint16
	Data range	-	Factory setting	0	Accessibility	RO	Related models	-	Map	NO

Subind	Name	Reserve				Data	-	Data type	Uint16

ex 03h							structure			
	Data range	-	Factory setting	10	Accessibility	RO	Related models	-	Map	NO

7.3.9 Torque control parameters

Index 2008h	Name	Torque control parameters					Data structure	ARR	Data type	Uint16
	Data range	OD Data range	Factory setting	OD default value	Accessibility	-	Related models	-	Map	YES
Subindex 00h	Name	Maximum subindex number					Data structure	-	Data type	Uint8
	Data range	-	Factory setting	13	Accessibility	RO	Related models	-	Map	NO
Subindex 01h	Name	Torque command filtering time constant (unit: 0.01ms)					Data structure	-	Data type	Uint16
	Data range	0～3000	Factory setting	1000	Accessibility	RW	Related models	-	Map	YES
Subindex 02h	Name	Second torque command filtering time constant (unit: 0.01ms)					Data structure	-	Data type	Uint16
	Data range	0～3000	Factory setting	1000	Accessibility	RW	Related models	-	Map	YES
Subindex 03h	Name	Reserve					Data structure	-	Data type	Uint16
	Data range	-	Factory setting	0	Accessibility	RO	Related models	-	Map	NO
Subindex 04h	Name	Reserve					Data structure	-	Data type	Uint16
	Data range	-	Factory setting	3000	Accessibility	RO	Related models	-	Map	NO
Subindex 05h	Name	Reserve					Data structure	-	Data type	Uint16
	Data range	-	Factory setting	3000	Accessibility	RO	Related models	-	Map	NO
Subindex 06h	Name	Reserve					Data structure	-	Data type	Uint16
	Data range	-	Factory setting	10	Accessibility	RO	Related models	-	Map	NO
Subindex 07h	Name	Reserve					Data structure	-	Data type	Uint16
	Data range	-	Factory setting	0	Accessibility	RO	Related models	-	Map	NO
Subindex 08h	Name	Reserve					Data structure	-	Data type	Uint16
	Data range	-	Factory setting	3000	Accessibility	RO	Related models	-	Map	NO
Subindex 09h	Name	Reserve					Data structure	-	Data type	Uint16
	Data range	-	Factory setting	3000	Accessibility	RO	Related models	-	Map	NO
Subindex 0Ah	Name	Torque reaches the reference value (unit: 0.1%)					Data structure	-	Data type	Uint16
	Data range	0～3000	Factory setting	0	Accessibility	RO	Related models	PT/CST	Map	NO
Subindex 0Bh	Name	Torque reaches the effective value (unit: 0.1%)					Data structure	-	Data type	Uint16
	Data range	0～3000	Factory setting	0	Accessibility	RW	Related models	PT/CST	Map	NO
Subindex	Name	Torque reaches the invalid value (unit: 0.1%)					Data structure	-	Data type	Uint16

0Ch	Data range	0～3000	Factory setting	0	Accessibility	RW	Related models	PT/CST	Map	NO

Subindex 0Dh	Name	Reserve					Data structure	-	Data type	Uint16
	Data range	-	Factory setting	50	Accessibility	RW	Related models	-	Map	NO

7.3.10 Gain parameters

Index 2009h	Name	Gain parameters					Data structure	ARR	Data type	Uint16
	Data range	OD Data range	Factory setting	OD default value	Accessibility	-	Related models	-	Map	YES

Subindex 00h	Name	Maximum subindex number					Data structure	-	Data type	Uint8
	Data range	-	Factory setting	22	Accessibility	RO	Related models	-	Map	NO

Subindex 01h	Name	1st speed proportional gain					Data structure	-	Data type	Uint16
	Data range	0～65535	Factory setting	5000	Accessibility	RW	Related models	-	Map	YES

Subindex 02h	Name	1st velocity integration time constant					Data structure	-	Data type	Uint16
	Data range	0～65535	Factory setting	2000	Accessibility	RW	Related models	-	Map	YES

Subindex 03h	Name	1st position proportional gain					Data structure	-	Data type	Uint16
	Data range	0～65535	Factory setting	600	Accessibility	RW	Related models	-	Map	YES

Subindex 04h	Name	2nd speed proportional gain					Data structure	-	Data type	Uint16
	Data range	0～65535	Factory setting	9000	Accessibility	RW	Related models	-	Map	YES

Subindex 05h	Name	2nd velocity integration time constant					Data structure	-	Data type	Uint16
	Data range	0～65535	Factory setting	3500	Accessibility	RW	Related models	-	Map	YES

Subindex 06h	Name	2nd position proportional gain					Data structure	-	Data type	Uint16
	Data range	0～65535	Factory setting	800	Accessibility	RW	Related models	-	Map	YES

Subindex 07h	Name	Speed Kd					Data structure	-	Data type	Uint16
	Data range	0～65535	Factory setting	0	Accessibility	RW	Related models	-	Map	YES

Subindex 08h	Name	Speed Kr					Data structure	-	Data type	Uint16
	Data range	0～65535	Factory setting	1000	Accessibility	RW	Related models	-	Map	YES

Subindex 09h	Name	Speed Km					Data structure	-	Data type	Uint16
	Data range	0～65535	Factory setting	0	Accessibility	RW	Related models	-	Map	YES

Subindex 0Ah	Name	Load inertia ratio (unit: %)					Data structure	-	Data type	Uint16
	Data range	0～65535	Factory setting	100	Accessibility	RW	Related models	-	Map	YES

Subindex 0Bh	Name	Speed feedforward filtering time constant					Data structure	-	Data type	Uint16
	Data range	0～65535	Factory setting	2000	Accessibility	RW	Related models	-	Map	YES

Subindex 0Ch	Name	Speed feedforward gain					Data structure	-	Data type	Uint16
	Data range	0～65535	Factory setting	0	Accessibility	RW	Related models	-	Map	YES

Subindex 0Dh	Name	Torque feedforward filtering time constant					Data structure	-	Data type	Uint16
	Data range	0～65535	Factory setting	2000	Accessibility	RW	Related models	-	Map	YES

Subindex 0Eh	Name	Torque feedforward gain					Data structure	-	Data type	Uint16
	Data range	0～65535	Factory setting	0	Accessibility	RW	Related models	-	Map	YES

Subindex 0Fh	Name	Speed feedback filtering time constant					Data structure	-	Data type	Uint16
	Data range	0～65535	Factory setting	1000	Accessibility	RW	Related models	-	Map	YES

Subindex 10h	Name	Speed feedback low-pass filter cut-off frequency 1					Data structure	-	Data type	Uint16
	Data range	0～65535	Factory setting	1000	Accessibility	RW	Related models	-	Map	YES

Subindex 11h	Name	Speed feedback low-pass filter cut-off frequency 2					Data structure	-	Data type	Uint16
	Data range	0～65535	Factory setting	2000	Accessibility	RW	Related models	-	Map	YES

Subindex 12h	Name	Reserve					Data structure	-	Data type	Uint16
	Data range	-	Factory setting	-	Accessibility	RO	Related models	-	Map	NO

Subindex 13h	Name	Torque given filtering time constant					Data structure	-	Data type	Uint16
	Data range	0～65535	Factory setting	3000	Accessibility	RW	Related models	-	Map	YES

Subindex 14h	Name	Torque feedback filtering time constant					Data structure	-	Data type	Uint16
	Data range	0～65535	Factory setting	3000	Accessibility	RW	Related models	-	Map	YES

Subindex 15h	Name	Current loop proportional gain					Data structure	-	Data type	Uint16
	Data range	0～65535	Factory setting	800	Accessibility	RW	Related models	-	Map	YES

Subindex 16h	Name	Current loop integration time constant					Data structure	-	Data type	Uint16
	Data range	0～65535	Factory setting	1500	Accessibility	RW	Related models	-	Map	YES

7.3.11 Self-tuning parameters

Index 200Ah	Name	Self-tuning parameters					Data structure	ARR	Data type	Uint16
	Data range	OD Data range	Factory setting	OD default value	Accessibility	-	Related models	-	Map	YES

Subindex 00h	Name	Maximum subindex number					Data structure	-	Data type	Uint8
	Data range	-	Factory setting	10	Accessibility	RO	Related models	-	Map	NO

Subindex 01h	Name	Adaptive notch filter mode selection					Data structure	-	Data type	Uint16
	Data range	0～65535	Factory setting	5000	Accessibility	RW	Related models	-	Map	YES

Subindex 02h	Name	The first group of notch filter frequency					Data structure	-	Data type	Uint16
	Data range	0～65535	Factory setting	1024	Accessibility	RW	Related models	-	Map	YES

Subindex 03h	Name	The first group of notch filter width level					Data structure	-	Data type	Uint16
	Data range	0～65535	Factory setting	128	Accessibility	RW	Related models	-	Map	YES

Subindex 04h	Name	The first group of notch filter depth level					Data structure	-	Data type	Uint16
	Data range	0～65535	Factory setting	5000	Accessibility	RW	Related models	-	Map	YES

Subindex 05h	Name	The second group of notch filter frequency					Data structure	-	Data type	Uint16
	Data range	0～65535	Factory setting	1024	Accessibility	RW	Related models	-	Map	YES

Subindex 06h	Name	The second group of notch filter width level					Data structure	-	Data type	Uint16
	Data range	0～65535	Factory setting	128	Accessibility	RW	Related models	-	Map	YES

Subindex 07h	Name	The second group of notch filter depth level					Data structure	-	Data type	Uint16
	Data range	0～65535	Factory setting	5000	Accessibility	RW	Related models	-	Map	YES

Subindex 08h	Name	The third group of notch filter frequency					Data structure	-	Data type	Uint16
	Data range	0～65535	Factory setting	1024	Accessibility	RW	Related models	-	Map	YES

Subindex 09h	Name	The third group of notch filter width level					Data structure	-	Data type	Uint16
	Data range	0～65535	Factory setting	128	Accessibility	RW	Related models	-	Map	YES

Subindex 0Ah	Name	The third group of notch filter depth level					Data structure	-	Data type	Uint16
	Data range	0～65535	Factory setting	5000	Accessibility	RW	Related models	-	Map	YES

Subindex 0Bh	Name	The fourth group of notch filter frequency					Data structure	-	Data type	Uint16
	Data range	0～65535	Factory setting	1024	Accessibility	RW	Related models	-	Map	YES

Subindex 0Ch	Name	The fourth group of notch filter width level					Data structure	-	Data type	Uint16
	Data range	0～65535	Factory setting	128	Accessibility	RW	Related models	-	Map	YES

Subindex 0Dh	Name	The fourth group of notch filter width level					Data structure	-	Data type	Uint16
	Data range	0～65535	Factory setting	5000	Accessibility	RW	Related models	-	Map	YES

Subindex 0Eh	Name	Resonance frequency identification result					Data structure	-	Data type	Uint16
	Data range	0～65535	Factory setting	1024	Accessibility	RW	Related models	-	Map	YES

Subindex 0Fh	Name	Torque disturbance compensation gain					Data structure	-	Data type	Uint16
	Data range	0～65535	Factory setting	128	Accessibility	RW	Related models	-	Map	YES

Subindex 10h	Name	Torque disturbance observer filter time constant					Data structure	-	Data type	Uint16
	Data range	0～65535	Factory setting	128	Accessibility	RW	Related models	-	Map	YES

Subind	Name	Low frequency resonance frequency	Data structure	-	Data type	Uint16

ex 11h	Data range	0～65535	Factory setting	100	Accessibility	RW	Related models	-	Map	YES

Subindex 12h	Name	Low frequency resonance frequency filter setting					Data structure	-	Data type	Uint16
	Data range	0～65535	Factory setting	1000	Accessibility	RW	Related models	-	Map	YES

7.3.12 Fault parameters

Index 200Bh	Name	Fault parameters					Data structure	ARR	Data type	Uint16
	Data range	OD Data range	Factory setting	OD default value	Accessibility	-	Related models	-	Map	YES

Subindex 00h	Name	Maximum subindex number					Data structure	-	Data type	Uint8
	Data range	-	Factory setting	11	Accessibility	RO	Related models	-	Map	NO

Subindex 01h	Name	Historical fault record 0					Data structure	-	Data type	Uint16
	Data range	-	Factory setting	-	Accessibility	RO	Related models	-	Map	NO

Subindex 02h	Name	Historical fault record 1					Data structure	-	Data type	Uint16
	Data range	-	Factory setting	-	Accessibility	RO	Related models	-	Map	NO

Subindex 03h	Name	Historical fault record 2					Data structure	-	Data type	Uint16
	Data range	-	Factory setting	-	Accessibility	RO	Related models	-	Map	NO

Subindex 04h	Name	Historical fault record 3					Data structure	-	Data type	Uint16
	Data range	-	Factory setting	-	Accessibility	RO	Related models	-	Map	NO

Subindex 05h	Name	Historical fault record 4					Data structure	-	Data type	Uint16
	Data range	-	Factory setting	-	Accessibility	RO	Related models	-	Map	NO

Subindex 06h	Name	Historical fault record 5					Data structure	-	Data type	Uint16
	Data range	-	Factory setting	-	Accessibility	RO	Related models	-	Map	NO

Subindex 07h	Name	Historical fault record 6					Data structure	-	Data type	Uint16
	Data range	-	Factory setting	-	Accessibility	RO	Related models	-	Map	NO

Subindex 08h	Name	Historical fault record 7					Data structure	-	Data type	Uint16
	Data range	-	Factory setting	-	Accessibility	RO	Related models	-	Map	NO

Subindex 09h	Name	Historical fault record 8					Data structure	-	Data type	Uint16
	Data range	-	Factory setting	-	Accessibility	RO	Related models	-	Map	NO

Subindex 0Ah	Name	Historical fault record 9					Data structure	-	Data type	Uint16
	Data range	-	Factory setting	-	Accessibility	RO	Related models	-	Map	NO

Subind	Name	Clear historical fault records	Data structure	-	Data type	Uint16

ex 0Ah	Data range	0～1	Factory setting	0	Accessibility	RW	Related models	-	Map	NO

7.4 Detailed description of sub-protocol definition parameters (group 6000h)

Index 603Fh	Name	Error code					Data structure	VAR	Data type	Uint16
	Data range	0x0000～0xFFFF	Factory setting	-	Accessibility	RO	Related models	ALL	Map	TPDO
When the drive has an error described in the DS402 sub-protocol, 603Fh is consistent with the DS402 protocol. The value of 603Fh is hexadecimal data										

Index 6040h	Name	Control word					Data structure	VAR	Data type	Uint16
	Data range	0x0000～0xFFFF	Factory setting	0	Accessibility	RW	Related models	ALL	Map	RPDO

Set control commands:

Bit	Name		Description
0	可以开启伺服运行	Switch on	0: invalid, 1: valid
1	接通主回路电	Enable voltage	0: invalid, 1: valid
2	快速停机	Quick stop	0: invalid, 1: valid
3	伺服运行	Enable operation	0: invalid, 1: valid
4～6	运行模式相关	Operation mode specific	Related to servo operation mode
7	故障复位	Fault reset	For resettable faults and warnings, perform fault reset function The rising edge of Bit7 is valid; Bit7 remains at 1, other control commands are invalid
8	暂停	Halt	Please check the object dictionary 605Dh for the pause mode in each mode
9	运行模式相关	Operation mode specific	Related to each servo operation mode
10	保留	Reverse	Undefined
11～15	厂家自定义	Manufacturer-specific	Manufacturer customization

◆ Note:
1)、It is meaningless to assign a value to each Bit of the control word separately, and it must form a control command without co-constructing with others;
2)、Bit0～Bit3 and Bit7 have the same meaning in each servo mode. Commands must be sent in order to guide the servo drive into the expected state according to the CiA402 state machine switching process. Each command corresponds to a certain state;
3)、Bit4～Bit6 are related to each servo mode, please check the control commands in different modes;
4)、Bit9 has no defined function.

index 6041h	name (of a thing)	status word					data structure	VAR	data type	Uint16
	Data range	0x0000~0xFFFF	Factory Settings	0	accessibility	RO	Related models	ALL	Is it possible to map	TPDO

eflect the current running status of the servo drive:

Bit	Name		Description
0	伺服准备好	Ready to switch on	0: invalid, 1: valid
1	可以开启伺服运行	Switch on	0: invalid, 1: valid
2	伺服运行	Operation enabled	0: invalid, 1: valid
3	故障	Fault	0: invalid, 1: valid
4	主电路电接通	Voltage enabled	0: invalid, 1: valid
5	快速停机	Quick stop	0: invalid, 1: valid
6	伺服不可运行	Switch on disabled	0: invalid, 1: valid
7	警告	Waming	0: invalid, 1: valid
8	厂家自定义	Manufacturer specific	Undefined functions
9	远程控制	Remote	0: invalid, 1: valid (control word valid)
10	目标到达	Target reach	0: invalid, 1: valid
11	内部限制有效	Internal limit active	0: invalid, 1: valid
12～13	运行模式相关	Operation limit active	Related to each servo operation mode
14	厂家自定义	Manufacturer specific	Undefined functions
15	原点已找到	Home find	0: invalid, 1: valid

display 值(二进制数值)	Description
xxxx xxxx x0xx 0000	未准备好(Not ready to switch on)
xxxx xxxx x1xx 0000	启动失效(Switch on disabled)
xxxx xxxx x01x 0001	准备好(Ready to switch on)
xxxx xxxx x01x 0011	启动(Switch on)
xxxx xxxx x01x 0111	操作使能(Operation enabled)
xxxx xxxx x00x 0111	快速停机有效(Quick stop active)
xxxx xxxx x0xx 1111	故障反应有效(Fault reaction active)
xxxx xxxx x0xx 1000	故障(Fault)

◆ Note:
1)、Bit0～Bit9 have the same meaning in each servo mode. After the control word 6040h sends commands in order, the servo will feedback a certain state.
2)、Bit12～Bit13 are related to each servo mode (please check the control commands in different modes)
3)、Bit10, Bit11, and Bit15 have the same meaning in each servo mode, and feedback the status of the servo after executing a certain servo mode.

Index 605Ah	Name	Quick stop mode selection					Data structure	VAR	Data type	Int16
	Data range	0～6	Factory setting	2	Accessibility	RW	Related models	ALL	Map	NO

Index 605Bh	Name	Shutdown method selection					Data structure	VAR	Data type	Int16
	Data range	0～6	Factory setting	0	Accessibility	RW	Related models	ALL	Map	NO

Index 605Ch	Name	Enable failure mode selection					Data structure	VAR	Data type	Int16
	Data range	0～6	Factory setting	1	Accessibility	RW	Related models	ALL	Map	NO

Index 605Eh	Name	Failure mode selection					Data structure	VAR	Data type	Int16
	Data range	0～6	Factory setting	1	Accessibility	RW	Related models	ALL	Map	NO

Index 6060h	Name	Mode selection					Data structure	VAR	Data type	Int8
	Data range	0～10	Factory setting	8	Accessibility	RW	Related models	ALL	Map	RPDO

Select the servo operation mode:

Set value	Servo mode	
0/2/5	NA	Reserve
1	轮廓位置模式(PP)	
3	轮廓速度模式(PV)	
4	轮廓转矩模式(PT)	
6	回零模式(HM)	
7	插补模式(IP)	
8	周期同步位置模式(CSP)	
9	周期同步速度模式(CSV)	
10	周期同步转矩模式(CST)	

Index 6061h	Name	Operation mode display					Data structure	VAR	Data type	Int8
	Data range	0～10	Factory setting	-	Accessibility	RO	Related models	ALL	Map	TPDO

Display the current operating mode of the servo drive:

Set value	Servo mode	
0/2/5	NA	Reserve
1	轮廓位置模式(PP)	
3	轮廓速度模式(PV)	
4	轮廓转矩模式(PT)	
6	回零模式(HM)	
7	插补模式(IP)	
8	周期同步位置模式(CSP)	
9	周期同步速度模式(CSV)	
10	周期同步转矩模式(CST)	

Index 6062h	Name	Position command (unit: command unit)					Data structure	VAR	Data type	Int32
	Data range	-	Factory setting	-	Accessibility	RW	Related models	PP/HM/CSP	Map	TPDO

Reflect the input position command (command unit) when the servo is enabled

Index 6063h	Name	Position feedback (unit: encoder unit)					Data structure	VAR	Data type	Int32
	Data range	-	Factory setting	-	Accessibility	RO	Related models	ALL	Map	TPDO

Index 6064h	Name	Position feedback (unit: command unit)					Data structure	VAR	Data type	Int32
	Data range	-	Factory setting	-	Accessibility	RO	Related models	ALL	Map	TPDO

Reflect real-time user absolute position feedback: position feedback 6064h x gear ratio 6091h = position feedback 6063h

Index 6065h	Name	Threshold for excessive position deviation (unit: command unit)					Data structure	VAR	Data type	Uint32
	Data range	0～(2^{32}-1)	Factory setting	Determined by model	Accessibility	RW	Related models	PP/HM/CSP	Map	RPDO

Set the threshold for excessive position deviation, when the absolute value of the position deviation (command unit) exceeds 6065h, AL.240 (excessive position deviation fault) will occur.
Note: When the set value of 6065h is 0xFFFFFFFF, the servo will not monitor the excessive position deviation, please use this function with caution.
Note: The saving of this parameter needs to write 1 to P12.20 through the USB serial port or the host computer debugging software to save it when the motor is not enabled.

Index 6067h	Name	Position reaches threshold					Data structure	VAR	Data type	Uint32
	Data range	0～(2^{32}-1)	Factory setting	92	Accessibility	RW	Related models	PP/HM/CSP	Map	RPDO

When setting the threshold of position reaching, the unit of 6067h can be set through 2006-07h, and the default is the command unit.
When the absolute value of the position deviation is within 6067h and the duration reaches 6068h, the position arrival is considered valid. In PP/HM/CSP mode, Bit10 of the status word 6041=1
In PP/HM/CSP mode, when the servo is enabled, this flag is meaningful, otherwise it is meaningless

Index 6068h	Name	Position arrival time window (unit: ms)	Data structure	VAR	Data type	Uint16

	Data range	0～(2^{16}-1)	Factory setting	10	Accessibility	RW	Related models	PP/HM/CSP	Map	RPDO
Set the time window for judging the position to arrive valid The absolute value of the difference between the user position command 6062h and the user actual position feedback 6064h or the internal position command 60FCh and the position feedback 6063h is within 6067h, and the time reaches 6068h, the position is considered to be reached, the status word 6041h Bit10=1, servo enable is invalid, this flag is meaningless										

Index 606Ch	Name	Speed feedback (unit: command unit/s)					Data structure	VAR	Data type	Int32
	Data range	-	Factory setting	-	Accessibility	RO	Related models	ALL	Map	TPDO

Index 606Dh	Name	Speed reaches threshold (unit: rpm)					Data structure	VAR	Data type	Uint16
	Data range	0～(2^{16}-1)	Factory setting	10	Accessibility	RW	Related models	PV/CSV	Map	RPDO
Set the threshold for reaching the speed. When the absolute value of the difference between the target speed 60FFh (when converted into motor speed in rpm unit)and the actual motor speed is within 606Dh, and the time reaches 606Eh, the speed is considered to be reached, the Bit10 of the status word 6041 is 1, and the speed reaches the OUT function signal output is valid										

Index 606Eh	Name	Speed arrival time window (unit: ms)					Data structure	VAR	Data type	Uint16
	Data range	0～(2^{16}-1)	Factory setting	10	Accessibility	RW	Related models	PV/CSV	Map	RPDO

Index 6071h	Name	Target torque (unit: 0.1%)					Data structure	VAR	Data type	Int16
	Data range	-3000～3000	Factory setting	0	Accessibility	RW	Related models	PT/CST	Map	RPDO
Set the servo target torque in contour torque mode (PT) and periodic synchronous torque mode (CST). 100.0% corresponds to 1 times the rated torque of the motor.										

Index 6072h	Name	Maximum torque (unit: 0.1%)					Data structure	VAR	Data type	Uint16
	Data range	0～3000	Factory setting	3000	Accessibility	RW	Related models	ALL	Map	RPDO
Set the maximum torque allowable value of the servo. 100.0% corresponds to 1 times the rated torque of the motor.										

Index 6074h	Name	Target torque (unit: 0.1%)					Data structure	VAR	Data type	Int16
	Data range	-	Factory setting	-	Accessibility	RO	Related models	ALL	Map	TPDO
Display the current value of the servo internal torque command in the servo running state. 100.0% corresponds to 1 times the rated torque of the motor.										

Index 6077h	Name	Torque feedback (unit: 0.1%)					Data structure	VAR	Data type	Int16
	Data range	-	Factory setting	-	Accessibility	RO	Related models	ALL	Map	TPDO
Display the internal torque feedback of the servo. 100.0% corresponds to 1 times the rated torque of the motor.										

Index 607Ah	Name	Target position (unit: command unit)					Data structure	VAR	Data type	Int32
	Data range	-2^{31}～(2^{31}-1)	Factory setting	0	Accessibility	RW	Related models	PP/CSP	Map	RPDO
Set the servo target position in profile position mode (PP) and cycle synchronous position mode (CSP).										

Index 607Ch	Name	Origin offset					Data structure	VAR	Data type	Int32
	Data range	-2^{31}～(2^{31}-1)	Factory setting	0	Accessibility	RW	Related models	HM	Map	RPDO
Set the physical position where the mechanical zero point deviates from the motor origin under zero return. Origin offset valid condition: this time power-on operation, the origin return operation has been completed, Bit15 of status word 6041h = 1										

Index 607Dh	Name	Software absolute position limit					Data structure	ARR	Data type	-
	Data range	OD Data range	Factory setting	OD default value	Accessibility	-	Related models	-	Map	YES
Set the minimum and maximum values of the absolute position limit of the software Minimum software absolute position limit = 607D-01h Maximum software absolute position limit = 607D-02h										
Subindex 00h	Name	Maximum Subindex number restricted by software absolute position					Data structure	VAR	Data type	Uint8
	Data range	-	Factory setting	2	Accessibility	RO	Related models	-	Map	NO

Subindex 01h	Name	Minimum software absolute position limit (unit: command unit)					Data structure	VAR	Data type	Int32
	Data range	-2^{31}～(2^{31}-1)	Factory setting	0	Accessibility	RW	Related models	ALL	Map	RPDO
Set the minimum software absolute position limit, which refers to the absolute position relative to the mechanical zero point.										
Subindex 02h	Name	Maximum software absolute position limit (unit: command unit)					Data structure	VAR	Data type	Int32
	Data range	-2^{31}～(2^{31}-1)	Factory setting	0	Accessibility	RW	Related models	ALL	Map	RPDO
Set the maximum software absolute position limit, which refers to the position relative to the mechanical zero point.										

Index 607Fh	Name	Maximum profile speed (unit: command unit/s)					Data structure	VAR	Data type	Uint32
	Data range	0～(2^{31}-1)	Factory setting	10000	Accessibility	RW	Related models	ALL	Map	RPDO

Index 6081h	Name	Profile speed (unit: command unit/s)					Data structure	VAR	Data type	Uint32
	Data range	0～(2^{31}-1)	Factory setting	10000	Accessibility	RW	Related models	PP	Map	RPDO
Set the uniform running speed of the displacement command in the profile position mode.										

Index 6083h	Name	Profile acceleration (unit: command unit/s2)					Data structure	VAR	Data type	Uint32
	Data range	0～(2^{31}-1)	Factory setting	100000	Accessibility	RW	Related models	PP/PV	Map	RPDO
Set the acceleration in profile position mode and profile velocity mode.										

Index 6084h	Name	Profile deceleration (unit: command unit/s2)					Data structure	VAR	Data type	Uint32
	Data range	0～(2^{31}-1)	Factory setting	100000	Accessibility	RW	Related models	PP/PV/CSP/CSV	Map	RPDO
Set the deceleration in profile position mode and profile speed mode.										

Index 6085h	Name	Quick stop deceleration (unit: command unit/s2)					Data structure	VAR	Data type	Uint32
	Data range	0～(2^{31}-1)	Factory setting	500000	Accessibility	RW	Related models	PP/PV/CSP/CSV/HM	Map	RPDO

Index 6087h	Name	Torque ramp (unit: 0.1%/s)					Data structure	VAR	Data type	Uint32
	Data range	0～(2^{31}-1)	Factory setting	3000	Accessibility	RW	Related models	PT/CST	Map	RPDO
Set the torque command acceleration in contour torque mode, and its meaning is: torque command increment per second.										

Index 6091h	Name	Gear ratio					Data structure	ARR	Data type	-
	Data range	OD Data range	Factory setting	OD default value	Accessibility	-	Related models	PP/PV/CSP/CSV/HM	Map	YES

The gear ratio is used to establish the proportional relationship between the displacement of the load shaft specified by the user and the displacement of the motor shaft.

1)、The relationship between motor feedback position (encoder unit) and load shaft position feedback (command unit):

$$\text{motor feedback position} = \text{load shaft position feedback} \times \text{gear ratio}$$

2)、The relationship between motor speed (rpm) and load shaft speed (command unit/s):

$$\text{motor speed (rpm)} = \frac{\text{load shaft speed} \times \text{gear ratio}}{\text{encoder resolution}} \times 60$$

3)、The relationship between motor acceleration (rpm/ms) and load shaft acceleration (command unit/s2):

$$\text{motor acceleration} = \frac{\text{load shaft accelerarion} \times \text{gear ratio}}{\text{encoder resolution}} \times \frac{1000}{60}$$

Subindex 00h	Name	Maximum subindex number of the gear ratio					Data structure	-	Data type	Uint8
	Data range	-	Factory setting	2	Accessibility	RO	Related models	-	Map	NO
Subindex 01h	Name	Gear ratio numerator					Data structure	VAR	Data type	Uint32
	Data range	1～(2^{31}-1)	Factory setting	1	Accessibility	RW	Related models	-	Map	RPDO
Subindex	Name	Gear ratio denominator					Data structure	VAR	Data type	Uint32

02h	Data range	1～(2^{31}-1)	Factory setting	1	Accessibility	RW	Related models	-	Map	RPDO

Index 6098h	Name	Method of homing					Data structure	VAR	Data type	Int8
	Data range	0～35	Factory setting	17	Accessibility	RW	Related models	HM	Map	RPDO

Select the method of homing:

Set value	Description
17	Return to zero in the reverse direction, the deceleration point is the reverse limit switch, and the origin is the reverse limit switch
18	Return to zero in the positive direction, the deceleration point is the positive limit switch, the origin is the positive limit switch
19	Return to zero in the positive direction, the deceleration point is the origin switch, and the origin is the origin switch
20	Return to zero in the positive direction, the deceleration point is the origin switch, and the origin is the origin switch
21	Return to zero in the reverse direction, the deceleration point is the origin switch, and the origin is the origin switch
22	Return to zero in the reverse direction, the deceleration point is the origin switch, and the origin is the origin switch
23	Return to zero in the positive direction, the deceleration point is the origin switch, and the origin is the origin switch
24	Return to zero in the positive direction, the deceleration point is the origin switch, and the origin is the origin switch
25	Return to zero in the positive direction, the deceleration point is the origin switch, and the origin is the origin switch
26	Return to zero in the positive direction, the deceleration point is the origin switch, and the origin is the origin switch
27	Return to zero in the reverse direction, the deceleration point is the origin switch, and the origin is the origin switch
28	Return to zero in the reverse direction, the deceleration point is the origin switch, and the origin is the origin switch
29	Return to zero in the reverse direction, the deceleration point is the origin switch, and the origin is the origin switch
30	Return to zero in the reverse direction, the deceleration point is the origin switch, and the origin is the origin switch
35	Take the current position as the origin

Index 6099h	Name	Speed of homing					Data structure	ARR	Data type	-
	Data range	OD Data range	Factory setting	OD default value	Accessibility	-	Related models	HM	Map	YES
Subindex 00h	Name	Maximum subindex number for speed of homing					Data structure	-	Data type	Uint8
	Data range	-	Factory setting	2	Accessibility	RO	Related models	-	Map	NO
Subindex 01h	Name	Search deceleration point signal speed (unit: command unit/s)					Data structure	VAR	Data type	Uint32
	Data range	0～(2^{31}-1)	Factory setting	10000	Accessibility	RW	Related models	HM	Map	RPDO
Subindex 02h	Name	Search origin signal speed (unit: command unit/s)					Data structure	VAR	Data type	Uint32
	Data range	0～(2^{31}-1)	Factory setting	2000	Accessibility	RW	Related models	HM	Map	RPDO

Index 609Ah	Name	Home acceleration (unit: command unit/s2)					Data structure	VAR	Data type	Uint32
	Data range	0～(2^{31}-1)	Factory setting	100000	Accessibility	RW	Related models	HM	Map	RPDO

Index 60B0h	Name	Position offset (unit: command unit)					Data structure	VAR	Data type	Int32
	Data range	-2^{31}～(2^{31}-1)	Factory setting	0	Accessibility	RW	Related models	CSP	Map	RPDO

Set the servo position command offset in the cyclic synchronous position mode. After the offset: Servo target position = 607Ah + 60B0h

Index 60B1h	Name	Speed offset (unit: command unit)					Data structure	VAR	Data type	Int32
	Data	-2^{31}～(2^{31}-1)	Factory	0	Accessib	RW	Related	CSP/CSV	Map	RPDO

	range		setting		ility		models			
Set the servo speed command offset in the periodic synchronous speed mode. After the offset: Servo target speed = 60FFh + 60B1h										

Index 60B2h	Name	Torque offset (unit: 0.1%)					Data structure	VAR	Data type	Int16
	Data range	-3000～3000	Factory setting	0	Accessib ility	RW	Related models	CSP/CSV/ CST	Map	RPDO
Set the servo torque command offset in the cyclic synchronous torque mode. After the offset: Servo target torque = 6071h + 60B2h										

Index 60B8h	Name	Probe function					Data structure	VAR	Data type	Uint16
	Data range	0～(2^{16}-1)	Factory setting	0	Accessib ility	RW	Related models	-	Map	RPDO

Setting the function of probe 1 and probe 2

Bit	Description	Setting
0	Probe 1 enable	0: Probe 1 is not enabled 1: Probe 1 enabled
1	Probe 1 trigger mode	0: Single trigger, trigger only when the trigger signal is valid for the first time 1: Continuous trigger
2	Probe 1 trigger signal selection	0: IN input signal 1: Meaningless
3	NA	Meaningless
4	Probe 1 rising edge enable	0: The rising edge is not latched 1: Rising edge latch
5	Probe 1 falling edge enable	0: The falling edge is not latched 1: Falling edge latch
6	NA	Meaningless
7	NA	Meaningless
8	Probe 2 enable	0: Probe 2 is not enabled 1: Probe 2 enabled
9	Probe 2 trigger mode	0: Single trigger, trigger only when the trigger signal is valid for the first time 1: Continuous trigger
10	Probe 2 trigger signal selection	0: IN input signal 1: Meaningless
11	NA	Meaningless
12	Probe 2 rising edge enable	0: The rising edge is not latched 1: Rising edge latch
13	Probe 2 falling edge enable	0: The falling edge is not latched 1: Falling edge latch
14	NA	Meaningless
15	NA	Meaningless

Index 60B9h	Name	Probe status					Data structure	VAR	Data type	Uint16
	Data range	-	Factory setting	-	Accessib ility	RO	Related models	-	Map	TPDO

Read the status of probe 1 and probe 2

Bit	Description	Remarks
0	Probe 1 enable	0: Probe 1 is not enabled 1: Probe 1 enabled
1	Probe 1 rising edge latch execution	0: The rising edge latch is not executed 1: The rising edge latch has been executed
2	Probe 1 falling edge latch execution	0: The falling edge latch is not executed 1: The falling edge latch has been executed
3～6	NA	Meaningless
7	Probe 1 trigger signal monitoring	0: IN is low level 1: IN is high level
8	Probe 2 enable	0: Probe 2 is not enabled 1: Probe 2 enabled
9	Probe 2 rising edge latch execution	0: The rising edge latch is not executed 1: The rising edge latch has been executed
10	Probe 2 falling edge latch execution	0: The falling edge latch is not executed 1: The falling edge latch has been executed
11～14	NA	Meaningless
15	0: IN is low level 1: IN is high level	Meaningless

Index	Name	Probe 1 rising edge position feedback (unit: command unit)	Data	VAR	Data type	Int32

60BAh						structure			
	Data range	-	Factory setting	-	Accessibility	RO	Related models	-	Map	TPDO

Index 60BBh	Name	Probe 1 falling edge position feedback (unit: command unit)					Data structure	VAR	Data type	Int32
	Data range	-	Factory setting	-	Accessibility	RO	Related models	-	Map	TPDO

Index 60BCh	Name	Probe 2 rising edge position feedback (unit: command unit)					Data structure	VAR	Data type	Int32
	Data range	-	Factory setting	-	Accessibility	RO	Related models	-	Map	TPDO

Index 60BDh	Name	Probe 2 falling edge position feedback (unit: command unit)					Data structure	VAR	Data type	Int32
	Data range	-	Factory setting	-	Accessibility	RO	Related models	-	Map	TPDO

Index 60D5h	Name	Probe 1 rising edge count					Data structure	VAR	Data type	Uint16
	Data range	-	Factory setting	-	Accessibility	RO	Related models	-	Map	TPDO

Index 60D6h	Name	Probe 1 falling edge count					Data structure	VAR	Data type	Uint16
	Data range	-	Factory setting	-	Accessibility	RO	Related models	-	Map	TPDO

Index 60D7h	Name	Probe 2 rising edge count					Data structure	VAR	Data type	Uint16
	Data range	-	Factory setting	-	Accessibility	RO	Related models	-	Map	TPDO

Index 60D8h	Name	Probe 2 falling edge count					Data structure	VAR	Data type	Uint16
	Data range	-	Factory setting	-	Accessibility	RO	Related models	-	Map	TPDO

Index 60E0h	Name	Maximum forward torque limit (unit: 0.1%)					Data structure	VAR	Data type	Uint16
	Data range	0～3000	Factory setting	3000	Accessibility	RW	Related models	ALL	Map	RPDO

Index 60E1h	Name	Maximum negative torque limit (unit: 0.1%)					Data structure	VAR	Data type	Uint16
	Data range	0～3000	Factory setting	3000	Accessibility	RW	Related models	ALL	Map	RPDO

Index 60F4h	Name	Position deviation (unit: command unit)					Data structure	VAR	Data type	Int32
	Data range	-	Factory setting	-	Accessibility	RO	Related models	PP/HM/CSP	Map	TPDO

Index 60FCh	Name	Position command (unit: encoder unit)					Data structure	VAR	Data type	Int32
	Data range	-	Factory setting	-	Accessibility	RO	Related models	PP/HM/CSP	Map	TPDO

Index 60FDh	Name	Digital input					Data structure	VAR	Data type	Uint32
	Data range	-	Factory setting	-	Accessibility	RO	Related models	-	Map	TPDO

Reflect the current IN terminal logic of the drive: 0-logic invalid, 1-logic valid

Bit	Description
0	Positive limit switch
1	Reverse limit switch
2	Origin switch
3～15	NA
16	IN1
17	IN2
18	IN3
19	IN4
20	IN5
21	IN6
22	IN7
23	IN8
24	IN9
25～31	NA

Index 60FEh	Name	Digital output					Data structure	ARR	Data type	-
	Data range	OD Data range	Factory setting	OD default value	Accessibility	-	Related models	-	Map	YES
Subindex 00h	Name	Maximum subindex number for digital output					Data structure	-	Data type	Uint8
	Data range	-	Factory setting	2	Accessibility	RO	Related models	-	Map	NO
Subindex 01h	Name	Physical output					Data structure	VAR	Data type	Uint32
	Data range	-	Factory setting	-	Accessibility	RO	Related models	-	Map	RPDO

Reflect the output logic of the OUT port of the drive

Bit	Related OUT ports	Description
0～15	NA	NA
16	OUT1	Forced output (0: OFF, 1: ON), only valid when Bit 16 of 60FE-02h is set to 1
17	OUT2	Forced output (0: OFF, 1: ON), only valid when Bit 17 of 60FE-02h is set to 1
18	OUT3	Forced output (0: OFF, 1: ON), only valid when Bit 18 of 60FE-02h is set to 1
19	OUT4	Forced output (0: OFF, 1: ON), only valid when Bit 19 of 60FE-02h is set to 1
20～31	NA	NA

Note:
The function setting value of the OUT port must be set to 31 (general output) to be controlled by 60FE-1h and 60FE-2h.

Subindex 02h	Name	Physical output enable					Data structure	VAR	Data type	Uint32
	Data range	-	Factory setting	-	Accessibility	RO	Related models	-	Map	RPDO

Set whether to enable OUT forced output:

Bit	Related OUT ports	Description
0～15	NA	NA
16	OUT1	0: Disable OUT1 forced output 1: Enables OUT1 forced output
17	OUT2	0: Disable OUT2 forced output 1: Enables OUT2 forced output
18	OUT3	0: Disable OUT3 forced output 1: Enables OUT3 forced output
19	OUT4	0: Disable OUT4 forced output 1: Enables OUT4 forced output
20～31	NA	NA

Index	Name	Target speed (unit: command unit/s)	Data	VAR	Data type	Int32

60FFh							structure			
	Data range	-2^{31}～(2^{31}-1)	Factory setting	0	Accessibility	RW	Related models	PV/CSV	Map	RPDO
Set the user speed command in contour speed mode and cycle synchronous speed mode.										

Index 60FFh	Name	Supports servo operation mode					Data structure	VAR	Data type	Uint32
	Data range	-	Factory setting	941	Accessibility	RO	Related models	-	Map	NO

Reflects the servo operation mode supported by the drive.

Bit	Description	Supported or not (0: not supported, 1: supported)
0	轮廓位置模式(PP)	1
1	变频调速模式(VL)	0
2	轮廓速度模式(PV)	1
3	轮廓转矩模式(PT)	1
4	NA	0
5	回零模式(HM)	1
6	插补模式(IP)	0
7	周期同步位置模式(CSP)	1
8	周期同步速度模式(CSV)	1
9	周期同步转矩模式(CST)	1
10～31	NA	0

Chapter 8 Application cases

8.1 Cooperate with Omron controller operation case

Testing environment:

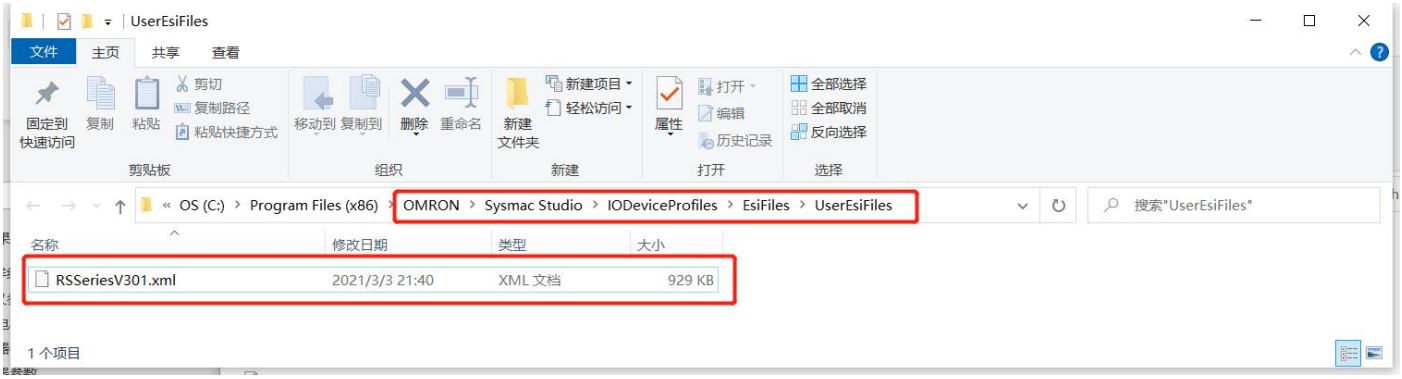
PC operating system: Windows 10

PLC development environment: Sysmac Studio Ver.1.23

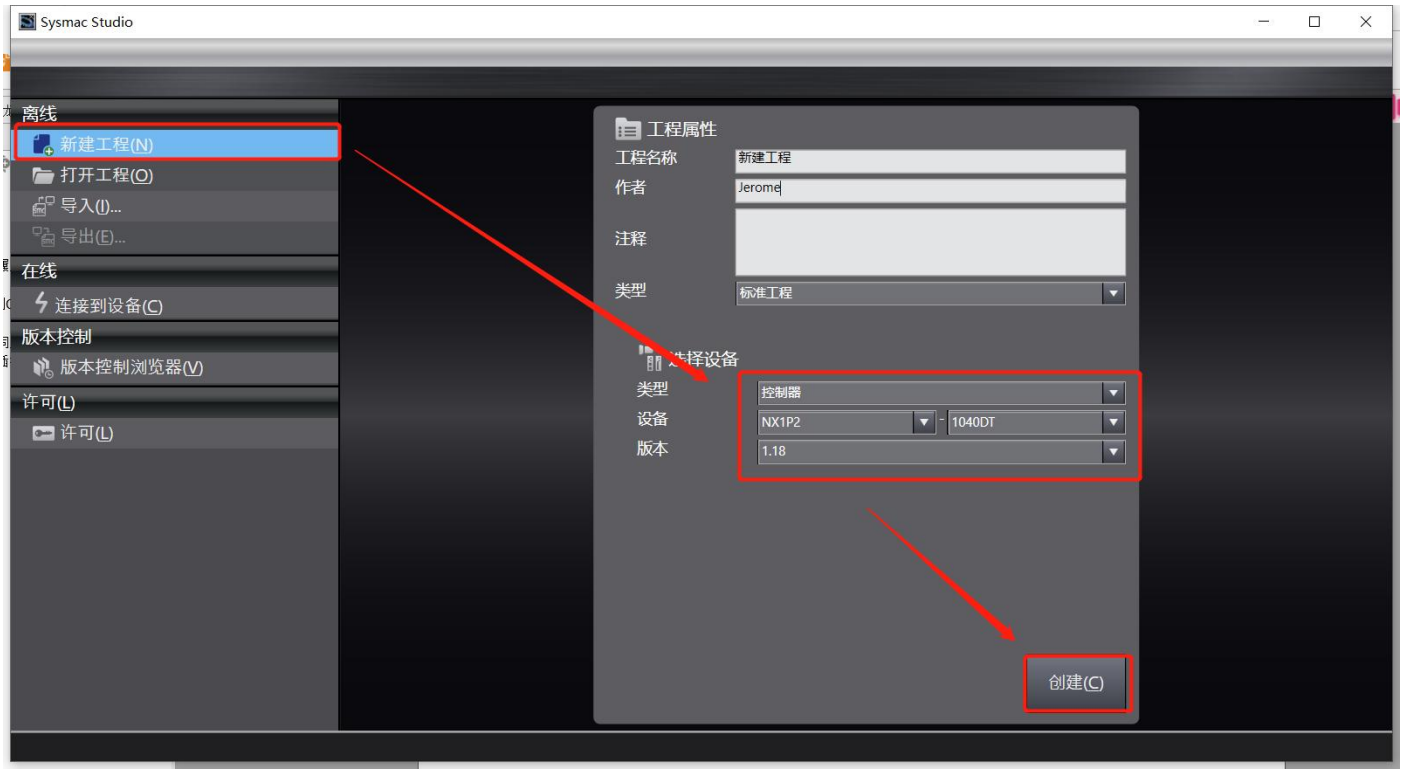
PLC controller model: OMRON NX1P2

8.1.1 Add device description fil

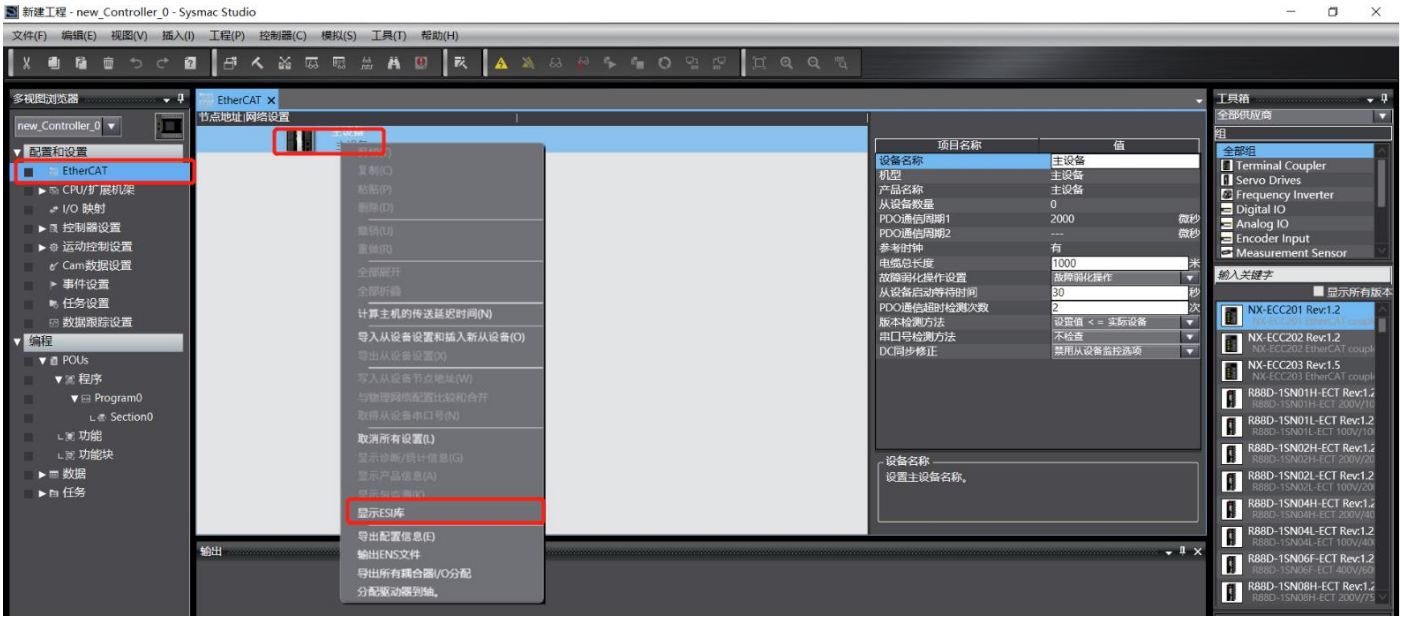
Find the installation directory of the PLC development environment Sysmac Studio, and copy the device description file of the drive to the following file path:



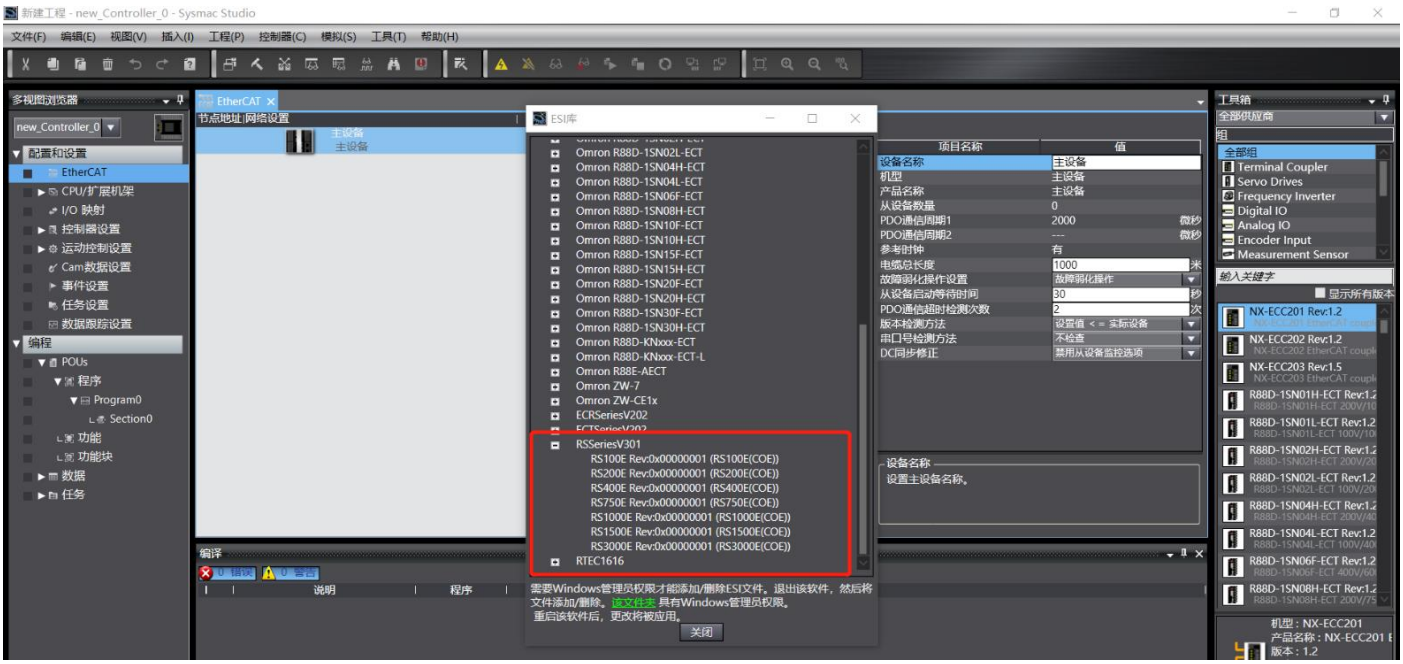
8.1.2 New construction



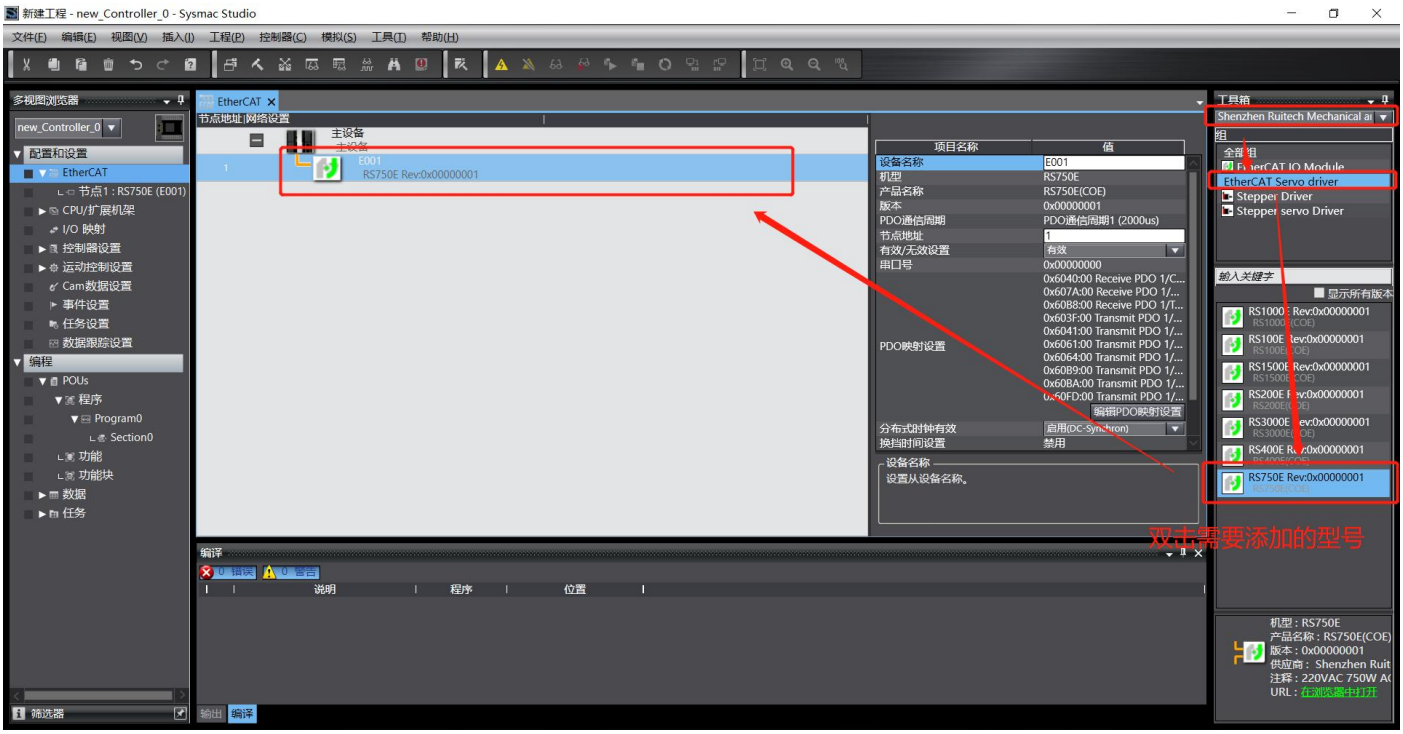
Check whether the drive device description file is installed correctly:



If the installation is successful, it will show as follows:

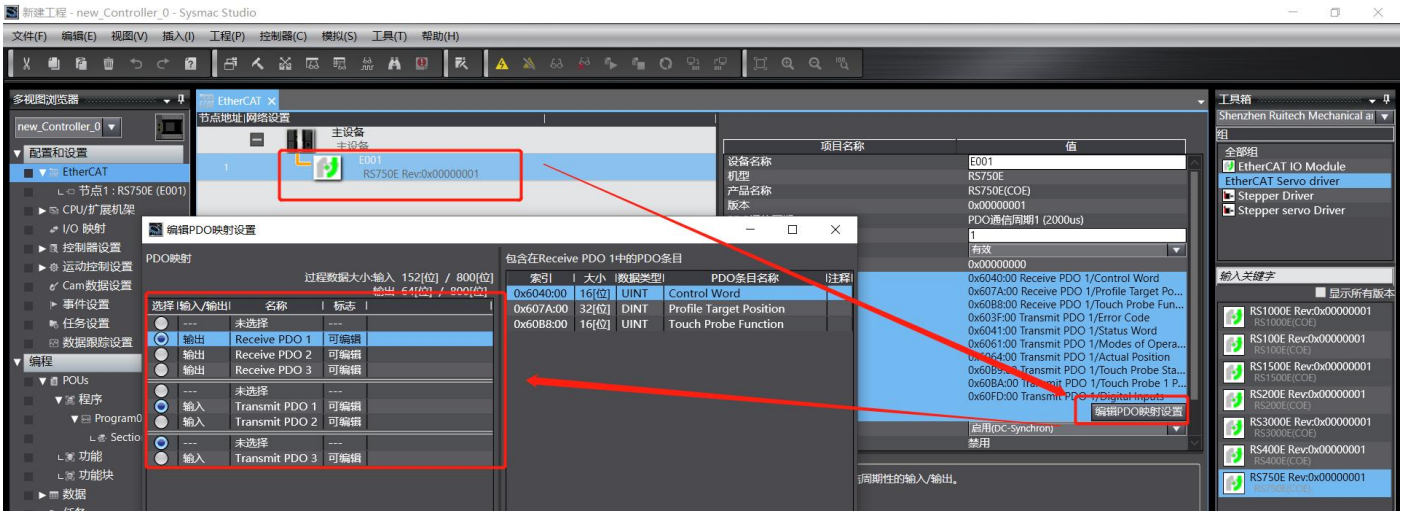


8.1.3 Add drive

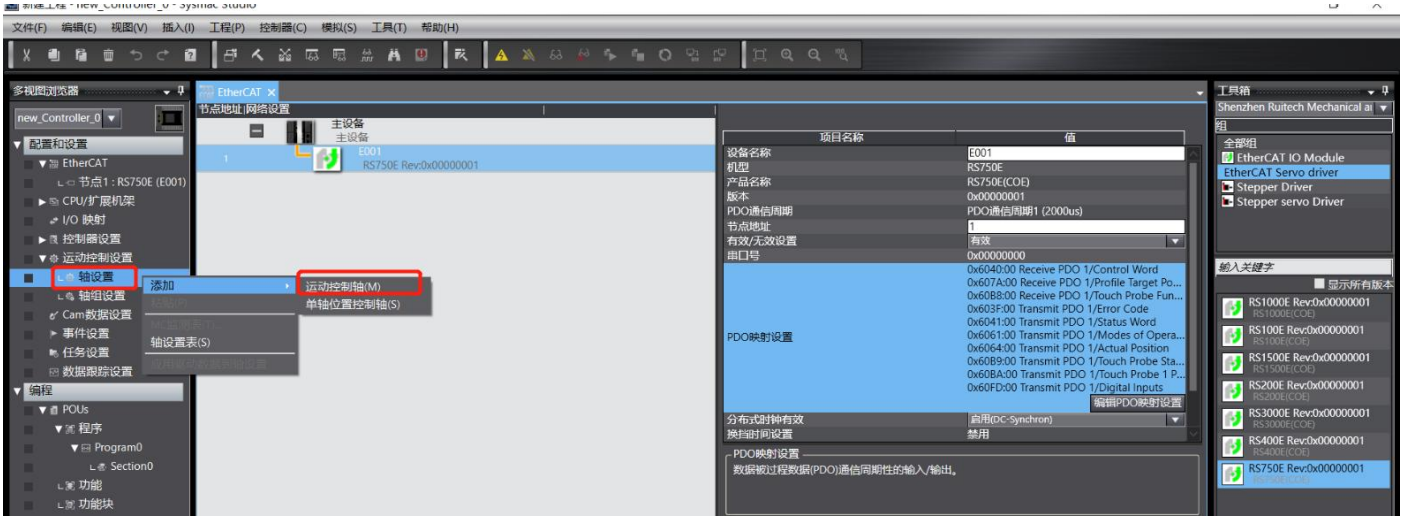


Edit PDO configuration:

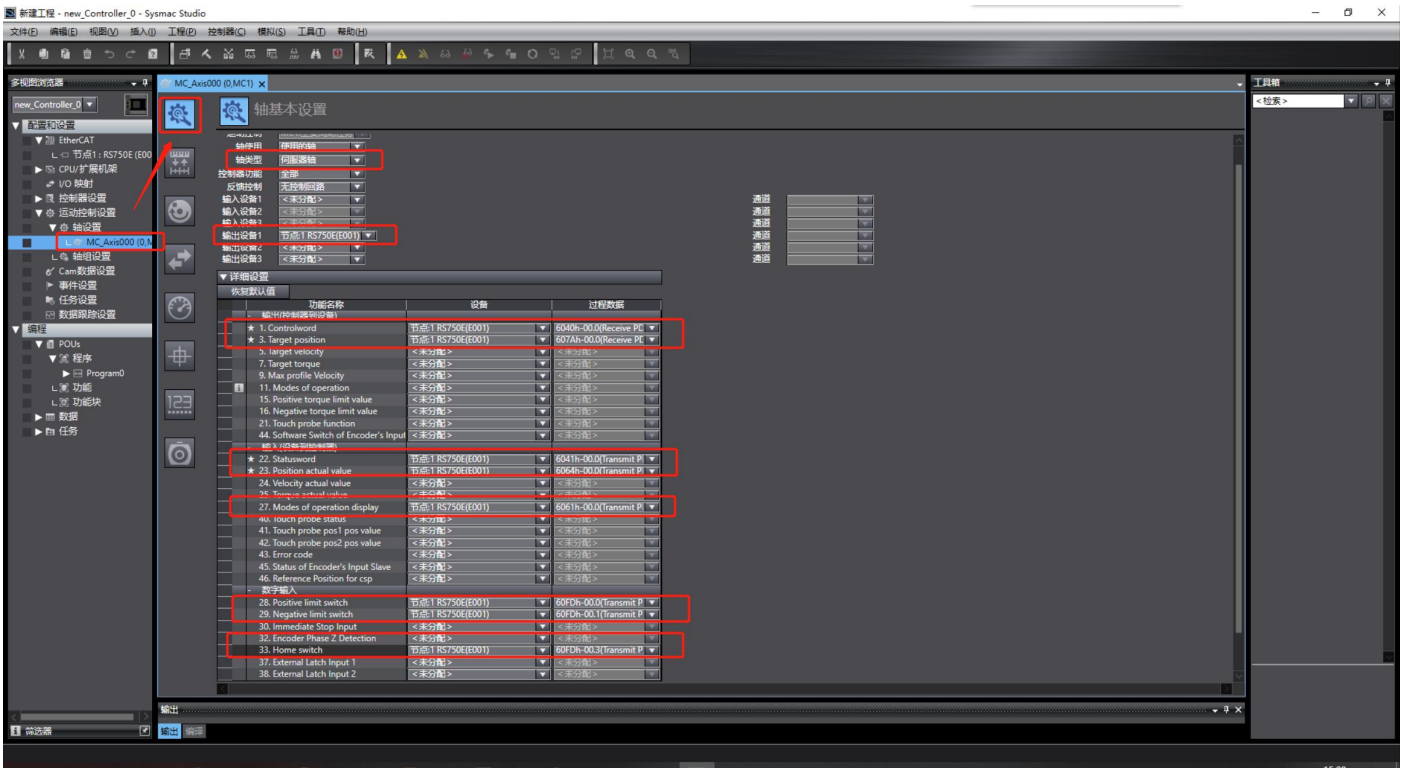
Generally keep the default



8.1.4 Add motion control axis

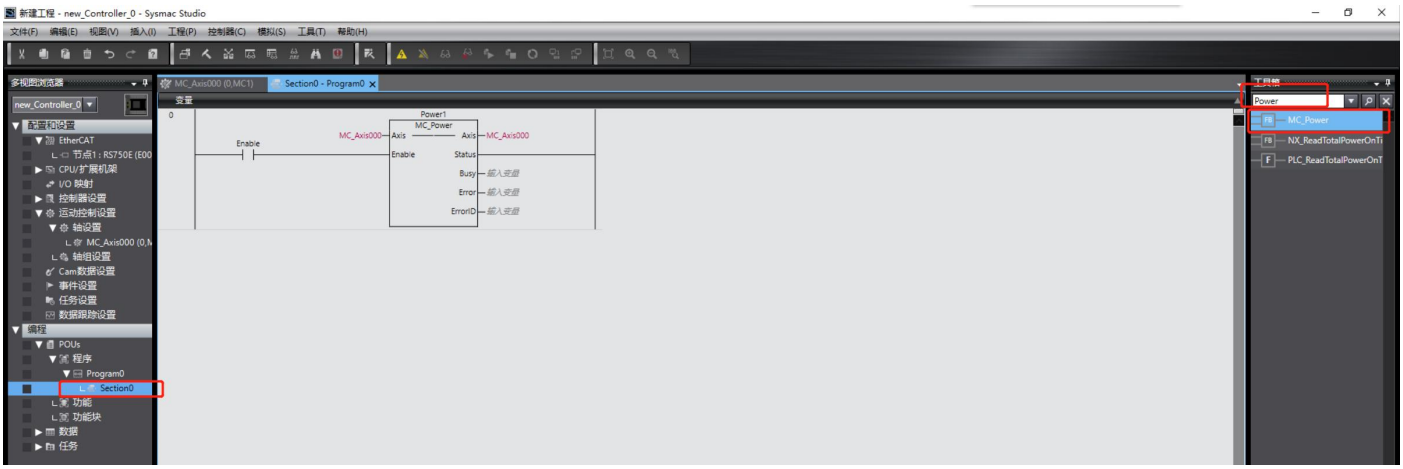


8.1.5 Map axis and drive

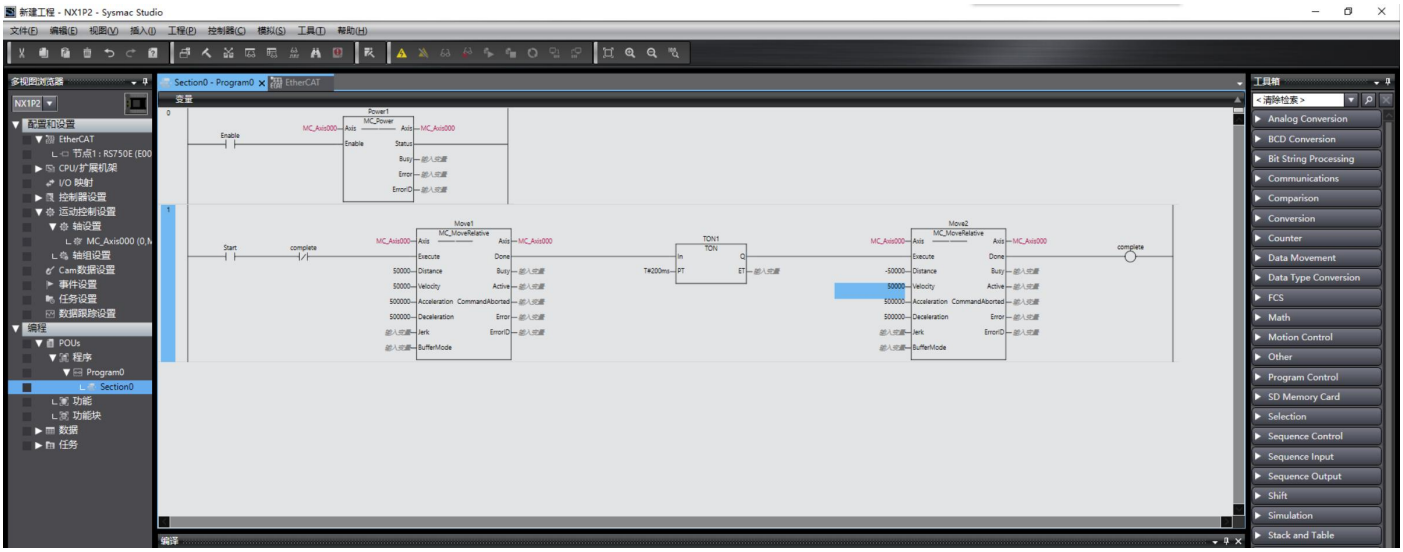


8.1.6 Write test code

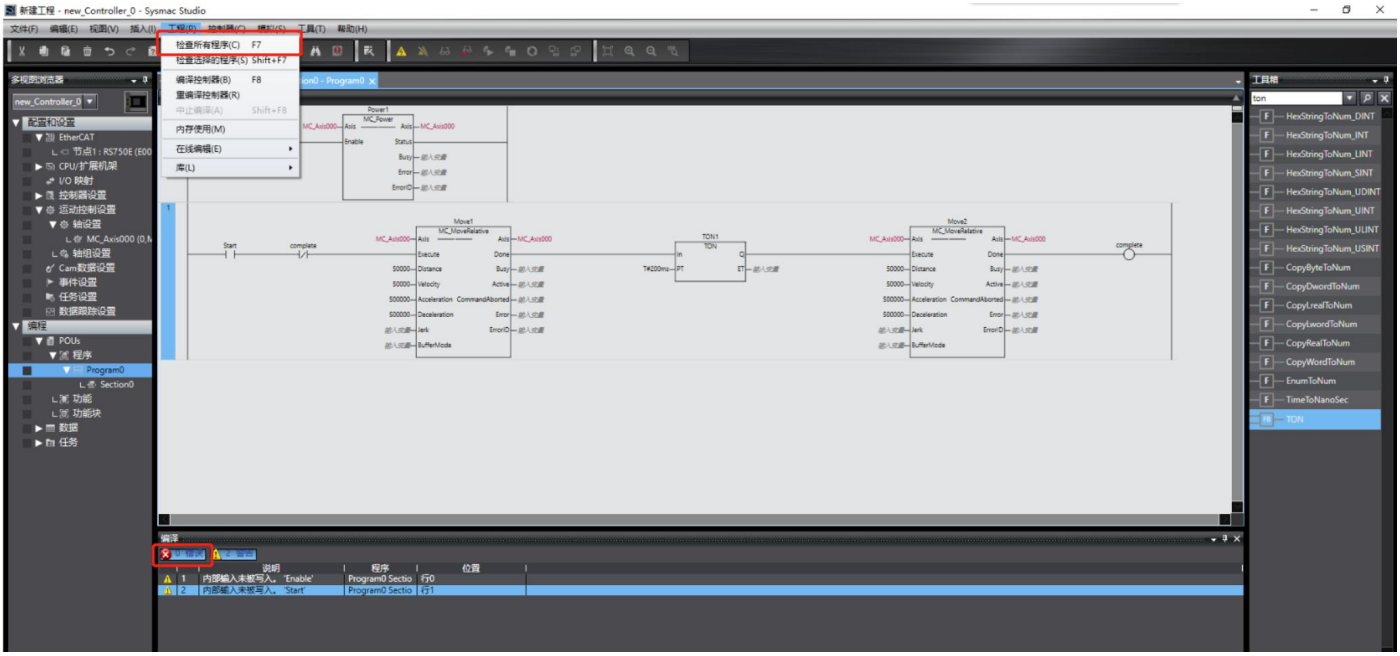
Write the enable program:



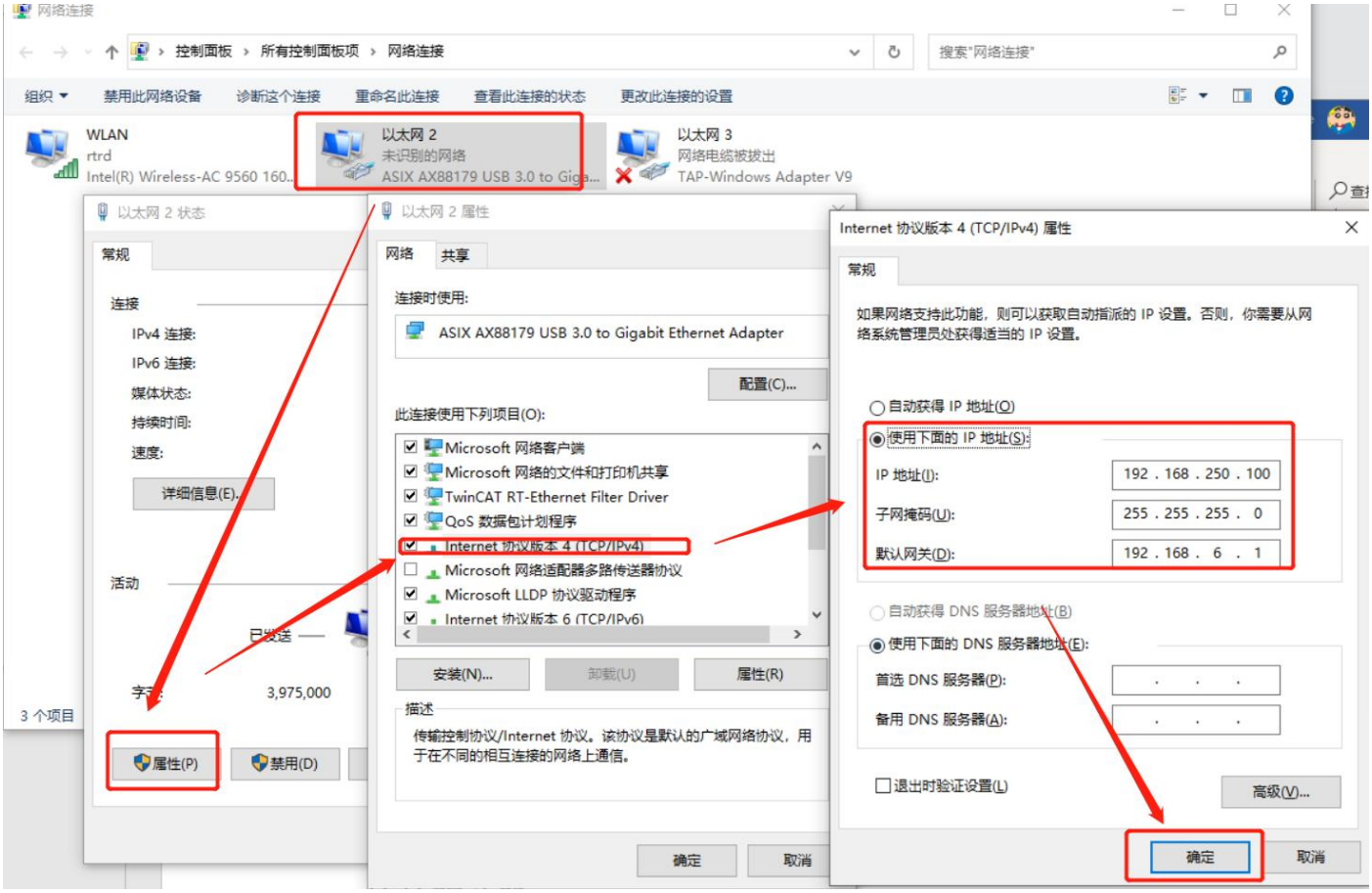
Write motion program:



Check if there are errors in the program:

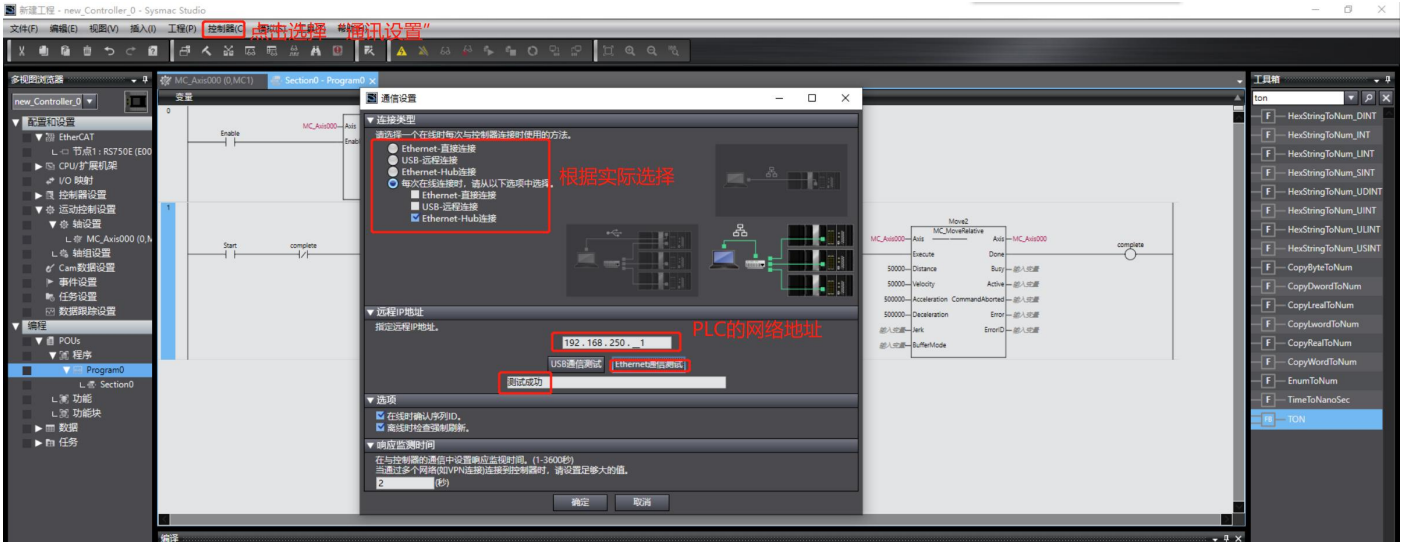


Modify the PC's network address so that it is in the same network segment as the PLC (Note: The PLC network address used in the test is 192.168.250.1):

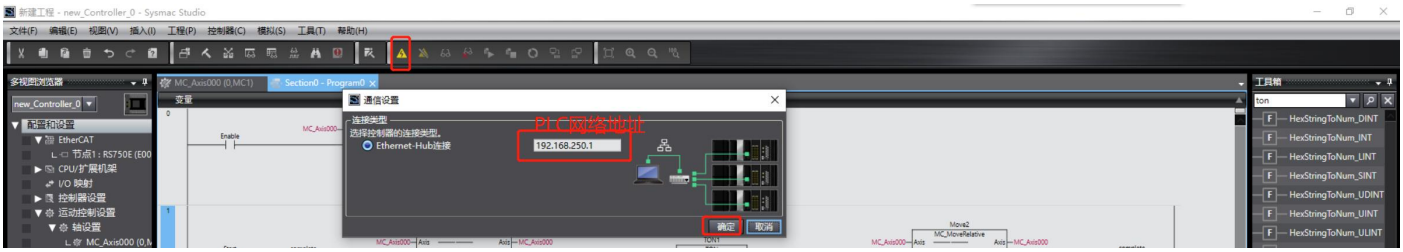


8.1.7 Connect the drive

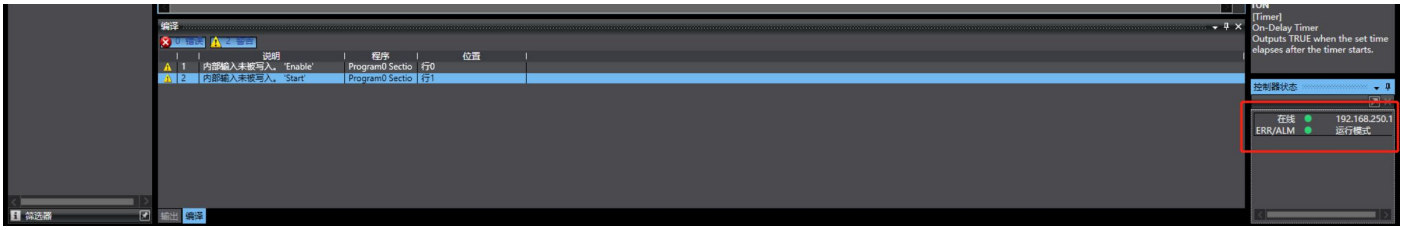
Set communication parameters:



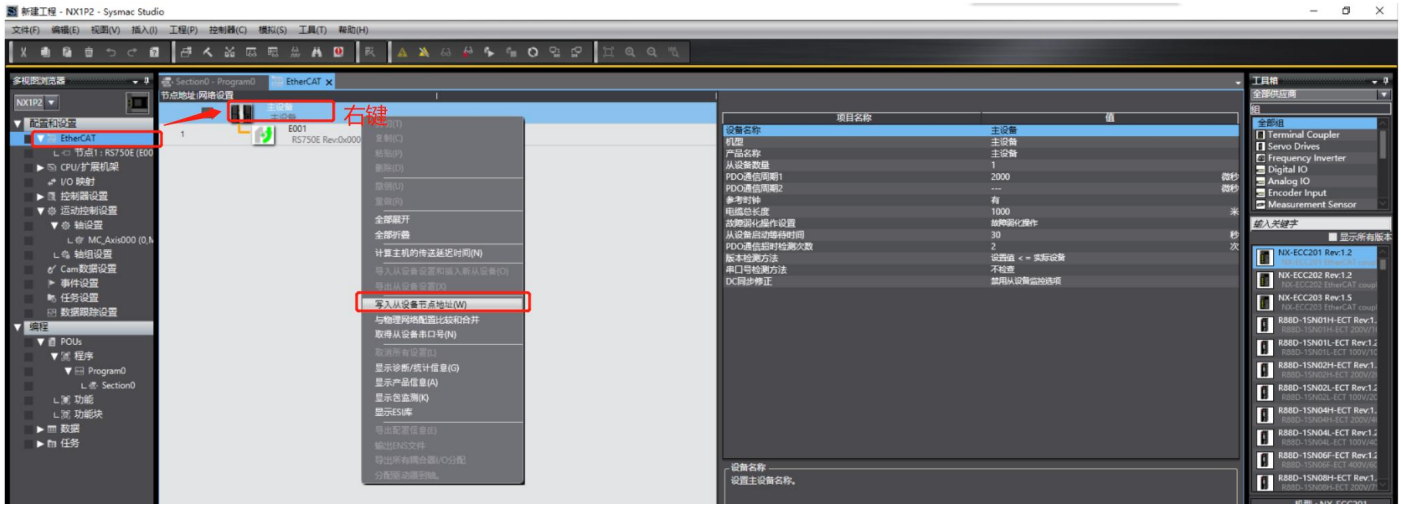
Connect to the PLC:



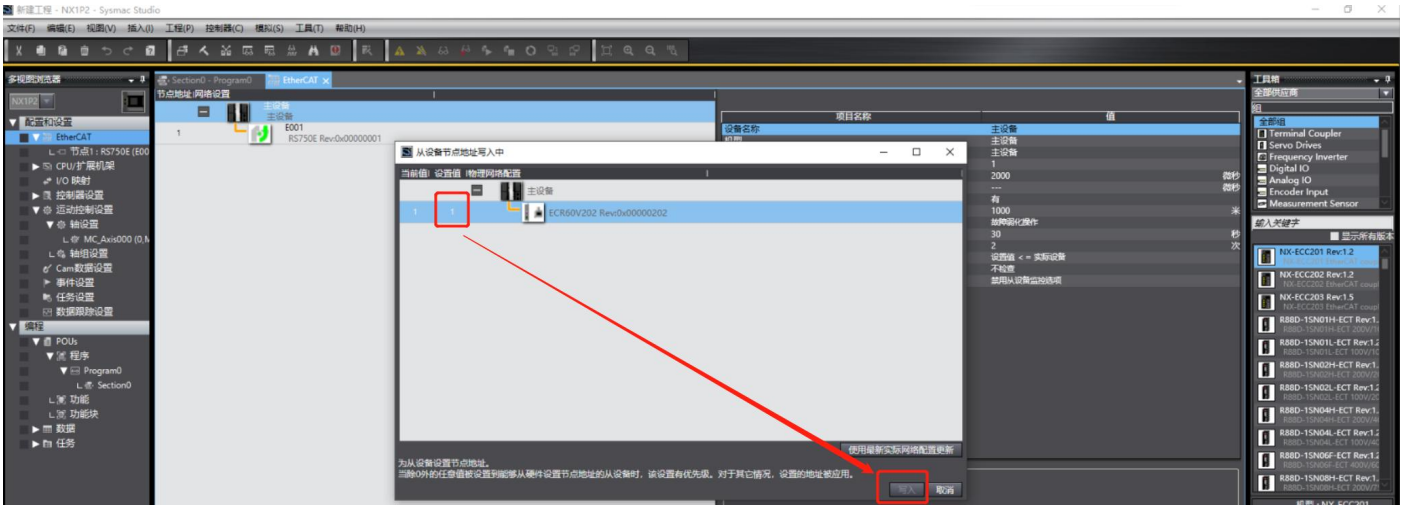
After the PLC is successfully connected, the controller status will be displayed on the PC software:



8.1.8 Assign drive address

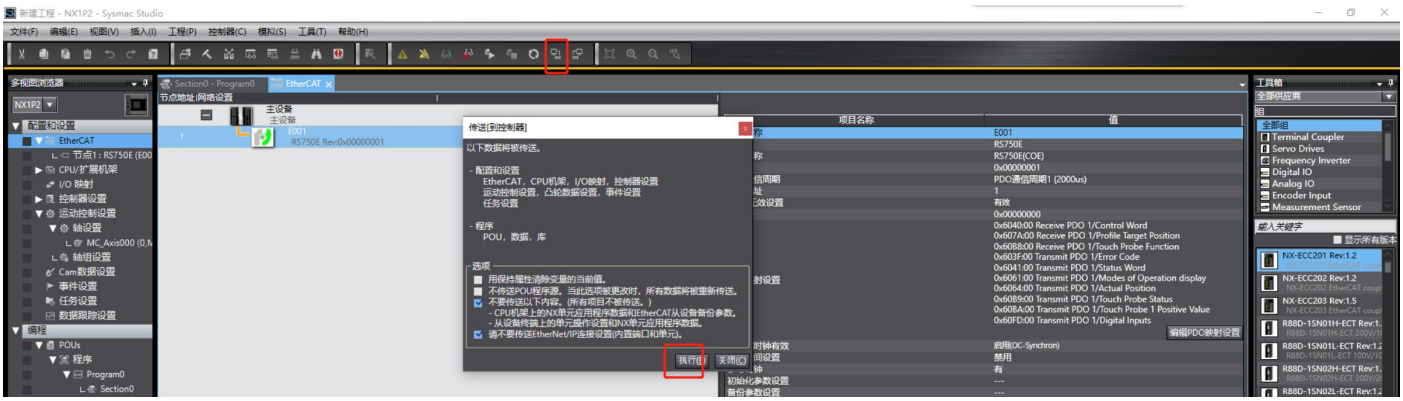


Set the setting value to 1, and then write:

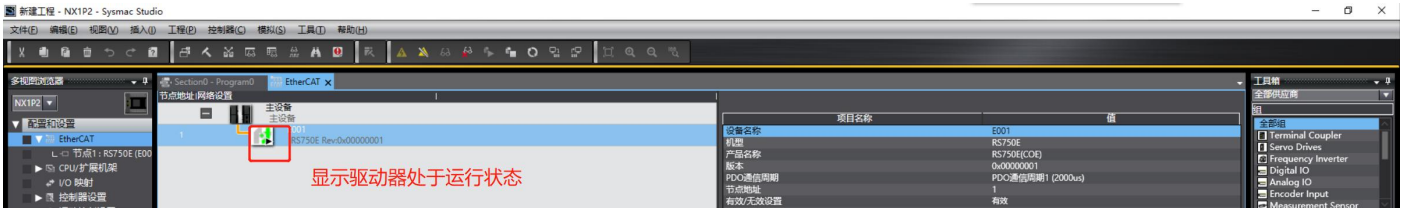


Note: After the writing is successful, please restart the drive according to the prompts

8.1.9 Program download

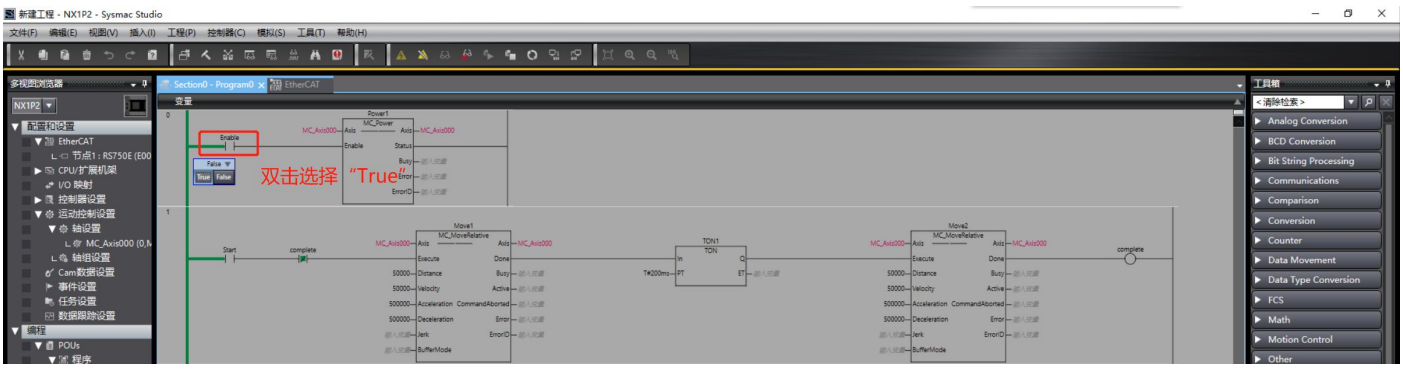


After always confirming, the download is complete. The drive shows that it is running:

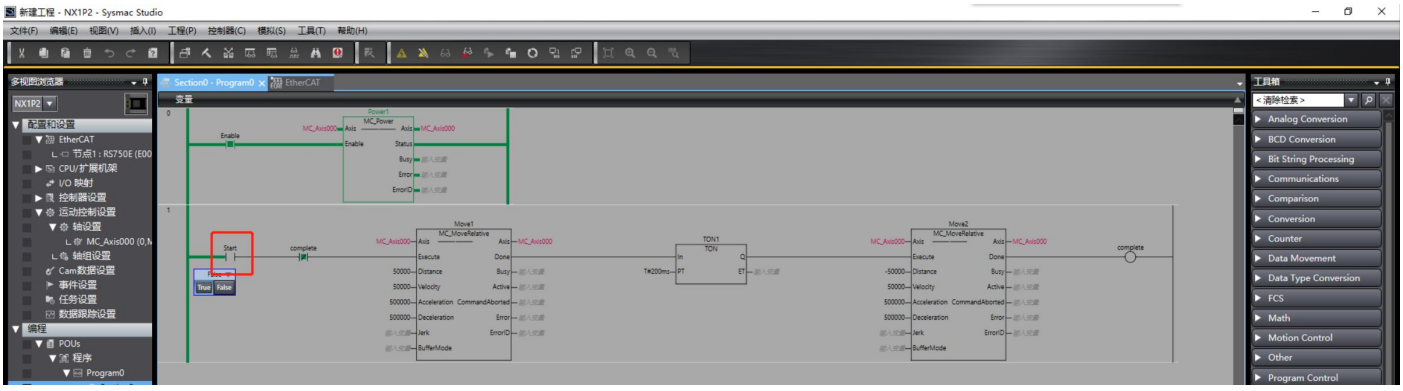


8.1.10 Motion test

By default, the motor is in a disabled state. Double-click the Enable contact in the PLC program and select "True", the motor will enter the enable state.



Double-click the Start contact in the PLC program and select "True", the motor will run in a logical cycle of "forward rotation"-"stop 200ms"-"reverse rotation":



8.2 Cooperate with Beckhoff controller operation case

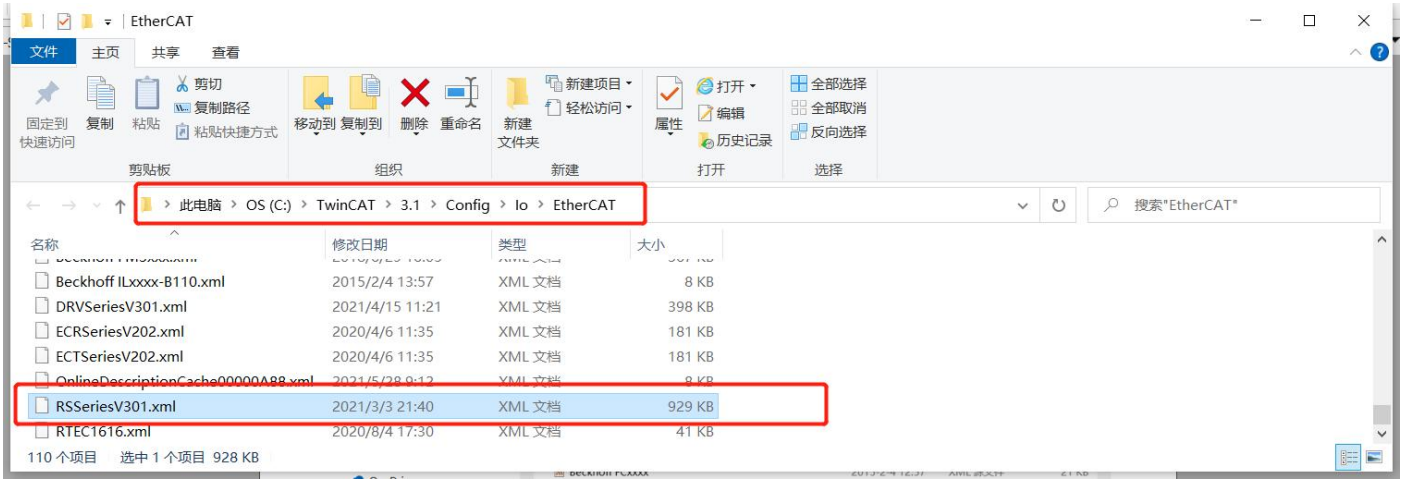
Testing environment:

PC operating system: Windows 10

TwinCAT version: V3.1.4024.11

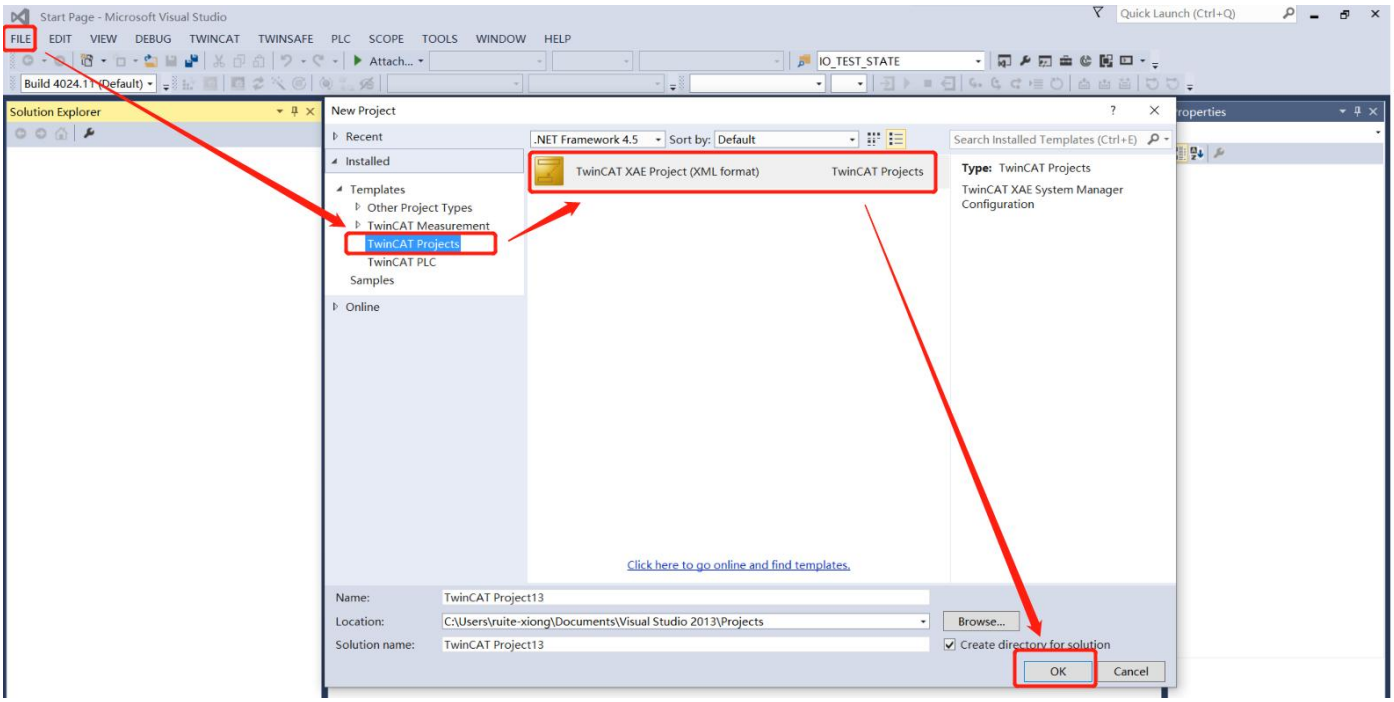
8.2.1 Add device description file

Copy the RSSeriesV301.xml file to the relevant path of TwinCAT as shown in the figure

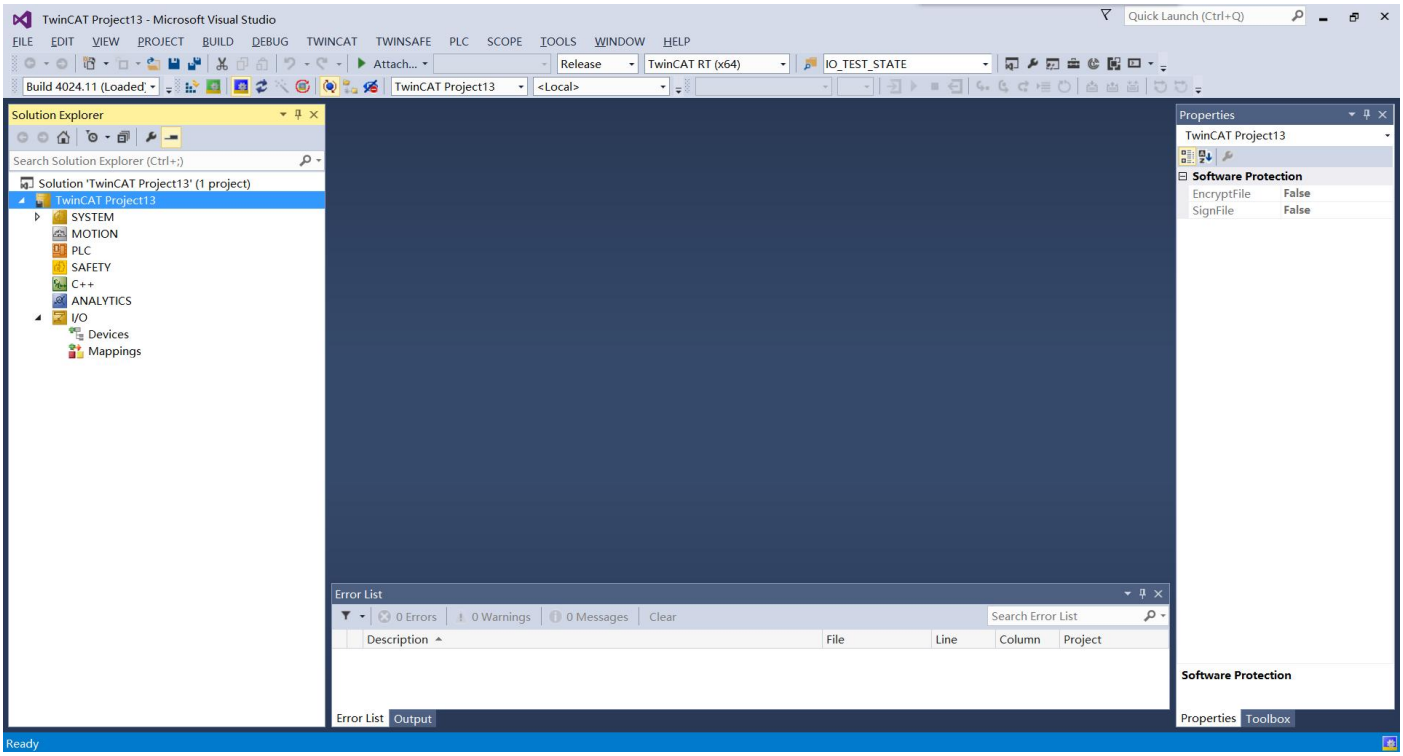


8.2.2 New Project

After clicking "FILE"-"New"-"Project" in turn, a new project window will pop up,



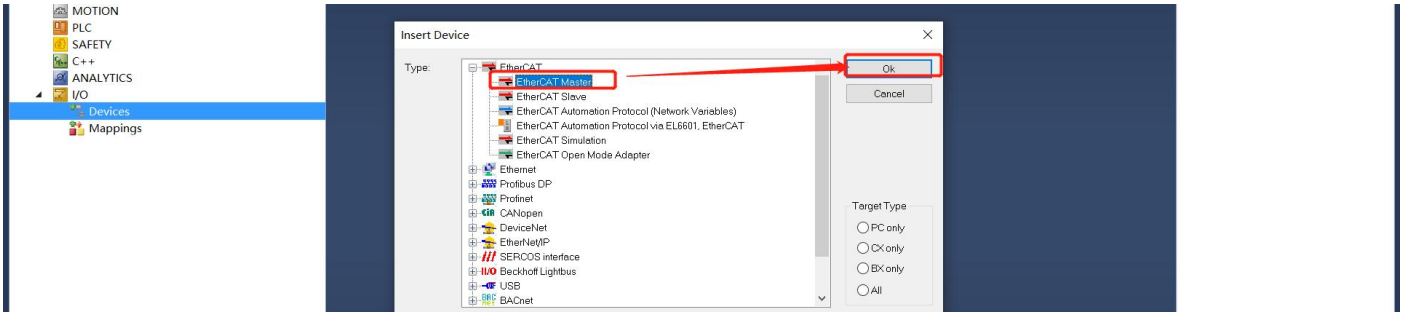
After the project is successfully created, the following figure shows:



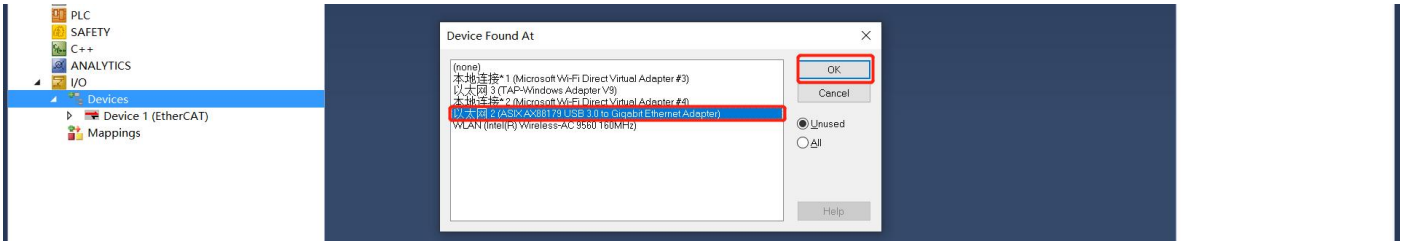
8.2.3 Add master network card

In the "I/O -> Devices" directory, right-click and select the "Add New Item" item:

Add the type as "EtherCAT -> EtherCAT Master":



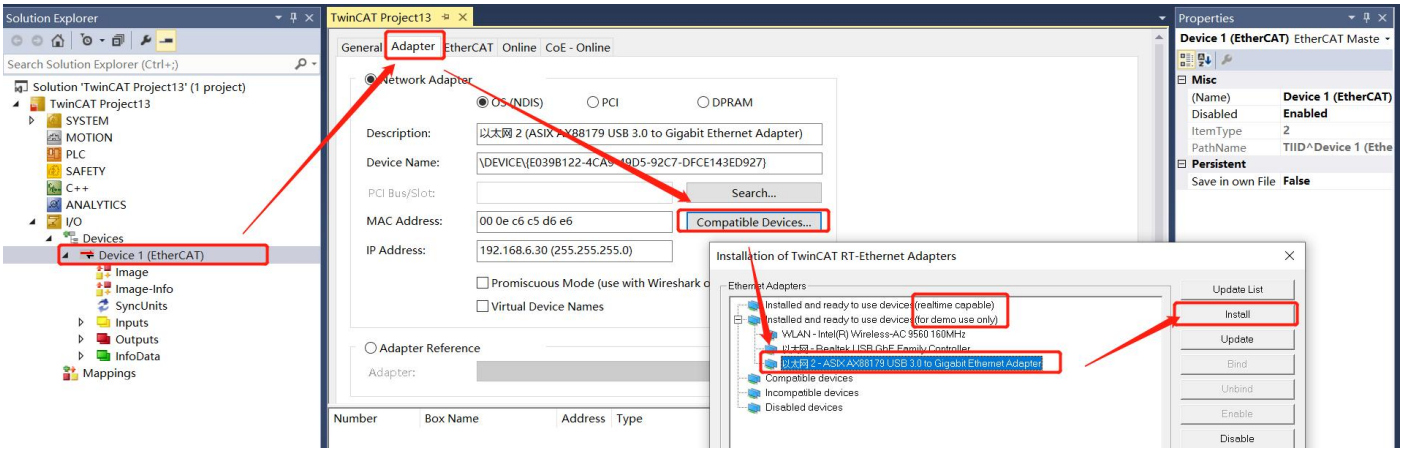
After clicking "OK", select the network card to be used:



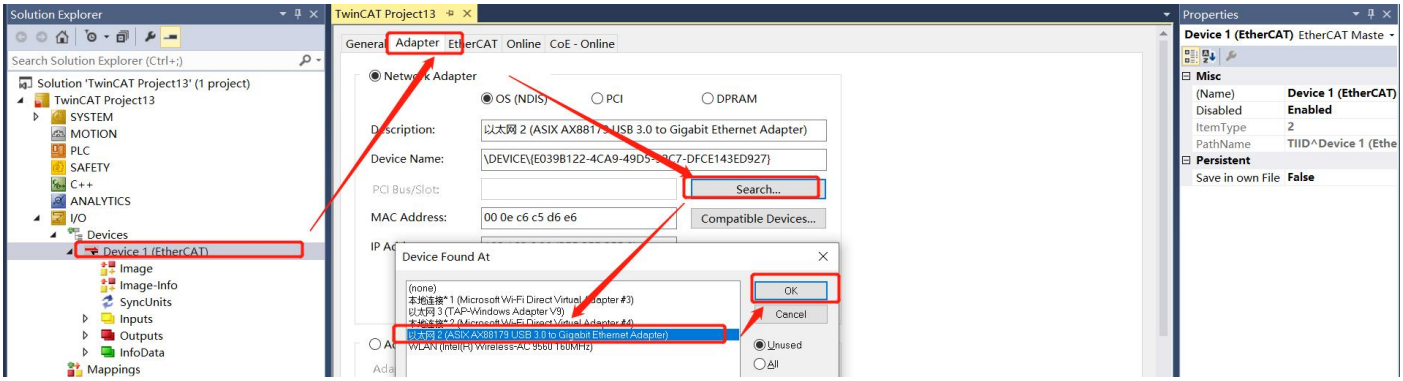
After selecting the corresponding network card, click "OK" to complete the setting, as shown in the following figure:

Note: On some computers, the computer's network card cannot be displayed here, please select the "Cancel" button, and select the network card in the next operation.

8.2.4 Install the network card driver

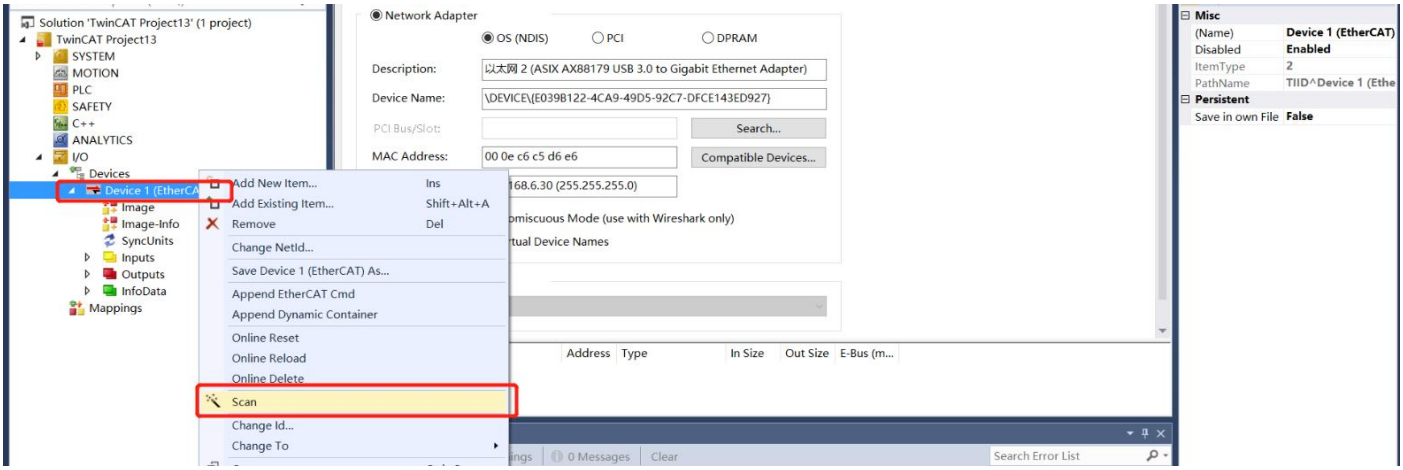


After installing the driver, click the "Search" button to find the corresponding network card:

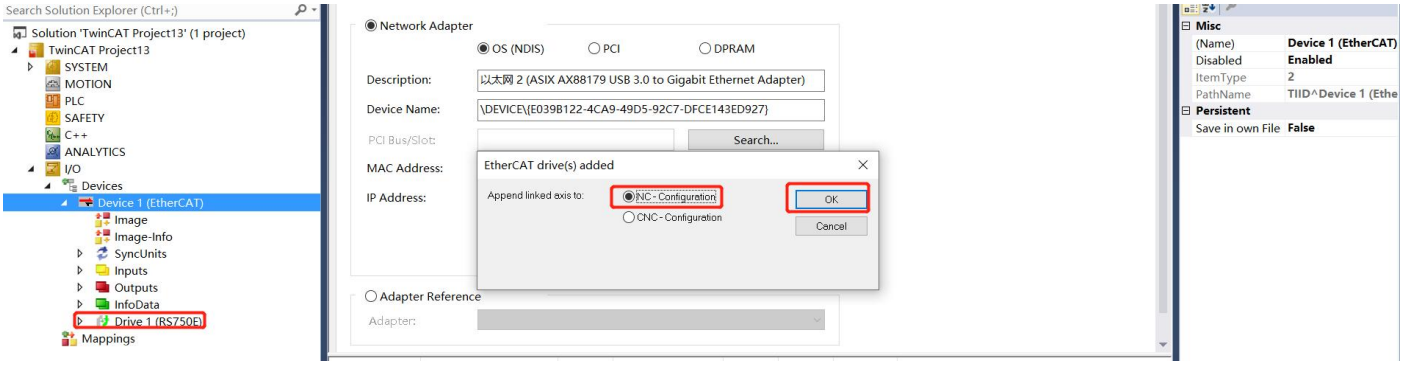


8.2.5 Find drive

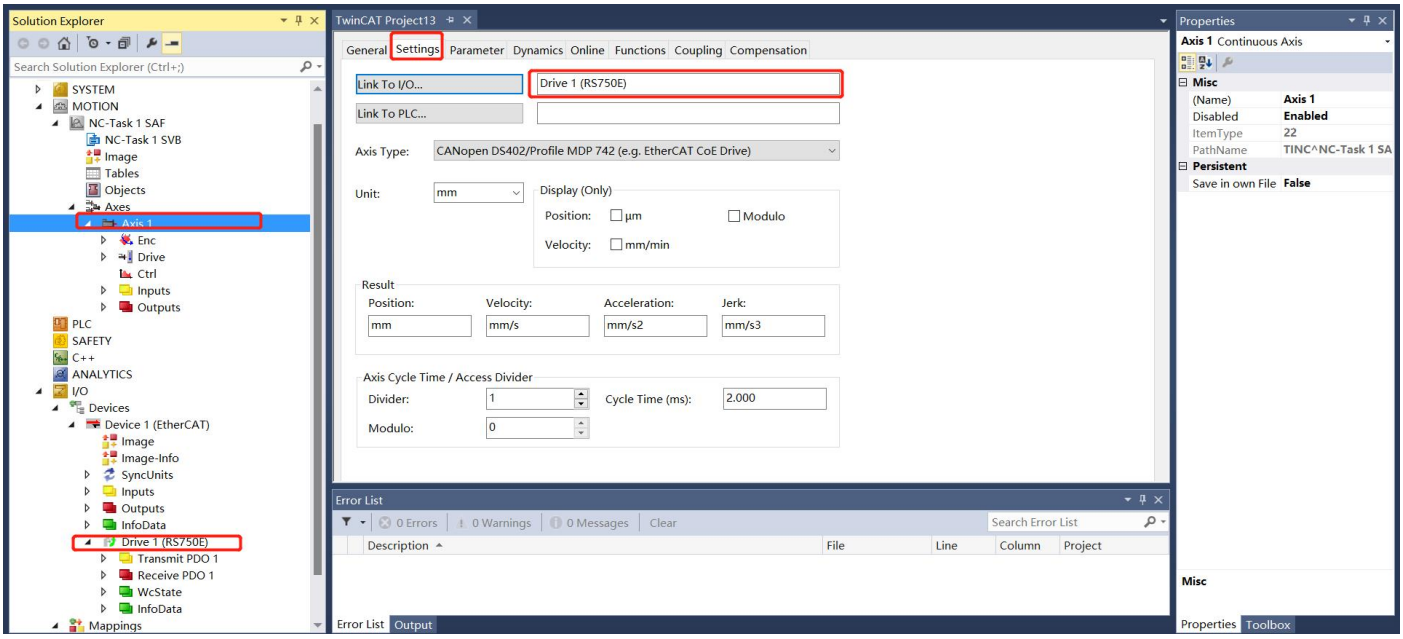
Connect the drive to the power supply, motor and network cable, and then right-click in the "Device 1 (EtherCAT)" item and select "Scan", as shown below:



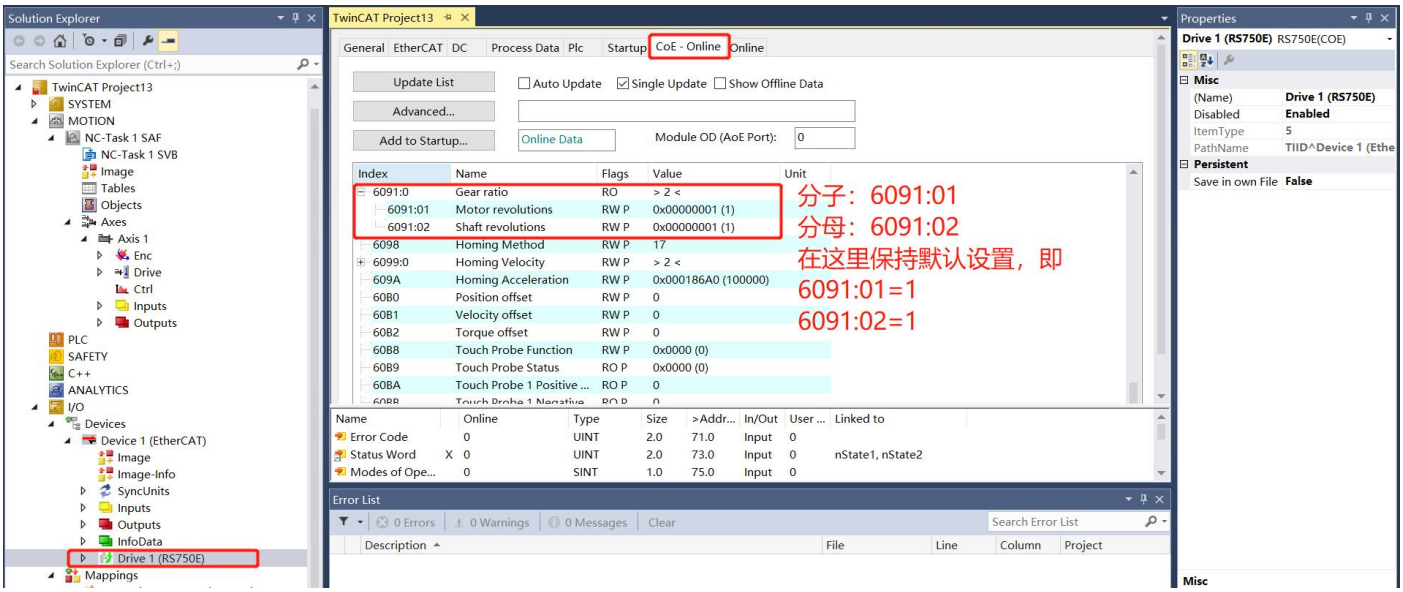
Under normal circumstances, the software prompts to find RS servo drive, and prompts whether to add a corresponding motion axis (NC), click the "OK" button:



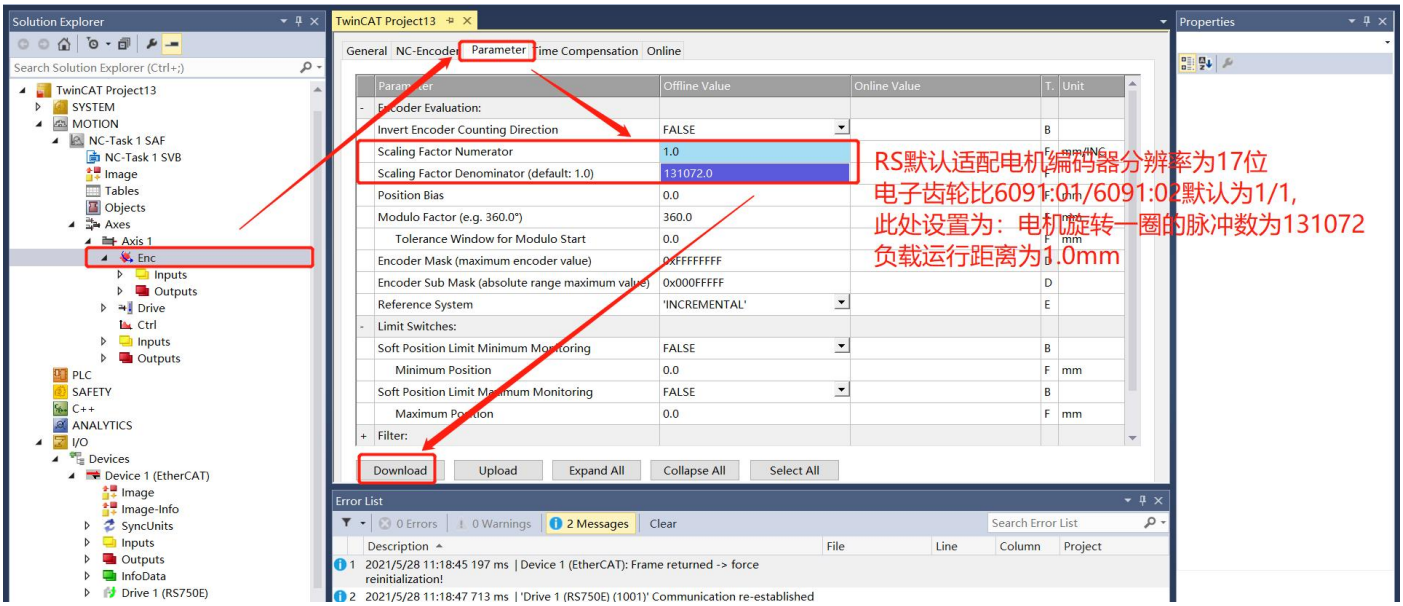
At this time, the software automatically adds a "Motion -> Axes -> Axis 1" and associates it with the drive "Drive 1 (RS750E)", as shown below:



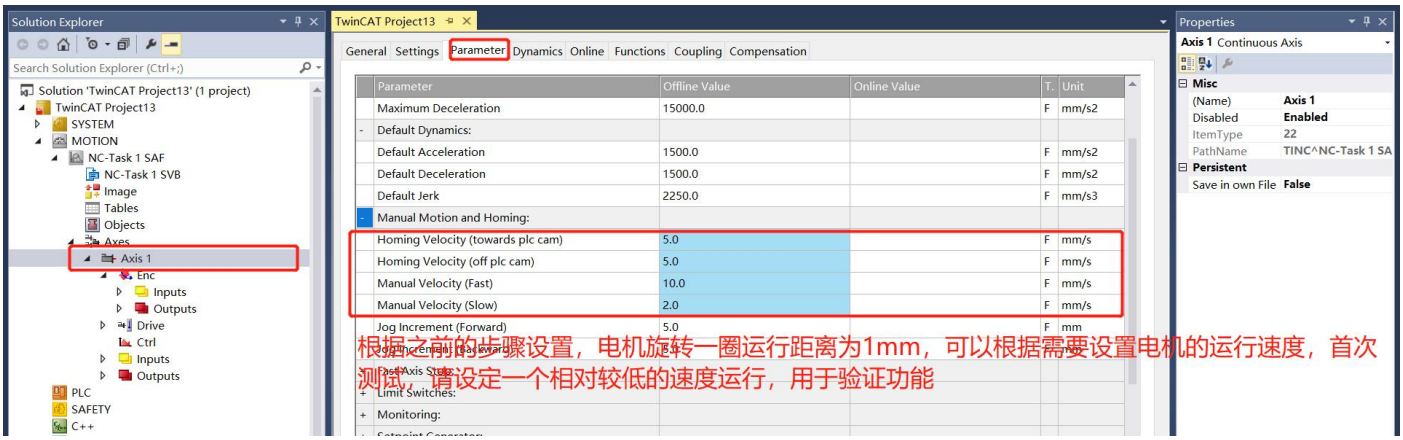
8.2.6 Set electronic gear ratio



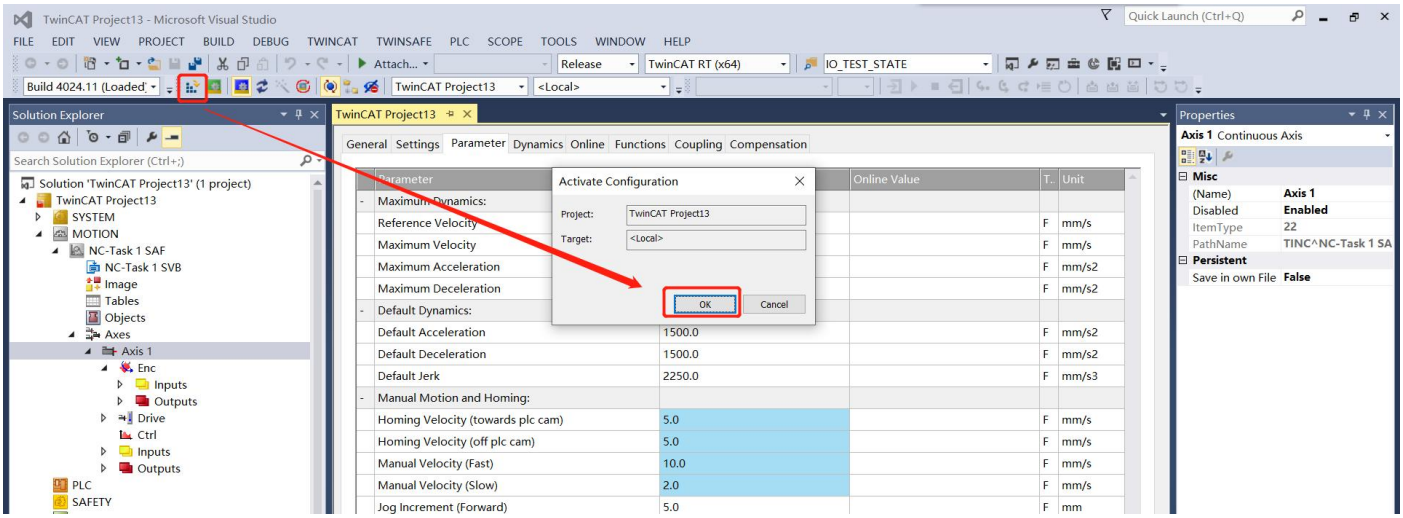
8.2.7 Encoder settings



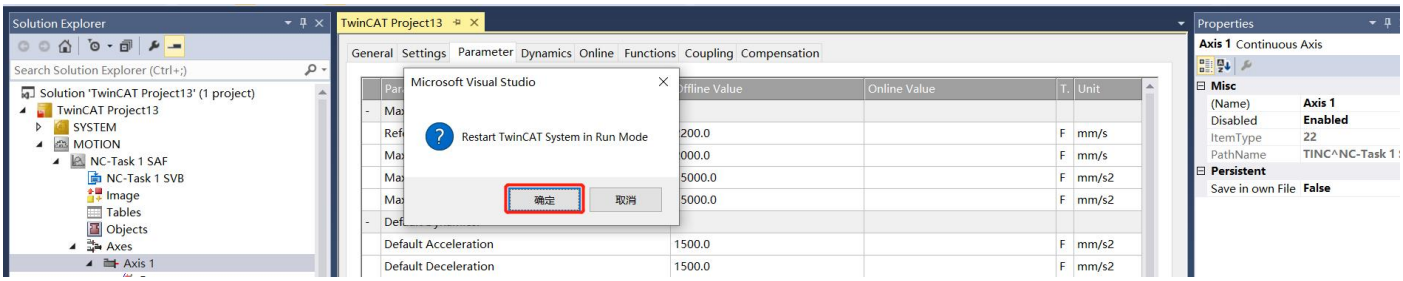
8.2.8 Set motion parameters



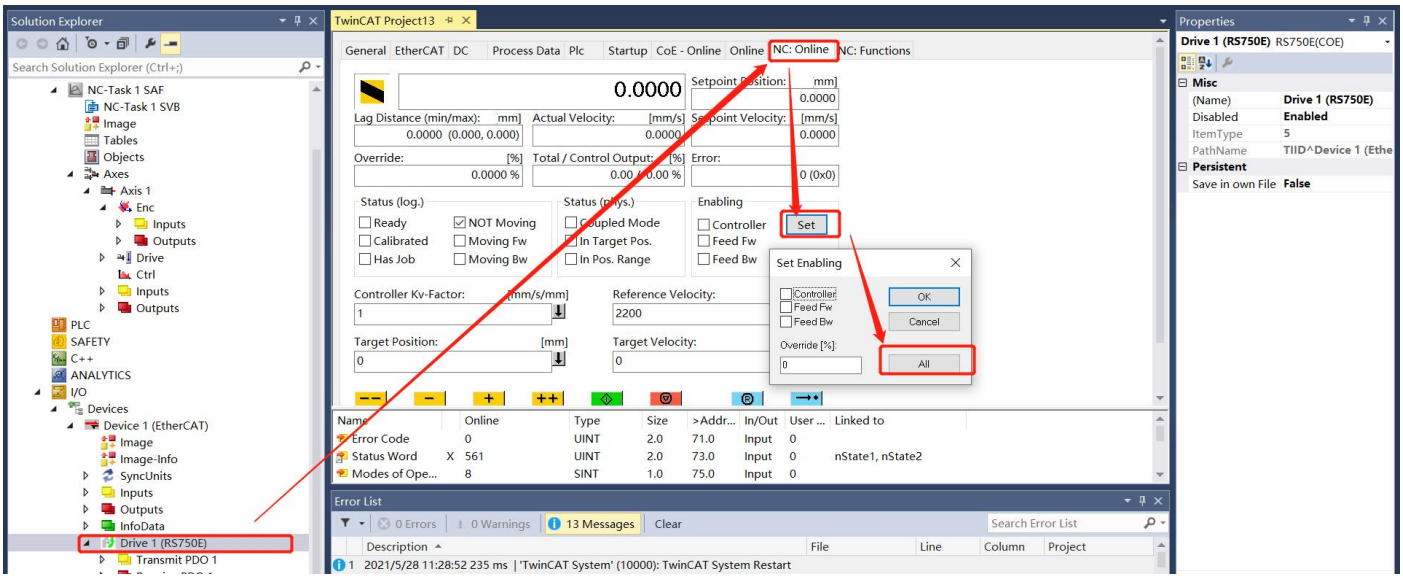
8.2.9 Activation



At this time, it prompts whether to enter "Run Mode", click "OK":

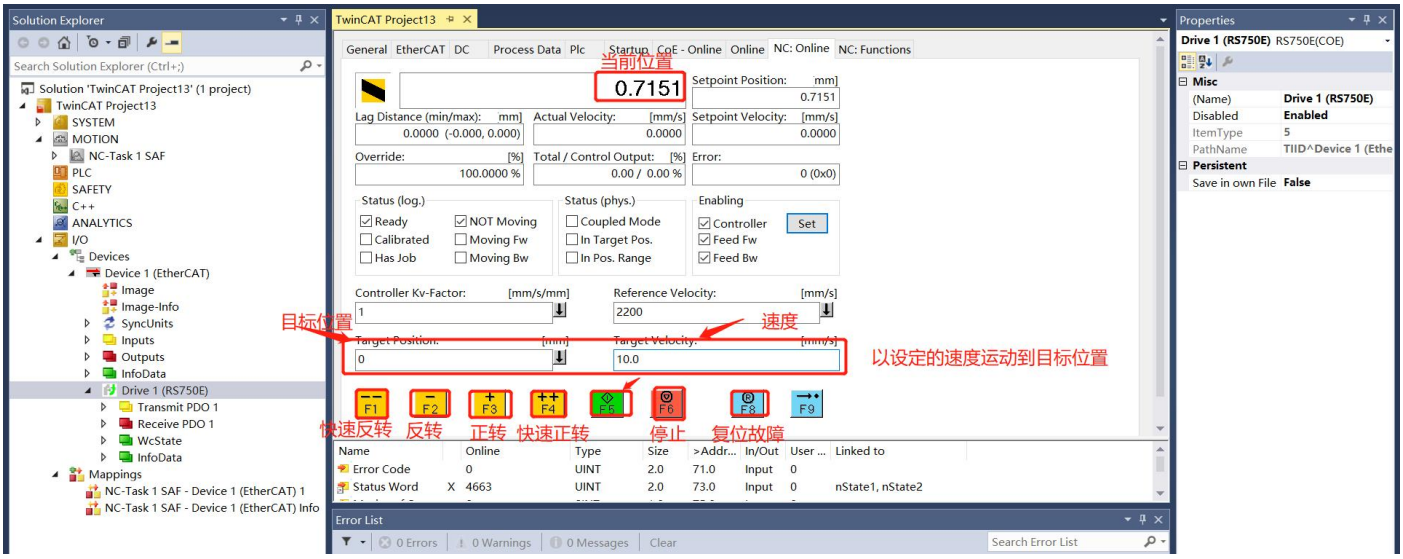


8.2.10 Enable motor

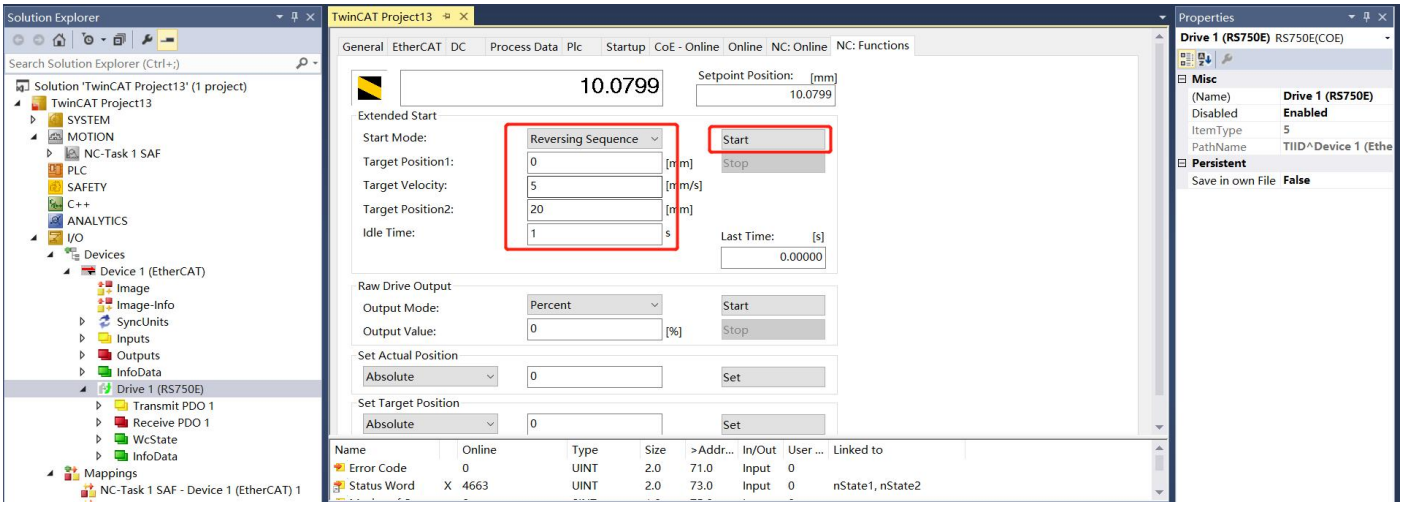


After the above operations, the motor shaft is enabled and there is power output.

8.2.11 Motion test



According to the settings in the figure below, the motor can be tested for forward and reverse rotation at a speed of 5mm/s between 0 and 20mm:


Solution Explorer
Search Solution Explorer (Ctrl+;)
Solution 'TwinCAT Project13' (1 project)
TwinCAT Project13
SYSTEM
MOTION
NC-Task 1 SAF
PLC
SAFETY
C++
ANALYTICS
I/O
Devices
Device 1 (EtherCAT)
Image
Image-Info
SyncUnits
Inputs
Outputs
InfoData
Drive 1 (RS750E)
Transmit PDO 1
Receive PDO 1
WcState
InfoData
Mappings
NC-Task 1 SAF - Device 1 (EtherCAT) 1
TwinCAT Project13
General EtherCAT DC Process Data Plc Startup CoE - Online Online NC: Online NC: Functions
10.0799
Setpoint Position: [mm]
10.0799
Extended Start
Start Mode: Reversing Sequence
Target Position1: 0 [mm]
Target Velocity: 5 [mm/s]
Target Position2: 20 [mm]
Idle Time: 1 s
Start
Stop
Last Time: [s]
0.00000
Raw Drive Output
Output Mode: Percent
Output Value: 0 [%]
Start
Stop
Set Actual Position
Absolute 0 Set
Set Target Position
Absolute 0 Set
Name Online Type Size >Addr... In/Out User ... Linked to
Error Code 0 UINT 2.0 71.0 Input 0
Status Word X 4663 UINT 2.0 73.0 Input 0 nState1, nState2
Properties
Drive 1 (RS750E) RS750E(COE)
Misc
(Name) Drive 1 (RS750E)
Disabled Enabled
ItemType 5
PathName TIID^Device 1 (Ethe
Persistent
Save in own File False

Chapter 9 Troubleshooting

9.1 Error code

Fault	Contens of the fault
AL.000	Normal state
AL.100	Parameter reading error A. Typically occurs after a firmware upgrade or when parameter reading operations are performed, the version of the stored parameters in the drive EEPROM does not match or the validation error. Need to re-import the firmware and save it. B. An alarm occurs when the drive does not upgrade the firmware. It is caused by an error in reading the internal parameters of the drive. Please power off the drive completely for 30s, and then restart the drive to check whether the alarm occurs. C. After the B-step operation, the drive still alarms, please try to restore the factory settings, then power off for 30s, and then restart the drive. If the drive still alarms, please contact the manufacturer for after-sales or replacement. If there is no alarm, please reset the parameters and continue to use it again.
AL.101	Parameter saving error Appears during parameter saving, generally due to abnormal communication of EEPROM chip, please completely power off the drive 30s, then restart the drive and carry out parameter save test, if there is still a warning, please contact the manufacturer after-sales or replacement.
AL.103	The drive program is running abnormally The drive program is running abnormally, please contact the manufacturer for after-sales service.
AL.105	Drive parameters do not match Drive P00.34 parameter setting is abnormal, please set this parameter correctly according to the motor model, this parameter is generally1/ 2.
AL.110 AL.111	AL.110: Drive IPM module overcurrent AL.111: Drive ADC overcurrent Whether the motor collides or not causes a blockage Motor P06.00,P06.01, P06.02, P06.28, P06.29 improper settings caused. Try to restore the drive parameters and restart to see if the warning still exists. If a warning still appears, please contact the manufacturer for after-sales service. By setting the P05.04 parameter, try to reduce the overload multiple of the drive to test whether there is an alarm.
AL.112 AL.113	AL.112: Motor command overload AL.113: Motor overheating Check if the motor is colliding causing a blockage Check whether the encoder cable is connected correctly, e.g. the motor encoder cable does not correspond to the correct connection when multi-axis Monitor the driver d03.tF to see the running torque of the motor, and judge whether it is caused by long time overload.

AL.114	Drive IPM module over temperature A.Check the drive housing temperature and ventilation cooling conditions Check that the drive fan is spinning properly
AL.115	Drive internal voltage error The internal voltage failure of the drive is generally caused by the internal hardware of the drive, please contact the manufacturer for after-sales service.
AL.120	Drive Encoder Interference Please check whether the motor PE cable connection is reliable Check that the encoder plug is connected reliably Replace the drive to check whether the fault is caused by the motor encoder
AL.121	Encoder communication error The fault occurs when power-up, generally will alarm AL.170 at the same time, please check that the encoder extension cord connection is reliable. If the drive simply alarms AL.121, usually caused by a faulty encoder, replace the motor.
AL.123	Encoder CRC check failure
AL.124	Encoder Z-phase signal failure
AL.125	Encoder counting failure
AL.126	Encoder disconnection fault Check that the encoder cable is reliably connected
AL.127	Encoder failure Appears during power-on initialization, the incremental encoder reads the Hall signal incorrectly when power-on, and the communication encoder shows that the drive cannot communicate with the encoder. Please check that the encoder cable connection is reliable
AL.128	Encoder type setting error Check that the P00.34 parameter value is set correctly
AL.129	Encoder data receiving timeout
AL.140	Position error overflow
AL.150	Braking resistance parameter setting is too small
AL.160	FPGA parameter initialization error It appears when the drive is powering on and initializing, power off the drive for 30s, then restart it to see if it still alarms, if it still alarms, please replace the drive.
AL.161	The program detected an SPI communication error Update the drive and contact the manufacturer for after-sales service.
AL.162	Read encoder EEPROM fault
AL.163	Save the encoder EEPROM fault
AL.164	Encoder data is incorrect It appears during power-on initialization, because the encoder has not been calibrated, please contact the manufacturer for after-sales service.
AL.165	Encoder data is incorrect When the initialization of power-on, the check and error of the encoder is caused, please power off and

	restart after 30s, if it still alarms, please contact the manufacturer for after-sales or replace the motor.
AL.166	Write encoder EEPROM failure
AL.167	Write encoder EEPROM failure (read back for verification).
AL.168	Read encoder EEPROM failure
AL.169	Read encoder EEPROM failure
AL.170	Read encoder EEPROM failure When power-on initialization occurs, generally due to the encoder extension cable, please check that the extension cable is connected correctly.
AL.171	FPGA initialization error It appears during power-on initialization and is caused by abnormal communication between DSP and FPGA.
AL.200	Control mode setting error Please check the P01.00 parameter setting value, whether it meets the requirements of the manual, or contact the manufacturer.
AL.201	Position command source setting error Please check whether the P03.00 parameter setting value meets the requirements of the manual, or contact the manufacturer.
AL.202	Speed command source setting error Please check the P04.00 parameter setting value, whether it meets the requirements of the manual, or contact the manufacturer.
AL.203	Torque command source setting error Please check whether the parameter setting values of P05.00, P05.01 and P05.02 meet the requirements of the manual or contact the manufacturer.
AL.210	Drive bus voltage is high Please plug in the brake resistance or check the quality of the brake resistance and whether the resistance value is appropriate. Please check whether the AC input power is too high and the drive input power requirement is below 260VAC.
AL.211	Drive bus voltage is low Please check whether the AC input power is indeed too low and the drive input power requirement is below 170VAC. Replace with a new drive to check if the drive is damaged.
AL.212	Driver bus voltage is high It occurs when the bus voltage of the driver is momentarily higher than the alarm threshold. Please plug in the brake resistance or check the quality of the brake resistance and whether the resistance value is appropriate. Please check whether the AC input power is too high and the drive input power requirement is below 260VAC.
AL.213	Torque-limited alarm output
AL.220	Encoder Battery Warning When power-on initialization occurs, the battery voltage is less than3.3V caused, please replace the battery

	in time. Use the AF.CEN function to clear the alarm
AL.221	Encoder battery failure The current encoder battery voltage is lower than 2.8V, please replace the battery The encoder battery is disconnected from the encoder. Use the AF.CEE function to clear the alarm When this alarm occurs, the multi-turn encoder data of the drive is already incorrect, and the zero point needs to be reset
AL.222	Encoder multi-turn data alarm It occurs during power-on initialization, usually due to the previous disconnection of the encoder battery and the encoder. The battery voltage is too low or the battery cable is abnormal Use the AF.CEN function to clear the alarm When this alarm occurs, the multi-turn encoder data of the drive is already incorrect, and the zero point needs to be reset
AL.230	Overspeed alarm
AL.231	The speed regulator output is saturated Check if the crash is caused Check that the P06.00, P06.01 parameters are set correctly Check that the power cable and the encoder extension cable are properly connected
AL.240	Position is out of tolerance Check that the power cable is properly connected Check that the electronic gear ratio parameters are set correctly Check that the frequency of the pulse input exceeds the maximum speed of the motor
AL.250	No braking feedback The brake feedback circuit of the drive is abnormal, replace the drive or contact the after-sales.
AL.251	Brake timeout Please connect the braking resistor or check whether the resistance of the braking resistor is normal Check that the input AC voltage is within the operating voltage range of the driver calibration
AL.252	Limit input abnormal Because the positive and negative limits take effect at the same time, please check the limit sensor and its input port polarity settings
AL.253	Braking voltage setting value is too large Please check whether the parameter setting value of P01.27 meets the requirements of the manual
AL.260	Analog input channel 1 zero drift setting is abnormal
AL.261	Analog input channel 2 zero drift setting is abnormal

Chapter 10 Appendix

Appendix A List of relationship between drive LED display parameters and object dictionary

Group P00:

LED Parameter	Object dictionary	Name	Setting range	Unit	Factory setting
P00.00	0x2000-01	Motor ID	0～65535	-	40604
P00.01	-	Driver ID	-	-	Display
P00.02	0x2001:01	MCU Software version number	-	-	Display
P00.03	0x2001:02	FPGA Software version	-	-	Display
P00.04	0x2001:03	EtherCAT Software version	-	-	Display
P00.05	-	Driver hardware version	-	-	Display
P00.06	-	CAN Software version	-	-	Display
P00.07	-	Software non-standard ID	-	-	Display
P00.08	-	Hardware non-standard ID	-	-	Display
P00.17	0x2000:02	Rated power	1～65535	0.01KW	40
P00.18	0x2000:03	Rated voltage	1～380	V	220
P00.19	0x2000:04	Rated current	1～65535	0.1A	28
P00.20	0x2000:05	Rated speed	100～6000	RPM	3000
P00.21	0x2000:06	Maximum speed	100～6000	RPM	5000
P00.22	0x2000:07	Rated torque	1～65535	0.01Nm	127
P00.23	0x2000:08	Maximum torque	1～65535	0.01Nm	382
P00.24	0x2000:09	Moment of inertia-JM	1～65535	0.01kgcm	63
P00.25	0x2000:0A	Motor pole pairs	2～360	pole pairs	5
P00.26	0x2000:0B	Stator resistance	1～65535	0.001Ω	7100
P00.27	0x2000:0C	Stator inductance-Lq	1～65535	0.01mH	1450
P00.28	0x2000:0D	Stator inductance-Ld	1～65535	0.01mH	1450
P00.29	-	Linear back-EMF coefficient	1～65535	0.01mv/rpm	3530
P00.30	0x2000:0E	Torque coefficient-Kt	1～65535	0.01Nm/Arms	55
P00.31	-	Electrical time constant-Te	1～65535	0.01ms	360
P00.32	-	Mechanical time constant-Tm	1～65535	0.01ms	360
P00.34	0x2002:01	Encoder Type	0～4	-	2
P00.35/P00.36	0x2002:02	Absolute encoder offset	0～1073741824	P	0
P00.37	0x2002:03	Absolute encoder resolution	0～65535	bit	17
P00.38	-	Incremental encoder resolution	-	P/r	-
P00.39	-	Z-phase signal offset pulse number of incremental encoder	-	P	-

P00.40	-	U-phase rising edge offset pulse number of incremental encoder	-	P	-
P00.41	0x2002:04	Prohibit multi-turn absolute encoder battery failure alarm function	0～1	-	0
P00.42	0x2002:05	Multi-turn absolute encoder multi-turn resolution	0～24	bit	16
P00.43	0x2002:06	Percentage of shaft current when power-on	0～100	%	90
P00.44	0x2002:07	Set the current position as the origin	0～1	-	0
P00.45/P00.46	0x2002:08	Set the encoder single-turn value of the mechanical zero position	0～16777216	P	0
P00.47/P00.48	0x2002:09	Set the encoder multi-turn value of the mechanical zero position	-16777216～16777216	circle	0
P00.49	0x2002:0A	Prohibit updating the position command according to the encoder position	0～1	-	0
P00.50/P00.51	-	Frequency division output gear ratio numerator	-	-	-
P00.52/P00.53	-	Frequency division output gear ratio denominator	-	-	-
P00.54	-	Frequency division output AB phase swap	-	-	-
P00.55	-	Encoder EEPROM version number	-	-	-
P00.56	-	Rotation mode enable / frequency division output Z-phase width	-	-	-
P00.57	-	Frequency division output Z-phase signal polarity	-	-	-
P00.58	-	Frequency division output Z-phase offset	-	P	-

Group P01:

LED Parameter	Object dictionary	Name	Setting range	Unit	Factory setting
P01.00	0x2003:01	Control mode selection	0～3	-	3
P01.01	0x2003:02	Direction selection	0～1	-	0
P01.02	-	Servo forced enable	-	-	-
P01.20	0x2003:03	The minimum value of braking resistance allowed by the drive	-	Ω	30
P01.21	0x2003:04	Power of Built-in brake resistance	-	W	40
P01.22	0x2003:05	Value of Built-in brake resistance	-	Ω	200
P01.23	0x2003:06	Heat dissipation coefficient of resistance	1～100	%	20
P01.24	0x2003:07	Resistance selection : 0-IN/1-EX	0～1	-	0
P01.25	0x2003:08	Power of external brake resistance	1～65535	W	100
P01.26	0x2003:09	Value of external brake resistance	1～1000	Ω	50
P01.27	0x2003:0A	Energy consumption brake opening voltage	50～400	V	370
P01.28	0x2003:0B	Energy consumption braking feedback detection function is prohibited	0～1	-	0
P01.29	0x2003:0C	Maximum duration of energy consumption brake	1～65535	ms	3000
P01.33	0x2003:0D	Emergency stop deceleration time constant	-	ms	-
P01.34	-	User password	0～65535	-	512
P01.35	-	Panel initial display function setting	0～99	-	1
P01.36	0x2003:0F	Servo enable delay off	0～65535	ms	50
P01.37	-	Speed loop saturation output detection time	0～65535	10ms	200

P01.39	-	Encoder disconnection detection function prohibited	-	-	-
P01.42	-	Detection point at the beginning of instruction overload	1～300	%	100
P01.43	-	Instruction overload peak detection point	1～300	%	300
P01.44	-	Instruction overload detection point	1～65535	10ms	200
P01.45	-	Initial detection point of thermal overload	1～300	%	100
P01.46	-	Thermal overload peak detection point	1～300	%	300
P01.47	-	Thermal overload detection time	1～65535	10ms	200
P01.48	-	Overvoltage alarm threshold	220～399	V	380
P01.49	-	Undervoltage alarm threshold	85～399	V	141

Group P02:

LED Parameter	Object dictionary	Name	Setting range	Unit	Factory setting
P02.00	0x2004:01	IN1 Terminal function selection	0～31	-	0
P02.01	0x2004:02	IN1 Terminal logical selection	0～1	-	0
P02.02	0x2004:03	IN2 Terminal function selection	0～31	-	30
P02.03	0x2004:04	IN2 Terminal logical selection	0～1	-	0
P02.04	0x2004:05	IN3 Terminal function selection	0～31	-	31
P02.05	0x2004:06	IN3 Terminal logical selection	0～1	-	0
P02.06	0x2004:07	IN4 Terminal function selection	0～31	-	5
P02.07	0x2004:08	IN4 Terminal logical selection	0～1	-	0
P02.08	0x2004:09	IN5 Terminal function selection	0～31	-	6
P02.09	0x2004:0A	IN5 Terminal logical selection	0～1	-	0
P02.10	0x2004:0B	IN6 Terminal function selection	0～31	-	23
P02.11	0x2004:0C	IN6 Terminal logical selection	0～1	-	0
P02.12	0x2004:0D	IN7 Terminal function selection	0～31	-	0
P02.13	0x2004:0E	IN7 Terminal logical selection	0～1	-	0
P02.14	0x2004:0F	IN8 Terminal function selection	0～31	-	11
P02.15	0x2004:10	IN8 Terminal logical selection	0～1	-	0
P02.16	-	IN9 Terminal function selection	-	-	-
P02.17	-	IN9 Terminal logical selection	-	-	-
P02.32	0x2005:01	OUT1 Terminal function selection	0～31	-	4
P02.33	0x2005:02	OUT1 Terminal logical selection	0～1	-	0
P02.34	0x2005:03	OUT2 Terminal function selection	0～31	-	1
P02.35	0x2005:04	OUT2 Terminal logical selection	0～1	-	0
P02.36	0x2005:05	OUT3 Terminal function selection	0～31	-	2
P02.37	0x2005:06	OUT3 Terminal logical selection	0～1	-	0
P02.38	0x2005:07	OUT4 Terminal function selection	0～31	-	0
P02.39	0x2005:08	OUT4 Terminal logical selection	0～1	-	0

P02.40	-	OUT5 Terminal function selection	-	-	-
P02.41	-	OUT5 Terminal logical selection	-	-	-
P02.42	-	OUT6 Terminal function selection	-	-	-
P02.43	-	OUT6 Terminal logical selection	-	-	-
P02.52	-	IN Terminal force active	0～65535	-	0
P02.53	-	OUT Terminal force active	0～65535	-	0
P02.54/P02.55	-	Input function flag register	-	-	display
P02.56/P02.57	-	Input function on flag register	-	-	display
P02.58/P02.59	-	Input function shutdown flag register	-	-	display
P02.60/P02.61	-	Output function flag register	-	-	display
P02.62	-	Output enable control register	0～65535	-	-
P02.63	-	Output status control register	0～65535	-	-
P02.64	-	AI1 offset	-	mV	-
P02.65	-	AI1 filter cutoff frequency	-	Hz	-
P02.66	-	AI1 dead zone	-	mV	-
P02.67	-	AI1 zero drift	-	mV	-
P02.68	-	AI2 offset	-	mV	-
P02.69	-	A2 filter cutoff frequency	-	Hz	-
P02.70	-	A2 dead zone	-	mV	-
P02.71	-	AI2 zero drift	-	mV	-
P02.72	-	AI1 digital sampling value	-	-	-
P02.73	-	AI2 digital sampling value	-	-	-
P02.74	-	AI1 input voltage	-	mV	-
P02.75	-	AI2 input voltage	-	mV	-
P02.76	-	AI1 processed voltage	-	mV	-
P02.77	-	AI2 processed voltage	-	mV	-
P02.78	-	Speed value corresponding to 10V voltage	-	RPM	-
P02.79	-	Torque corresponding to 10V voltage	-	%	-
P02.80	-	Calibrate AI1/AI2 channel zero drift	-	-	-
P02.81	-	AI1/AI2 channel dead zone processing method	-	-	-

Group P03:

LED Parameter	Object dictionary	Name	Setting range	Unit	Factory setting
P03.00	-	Position command source	0～10	-	3
P03.02	-	Pulse command type	0～3	-	0
P03.03	-	Pulse input port filtering	-	-	-
P03.04	-	Pulse smoothing filter	1～2048	100us	1
P03.06/P03.07	-	Subdivision	0～1048576	P/r	0

P03.08/P03.09	0x6091:01	Electronic gear ratio numerator 1	1～1072741824	-	1
P03.10/P03.11	0x6091:02	Electronic gear ratio denominator 1	1～1072741824	-	1
P03.12/P03.13	-	Electronic gear ratio numerator 2	-	-	-
P03.14/P03.15	-	Electronic gear ratio denominator 2	-	-	-
P03.20	0x6068	In-position signal establishment time	0～65535	ms	10
P03.21	0x2006:07	In-position deviation threshold unit	0～1	-	0
P03.22	0x6067	Positioning completion threshold	1～65535	P	92
P03.23	0x2006:01	Offline position deviation processing mode	0～1	-	0
P03.25/P03.26	0x6065	Alarm threshold for excessive position deviation	0～1073741824	P	393216
P03.28/P03.29	-	Step operation command pulse number	-1073741824～1073741824	P	10000
P03.30	-	Maximum speed of stepping	0～6000	RPM	1000
P03.31	-	Stepping operation acceleration time constant	1～65535	ms	200
P03.32	-	Stepping operation deceleration time constant	1～65535	ms	200
P03.40	-	Home position return enable control	-	-	0
P03.41	0x2006:02	Home position return mode	0～6	-	0
P03.42	-	High-speed search for the speed of the origin switch signal	-	RPM	-
P03.43	-	Low-speed search for the speed of origin switch signal	-	RPM	-
P03.44	-	Search for the acceleration/deceleration time constant of the origin switch signal	-	ms	-
P03.45	0x2006:03	Limit the time to find the origin	0～65535	ms	0
P03.46/P03.47	-	Machine origin offset	-	P	-
P03.49	-	Mechanical origin offset and limit processing method	-	-	-
P03.50	-	Touch stop and return to zero detection time	-	ms	-
P03.51	-	Touch stop and return to zero detection speed	-	RPM	-
P03.52	-	Touch stop and return to zero torque limit	-	%	-

Group P04:

LED Parameter	Object dictionary	Name	Setting range	Unit	Factory setting
P04.00	-	Speed command source	0～10	-	2
P04.01	-	Speed command digital given value	-	RPM	-
P04.02	-	Speed command analog input channel selection	-	-	-
P04.04	0x2007:01	Jog speed	0～6000	RPM	100
P04.05	-	Acceleration time constant of digital given command source	1～65535	ms	100
P04.06	-	Deceleration time constant of digital given command source	1～65535	ms	100
P04.12	-	Speed reaches window	0～65535	p/s	10
P04.13	-	Speed arrival time window	0～65535	ms	10
P04.16	-	Speed mode jog forward speed	-	RPM	-
P04.17	-	Speed mode jog reversal speed	-	RPM	-

P04.18	-	Speed mode jog acceleration time constant	-	ms	-
P04.19	-	Speed mode jog deceleration time constant	-	ms	-
P04.20	-	Position mode jog forward speed	-	RPM	-
P04.21	-	Position mode jog reversal speed	-	RPM	-
P04.22	-	Position mode acceleration time constant	-	ms	-
P04.23	-	Position mode deceleration time constant	-	ms	-
P04.24/P04.25	-	Position mode fixed-length stroke	-	p	-
P04.55	-	QHJX customization-synchronization speed	-	-	-
P04.56	-	QHJX customization-synchronous mode	-	-	-
P04.57	-	QHJX customization-running status	-	-	-
P04.58	-	QHJX customization-delayed start time	-	-	-
P04.59	-	QHJX customization-actual speed	-	-	-
P04.60/P04.61	-	Number of pulses for commissioning operation	0～1073741824	P	50000
P04.62	-	Debug running speed	0～6000	RPM	1000
P04.63	-	Debug running acceleration time constant	1～65535	ms	100
P04.64	-	Debug running deceleration time constant	1～65535	ms	100
P04.65	-	Movement demonstration mode setting	0～1	-	0
P04.66	-	Movement demonstration starting direction	0～1	-	0
P04.67	-	Number of movement demonstration runs	0～65535	-	0
P04.68	-	Open loop running speed	0～3000	RPM	100
P04.69	-	Open loop running acceleration	1～100	r/s^2	10
P04.70	-	Open loop running deceleration	1～100	r/s^2	10
P04.71	-	Open loop operating torque	0～100	%	50
P04.72	-	Open loop operation start command	0～6	-	0
P04.73	-	Lock shaft operating angle	0～65535	P	0
P04.74	-	Operating torque of lock shaft	0～100	%	50
P04.75	-	Lock shaft operation start command	0～2	-	0
P04.76	-	Encoder calibration speed	1～100	RPM	10
P04.77	-	Encoder calibration acceleration	1～10	r/s^2	1
P04.78	-	Encoder calibration deceleration	1～10	r/s^2	1
P04.79	-	Encoder calibration torque	0～100	%	85
P04.80	-	Encoder calibration start command	0～3	-	0
P04.81	-	Encoder failure counter: insufficient received data	-	-	display
P04.82	-	Encoder failure counter: received data is empty	-	-	display
P04.83	-	Encoder failure counter: receive CRC	-	-	display
P04.84	-	Encoder failure counter: receiving serial port	-	-	display
P04.85	-	Encoder failure counter: continuous error	-	-	display

Group P05:

LED Parameter	Object dictionary	Name	Setting range	Unit	Factory setting
P05.00	-	Torque command source A	0～2	-	0
P05.01	-	Torque command source B	0～2	-	0
P05.02	-	Torque command source selection	0～9	-	0
P05.03	-	Torque command button setting value	-3000～3000	0.1%	500
P05.04	0x6072	Motor overload factor	500～3000	0.1%	3000
P05.05	-	Torque command ramp	1～65535	0.1%/s	0
P05.06	0x2008:03	Torque command limit source selection	0～4	-	0
P05.07	-	Analog channel torque limit source selection	-	-	-
P05.08	0x2008:04	Torque command internal positive torque limit	0～3000	0.1%	3000
P05.09	0x2008:05	Torque command internal negative torque limit	0～3000	0.1%	3000
P05.10	-	Torque command external positive torque limit	-	0.1%	-
P05.11	-	Torque command external negative torque limit	-	0.1%	-
P05.12	0x2008:07	Torque mode speed limit source	0～2	-	0
P05.13	-	Torque mode analog limit source selection	-	-	-
P05.14	0x2008:08	Torque mode speed limit 1	0～6000	RPM	3000
P05.15	0x2008:09	Torque mode speed limit 2	0～6000	RPM	3000
P05.16	0x2008:0A	Torque reaches the reference value	0～3000	0.1%	0
P05.17	0x2008:0B	Torque reaches effective value	0～3000	0.1%	0
P05.18	0x2008:0C	Torque reaches invalid value	0～3000	0.1%	0
P05.19	0x2008:0D	Torque arrival detection time	0～65535	ms	50
P05.20	-	Torque reaches the set value of communication	-3000～3000	0.1%	200
P05.21	-	Torque mode acceleration time constant	1～65535	ms	100
P05.22	-	Torque mode deceleration time constant	1～65535	ms	100
P05.23	-	Torque mode hold time	0～65535	ms	500
P05.24	-	Torque mode shutdown mode setting	0～3	-	0
P05.25	-	Torque mode communication start	0～2	-	0
P05.26	-	Torque working mode selection	0～65535	-	0
P05.33	-	Torque limit detection time	0～65535	ms	0

Group P06:

LED Parameter	Object dictionary	Name	Setting range	Unit	Factory setting
P06.00	0x2009:01	Speed proportional gain 1	0～50000	-	4000
P06.01	0x2009:02	Speed integral time constant 1	1～10000	-	1500
P06.02	0x2009:03	Position proportional gain 1	0～5000	-	800

P06.03	0x2009:04	Speed proportional gain 2	0～50000	-	4000
P06.04	0x2009:05	Speed integral time constant 2	1～10000	-	1500
P06.05	0x2009:06	Position proportional gain 2	0～5000	-	800
P06.06	0x2009:07	Speed Kd	0～50000	-	0
P06.07	0x2009:08	Speed Kr	0～50000	-	1000
P06.08	0x2009:09	Speed Km	0～50000	-	0
P06.09	-	Position Ki	0～50000	-	0
P06.10	-	Position kd	0～50000	-	0
P06.13	0x2009:0A	Load moment of inertia ratio	0～65535	-	100
P06.14	0x2009:0B	Speed feedforward filter time constant	1～10000	ms	2000
P06.15	0x2009:0C	Speed feedforward gain	0～1000	-	0
P06.16	0x2009:0D	Torque feedforward filter time constant	1～10000	ms	2000
P06.17	0x2009:0E	Torque feedforward gain	0～1000	-	0
P06.19	0x2009:10	Speed feedback low-pass filter cut-off frequency 1	1～10000	Hz	1000
P06.20	0x2009:11	Speed feedback low-pass filter cut-off frequency 2	1～10000	Hz	2000
P06.24	0x2009:13	Current given low-pass filter cut-off frequency 1	1～10000	Hz	3000
P06.25	-	Current given low-pass filter cut-off frequency 2	1～10000	Hz	0
P06.26	0x2009:14	Current feedback low-pass filter cut-off frequency 1	1～10000	Hz	3000
P06.27	-	Current feedback low-pass filter cut-off frequency 2	1～10000	Hz	0
P06.28	0x2009:15	Current proportional gain	0～50000	-	800
P06.29	0x2009:16	Current integration time constant	1～10000	-	500
P06.30	-	PVIA_KP	0～50000	-	1000
P06.31	-	PVIA_KI	0～50000	-	100
P06.32	-	PVIA_KV1	0～50000	-	100
P06.33	-	PVIA_KV2	0～50000	-	100
P06.34	-	PVIA_KA	0～50000	-	0
P06.35	-	PVIA_KVFF	0～50000	-	0
P06.36	-	PVIA_KAFF	0～50000	-	0
P06.37	-	PVIA given speed filter cut-off frequency	1～10000	Hz	1000
P06.38	-	Filter cut-off frequency of given acceleration	1～10000	Hz	1000
P06.39	-	Feedback acceleration filter cut-off frequency	1～10000	Hz	1000
P06.40	-	Motion control algorithm selection	0～1	-	0

Group P08:

LED Parameter	Object dictionary	Name	Setting range	Unit	Factory setting
P08.00	-	RS485 device address	-	-	-
P08.01	-	RS485 baud rate	-	-	-

P08.02	-	RS485 data format	-	-	-
P08.05	-	CAN device address	-	-	-
P08.06	-	CAN baud rate	-	-	-
P08.07	-	CAN disconnection detection time ms	-	-	-
P08.30	-	RS232 device address	-	-	-
P08.31	-	RS232 baud rate	-	-	-
P08.32	-	RS232 data format	-	-	-

Group P12:

LED Parameter	Object dictionary	Name	Setting range	Unit	Factory setting
P12.00	0x1010:01	Save parameters	0x65766173	-	0
P12.01	-	Read parameters	0～1	-	0
P12.02	0x1011:01	Reset	0x64616F6C	-	0
P12.03	-	Clear alarm fault	0～1	-	0
P12.04	-	Reset the encoder single-turn value	0～1	-	0
P12.05	-	Reset the encoder multi-turn value and fault	0～1	-	0
P12.06	-	Reset encoder fault	0～1	-	0
P12.07	-	Reset MCU	0～1	-	0
P12.08	-	Clear fault record	0～1	-	0
P12.09	-	Internal motion command mode	0～1	-	0
P12.10	-	Internal motion command	0～9	-	6
P12.11	-	Internal motion mode	0～1	-	0
P12.12	-	Internal demo mode delay	0～65535	ms	200
P12.13	-	Internal demo start command	0～1	-	0
P12.14	-	Clear position error	0～1	-	0
P12.15	-	Current step test	0～1	-	0
P12.16	-	Data sampling channel 1	0～30	-	0
P12.17	-	Data sampling channel 2	0～30	-	0
P12.18	-	Data sampling depth	0～65535	-	0
P12.19	-	Data sampling flag	0～1	-	0
P12.20	-	Save encoder parameters	0～1	-	0
P12.21	-	Brake test	0～1	-	0

Group P13:

LED Parameter	Object dictionary	Name	Setting range	Unit	Factory setting
P13.00	-	Operating status	-	-	display
P13.01	-	Motor speed	-	rpm	display

P13.02	-	Speed command	-	rpm	display
P13.03	-	Motor torque	-	%	display
P13.04	-	Torque command	-	%	display
P13.07/P13.08	-	Position command counter	-	command unit	display
P13.09/P13.10	-	Position command counter	-	encoder unit	display
P13.11/P13.12	-	Position feedback counter	-	encoder unit	display
P13.13/P13.14	-	Position deviation counter	-	command unit	display
P13.15/P13.16	-	Position deviation counter	-	encoder unit	display
P13.17	-	Position command speed	-	rpm	display
P13.18	-	Position command frequency	-	KHz	display
P13.19	-	Input signal monitoring	-	-	display
P13.20	-	Output signal monitoring	-	-	display
P13.21/P13.22	-	The current mechanical angle of the motor	-	encoder unit	display
P13.23	-	The current electrical angle of the motor	-	degree	display
P13.24	-	The current voltage value of the drive	-	V	display
P13.25/P13.26	-	Encoder status register	-	-	display
P13.27/P13.28	-	Input pulse counter	-	command unit	display
P13.29	-	Divided output pulse counter	-	command unit	display
P13.30/P13.31	-	Actual value of current position	-	command unit	display
P13.32/P13.33	-	Target position	-	command unit	display
P13.36	-	Current fault code	-	-	display