D5V EtherCAT Series Low Voltage Servo Drive User Manual

Shenzhen Rtelligent Technology Co., Ltd

Perface

Thank you for purchasing the D5V EtherCAT series V5.0 servo drive!

D5V EtherCAT series V5.0 servo drive is the 5th generation bus-type AC servo drive independently developed by Rtelligent. The power range of this series of products is 0.4~1.5KW, supports CoE (CANopen over EtherCAT), and can be networked. The drive also contains an internal PLC mode to facilitate customer customization.

The D5V EtherCAT 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 dimension and high speed precise positioning.

The D5V EtherCAT series servo system has the characteristics of fast positioning and good adaptability. The drive 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 drive's "internal PLC programming".

This manual is a comprehensive user manual for the D5V EtherCAT series V5.0 servo drive. Please read this manual carefully to confirm the relevant information before the formal power-on connection. If you have any doubts about the functions and performance of the product, please consult our technical support.

As we are committed to the continuous improvement of servo drives, the information provided by the company is subject to change without prior notice.

Revision History

Date	Version	Description
2024.11.29	V5.0	Version 5 product updates
2025.02.28	V5.1	Modified other errors

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1. Safety Instructions

1.1. Safety Precaution

- Please disconnect the power supply for more than 5 minutes before removing or disassembling the drive, otherwise it may cause electric shock due to residual voltage.
- Please never touch the inside of the servo drive, 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 drive.
- 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 drive, 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 drive, 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 drive (single-phase L1, L2), 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 drive 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. Unpacking Inspection

Items	Description
Check whether the delivered products comply with you ordered.	The packaging box contains the products you ordered. Please confirm it by the nameplate model of the servo motor and servo drive.
Check whether the products are intact.	Please check the product 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.
Check whether the motor is rotating smoothly	It is normal to be able to turn gently by hand. Except for servo motors with brakes.

1.3. Packing List

NO.	Products
1	D5V EtherCAT servo drive * 1
2	Low voltage servo motor * 1
3	Motor matching power extension cable * 1
4	Motor matching encoder extension cable*1
5	Brake extension cable for brake motor * 1 (special for motor with brake) (optional)
6	Communication cable for drive debugging software*1 (optional)

2. Product Information

2.1. Drive Introduction

2.1.1. Drive Naming

D	5	V	120	E
①	②	③	④	⑤

① Product Series	③ Voltage level	⑤ Product type
R: R series servo S: S series servo (cost-effective) D: D series low-voltage DC servo	L: 220V AC H: 380V AC D: 110V AC V: 24V~70V DC	Null: Pulse E: EtherCAT C: CANopen + RS485 Modbus
② Product version	④ rated current	
5: 5th generation servo	120: 12A 250: 25A 380: 38A	

◆ Note: Model naming rules are only used to resolve model meanings.

2.1.2. Drive Specification

(1) Basic specification

Drive model	D5V120C	D5V250C	D5V380C
Communication	EtherCAT		
Overload capacity	Supports 3x overload		
Adaptive power	400W	750W	1500W
Rated current	12A （No auxiliary heat dissipation 12A）	25A (No auxiliary heat dissipation 20A）	38A (No auxiliary heat dissipation 30A）
Maximum current	36A	75A	114A
Power supply	DC 24~70V		
Size code	Type A		
Size	175*98*33		
Braking resistor function	Braking resistor external		

(2) Electrical specification

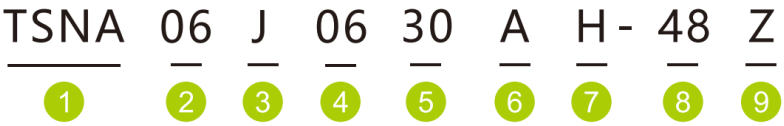
Item		Description
Control mode		IPM PWM control, SVPWM drive mode
Encoder feedback		Absolute encoder
Isolation function		Power/communication isolation; encoder input isolation; digital input/output isolation
Protection function		Overvoltage, undervoltage, overcurrent, overload, overheat, overspeed, communication abnormal, register abnormal, encoder errors, etc
Parameter setting		Key or RTServoStudio software
Power-off hold		Keep all optional parameters
Speed variation rate (at rated speed)	Load variation rate	0~100%: less than 0.1%
	Voltage variation rate	Rated voltage ±10%: 0%
	Temperature variation rate	25±25℃: less than ±0.1%
Digital input (4-way DI)		Positive travel limit, negative travel limit, latch signal, origin signal, etc. ◆ Note: The pin function can be assigned through the software configuration parameters, and the valid logic level can be entered
Digital output (4-way DO)		Servo ready, alarm output, brake release, command complete output, positioning complete output, speed reached, torque limit reached, etc. ◆ Note: Pin functions can be assigned by software configuration parameters to output valid logic levels
EtherCAT communication	Communication protocol	EtherCAT protocol
	Support services	COE (PDO, SDO)
	Synchronization method	Dc-distributed clock
	Physical layer	100base-TX
	Baud rate	100Mbit/s
	Duplex mode	Full duplex
	Topological structure	Linear, circular

	Transmission media	Shielded Category 5e or Category 6 or higher electrical performance specifications network cables
	Transmission distance	Less than 100M between two nodes (good environment, good cable)
	Slave station number	Protocol support up to 65535, the actual use of not more than 100
	EtherCAT frame length	The value ranges from 44 to 1498 bytes
	Process data	A single Ethernet frame has a maximum of 1486 bytes
	Synchronous jitter of two slave stations	<1us
	Refresh time	1000 switch input and output about 30us; 100 servo shafts about 100us; Define different refresh times for different interfaces.
	Bit error rate of communication	10^{-10} ethernet standard
EtherCAT configuration unit	Storage synchronization management unit	8 units
	Process data RAM	8KB
	Distributed clock	64
	E2PROM capacity	32kbit
Soft start/stop		Can be set 0~10s/1000rpm acceleration and deceleration
S-curve acceleration/deceleration		The acceleration and deceleration time of S-curve can be set in PP and PV mode
Homing function		Speed, acceleration and origin reset method can be specified, and 25 homing modes are supported.
Probe function		With a high-speed digital input position latch signal as the event trigger signal, the current axis position can be stored for the parameterized event along the effective, the position data will be stored by the control system immediately, there will be no delay caused by missing trigger.

Braking resistor protection function		The resistance and power of the internal and external braking resistors can be set to automatically calculate the output duty cycle that limits the discharge of the braking tube, preventing damage to the drive and braking resistor due to overheating.
Absolute value multi-turn data clearing		The multi-turn data of the encoder can be cleared through the upper computer communication or the key panel.
Optional Whether to store the parameter in EEPROM		Communication change parameters can be set to save directly to EEPROM
Monitoring function		Internal oscilloscope, on Windows application software, can monitor operating parameters, such as speed, position, voltage, current, etc
Command smoothing mode		Speed control mode: low-pass filtering, smoothing time constant 0~2500 (x10us)
Torque limit (speed control mode)		Internal parameters
Speed limit (torque control mode)		
Feedforward compensation		0~1000‰ (set resolution 1‰)
In-place error setting		0~32767 command unit (set resolution to 1 command unit)
Electronic gear ratio	N	1/200<N/M<200。
	M	

2.2 Motor Introduction

2.2.1 Motor Naming



1 Serial Name
A:Five pairs of poles, sliver

2 Motor flange size
06:60mm 13:130mm

3 Encoder code
J:17bit magnetic unicyclic absolute encoder
G:17bit magnetic multiturn absolute encoder
L:23bit optical multiturn absolute encoder

4 Motor rated torque
06:0.6Nm 13:1.3Nm

5 Motor rated speed
30:3000rpm

6 Is there an oil seal
A: With oil seal inside
None: No oil seal inside

7 Motor power connector code
Optional

8 Motor rated voltage
48:48V

9 Brake code
Z: With brake

◆ Note: Model naming rules are only used for model meaning analysis. For specific optional models, please refer to the details page.

2.2.2 Motor Specification

(1) Basic Specification

Frame (mm)	Model	power	Motor Length (mm)	Motor length with brake (mm)
40	TS□A-04J0130A-48	50W	61.5	-
	TS□A-04J0330A-48	100W	81.5	110
60	TS□A-06J0630A-48	200W	80	109
	TS□A-06J1330A-48	400W	98	127
80	TS□A-08J2430A-48	750W	107	144
	TS□A-08J3230A-48	1000W	127	163
	TS□A-13J5030A-48	1.5KW	148	172

◆ Note: The encoder comes standard with 17-bit magnetic encoding, 23-bit optical encoding is optional, and multi-turn absolute value specifications are optional.

(2) Electrical specification

Item	Description
Rated Voltage	48VDC
Encoder Type	17bit magnetic encoder / 23bit optical encoder optional

2.2.3 Encoder Type

(1) Encoder specification

Encoder code	Description
J	17-bit single-turn magnetic absolute encoder
H	23-bit single-turn optical absolute encoder
G	17-bit multi-turn magnetic absolute encoder
L	23-bit multi-turn optical absolute encoder

(2) Encoder performance instruction

◆ 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 drive. 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.

- The absolute encoder can feedback 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 occasions with high precision and precise positioning.
- 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 Braking Resistor Introduction

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 drive. 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. When the drive with resistance is not enough to absorb the braking energy consumption, the user can connect a proper external braking resistor.

(1) Braking resistor specification

Drive model	D5V120E	D5V250E	D5V380E
Adaptive motor power	50W~400W	750W	1KW~2.3KW
Continuous current	12A	25	38A
Maximum current	36A	75A	114A
Allowable braking power	-	400W	
Minimum resistance of external braking resistor	-	3Ω	

(2) 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 drive bus capacitor cannot meet the discharge requirements, an appropriate external braking resistor is required. 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.

2.4 Accessories

2.4.1 Motor & Encoder Cables

(1) Wiring matching table

1) AMP plug type motor (Frame 40/60/80mm)

◆ Note: motor cable model of 100W motor is SMS4-***.

Cable Type	Cable Length		
	3M	5M	8M
Motor cable	DMH4-030☐	DMH4-050☐	DMH4-080☐
Single-turn absolute encoder cable	SES4-030	SES4-050	SES4-080
Multi-turn absolute encoder cable	SES6-030	SES6-050	SES6-080
Brake cable	SBS2-030	SBS2-050	SBS2-080

2) Aviation plug type motor (Frame 110/130mm)

Cable Type	Cable Length		
	3M	5M	8M
Motor cable	DMH4-030☐	DMH4-050☐	DMH4-080☐
Single-turn absolute encoder cable	SEH4-030	SEH4-050	SEH4-080
Multi-turn absolute encoder cable	SEH6-030	SEH6-050	SEH6-080
Brake cable	SBH2-030	SBH2-050	SBH2-080

◆ Note: The standard length of the extension cable is 3 meters, if you need other sizes, please specify when ordering.

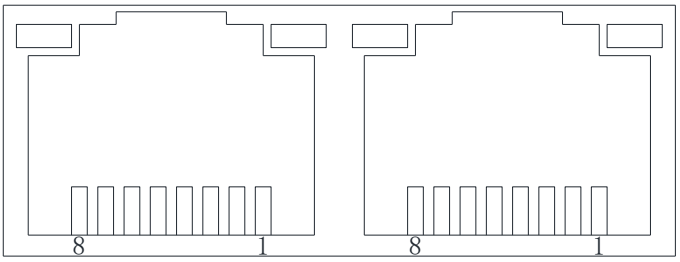
(2) Motor wiring requirements

- The motor power cable needs to meet certain current carrying requirements, The motor with frame 40/60/80mm shall use the wire diameter specification of $0.5\mathrm{mm}^2$ or above, and the motor with frame 110/130mm shall use the wire diameter specification of $0.75\mathrm{mm}^2$ or above.
- The encoder cable of motor needs to meet the requirements of shielding isolation, standard configuration $0.14\mathrm{mm}^2$ wire diameter, twisted pair, shielded cable.
- 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.

2.4.2 Type-C Debugging Cable

Please purchase your own Type-C debugging cable, and contact after-sales or go through official website to download the drive program.

2.4.3 EtherCAT Communication Cable



Signal		Pin	Function
Communication signal	TX+	1	Data sending +
	TX-	2	Data sending -
	RX+	3	data receiving +
	CAN_H	4	CAN communication port
	CAN_L	5	
	RX-	6	data receiving -
	DGND	7	GND signal
	-	8	-

3. Installation

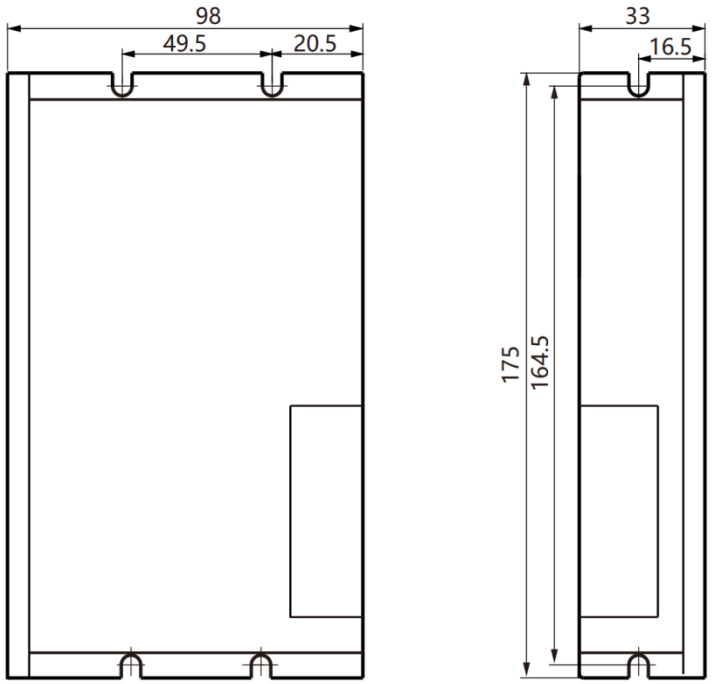
3.1. Drive Installation

3.1.1. Servo Environment

Item	Requirement
Working temperature	0℃ ~ +45℃
Storage temperature	-20℃ ~ +70℃
Ambient humidity	Work/Store ≤90% RH no condensation
Anti-Vibration	10~57Hz 3.5mm，57~150Hz 1g
Atmospheric environment	No corrosive gas, flammable gas, oil mist or dust, etc, 86-106kpa
Altitude	Less than 1000m

3.1.2. Dimension

(1) Type A: D5V120E，D5V250E，D5V380E（Unit:mm）



3.1.3. Installation Precaution

- Please install the drive in an electrical cabinet free from sunlight and rain.
- Do not place the drive 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 drive. Fix the servo drive firmly on the mounting surface through 2~4 mounting holes (the number of mounting holes varies according to the capacity). When installing, please face the front of the drive 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 drive failure.
- When multiple drives 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 drive, 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 drive.

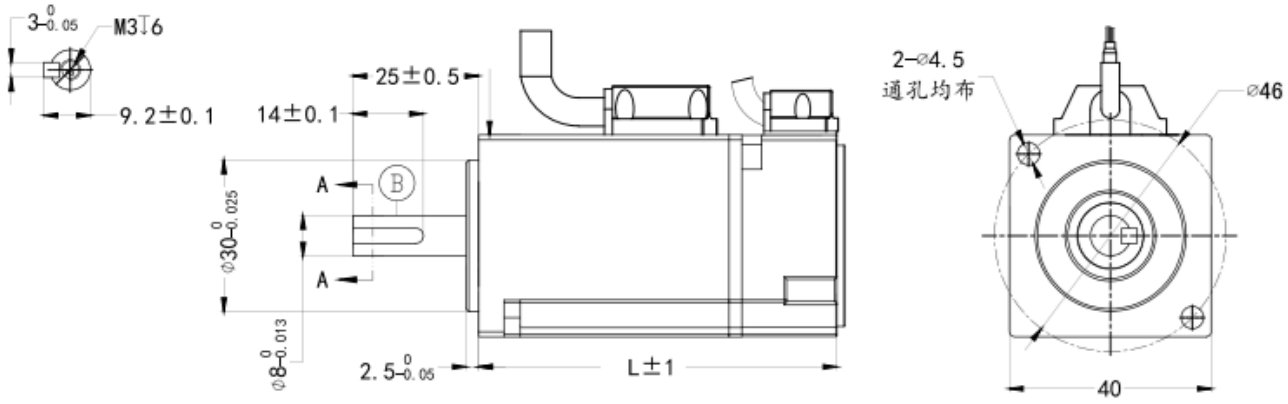
3.2. Motor Installation

3.2.1. Motor Environment

Item	Requirement
Ambient temperature	0～40°C
Storage temperature	-20～60°C
Ambient/storage humidity	Below 90%RH (free from condensation)
Vibration/impact	49m/s2 /196m/s2
Protection class	IP65
Altitude	Below 1000m

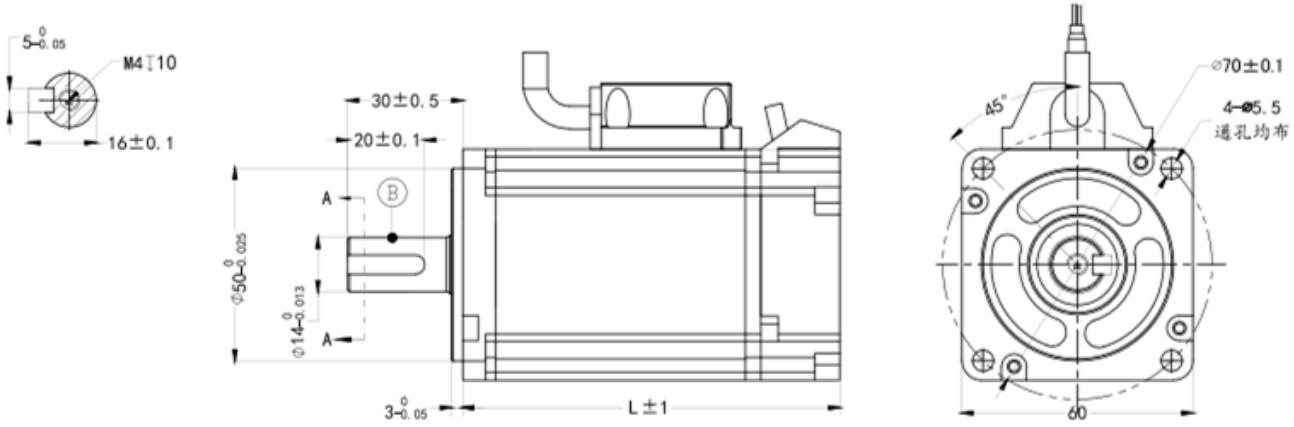
3.2.2. Dimension

(1) Frame 40mm (AMP plug outlet*)



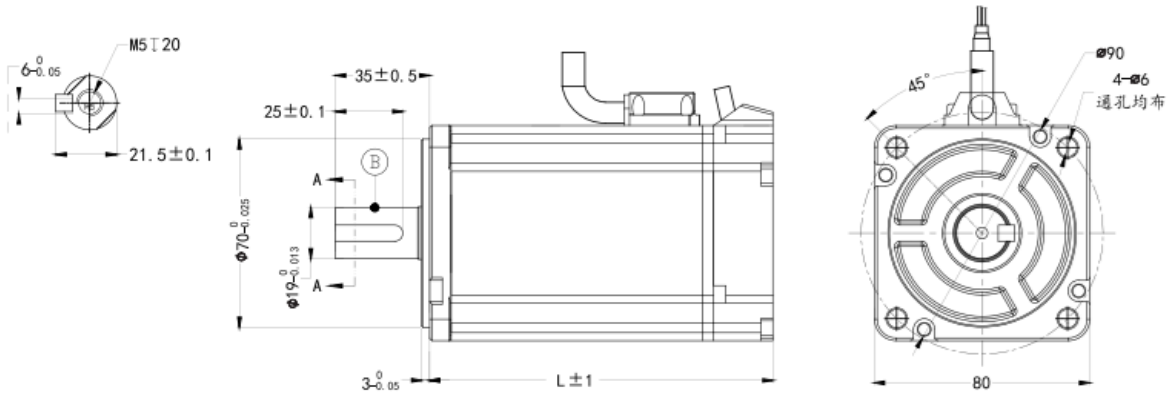
Description	Model	Length (mm)	Weight (Kg)
50W	TS□A-04J0130A-48	61.5	0.35
100W	TS□A-04J0330A-48	81.5	0.46
100W with brake	TS□A-04J0330A-48Z	110	0.66

(2) Frame 60mm (AMP plug outlet*)



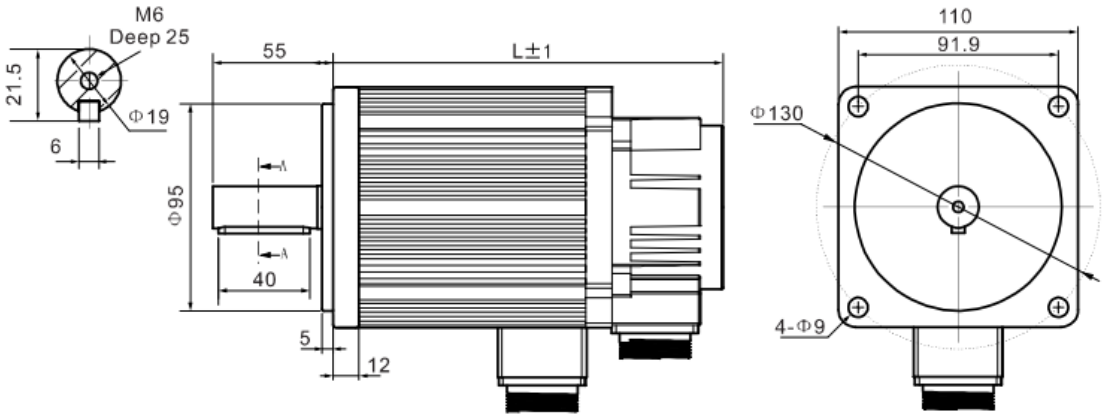
Description	Model	Length (mm)	Weight (Kg)
200W	TS□A-06J0630A-48	80	0.84
400W	TS□A-06J1330A-48	98	1.19
200W with brake	TS□A-06J0630A-48Z	109	1.21
400W with brake	TS□A-06J1330A-48Z	127	1.56

(3) Frame 80mm (AMP plug outlet*)



Description	Model	Length (mm)	Weight (Kg)
750W	TS□A-08J2430A-48	107	2.27
1000W	TS□A-08J3230A-48	127	2.95
750W with brake	TS□A-08J2430A-48Z	144	3.05
1000W with brake	TS□A-08J3230A-48Z	163	3.73

(4) Frame 110mm (Aviation plug outlet*)



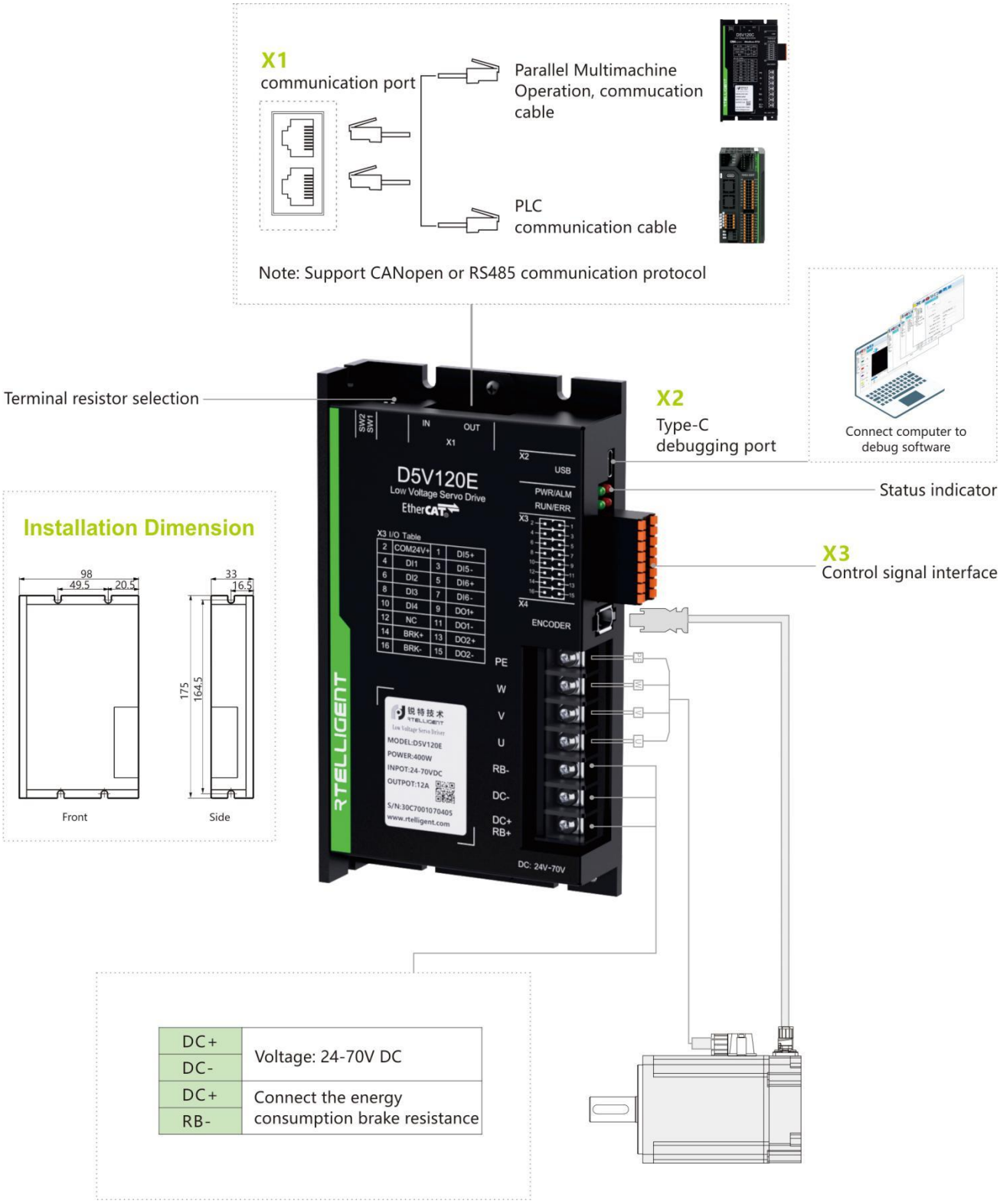
Description	Model	Length (mm)	Weight (Kg)
1.5KW	TS□A-13J5030A-48	148	6.5
1.5KW with brake	TS□A-13J6025A-Z	172	-

3.2.3. Installation Precaution

- Please ensure that the installation direction is perpendicular to the wall, and use natural air convection or a fan to cool the servo drive. By 2 ~ 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 drive 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 drive failure.
- When multiple drives 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 drive, 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 drive.

4. Wiring

4.1. Drive Interface & Connection



4.2. Main Circuit Input Interface

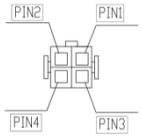
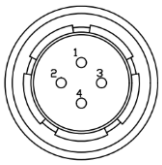
(1) Type A low voltage servo drive main loop input interface definition

Terminal mark	Name	Description
DC+	Power supply input terminal	Servo drive power supply input terminal within DC24-70V
DC-		
DC+	Braking resistor terminal	Connect to energy consumption braking resistor
Br-		
U	Low-voltage Servo Motor connection terminal	Low-voltage Servo motor connection terminals, must be connected to the U, V, W, and PE terminals of the motor
V		
W		
PE		

Circuit wiring precautions:

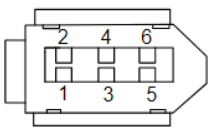
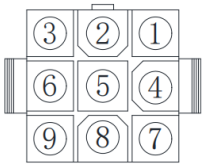
- Do not connect the input power cable to the output terminals U, V, W, otherwise the servo drive will be damaged.
- Do not pass the power cable and signal cable through the same pipe or bundle them together. To avoid interference, the distance between them should be more than 30cm.
- Do not turn on/off 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 drive 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 drive to the ground reliably, and the PE wire should be as thick as possible to ensure that the grounding resistance is less than 100Ω.
- 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 drive error occurs.
- Do not power on and use the servo drive when the terminal screws or cables are loose, otherwise it may cause a fire.

(2) Face the servo motor power extension cable motor side terminals, their terminal definition serial number as shown in the following schematic diagram

Connector	Pin	Definition
 Motor side (AMP connector)	1	U
	2	V
	3	W
	4	PE
 Motor side (Aviation connector)	1	PE
	2	U
	3	V
	4	W

4.3. Encoder Signal - X4

Face the servo side and motor side terminals of the servo encoder extension cable, and their terminal definition serial numbers are shown in the following schematic diagram:

Terminal mark	Connector	drive side	Motor side		Definition
			AMP connector	Aviation connector	
CN2	 drive side	1	2	7	Power output positive: +5V
		2	3	5	Power output negative: 0V
	 Motor side (AMP connector)	-	6	3	Encoder battery: BAT+
		-	7	2	Encoder battery: BAT-
		5	4	6	Encoder bus signal: SD+
		6	5	4	Encoder bus signal: SD-
	 Motor side (Aviation connector)	Shell	1	1	PE grounding (shielding layer)
⚠ Attention	◆ Do not short-circuit the encoder PE ground line with the encoder signal line, otherwise the servo drive will not work properly				

Remark:

- 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 multi-turn 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.

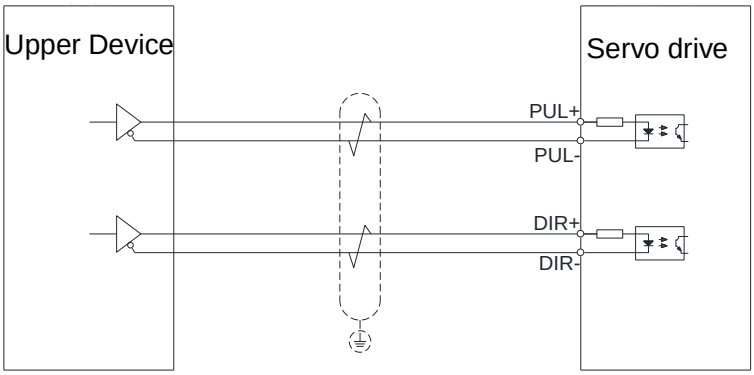
4.4. Control Signal Interface - X3

4.4.1. Position command input signal

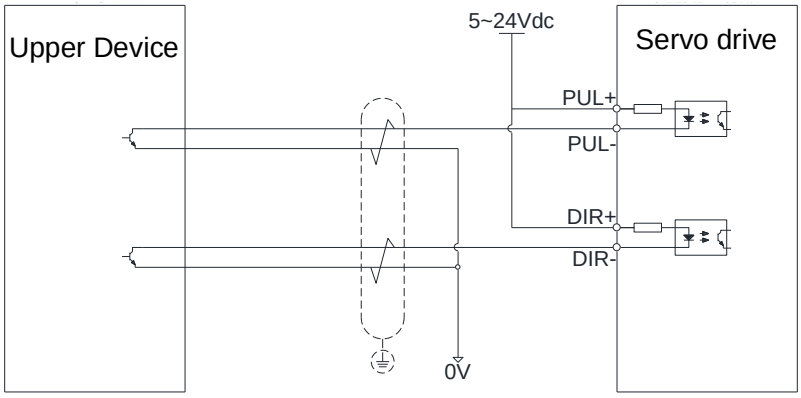
Note: Pulse input signals can only be connected to D5V pulse/RS485 drive models

Signal name		PIN NO.	Function
Position Command	PUL+	1	External command pulse input terminal, input pulse forms include: ● Pulse+direction ● CW/CCW pulse **Note: The signal terminal can accept 5V-24V signals without the need for a series resistor**
	PUL-	3	
	DIR+	5	
	DIR-	7	

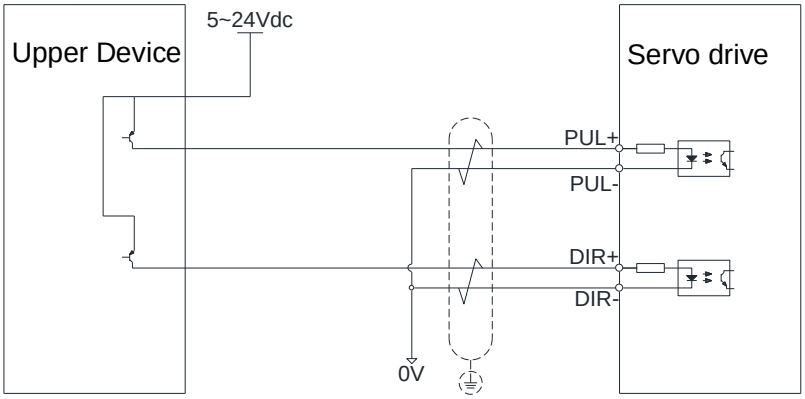
(1) Differential pulse signal



(2) Single ended common anode signal



(3) Single ended common cathode signal



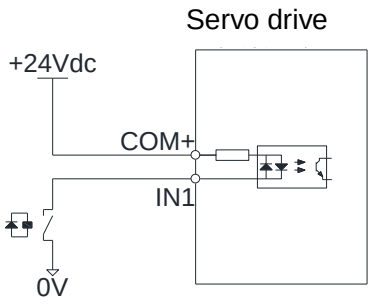
4.4.2. Digital input signal

D5V series CAN bus model drive:

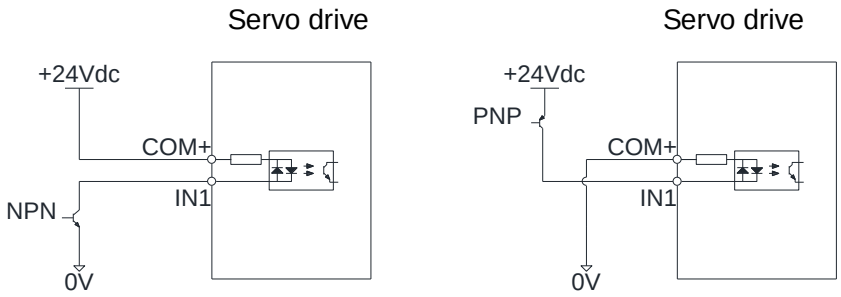
Signal name		Default	PIN NO.	Function
General Purpose Input Output	COM24V+		2	Input terminal common terminal
	DI1	P_OT	4	Positive limit
	DI2	N_OT	6	Negative limit position
	DI3	HOME	8	origin
	DI4	EME	10	emergency stop
	DI5+	P_OT	1	Set according to requirements
	DI5-		3	
	DI6+	GEAR_SE	5	Set according to requirements
	DI6-		7	

The DI5 and DI6 interface circuits are consistent with PUL and DIR, and can refer to the wiring instructions for position command input signals. The interface circuits of DI1 to DI4 are consistent, using DI1 as an example.

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



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



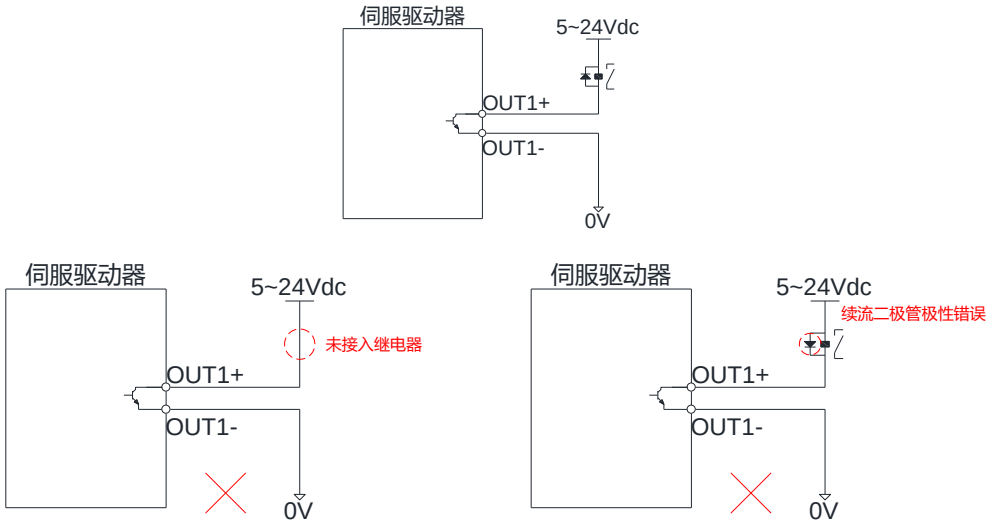
◆ Note: Mixing NPN and PNP is not supported

4.4.3. Digital output signal

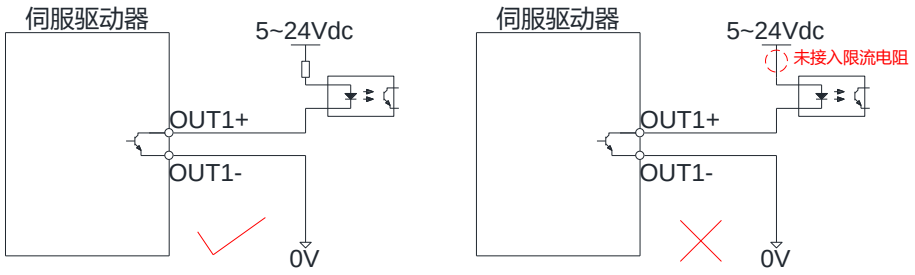
Signal name		Default	PIN NO.	Function
General Purpose Input Output	DO1+	ALM	9	Alarm output
	DO1-		11	
	DO2+	HOME_DONE	13	Homing completed
	DO2-		15	

The interface circuits of DO1 and DO2 are consistent, using DO1 as an example.

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

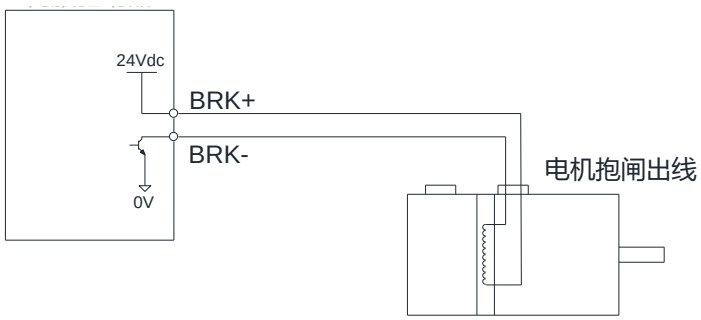


(2) When the upper device is optocoupler input



4.4.4. Brake output signal

Signal name		Default	PIN NO.	Function
General Purpose Input Output	BRK+	BRK	14	Brake output terminal: The positive and negative signal terminals of the electromagnetic brake that can be directly connected to the motor do not require relay drive
	BRK-		16	



Servo motor wih brake

4.5. 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 $2.0\mathrm{mm}^2$)
- 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

- Install the host computer device and noise filter near the servo drive as much as possible.
- Install surge suppressors on the coils of relays, screw tubes, and electromagnetic contactors.
- When wiring, please lay the strong current cables separately from the weak current cables, and keep an interval of more than 30cm. Do not put them in the same pipe or bundle them together.
- 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.

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 drive 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

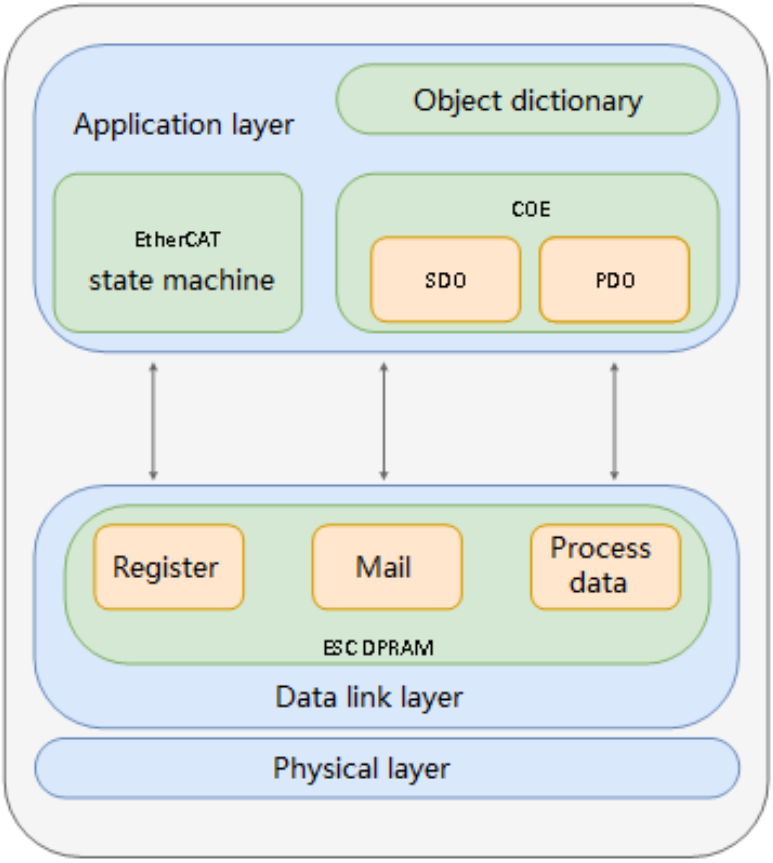
5.3. EtherCAT Communication Basics

5.3.1. EtherCAT Communication Specification

Item		Specifications
Communication protocol		IEC 61158 Type 12, IEC 61800-7 CIA402 drive 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

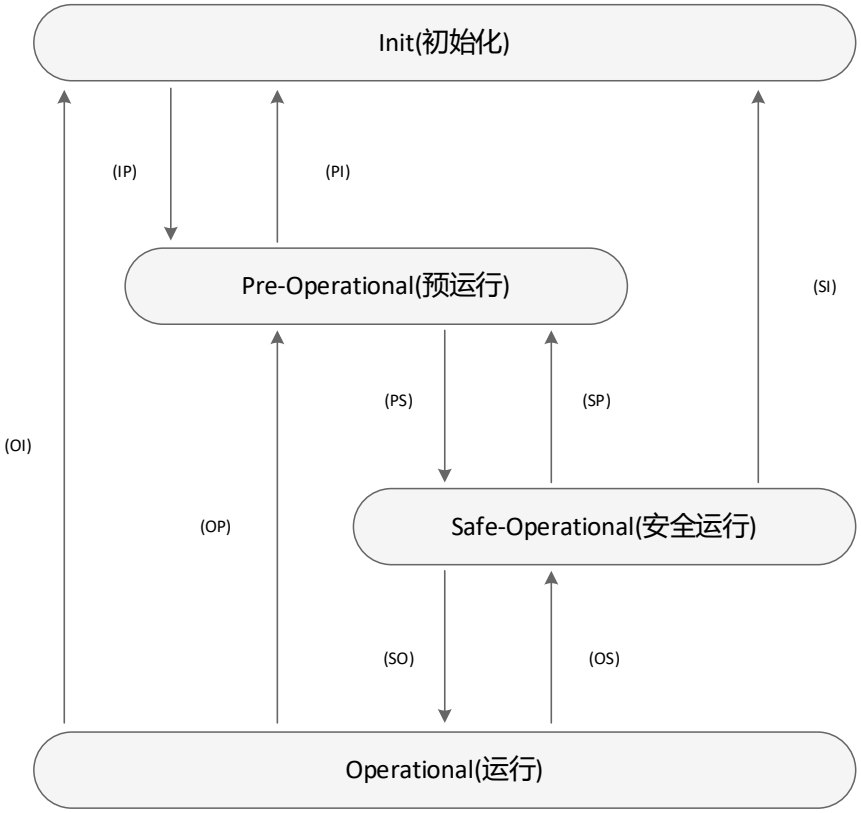
There are a variety of application layer protocols using EtherCAT communication. In the RS EtherCAT series servo drives, the IEC61800-7 (CIA402)-CANOpen motion control sub-protocol is used. The figure below is the EtherCAT communication structure based on the CANOpen application layer.



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 P

Safe-Operational: safe operation, abbreviated as S

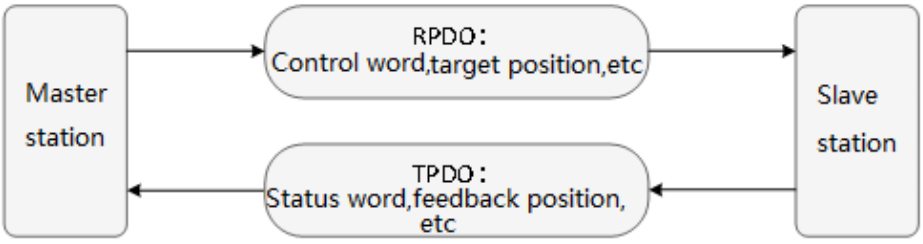
Operational: Operation, abbreviated as O.

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 D5V EtherCAT series servo drives 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 D5V EtherCAT series servo drives, 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 604000 10h

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:

- Emergency information
- SDO request

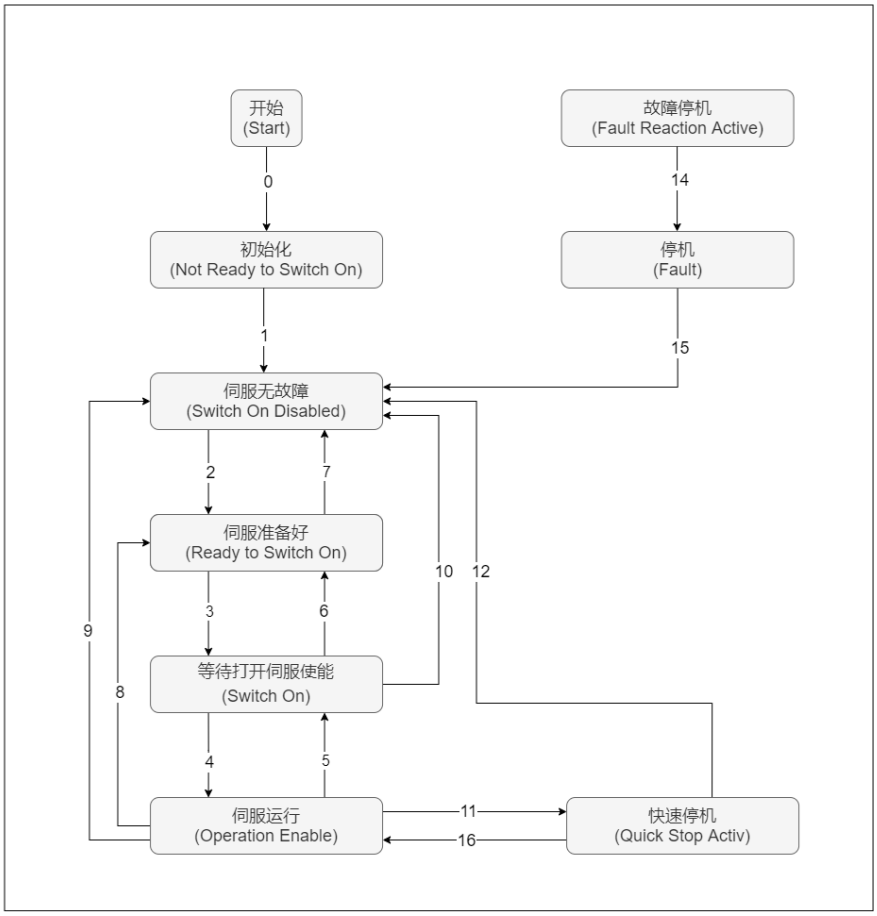
- SDO response
- TXPDO
- RXPDO
- Remote TXPDO sending request
- Remote RXPDO sending request
- SDO information

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. D5V EtherCAT series drives 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. CIA402 Control Introduction

To use D5V EtherCAT drive, the servo drive 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.



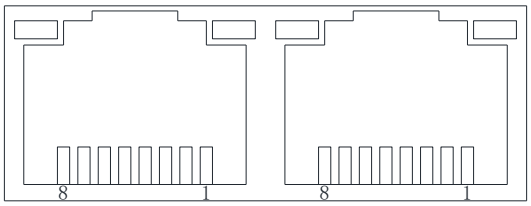
The description of each state is as follows:

Initialization	drive initialization and internal self-check have been completed. The parameters of the drive cannot be set, nor can the drive function be executed.
Servo without failure	The servo drive has no fault or the error has been eliminated. drive parameters can be set.
Servo ready	Servo drive is ready. drive parameters can be set.
Waiting to turn on servo enable	The servo drive is waiting to turn on the servo enable. drive parameters can be set.
Servo operation	The drive 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 drive is executing the quick stop function. The drive parameter attribute can be set as "operational change", otherwise it cannot be set.
Fault shutdown	The drive has failed and is in the process of shutdown. The drive parameter attribute can be set as "operational change", otherwise it cannot be set.
Faults	When the fault stop is completed, all drive functions are prohibited, and the drive parameters are allowed to be changed in order to eliminate the fault.

5.3.8. 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.

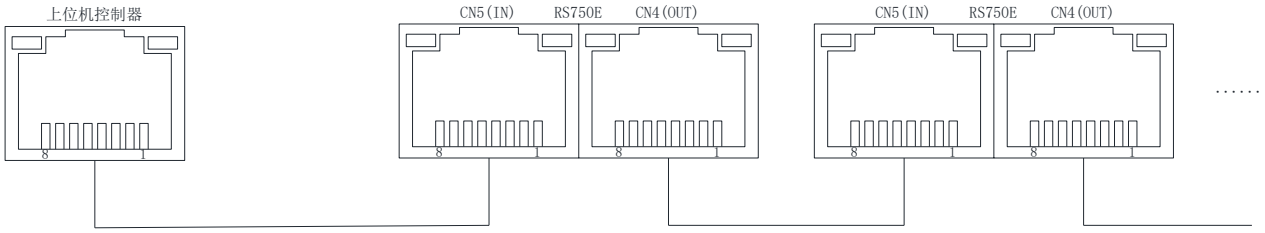


Pin	Meaning	Description
1	TX+	Data sending+
2	TX-	Data sending-
3	RX+	Data reception+
4	NULL	none
5	NULL	none
6	RX-	Data reception-
7	NULL	none
8	NULL	none

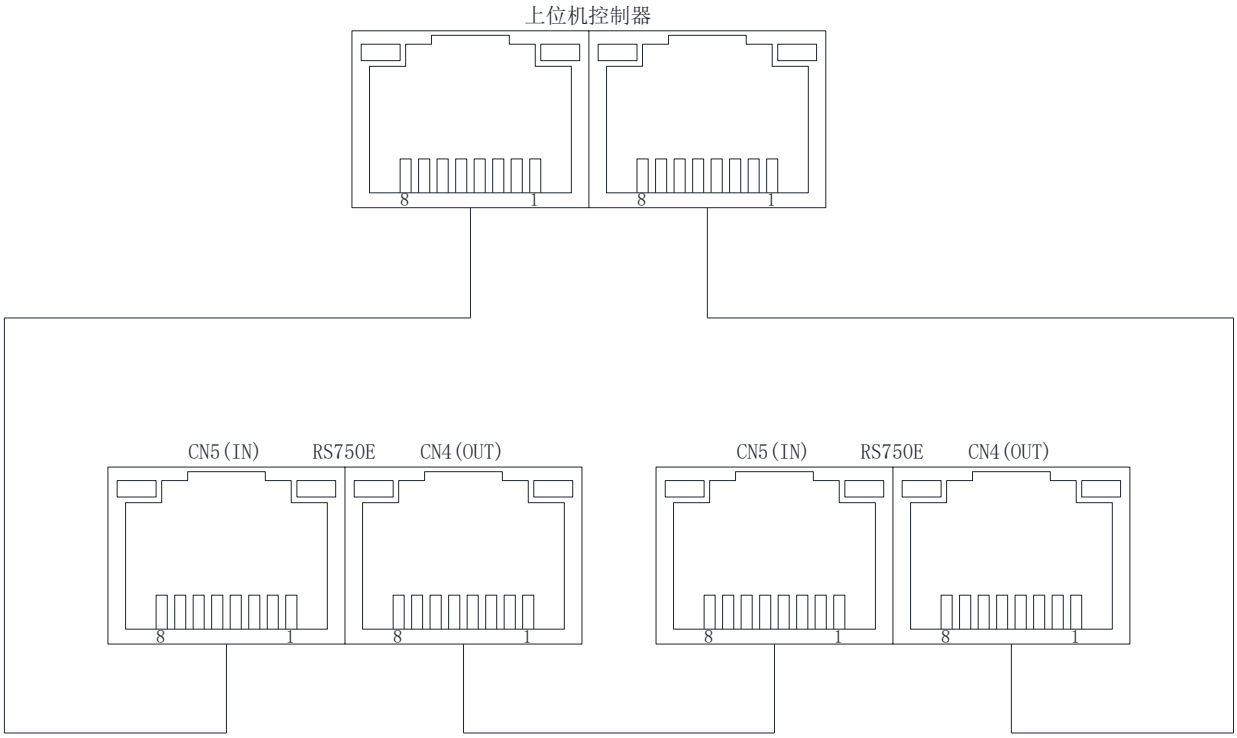
(2) Topological connection

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.

1) Linear connection



2) 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

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 drive:

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 * 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	Name	Gear ratio					Data structure	ARR	Data type	Uint32
6091h	Data range	OD data range	Factory setting	OD default	Accessibility	-	Related mode	PP/PV/CS P/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	Name	Maximum subindex number of the gear ratio					Data structure	-	Data type	Uint8
00h	Data range	-	Factory setting	2	Accessibility	RO	Related mode	-	Map	NO

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

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

Encoder resolution for motor model TSNA-08J2430A-48 is P = 131072 (p/r)

Therefore, the position factor is calculated as follows:

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

Therefore:

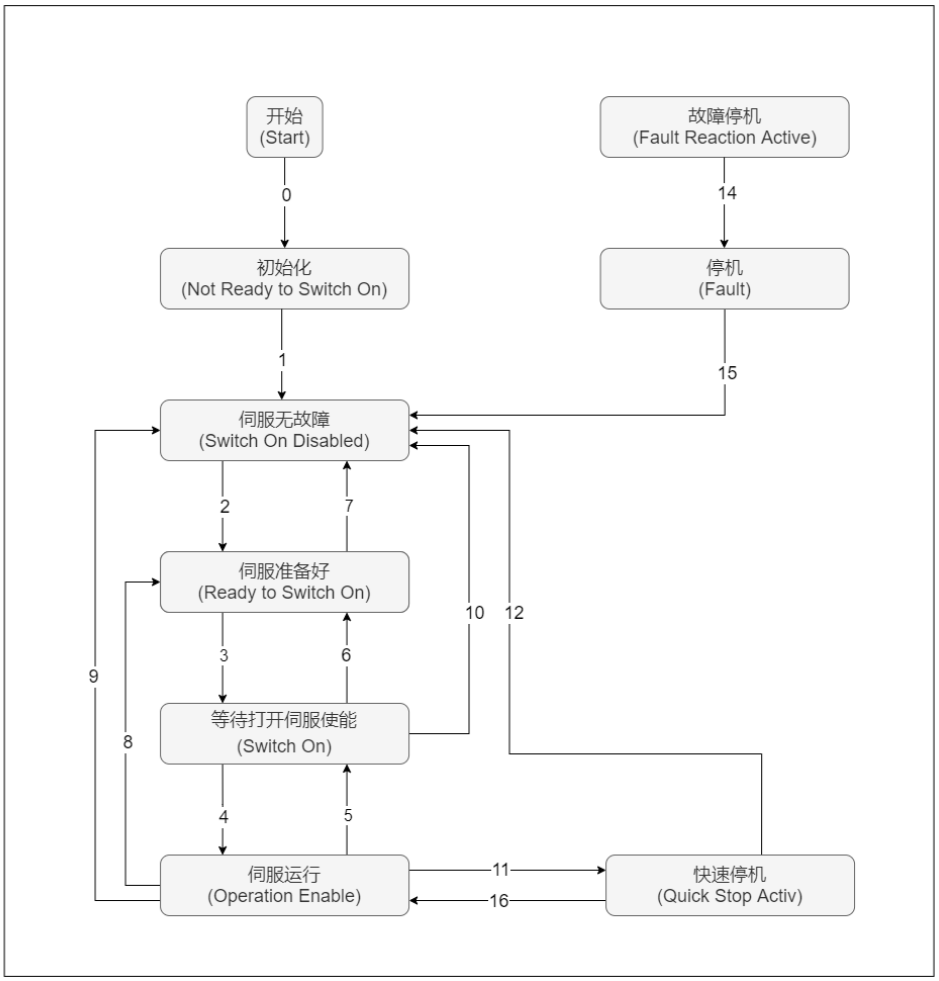
6091-01h = 65536

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 drive 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	drive initialization and internal self-check have been completed The parameters of the drive cannot be set, nor can the drive function be executed
Servo without failure	The servo drive has no fault or the error has been eliminated drive parameters can be set
Servo ready	Servo drive is ready drive parameters can be set
Waiting to turn on servo enable	The servo drive is waiting to turn on the servo enable drive parameters can be set
Servo operation	The drive 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 drive is executing the quick stop function The drive parameter attribute can be set as "operational change", otherwise it cannot be set
Fault shutdown	The drive has failed and is in the process of shutdown. The drive parameter attribute can be set as "operational change", otherwise it cannot be set
Faults	When the fault stop is completed, all drive functions are prohibited, and the drive 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 drive 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	Name	Control word					Data structure	VAR	Data type	Uint16
6040h	Data Range	0～65535	Factory setting	0	Accessibility	RW	Related mode	ALL	Map	RPDO

Set control command:

Bit	Name	Description
0	Switch on	0: Invalid, 1: Effective
1	Enable voltage	0: Invalid, 1: Effective
2	Quick stop	0: Invalid, 1: Effective
3	Enable operation	0: Invalid, 1: Effective
4～6	Operation mode specific	Related to the servo operation mode
7	Fault reset	For resettable faults and warnings, perform the fault reset function. Bit7 rising edge is effective; Bit7 remains at 1 and all other control commands are invalid
8	Halt	For the halt modes in each mode, query object dictionary 605Dh
9	Operation mode specific	Related to the servo operation mode
10	ReveD5V EtherCAT	Undefined
11～15	Manufacturer-specific	Manufacturer-specific

- 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；
- Bit0 to Bit3 and Bit7 have the same meaning in each servo mode, and commands must be sent in sequence to direct the servo drive into the expected state according to the CiA402 state machine switching process, with each command corresponding to a defined state.；
- Bit4 to Bit6 are related to each servo mode, please check the control commands in different modes；
- Bit9 undefined function

6.2.2. Status Word 6041h

Index	Name	Status word					Data structure	VAR	Data type	Uint16
6041h	Data Range	0～65535	Factory setting	0	Accessibility	RO	Related mode	ALL	Map	TPDO

Reflects the current operating status of the servo drive:

Bit	Name	Description
0	Ready to switch on	0: Invalid, 1: Effective
1	Switch on	0: Invalid, 1: Effective
2	Operation enabled	0: Invalid, 1: Effective
3	Fault	0: Invalid, 1: Effective
4	Voltage enabled	0: Invalid, 1: Effective
5	Quick stop	0: Invalid, 1: Effective
6	Switch on disabled	0: Invalid, 1: Effective
7	Waming	0: Invalid, 1: Effective
8	Manufacturer specific	Undefined
9	Remote	0: Invalid, 1: Effective (Control word in effect)
10	Target reach	0: Invalid, 1: Effective
11	Internal limit active	0: Invalid, 1: Effective
12～13	Operation limit active	Related to the servo operation mode
14	Manufacturer specific	Undefined
15	Home find	0: Invalid, 1: Effective

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

- 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.
- Bit12 to Bit13 are related to each servo mode (please check the control commands in different modes)
- 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. Servo Mode Introduction

Index	Name	Support servo operation mode					Data structure	VAR	Data type	Uint32
6502h	Data range	-	Factory setting	941	Accessibility	RO	Related mode	-	Map	NO

Reflects the servo operation mode supported by the drive:

Bit	Description	Supported or not (0: not supported, 1: supported)
0	Profile Position Mode (PP)	1
1	Variable Frequency Velocity Regulation Mode (VL)	0
2	Profile Velocity Mode (PV)	1
3	Profile Velocity Mode (PT)	1
4	NA	0
5	Homing Mode (HM)	1
6	Interpolation Mode (IP)	0
7	Cyclic Synchronous Position Mode (CSP)	1
8	Cyclic Synchronous Velocity Mode (CSV)	1
9	Cyclic Synchronous Torque Mode (CST)	1
10～31	NA	0

Index	Name	Operation mode					Data structure	VAR	Data type	Int16
6060h	Data range	0～10	Factory setting	0	Accessibility	RW	Related mode	ALL	Map	RPDO

Select servo operation mode:

Set value	Servo mode	
0/2/5	NA	Reserve
1	Profile Position Mode (PP)	
3	Profile Velocity Mode (PV)	
4	Profile Torque Mode (PT)	
6	Homing mode (HM)	
7	Interpolation Mode (IP)	
8	Cyclic Synchronous Position Mode (CSP)	
9	Cyclic Synchronous Velocity Mode (CSV)	
10	Cyclic Synchronous Torque Mode (CST)	

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

Oath the current operating mode of the servo drive:

Set value	Servo mode	
0/2/5	NA	Reserve
1	Profile Position Mode (PP)	
3	Profile Velocity Mode (PV)	
4	Profile Torque Mode (PT)	
6	Homing mode (HM)	
7	Interpolation Mode (IP)	
8	Cyclic Synchronous Position Mode (CSP)	
9	Cyclic Synchronous Velocity Mode (CSV)	
10	Cyclic Synchronous Torque Mode (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	Switch On	When the value of Bit0 to Bit3 is 1, the motor is enabled
1	Enable Voltage	
2	Quick Stop	
3	Enable Operation	
7	Reset Fault	0: No effect 1: Reset drive failure

Status word 6041h		
Bit	**Name**	**Description**
10	Target Reached	0: Target position not reached 1: Target position reached
11	Internal Limit Active	0: Neither the position command nor the position feedback exceeds the limit 1: Position command or position feedback overrun
12	drive Follow the Command	0: Slave not following command 1: Slave follow command
13	Following Error	0: No excessive position deviation fault 1: Excessive position deviation fault occurs
15	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	-
2006	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

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: Control Word	6041h: Status Word	Necessary
607Ah: Target Position	6064h: Position Actual Value	Necessary
6060h: Modes of Operation	6061h: Modes of Operation Display	Optional
	603Fh: Error Code	Optional
	60FDh: 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	Switch On	When the value of Bit0 to Bit3 is 1, the motor is enabled
1	Enable Voltage	
2	Quick Stop	
3	Enable Operation	
7	Reset Fault	0: No effect 1: Reset drive failure

Status word 6041h		
Bit	**Name**	**Description**
10	Target Reached	0: Target position not reached 1: Target position reached
11	Internal Limit Active	0: Neither the position command nor the position feedback exceeds the limit 1: Position command or position feedback overrun
12	drive Follow the Command	0: Slave not following command 1: Slave follow command
15	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	-
6091	01	Gear ratio numerator	Uint32	1～2^{32}-1	RW	1
	02	Gear ratio denominator	Uint32	1～2^{32}-1	RW	1
60FF	00	Target speed (unit: command unit/s)	Int32	-	RO	0
2006	01	Speed loop gain	Uint16	0～50000	RW	4000
	02	Speed loop integration time	Uint16	1～30000	RW	1500

6.5.2. Related Function Settings

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: Control Word	6041h: Status Word	Necessary
6060h: Modes of Operation	6061h: Modes of Operation Display	Optional
60FFh: Target Velocity		Necessary
	6064h: Position Actual Value	Optional
	606Ch: Velocity Actual Value	Optional
	603Fh: Error Code	Optional
	60FDh: 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	Switch On	When the value of Bit0 to Bit3 is 1, the motor is enabled
1	Enable Voltage	
2	Quick Stop	
3	Enable Operation	
7	Reset Fault	0: No effect 1: Reset drive failure

Status word 6041h		
Bit	**Name**	**Description**
10	Target Reached	0: Target position not reached 1: Target position reached
11	Internal Limit Active	0: Neither the position command nor the position feedback exceeds the limit 1: Position command or position feedback overrun
12	drive Follow the Command	0: Slave not following command 1: Slave follow command
15	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	-
2006	01	Speed loop gain	Uint16	0～50000	RW	4000
	02	Speed loop integration time	Uint16	1～30000	RW	1500

6.6.2. Related Function Settings

Torque reach output setting:

Index (Hex)	Subindex (Hex)	Name	Description
2008	11	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	12	Torque reaches effective value	
2008	13	Torque reaches invalid value	

6.6.3. Recommended Configuration

RPDO	TPDO	Description
6040h: Control Word	6041h: Status Word	Necessary
6060h: Modes of Operation	6061h: Modes of Operation Display	Optional
6071h: Target Torque		Necessary
	6064h: Position Actual Value	Optional
	606Ch: Velocity Actual Value	Optional
	6077h: Torque Actual Value	Optional
	603Fh: Error Code	Optional
	60FDh: 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	Switch On	When the value of Bit0 to Bit3 is 1, the motor is enabled
1	Enable Voltage	
2	Quick Stop	
3	Enable Operation	
4	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	Change Set Immediately	0: Not immediately updated 1: Update immediately
6	Absolute/Relative	0: The target position is an absolute position command 1: The target position is a relative position command
7	Reset Fault	0: no effect 1: Reset drive failure
8	Halt	0: Servo is set according to Bit0～Bit3 1: Servo pauses according to 605Dh setting

Status word 6041h		
Bit	**Name**	**Description**
10	Target Reached	0: Target position not reached 1: Target position reached
11	Internal Limit Active	0: Neither the position command nor the position feedback exceeds the limit 1: Position command or position feedback overrun
12	drive Follow the Command	0: Slave not following command 1: Slave follow command
13	Following Error	0: No excessive position deviation fault 1: Excessive position deviation fault occurs
15	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: 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
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	-
2006	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

6.7.2. Related Function Settings

(1) Positioning completion signal

Index (Hex)	Subindex (Hex)	Name	Description
2003	14	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

6.7.3. Position Curve Generator

(1) Update immediately

1) 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).

2) 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.

3) 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.

4) 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.

5) 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) Update immediately

1) 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).

2) 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.

3) 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.

4) 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.

5) 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: Control Word	6041h: Status Word	Necessary
607Ah: Target Position	6064h: Position Actual Value	Necessary
6060h: Modes of Operation	6061h: Modes of Operation Display	Optional
6081h: Profile Velocity		Necessary
6083h: Profile Acceleration		Optional
6084h: 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 drive, and the speed and torque adjustment is performed internally by the servo.

6.8.1. Related Objects

Control word 6040h		
Bit	**Name**	**Description**
0	Switch On	When the value of Bit0 to Bit3 is 1, the motor is enabled
1	Enable Voltage	
2	Quick Stop	
3	Enable Operation	
4	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	Change Set Immediately	0: Not immediately updated 1: Update immediately
6	Absolute/Relative	0: The target position is an absolute position command 1: The target position is a relative position command
7	Reset Fault	0: no effect 1: Reset drive failure
8	Halt	0: Servo is set according to Bit0～Bit3 1: Servo pauses according to 605Dh setting

Status word 6041h		
Bit	**Name**	**Description**
10	Target Reached	0: Target position not reached 1: Target position reached
11	Internal Limit Active	0: Neither the position command nor the position feedback exceeds the limit 1: Position command or position feedback overrun
15	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 velocity (unit: command unit/s)	Int32	$0～2^{32}-1$	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
2006	01	Speed loop gain	Uint16	0～50000	RW	4000
	02	Speed loop integration time	Uint16	1～30000	RW	1500

6.8.2. Related Function Settings

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: Control Word	6041h: Status Word	Necessary
6060h: Modes of Operation	6061h: Modes of Operation Display	Optional
60FFh: Target Velocity		Necessary
6083h: Profile Acceleration	6064h: Position Actual Value	Optional
6084h: Profile Deceleration	606Ch: Velocity Actual Value	Optional
	603Fh: Error Code	Optional
	60FDh: 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	Switch On	When the value of Bit0 to Bit3 is 1, the motor is enabled
1	Enable Voltage	
2	Quick Stop	
3	Enable Operation	
7	Reset Fault	0: No effect 1: Reset drive failure

Status word 6041h		
Bit	**Name**	**Description**
10	Target Reached	0: Target position not reached 1: Target position reached
11	Internal Limit Active	0: Neither the position command nor the position feedback exceeds the limit 1: Position command or position feedback overrun
15	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
2006	01	Speed loop gain	Uint16	0～50000	RW	4000
	02	Speed loop integration time	Uint16	1～30000	RW	1500

6.9.2. Related Function Settings

Torque reach output setting:

Index (Hex)	Subindex (Hex)	Name	Description
2005	11	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.
2005	12	Torque reaches effective value	
2005	13	Torque reaches invalid value	

6.9.3. Recommended Configuration

RPDO	TPDO	Description
6040h: Control Word	6041h: Status Word	Necessary
6060h: Modes of Operation	6061h: Modes of Operation Display	Optional
6071h: Target Torque		Necessary
6087h: Torque Slope	6064h: Position Actual Value	Optional
607Fh: Profile Velocity	606Ch: Velocity Actual Value	Optional
	6077h: Torque Actual Value	Optional
	603Fh: Error Code	Optional
	60FDh: 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

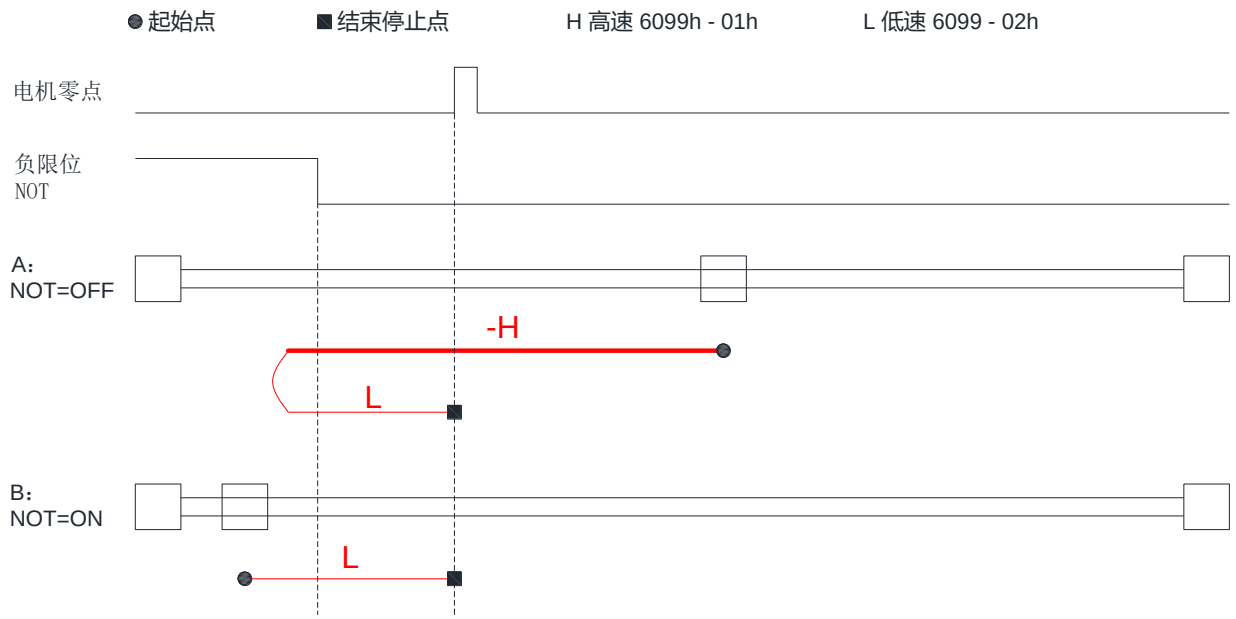
Control word 6040h		
Bit	**Name**	**Description**
0	Switch On	When the value of Bit0 to Bit3 is 1, the motor is enabled
1	Enable Voltage	
2	Quick Stop	
3	Enable Operation	
4	New Set-Point	This is the rising edge from 0 to 1 indicates the pre-triggered new target position 607Ah, profile velocity 6081h, acceleration 6083h, deceleration 6084h given
7	Reset Fault	0: no effect 1: Reset drive failure
8	Halt	0: Servo is set according to Bit0～Bit3 1: Servo pauses according to 605Dh setting

Status word 6041h		
Bit	**Name**	**Description**
10	Target Reached	0: Target position not reached 1: Target position reached
11	Internal Limit Active	0: Neither the position command nor the position feedback exceeds the limit 1: Position command or position feedback overrun
12	drive Follow the Command	0: Slave not following command 1: Slave follow command
13	Following Error	0: No excessive position deviation fault 1: Excessive position deviation fault occurs
15	Home Find	0: Home not completed 1: Home completed

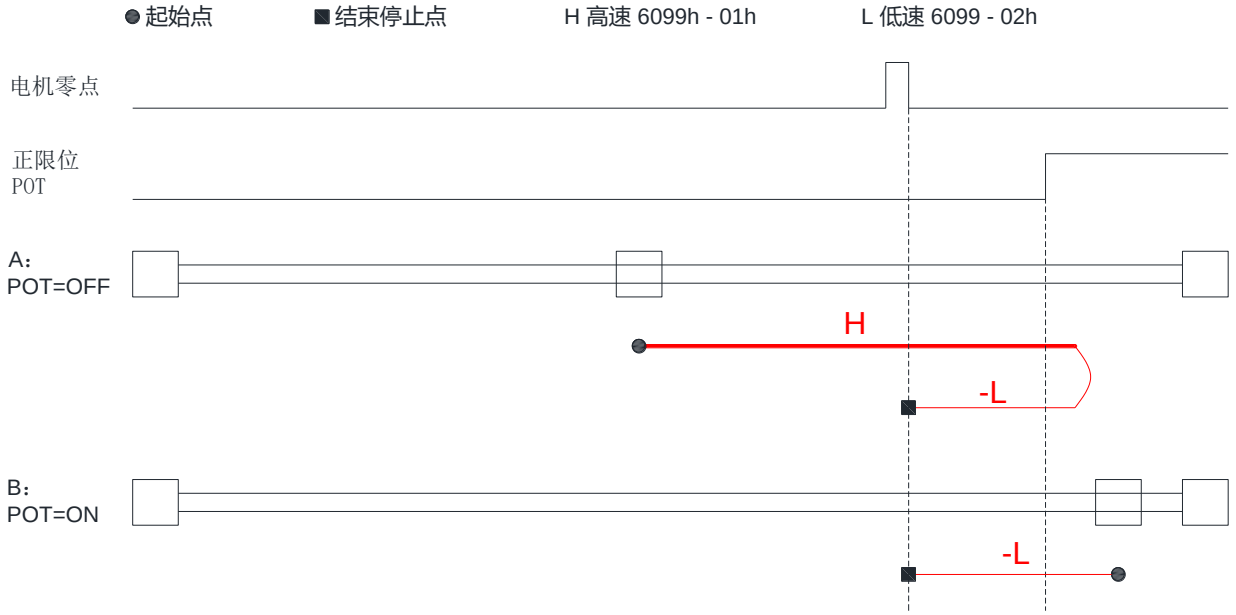
Index (Hex)	Subindex (Hex)	Name	Data type	Setting range	Accessibility	Default value
6040	00	Control word	Uint16	0～65535	RW	0
6041	00	Status word	Uint16	-	RO	0
6060	00	Operating mode	Int16	0～10	RW	8
6061	00	Mode display	Int16	-	RO	8
6062	00	Position command (unit: command unit)	Int32	-	RO	-
6063	00	Position 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	-
2006	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

6.10.2. Home Operation Instruction

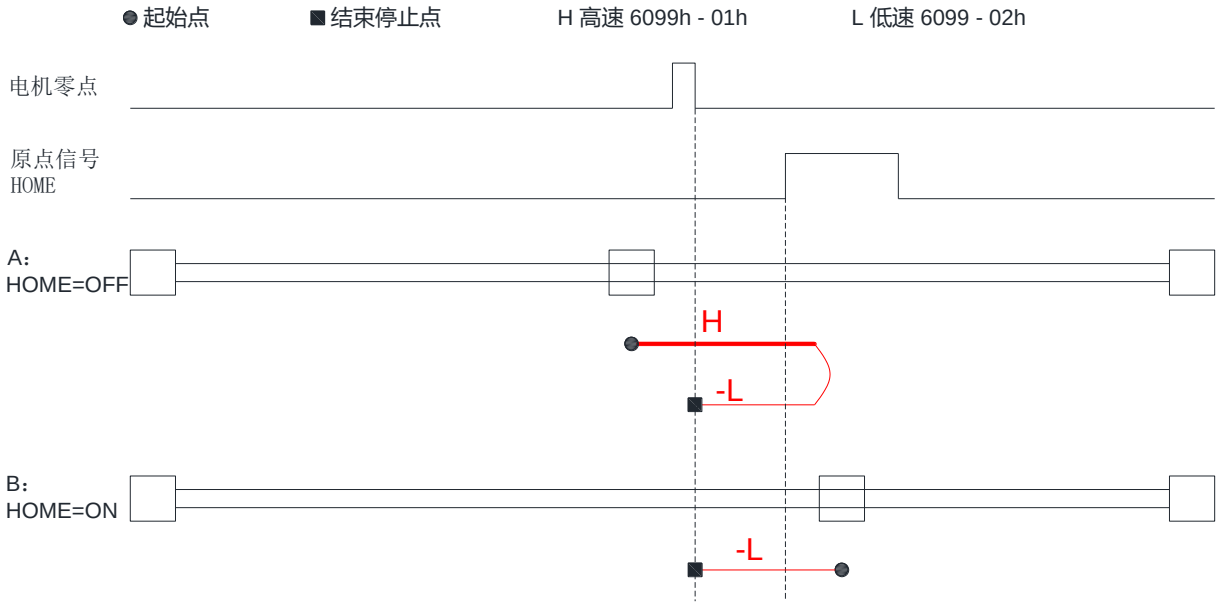
(1) Object 6098h = 1



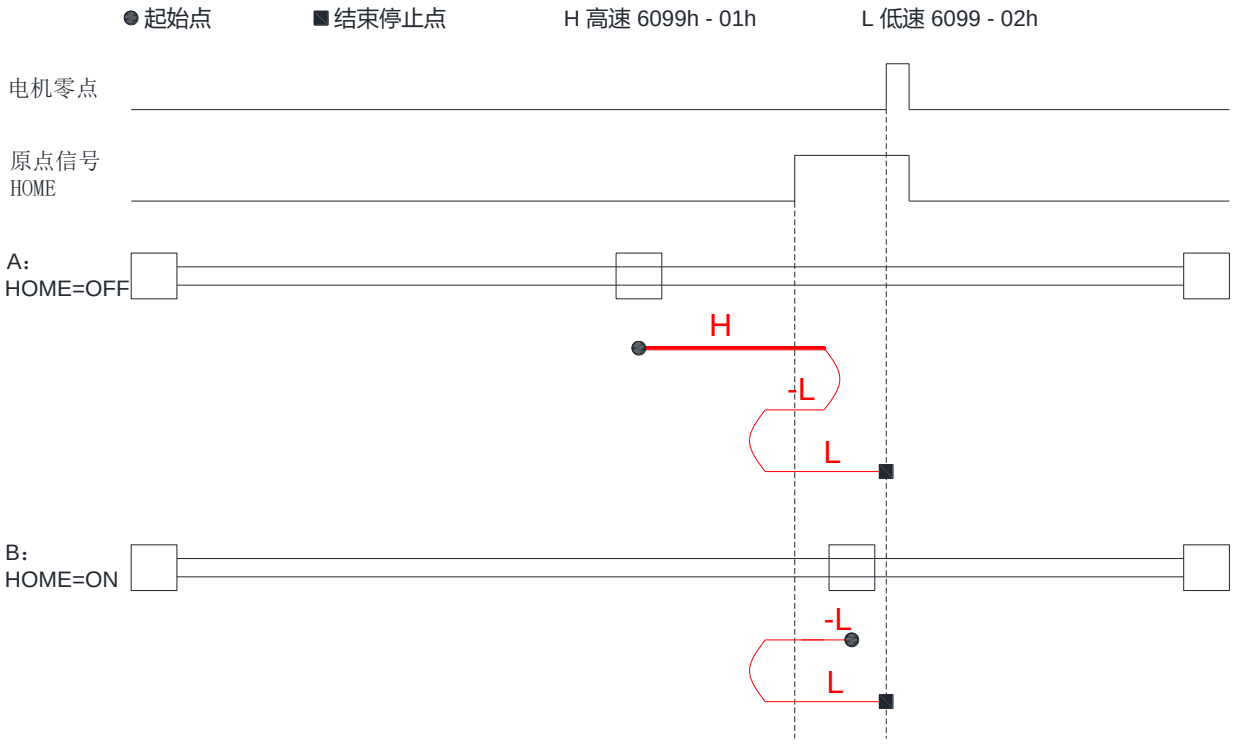
(2) Object 6098h = 2



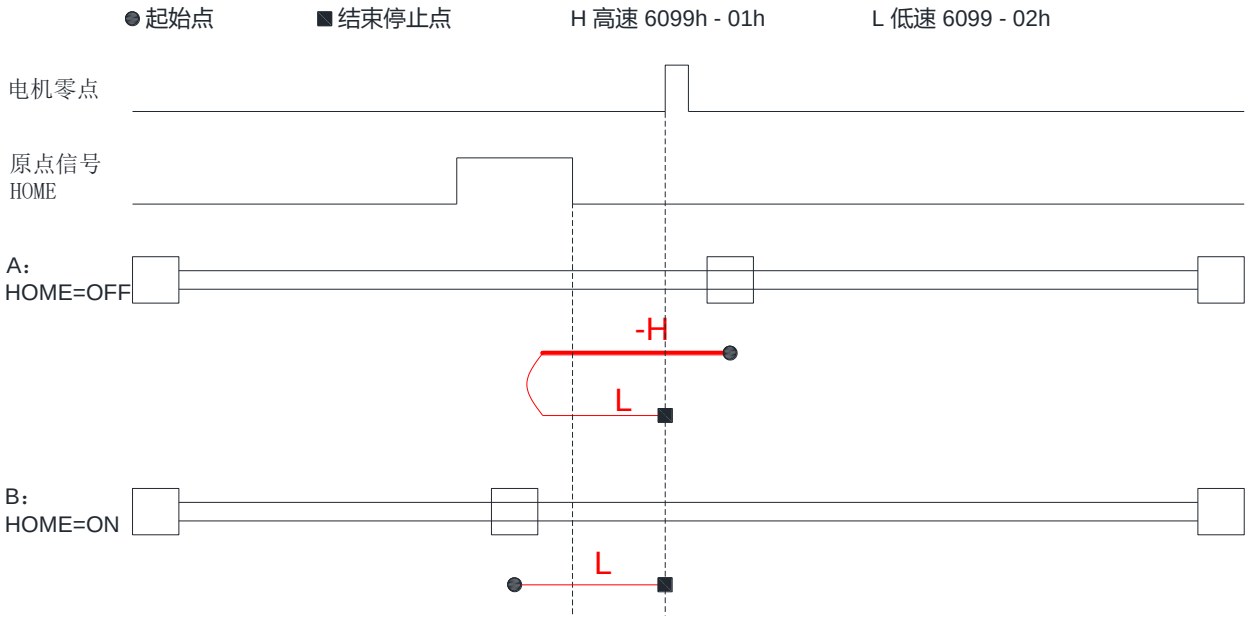
(3) Object 6098h = 3



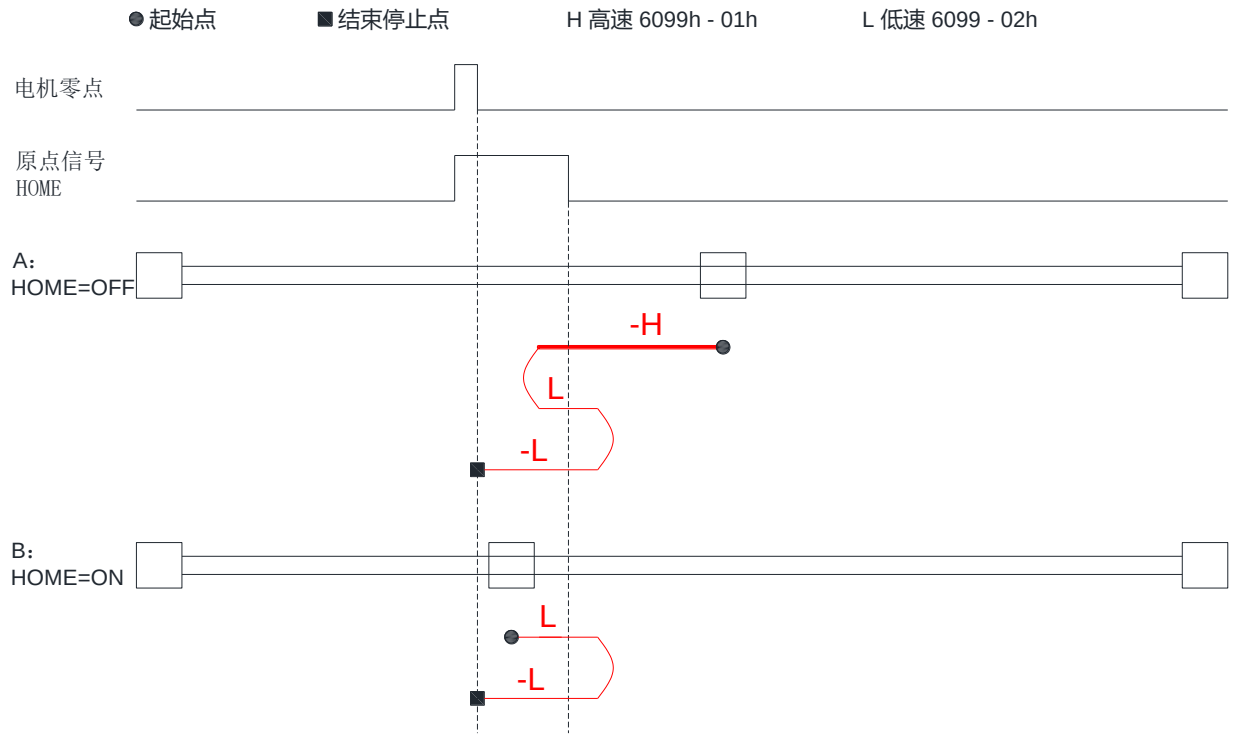
(4) Object 6098h = 4



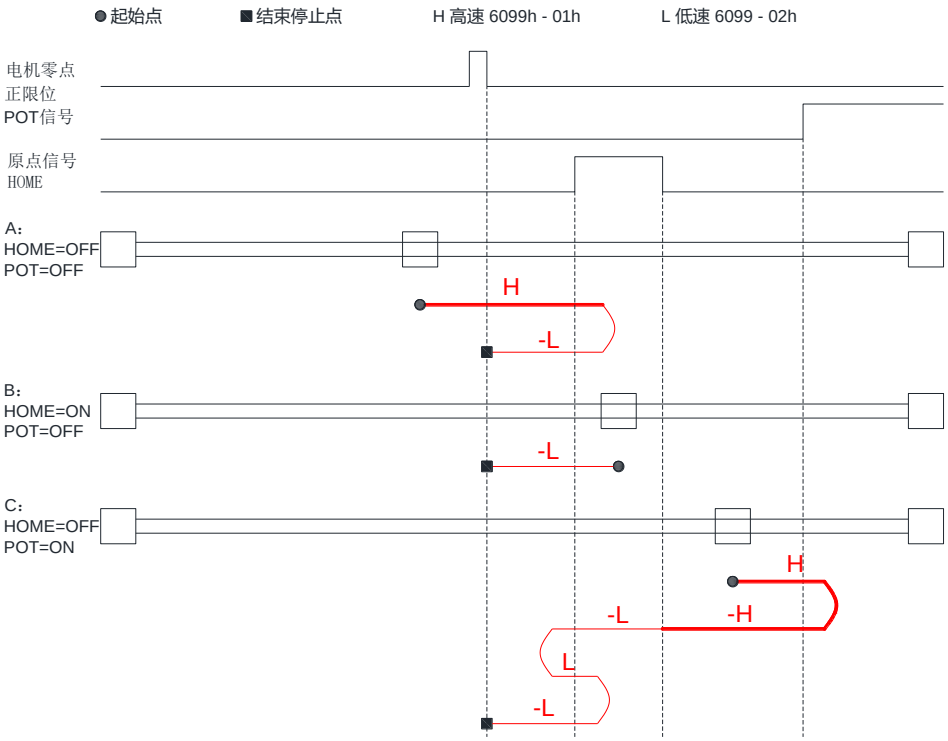
(5) Object 6098h = 5



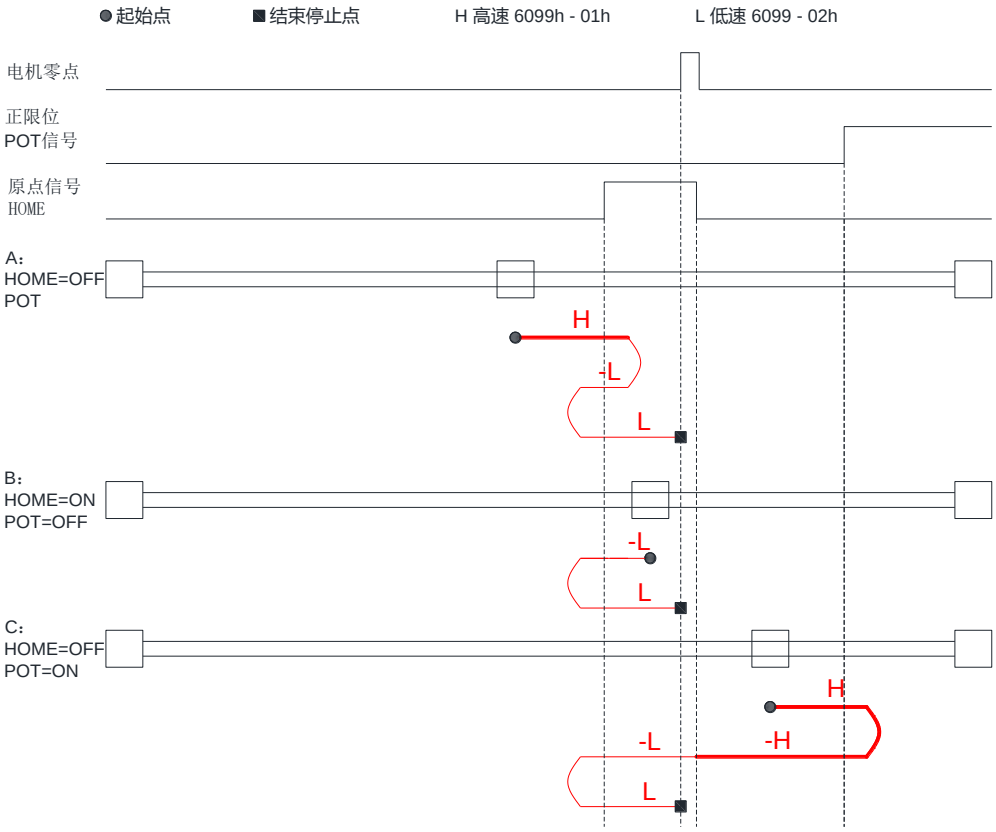
(6) Object 6098h = 6



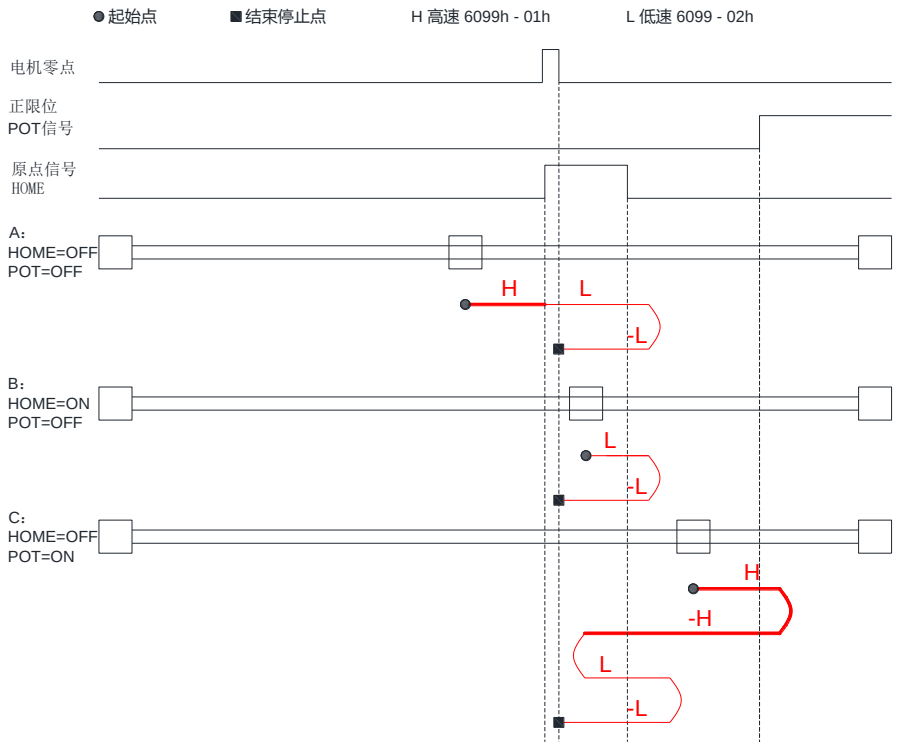
(7) Object 6098h = 7



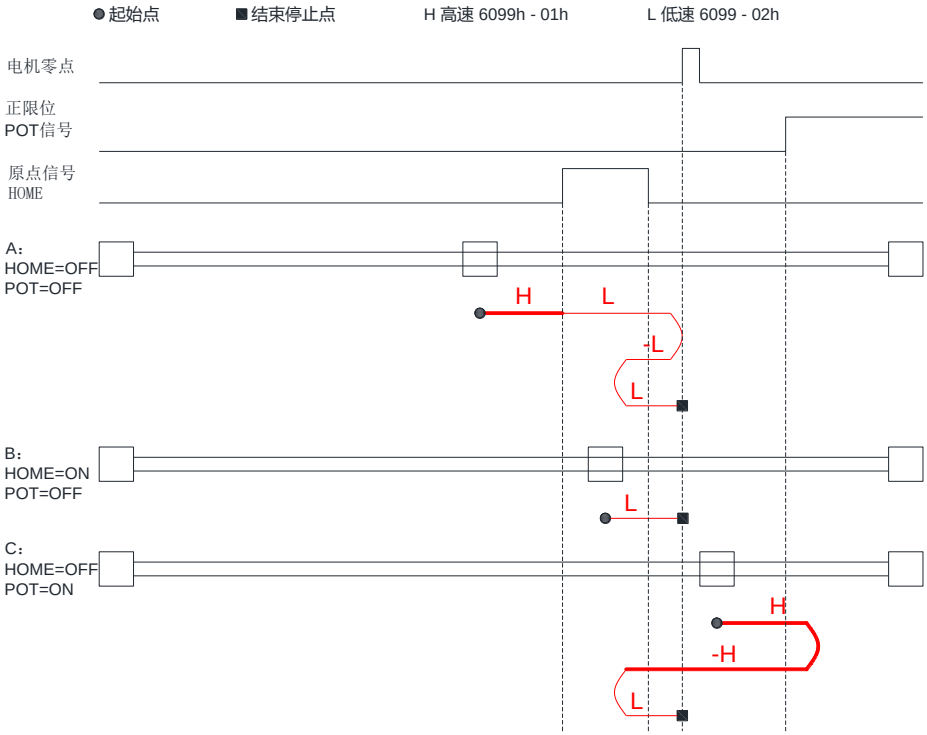
(8) Object 6098h = 8



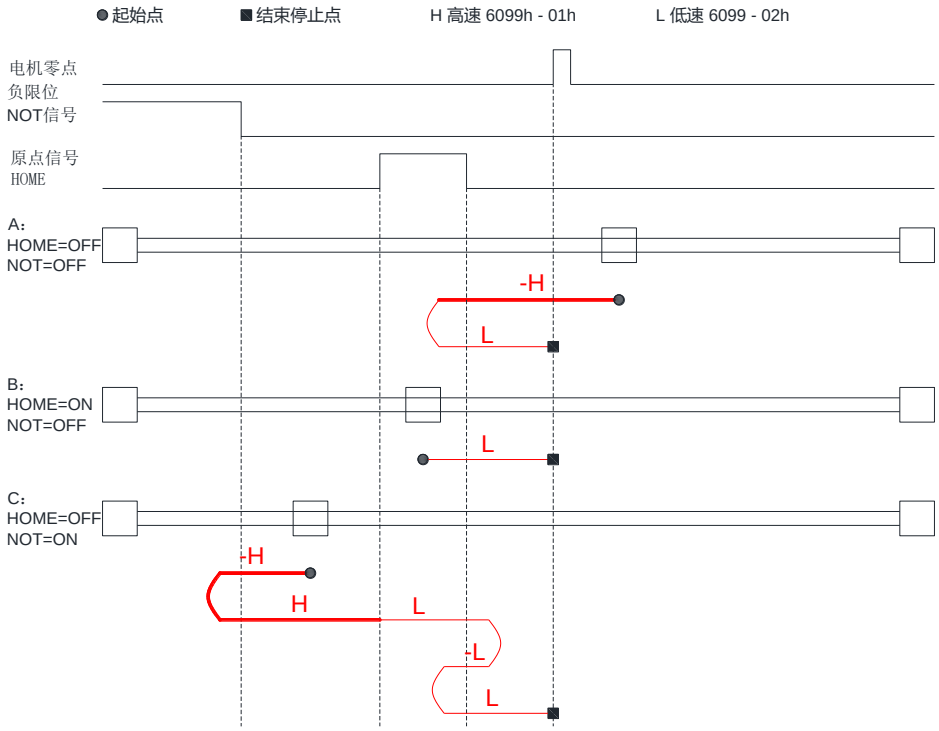
(9) Object 6098h = 9



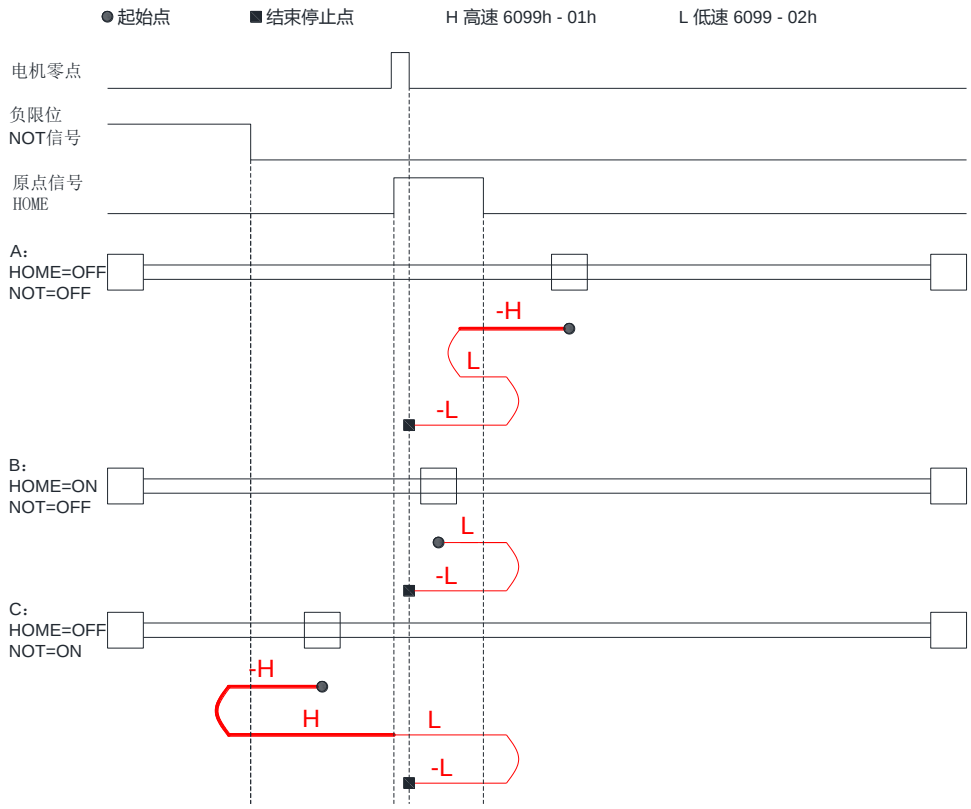
(10) Object 6098h = 10



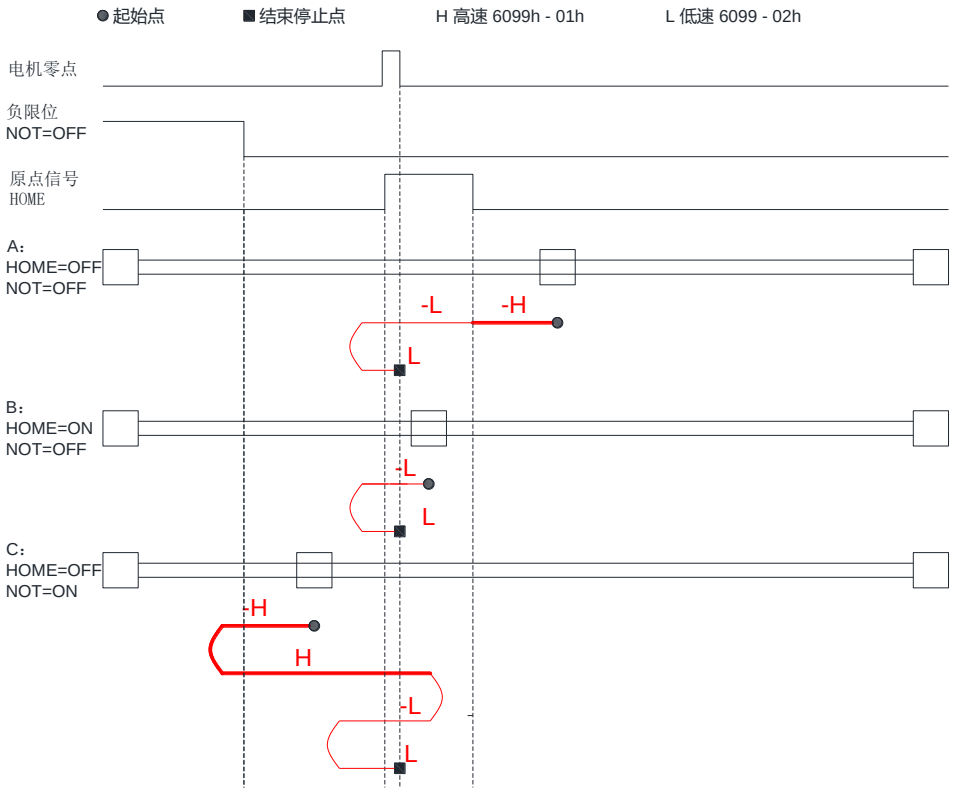
(11) Object 6098h = 11



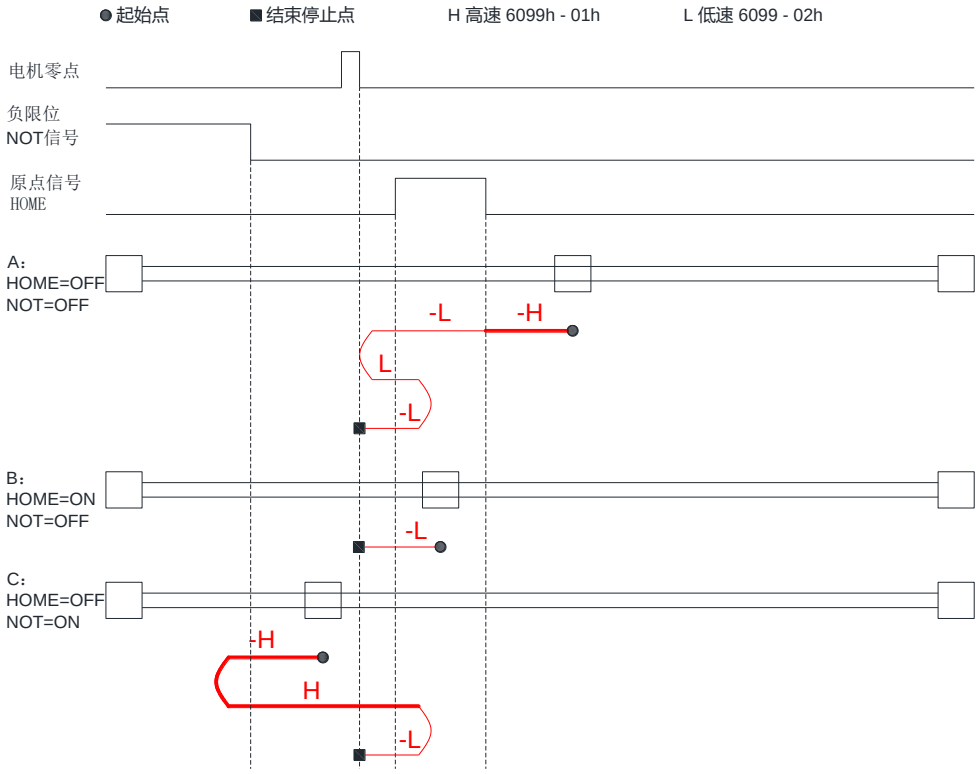
(12) Object 6098h = 12



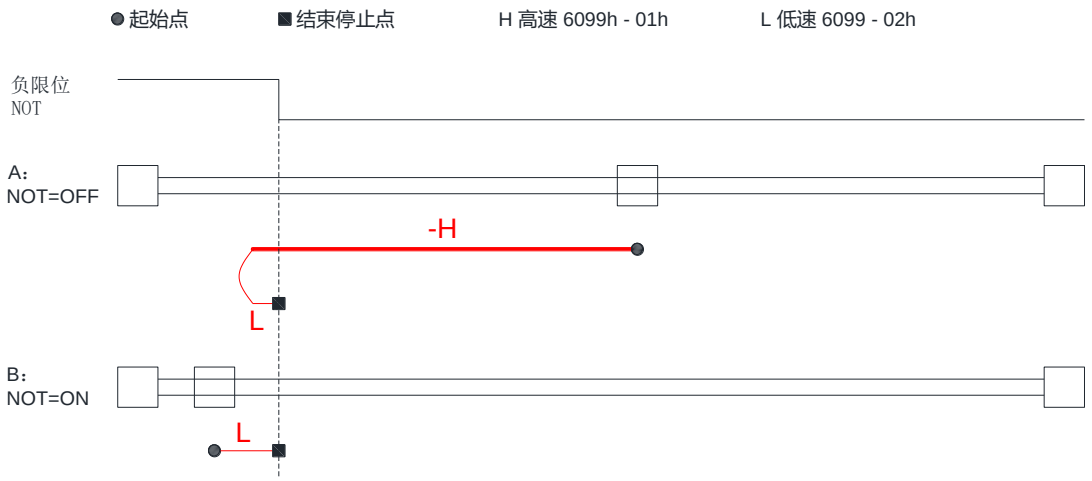
(13) Object 6098h = 13



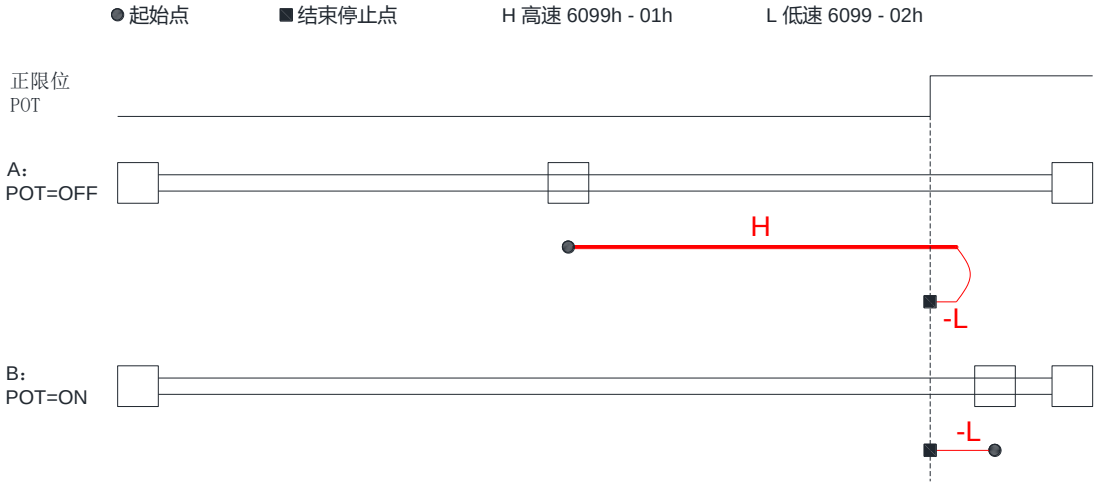
(14) Object 6098h = 14



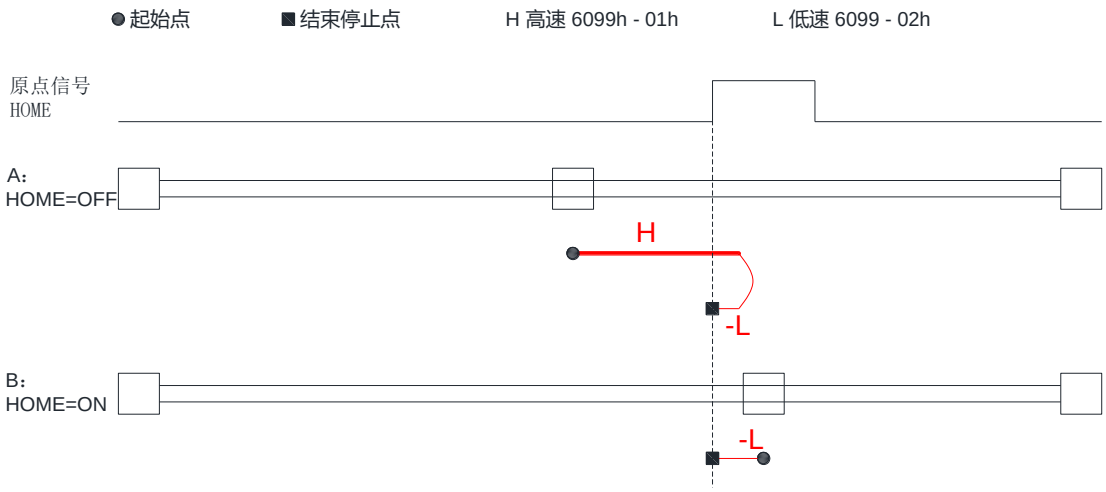
(15) Object 6098h = 17



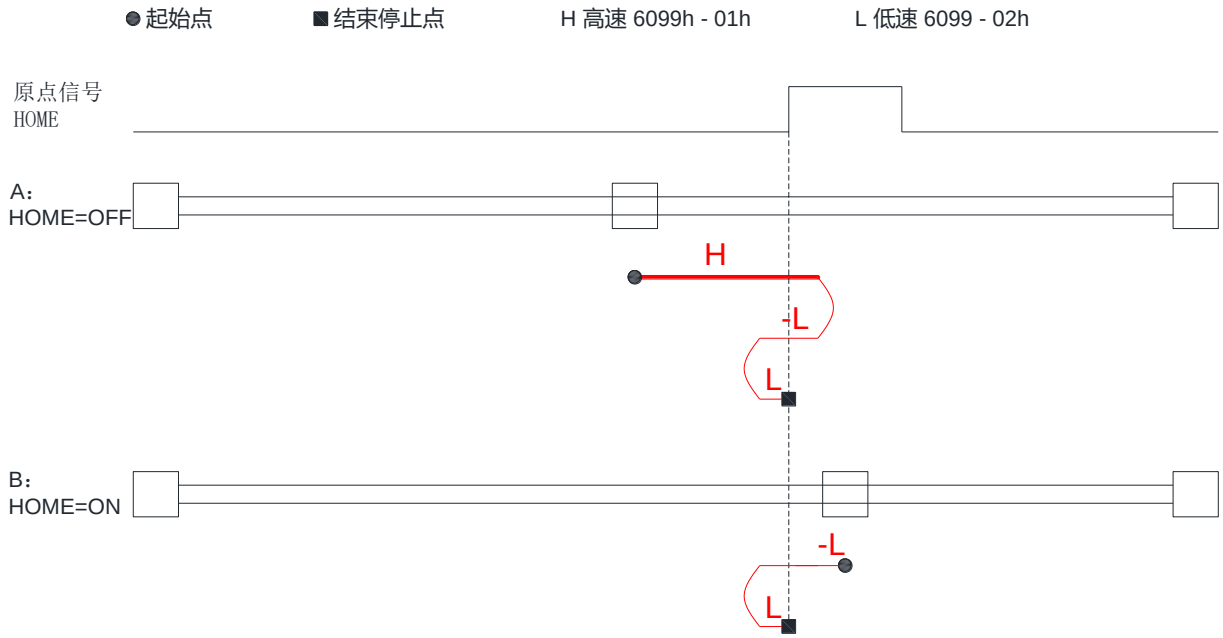
(16) Object 6098h = 18



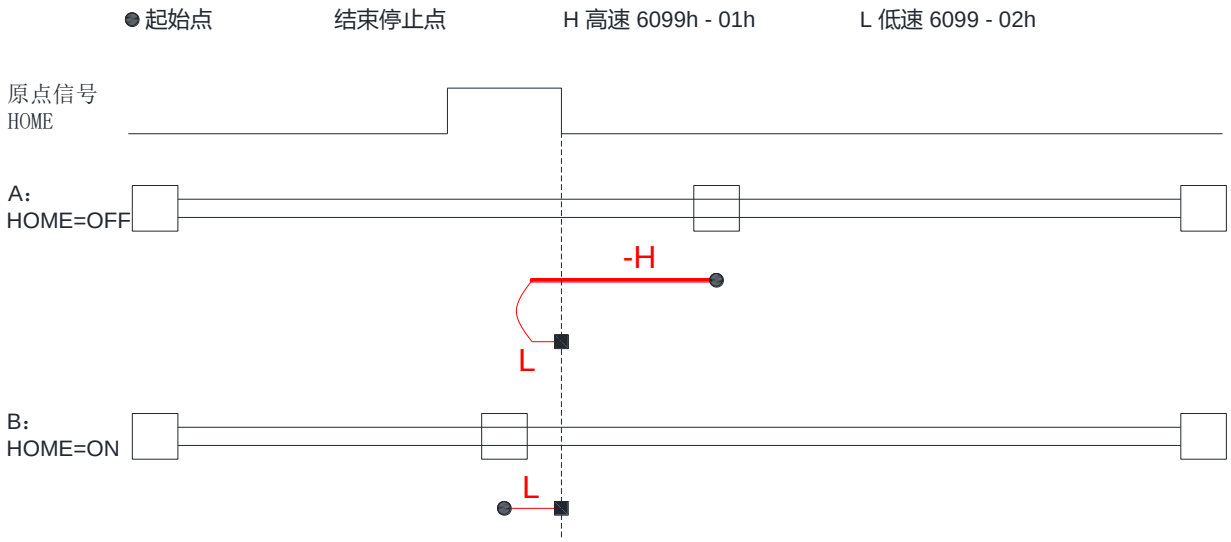
(17) Object 6098h = 19



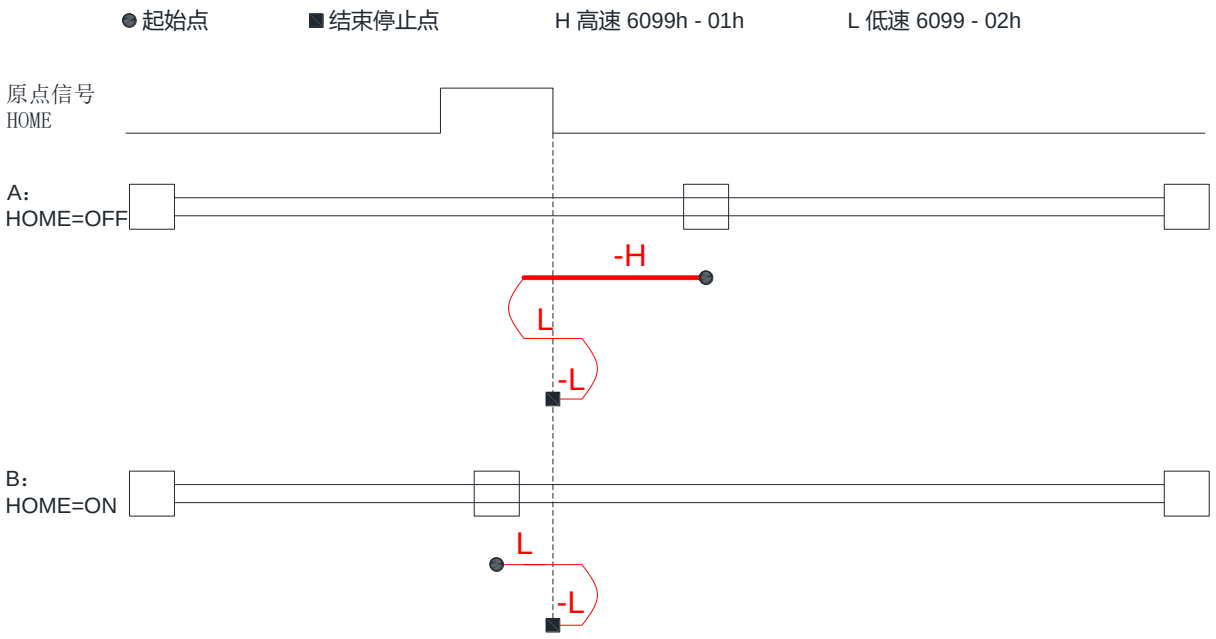
(18) Object 6098h = 20



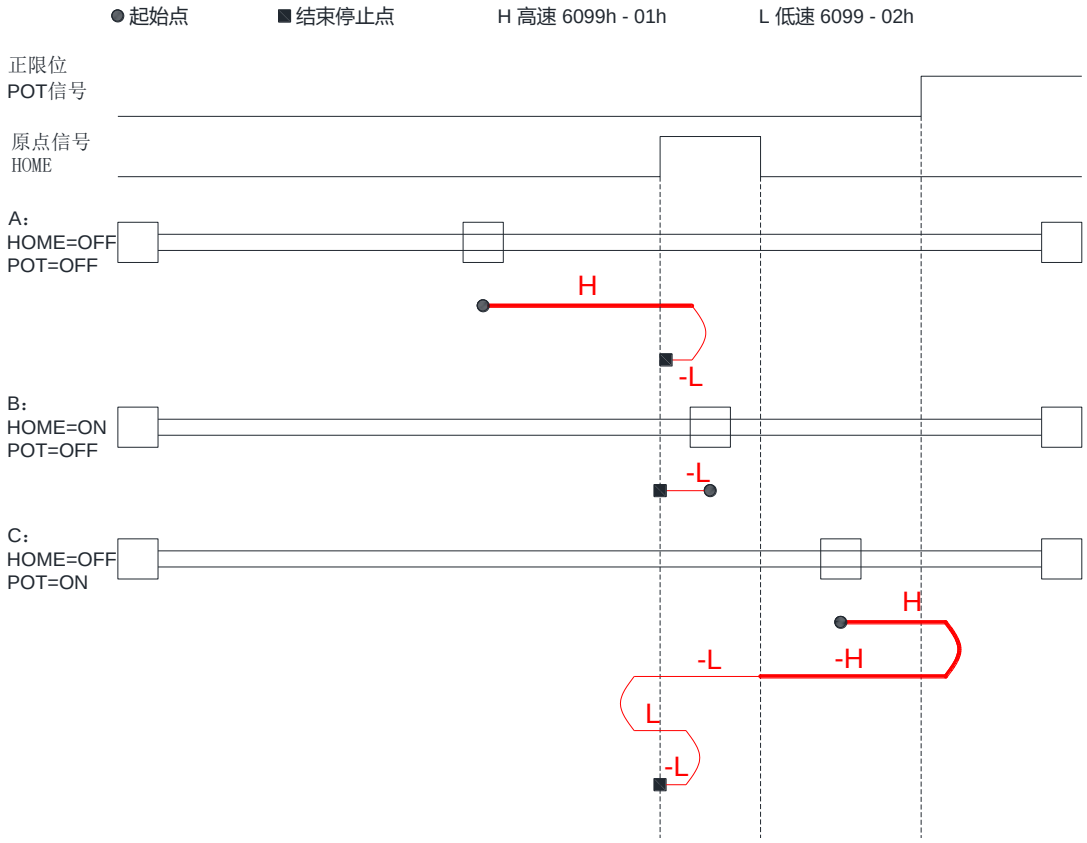
(19) Object 6098h = 21



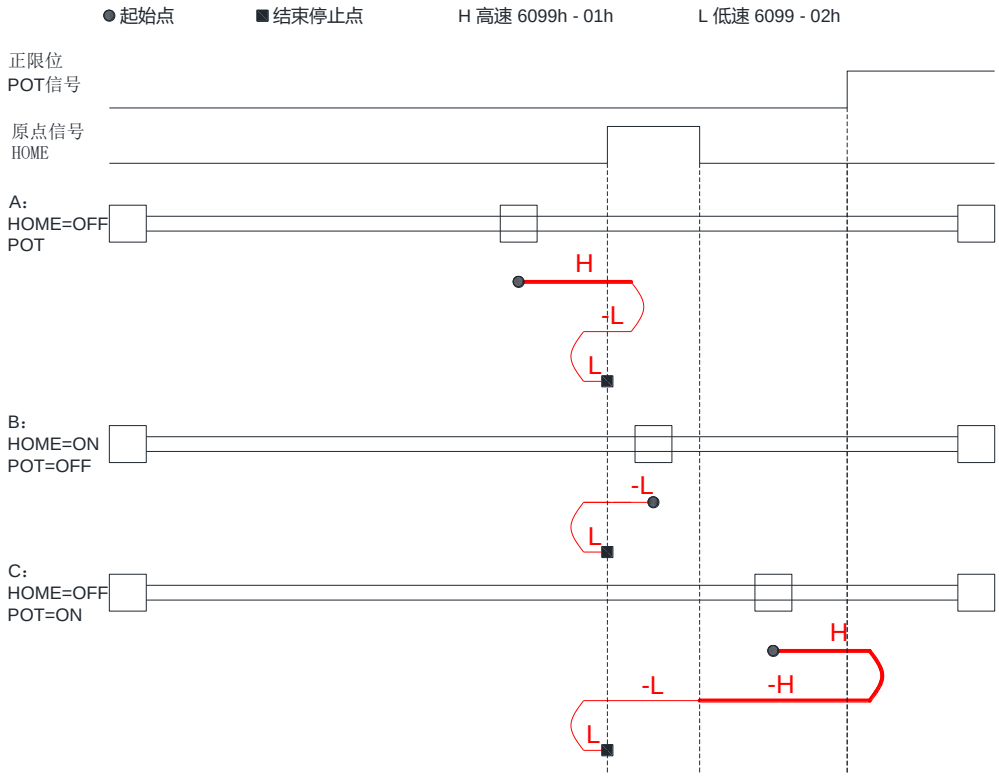
(20) Object 6098h = 22



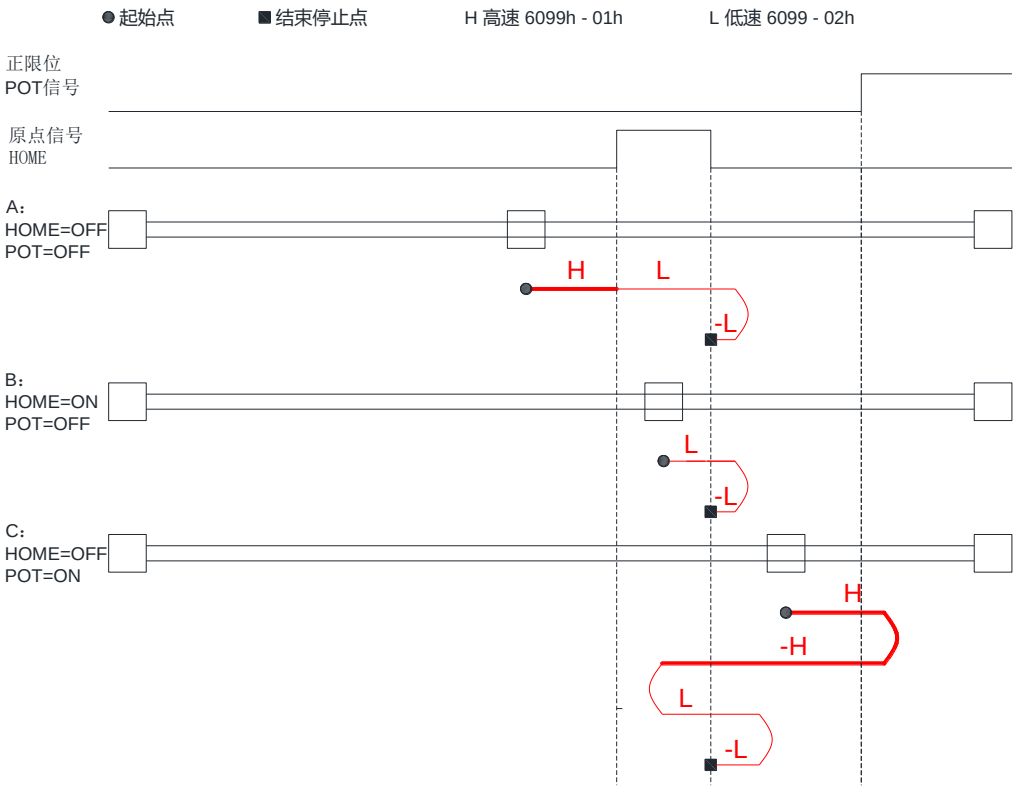
(21) Object 6098h = 23



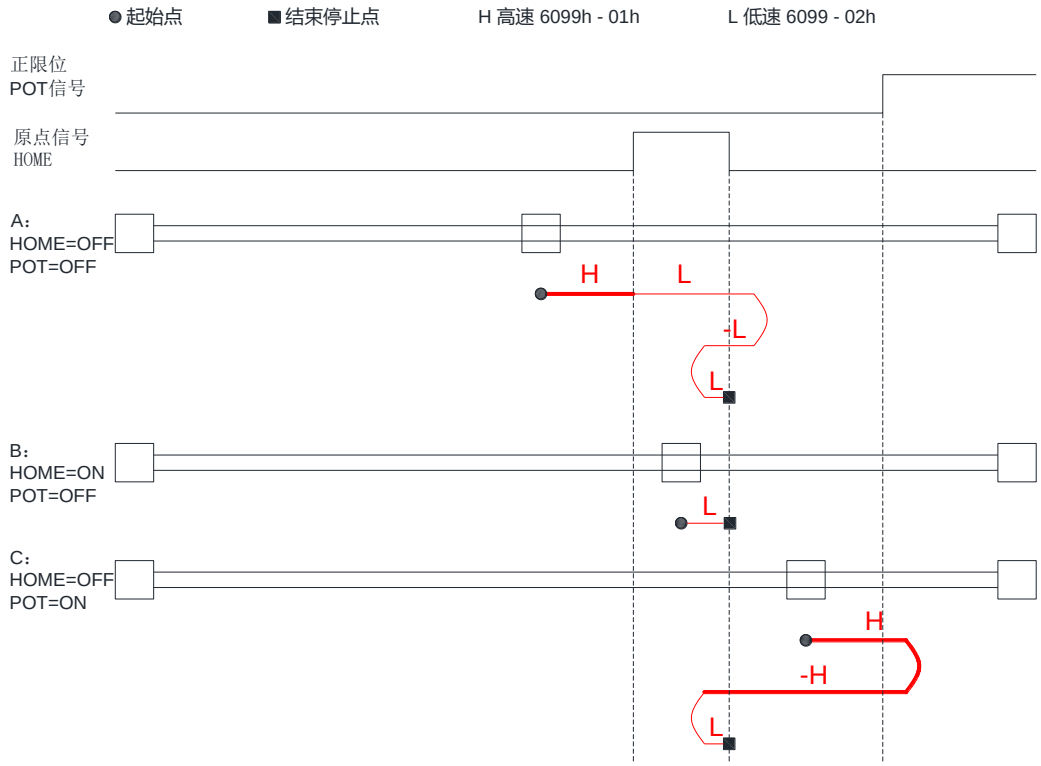
(22) Object 6098h = 24



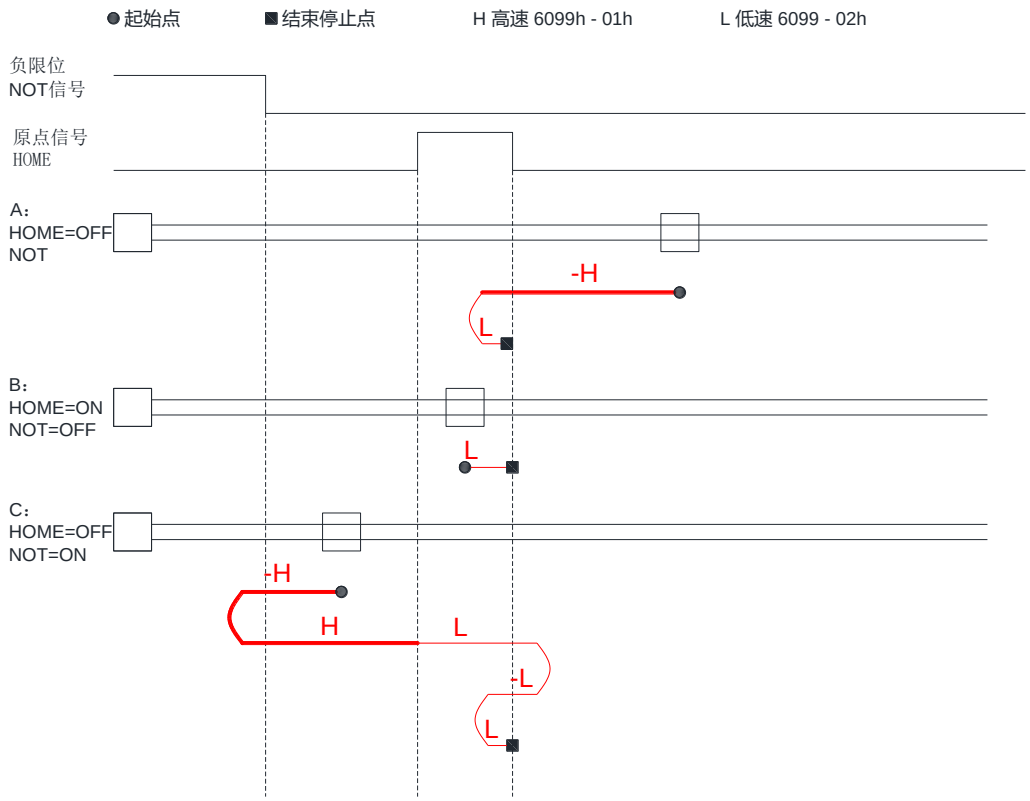
(23) Object 6098h = 25



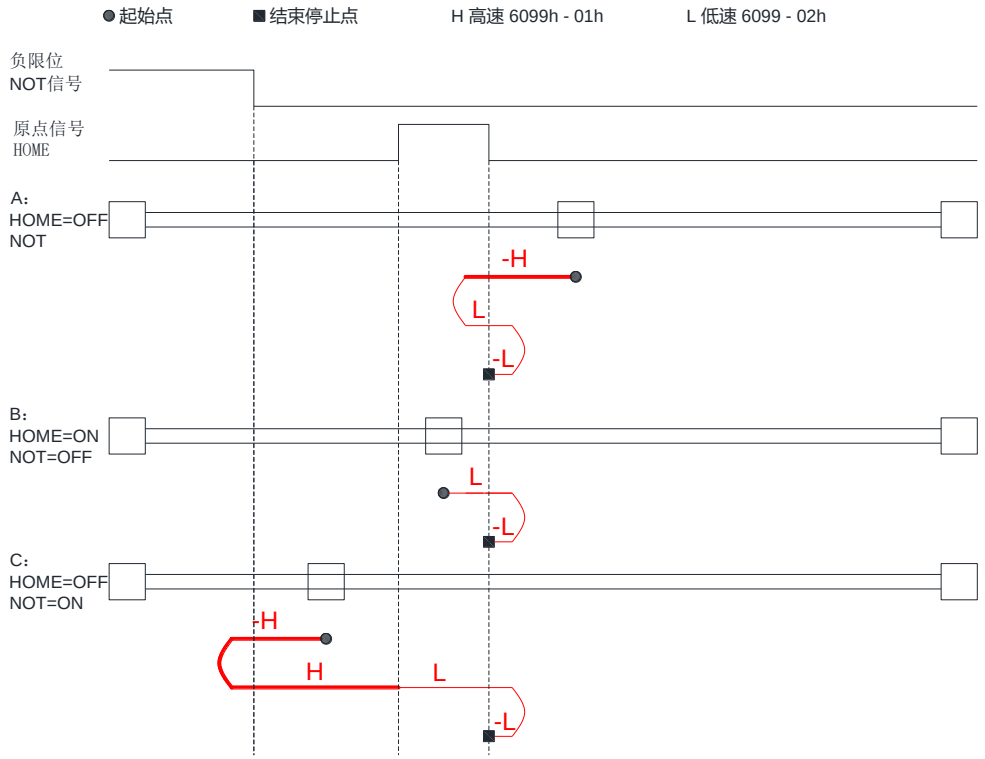
(24) Object 6098h = 26



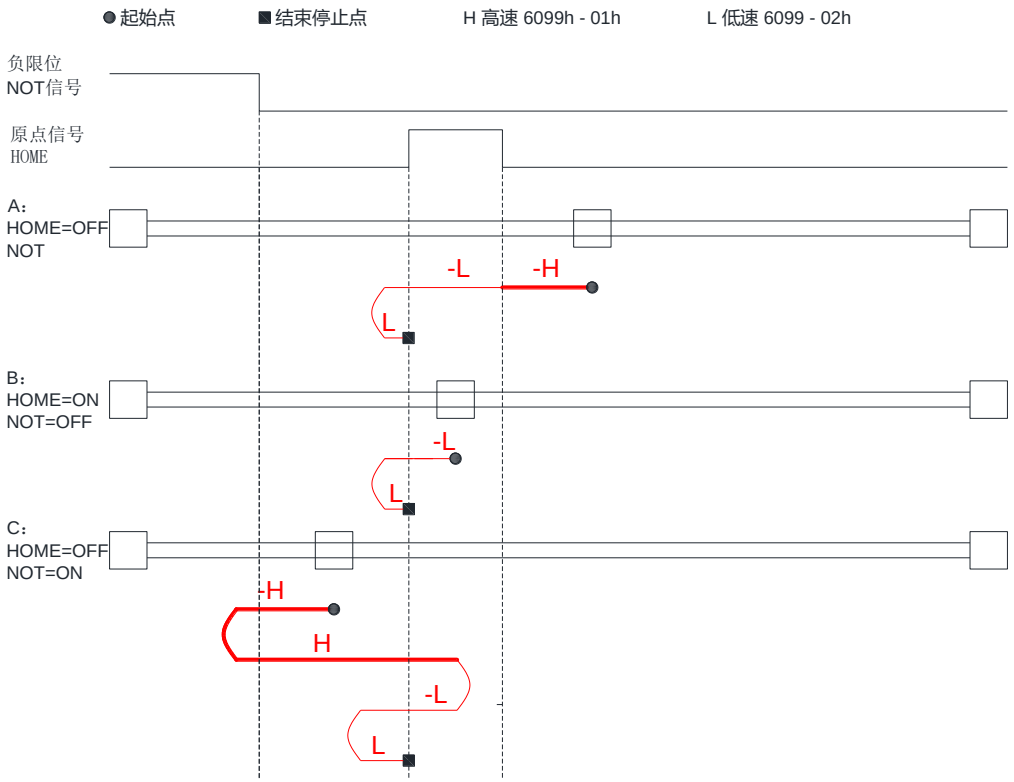
(25) Object 6098h = 27



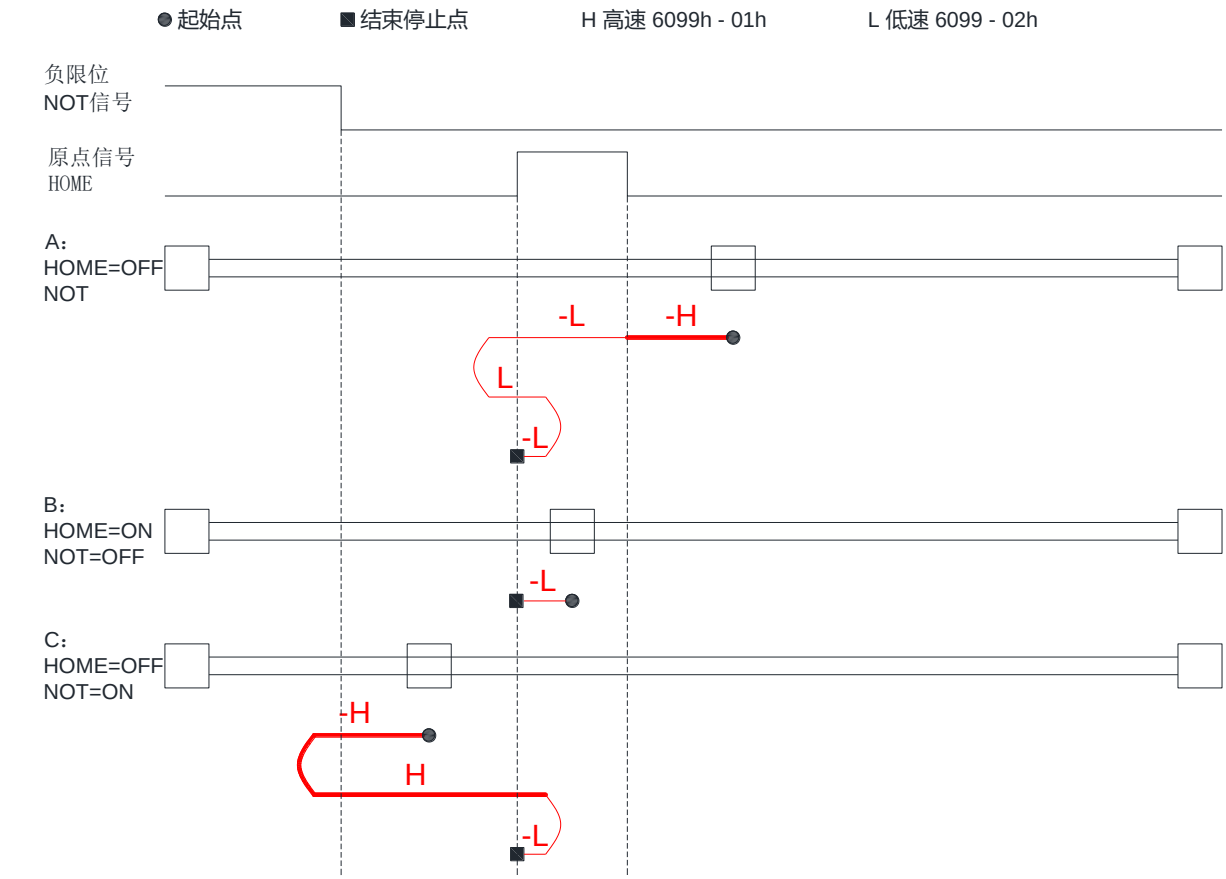
(26) Object 6098h = 28



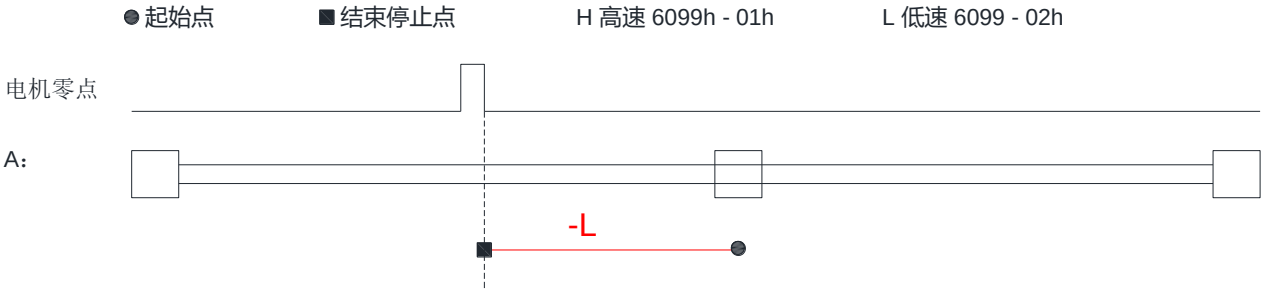
(27) Object 6098h = 29



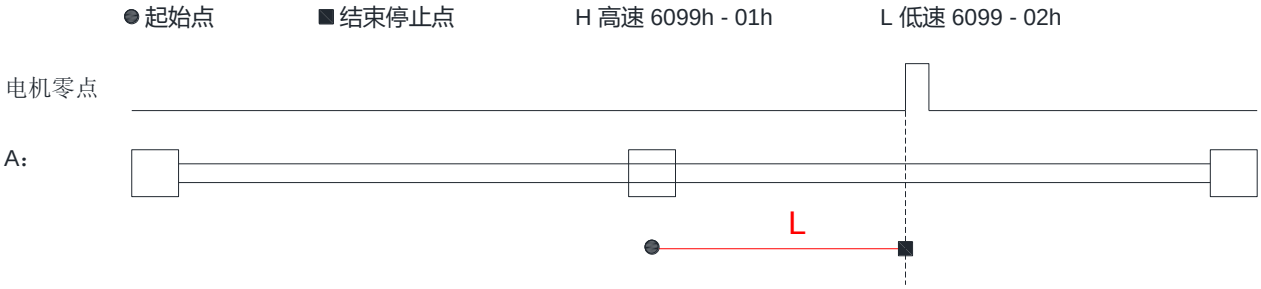
(28) Object 6098h = 30



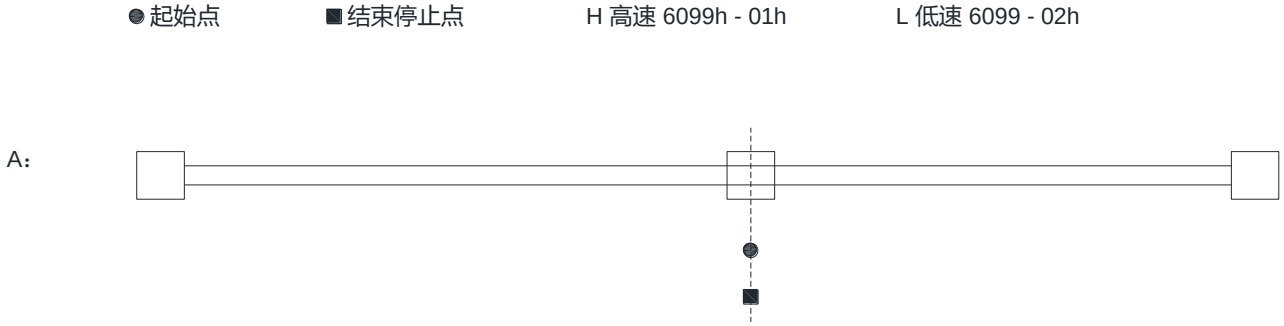
(29) Object 6098h = 33, 37



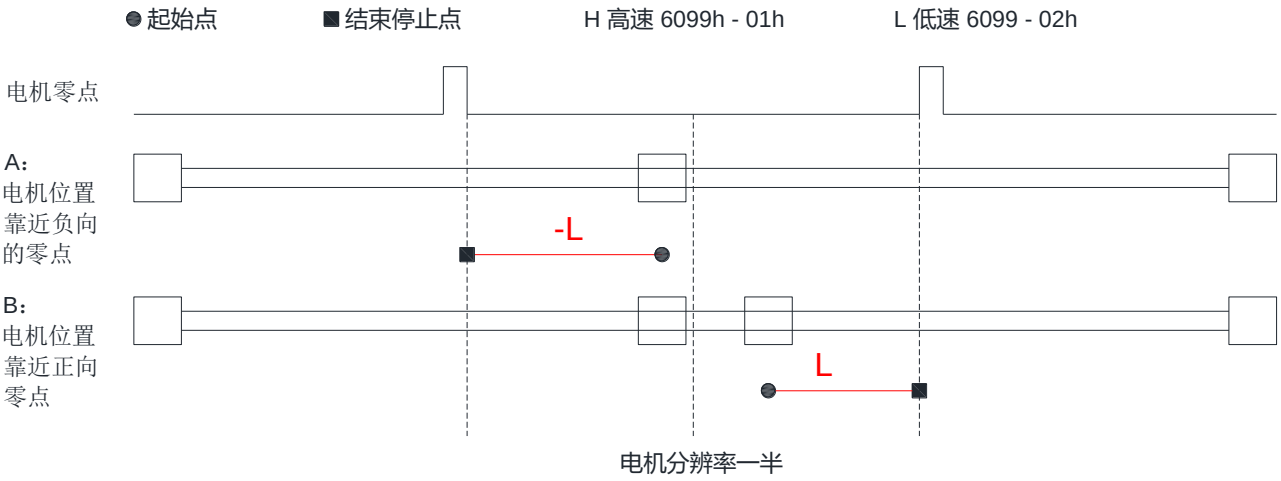
(30) Object 6098h = 34, 36



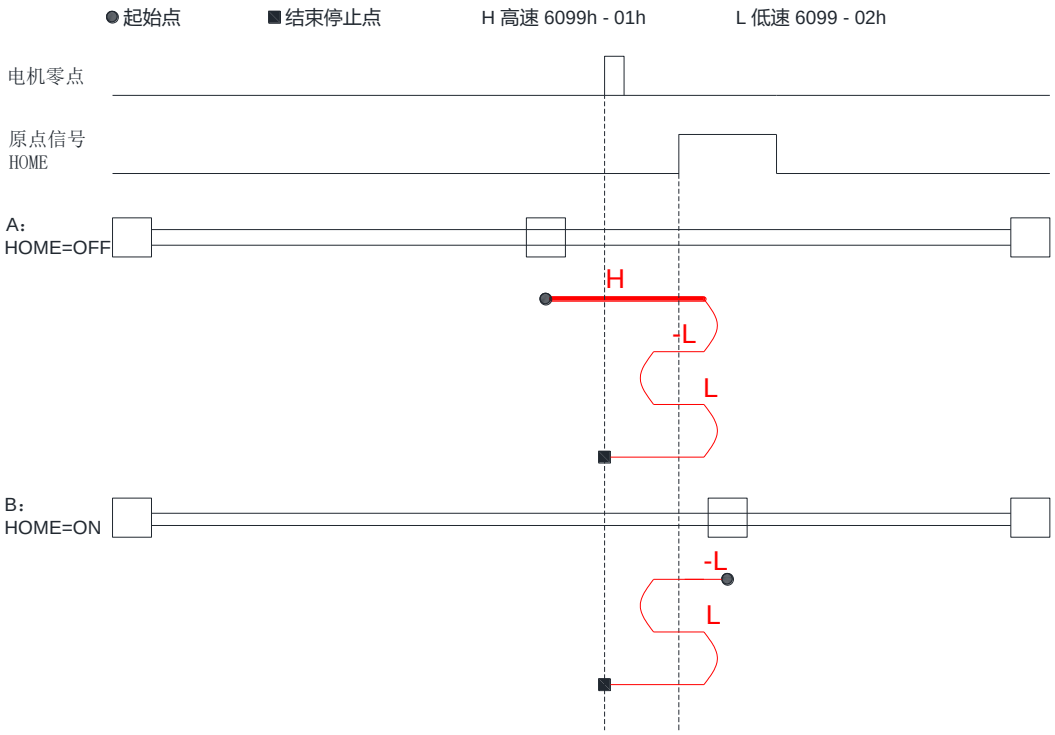
(31) Object 6098h = 35



(32) Object 6098h = 38



(33) Object 6098h = 39



6.10.3. Recommended Configuration

RPDO	TPDO	Description
6040h: Control Word	6041h: Status Word	Necessary
6060h: Modes of Operation	6061h: Modes of Operation Display	Optional
6098h: Homing Method		
6099-01h: Speed during search for switch		
6099-02h: Speed during search for zero	603Fh: Error Code	Optional
609Ah: Homing acceleration	60FDh: Digital Inputs	Optional

6.11. Homing Mode (HM)

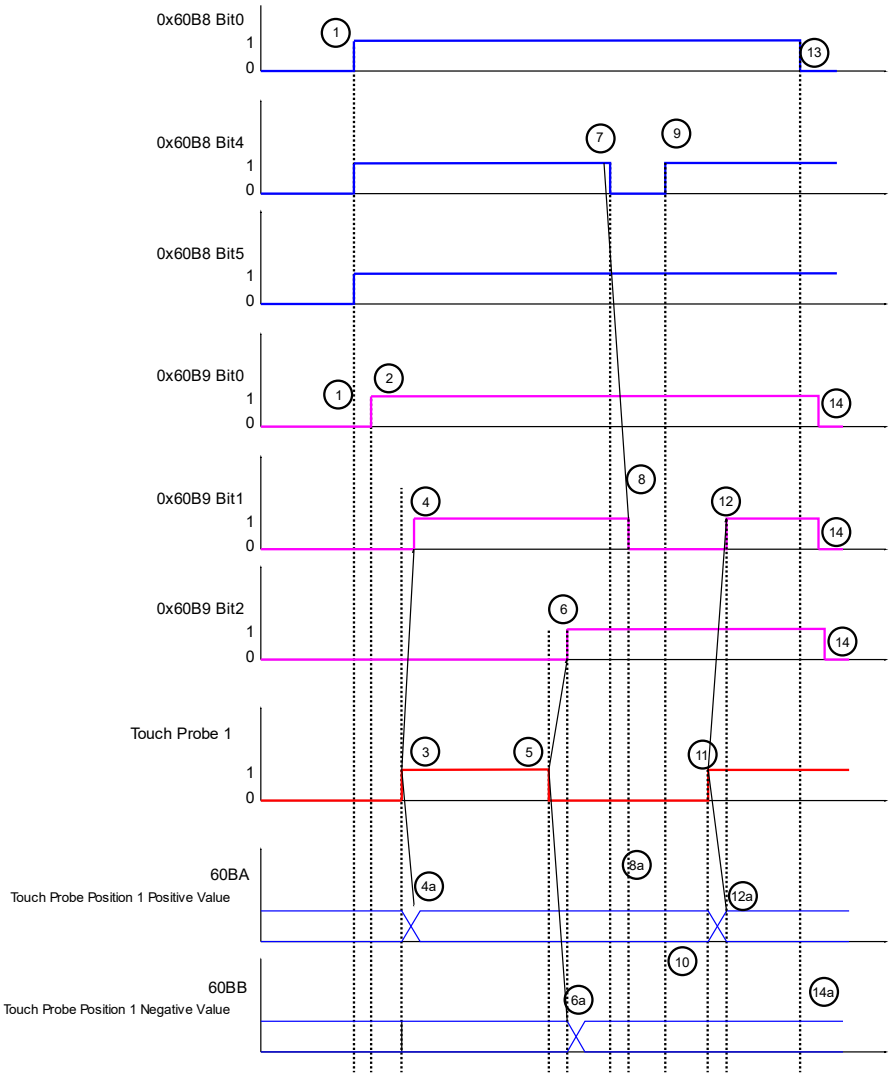
6.11.1. Probe Function

The probe function latches the motor position information through the digital input port. The function and polarity of the digital input port of D5V EtherCAT drive can be defined by index 0x2004.

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

Index	Object description
0x60B8	Touch Probe Function
0x60B9	Touch Probe Status
0x60BA	Touch Probe Position 1 Positive Value
0x60BB	Touch Probe Position 1 Negative Value
0x60BC	Touch Probe Position 2 Positive Value
0x60BD	Touch Probe Position 2 Negative Value

The timing diagram of the probe is as follows:



The probe timing description is as follows:

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 zignal 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

7. Object Dictionary Details

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 EtherCAT 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 D5V 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		Electronic gear ratio numerator
6091h	02h		Electronic gear ratio denominator

◆ **The mapping between D5V EtherCAT series servo drive function codes and object dictionaries is as follows:**

Object dictionary index = 0x2000 + Function code group number

Object dictionary subindex = Function code set internal bias in hexadecimal + 1

For example:

The object dictionary corresponding to function code P03.04 is 2003-05h.

The object dictionary corresponding to function code P13.23 is 200D-18h.

◆ “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 mode”

Related mode	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. Communication Parameters in Detail (Group 1000h)

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

Describe the subprotocol types of CoE devices:

Bit	Name	Description
0～15	Device subprotocol	402(192h): Device subprotocol
16～23	Type	02: Servo drive
25～31	Mode	Manufacturer-specific

Index	Name	Error register					Data structure	-	Data type	-
1001h	Data range	-	Factory setting	Determined by model	Accessibility	RO	Related mode	-	Map	NO

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

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

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

Index	Name	Storage parameter					Data structure	-	Data type	-
1010h	Data range	-	Factory setting	Determined by version	Accessibility	RW	Related mode	-	Map	NO

Index	Name	Factory reset					Data structure	-	Data type	-
1011h	Data range	-	Factory setting	Determined by version	Accessibility	RW	Related mode	-	Map	NO

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

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

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

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

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

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

Index 10F1h	Name	Error setting					Data structure	REC	Data type	-
	Data range	OD data range	Factory setting	OD default value	Accessibility	RW	Related mode	ALL	Map	NO

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

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

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

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

Subindex 04h	Name	The 4th mapping object					Data structure	-	Data type	Uint32
	Data range	0～4294967295	Factory setting	0x60830020	Accessibility	RW	Related mode	ALL	Map	NO

Subindex 05h	Name	The 5th mapping object					Data structure	-	Data type	Uint32
	Data range	0～4294967295	Factory setting	0x60840020	Accessibility	RW	Related mode	ALL	Map	NO

Subindex 06h	Name	The 6th mapping object					Data structure	-	Data type	Uint32
	Data range	0～4294967295	Factory setting	0x60600008	Accessibility	RW	Related mode	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 mode	ALL	Map	NO

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

Subindex 04h	Name	The 4th mapping object					Data structure	-	Data type	Uint32
	Data range	0~4294967295	Factory setting	0x60FF0020	Accessibility	RW	Related mode	ALL	Map	NO

Subindex 05h	Name	The 5th mapping object					Data structure	-	Data type	Uint32
	Data range	0~4294967295	Factory setting	0x60600008	Accessibility	RW	Related mode	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 mode	ALL	Map	NO

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

Subindex 04h	Name	The 4th mapping object					Data structure	-	Data type	Uint32
	Data range	0~4294967295	Factory setting	0x60400020	Accessibility	RW	Related mode	ALL	Map	NO

Subindex 05h	Name	The 5th mapping object					Data structure	-	Data type	Uint32
	Data range	0~4294967295	Factory setting	0x60B90010	Accessibility	RW	Related mode	ALL	Map	NO

Subindex 06h	Name	The 6th mapping object					Data structure	-	Data type	Uint32
	Data range	0~4294967295	Factory setting	0x60BA0020	Accessibility	RW	Related mode	ALL	Map	NO

Subindex 07h	Name	The 7th mapping object					Data structure	-	Data type	Uint32
	Data range	0~4294967295	Factory setting	0x60FD0020	Accessibility	RW	Related mode	ALL	Map	NO

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

Index 1A01h	Name	TPDO2 mapping object					Data structure	REC	Data type	Uint32
	Data range	OD data range	Factory setting	OD default value	Accessibility	RW	Related mode	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 mode	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 mode	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 mode	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 mode	ALL	Map	NO

Subindex 04h	Name	The 4th mapping object					Data structure	-	Data type	Uint32
	Data range	0~4294967295	Factory setting	0x60FD0020	Accessibility	RW	Related mode	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 mode	ALL	Map	NO

Index 1A02h	Name	TPDO3 mapping object					Data structure	REC	Data type	Uint32
	Data range	OD data range	Factory setting	OD default value	Accessibility	RW	Related mode	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 mode	ALL	Map	NO

Subindex 01~0Ch	Name	The 1st to 12th mapping objects					Data structure	-	Data type	Uint32
	Data range	0~4294967295	Factory setting	-	Accessibility	RW	Related mode	ALL	Map	NO

Index 1C00h	Name	Synchronous management communication type					Data structure	REC	Data type	Uint32
	Data range	OD data range	Factory setting	OD default value	Accessibility	RW	Related mode	ALL	Map	NO

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

Subindex 01h	Name	SM0 communication type					Data structure	-	Data type	Uint8
	Data range	-	Factory setting	0x01	Accessibility	RO	Related mode	-	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 mode	-	Map	NO
SM1 communication type: receiving mailbox										

Subindex 03h	Name	SM2 communication type					Data structure	-	Data type	Uint8
	Data range	-	Factory setting	0x03	Accessibility	RO	Related mode	-	Map	NO
SM2 communication type: receiving mailbox										

Subindex 04h	Name	SM3 communication type					Data structure	-	Data type	Uint8
	Data range	-	Factory setting	0x04	Accessibility	RO	Related mode	-	Map	NO
SM3 communication type: receiving mailbox										

Index 1C12h	Name	RxPDO assignment					Data structure	ARR	Data type	Uint16
	Data range	OD data range	Factory setting	OD default value	Accessibility	RW	Related mode	ALL	Map	NO
Set the assigned object index of the RPDO										

Subindex 00h	Name	Maximum subindex number assigned by synchronous management 2 RPDO					Data structure	-	Data type	Uint8
	Data range	0~1	Factory setting	1	Accessibility	RW	Related mode	ALL	Map	NO

Index 01h	Name	Assigned object index of the RPDO					Data structure	-	Data type	Uint16
	Data range	0~65535	Factory setting	0x1600	Accessibility	RW	Related mode	-	Map	NO
Set the assigned object index of the RPDO.										

Index 1C13h	Name	TxPDO assignment					Data structure	ARR	Data type	Uint16
	Data range	OD data range	Factory setting	OD default value	Accessibility	RW	Related mode	ALL	Map	NO
Set the assigned object index of the TPDO.										

Subindex 00h	Name	Maximum subindex number assigned by synchronous management 3 TPDO					Data structure	-	Data type	Uint8
	Data range	0~1	Factory setting	1	Accessibility	RW	Related mode	ALL	Map	NO

Index 01h	Name	Assigned object index of the TPDO					Data structure	-	Data type	Uint16
	Data range	0~65535	Factory setting	0x1A00	Accessibility	RW	Related mode	-	Map	NO
Set the assigned object index of the TPDO.										

Index 1C32h	Name	Synchronization Manager synchronizes output parameters					Data structure	REC	Data type	Uint16
	Data range	OD data range	Factory setting	OD default value	Accessibility	RO	Related mode	ALL	Map	NO
Describes the output parameters of SM2.										

Subindex 00h	Name	Maximum subindex number of the synchronous management 2 synchronizes output parameters					Data structure	-	Data type	Uint8
	Data range	-	Factory setting	32	Accessibility	RO	Related mode	-	Map	NO

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

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

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

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

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

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

Subindex	Name	Synchronization error					Data structure	-	Data type	Bool
20h	Data range	-	Factory setting	0	Accessibility	RO	Related mode	-	Map	NO
Indicates whether a synchronization error occurs: TRUE: Synchronization is enabled and no synchronization error occurs. FALSE: Synchronization is not activated or a synchronization error occurs.										

Index	Name	Synchronization Manager synchronizes input parameters					Data structure	REC	Data type	OD type
1C33h	Data range	OD data range	Factory setting	-	Accessibility	RO	Related mode	-	Map	NO
Describes the input parameters of SM3.										

Subindex	Name	Maximum subindex number of the synchronous management 2 synchronizes input parameters					Data structure	-	Data type	Uint8
00h	Data range	-	Factory setting	32	Accessibility	RO	Related mode	-	Map	NO

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

Subindex	Name	Cycle time (unit: ns)					Data structure	-	Data type	Uint32
02h	Data range	-	Factory setting	0x003D0900	Accessibility	RO	Related mode	-	Map	NO

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

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

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

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

Subindex	Name	Synchronization error					Data structure	-	Data type	Bool
20h	Data range	-	Factory setting	0	Accessibility	RO	Related mode	-	Map	NO

7.3. Manufacturer Defines Parameters in Detail (Group 2000h)

7.3.1. Servo Parameters

Index	Name	Servo Parameters					Data structure	ARR	Data type	Uint16
2000h	Data range	OD data range	Factory setting	OD default value	Accessibility	-	Related mode	-	Map	NO

Subindex	Name	Maximum subindex number					Data structure	-	Data type	Uint8
00h	Data range	-	Factory setting	38h	Accessibility	RO	Related mode	-	Map	NO

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

Subindex	Name	drive model					Data structure	-	Data type	Uint16
02h	Data range	0~65535	Factory setting	Determined by model	Accessibility	RW	Related mode	-	Map	NO

Set the drive model:

Display value	Description
0x92(146)	D5V120E
0x93(147)	D5V250E
0x95(149)	D5V380E

Subindex	Name	Servo software version					Data structure	-	Data type	Uint16
03h	Data range	-	Factory setting	-	Accessibility	RO	Related mode	-	Map	NO

Subindex	Name	EtherCAT software version					Data structure	-	Data type	Uint16
05h	Data range	-	Factory setting	-	Accessibility	RO	Related mode	-	Map	NO

Subindex	Name	Servo hardware version					Data structure	-	Data type	Uint16
06h	Data range	-	Factory setting	-	Accessibility	RO	Related mode	-	Map	NO

Subindex 08h	Name	Servo customized version					Data structure	-	Data type	Uint32
	Data range	-	Factory setting	-	Accessibility	RO	Related mode	-	Map	NO

Subindex 0Ah	Name	Software build number					Data structure	-	Data type	Uint32
	Data range	-	Factory setting	-	Accessibility	RO	Related mode	-	Map	NO

Subindex 0Bh	Name	Reserved					Data structure	-	Data type	Uint32
	Data range	-	Factory setting	-	Accessibility	RO	Related mode	-	Map	NO

Subindex 0Eh	Name	Inner marco					Data structure	-	Data type	Uint32
	Data range	-	Factory setting	-	Accessibility	RO	Related mode	-	Map	NO

Subindex 11h	Name	Motor ID					Data structure	-	Data type	Uint16
	Data range	0~65535	Factory setting	Determined by model	Accessibility	RW	Related mode	-	Map	NO

Subindex 12h	Name	Motor rated power (unit: 0.01KW)					Data structure	-	Data type	Uint16
	Data range	0~65535	Factory setting	Determined by model	Accessibility	RW	Related mode	-	Map	NO

Subindex 13h	Name	Motor rated voltage (uit: V)					Data structure	-	Data type	Uint16
	Data range	0~65535	Factory setting	Determined by model	Accessibility	RW	Related mode	-	Map	NO

Subindex 14h	Name	Motor rated current (unit: 0.1A)					Data structure	-	Data type	Uint16
	Data range	0~65535	Factory setting	Determined by model	Accessibility	RW	Related mode	-	Map	NO

Subindex 15h	Name	Motor rated speed (unit: rpm)					Data structure	-	Data type	Uint16
	Data range	0~65535	Factory setting	Determined by model	Accessibility	RW	Related mode	-	Map	NO

Subindex 16h	Name	Motor max speed (unit: rpm)					Data structure	-	Data type	Uint16
	Data range	0~65535	Factory setting	Determined by model	Accessibility	RW	Related mode	-	Map	NO

Subindex 17h	Name	Motor rated torque (unit: 0.01Nm)					Data structure	-	Data type	Uint16
	Data range	0~65535	Factory setting	Determined by model	Accessibility	RW	Related mode	-	Map	NO

Subindex 18h	Name	Motor max torque (unit: 0.01Nm)					Data structure	-	Data type	Uint16
	Data range	0~65535	Factory setting	Determined by model	Accessibility	RW	Related mode	-	Map	NO

Subindex 19h	Name	Motor moment of inertia (unit: 0.01Kg.cm^2)					Data structure	-	Data type	Uint16
	Data range	0~65535	Factory setting	Determined by model	Accessibility	RW	Related mode	-	Map	NO

Subindex 1Ah	Name	Motor pole pairs (unit: pole pairs)					Data structure	-	Data type	Uint16
	Data range	0~65535	Factory setting	Determined by model	Accessibility	RW	Related mode	-	Map	NO

Subindex 1Bh	Name	Motor stator resistance (unit: 0.001Ω)					Data structure	-	Data type	Uint16
	Data range	0~65535	Factory setting	Determined by model	Accessibility	RW	Related mode	-	Map	NO

Subindex 1Ch	Name	Motor stator inductance Lq (unit: 0.01mH)					Data structure	-	Data type	Uint16
	Data range	0~65535	Factory setting	Determined by model	Accessibility	RW	Related mode	-	Map	NO

Subindex 1Dh	Name	Motor stator inductance Ld (unit: 0.01mH)					Data structure	-	Data type	Uint16
	Data range	0~65535	Factory setting	Determined by model	Accessibility	RW	Related mode	-	Map	NO

Subindex 1Eh	Name	Motor back EMF coefficient (unit: 0.01mV/rpm)					Data structure	-	Data type	Uint16
	Data range	0~65535	Factory setting	Determined by model	Accessibility	RW	Related mode	-	Map	NO

Subindex 1Fh	Name	Motor torque coefficient (unit: 0.01Nm/A）					Data structure	-	Data type	Uint16
	Data range	0~65535	Factory setting	Determined by model	Accessibility	RW	Related mode	-	Map	NO

Subindex 20h	Name	Motor electrical time constant (unit: 0.01ms)					Data structure	-	Data type	Uint16
	Data range	0~65535	Factory setting	Determined by model	Accessibility	RW	Related mode	-	Map	NO

Subindex 21h	Name	Motor mechanical time constant (unit: 0.01ms)					Data structure	-	Data type	Uint16
	Data range	0~65535	Factory setting	Determined by model	Accessibility	RW	Related mode	-	Map	NO

Subindex 23h	Name	Motor encoder type					Data structure	-	Data type	Uint16
	Data range	1~2	Factory setting	Determined by model	Accessibility	RW	Related mode	-	Map	NO

Set the motor encoder type correctly, otherwise the drive will not work properly.

Set value	Motor encoder type
1	Multi-turn absolute encoder
2	Single-turn absolute encoder

Subindex 24h	Name	Encoder zero offset (unit: encoder unit)					Data structure	-	Data type	Uint16
	Data range	0~4294967295	Factory setting	0	Accessibility	RW	Related mode	-	Map	NO

Subindex 26h	Name	Encoder resolution (unit: Bits)					Data structure	-	Data type	Uint16
	Data range	0~65535	Factory setting	Determined by model	Accessibility	RW	Related mode	-	Map	NO

Subindex 38h	Name	Encoder version					Data structure	-	Data type	Uint16
	Data range	-	Factory setting	-	Accessibility	RO	Related mode	-	Map	NO

7.3.2. Basic Control Parameters

Index	Name	Basic control parameters					Data structure	ARR	Data type	Uint16
2001h	Data range	OD data range	Factory setting	OD default value	Accessibility	-	Related mode	ALL	Map	NO

Subindex	Name	Maximum subindex number					Data structure	-	Data type	Uint8
00h	Data range	-	Factory setting	58h	Accessibility	RO	Related mode	-	Map	NO

Subindex	Name	Control mode selection					Data structure	-	Data type	Uint16
01h	Data range	0~8	Factory setting	3	Accessibility	RW	Related mode	ALL	Map	NO

Set the drive control mode:

Set value	Control mode
0	Position control mode
1	Speed control mode
2	Torque control mode
3	EtherCAT/CANopen control mode
4	Speed - Torque control mode
5	Position - Speed control mode
6	Position - Torque control mode
7	Position - Speed - Toruqe control mode
8	CANopen control mode

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

When viewed from the motor output shaft, the motor rotates in the positive direction.

Set value	Rotation direction	Remark
0	Using CCW direction as the positive direction for motor operation	When giving a forward command, when viewed from the motor shaft side, the motor rotates in the CCW direction, which means the motor rotates counterclockwise.
1	Using CW direction as the positive direction for motor operation	When giving a forward command, when viewed from the motor shaft side, the motor rotates in the CW direction, which means the motor rotates clockwise.

Subindex	Name	Position mode selection					Data structure	-	Data type	Uint16
04h	Data range	0～1	Factory setting	0	Accessibility	RW	Related mode	ALL	Map	NO

Set absolute position mode:

Set value	Position mode
0	Incremental position mode
1	Absolute linear position mode
2	Absolute rotation position mode

Subindex	Name	Delay from servo OFF to brake output (unit: ms)					Data structure	-	Data type	Uint16
05h	Data range	0~1000	Factory setting	500	Accessibility	RW	Related mode	-	Map	NO

Subindex	Name	Servo OFF to brake output speed limit (unit: rpm)					Data structure	-	Data type	Uint16
06h	Data range	0~3000	Factory setting	30	Accessibility	RW	Related mode	-	Map	NO

Subindex	Name	Servo OFF stop mode selection					Data structure	-	Data type	Uint16
07h	Data range	0~4	Factory setting	3	Accessibility	RW	Related mode	-	Map	NO

Set value	Servo OFF stop mode selection
0	Coast to stop, keeping de-energized state
1	Stop at zero speed, keeping position lock state
2	Coast to stop, keeping DB state
3	Stop by DB, keeping DB state
4	Stop at zero speed, keeping DB state

Subindex	Name	Overtravel stop mode selection					Data structure	-	Data type	Uint16
08h	Data range	0~4	Factory setting	3	Accessibility	RW	Related mode	-	Map	NO

Set value	Overtravel stop mode selection
0	Coast to stop, keeping de-energized state
1	Coast to stop, keeping DB state
2	Stop by DB, keeping DB state
3	Stop at zero speed, keeping position lock state
4	Stop at zero speed, keeping de-energized state

Subindex	Name	Fault 2 stop mode selection					Data structure	-	Data type	Uint16
09h	Data range	0~5	Factory setting	2	Accessibility	RW	Related mode	-	Map	NO

Set value	Fault 2 stop mode selection
0	Coast to stop, keeping de-energized state
1	Coast to stop, keeping DB state
2	Stop by DB, keeping DB state
3	Stop at zero speed, keeping de-energized state
4	Stop at zero speed, keeping DB state
5	Stop by DB, keeping de-energized state

Subindex	Name	Fault 1 stop mode selection					Data structure	-	Data type	Uint16
0Ah	Data range	0~3	Factory setting	2	Accessibility	RW	Related mode	-	Map	NO

Set value	Fault 1 stop mode selection
0	Coast to stop, keeping de-energized state
1	Coast to stop, keeping DB state
2	Stop by DB, keeping DB state
5	Stop by DB, keeping de-energized state

Subindex	Name	S-ON OFF zero speed stop function					Data structure	-	Data type	Uint16
0Bh	Data range	0: Disable 1: Enable	Factory setting	30	Accessibility	RW	Related mode	-	Map	NO

Subindex	Name	Delay from servo ON to brake output (unit: ms)					Data structure	-	Data type	Uint16
0Ch	Data range	0~2000	Factory setting	0	Accessibility	RW	Related mode	-	Map	NO

Subindex	Name	Delay from brake output to command received (unit: ms)					Data structure	-	Data type	Uint16
0Dh	Data range	0~2000	Factory setting	100	Accessibility	RW	Related mode	-	Map	NO

Subindex	Name	Delay from brake output to servo OFF (unit: ms)					Data structure	-	Data type	Uint16
0Eh	Data range	1~2000	Factory setting	200	Accessibility	RW	Related mode	-	Map	NO

Subindex 12h	Name	Disable warning display					Data structure	-	Data type	Uint16
	Data range	0: Disable 1: Enable	Factory setting	0	Accessibility	RW	Related mode	-	Map	NO

Subindex 13h	Name	Auto setting absolute mode					Data structure	-	Data type	Uint16
	Data range	0: Disable 1: Enable	Factory setting	0	Accessibility	RW	Related mode	-	Map	NO

Subindex 15h	Name	Permissible minimum resistance of brake resistor (unit: Ω)					Data structure	-	Data type	Uint16
	Data range	-	Factory setting	40	Accessibility	RO	Related mode	-	Map	NO

Subindex 18h	Name	Brake resistor heat dissipation coefficient					Data structure	-	Data type	Uint16
	Data range	10～100	Factory setting	30	Accessibility	RW	Related mode	-	Map	NO

Subindex 19h	Name	Brake resistor type selection					Data structure	-	Data type	Uint16
	Data range	0～3	Factory setting	1	Accessibility	RW	Related mode	-	Map	NO

Set value	Brake resistor type
0	Internal brake resistor
1	External brake resistor
2	No brake resistor
3	External brake resistor with air-cooled

Subindex 1Ah	Name	External brake resistor power (unit: W)					Data structure	-	Data type	Uint16
	Data range	1～65535	Factory setting	75	Accessibility	RW	Related mode	-	Map	NO

Subindex 1Bh	Name	External brake resistor resistance (unit: Ω)					Data structure	-	Data type	Uint16
	Data range	1～2000	Factory setting	50	Accessibility	RW	Related mode	-	Map	NO

Subindex 1Ch	Name	Brake threshold voltage (unit: V)					Data structure	-	Data type	Uint16
	Data range	0～999	Factory setting	380	Accessibility	RW	Related mode	-	Map	NO

Subindex 1Dh	Name	Brake feedback mode					Data structure	-	Data type	Uint16
	Data range	0: Enable feedback detection 1: Disable feedback detection	Factory setting	1	Accessibility	RW	Related mode	-	Map	NO

Subindex 1Eh	Name	Brake maximum duration (unit: ms)					Data structure	-	Data type	Uint16
	Data range	500~65535	Factory setting	8000	Accessibility	RW	Related mode	-	Map	NO

Subindex 1Fh	Name	Reserved (Don't set)					Data structure	-	Data type	Uint16
	Data range	0～1	Factory setting	0	Accessibility	RW	Related mode	-	Map	NO

Subindex 20h	Name	Fan voltage control					Data structure	-	Data type	Uint16
	Data range	0～8	Factory setting	0	Accessibility	RW	Related mode	-	Map	NO

Set value	Fan voltage control	Set value	Fan voltage control
0	100%	5	75%
1	95%	6	70%
2	90%	7	65%
3	85%	8	60%
4	80%		

Subindex 21h	Name	Disable update current gain					Data structure	-	Data type	Uint16
	Data range	0～1	Factory setting	0	Accessibility	RW	Related mode	-	Map	NO

Subindex 23h	Name	Reserved (Don't set)					Data structure	-	Data type	Uint16
	Data range	0～65535	Factory setting	0	Accessibility	RW	Related mode	-	Map	NO

Subindex 24h	Name	LED default monitoring object selection					Data structure	-	Data type	Uint16
	Data range	0～99	Factory setting	1	Accessibility	RW	Related mode	-	Map	NO

Subindex 25h	Name	LED blinking setting					Data structure	-	Data type	Uint16
	Data range	0～99	Factory setting	0	Accessibility	RW	Related mode	-	Map	NO

Subindex	Name	Reserved (Don't set)					Data structure	-	Data type	Uint16
26h	Data range	0～65535	Factory setting	0	Accessibility	RW	Related mode	-	Map	NO

Subindex	Name	Reserved (Don't set)					Data structure	-	Data type	Uint16
27h	Data range	0～65535	Factory setting	0	Accessibility	RW	Related mode	-	Map	NO

Subindex	Name	Manufacturer password					Data structure	-	Data type	Uint16
28h	Data range	0～65535	Factory setting	0	Accessibility	RW	Related mode	-	Map	NO

Subindex	Name	Reserved (Don't set)					Data structure	-	Data type	Uint16
29h	Data range	0～65535	Factory setting	0	Accessibility	RO	Related mode	-	Map	NO

Subindex	Name	Reserved (Don't set)					Data structure	-	Data type	Uint16
2Ah	Data range	0～65535	Factory setting	0	Accessibility	RO	Related mode	-	Map	NO

Subindex	Name	Reserved (Don't set)					Data structure	-	Data type	Uint16
2Bh	Data range	0～65535	Factory setting	0	Accessibility	RO	Related mode	-	Map	NO

Subindex	Name	Overvoltage protection (unit: V)					Data structure	-	Data type	Uint16
31h	Data range	0～999	Factory setting	420	Accessibility	RW	Related mode	-	Map	NO

Subindex	Name	Undervoltage protection (unit: V)					Data structure	-	Data type	Uint16
32h	Data range	0～999	Factory setting	200	Accessibility	RW	Related mode	-	Map	NO

Subindex	Name	Disable encoder eeprom					Data structure	-	Data type	Uint16
33h	Data range	0～1	Factory setting	0	Accessibility	RW	Related mode	-	Map	NO

Subindex	Name	Disable encoder multi-turn overflow fault					Data structure	-	Data type	Uint16
34h	Data range	0: Enable multi-turn overflow fault 1: Disable multi-turn overflow fault	Factory setting	0	Accessibility	RW	Related mode	-	Map	NO

Subindex	Name	Enable power-off parameter saving function					Data structure	-	Data type	Uint16
35h	Data range	0～1	Factory setting	0	Accessibility	RW	Related mode	-	Map	NO

Subindex 36h	Name	Soft limit function selection					Data structure	-	Data type	Uint16
	Data range	0: Disable soft limit 1: Enable soft limit immediately 2: Enable after successful homing	Factory setting	0	Accessibility	RW	Related mode	-	Map	NO

Subindex 38h	Name	Soft limit function selection					Data structure	-	Data type	Uint16
	Data range	0～10000	Factory setting	0	Accessibility	RW	Related mode	-	Map	NO

Subindex 39h	Name	Enable runaway protection					Data structure	-	Data type	Uint16
	Data range	0～1	Factory setting	1	Accessibility	RW	Related mode	-	Map	NO

Subindex 3Ah	Name	Locked rotor fault detection time (unit: ms)					Data structure	-	Data type	Uint16
	Data range	10～65535	Factory setting	200	Accessibility	RW	Related mode	-	Map	NO

Subindex 3Bh	Name	Enable locked rotor fault					Data structure	-	Data type	Uint16
	Data range	0～3	Factory setting	1	Accessibility	RW	Related mode	-	Map	NO

Set value	Enable locked rotor fault
0	Disable
1	Alarm when command torque ≥ positive/negative torque limit
2	Alarm when command torque is greater than P01.82 set value
3	Alarm when the commanded torgue is greater than the larger of P01.82 and positive/negative torque limit values

Subindex 3Ch	Name	Motor overload protection coefficient (unit: %)					Data structure	-	Data type	Uint16
	Data range	40～500	Factory setting	100	Accessibility	RW	Related mode	-	Map	NO

◆ Note: The smaller the value of this parameter, the more likely the drive is to trigger an alarm.

Subindex 3Dh	Name	Reserved (Don't set)					Data structure	-	Data type	Uint16
	Data range	0～100	Factory setting	0	Accessibility	RW	Related mode	-	Map	NO

Subindex	Name	Overload setting					Data structure	-	Data type	Uint16
3Eh	Data range	0～3	Factory setting	3	Accessibility	RW	Related mode	-	Map	NO

Set value	Overload setting
0	Disable
1	Enable motor overload, disable drive overload
2	Disable motor overload.enable drive overload
3	Enable motor overload.enable drive overload

Subindex	Name	Reserved (Don't set)					Data structure	-	Data type	Uint16
3Fh	Data range	0～65535	Factory setting	0	Accessibility	RO	Related mode	-	Map	NO

Subindex	Name	Reserved (Don't set)					Data structure	-	Data type	Uint16
40h	Data range	0～65535	Factory setting	0	Accessibility	RO	Related mode	-	Map	NO

Subindex	Name	Reserved (Don't set)					Data structure	-	Data type	Uint16
41h	Data range	0～65535	Factory setting	0	Accessibility	RO	Related mode	-	Map	NO

Subindex	Name	Reserved (Don't set)					Data structure	-	Data type	Uint16
42h	Data range	0～65535	Factory setting	0	Accessibility	RO	Related mode	-	Map	NO

Subindex	Name	Reserved (Don't set)					Data structure	-	Data type	Uint16
43h	Data range	0～65535	Factory setting	0	Accessibility	RO	Related mode	-	Map	NO

Subindex	Name	Reserved (Don't set)					Data structure	-	Data type	Uint16
44h	Data range	0～65535	Factory setting	0	Accessibility	RO	Related mode	-	Map	NO

Subindex	Name	Reserved (Don't set)					Data structure	-	Data type	Uint16
45h	Data range	0～65535	Factory setting	0	Accessibility	RO	Related mode	-	Map	NO

Subindex	Name	Reserved (Don't set)					Data structure	-	Data type	Uint16
46h	Data range	0～65535	Factory setting	0	Accessibility	RO	Related mode	-	Map	NO

Subindex	Name	Disable running timeout fault					Data structure	-	Data type	Uint16
4Fh	Data range	0～1	Factory setting	1	Accessibility	RW	Related mode	-	Map	NO

Subindex	Name	ECAT limit warning locked					Data structure	-	Data type	Uint16
50h	Data range	0～7	Factory setting	0	Accessibility	RW	Related mode	-	Map	NO

Select ECAT limit warning locked mode:

Set value	ECAT limit warning locked mode
0	Update status word, update fault code, enable limit alarm
1	Not update status word, update fault code, enable limit alarm
2	Update status word, not update fault code. enable limit alarm
3	Not update status word, not update fault code, enable limit alarm
4	Update status word, update fault code, disable limit alarm
5	Not update status word, update fault code, disable limit alarm
6	Update status word, not update fault code, disable limit alarm
7	Not update status word, not update fault code, disable limit alarm

Subindex	Name	Disable over speed fault					Data structure	-	Data type	Uint16
51h	Data range	0: Enable over speed fault 1: Disable over speed fault	Factory setting	0	Accessibility	RW	Related mode	-	Map	NO

Subindex	Name	EtherCAT bus error level					Data structure	-	Data type	Uint16
52h	Data range	0～2	Factory setting	0	Accessibility	RW	Related mode	-	Map	NO

Subindex	Name	Stall detection initial torque (unit: 0.1%)					Data structure	-	Data type	Uint16
53h	Data range	10～3000	Factory setting	2400	Accessibility	RW	Related mode	-	Map	NO

Subindex	Name	Electrical angle compensation coefficient (unit: 1%)					Data structure	-	Data type	Uint16
54h	Data range	0～100	Factory setting	0	Accessibility	RW	Related mode	-	Map	NO

Subindex	Name	Current bias sampling mode					Data structure	-	Data type	Uint16
55h	Data range	0: First enable 1: Each enable	Factory setting	0	Accessibility	RW	Related mode	-	Map	NO

Subindex	Name	Power cable phase loss initial detection torque (unit: 1%)					Data structure	-	Data type	Uint16
56h	Data range	0～300	Factory setting	20	Accessibility	RW	Related mode	-	Map	NO

◆ Set to 0 to disable power cable phase loss detection.

Subindex	Name	Power cable phase loss detection time (unit: 1ms)					Data structure	-	Data type	Uint16
57h	Data range	1～65535	Factory setting	50	Accessibility	RW	Related mode	-	Map	NO

Subindex	Name	Power cable phase loss detection speed limit (unit: 1rpm)					Data structure	-	Data type	Uint16
58h	Data range	500~10000	Factory setting	4500	Accessibility	RW	Related mode	-	Map	NO

7.3.3. Input/Output Terminal Parameters

Index	Name	Input/output parameters					Data structure	ARR	Data type	Uint16
2002h	Data range	OD data range	Factory setting	OD default value	Accessibility	-	Related mode	-	Map	YES

Subindex	Name	Maximum subindex number					Data structure	-	Data type	Uint8
00h	Data range	-	Factory setting	54h	Accessibility	RO	Related mode	-	Map	NO

Subindex	Name	DI1 function selection					Data structure	-	Data type	Uint16
01h	Data range	0～63	Factory setting	0	Accessibility	RW	Related mode	-	Map	YES

Set the DI1 function corresponding to the hardware DI terminal, and refer to the following table for parameter value settings:

Set value	IN terminal function	Set value	IN terminal function
0	FunIN.0: No function selection	21	FunIN.21: Position/Speed table running enable
1	FunIN.1: Servo enable	22	FunIN.22: Homing enable
2	FunIN.2: Fault reset	23	FunIN.23: Home switch
3	FunIN.3: Pulse command inhibit	24	FunIN.24: USER 1
4	FunIN.4: Position deviation clearing	25	FunIN.25: USER 2
5	FunIN.5: Positive limit	26	FunIN.26: USER 3
6	FunIN.6: Negative limit	27	FunIN.27: USER 4
7	FunIN.7: Gain switching	28	FunIN.28: USER 5
8	FunIN.8: Electronic gear ratio switching	29	FunIN.29: Control mode selection 2
9	FunIN.9: Zero speed clamping enable	30	FunIN.30: ECAT probe 1
10	FunIN.10: Control mode selection 1	31	FunIN.31: ECAT probe 2
11	FunIN.11: Emergency stop	32	FunIN.32: Speed table direction selection
12	FunIN.12: Position command inhibit	33	FunIN.33: Forward external torque limit
13	FunIN.13: Step amount enable	34	FunIN.34: Reverse external torque limit
14	FunIN.14: Position/speed table 1	35	FunIN.35: Torque mode speed limit source selection
15	FunIN.15: Position/speed table 2	36	FunIN.36: Interrupt fixed length state release
16	FunIN.16: Position/speed table 3	37	FunIN.37: Interrupt fixed length inhibit
17	FunIN.17: Position/speed table 4	38	FunIN.38: Speed command source selection
18	FunIN.18: Torque command direction selection	39	FunIN.39: Jog forward enable
19	FunIN.19: Speed command direction selection	40	FunIN.40: Jog reverse enable
20	FunIN.20: Position command direction selection		

Subindex	Name	DI1 logic selection					Data structure	-	Data type	Uint16
02h	Data range	0～4	Factory setting	0	Accessibility	RW	Related mode	-	Map	YES

Set the level logic of the hardware DI1 terminal when the DI function selected by DI1 is enabled. Please set the effective level logic correctly according to the upper computer and peripheral circuit.

Set value	When the IN function is valid, the IN terminal logic
0	Normally open
1	Normally closed
2	Rising edge
3	Falling edge
4	Rising/falling edge

Subindex	Name	DI2 function selection					Data structure	-	Data type	Uint16
03h	Data range	0～63	Factory setting	0	Accessibility	RW	Related mode	-	Map	YES

Subindex	Name	DI2 logic selection					Data structure	-	Data type	Uint16
04h	Data range	0～4	Factory setting	0	Accessibility	RW	Related mode	-	Map	YES

Subindex	Name	DI3 function selection					Data structure	-	Data type	Uint16
05h	Data range	0～63	Factory setting	11	Accessibility	RW	Related mode	-	Map	YES

Subindex	Name	DI3 logic selection					Data structure	-	Data type	Uint16
06h	Data range	0～4	Factory setting	0	Accessibility	RW	Related mode	-	Map	YES

Subindex	Name	DI4 function selection					Data structure	-	Data type	Uint16
07h	Data range	0～63	Factory setting	5	Accessibility	RW	Related mode	-	Map	YES

Subindex	Name	DI4 logic selection					Data structure	-	Data type	Uint16
08h	Data range	0～4	Factory setting	0	Accessibility	RW	Related mode	-	Map	YES

Subindex	Name	DI5 function selection					Data structure	-	Data type	Uint16
09h	Data range	0～63	Factory setting	6	Accessibility	RW	Related mode	-	Map	YES

Subindex	Name	DI5 logic selection					Data structure	-	Data type	Uint16
0Ah	Data range	0～4	Factory setting	0	Accessibility	RW	Related mode	-	Map	YES

Subindex	Name	DI6 function selection					Data structure	-	Data type	Uint16
0Bh	Data range	0～63	Factory setting	23	Accessibility	RW	Related mode	-	Map	YES

Subindex	Name	DI6 logic selection					Data structure	-	Data type	Uint16
0Ch	Data range	0～4	Factory setting	0	Accessibility	RW	Related mode	-	Map	YES

Subindex	Name	DI7 function selection					Data structure	-	Data type	Uint16
0Dh	Data range	0～63	Factory setting	30	Accessibility	RW	Related mode	-	Map	YES

Subindex	Name	DI7 logic selection					Data structure	-	Data type	Uint16
0Eh	Data range	0～4	Factory setting	0	Accessibility	RW	Related mode	-	Map	YES

Subindex	Name	DI8 function selection					Data structure	-	Data type	Uint16
0Fh	Data range	0～63	Factory setting	31	Accessibility	RW	Related mode	-	Map	YES

Subindex	Name	DI8 logic selection					Data structure	-	Data type	Uint16
10h	Data range	0～4	Factory setting	0	Accessibility	RW	Related mode	-	Map	YES

Subindex	Name	DO1 function selection					Data structure	-	Data type	Uint16
21h	Data range	0～31	Factory setting	0	Accessibility	RW	Related mode	-	Map	YES

Set the DO1 function corresponding to the hardware DO terminal. Please refer to the table below for parameter value settings.

Set value	OUT terminal function	Set value	OUT terminal function
0	FunOUT.0: Brake	16	FunOUT.16: Interrupt fixed length completed
1	FunOUT.1: Faullt	17	FunOUT.17: Motor rotation state
2	FunOUT.2: Positioning completed	18	FunOUT.18: Speed consistent
3	FunOUT.3: Speed reached	19	FunOUT.19: Motor zero speed state
4	FunOUT.4: Speed reached	20	FunOUT.20: Warning
5	FunOUT.5: Internal command completed	21	FunOUT.21: Reserved (Don't set)
6	FunOUT.6: Origin homing completed	22	FunOUT.22: Reserved (Don't set)
7	FunOUT.7: USER 1	23	FunOUT.23: Reserved (Don't set)
8	FunOUT.8: USER 2	24	FunOUT.24: Positioning proximity
9	FunOUT.9: USER 3	25	FunOUT.25: Torque limited
10	FunOUT.10: USER 4	26	FunOUT.26: Speed limited
11	FunOUT.11: USER 5	27	FunOUT.27: Electrical homing completed
12	FunOUT.12: USER 6	28	FunOUT.28: Reserved (Don't set)

Subindex	Name	DO1 logic selection					Data structure	-	Data type	Uint16
22h	Data range	0～1	Factory setting	0	Accessibility	RW	Related mode	-	Map	YES

When the DO1 function selected for DO is enabled, the output level logic of the hardware DO1 terminal

Set value	When the OUT function is valid, the OUT terminal logic
0	Normally open
1	Normally closed

Subindex	Name	DO2 function selection					Data structure	-	Data type	Uint16
23h	Data range	0～31	Factory setting	1	Accessibility	RW	Related mode	-	Map	YES

Subindex	Name	DO2 logic selection					Data structure	-	Data type	Uint16
24h	Data range	0～1	Factory setting	0	Accessibility	RW	Related mode	-	Map	YES

Subindex	Name	DO3 function selection					Data structure	-	Data type	Uint16
25h	Data range	0～31	Factory setting	2	Accessibility	RW	Related mode	-	Map	YES

Subindex	Name	DO3 logic selection					Data structure	-	Data type	Uint16
26h	Data range	0～1	Factory setting	0	Accessibility	RW	Related mode	-	Map	YES

Subindex	Name	DO4 function selection					Data structure	-	Data type	Uint16
27h	Data range	0～31	Factory setting	0	Accessibility	RW	Related mode	-	Map	YES

Subindex	Name	DO4 logic selection					Data structure	-	Data type	Uint16
28h	Data range	0～1	Factory setting	0	Accessibility	RW	Related mode	-	Map	YES

Subindex	Name	Reserved (Don't set)					Data structure	-	Data type	Uint16
37h	Data range	0～65535	Factory setting	0	Accessibility	RW	Related mode	-	Map	YES

Subindex	Name	Reserved (Don't set)					Data structure	-	Data type	Uint16
38h	Data range	0～65535	Factory setting	0	Accessibility	RW	Related mode	-	Map	YES

Subindex	Name	Reserved (Don't set)					Data structure	-	Data type	Uint16
39h	Data range	0～65535	Factory setting	0	Accessibility	RW	Related mode	-	Map	YES

Subindex	Name	Reserved (Don't set)					Data structure	-	Data type	Uint16
3Ah	Data range	0～65535	Factory setting	0	Accessibility	RW	Related mode	-	Map	YES

Subindex	Name	Reserved (Don't set)					Data structure	-	Data type	Uint16
3Bh	Data range	0～65535	Factory setting	0	Accessibility	RW	Related mode	-	Map	YES

Subindex	Name	IN terminal filter time (unit: ms)					Data structure	-	Data type	Uint16
54h	Data range	0～999	Factory setting	0	Accessibility	RW	Related mode	-	Map	YES

7.3.4. Position Control Parameters

Index 2003h	Name	Position control parameters					Data structure	ARR	Data type	Uint16
	Data range	OD data range	Factory setting	OD default value	Accessibility	-	Related mode	-	Map	YES

Subindex 00h	Name	Maximum subindex number					Data structure	-	Data type	Uint8
	Data range	-	Factory setting	53h	Accessibility	RO	Related mode	-	Map	NO

Subindex 01h	Name	Position command source					Data structure	-	Data type	Uint8
	Data range	0～5	Factory setting	0	Accessibility	RW	Related mode	-	Map	YES

When in position control mode, it is used to select the source of position commands. Among them, pulse commands belong to external position command, while step amount command, multi-segment position command, and internal test position command belong to internal position command.

Set value	Command source	Command retrieval method
0	Pulse command	The upper computer or other pulse generating devices generate position commands, which are input into the servo drive through hardware terminals.
1	Step amount command	Set the step displacement based on parameters P03.28/P03.29, and trigger step operation with IN function FunIN.13.
2	Multi-segment position command	Set the multi position operation mode based on P09 parameters, and trigger multi position operation through the IN function FunIN.21.
3	Reserved (Don't set)	-
4	Reserved (Don't set)	-
5	Reserved (Don't set)	-

Subindex 05h	Name	Position command average filter time (unit: 0.1ms)					Data structure	-	Data type	Uint8
	Data range	0～1280	Factory setting	0	Accessibility	RW	Related mode	-	Map	YES

Set the average filtering time constant for the position instruction (encoder unit). This feature has no impact on the total number of location commands. If the Set value is too large, it will increase the latency of the response, and the filtering time constant should be set according to the actual situation.

Subindex 06h	Name	Position command low-pass filter time (unit: 0.1ms)					Data structure	-	Data type	Uint8
	Data range	0～65535	Factory setting	0	Accessibility	RW	Related mode	-	Map	YES

Set the first-order low-pass filtering time constant for the position instruction (encoder unit). This feature has no impact on the total number of location commands. If the Set value is too large, it will increase the latency of the response, and the filtering time constant should be set according to the actual situation.

Subindex	Name	Reserved (Don't set)					Data structure	-	Data type	Uint16
12h	Data range	0～65535	Factory setting	0	Accessibility	RO	Related mode	-	Map	NO

Subindex	Name	Position window unit setting					Data structure	-	Data type	Uint16
14h	Data range	0: Encoder unit 1: Command unit	Factory setting	1	Accessibility	RW	Related mode	-	Map	NO

Subindex	Name	Position deviation clearing mode					Data structure	-	Data type	Uint16
18h	Data range	0～2	Factory setting	0	Accessibility	RW	Related mode	-	Map	NO

Set value	Position deviation clearing mode
0	Servo OFF and fault
1	Servo fault
2	DI input terminal

Subindex	Name	Number of step running pulses (unit: pulse)					Data structure	-	Data type	Uint16
1Dh	Data range	-32768～32767	Factory setting	10000	Accessibility	RW	Related mode	-	Map	NO

Subindex	Name	Homing control					Data structure	-	Data type	Uint16
29h	Data range	0～7	Factory setting	0	Accessibility	RW	Related mode	-	Map	NO

Set the homing control mode and trigger signal source.

Set value	Homing control mode
0	Disable homing
6	The present position is used as the home

Subindex	Name	The present position is used as the home (unit: ms)					Data structure	-	Data type	Uint16
31h	Data range	0～65535	Factory setting	1000	Accessibility	RW	Related mode	-	Map	NO

Subindex	Name	Absolute multi-turn offset					Data structure	-	Data type	Uint16
40h	Data range	0～65535	Factory setting	0	Accessibility	RW	Related mode	-	Map	NO

Subindex	Name	Absolute zero offset					Data structure	-	Data type	Int64
41h	Data range	-2^{63}～$(2^{63}-1)$	Factory setting	0	Accessibility	RW	Related mode	-	Map	NO

Subindex	Name	Absolute rotation mode mechanical gear ratio numerator					Data structure	-	Data type	Uint16
45h	Data range	0～65535	Factory setting	1	Accessibility	RW	Related mode	-	Map	NO

Subindex 46h	Name	Absolute rotation mode mechanical gear ratio denominator					Data structure	-	Data type	Uint16
	Data range	0～65535	Factory setting	1	Accessibility	RW	Related mode	-	Map	NO

Subindex 47h	Name	Absolute rotation mode mechanical gear ratio denominator					Data structure	-	Data type	Int64
	Data range	$0～(2^{63}-1)$	Factory setting	1	Accessibility	RW	Related mode	-	Map	NO

Subindex 4Ch	Name	Reserved (Don't set)					Data structure	-	Data type	Uint16
	Data range	-	Factory setting	-	Accessibility	RO	Related mode	-	Map	NO

Subindex 4Eh	Name	Position out of tolerance threshold source					Data structure	-	Data type	Uint16
	Data range	0～1	Factory setting	0	Accessibility	RW	Related mode	-	Map	NO

Set value	Position out of tolerance threshold mode
0	Encoder Eeprom
1	drive Eeprom

Subindex 4Fh	Name	Internal tralectory actual position source					Data structure	-	Data type	Uint16
	Data range	0～1	Factory setting	0	Accessibility	RW	Related mode	-	Map	NO

Set value	Internal tralectory actual position source
0	Shaft actual position
1	Shaft command position

Subindex 50h	Name	Absolute position mode actual position mode					Data structure	-	Data type	Uint16
	Data range	0～2	Factory setting	0	Accessibility	RW	Related mode	-	Map	NO

Set value	Absolute position mode actual position mode
0	The actual position is within the positive/negative upper limit
1	The actual position is within 0 to the positive upper limit
2	32-bit continuous accumulation

Subindex 51h	Name	Shaft command position monitoring					Data structure	-	Data type	Uint16
	Data range	-2147483648 ~2147483647	Factory setting	0	Accessibility	RO	Related mode	-	Map	NO

Subindex 53h	Name	Absolute rotation mode position upper limit					Data structure	-	Data type	Uint16
	Data range	$0～(2^{63}-1)$	Factory setting	0	Accessibility	RO	Related mode	-	Map	NO

7.3.5. Speed Control Parameters

Index	Name	Speed control parameters					Data structure	ARR	Data type	Uint16
2004h	Data range	OD data range	Factory setting	OD default value	Accessibility	-	Related mode	-	Map	YES

Subindex	Name	Maximum subindex number					Data structure	-	Data type	Uint8
00h	Data range	-	Factory setting	63h	Accessibility	RO	Related mode	-	Map	NO

Subindex	Name	Jog speed (unit: rpm)					Data structure	-	Data type	Uint16
05h	Data range	0~6000	Factory setting	100	Accessibility	RW	Related mode	-	Map	YES
Set the jog operation speed command value when using the servo drive button jog function. To use the servo drive button jog function, please set the servo enable to OFF state. Its acceleration time constant and deceleration time constant are set by P04.05 and P04.06.										

Subindex	Name	Acceleration time constant (unit: ms)					Data structure	-	Data type	Uint16
06h	Data range	0~65535	Factory setting	100	Accessibility	RW	Related mode	-	Map	YES
The time for the motor speed to change from 0rpm to 1000rpm uniformly.										

Subindex	Name	Deceleration time constant (unit: ms)					Data structure	-	Data type	Uint16
07h	Data range	0~65535	Factory setting	100	Accessibility	RW	Related mode	-	Map	YES
The time for the motor speed to change from 1000rpm to 0rpm uniformly.										

Subindex	Name	Zero clamp speed (unit: rpm)					Data structure	-	Data type	Uint16
08h	Data range	0~65535	Factory setting	10	Accessibility	RW	Related mode	-	Map	YES
The speed threshold at which the zero speed clamp operation can only take effect when the actual motor speed is set below the set value. ◆ Note: When the upper computer provides a zero speed clamp signal and the actual motor speed is lower than the set value, the motor clamp is in the current position.										

Subindex	Name	Motor rotation speed (unit: rpm)					Data structure	-	Data type	Uint8
09h	Data range	0~6000	Factory setting	10	Accessibility	RW	Related mode	-	Map	NO

Subindex	Name	Motor speed consistent width threshold (unit: rpm)					Data structure	-	Data type	Uint8
0Ah	Data range	0~500	Factory setting	10	Accessibility	RW	Related mode	-	Map	NO

Subindex	Name	Speed reached threshold (unit: rpm)					Data structure	-	Data type	Uint16
0Bh	Data range	0~6000	Factory setting	1000	Accessibility	RW	Related mode	-	Map	YES

When the absolute value of the actual speed of the filtered servo motor exceeds the threshold set in P04.10, it is considered that the actual speed of the servo motor has reached the expected value, and the servo drive can output a speed arrival signal at this time. On the contrary, if the absolute value of the actual speed of the filtered servo motor is not greater than this value, the speed arrival signal is invalid. The determination of the speed arrival signal is not affected by the operating status and control mode of the drive.

Subindex	Name	Zero speed state threshold (unit: rpm)					Data structure	-	Data type	Uint8
0Ch	Data range	1~6000	Factory setting	10	Accessibility	RW	Related mode	-	Map	NO

Subindex	Name	Maximum speed limit (unit: rpm)					Data structure	-	Data type	Uint8
0Dh	Data range	0~6000	Factory setting	5000	Accessibility	RW	Related mode	-	Map	NO

Subindex	Name	Forward speed limit (unit: rpm)					Data structure	-	Data type	Uint8
0Eh	Data range	0~6000	Factory setting	5000	Accessibility	RW	Related mode	-	Map	NO

Subindex	Name	Reverse speed limit (unit: rpm)					Data structure	-	Data type	Uint8
0Fh	Data range	0~6000	Factory setting	5000	Accessibility	RW	Related mode	-	Map	NO

Subindex	Name	Speed feedforward selection					Data structure	-	Data type	Uint16
10h	Data range	0~3	Factory setting	1	Accessibility	RW	Related mode	-	Map	YES

Set the speed feedforward selection mode:

Set value	Speed feedforward selection mode
0	No speed feedforward
1	Internal speed feedforward
2	AI1 input as speed feedforward
3	AI2 input as speed feedforward

Subindex	Name	Speed state filter time (unit: ms)					Data structure	-	Data type	Uint8
1Dh	Data range	0~5000	Factory setting	10	Accessibility	RW	Related mode	-	Map	NO

Subindex	Name	Speed display filter time (unit: ms)					Data structure	-	Data type	Uint8
1Eh	Data range	0~5000	Factory setting	50	Accessibility	RW	Related mode	-	Map	NO

Subindex 1Fh	Name	Communication given speed (unit:: 0.001rpm)					Data structure	-	Data type	Uint8
	Data range	-9000000 ~9000000	Factory setting	0	Accessibility	RW	Related mode	-	Map	NO

Subindex 52h	Name	Encoder data length error counter					Data structure	-	Data type	Uint16
	Data range	-	Factory setting	-	Accessibility	RO	Related mode	-	Map	NO

Subindex 53h	Name	Encoder data null error counter					Data structure	-	Data type	Uint16
	Data range	-	Factory setting	-	Accessibility	RO	Related mode	-	Map	NO

Subindex 54h	Name	Encoder data check error counter					Data structure	-	Data type	Uint16
	Data range	-	Factory setting	-	Accessibility	RO	Related mode	-	Map	NO

Subindex 55h	Name	Encoder count error counter					Data structure	-	Data type	Uint16
	Data range	-	Factory setting	-	Accessibility	RO	Related mode	-	Map	NO

Subindex 56h	Name	Encoder real-time error times					Data structure	-	Data type	Uint16
	Data range	-	Factory setting	-	Accessibility	RO	Related mode	-	Map	NO

Subindex 57h	Name	Encoder real-time error times					Data structure	-	Data type	Uint16
	Data range	0~99	Factory setting	10	Accessibility	RW	Related mode	-	Map	NO

Subindex 58h	Name	Encoder receive command error times					Data structure	-	Data type	Uint16
	Data range	-	Factory setting	-	Accessibility	RO	Related mode	-	Map	NO

Subindex 5Ah	Name	ECAT port 0 invalid data frame count					Data structure	-	Data type	Uint16
	Data range	-	Factory setting	-	Accessibility	RO	Related mode	-	Map	NO

Subindex 5Bh	Name	ECAT port 0 receives error count					Data structure	-	Data type	Uint16
	Data range	-	Factory setting	-	Accessibility	RO	Related mode	-	Map	NO

Subindex 5Ch	Name	ECAT port 1 invalid data frame count					Data structure	-	Data type	Uint16
	Data range	-	Factory setting	-	Accessibility	RO	Related mode	-	Map	NO

Subindex 5Dh	Name	ECAT port 1 receives error count					Data structure	-	Data type	Uint16
	Data range	-	Factory setting	-	Accessibility	RO	Related mode	-	Map	NO

Subindex 5Eh	Name	ECAT port 0 forwards error count					Data structure	-	Data type	Uint16
	Data range	-	Factory setting	-	Accessibility	RO	Related mode	-	Map	NO

Subindex 5Fh	Name	ECAT port 1 forwards error count					Data structure	-	Data type	Uint16
	Data range	-	Factory setting	-	Accessibility	RO	Related mode	-	Map	NO

Subindex 60h	Name	ECAT handles the error count					Data structure	-	Data type	Uint16
	Data range	-	Factory setting	-	Accessibility	RO	Related mode	-	Map	NO

Subindex 61h	Name	ECAT MCU and ECAT chip interface PDI communication error count					Data structure	-	Data type	Uint16
	Data range	-	Factory setting	-	Accessibility	RO	Related mode	-	Map	NO

Subindex 62h	Name	ECAT port 0 link loss count					Data structure	-	Data type	Uint16
	Data range	-	Factory setting	-	Accessibility	RO	Related mode	-	Map	NO

Subindex 63h	Name	ECAT port 1 link loss count					Data structure	-	Data type	Uint16
	Data range	-	Factory setting	-	Accessibility	RO	Related mode	-	Map	NO

Subindex 21h	Name	Encoder position during power failure after calculation					Data structure	-	Data type	Int64
	Data range	0~（$2^{63}-1$）	Factory setting	0	Accessibility	RO	Related mode	-	Map	NO

Subindex 25h	Name	Initial encoder position					Data structure	-	Data type	Uint16
	Data range	0~（$2^{63}-1$）	Factory setting	0	Accessibility	RO	Related mode	-	Map	NO

Subindex 29h	Name	Absolute rotation mode position upper limit					Data structure	-	Data type	Uint16
	Data range	0~（$2^{63}-1$）	Factory setting	0	Accessibility	RO	Related mode	-	Map	NO

7.3.6. Torque Control Parameters

Index	Name	Torque control parameters					Data structure	ARR	Data type	Uint16
2005h	Data range	OD data range	Factory setting	OD default value	Accessibility	-	Related mode	-	Map	YES

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

Subindex	Name	Torque limit source					Data structure	-	Data type	Uint16
07h	Data range	0~4	Factory setting	2	Accessibility	RW	Related mode	-	Map	YES

Set torque limit source mode:

Set value	Torque limit source mode
0	Internal torque limit
1	Internal/external torque limit
2	ECAT control (0x6072 and the smaller of 0x60E0/0x60E1)
3	ECAT control (0x6072 and the smaller of 0x60E0/0x60E1 or to smaller values of external torque)
4	ECAT control (internal toraue limit and 0x6072 or to the smaller of 0x60E0/0x60E1)

Subindex	Name	Forward internal torque limit (unit: 0.1%)					Data structure	-	Data type	Uint16
09h	Data range	0~3000	Factory setting	3000	Accessibility	RW	Related mode	-	Map	YES

Subindex	Name	Reverse internal torque limit (unit: 0.1%)					Data structure	-	Data type	Uint16
0Ah	Data range	0~3000	Factory setting	3000	Accessibility	RW	Related mode	-	Map	YES

Subindex	Name	Forward external torque limit (unit: 0.1%)					Data structure	-	Data type	Uint16
0Bh	Data range	0~3000	Factory setting	3000	Accessibility	RW	Related mode	-	Map	YES

Subindex	Name	Reverse external torque limit (unit: 0.1%)					Data structure	-	Data type	Uint16
0Ch	Data range	0~3000	Factory setting	3000	Accessibility	RW	Related mode	-	Map	YES

Subindex	Name	Torque mode speed limit source					Data structure	-	Data type	Uint16
0Dh	Data range	0~2	Factory setting	1	Accessibility	RW	Related mode	-	Map	YES

Set the speed limit source for torque mode:

Set value	Torque mode speed limit source
0	Internal speed limit
1	ECAT uses the 0x607F limit
2	Select internal speed limit by DI

Subindex	Name	Torque mode forward internal speed limit (unit: rpm)					Data structure	-	Data type	Uint16
0Fh	Data range	0~3000	Factory setting	1000	Accessibility	RW	Related mode	-	Map	YES

Subindex	Name	Torque mode reverse internal speed limit (unit: rpm)					Data structure	-	Data type	Uint16
10h	Data range	0~3000	Factory setting	1000	Accessibility	RW	Related mode	-	Map	YES

Subindex	Name	Torque reaches output reference value (unit: 0.1%)					Data structure	-	Data type	Uint16
11h	Data range	0~3000	Factory setting	0	Accessibility	RW	Related mode	-	Map	YES

Subindex	Name	Torque reaches output effective value (unit: 0.1%)					Data structure	-	Data type	Uint16
12h	Data range	0~3000	Factory setting	300	Accessibility	RW	Related mode	-	Map	YES

Subindex	Name	Torque reaches output invalid value (unit: 0.1%)					Data structure	-	Data type	Uint16
13h	Data range	0~3000	Factory setting	200	Accessibility	RW	Related mode	-	Map	YES

Subindex	Name	Communication given torque (unit: 0.001%)					Data structure	-	Data type	Uint16
15h	Data range	-300000~300000	Factory setting	0	Accessibility	RW	Related mode	-	Map	YES

Subindex	Name	Torque feedforward selection					Data structure	-	Data type	Uint16
2Dh	Data range	0: No torque feedforward 1: Internal torque feedforward 2: ECAT control	Factory setting	1	Accessibility	RW	Related mode	-	Map	YES

Subindex	Name	Reserved (Don't set)					Data structure	-	Data type	Uint16
2Eh	Data range	0~65535	Factory setting	0	Accessibility	RO	Related mode	-	Map	NO

Subindex	Name	Reserved (Don't set)					Data structure	-	Data type	Uint16
2Fh	Data range	0~65535	Factory setting	0	Accessibility	RO	Related mode	-	Map	NO

Subindex	Name	Reserved (Don't set)					Data structure	-	Data type	Uint16
30h	Data range	0~65535	Factory setting	0	Accessibility	RO	Related mode	-	Map	NO

Subindex	Name	Torque command filter time constant 1 (unit: 0.01ms)					Data structure	-	Data type	Uint16
31h	Data range	0～3000	Factory setting	80	Accessibility	RW	Related mode	-	Map	NO

Subindex	Name	Torque command filter time constant 2 (unit: 0.01ms)					Data structure	-	Data type	Uint16
32h	Data range	0～3000	Factory setting	80	Accessibility	RW	Related mode	-	Map	NO

Subindex	Name	Emergency stop torque (unit: 0.1%)					Data structure	-	Data type	Uint16
33h	Data range	0～3000	Factory setting	1000	Accessibility	RW	Related mode	-	Map	NO

Subindex	Name	Reserved (Don't set)					Data structure	-	Data type	Uint16
34h	Data range	0~65535	Factory setting	0	Accessibility	RO	Related mode	-	Map	NO

Subindex	Name	Reserved (Don't set)					Data structure	-	Data type	Uint16
35h	Data range	0~65535	Factory setting	0	Accessibility	RO	Related mode	-	Map	NO

Subindex	Name	Current PI parameter source					Data structure	-	Data type	Uint16
36h	Data range	0: Encoder Eeprom 1: drive Eeprom	Factory setting	0	Accessibility	RW	Related mode	-	Map	NO

Subindex	Name	Torque feedback filter time constant 1 (unit: 0.01ms)					Data structure	-	Data type	Uint16
37h	Data range	0～3000	Factory setting	80	Accessibility	RW	Related mode	-	Map	NO

Subindex	Name	Torque feedback filter time constant 2 (unit: 0.01ms)					Data structure	-	Data type	Uint16
38h	Data range	0～3000	Factory setting	80	Accessibility	RW	Related mode	-	Map	NO

Subindex	Name	Motor actual torque (unit: 0.01Nm)					Data structure	-	Data type	Uint16
3Dh	Data range	-	Factory setting	0	Accessibility	RO	Related mode	-	Map	NO

7.3.7. Gain Parameters

Index	Name	Gain parameters					Data structure	ARR	Data type	Uint16
2006h	Data range	OD data range	Factory setting	OD default value	Accessibility	-	Related mode	-	Map	YES

Subindex	Name	Maximum subindex number					Data structure	-	Data type	Uint8
00h	Data range	-	Factory setting	52h	Accessibility	RO	Related mode	-	Map	NO

Subindex	Name	Speed loop gain (unit: 0.1Hz)					Data structure	-	Data type	Uint16
01h	Data range	1~50000	Factory setting	250	Accessibility	RW	Related mode	-	Map	YES

Subindex	Name	Speed loop integration time (unit: 0.01ms)					Data structure	-	Data type	Uint16
02h	Data range	15~51200	Factory setting	3183	Accessibility	RW	Related mode	-	Map	YES

Subindex	Name	Position loop gain (unit: 0.1Hz)					Data structure	-	Data type	Uint16
03h	Data range	0~50000	Factory setting	400	Accessibility	RW	Related mode	-	Map	YES

Subindex	Name	Speed loop gain 2 (unit: 0.1Hz)					Data structure	-	Data type	Uint16
04h	Data range	1~50000	Factory setting	400	Accessibility	RW	Related mode	-	Map	YES

Subindex	Name	Speed loop integration time 2 (unit: 0.01ms)					Data structure	-	Data type	Uint16
05h	Data range	15~51200	Factory setting	2000	Accessibility	RW	Related mode	-	Map	YES

Subindex	Name	Position loop gain 2 (unit: 0.1Hz)					Data structure	-	Data type	Uint16
06h	Data range	0~50000	Factory setting	640	Accessibility	RW	Related mode	-	Map	YES

Subindex	Name	Speed loop gain 3 (unit: 0.1Hz)					Data structure	-	Data type	Uint16
07h	Data range	1~50000	Factory setting	400	Accessibility	RW	Related mode	-	Map	YES

Subindex	Name	Speed loop integration time 3 (unit: 0.01ms)					Data structure	-	Data type	Uint16
08h	Data range	15~51200	Factory setting	2000	Accessibility	RW	Related mode	-	Map	YES

Subindex	Name	Position loop gain 3 (unit: 0.1Hz)					Data structure	-	Data type	Uint16
09h	Data range	0~50000	Factory setting	640	Accessibility	RW	Related mode	-	Map	YES

Subindex 0Ch	Name	Current PI selection					Data structure	-	Data type	Uint16
	Data range	0: PI group 1 1: PI group 2	Factory setting	0	Accessibility	RW	Related mode	-	Map	YES

Subindex 0Dh	Name	Load inertia ratio (unit: 1%)					Data structure	-	Data type	Uint16
	Data range	0~12000	Factory setting	100	Accessibility	RW	Related mode	-	Map	YES

Subindex 0Fh	Name	Speed feedforward filter time (unit: 0.01ms)					Data structure	-	Data type	Uint16
	Data range	0~6400	Factory setting	50	Accessibility	RW	Related mode	-	Map	YES

Subindex 10h	Name	Speed feedforward gain (unit: 1%)					Data structure	-	Data type	Uint16
	Data range	0~1000	Factory setting	0	Accessibility	RW	Related mode	-	Map	YES

Subindex 11h	Name	Torque feedforward filter time (unit: 0.01ms)					Data structure	-	Data type	Uint16
	Data range	0~6400	Factory setting	50	Accessibility	RW	Related mode	-	Map	YES

Subindex 12h	Name	Torque feedforward gain (unit: 1%)					Data structure	-	Data type	Uint16
	Data range	0~1000	Factory setting	0	Accessibility	RW	Related mode	-	Map	YES

Subindex 13h	Name	Speed feedback source					Data structure	-	Data type	Uint16
	Data range	0: No filtering 1: After filtering	Factory setting	0	Accessibility	RW	Related mode	-	Map	YES

Subindex 14h	Name	Speed feedback smoothing filtering					Data structure	-	Data type	Uint16
	Data range	0~4	Factory setting	0	Accessibility	RW	Related mode	-	Map	YES

Set value	Function
0	No filtering
1	2 times of smooth filtering
2	4 times of smooth filtering
3	8 times of smooth filtering
4	16 times of smooth filtering

Subindex 15h	Name	Speed feedback low-pass filter cut-off frequency (unit: 1Hz)					Data structure	-	Data type	Uint16
	Data range	100~4000	Factory setting	4000	Accessibility	RW	Related mode	-	Map	YES

Subindex	Name	Speed PDFF control kref (unit: 1%)					Data structure	-	Data type	Uint16
16h	Data range	0~1000	Factory setting	1000	Accessibility	RW	Related mode	-	Map	YES

Subindex	Name	Speed PDFF control Kfdb (unit: 1%)					Data structure	-	Data type	Uint16
17h	Data range	0~1000	Factory setting	0	Accessibility	RW	Related mode	-	Map	YES

Subindex	Name	2nd gain mode					Data structure	-	Data type	Uint16
33h	Data range	0~1	Factory setting	0	Accessibility	RW	Related mode	-	Map	YES

Set value	Function
0	1st gain fixed
1	1st and 2nd gain switching

Subindex	Name	Gain switching condition					Data structure	-	Data type	Uint16
34h	Data range	0~11	Factory setting	0	Accessibility	RW	Related mode	-	Map	YES

Set value	Function
0	1st gain fixed
1	Gain switching with input IN signal
2	Torque command
3	Speed command
4	Speed command change rate
5	Speed command high and low speed thresholds
6	Position deviation
7	With position command
8	Positioning incomplete
9	Actual speed
10	With position command and actual speed
11	With position command and actual speed mode 2

Subindex	Name	Gain switching delay time (unit: 0.1ms)					Data structure	-	Data type	Uint16
35h	Data range	0~50000	Factory setting	50	Accessibility	RW	Related mode	-	Map	YES

Subindex	Name	Gain switching level					Data structure	-	Data type	Uint16
36h	Data range	0~50000	Factory setting	50	Accessibility	RW	Related mode	-	Map	YES

Subindex	Name	Gain switching hysteresis					Data structure	-	Data type	Uint16
37h	Data range	0~50000	Factory setting	30	Accessibility	RW	Related mode	-	Map	YES

Subindex	Name	Position gain switching ramp time (unit: 0.1ms)					Data structure	-	Data type	Uint16
38h	Data range	0~50000	Factory setting	30	Accessibility	RW	Related mode	-	Map	YES

Subindex	Name	3rd gain switching delay time (unit: 0.1ms)					Data structure	-	Data type	Uint16
39h	Data range	0~65535	Factory setting	30	Accessibility	RW	Related mode	-	Map	YES

Subindex	Name	Current gain switching delay time (unit: 0.1ms)					Data structure	-	Data type	Uint16
3Ah	Data range	0~65535	Factory setting	0	Accessibility	RW	Related mode	-	Map	YES

◆ Note: When the value of this parameter is set to 0, the current gain is not switched.

Subindex	Name	D-axis current proportional gain 1					Data structure	-	Data type	Uint16
3Dh	Data range	0~65535	Factory setting	180	Accessibility	RW	Related mode	-	Map	YES

Subindex	Name	D-axis current integral gain 1					Data structure	-	Data type	Uint16
3Eh	Data range	0~65535	Factory setting	200	Accessibility	RW	Related mode	-	Map	YES

Subindex	Name	D-axis BEMF compensation coefficient					Data structure	-	Data type	Uint16
3Fh	Data range	0~65535	Factory setting	600	Accessibility	RW	Related mode	-	Map	YES

Subindex	Name	Q-axis current proportional gain 1					Data structure	-	Data type	Uint16
40h	Data range	0~65535	Factory setting	180	Accessibility	RW	Related mode	-	Map	YES

Subindex	Name	Q-axis current integral gain 1					Data structure	-	Data type	Uint16
41h	Data range	0~65535	Factory setting	200	Accessibility	RW	Related mode	-	Map	NO

Subindex	Name	Q-axis BEMF compensation coefficient					Data structure	-	Data type	Uint16
42h	Data range	0~65535	Factory setting	1000	Accessibility	RW	Related mode	-	Map	YES

Subindex	Name	D-axis current proportional gain 2					Data structure	-	Data type	Uint16
43h	Data range	0~65535	Factory setting	180	Accessibility	RW	Related mode	-	Map	YES

Subindex	Name	D-axis current integral gain 2					Data structure	-	Data type	Uint16
44h	Data range	0~65535	Factory setting	200	Accessibility	RW	Related mode	-	Map	YES

Subindex	Name	Q-axis current proportional gain 2					Data structure	-	Data type	Uint16
45h	Data range	0~65535	Factory setting	180	Accessibility	RW	Related mode	-	Map	YES

Subindex	Name	Q-axis current integral gain 2					Data structure	-	Data type	Uint16
46h	Data range	0~65535	Factory setting	200	Accessibility	RW	Related mode	-	Map	YES

Subindex	Name	Flux-weakening control coefficient (unit: 0.1%)					Data structure	-	Data type	Uint16
4Dh	Data range	0~2250	Factory setting	2250	Accessibility	RW	Related mode	-	Map	YES

Subindex	Name	Flux-weakening control single increment (unit: 0.1%)					Data structure	-	Data type	Uint16
4Eh	Data range	0~3000	Factory setting	10	Accessibility	RW	Related mode	-	Map	YES

Subindex	Name	Flux-weakening control single reduction (unit: 0.1%)					Data structure	-	Data type	Uint16
4Fh	Data range	0~3000	Factory setting	50	Accessibility	RW	Related mode	-	Map	YES

Subindex	Name	Flux-weakening control performs frequency division coefficient					Data structure	-	Data type	Uint16
50h	Data range	0~65535	Factory setting	10	Accessibility	RW	Related mode	-	Map	YES

Subindex	Name	Vd output limit (unit: 0.1%)					Data structure	-	Data type	Uint16
51h	Data range	350~1000	Factory setting	707	Accessibility	RW	Related mode	-	Map	YES

Subindex	Name	Weak magnetic voltage reference coefficient (unit: 1%)					Data structure	-	Data type	Uint16
52h	Data range	75~100	Factory setting	90	Accessibility	RW	Related mode	-	Map	YES

7.3.8. Auto-tunning Parameters

Index	Name	Auto-tunning parameters					Data structure	ARR	Data type	Uint16
2007h	Data range	OD data range	Factory setting	OD default value	Accessibility	-	Related mode	-	Map	YES

Subindex	Name	Maximum subindex number					Data structure	-	Data type	Uint8
00h	Data range	-	Factory setting	21h	Accessibility	RO	Related mode	-	Map	NO

Subindex	Name	Auto-tunning mode					Data structure	-	Data type	Uint16
01h	Data range	0~8	Factory setting	0	Accessibility	RW	Related mode	-	Map	YES

Set value	Function
0	Invalid
1	Standard stiffness table mode
2	Positioning mode

Subindex	Name	Stiffness table level setting					Data structure	-	Data type	Uint16
02h	Data range	0~31	Factory setting	12	Accessibility	RW	Related mode	-	Map	YES

◆ The larger the value, the higher the rigidity. Excessive rigidity can generate vibration noise.

Subindex	Name	Offline inertia auto-tuning mode					Data structure	-	Data type	Uint16
06h	Data range	0~1	Factory setting	0	Accessibility	RW	Related mode	-	Map	YES

Subindex	Name	Maximum speed of inertia auto-tuning (unit: rpm)					Data structure	-	Data type	Uint16
07h	Data range	100~1000	Factory setting	500	Accessibility	RW	Related mode	-	Map	YES

Subindex	Name	Acceleration time of inertia auto-tuning (unit: ms)					Data structure	-	Data type	Uint16
08h	Data range	20~800	Factory setting	125	Accessibility	RW	Related mode	-	Map	YES

Subindex	Name	Inertia auto-tuning interval (unit: ms)					Data structure	-	Data type	Uint16
09h	Data range	50~10000	Factory setting	1000	Accessibility	RW	Related mode	-	Map	YES

Subindex	Name	Number of motor revolutions per inertia auto-tuning (unit: 0.1 turns)					Data structure	-	Data type	Uint16
0Ah	Data range	-	Factory setting	-	Accessibility	RO	Related mode	-	Map	YES

Subindex	Name	Adaptive notch mode selection					Data structure	-	Data type	Uint16
0Ch	Data range	0~4	Factory setting	0	Accessibility	RW	Related mode	-	Map	YES

Set value	Function
0	Disable adaptive notch
1	Adaptive notch setting Group 3
2	Adaptive notch setting Group 3/4
4	Restore default notch settings

Subindex	Name	Frequency of the 1st notch (unit: 1Hz)					Data structure	-	Data type	Uint16
0Dh	Data range	50~4000	Factory setting	4000	Accessibility	RW	Related mode	-	Map	YES

Subindex	Name	Width level of the 1st notch					Data structure	-	Data type	Uint16
0Eh	Data range	0~20	Factory setting	2	Accessibility	RW	Related mode	-	Map	YES

Subindex	Name	Depth level of the 1st notch					Data structure	-	Data type	Uint16
0Fh	Data range	0~99	Factory setting	0	Accessibility	RW	Related mode	-	Map	YES

Subindex	Name	Frequency of the 2th notch (unit: 1Hz)					Data structure	-	Data type	Uint16
10h	Data range	50~4000	Factory setting	4000	Accessibility	RW	Related mode	-	Map	YES

Subindex	Name	Width level of the 2th notch					Data structure	-	Data type	Uint16
11h	Data range	0~20	Factory setting	2	Accessibility	RW	Related mode	-	Map	YES

Subindex	Name	Depth level of the 2nd notch					Data structure	-	Data type	Uint16
12h	Data range	0~99	Factory setting	0	Accessibility	RW	Related mode	-	Map	YES

Subindex	Name	Frequency of the 3rd notch (unit: 1Hz)					Data structure	-	Data type	Uint16
13h	Data range	50~4000	Factory setting	4000	Accessibility	RW	Related mode	-	Map	YES

Subindex	Name	Width level of the 3rd notch					Data structure	-	Data type	Uint16
14h	Data range	0~20	Factory setting	2	Accessibility	RW	Related mode	-	Map	YES

Subindex	Name	Depth level of the 3rd notch					Data structure	-	Data type	Uint16
15h	Data range	0~99	Factory setting	0	Accessibility	RW	Related mode	-	Map	YES

Subindex	Name	Frequency of the 4th notch (unit: 1Hz)					Data structure	-	Data type	Uint16
16h	Data range	50~4000	Factory setting	4000	Accessibility	RW	Related mode	-	Map	YES

Subindex	Name	Width level of the 4th notch					Data structure	-	Data type	Uint16
17h	Data range	0~20	Factory setting	2	Accessibility	RW	Related mode	-	Map	YES

Subindex	Name	Depth level of the 4th notch					Data structure	-	Data type	Uint16
18h	Data range	0~99	Factory setting	0	Accessibility	RW	Related mode	-	Map	YES

Subindex	Name	Disturbance compensation gain (unit: 0.1%)					Data structure	-	Data type	Uint16
1Dh	Data range	-1000~1000	Factory setting	0	Accessibility	RW	Related mode	-	Map	YES

Subindex	Name	Disturbance observer filter tme (unit: 0.01ms)					Data structure	-	Data type	Uint16
1Eh	Data range	0~2500	Factory setting	50	Accessibility	RW	Related mode	-	Map	YES

Subindex	Name	Gravity compensation value (unit: 0.1%)					Data structure	-	Data type	Uint16
1Fh	Data range	-1000~1000	Factory setting	0	Accessibility	RW	Related mode	-	Map	YES

Subindex	Name	Forward friction compensation value (unit: 0.1%)					Data structure	-	Data type	Uint16
20h	Data range	-1000~1000	Factory setting	0	Accessibility	RW	Related mode	-	Map	YES

Subindex	Name	Reverse friction compensation value (unit: 0.1%)					Data structure	-	Data type	Uint16
21h	Data range	-1000~1000	Factory setting	0	Accessibility	RW	Related mode	-	Map	YES

7.3.9. Auxiliary Parameters

Index 200Ch	Name	Auxiliary parameters					Data structure	ARR	Data type	Uint16
	Data range	OD data range	Factory setting	OD default value	Accessibility	-	Related mode	-	Map	YES

Subindex 00h	Name	Maximum subindex number					Data structure	-	Data type	Uint8
	Data range	-	Factory setting	1Fh	Accessibility	RO	Related mode	-	Map	NO

Subindex 01h	Name	Parameters initialization					Data structure	-	Data type	Uint16
	Data range	0~65535	Factory setting	0	Accessibility	RW	Related mode	-	Map	NO

Set value	Function
0	No effect
1	Reset
2	Clear fault log

Subindex 06h	Name	Absolute encoder reset					Data structure	-	Data type	Uint16
	Data range	0~2	Factory setting	0	Accessibility	RW	Related mode	-	Map	NO

Set value	Function
0	No effect
1	Clear encoder fault
2	Clear encoder fault and multi-turn value

Subindex 07h	Name	Communication encoder storage operation					Data structure	-	Data type	Uint16
	Data range	0~3	Factory setting	0	Accessibility	RW	Related mode	-	Map	NO

Set value	Function
0	No effect
1	Write encoder data
2	Read encoder data
3	Read-write operation fault display

Subindex	Name	Software reset DSP					Data structure	-	Data type	Uint8
08h	Data range	0~1	Factory setting	0	Accessibility	RW	Related mode	-	Map	NO

Subindex	Name	Fault reset					Data structure	-	Data type	Uint8
09h	Data range	0~1	Factory setting	0	Accessibility	RW	Related mode	-	Map	NO

Subindex	Name	Emergency stop					Data structure	-	Data type	Uint8
0Ah	Data range	0~1	Factory setting	0	Accessibility	RW	Related mode	-	Map	NO

Subindex	Name	JOG running					Data structure	-	Data type	Uint8
0Bh	Data range	0~65535	Factory setting	0	Accessibility	RW	Related mode	-	Map	NO

Subindex	Name	Offline inertia auto-tuning					Data structure	-	Data type	Uint8
0Ch	Data range	0~65535	Factory setting	0	Accessibility	RW	Related mode	-	Map	NO

Subindex	Name	AI zero drift correction					Data structure	-	Data type	Uint16
0Fh	Data range	0~2	Factory setting	0	Accessibility	RW	Related mode	-	Map	NO

Set value	Function
0	No effect
1	AI1 zero drift correction
2	AI2 zero drift correction

Subindex	Name	DI/DO port force function					Data structure	-	Data type	Uint8
10h	Data range	0~65535	Factory setting	0	Accessibility	RW	Related mode	-	Map	NO

Subindex	Name	Reserved					Data structure	-	Data type	Uint8
11h	Data range	0~65535	Factory setting	0	Accessibility	RW	Related mode	-	Map	NO

Subindex	Name	Reserved					Data structure	-	Data type	Uint8
12h	Data range	0~65535	Factory setting	0	Accessibility	RW	Related mode	-	Map	NO

Subindex	Name	Reserved					Data structure	-	Data type	Uint8
13h	Data range	0~1	Factory setting	0	Accessibility	RW	Related mode	-	Map	NO

Subindex	Name	Enable torque PI auto-tuning					Data structure	-	Data type	Uint8
15h	Data range	0~1	Factory setting	0	Accessibility	RW	Related mode	-	Map	NO

Subindex	Name	Torque PI auto-tuning mode					Data structure	-	Data type	Uint8
1Ah	Data range	0: PI tuning 1 1:PI tuning 2	Factory setting	0	Accessibility	RW	Related mode	-	Map	NO

Subindex	Name	Torque PI auto-tuning torque (unit: 0.1%)					Data structure	-	Data type	Uint8
1Bh	Data range	0~3000	Factory setting	200	Accessibility	RW	Related mode	-	Map	NO

Subindex	Name	Disable heartbeat function					Data structure	-	Data type	Uint8
1Ch	Data range	0~1	Factory setting	0	Accessibility	RW	Related mode	-	Map	NO

Subindex	Name	Reserved					Data structure	-	Data type	Uint8
1Dh	Data range	0~1	Factory setting	0	Accessibility	RW	Related mode	-	Map	NO

Subindex	Name	Debug command (manufacturer reserved)					Data structure	-	Data type	Uint8
1Eh	Data range	0~65535	Factory setting	0	Accessibility	RW	Related mode	-	Map	NO

Subindex	Name	Debug data (manufacturer reserved)					Data structure	-	Data type	Uint8
1Fh	Data range	0~65535	Factory setting	0	Accessibility	RW	Related mode	-	Map	NO

7.3.10. Monitor Parameters

Index	Name	Monitor parameters					Data structure	ARR	Data type	Uint16
200Dh	Data range	OD data range	Factory setting	OD default value	Accessibility	-	Related mode	-	Map	YES

Subindex	Name	Maximum subindex number					Data structure	-	Data type	Uint8
00h	Data range	-	Factory setting	61h	Accessibility	RO	Related mode	-	Map	NO

Subindex	Name	Servo running status					Data structure	-	Data type	Uint16
01h	Data range	-	Factory setting	-	Accessibility	RO	Related mode	-	Map	NO

Subindex	Name	Motor actual speed (unit: rpm)					Data structure	-	Data type	Uint16
02h	Data range	-	Factory setting	-	Accessibility	RO	Related mode	-	Map	NO
Display the actual speed of the servo motor, rounded to the nearest integer, with an accuracy of 1rpm.										

Subindex	Name	Speed command (unit: rpm)					Data structure	-	Data type	Uint16
03h	Data range	-	Factory setting	-	Accessibility	RO	Related mode	-	Map	NO
Display the current speed command value of the servo drive, rounded to the nearest integer, with an accuracy of 1rpm.										

Subindex	Name	Motor torque (unit: 0.1%)					Data structure	-	Data type	Uint16
04h	Data range	-	Factory setting	-	Accessibility	RO	Related mode	-	Map	NO
Display the actual torque of the servo motor, with 100% corresponding to 1 times the rated torque of the motor.										

Subindex	Name	Torque command (unit: 0.1%)					Data structure	-	Data type	Uint16
05h	Data range	-	Factory setting	-	Accessibility	RO	Related mode	-	Map	NO
Display the current torque command value of the servo drive, with 100% corresponding to 1 times the rated torque of the motor.										

Subindex	Name	Average load ratio (unit: 0.1%)					Data structure	-	Data type	Uint16
06h	Data range	-	Factory setting	-	Accessibility	RO	Related mode	-	Map	NO

Subindex	Name	Position command (unit: command pulse)					Data structure	-	Data type	Uint16
08h	Data range	-	Factory setting	-	Accessibility	RO	Related mode	-	Map	NO
In position control mode, during servo operation, count and display the number of position commands that have not been multiplied by the electronic gear ratio. P13.07 and P13.08 are combined to form a 32-bit value, where P13.07 is the low 16-bit value and P13.08 is the high 16-bit value. P13.07 will be used to represent the 32-bit parameter in the future.										

Subindex	Name	Actual position (unit: command pulse)					Data structure	-	Data type	Uint16
0Ah	Data range	-	Factory setting	-	Accessibility	RO	Related mode	-	Map	NO
In position control mode, during servo operation, count and display the number of position commands that have not been multiplied by the electronic gear ratio. P13.09 and P13.10 are combined to form a 32-bit value, where P13.09 is the low 16-bit value and P13.10 is the high 16-bit value. P13.09 will be used to represent the 32-bit parameter in the future.										

Subindex	Name	Position feedback counter (unit: encoder pulse)					Data structure	-	Data type	Uint16
0Ch	Data range	-	Factory setting	-	Accessibility	RO	Related mode	-	Map	NO
Used to count the number of encoder feedback pulses since the last reset. P13.11 and P13.12 are combined to form a 32-bit value, where P13.11 is the low 16-bit value and P13.12 is the high 16-bit value. Use P13.11 to represent the 32-bit parameter in the future.										

Subindex	Name	Position error (unit: command pulse)					Data structure	-	Data type	Uint16
0Eh	Data range	-	Factory setting	-	Accessibility	RO	Related mode	-	Map	NO
In position control mode, calculate and display the deviation value of position commands. P13.13 and P13.14 are combined to form a 32-bit value, where P13.13 is the low 16-bit value and P13.14 is the high 16-bit value. Use P13.13 to represent the 32-bit parameter in the future.										

Subindex	Name	Position error (unit: encoder pulse)					Data structure	-	Data type	Uint16
10h	Data range	-	Factory setting	-	Accessibility	RO	Related mode	-	Map	NO
In position control mode, calculate and display the position deviation value of the electronic gear after multiplication. P13.15 and P13.16 are combined to form a 32-bit value, where P13.15 is the low 16-bit value and P13.16 is the high 16-bit value. Use P13.15 to represent the 32-bit parameter in the future.										

Subindex	Name	Pulse command speed					Data structure	-	Data type	Uint16
12h	Data range	-	Factory setting	-	Accessibility	RO	Related mode	-	Map	NO
Display the speed value corresponding to the position instruction of a single position control cycle of the drive.										

Subindex	Name	Input signal monitoring					Data structure	-	Data type	Uint16
14h	Data range	-	Factory setting	-	Accessibility	RO	Related mode	-	Map	NO

Subindex	Name	Output signal monitoring					Data structure	-	Data type	Uint16
15h	Data range	-	Factory setting	-	Accessibility	RO	Related mode	-	Map	NO

Subindex	Name	Mechanical angle					Data structure	-	Data type	Uint16
16h	Data range	-	Factory setting	-	Accessibility	RO	Related mode	-	Map	NO
Display the current mechanical angle of the motor (encoder unit), where 0 corresponds to a mechanical angle of 0.										

Subindex	Name	Electrical angle (unit: 0.1°)					Data structure	-	Data type	Uint16
17h	Data range	-	Factory setting	-	Accessibility	RO	Related mode	-	Map	NO
Display the current electrical angle of the motor, P13.22 ＝ (P13.21 ÷ Encoder pulse count) × 360°。										

Subindex	Name	Bus voltage (unit: 0.1V)					Data structure	-	Data type	Uint16
18h	Data range	-	Factory setting	-	Accessibility	RO	Related mode	-	Map	NO

Subindex	Name	Encoder single-turn value					Data structure	-	Data type	Uint16
19h	Data range	-	Factory setting	-	Accessibility	RO	Related mode	-	Map	NO

Subindex	Name	Encoder multi-turn value (unit: revolutions)					Data structure	-	Data type	Uint16
1Bh	Data range	-	Factory setting	-	Accessibility	RO	Related mode	-	Map	NO

Subindex	Name	AI1 voltage (unit: 0.01V)					Data structure	-	Data type	Uint16
1Eh	Data range	-	Factory setting	-	Accessibility	RO	Related mode	-	Map	NO

Subindex	Name	Actual position (unit: command pulse)					Data structure	-	Data type	Uint16
1Fh	Data range	-	Factory setting	-	Accessibility	RO	Related mode	-	Map	NO

Subindex	Name	Total servo running time (unit: 0.1s)					Data structure	-	Data type	Uint16
21h	Data range	-	Factory setting	-	Accessibility	RO	Related mode	-	Map	NO

Subindex	Name	AI2 voltage (unit: 0.01V)					Data structure	-	Data type	Uint16
23h	Data range	-	Factory setting	-	Accessibility	RO	Related mode	-	Map	NO

Subindex	Name	History fault selection					Data structure	-	Data type	Uint16
24h	Data range	0~9	Factory setting	-	Accessibility	RW	Related mode	-	Map	NO

Subindex	Name	Fault code of the selected fault					Data structure	-	Data type	Uint16
25h	Data range	-	Factory setting	-	Accessibility	RO	Related mode	-	Map	NO

Subindex	Name	U-phase current upon occurrence of the selected fault (unit: 0.01A)					Data structure	-	Data type	Uint16
26h	Data range	-	Factory setting	-	Accessibility	RO	Related mode	-	Map	NO

Subindex	Name	V-phase current upon occurrence of the selected fault (unit: 0.01A)					Data structure	-	Data type	Uint16
27h	Data range	-	Factory setting	-	Accessibility	RO	Related mode	-	Map	NO

Subindex	Name	Input status upon occurrence of the selected fault					Data structure	-	Data type	Uint16
28h	Data range	-	Factory setting	-	Accessibility	RO	Related mode	-	Map	NO

Subindex	Name	Output status upon occurrence of the selected fault					Data structure	-	Data type	Uint16
29h	Data range	-	Factory setting	-	Accessibility	RO	Related mode	-	Map	NO

Subindex	Name	Bus voltage upon occurrence of the selected fault (unit: V)					Data structure	-	Data type	Uint16
2Ah	Data range	-	Factory setting	-	Accessibility	RO	Related mode	-	Map	NO

Subindex	Name	Motor speed upon occurrence of the selected fault (unit: rpm)					Data structure	-	Data type	Uint16
2Bh	Data range	-	Factory setting	-	Accessibility	RO	Related mode	-	Map	NO

Subindex	Name	Running time upon occurrence of the selected fault (unit: 0.1s)					Data structure	-	Data type	Uint16
2Ch	Data range	-	Factory setting	-	Accessibility	RO	Related mode	-	Map	NO

Subindex	Name	Abnormal group No.					Data structure	-	Data type	Uint16
34h	Data range	-	Factory setting	-	Accessibility	RO	Related mode	-	Map	NO

Subindex	Name	Abnormal intra-group offset					Data structure	-	Data type	Uint16
35h	Data range	-	Factory setting	-	Accessibility	RO	Related mode	-	Map	NO

Subindex	Name	Internal fault code					Data structure	-	Data type	Uint16
36h	Data range	-	Factory setting	-	Accessibility	RO	Related mode	-	Map	NO

Subindex	Name	Real-time pulse counter (unit: command pulse)					Data structure	-	Data type	Uint16
37h	Data range	-	Factory setting	-	Accessibility	RO	Related mode	-	Map	NO

Subindex	Name	Internal fault code of the selected fault					Data structure	-	Data type	Uint16
3Ch	Data range	-	Factory setting	-	Accessibility	RO	Related mode	-	Map	NO

Subindex	Name	Encoder real-time position (unit: encoder pulse)					Data structure	-	Data type	Int64
3Dh	Data range	-	Factory setting	-	Accessibility	RO	Related mode	-	Map	NO

Subindex	Name	Real-time mechanical position (unit: encoder pulse)					Data structure	-	Data type	Int64
41h	Data range	-	Factory setting	-	Accessibility	RO	Related mode	-	Map	NO

Subindex	Name	Absolute rotation mode mechanical single-turn position (unit: encoder unit)					Data structure	-	Data type	Int64
47h	Data range	-	Factory setting	-	Accessibility	RO	Related mode	-	Map	NO

Subindex	Name	Absolute rotation mode mechanical single-turn position (unit: command unit)					Data structure	-	Data type	Uint16
4Bh	Data range	-	Factory setting	-	Accessibility	RO	Related mode	-	Map	NO

Subindex	Name	Motor actual speed (unit: 0.1rpm)					Data structure	-	Data type	Uint16
4Dh	Data range	-	Factory setting	-	Accessibility	RO	Related mode	-	Map	NO

Subindex	Name	Cycle running cycle					Data structure	-	Data type	Uint16
53h	Data range	-	Factory setting	-	Accessibility	RO	Related mode	-	Map	NO

Subindex	Name	Cycle running time					Data structure	-	Data type	Uint16
54h	Data range	-	Factory setting	-	Accessibility	RO	Related mode	-	Map	NO

Subindex	Name	Speed loop running time					Data structure	-	Data type	Uint16
55h	Data range	-	Factory setting	-	Accessibility	RO	Related mode	-	Map	NO

Subindex	Name	Position loop running time					Data structure	-	Data type	Uint16
56h	Data range	-	Factory setting	-	Accessibility	RO	Related mode	-	Map	NO

Subindex	Name	D-axis given torque (unit: 0.1%)					Data structure	-	Data type	Uint16
59h	Data range	-	Factory setting	-	Accessibility	RO	Related mode	-	Map	NO

Subindex	Name	D-axis feedback torque (unit: 0.1%)					Data structure	-	Data type	Uint16
5Ah	Data range	-	Factory setting	-	Accessibility	RO	Related mode	-	Map	NO

Subindex	Name	Deviation value at ECAT synchronous deviation alarm (unit: $\frac{1}{288}us$)					Data structure	-	Data type	Uint16
5Bh	Data range	-	Factory setting	-	Accessibility	RO	Related mode	-	Map	NO

Subindex	Name	ECAT synchronous deviation compensation excessive count					Data structure	-	Data type	Uint16
5Ch	Data range	-	Factory setting	-	Accessibility	RO	Related mode	-	Map	NO

Subindex	Name	ECAT synchronous deviation real-time value (unit: $\frac{1}{288}us$)					Data structure	-	Data type	Uint16
5Dh	Data range	-	Factory setting	-	Accessibility	RO	Related mode	-	Map	NO

Subindex	Name	Maximum value of ECAT synchronous deviation (unit: $\frac{1}{288}us$)					Data structure	-	Data type	Uint16
5Eh	Data range	-	Factory setting	-	Accessibility	RO	Related mode	-	Map	NO

Subindex	Name	Status flag					Data structure	-	Data type	Uint16
5Fh	Data range	-	Factory setting	-	Accessibility	RO	Related mode	-	Map	NO

Subindex	Name	Status flag					Data structure	-	Data type	Uint16
61h	Data range	-	Factory setting	-	Accessibility	RO	Related mode	-	Map	NO

7.3.11. Communication Parameters

Index 2008h	Name	Communication parameters					Data structure	ARR	Data type	Uint16
	Data range	OD data range	Factory setting	OD default value	Accessibility	-	Related mode	-	Map	YES

Subindex 00h	Name	Maximum subindex number					Data structure	-	Data type	Uint8
	Data range	-	Factory setting	37h	Accessibility	RO	Related mode	-	Map	NO

Subindex 09h	Name	ECAT station address					Data structure	-	Data type	Uint16
	Data range	-	Factory setting	-	Accessibility	RO	Related mode	-	Map	NO

Subindex 0Ah	Name	ECAT station alias display					Data structure	-	Data type	Uint16
	Data range	0~65535	Factory setting	0	Accessibility	RO	Related mode	-	Map	NO

Subindex 0Bh	Name	ECAT station alias setting					Data structure	-	Data type	Uint16
	Data range	0~65535	Factory setting	0	Accessibility	RW	Related mode	-	Map	NO

Subindex 0Ch	Name	EEPROM operation mode					Data structure	-	Data type	Uint16
	Data range	0~7	Factory setting	0	Accessibility	RW	Related mode	-	Map	NO

EEPROM operation mode selection:

Set value	EEPROM operation mode
0	Communication modification parameters are not saved to eeprom
1	Modbus communication modification parameters are saved to eeprom
2	ECAT modification factory parameters are saved to eeprom
3	Modbus and ECAT modification factory parameters are saved to eeprom
4	ECAT modification ClA402 parameters are saved to eeprom
5	Modbus and ECAT modification CIA402 parameters are saved to eeprom
6	ECAT modification factory and CIA402 parameters are saved to eeprom
7	Modbus and ECAT modification parameters are saved to eeprom

Subindex 0Dh	Name	Reserved (Don't set)					Data structure	-	Data type	Uint16
	Data range	0~65535	Factory setting	0	Accessibility	RO	Related mode	-	Map	NO

Subindex	Name	Modbus response delay					Data structure	-	Data type	Uint16
0Eh	Data range	0~5000	Factory setting	0	Accessibility	RW	Related mode	-	Map	NO

Subindex	Name	Reserved (Don't set)					Data structure	-	Data type	Uint16
0Fh	Data range	0~65535	Factory setting	0	Accessibility	RW	Related mode	-	Map	NO

Subindex	Name	Reserved (Don't set)					Data structure	-	Data type	Uint16
10h	Data range	0~65535	Factory setting	0	Accessibility	RW	Related mode	-	Map	NO

Subindex	Name	Reserved (Don't set)					Data structure	-	Data type	Uint16
11h	Data range	0~1	Factory setting	0	Accessibility	RW	Related mode	-	Map	NO

Subindex	Name	Enable virtual DI					Data structure	-	Data type	Uint16
12h	Data range	0~1	Factory setting	0	Accessibility	RW	Related mode	-	Map	NO

Subindex	Name	Virtual DI default initial value					Data structure	-	Data type	Uint16
13h	Data range	0~65535	Factory setting	0	Accessibility	RW	Related mode	-	Map	NO

Subindex	Name	Enable virtual DO					Data structure	-	Data type	Uint16
14h	Data range	0~1	Factory setting	0	Accessibility	RW	Related mode	-	Map	NO

Subindex	Name	Reserved (Don't set)					Data structure	-	Data type	Uint16
15h	Data range	0~65535	Factory setting	0	Accessibility	RW	Related mode	-	Map	NO

Subindex	Name	Reserved (Don't set)					Data structure	-	Data type	Uint16
16h	Data range	0~65535	Factory setting	0	Accessibility	RW	Related mode	-	Map	NO

Subindex	Name	Reserved (Don't set)					Data structure	-	Data type	Uint16
17h	Data range	0~65535	Factory setting	0	Accessibility	RW	Related mode	-	Map	NO

Subindex	Name	ECAT synchronism deviation fault threshold					Data structure	-	Data type	Uint16
18h	Data range	0~5000	Factory setting	3000	Accessibility	RW	Related mode	-	Map	NO

Subindex	Name	Reserved (Don't set)					Data structure	-	Data type	Uint16
19h	Data range	0~65535	Factory setting	0	Accessibility	RW	Related mode	-	Map	NO

Subindex	Name	Reserved (Don't set)					Data structure	-	Data type	Uint16
1Ah	Data range	0~65535	Factory setting	0	Accessibility	RW	Related mode	-	Map	NO

Subindex	Name	Reserved (Don't set)					Data structure	-	Data type	Uint16
1Bh	Data range	0~65535	Factory setting	0	Accessibility	RW	Related mode	-	Map	NO

Subindex	Name	Reserved (Don't set)					Data structure	-	Data type	Uint16
1Ch	Data range	0~65535	Factory setting	0	Accessibility	RW	Related mode	-	Map	NO

Subindex	Name	Reserved (Don't set)					Data structure	-	Data type	Uint16
1Dh	Data range	0~65535	Factory setting	0	Accessibility	RW	Related mode	-	Map	NO

Subindex	Name	Reserved (Don't set)					Data structure	-	Data type	Uint16
1Eh	Data range	0~65535	Factory setting	0	Accessibility	RW	Related mode	-	Map	NO

Subindex	Name	ECAT synchronization enable delay time (unit: ms)					Data structure	-	Data type	Uint16
1Fh	Data range	0~5000	Factory setting	3500	Accessibility	RW	Related mode	-	Map	NO

Subindex	Name	Reinitialize USB					Data structure	-	Data type	Uint16
22h	Data range	0~1	Factory setting	0	Accessibility	RW	Related mode	-	Map	NO

Subindex	Name	ECAT status					Data structure	-	Data type	Uint16
25h	Data range	0~1	Factory setting	0	Accessibility	RW	Related mode	-	Map	NO

Subindex	Name	ECAT AL status					Data structure	-	Data type	Uint16
26h	Data range	0~1	Factory setting	0	Accessibility	RW	Related mode	-	Map	NO

Subindex	Name	ECAT PHY operation command					Data structure	-	Data type	Uint16
2Dh	Data range	0~65535	Factory setting	0	Accessibility	RW	Related mode	-	Map	NO

Set value	ECAT PHY operation command
0	No effect
100	Read PHY register
200	Write PHY register
300	Restore ECAT default eeprom

Subindex	Name	ECAT PHY address					Data structure	-	Data type	Uint16
2Eh	Data range	0~65535	Factory setting	0	Accessibility	RW	Related mode	-	Map	NO

Subindex	Name	ECAT PHY register address					Data structure	-	Data type	Uint16
2Fh	Data range	0~65535	Factory setting	0	Accessibility	RW	Related mode	-	Map	NO

Subindex	Name	ECAT PHY register value					Data structure	-	Data type	Uint16
30h	Data range	0~65535	Factory setting	0	Accessibility	RW	Related mode	-	Map	NO

Subindex	Name	ECAT PHY power-on initialization address					Data structure	-	Data type	Uint16
31h	Data range	0~65535	Factory setting	0	Accessibility	RW	Related mode	-	Map	NO

Subindex	Name	Prohibit ECAT synchronous interrupt handling mode					Data structure	-	Data type	Uint16
32h	Data range	0~65535	Factory setting	0	Accessibility	RW	Related mode	-	Map	NO

Subindex	Name	ECAT interrupt not occurred count					Data structure	-	Data type	Uint16
33h	Data range	0~65535	Factory setting	0	Accessibility	RW	Related mode	-	Map	NO

Subindex	Name	ECAT interrupt unread PDO count					Data structure	-	Data type	Uint16
34h	Data range	0~65535	Factory setting	0	Accessibility	RW	Related mode	-	Map	NO

Subindex	Name	ECAT interrupt unoperation PDO count					Data structure	-	Data type	Uint16
35h	Data range	0~65535	Factory setting	0	Accessibility	RW	Related mode	-	Map	NO

Subindex	Name	ECAT interrupt processing completion count					Data structure	-	Data type	Uint16
36h	Data range	0~65535	Factory setting	0	Accessibility	RW	Related mode	-	Map	NO

Subindex	Name	ECAT synchronization interrupt deviation large count					Data structure	-	Data type	Uint16
37h	Data range	0~65535	Factory setting	0	Accessibility	RW	Related mode	-	Map	NO

7.4. Detailed Explanation of Sub-protocol Definition Parameters (Group 6000h)

Index	Name	Error code					Data structure	VAR	Data type	Uint16
603Fh	Data range	0～65535	Factory setting	-	Accessibility	RO	Related mode	ALL	Map	TPDO
When the drive encounters an error in the description of the DS402 sub protocol, 603Fh is consistent with the DS402 protocol specifications. The value of 603Fh is hexadecimal data.										

Index	Name	Control word					Data structure	VAR	Data type	Uint16
6040h	Data range	0～65535	Factory setting	0	Accessibility	RW	Related mode	ALL	Map	RPDO

Set control command:

Bit	Name	Description
0	Switch on	0: Invalid; 1: effecitive
1	Enable voltage	0: Invalid; 1: effecitive
2	Quick stop	0: Invalid; 1: effecitive
3	Enable operation	0: Invalid; 1: effecitive
4～6	Operation mode specific	Related to servo operation mode
7	Fault reset	For resettable faults and warnings, execute the fault reset function; Bit7 rising edge is effective; Bit7 remains at 1, all other control commands are invalid
8	Halt	Please refer to the object dictionary 605Dh for the pause methods in each mode
9	Operation mode specific	Related to various servo operation modes
10	ReveD5V EtherCAT	Undefined
11～15	Manufacturer-specific	Manufacturer customization

- Each bit of the control word assigned individually is meaningless and must be combined with other bits to form a certain control command.
- Bit0~Bit3 and Bit7 have the same meaning in each servo mode, and 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 specific state.
- Bit4 to Bit6 are related to various servo modes, please refer to the control commands under different modes.
- Bit9 does not define a function.

Index	Name	Status word					Data structure	VAR	Data type	Uint16
6041h	Data range	0～65535	Factory setting	0	Accessibility	RO	Related mode	ALL	Map	RPDO

Reflecting the current operation status of the servo drive:

Bit	Name	Description
0	Ready to switch on	0: Invalid; 1: effecitive
1	Switch on	0: Invalid; 1: effecitive
2	Operation enabled	0: Invalid; 1: effecitive
3	Fault	0: Invalid; 1: effecitive
4	Voltage enabled	0: Invalid; 1: effecitive
5	Quick stop	0: Invalid; 1: effecitive
6	Switch on disabled	0: Invalid; 1: effecitive
7	Waming	0: Invalid; 1: effecitive
8	Manufacturer specific	Undefined function
9	Remote	0: Invalid; 1: effecitive (Control word takes effect)
10	Target reach	0: Invalid; 1: effecitive
11	Internal limit active	0: Invalid; 1: effecitive
12～13	Operation limit active	Related to various servo operation modes
14	Manufacturer specific	Undefined function
15	Home find	0: Invalid; 1: effecitive

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

- Bit0 to Bit9 have the same meaning in each servo mode. After the control word 6040h sends commands in sequence, the servo feedback a certain state.
- Bit12 to Bit13 are related to each servo mode (please refer to the control commands for different modes).
- Bit10, Bit11, and Bit15 have the same meaning in each servo mode, and provide feedback on the status of the servo after executing a certain servo mode.

Index	Name	Quick stop option code					Data structure	VAR	Data type	Int16
605Ah	Data range	0～7	Factory setting	2	Accessibility	RW	Related mode	ALL	Map	NO

Index	Name	Halt stop option code					Data structure	VAR	Data type	Int16
605Dh	Data range	1～3	Factory setting	3	Accessibility	RW	Related mode	ALL	Map	NO

Index	Name	Operation mode					Data structure	VAR	Data type	Int16
6060h	Data range	0～10	Factory setting	0	Accessibility	RW	Related mode	ALL	Map	RPDO

Select servo operation mode:

Set value	Servo mode	
0/2/5	NA	Reserve
1	Profile Position Mode (PP)	
3	Profile Velocity Mode (PV)	
4	Profile Torque Mode (PT)	
6	Homing mode (HM)	
7	Interpolation Mode (IP)	
8	Cyclic Synchronous Position Mode (CSP)	
9	Cyclic Synchronous Velocity Mode (CSV)	
10	Cyclic Synchronous Torque Mode (CST)	

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

Oath the current operating mode of the servo drive:

Set value	Servo mode	
0/2/5	NA	Reserve
1	Profile Position Mode (PP)	
3	Profile Velocity Mode (PV)	
4	Profile Torque Mode (PT)	
6	Homing mode (HM)	
7	Interpolation Mode (IP)	
8	Cyclic Synchronous Position Mode (CSP)	
9	Cyclic Synchronous Velocity Mode (CSV)	
10	Cyclic Synchronous Torque Mode (CST)	

Index	Name	Position command (unit: command unit)					Data structure	VAR	Data type	Int32
6062h	Data range	-	Factory setting	-	Accessibility	RO	Related mode	PP/HM/CSP	Map	TPDO
Reflect the position command (command unit) that has been input in the servo enabled state.										

Index	Name	Position feedback (unit: encoder unit)					Data structure	VAR	Data type	Int32
6063h	Data range	-	Factory setting	-	Accessibility	RO	Related mode	ALL	Map	TPDO
Reflect the absolute position of the motor.										

Index	Name	Position feedback (unit: command unit)					Data structure	VAR	Data type	Int32
6064h	Data range	-	Factory setting	-	Accessibility	RO	Related mode	ALL	Map	TPDO
Reflect real-time user absolute position feedback: Position feedback 6064h x Gear ratio 6091h = Position feedback 6063h。										

Index	Name	Position deviation fault threshold (unit: command unit)					Data structure	VAR	Data type	Uint32
6065h	Data range	0～（$2^{32}-1$）	Factory setting	17-bit: 1310720 23-bit: 83886080	Accessibility	RW	Related mode	PP/HM/CSP	Map	RPDO

When the absolute value of the position deviation (instruction unit) exceeds 6065h due to setting a threshold for excessive position deviation, AL.240 occurs (excessive position deviation fault).

- Note: When the set value of 6065h is 0xFFFFFFFF, the servo does not monitor excessive position deviation. Please use this function with caution.
- Note: The parameter needs to be saved by writing 1 to P12.20 through USB serial port or upper computer debugging software when the motor is not enabled.

Index	Name	Position deviation judgment time window (unit: ms)					Data structure	VAR	Data type	Uint32
6066h	Data range	0~65535	Factory setting	0	Accessibility	RW	Related mode	PP/HM/CSP	Map	RPDO

Index	Name	Position window (unit: encoder unit)					Data structure	VAR	Data type	Uint32
6067h	Data range	0~65535	Factory setting	65	Accessibility	RW	Related mode	PP/HM/CSP	Map	RPDO

Set the threshold for reaching the position. The unit of 6067h can be set through 2006-07h and defaults to the instruction unit.

When the absolute value of the position deviation is within 6067h and the time reaches 6068h, the position is considered valid. In PP/HM/CSP mode, Bit10=1 for status word 6041.

In PP/HM/CSP mode, this flag is meaningful when the servo enable is active, otherwise it is meaningless.

Index	Name	Position window time (unit: ms)					Data structure	VAR	Data type	Uint16
6068h	Data range	0~65535	Factory setting	15	Accessibility	RW	Related mode	PP/HM /CSP	Map	RPDO
Set a time window for determining the arrival of a valid location When the absolute value of the difference between the user position instruction 6062h and the user's actual position feedback 6064h or the internal position instruction 60FCh and the position feedback 6063h is within 6067h, and the time reaches 6068h, it is considered that the position has been reached. Bit10=1 in the status word 6041h. When the servo enable is invalid, this flag is meaningless.										

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

Index	Name	Speed windom (unit: rpm)					Data structure	VAR	Data type	Uint16
606Dh	Data range	0~65535	Factory setting	10	Accessibility	RW	Related mode	PV/CSV	Map	RPDO
Set the threshold for reaching the speed. When the absolute value of the difference between the target speed of 60FFh (converted to motor speed rpm units) and the actual motor speed is within 606Dh, and the time reaches 606Eh, it is considered that the speed has reached, and Bit10=1 in status word 6041. At the same time, the speed has reached the DO Function signal output and is valid.										

Index	Name	Speed windom time (unit: ms)					Data structure	VAR	Data type	Uint16
606Eh	Data range	0~65535	Factory setting	0	Accessibility	RW	Related mode	PV/CSV	Map	RPDO

Index	Name	Target torque (unit: 0.1%)					Data structure	VAR	Data type	Int16
6071h	Data range	-5000~5000	Factory setting	0	Accessibility	RW	Related mode	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	Name	Maximum torque command limit (unit: 0.1%)					Data structure	VAR	Data type	Uint16
6072h	Data range	0~5000	Factory setting	5000	Accessibility	RW	Related mode	ALL	Map	RPDO
Set the maximum allowable torque value for the servo. 100.0% corresponds to 1 times the rated torque of the motor.										

Index 6074h	Name	Internal torque command (unit: 0.1%)					Data structure	VAR	Data type	Int16
	Data range	-5000~5000	Factory setting	-	Accessibility	RO	Related mode	ALL	Map	TPDO
Display the current value of the internal torque command of the servo while it is in operation. 100.0% corresponds to 1 times the rated torque of the motor.										

Index 6077h	Name	Actual torque (unit: 0.1%)					Data structure	VAR	Data type	Int16
	Data range	-5000~5000	Factory setting	-	Accessibility	RO	Related mode	ALL	Map	TPDO
Display servo internal torque feedback. 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	-2147483648 ~2147483647	Factory setting	0	Accessibility	RW	Related mode	PP/CSP	Map	RPDO
Set the servo target position in contour position mode (PP) and periodic synchronous position mode (CSP).										

Index 607Ch	Name	Home offset					Data structure	VAR	Data type	Int32
	Data range	-2147483648 ~2147483647	Factory setting	0	Accessibility	RW	Related mode	HM	Map	RPDO
Set the origin back to the physical position where the mechanical zero point deviates from the motor origin. Condition for origin bias to take effect: During this power on operation, the origin reset operation has been completed, and Bit15=1 for status word 6041h The function of origin bias is to determine the current position of the user after the origin returns to zero based on 60E6h.										

Index 607Dh	Name	Software absolute position limit					Data structure	ARR	Data type	Uint16
	Data range	OD data range	Factory setting	OD default value	Accessibility	-	Related mode	-	Map	YES

Subindex 00h	Name	The maximum number of subindiex for software absolute position limitation					Data structure	-	Data type	Uint8
	Data range	-	Factory setting	2	Accessibility	RO	Related mode	-	Map	NO

Subindex 01h	Name	Minimum soft limit (unit: command unit)					Data structure	VAR	Data type	Int32
	Data range	-2147483648 ~2147483647	Factory setting	0	Accessibility	RW	Related mode	ALL	Map	RPDO
Set the minimum value of the soft limit, which refers to the absolute position relative to the mechanical zero point.										

Subindex 02h	Name	Maximum soft limit (unit: command unit)					Data structure	VAR	Data type	Int32
	Data range	-2147483648 ~2147483647	Factory setting	0	Accessibility	RW	Related mode	ALL	Map	RPDO
Set the maximum value of the soft limit, which refers to the absolute position relative to the mechanical zero point.										

Index 607Eh	Name	Command polarity setting (unit: command/s)					Data structure	ARR	Data type	Uint32
	Data range	0~255	Factory setting	0	Accessibility	RW	Related mode	ALL	Map	RPDO

Index 607Fh	Name	Maximum speed limit (unit: command/s)					Data structure	ARR	Data type	Uint32
	Data range	$0\sim(2^{32}-1)$	Factory setting	0	Accessibility	RW	Related mode	ALL	Map	RPDO

Index 6081h	Name	Profile speed (unit: command/s)					Data structure	ARR	Data type	Uint32
	Data range	$0\sim(2^{32}-1)$	Factory setting	0	Accessibility	RW	Related mode	PP	Map	RPDO
Set the uniform running speed of the displacement command for this segment in profile position mode.										

Index 6083h	Name	Profile acceleration (unit: command/s2)					Data structure	VAR	Data type	Uint32
	Data range	$1\sim(2^{32}-1)$	Factory setting	131072	Accessibility	RW	Related mode	PP/PV	Map	RPDO
Set acceleration in profile position mode and profile velocity mode.										

Index 6084h	Name	Profile deceleration (unit: command/s2)					Data structure	VAR	Data type	Uint32
	Data range	$1\sim(2^{32}-1)$	Factory setting	131072	Accessibility	RW	Related mode	PP/PV/CSP/CSV	Map	RPDO
Set deceleration in profile position mode and profile velocity mode.										

Index 6085h	Name	Quick stop deceleration (unit: 0.1%/s2)					Data structure	VAR	Data type	Uint32
	Data range	$1\sim(2^{32}-1)$	Factory setting	131072	Accessibility	RW	Related mode	PP/PV/CSP/CSV/HM	Map	RPDO

Index 6087h	Name	Torque slope (unit: 0.1%/s)					Data structure	VAR	Data type	Uint32
	Data range	$0\sim(2^{32}-1)$	Factory setting	131072	Accessibility	RW	Related mode	PT/CST	Map	RPDO
Set the torque command acceleration in profile torque mode, which means: incremental torque command per second.										

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

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

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

$$\text{Motor feedback position} = \text{Load shaft position feedback} * \text{Gear ratio}$$

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

$$\text{Motor speed (rpm)} = \frac{\text{Load shaft speed} * \text{Gear ratio}}{\text{Encoder resolution}} * 60$$

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

$$\text{Motor acceleration} = \frac{\text{Load shaft acceleration} * \text{Gear ratio}}{\text{Encoder resolution}} * \frac{1000}{60}$$

Subindex 00h	Name	The maximum subindex number of electronic gear ratio					Data structure	-	Data type	Uint8
	Data range	-	Factory setting	2	Accessibility	RO	Related mode	-	Map	NO

Subindex 01h	Name	Electronic gear ratio numerator					Data structure	VAR	Data type	Int32
	Data range	$1\sim(2^{32}-1)$	Factory setting	1	Accessibility	RW	Related mode	-	Map	RPDO

Subindex 02h	Name	Electronic gear ratio denominator					Data structure	VAR	Data type	Int32
	Data range	$1\sim(2^{32}-1)$	Factory setting	1	Accessibility	RW	Related mode	-	Map	RPDO

Index 6098h	Name	Homing method					Data structure	VAR	Data type	Int8
	Data range	0~35	Factory setting	19	Accessibility	RW	Related mode	HM	Map	RPDO
Please refer to the chapter on 'Homing Mode (HM)'										

Index 6099h	Name	Homing speed					Data structure	ARR	Data type	Uint32
	Data range	OD data range	Factory setting	OD default value	Accessibility	-	Related mode	HM	Map	YES

Subindex 00h	Name	The maximum subindex number of homing speed					Data structure	-	Data type	Uint8
	Data range	-	Factory setting	2	Accessibility	RO	Related mode	-	Map	NO

Subindex 01h	Name	High-speed homing (unit: command/s)					Data structure	VAR	Data type	Uint32
	Data range	$0\sim(2^{32}-1)$	Factory setting	131072	Accessibility	RW	Related mode	HM	Map	RPDO

Subindex 02h	Name	Low-speed homing (unit: command/s)					Data structure	VAR	Data type	Uint32
	Data range	$0\sim(2^{32}-1)$	Factory setting	65535	Accessibility	RW	Related mode	HM	Map	RPDO

Index 609Ah	Name	Homing acceleration (unit: command/s2)					Data structure	VAR	Data type	Uint32
	Data range	$0\sim(2^{32}-1)$	Factory setting	131072	Accessibility	RW	Related mode	HM	Map	RPDO

Index 60B0h	Name	Position offset (unit: command unit)					Data structure	VAR	Data type	Int32
	Data range	$-2^{31}\sim(2^{31}-1)$	Factory setting	0	Accessibility	RW	Related mode	CSP	Map	RPDO
Set the servo position command offset in the cyclic synchronous position mode. After offset: Servo target position = 607Ah + 60B0h.										

Index 60B1h	Name	Speed offset (unit: command/s)					Data structure	VAR	Data type	Int32
	Data range	$-2^{31}\sim(2^{31}-1)$	Factory setting	0	Accessibility	RW	Related mode	CSP/CSV	Map	RPDO
Set the servo speed command offset in the cyclic synchronous velocity mode. After offset: Servo target speed = 60FFh + 60B1h										

Index 60B2h	Name	Torque offset (unit: 0.1%)					Data structure	VAR	Data type	Int16
	Data range	-5000～5000	Factory setting	0	Accessibility	RW	Related mode	CSP/CSV/ CST	Map	RPDO
Set the servo torque command offset in the cyclic synchronous torque mode. After offset: Servo target torque = 6071h + 60B2h										

Index	Name	Probe mode					Data structure	VAR	Data type	Uint16
60B8h	Data range	0～65535	Factory setting	0	Accessibility	RW	Related mode	-	Map	RPDO

Set the functions of probe 1 and probe 2:

Bit	Description	Setting
0	Probe 1 enable	0: Probe 1 disable 1: Probe 1 enable
1	Probe 1 trigger mode	0: Single trigger, only triggered when the trigger signal is valid for the first time 1: Continuous triggering
2	Probe 1 trigger signal selection	0: DI input signal 1: Meaningless
3	NA	Meaningless
4	Probe 1 rising edge enable	0: No latch on rising edge 1: Rising edge latch
5	Probe 1 falling edge enable	0: No latch on falling edge 1: Falling edge latch
6	NA	Meaningless
7	NA	Meaningless
8	Probe 2 enable	0: Probe 2 disable 1: Probe 2 enable
9	Probe 2 trigger mode	0: Single trigger, only triggered when the trigger signal is valid for the first time 1: Continuous triggering
10	Probe 2 trigger signal selection	0: DI input signal 1: Meaningless
11	NA	Meaningless
12	Probe 2 rising edge enable	0: No latch on rising edge 1: Rising edge latch
13	Probe 2 falling edge enable	0: No latch on falling edge 1: Falling edge latch
14	NA	Meaningless
15	NA	Meaningless

Index	Name	Probe status					Data structure	VAR	Data type	Uint16
60B9h	Data range	-	Factory setting	-	Accessibility	RO	Related mode	-	Map	TPDO

Read the status of probe 1 and probe 2:

Bit	Description	Remark
0	Probe 1 enable	0: Probe 1 disable 1: Probe 1 enable
1	Probe 1 rising edge latch execution	0: The rising edge latch is not executed 1: The rising edge latch is executed
2	Probe 1 falling edge latch execution	0: The falling edge latch is not executed 1: The falling edge latch is executed
3～6	NA	Meaningless
7	Probe 1 triggers signal monitoring	0: DI indicates a low level 1: DI indicates a high level
8	Probe 2 enable	0: Probe 2 disable 1: Probe 2 enable
9	Probe 2 rising edge latch execution	0: The rising edge latch is not executed 1: The rising edge latch is executed
10	Probe 2 falling edge latch execution	0: The falling edge latch is not executed 1: The falling edge latch is executed
11～14	NA	Meaningless
15	0: DI indicates a low level 1: DI indicates a high level	Meaningless

Index	Name	Probe 1 rising edge position latch (unit: command unit)					Data structure	VAR	Data type	Int32
60BAh	Data range	-	Factory setting	-	Accessibility	RO	Related mode	-	Map	TPDO

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

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

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

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

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

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

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

Index	Name	Forward torque limit (unit: 0.1%)					Data structure	VAR	Data type	Uint16
60E0h	Data range	0~5000	Factory setting	5000	Accessibility	RW	Related mode	ALL	Map	RPDO

Index	Name	Reverse torque limit (unit: 0.1%)					Data structure	VAR	Data type	Uint16
60E1h	Data range	0~5000	Factory setting	5000	Accessibility	RW	Related mode	ALL	Map	RPDO

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

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

Index	Name	Input status					Data structure	VAR	Data type	Uint32
60FDh	Data range	-	Factory setting	-	Accessibility	RO	Related mode	-	Map	TPDO

Reflecting the current DI terminal logic of the drive: 0-logic invalid, 1-logic valid:

Bit	Description
0	Forward limit switch
1	Reverse limit switch
2	Origin switch
3～15	NA
16	DI1
17	DI2
18	DI3
19	DI4
20	DI5
21	DI6
22	DI7
23	DI8
24～31	NA

Index	Name	Digital output					Data structure	VAR	Data type	Uint32
60FEh	Data range	OD data range	Factory setting	OD default value	Accessibility	-	Related mode	-	Map	YES

Subindex	Name	The maximum sub index number of digital output					Data structure	-	Data type	Uint8
00h	Data range	-	Factory setting	2	Accessibility	RO	Related mode	-	Map	NO

Subindex	Name	Output enable					Data structure	VAR	Data type	Uint32
01h	Data range	$0\sim(2^{32}-1)$	Factory setting	0	Accessibility	RW	Related mode	-	Map	RPDO

Reflect the output logic of the drive DO port:

Bit	Related output port	Description
0～15	NA	
16	DO1	Forced output (0: OFF, 1: ON), only takes effect when Bit16 of 60FE-02h is set to 1
17	DO2	Forced output (0: OFF, 1: ON), only takes effect when Bit17 of 60FE-02h is set to 1
18	DO3	Forced output (0: OFF, 1: ON), only takes effect when Bit18 of 60FE-02h is set to 1
19	DO4	Forced output (0: OFF, 1: ON), only takes effect when Bit19 of 60FE-02h is set to 1
20～31	NA	

◆ Note: The Function setting value of the DO port needs to be set to 31 (universal output) in order to be controlled by 60FE-1h and 60FE-2h.

Subindex 02h	Name	Output control					Data structure	VAR	Data type	Uint32
	Data range	$0\sim(2^{32}-1)$	Factory setting	0	Accessibility	RW	Related mode	-	Map	RPDO

Set whether to enable DO forced output:

Bit	Related DO port	Description
0～15	NA	
16	DO1	0: Prohibit forced output of DO1 1: Enable DO1 to force output
17	DO2	0: Prohibit forced output of DO2 1: Enable DO2 to force output
18	DO3	0: Prohibit forced output of DO3 1: Enable DO3 to force output
19	DO4	0: Prohibit forced output of DO4 1: Enable DO4 to force output
20～31	NA	

Index 60FFh	Name	Target speed (unit: command/s)					Data structure	VAR	Data type	Int32
	Data range	$-2^{31}\sim(2^{31}-1)$	Factory setting	131072	Accessibility	RW	Related mode	PV/CSV	Map	RPDO

Set the user speed command in profile velocity speed mode and cyclic synchronous velocity mode.

Index 6502h	Name	Supported operation modes					Data structure	VAR	Data type	Uint32
	Data range	-	Factory setting	929	Accessibility	RO	Related mode	-	Map	NO

Reflect the servo operation modes supported by the drive:

Bit	Description	Support or not (0: not supported, 1: supported)
0	Profile position mode (PP)	1
1	Variable frequency speed regulation mode (VL)	0
2	Profile velocity mode (PV)	1
3	Profile torque mode (PT)	1
4	NA	0
5	Homing mode (HM)	1
6	Interpolation mode (IP)	0
7	Cyclic synchronous position mode (CSP)	1
8	Cyclic synchronous velocity mode (CSV)	1
9	Cyclic synchronous torque mode(CST)	1
10～31	NA	0

8. Application Cases

8.1. Cooperate with Omron Controller Operation Case

Testing environment:

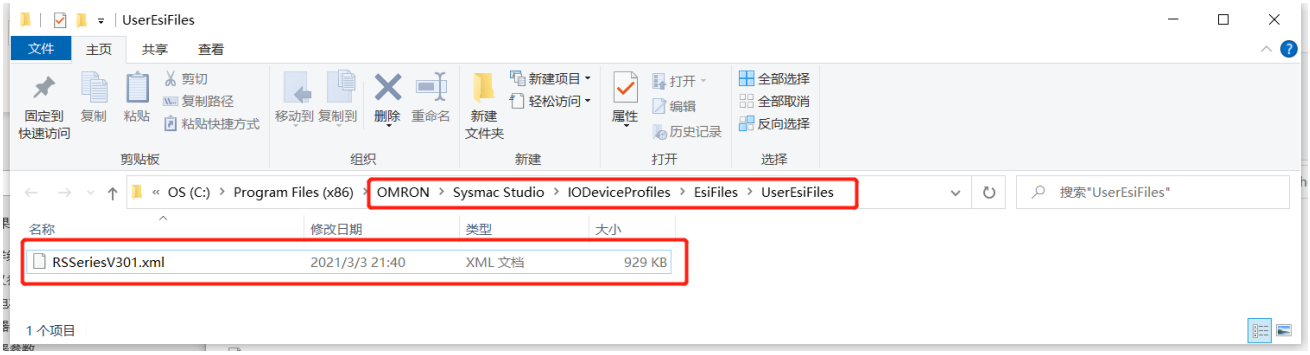
PC operating system: Windows 10

PLC development environment: Sysmac Studio Ver.1.23

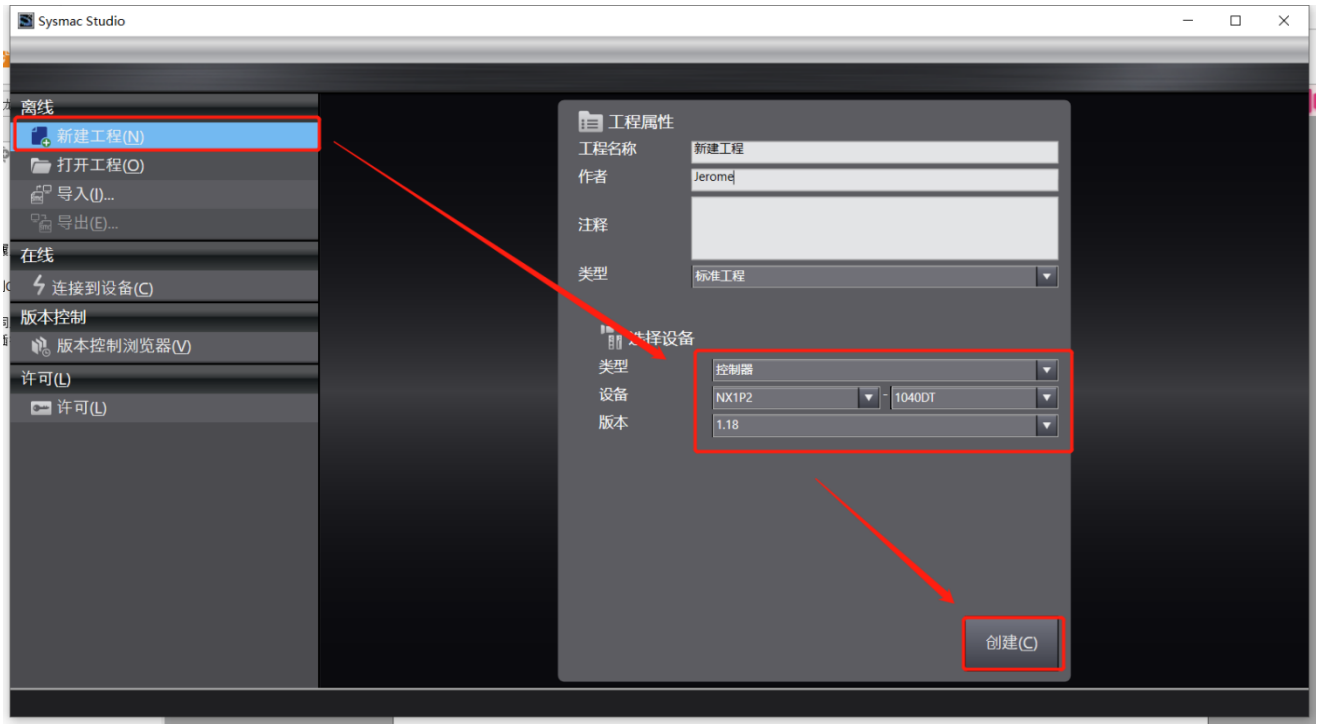
PLC controller model: OMRON NX1P2

8.1.1. Add Device Description File

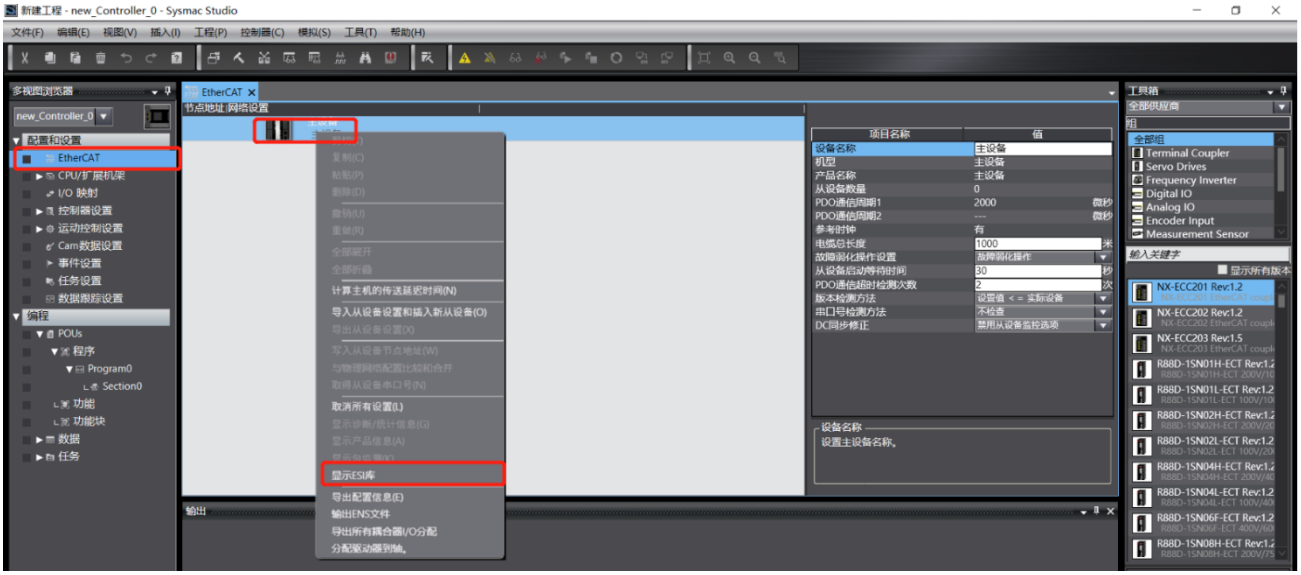
Find the installation directory of the PLC development environment Sysmac Studio, and copy the device description file of the drive to the following file path:



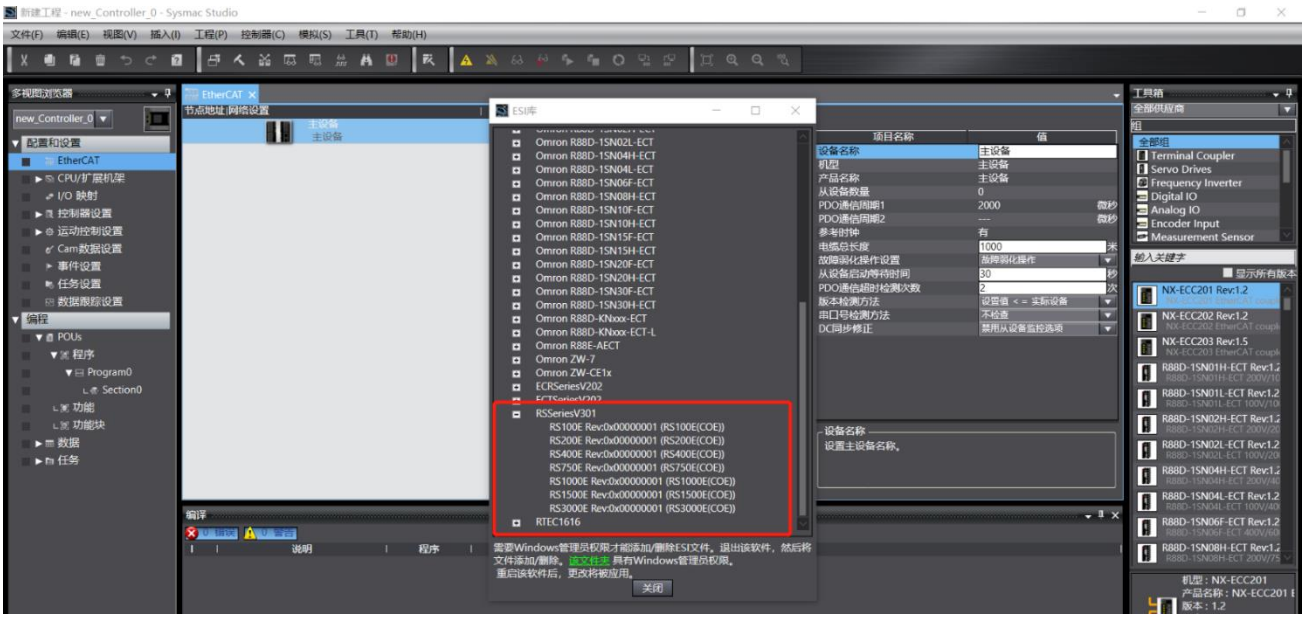
8.1.2. Create a New Project



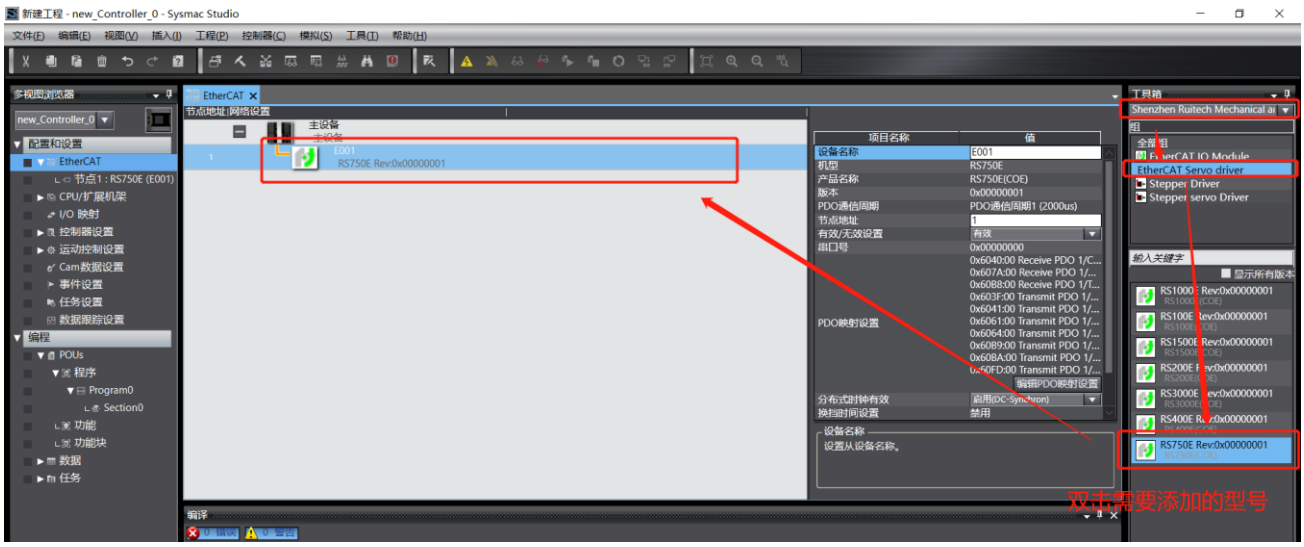
Check whether the drive device description file is installed correctly:



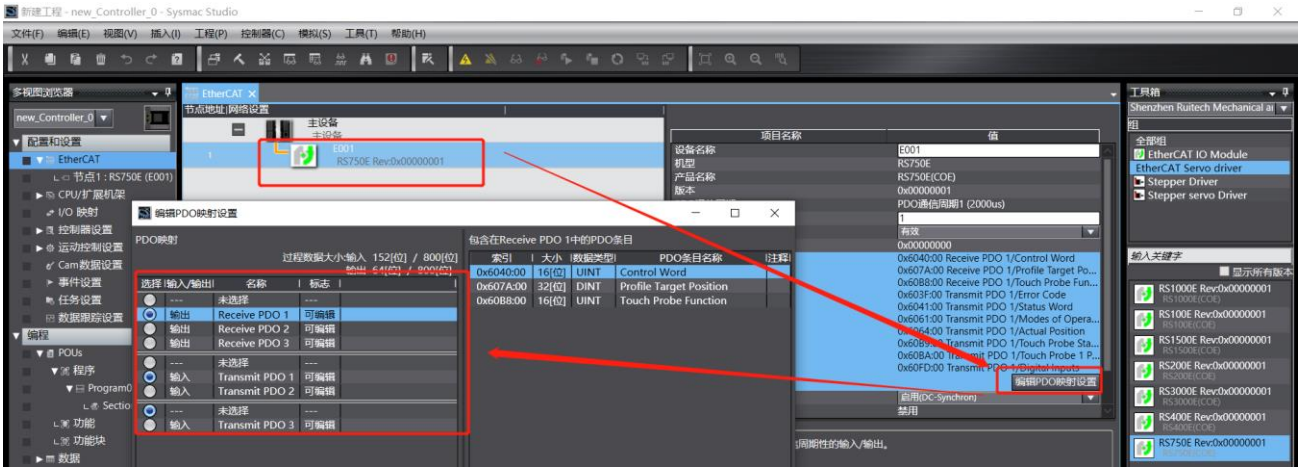
If the installation is successful, it will show as follows:



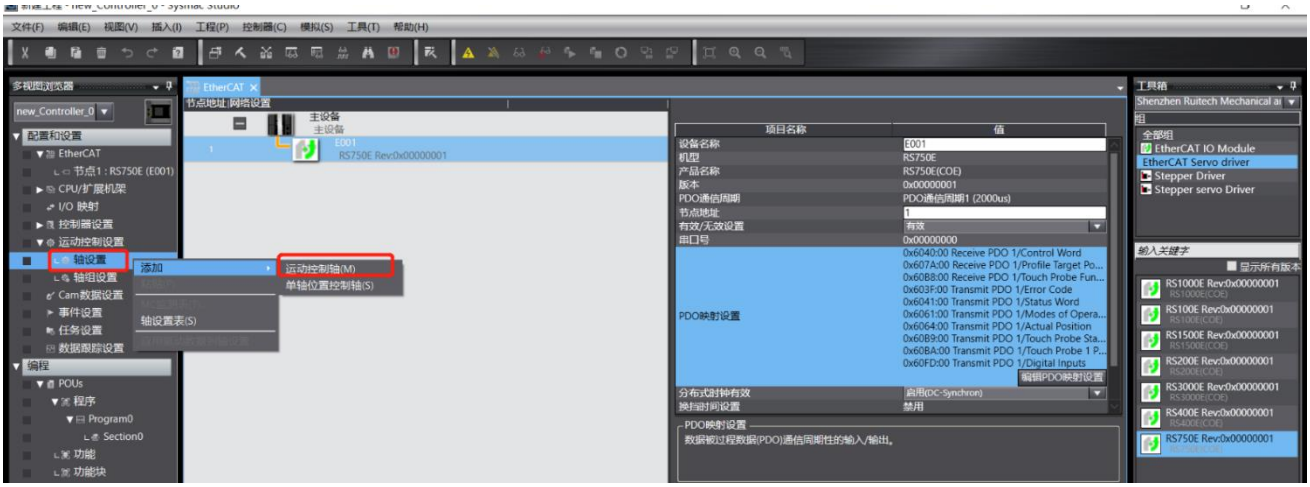
8.1.3. Add Drive



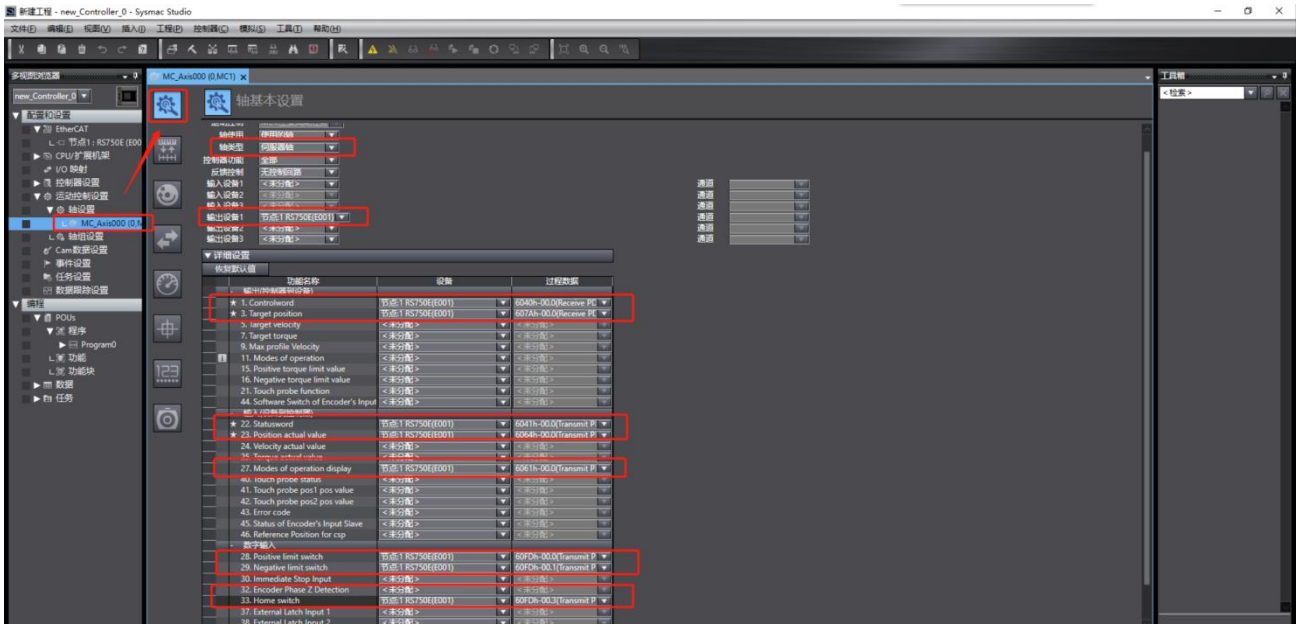
Edit PDO configuration, generally keep the default:



8.1.4. Add Motion Control Axis

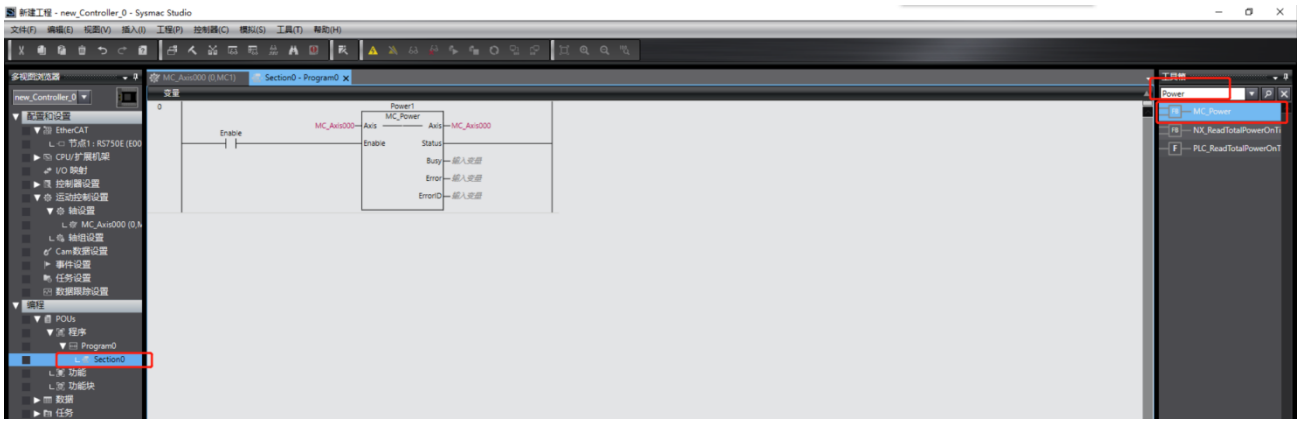


8.1.5. Map Axis and Drive

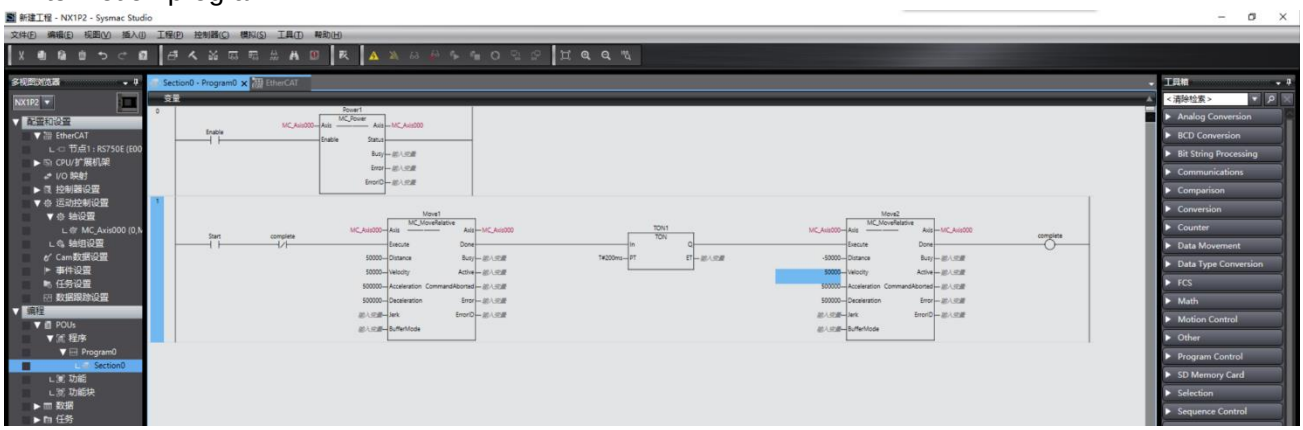


8.1.6. Write Test Code

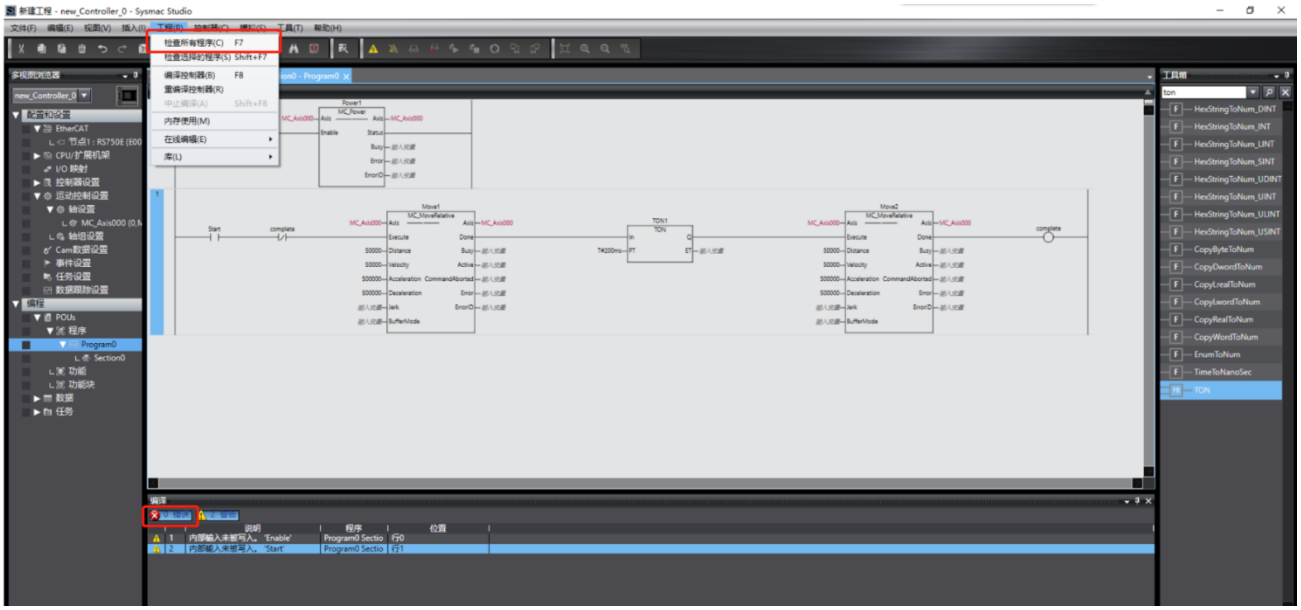
Write the enable program:



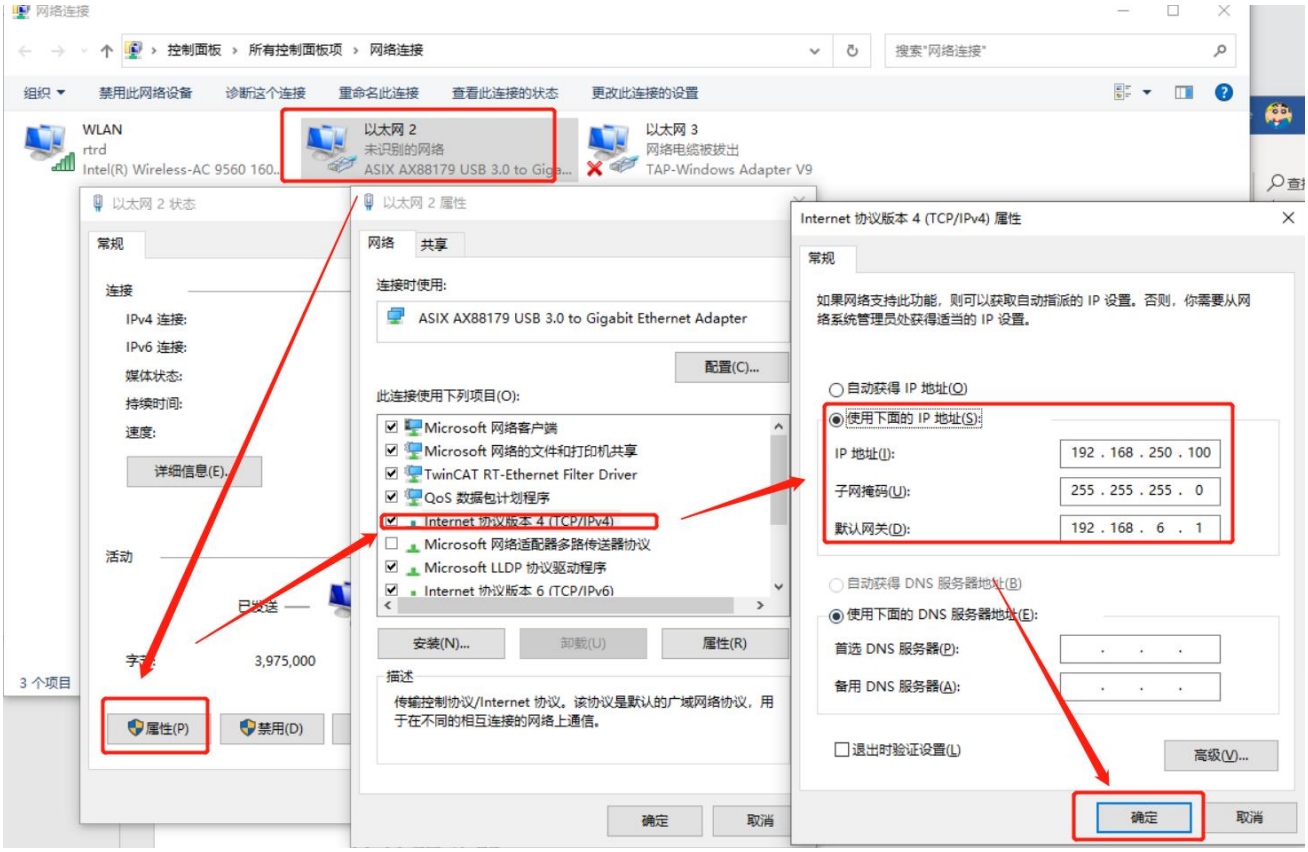
Write motion program:



Check if there are errors in the program:

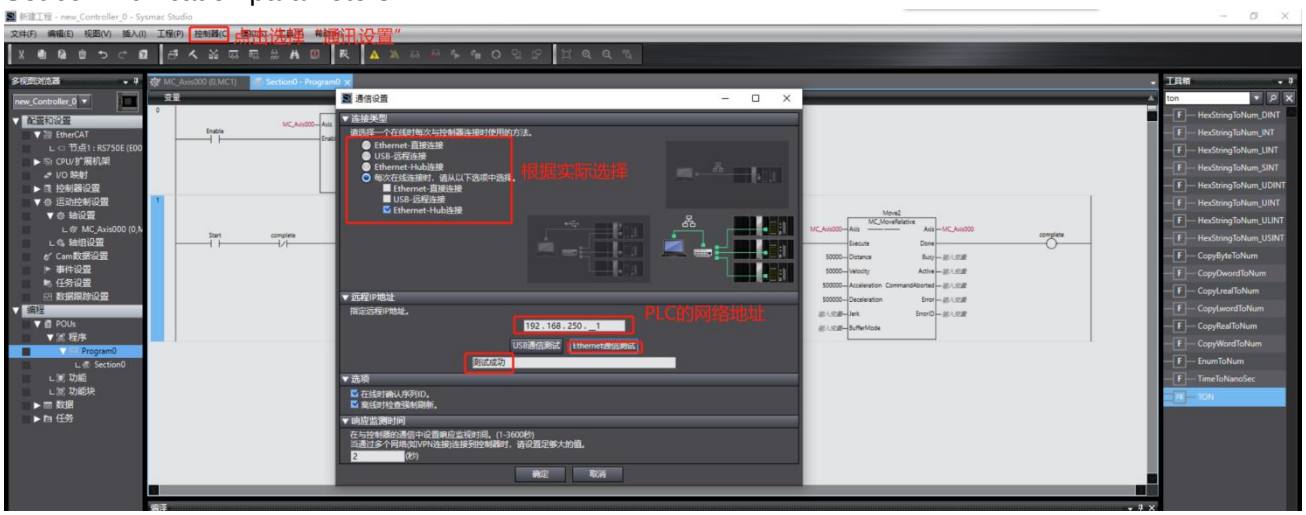


Modify the PC's network address so that it is in the same network segment as the PLC (Note: The PLC network address used in the test is 192.168.250.1):

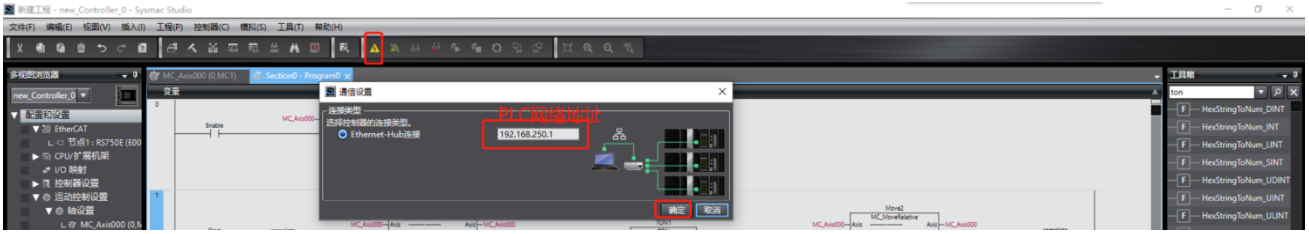


8.1.7. Connect to the Drive

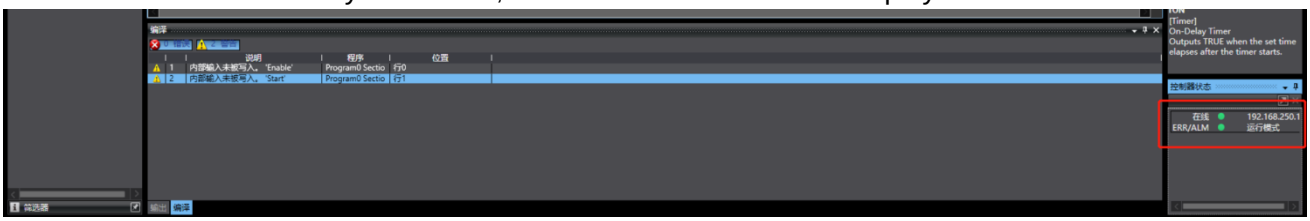
Set communication parameters:



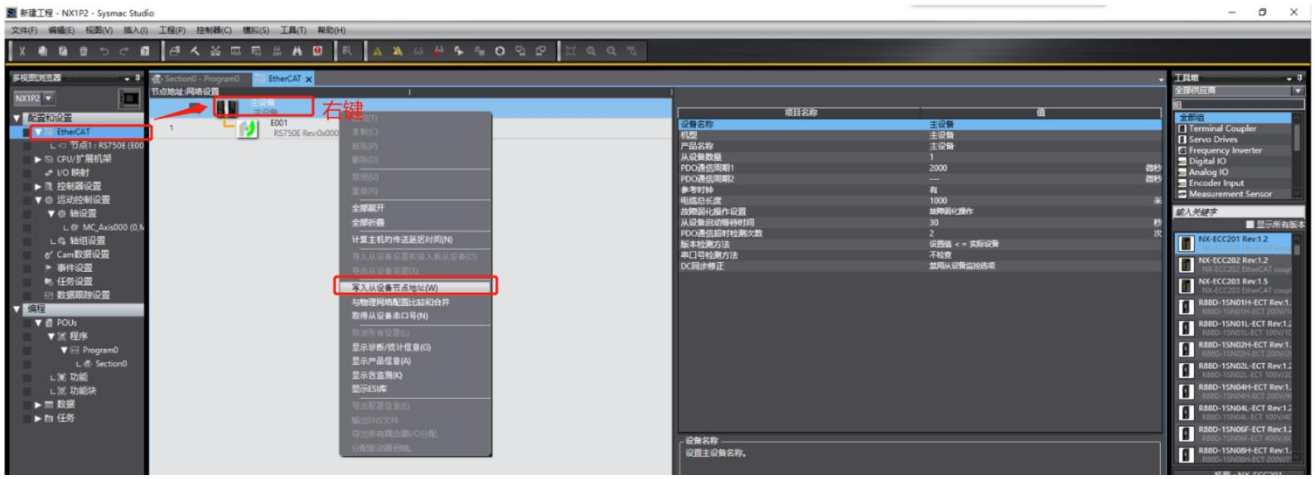
Connect to the PLC:



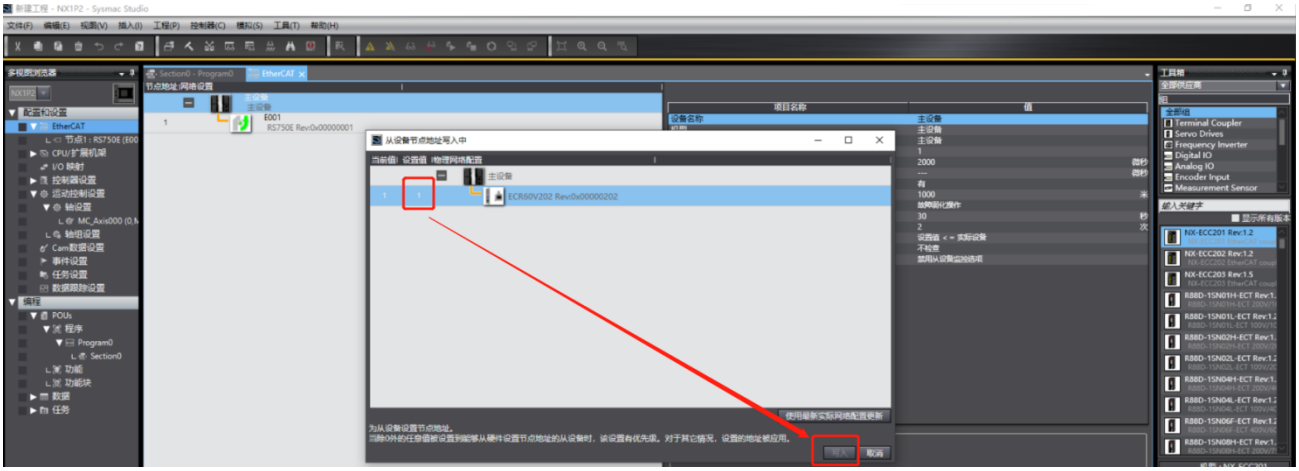
After the PLC is successfully connected, the controller status will be displayed on the PC software:



8.1.8. Assign Drive Address

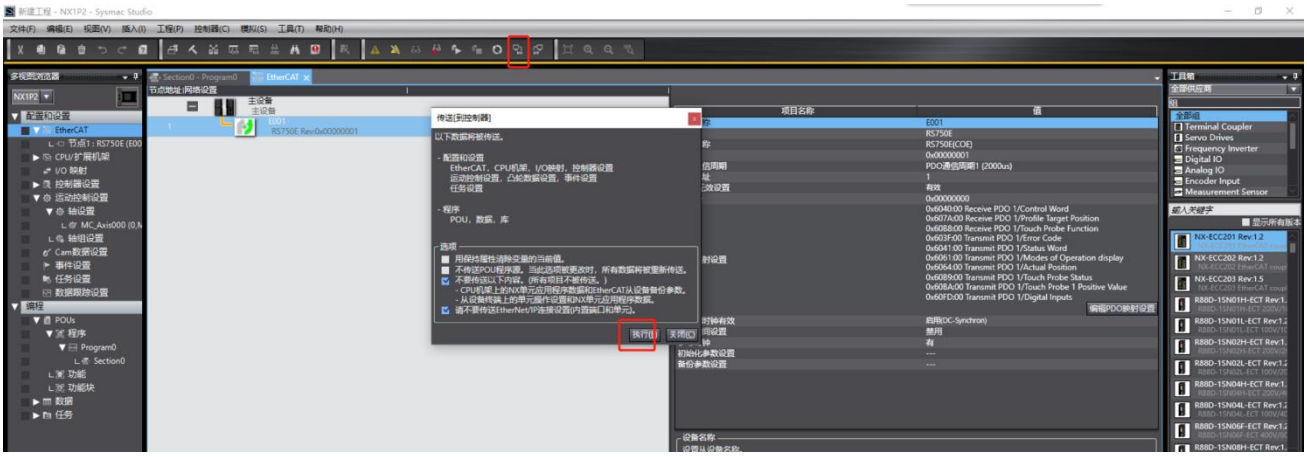


Set the setting value to 1, and then write:

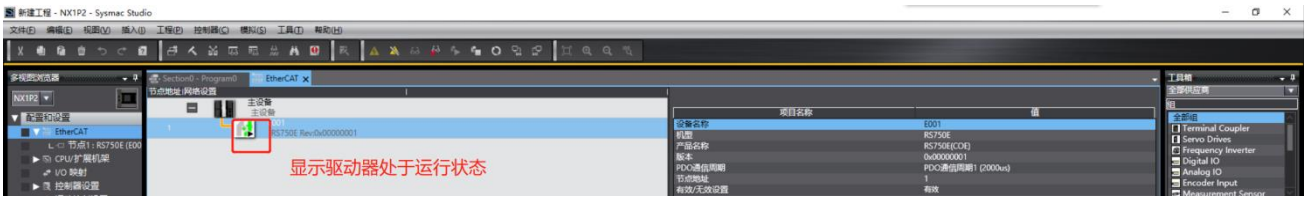


Note: After the writing is successful, please restart the drive according to the prompts

8.1.9. Program Download

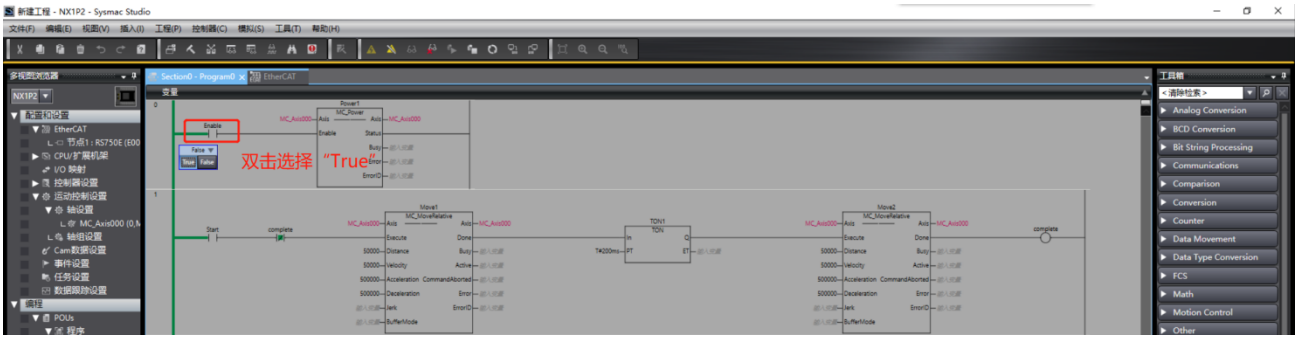


After always confirming, the download is complete. The drive shows that it is running:

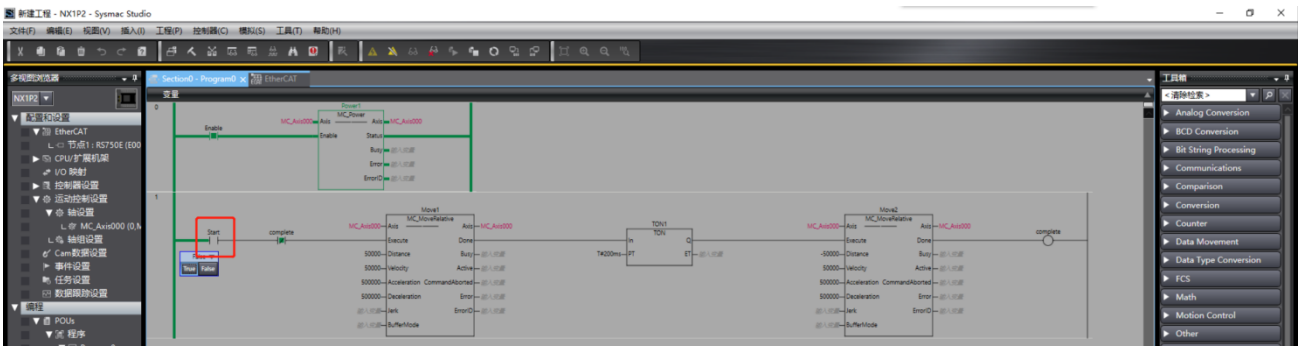


8.1.10. Motion Test

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

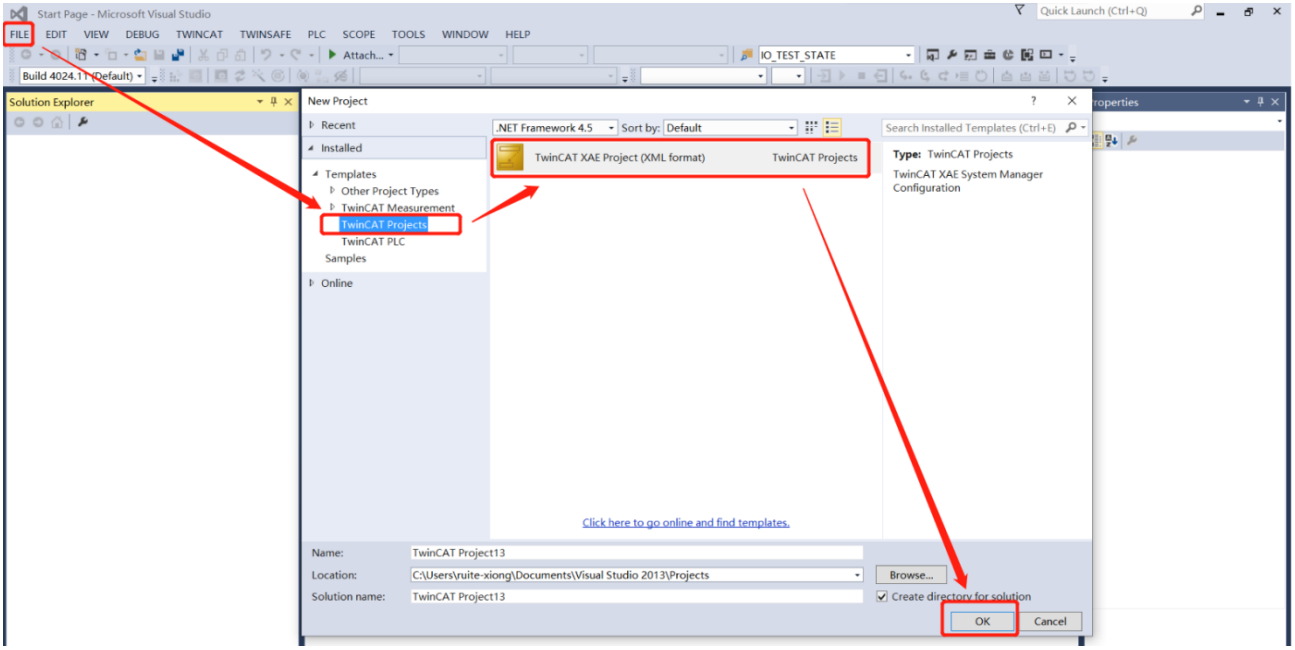
TwinCAT version: V3.1.4024.11

8.2.1. Add Device Description File

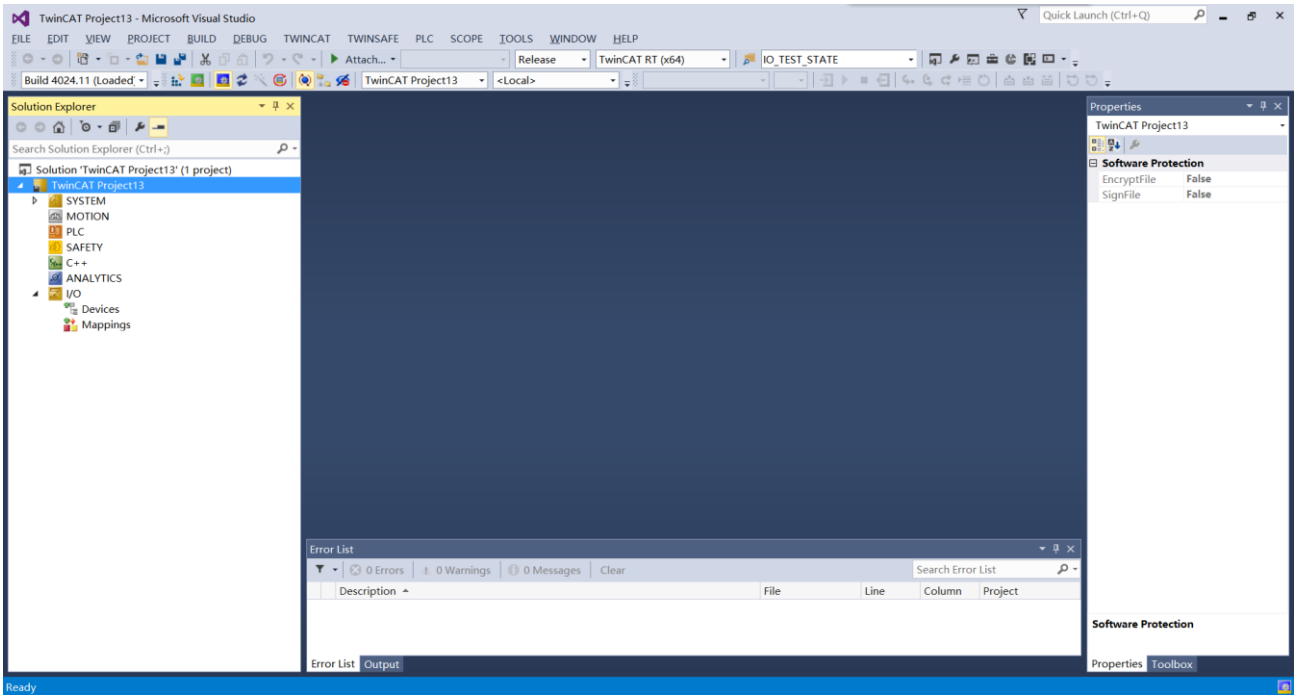
Copy the RSSeriesV401.xml file to the relevant path of TwinCAT as shown in the figure:

8.2.2. Create a New Project

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



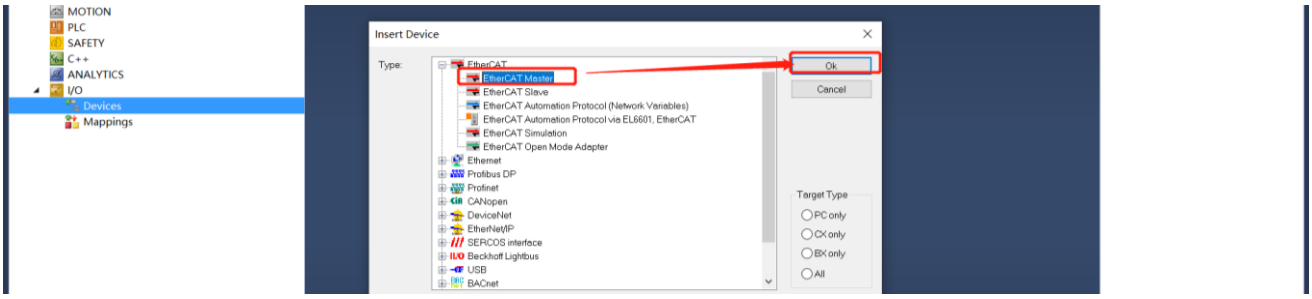
After the project is successfully created, the following figure shows:



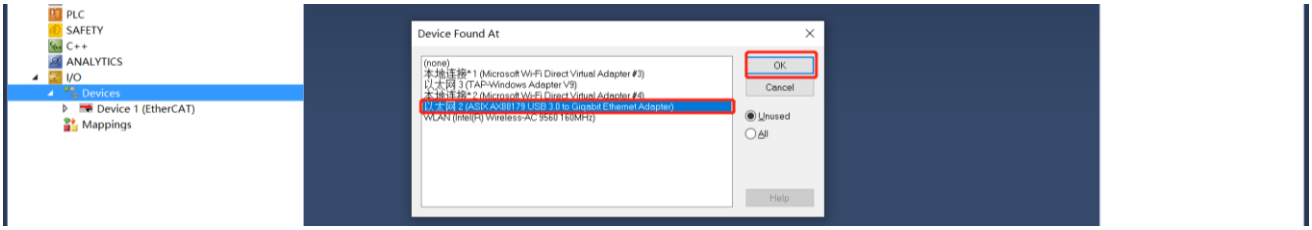
8.2.3. Add Master Network Card

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

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



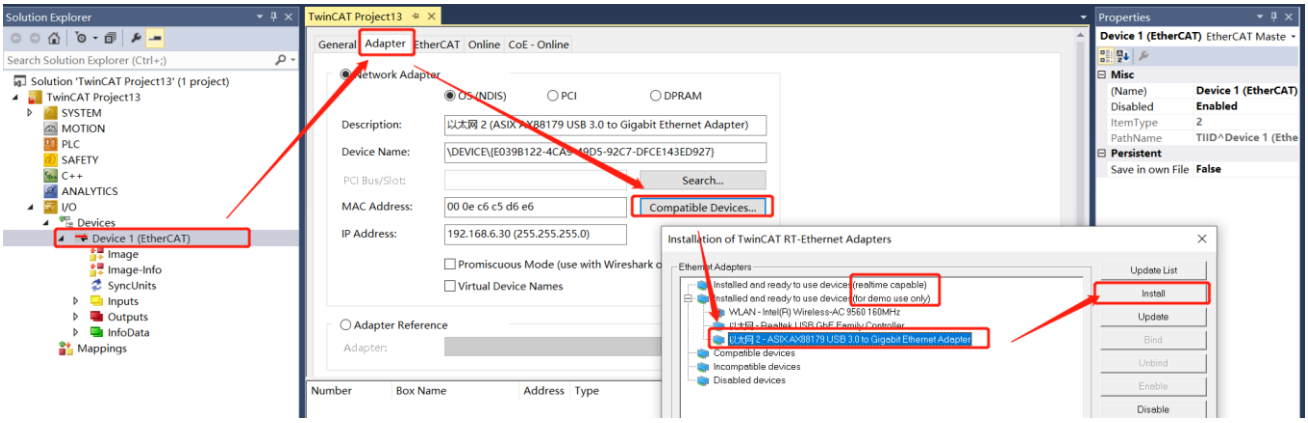
After clicking "OK", select the network card to be used:



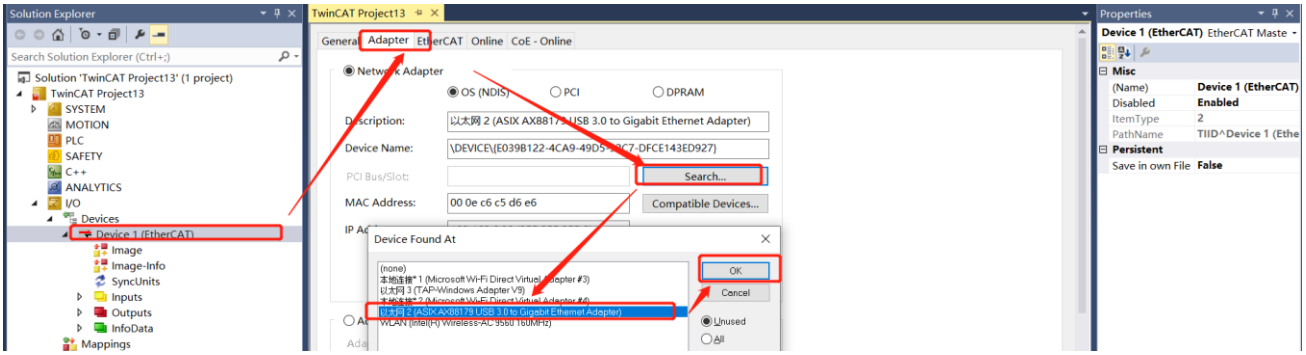
After selecting the corresponding network card, click "OK" to complete the setting, as shown in the following figure:

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 Drive

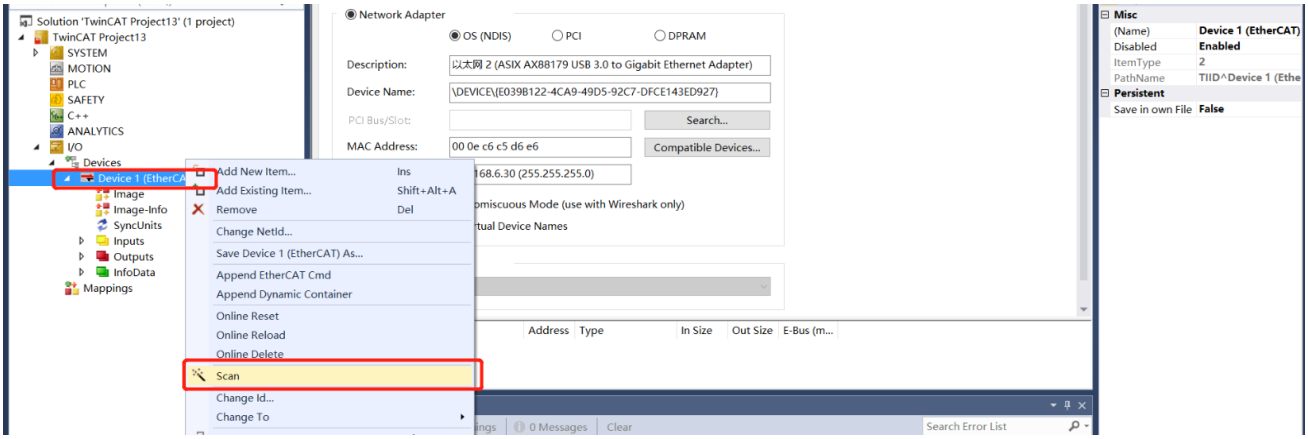


After installing the drive, click the "Search" button to find the corresponding network card:

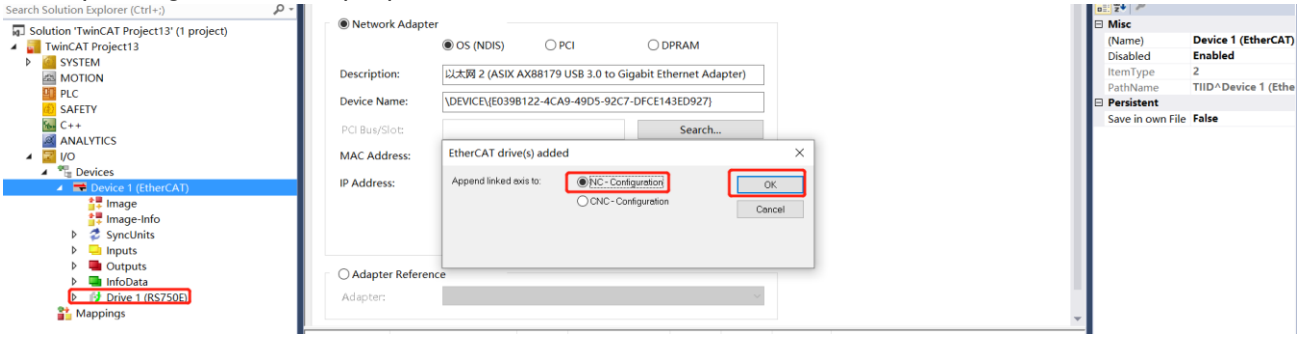


8.2.5. Search Drive

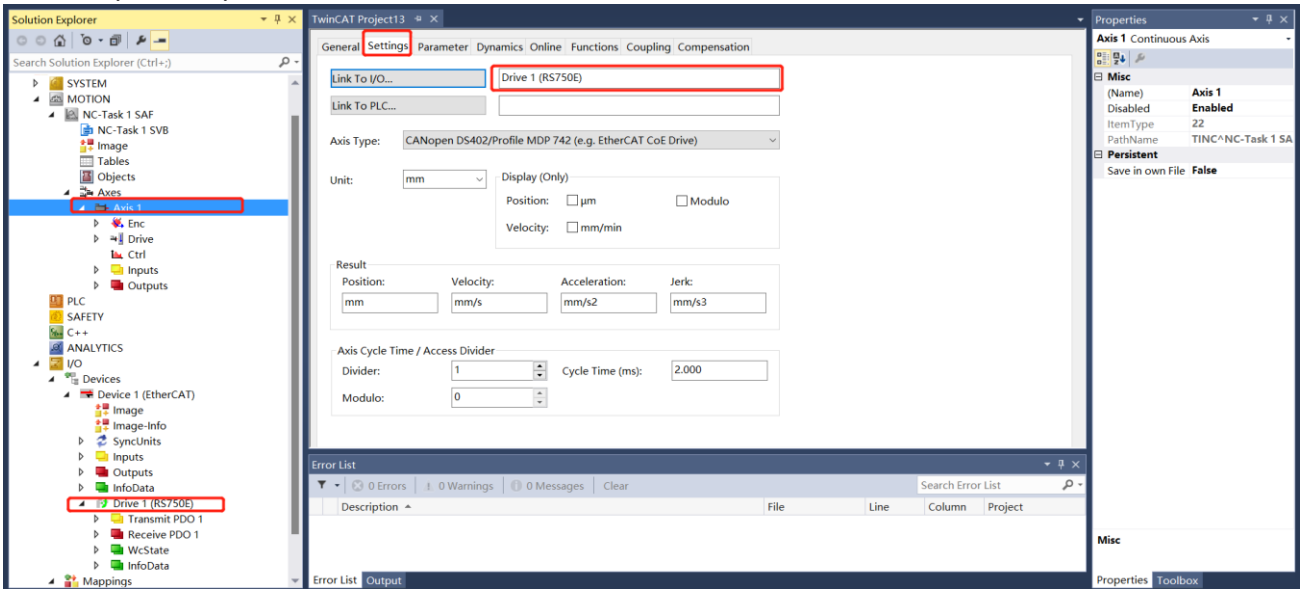
Connect the drive to the power supply, motor and network cable, and then right-click in the "Device 1 (EtherCAT)" item and select "Scan", as shown below:



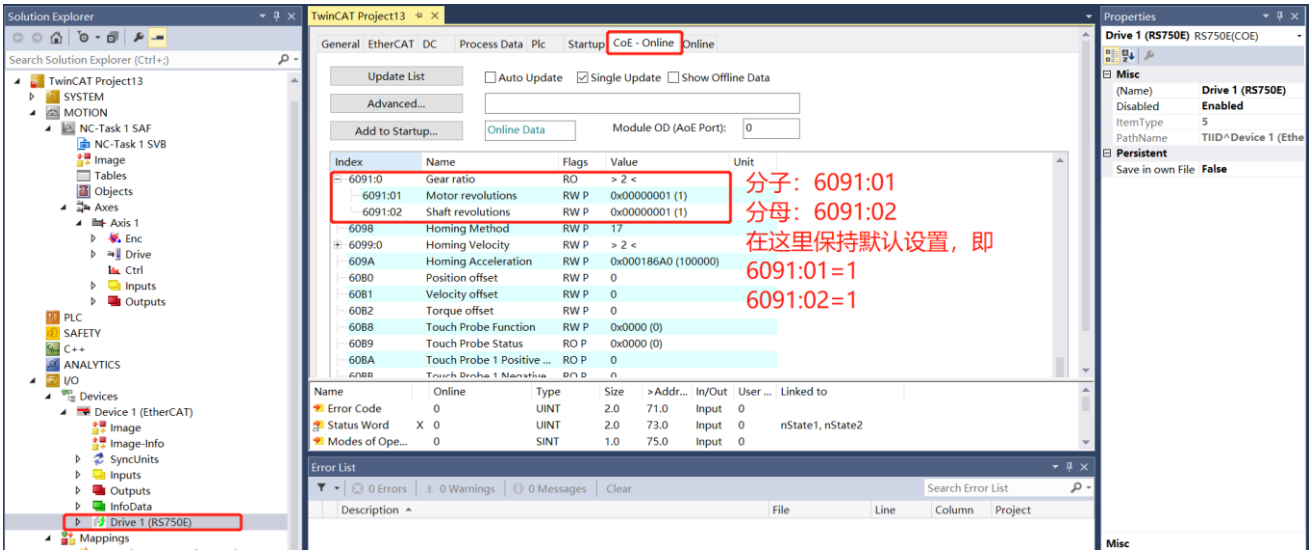
Under normal circumstances, the software prompts to find RS servo drive, and prompts whether to add a corresponding motion axis (NC), click the "OK" button:



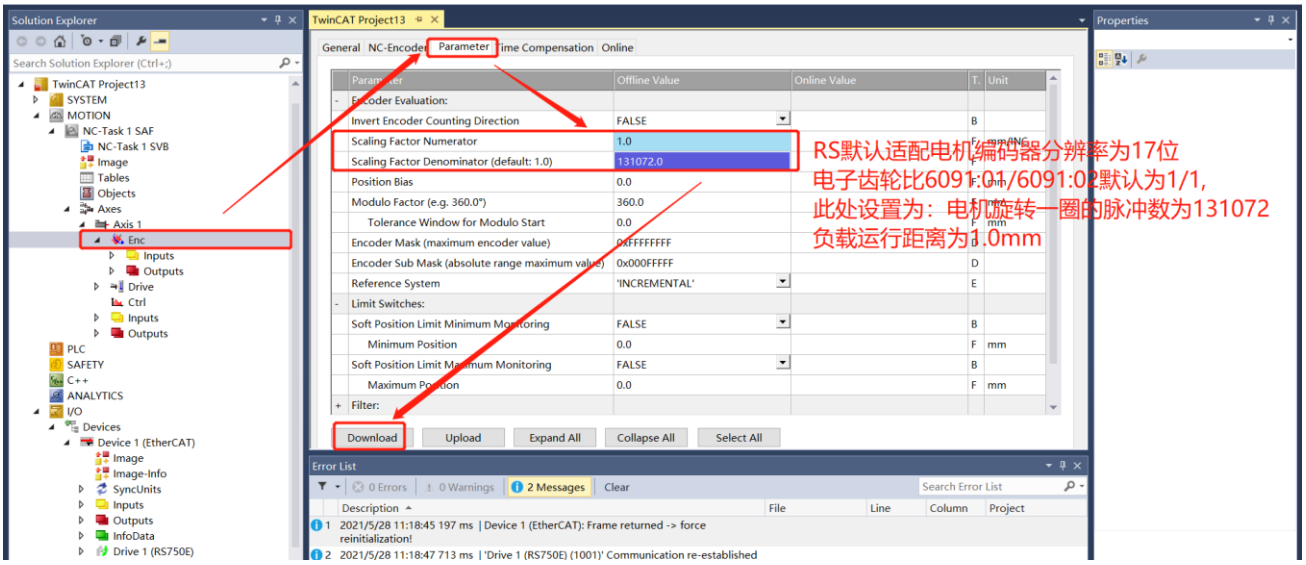
At this time, the software automatically adds a "Motion -> Axes -> Axis 1" and associates it with the drive "Drive 1 (RS750E)", as shown below:



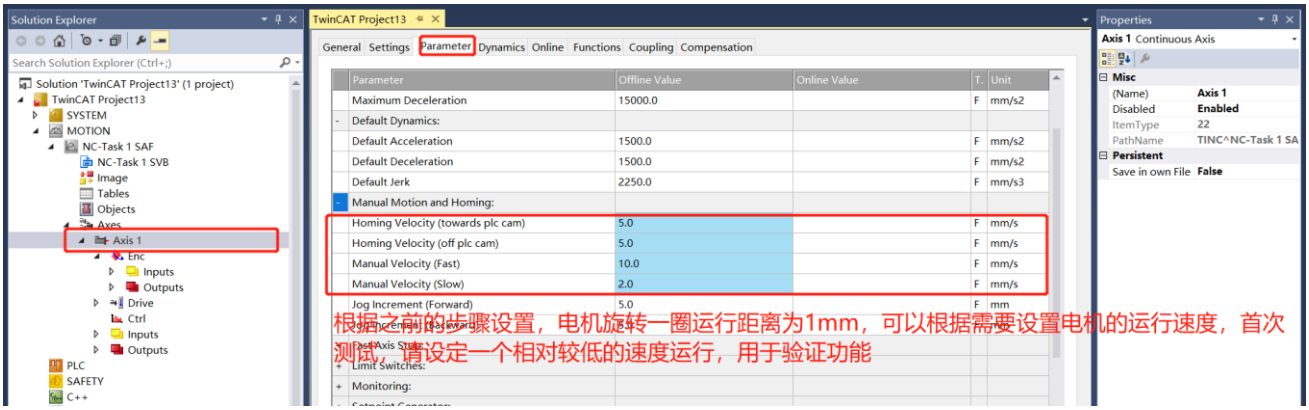
8.2.6. Set Electronic Gear Ratio



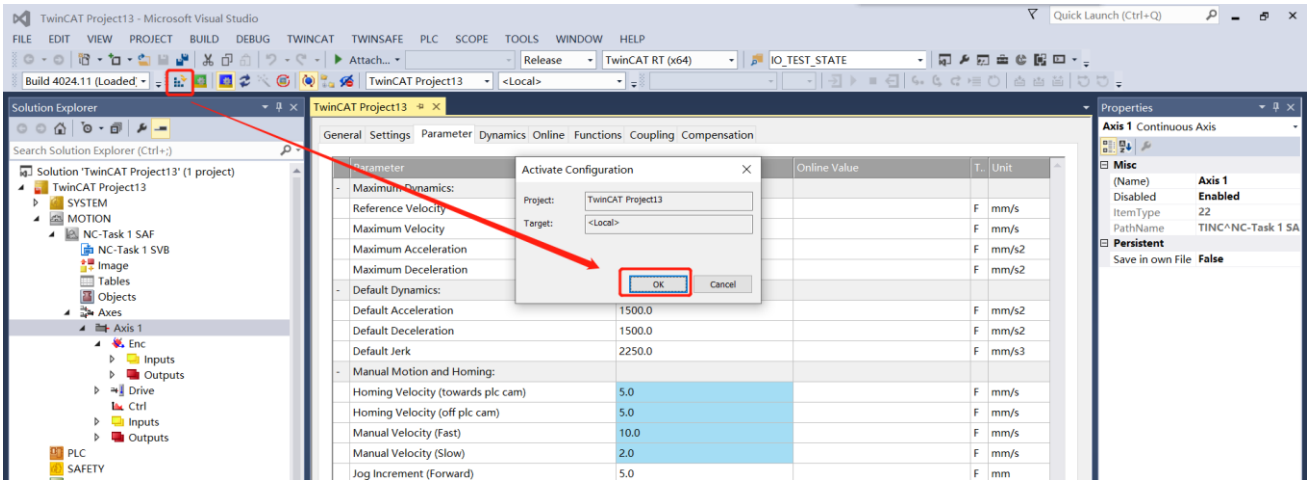
8.2.7. Encoder Settings



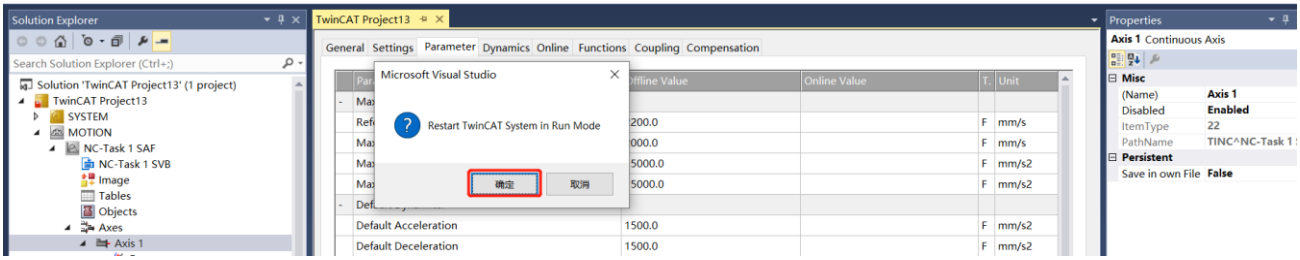
8.2.8. Set Motion Parameters



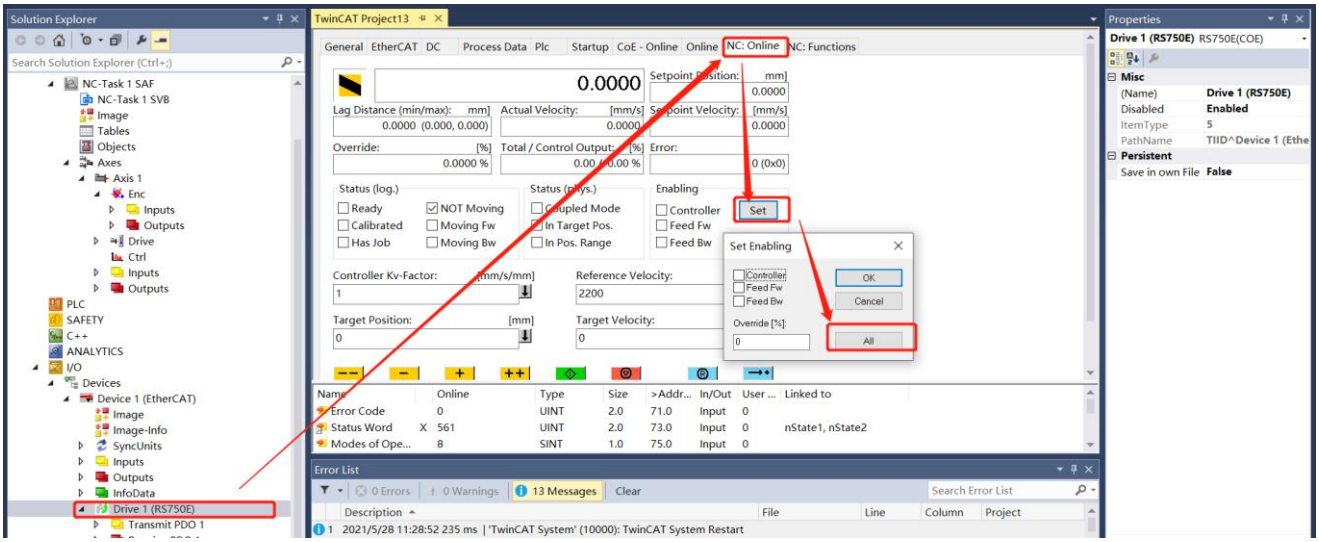
8.2.9. Activation



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

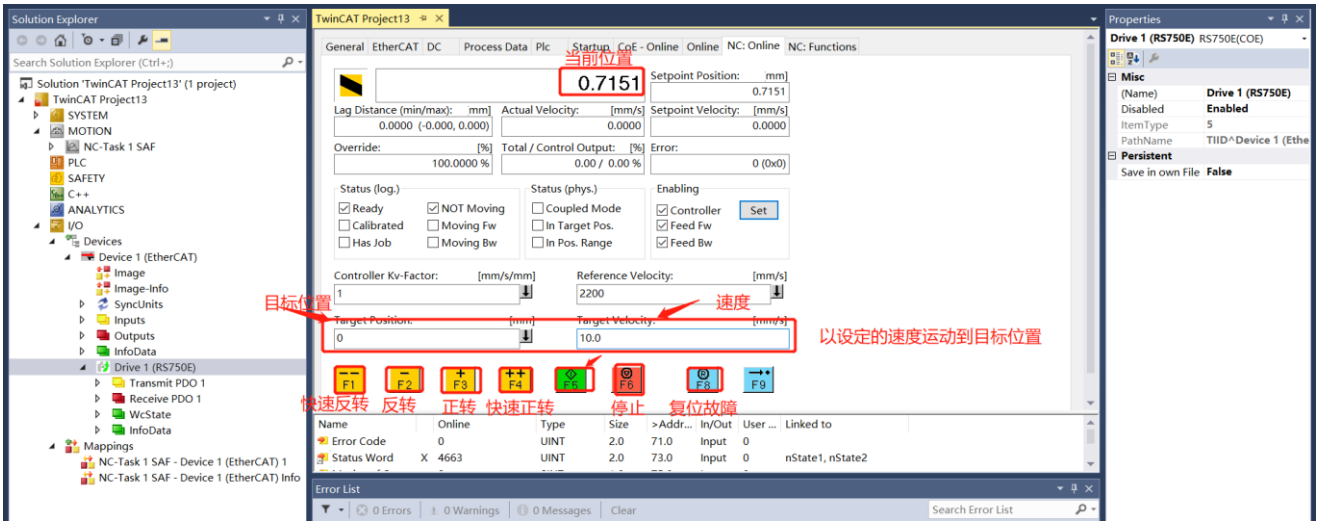


8.2.10. Enable Motor

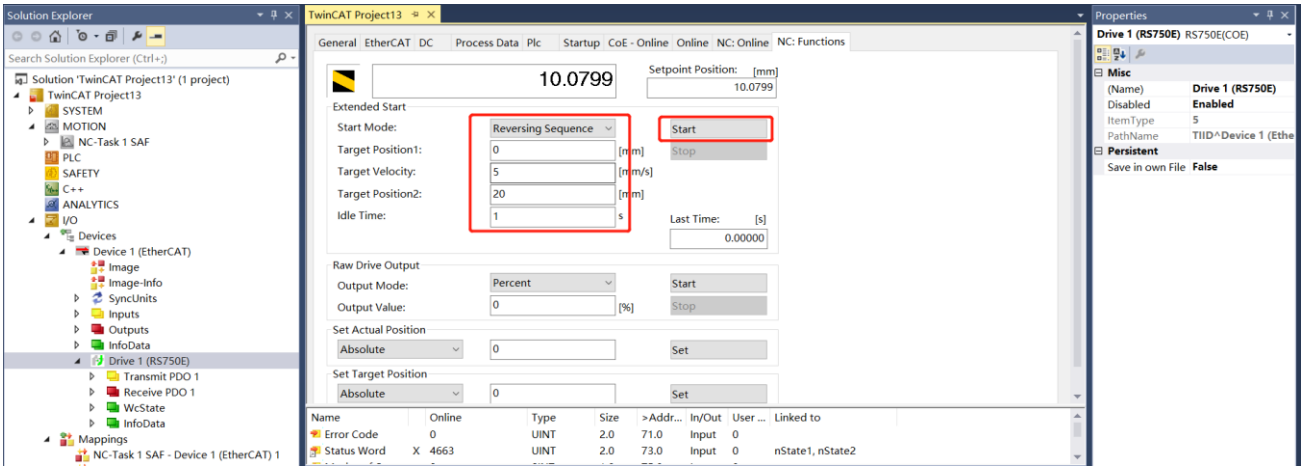


After the above operations, the motor shaft is enabled and there is power output.

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:



9. Troubleshooting

9.1. LED Indicates Relationship with Error Code

LED Indication	Error Code
Green light is always on	0
Green light flashing	0
1 green 1 red	AL.110、AL.111、AL.180、AL.181、AL.182、AL.183、AL.184
1 green 2 red	AL.210
1 green 3 red	AL.114、AL.115、AL.185、AL.186、AL.302、AL.303、AL.304、AL.463
1 green 4 red	AL.240、AL.242
1 green 5 red	AL.211
1 green 6 red	AL.100、AL.101、AL.102
1 green 7 red	AL.130、AL.187、AL.452
1 green 8 red	AL.120、AL.121、AL.122、AL.123、AL.125、AL.126、AL.127、AL.129、AL.160、AL.162、AL.164、AL.171、AL.191、AL.192、AL.275、AL.473、AL.475
1 green 9 red	AL.480、AL.481
1 green 10 red	AL.248、AL.249
1 green 11 red	AL.244、AL.245、246、AL.460
1 green 12 red	AL.225、AL.226
1 green 13 red	AL.321
1 green 14 red	AL.322
1 green 15 red	AL.103、AL.133、AL.139、AL.270、AL.271、AL.315、AL.325、AL.326、AL.327、AL.400、AL.421、AL.450
1 green 16 red	AL.247、AL.461
1 green 17 red	AL.221、AL.222、AL.223、AL.224、AL.418
1 green 18 red	AL.420
1 green 19 red	AL.128、AL.135、AL.136、AL.137、AL.138、AL.141、AL.142
1green 20 red	AL.189、AL.190、AL.430
1 green 21 red	AL.300、AL.440
1green 22 red	AL.482、AL.490
1green 23 red	AL.310、AL.311、AL.312、AL.313
1green 24 red	AL.104、AL.105、AL.106、AL.119
1green 25 red	AL.284、AL.285、AL.286、287、AL.292、AL.298
1green 26 red	AL.108、AL.109、AL.116、AL.117、AL.118、AL.146、AL.272、AL.274、AL.306、AL.410、AL.411、AL.412、AL.413、AL.415

9.2. Error Code

Due to the large number of fault codes, the LED light cannot fully indicate them, and some LED indication states are combined with multiple fault codes, resulting in constant error checking. The current fault code can be read through the P13.36 parameter. If there are multiple fault codes, each time the parameter is read, another fault code will be automatically uploaded and cycled. If there is a fault code 121/170, the first read data is 170, then the next read data is 121, and the next read data is 170... and so on.

The following table shows the fault contents of the fault code. Fault code: AL.xxx, where xxx is a three-digit decimal value:

Range of error code values	Description
100-199	The first type of non resettable fault can only be reset through power outage and restart.
200-299	The first type of resettable fault can be reset through IO or software.
300-399	The second type of resettable fault can be reset through IO or software.
400-499	Drive warning code, which does not affect the enabled operation of the drive when it appears, is only used as a warning prompt.

Error code	Fault content
AL.000	**Normal state**
AL.100	**System parameter error** Most cases occur after system firmware updates, when unsupported parameters are set on the drive. It is necessary to restore the factory settings and power off for 30 seconds before restarting the drive. If the drive still alarms, please contact the manufacturer's after-sales service to check the relevant abnormal parameters. If there is no alarm, please reset the parameters before continuing to use it again.
AL.101	**The drive failed or timed out reading parameters stored in EEPROM** Generally, due to abnormal communication of the EEPROM chip, please completely power off the drive for 30s before restarting it. If the alarm code still appears, please contact the manufacturer's after-sales service or replace it.
AL.102	**Failure or timeout in writing drive parameters to EEPROM** Generally, due to abnormal communication of the EEPROM chip, please completely power off the drive for 30 seconds before restarting it. If the alarm code still appears after modifying the parameters, please contact the manufacturer's after-sales service or replace it.

AL.103	**The drive parameters are abnormal or the parameter range is incorrect** It usually occurs after firmware update, and the parameter range of the new and old firmware is inconsistent. The abnormal parameter number can be determined by P13.51 (parameter abnormal group number) and P13.52 (parameter abnormal group offset).
AL.104	The parameter settings of the drive system are incorrect. Please contact the manufacturer's after-sales service or replace it.
AL.105	The parameter settings of the drive system are incorrect. Please contact the manufacturer's after-sales service or replace it.
AL.106	**The interrupt timeout triggered an exception**
AL.107 **AL.108**	**FPGA data timeout write exception**
AL.109	**Encoder timeout response**
AL.110 **AL.111**	**AL.110: Drive IPM module overcurrent** **AL.111: Drive ADC overcurrent** A. Whether the motor collides or not causes a blockage B. Motor P06.00、P06.01、P06.02、P06.60、P06.61、P06.63、P06.64 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. C. By setting the P05.04 parameter, try to reduce the overload multiple of the drive to test whether there is an alarm.
AL.114	Undervoltage of the control power supply usually occurs in situations where the power is quickly turned on and off, and the fault can be cleared by restarting after 30s of power outage.
AL.115	**Drive internal voltage error** The internal voltage fault of the drive is usually caused by the internal hardware of the drive. If the error persists after restarting the power supply, please contact the manufacturer's after-sales service.
AL.116 **AL.117** **AL.118**	**Current sampling timeout exception**
AL.119	The operation time of the control loop exceeds the control cycle time. Please contact the manufacturer for after-sales treatment.
AL.120	**Drive Encoder Interference** A. Please check whether the motor PE cable connection is reliable B. Check that the encoder plug is connected reliably

	C. Replace the drive to check whether the fault is caused by the motor encoder
AL.121	**Encoder communication error** A. 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. B. If the drive simply alarms AL.121, usually caused by a faulty encoder, replace the motor.
AL.122	**Encoder busy/Response timeout**
AL.123	**Encoder CRC check failure**
AL.124	**Encoder Z-phase signal failure**
AL.125	**Encoder zero adjustment failed**
AL.126	**Encoder EEPROM read and write failure** It generally occurs during power on or operation of the encoder EEPROM. When power on occurs, try restarting the drive to confirm if the fault still exists. After restarting, the fault still occurred. Please check if the encoder extension cable contact is reliable, or replace the drive for comparison and confirmation.
AL.127	**Encoder failure** A. 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. B. Please check that the encoder cable connection is reliable
AL.128	**The motor model setting is incorrect** Please restore the factory settings and restart to confirm if the fault is cleared. If the fault still exists, please contact after-sales and inform the P00.00 value.
AL.129	**Incremental encoder interference**
AL.130	**Motor runaway fault** Please check if the UVW cable sequence of the motor power cable is correct. If it is the Z-axis up and down mechanism, it may be caused by the drive's false alarm. You can set P01.56 to 0 to prohibit flying and reporting errors.
AL.133	**The parameter value range is abnormal** Use P13.51 to check the abnormal group number, and P13.52 to check the intra group offset of the abnormality.
AL.134	**Drive peripheral initialization, PHY initialization failed.**
AL.135	**Unsupported motor encoder type** please check if P00.00 motor model is set to 50000.
AL.136	**Product mismatch, unsupported motor Model**

AL.137	**The drive model is set incorrectly** Please check if the P00.02 parameter is set abnormally. Please contact the manufacturer's after-sales service and inform them of the parameter value.
AL.138	**The drive and motor do not match** The rated current of the drive is less than the rated current of the motor. Replace with a higher power drive or reduce the rated current of the motor.
AL.139	**Drive rated voltage parameter setting error.**
AL.141	**The absolute value mode setting error** It generally caused by P01.03 being set to absolute value mode, but the motor is not an absolute value motor. Please check if the motor is an absolute value motor. If so, please contact the manufacturer's after-sales service to change the motor encoder type.
AL.142	Encoder Model does not match, set the encoder type that the drive does not support.
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.162	Encoder EEPROM read and write operation failure, power off and retry.
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.171	**FPGA initialization error** A. It appears during power-on initialization and is caused by abnormal communication between DSP and FPGA. B. Check if P00.50, P00.52, and P00.56 are set incorrectly, such as 0.
AL.180	**Drive Q-axis feedback overcurrent**
AL.181	**Drive U-phase feedback overcurrent**
AL.182	**Drive V-phase feedback overcurrent**
AL.183	**Drive W-phase feedback overcurrent**
AL.185 AL.186	**Drive output short circuit**
AL.187	**Abnormal phase sequence of motor power cable UVW**
AL.189	**Analog input overvoltage saturation**
AL.190	**AD sampling error**
AL.191	**The incremental encoder UVW phase sequence is abnormal**
AL.192	**Incremental encoder Z-phase signal disconnected**

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, P04.02, P04.03 parameter setting values, whether they 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.204	**Motor power cable phase loss** A. Check whether the motor power cable has a missing phase. B. Detect whether the motor winding is disconnected and whether the three-phase resistance is balanced. C. Check whether P01.85 settings are correct. D. If the false alarm is caused by high speed, the alarm detection at high speed can be limited by the P01.87 parameter.
AL.210	**Drive bus voltage is high** A. Please plug in the brake resistance or check the quality of the brake resistance and whether the resistance value is appropriate. B. Please check if it is indeed caused by high AC input power supply; Please check if the parameter setting of P01.48 (overvoltage protection) is correct; Replace the drive with a new one to check if it is caused by damage to the drive.
AL.211	**Drive bus voltage is low** Please check if it is indeed caused by low AC input power supply; Please check if the parameter setting of P01.49 (undervoltage protection) is correct; Replace the drive with a new one to check if it is caused by damage to the drive.

AL.212	**Drive bus voltage is high** A. It occurs when the bus voltage of the drive is momentarily higher than the alarm threshold. B. Please plug in the brake resistance or check the quality of the brake resistance and whether the resistance value is appropriate. C. Please check whether the AC input power is too high and the drive input power requirement is below 260VAC.
AL.221	**Encoder battery failure** Encoder battery failure, this fault code is provided by the encoder, usually caused by low battery voltage. When this fault occurred, the encoder was no longer able to correctly remember the absolute position of multiple turns, so after replacing the battery, it was necessary to reset the zero point. It is necessary to manually set the P12.05 parameter to 1 to clear this fault.
AL.222	**Encoder multi-turn data alarm** Encoder multi-turn data alarm occurs during power on initialization, usually due to the disconnection of the encoder battery and encoder before. This alarm also appears when the battery voltage is too low or there is an abnormality in the battery connection cable. When this alarm occurs, the data of the drive's multi turn encoder is no longer correct and needs to be reset to zero. It is necessary to manually set the P12.05 parameter to 1 to clear this fault.
AL.223 AL.224	**The multi-turn encoder counts overflow** The multi-turn encoder counts overflow, which is caused by the number of rotations exceeding the resolution of the multi-turn motor. It can also be set to 1 through P01.51 to prevent multi-turn overflow from reporting errors.
AL.225 AL.226	**The speed feedback exceeds the maximum motor speed setting value**
AL.240	**Position is out of tolerance** A. Check that the power cable is properly connected B. Check that the electronic gear ratio parameters are set correctly C. Check that the frequency of the pulse input exceeds the maximum speed of the motor
AL.241	The input frequency of the position command exceeds P01.54 (maximum input pulse frequency), which is caused. Please check if the setting value of P01.54 is correct.
AL.242	**The position deviation of the full closed loop is too large.**
AL.244	**Drive overload fault**
AL.245 AL.246	**Motor overload fault**

AL.247	**Motor stall fault**
AL.248	**Drive over temperature fault**
AL.249	**Motor over temperature fault**
AL.270	**Digital input port function parameter setting fault**
AL.271	**Digital output port function parameter setting fault**
AL.272	**Current D/Q axis calculation overflow**
AL.273	**Inertia identification anomaly**
AL.274	**Angle identification fault**
AL.275	**External encoder exception**
AL.284	**EtherCAT synchronization deviation too large fault**
AL.285	**EtherCAT synchronization time setting error fault**
AL.286	**EtherCAT initialization error fault**
AL.287	**The EtherCAT configuration information is abnormal**
AL.288 AL.289	**EtherCAT parameters are abnormal**
AL.292	**EtherCAT synchronization loss fault**
AL.293 AL.294 AL.295 AL.296 AL.297 AL.298 AL.299	**EtherCAT bus error fault**
AL.300	The servo enable input failure is usually caused by the input of an enable signal through the digital input port when the drive is internally enabled.
AL.301	**STO signal input protection**
AL.302 AL.303 AL.304 AL.305	**Power supply phase failure**
AL.306	**Frequency division output frequency too high fault**
AL.307	**The password is incorrect when initializing the encoder zero offset.** Please set the P01.39 value correctly before initializing the zero offset. Please contact the

	manufacturer for after-sales service.
AL.310 **AL.311** **AL.312** **AL.313**	**Electronic gear ratio setting error fault**
AL.314	**Communication connection exception**
AL.315	**The multi-segment position absolute value mode parameter is incorrectly set**
AL.320	**CANopen communication timeout**
AL.321	**CANopen enters the initialization state**
AL.322	**CANopen enters the stopped state**
AL.323	**CAN bus off**
AL.324	**The PDO transmission length of the CAN bus is incorrectly set**
AL.325	**Soft limit setting abnormal fault**
AL.326	**Soft limit setting abnormal fault**
AL.327	**ECAT synchronization deviation is too large alarm**
AL.330	**Pulse mode set an unsupported homing mode**
AL.331	**CAN bus disconnection**
AL.332	**CAN receive cache overflow fault**
AL.333	**Data loss caused by CAN reception not being processed in a timely manner**
AL.334	**CAN transmission error counter is in passive error state**
AL.335	**CAN receive error counter is in a passive error state**
AL.336	**CAN transmission error**
AL.337	**CAN transmission cache overflow fault**
AL.338	**CAN frame bit filling detection error**
AL.339	**CAN frame format error**
AL.340	**CAN frame response bit error**
AL.341	**CAN frame bit0 error**
AL.342	**CAN frame bit1 error**
AL.343	**CAN frame CRC error**
AL.400	Warning of abnormal setting of electronic gear ratio in frequency division output, due to the number of pulses in frequency division output exceeding the encoder resolution.
AL.410 **AL.411**	**Parameter identification exception**

AL.412 **AL.413** **AL.415** **AL.416** **AL.417**	
AL.418	**Absolute encoder battery warning** When this warning appears, the absolute encoder can still remember the position correctly, but the battery needs to be replaced in a timely manner to prevent position loss. When replacing the battery, please power on and operate the drive normally before replacing the encoder battery.
AL.420	**Warning of abnormal origin homing** Timeout of zero return, abnormal positive and negative limit positions, etc. can all cause this warning. Please check if the sensor is correct, etc.
AL.421	**Origin homing mode setting error warning**
AL.430	**AI channel zero drift set value too large warning**
AL.440	**Emergency stop input warning**
AL.450	The external braking resistance value is less than the minimum braking resistance value required by the drive.
AL.452	**Brake resistor overload warning** Check if the brake parameter settings are correct. If frequent braking causes significant heating of the braking resistor, it can be solved by extending the deceleration time or replacing it with a higher power braking resistor.
AL.460	**Motor overload warning**
AL.461	**Motor power cable disconnection warning**
AL.463	**Power supply phase failure**
AL.475	**Encoder overheat warning**
AL.480	**Positive limit valid warning**
AL.481	**Negative limit valid warning**
AL.482	**Frequent parameter storage warning**
AL.490	Performed an operation that requires a restart to take effect or modified parameters that require a restart to take effect.