

R5L EtherCAT series AC Servo Driver

User Manual



Shenzhen Rtelligent Technology Co., Ltd

Preface

Thank you for purchasing the R5L EtherCAT series V5.0 servo driver!

R5L EtherCAT series V5.0 servo driver is the 5th generation bus-type AC servo driver independently developed by Rtelligent. The power range of this series of products is 0.05~2.3KW, supports CoE (CANopen over EtherCAT), and can be networked. The driver also contains an internal PLC mode to facilitate customer customization.

The R5L 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 R5L EtherCAT series servo system has the characteristics of fast positioning and good adaptability. The driver has seven basic control modes (CSP control, CSV control, CST control, PP control, PV control, PT control, HM control). In addition, more flexible application functions can be realized by using the driver's "internal PLC programming".

This manual is a comprehensive user manual for the R5L EtherCAT series V5.0 servo driver. 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 drivers, the information provided by the company is subject to change without prior notice.

Revision History

Date	Version	Description
2024.10.23	V5.0	Version 5 product updates

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1. Safety Instructions

1.1. Safety Precautions

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

- ◆ Please take measures to ensure that personal safety will not be endangered when restarting, otherwise it may cause injury.
- ◆ Please do not modify the product in any way, otherwise it may cause injury or mechanical damage.
- ◆ Please install the servo driver, servo motor, and external braking resistor on non-combustible materials, otherwise it may cause a fire.
- ◆ Between the power supply and the main circuit power supply of the servo driver (single-phase L1, L2), be sure to connect an electromagnetic contactor and a non-fuse circuit breaker. Otherwise, when the servo driver fails, the large current cannot be cut off, which may cause a fire.
- ◆ In the servo driver and servo motor, please do not mix oil, grease and other flammable foreign objects and screws, metal pieces and other conductive foreign objects, otherwise it may cause fire and other accidents.

1.2. 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	R5L servo driver * 1 (including one push type terminal kit + one main circuit terminal)
2	Servo motor * 1
3	Motor supporting power extension cable*1
4	Motor supporting encoder extension cable*1
5	Brake extension cable for brake motor * 1 (special for motor with brake)

2. Product Information

2.1. Driver Introduction

2.1.1. Driver Naming

R **5** **L** **028** **M** - **Z**
 ① ② ③ ④ ⑤ ⑥

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 H: 380V	Null: Pulse E: EtherCAT P: Profinet C: CANopen M: RS485 Modbus + Pulse
② Product version	④ Rated current	⑥ Relay version
5: 5th generation servo	028: 2.8A 042: 4.2A 130: 13.0A	Null: No brake relay Z: With brake relay

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

2.1.2. Driver Specification

(1) Basic specification

Driver model	R5L028E	R5L042E	R5L130E
Communication	EtherCAT Communication		
Overload capacity	Supports 3x overload	Supports 2x overload	
Adaptive power	50W~400W	750W	1KW~2.3KW
Continuous current	2.8A	4.2A	13.0A
Maximum current	8.4A	12.6A	24.0A
Power supply	Single-phase 220VAC $\pm 10\%$, 50/60Hz		
Size code	Type A	Type B	
Size	175*156*40	175*156*51	
Braking resistor function	No braking resistor	With braking resistor (75W, 50 Ω)	

(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
Display and operation		5-bit LED display, 5-bit key operation
		DC bus indicator
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 $\pm 10\%$: 0%
	Temperature variation rate	$25\pm 25^{\circ}\text{C}$: less than $\pm 0.1\%$
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 driver and braking resistor due to overheating.
STO security function		Support
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
Input pulse signal form		Pulse + direction, A phase + B phase, CW + CCW
Command control method		External pulse command /16 segment communication register command
		Speed control mode: 8 internal speed commands / 32 communication register commands
		Torque control mode: 32 segments communication register command
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

TSNA 06 J 06 30 A H - 48 Z

1 2 3 4 5 6 7 8 9

- 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	RSNA-M04J0130A	50W	61.5	93.5
	RSNA-M04J0330A	100W	81.5	110
60	RSNA-M06J0630A	200W	80	109
	RSNA-M06J1330A	400W	98	127
80	RSNA-M08J2430A	750W	107	144
	RSNA-M08J3230A	1000W	127	163
110	RS□-M11J4030A	1.2KW	189	294
	RS□-M11J5030A	1.5KW	204	264
	RS□-M11J6030A	1.8KW	219	294
130	RS□-M13J4025A	1.0KW	166	223
	RS□-M13J6025A	1.5KW	179	236
	RS□-M13J7725A	2.0KW	192	249
	RS□-M13J10025A	2.5KW	209	290
	RS□-M13J15015A	2.3KW	241	322
	RS□-M13J15025A	3.8KW	231	303

◆ 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	220VAC
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 driver. It is obvious that a high-resolution encoder can "cut" the movement of the motor in one revolution into smaller units, so a high-resolution encoder can provide higher precision information.
- ◆ 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 driver 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 driver. This energy is fed back to the capacitor in the DC bus so that its voltage value rises. When it rises to a certain value, the capacitor cannot fully absorb the feedback energy, and a braking resistor is needed to dissipate it.

The braking resistor is connected to the P+ and Br ports. The driver has a braking resistor with a certain power. When the built-in resistor of the driver is not enough to absorb the braking energy consumption, the user can also connect an external braking resistor with a larger power. In this case, it is only necessary to replace the braking resistor built in the driver with a high-power braking resistor.

1. Braking resistor specification

Drive model	R5L028E	R5L042E	R5L130E
Adaptive motor power	50W~400W	750W	1KW~2.3KW
Continuous current	2.8A	4.2A	13.0A
Maximum current	8.4A	12.6A	24.0A
Built-in braking resistor resistance and power	-	50 Ω	
	-	75W	
Allowable braking power	-	38W	
Minimum resistance of external braking resistor	-	30 Ω	

2. Configuration reference of braking resistor

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

When the built-in braking resistor of the driver cannot meet the discharge requirements, it is necessary to replace the braking resistor with a larger specification. The power of the braking resistor needs to be greater than the power of the built-in braking resistor of the driver. 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)

Cable type	Cable length		
	3 meters	5 meters	8 meters
Motor cable	SMS4-030A	SMS4-050A	SMS4-080A
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		
	3 meters	5 meters	8 meters
Motor cable	SMH4-030	SMH4-050	SMH4-080
Single-turn absolute encoder cable	SEH4-030	SEH4-050	SEH4-080
Multi-turn absolute encoder cable	SEH6-030	SEH6-050	SEH6-080
Brake cable (optional)	SZH2-030	SZH2-050	SZH2-080

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

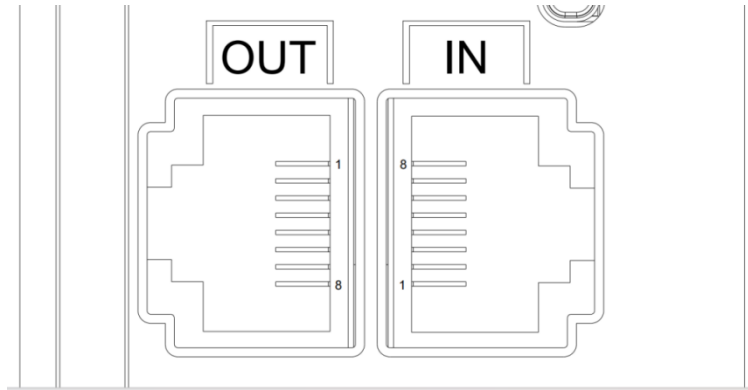
2. Motor wiring requirements

- ◆ 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 0.5mm^2 or above, and the motor with frame 110/130mm shall use the wire diameter specification of 0.75mm^2 or above.
- ◆ The encoder cable of motor needs to meet the requirements of shielding isolation, standard configuration 0.14mm^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

The EtherCAT network cable is connected to a metal-shielded RJ45 terminal with input (IN/CN5) and output (OUT/CN4) interfaces. Electrical characteristics in line with IEEE802.3, ISO8877 standards.

2.4.3. EtherCAT Communication Cable



Signal		Pin	Function
Communication signal	TX+	1	Data sending +
	TX-	2	Data sending -
	RX+	3	data receiving +
	-	4	-
	-	5	-
	RX-	6	data receiving -
	-	7	-
	-	8	-

3. Installation

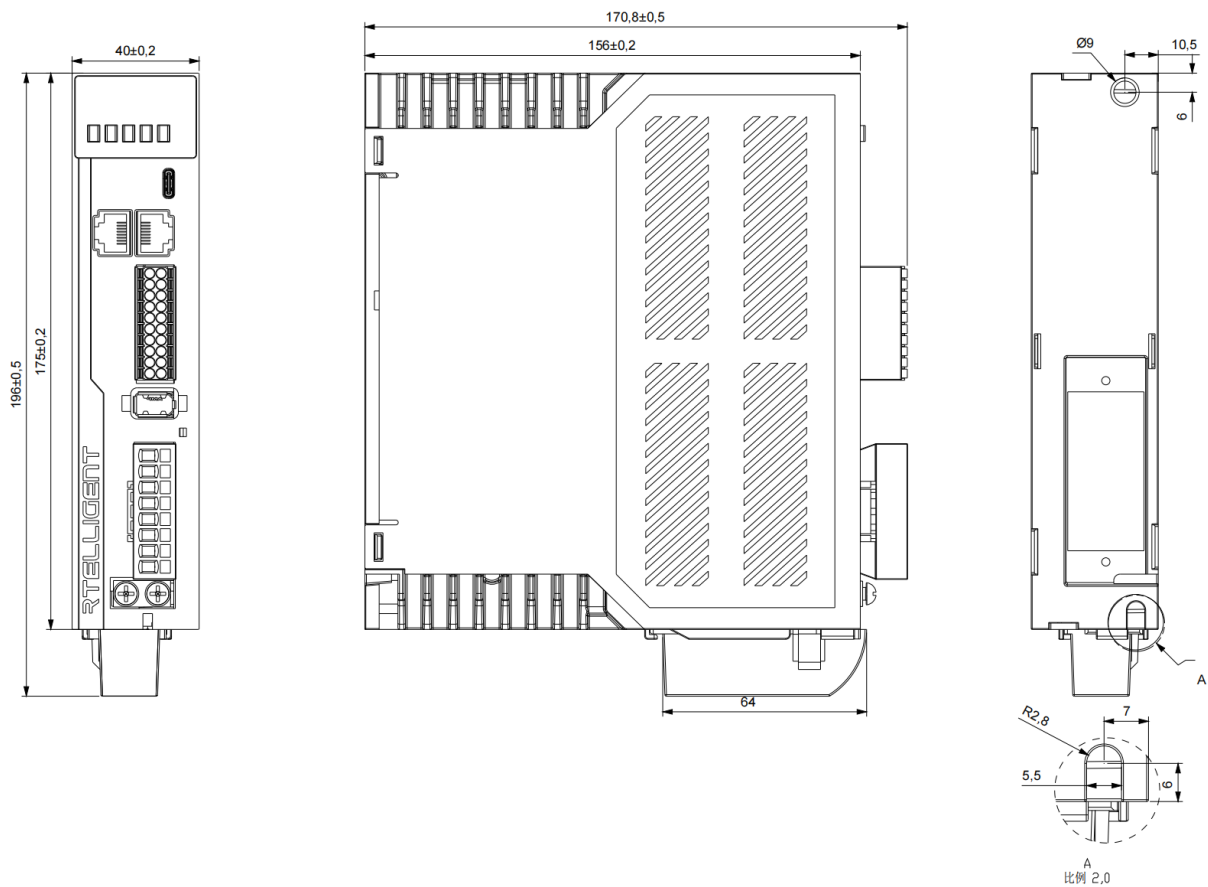
3.1. Servo Driver Installation

3.1.1. Driver Environment

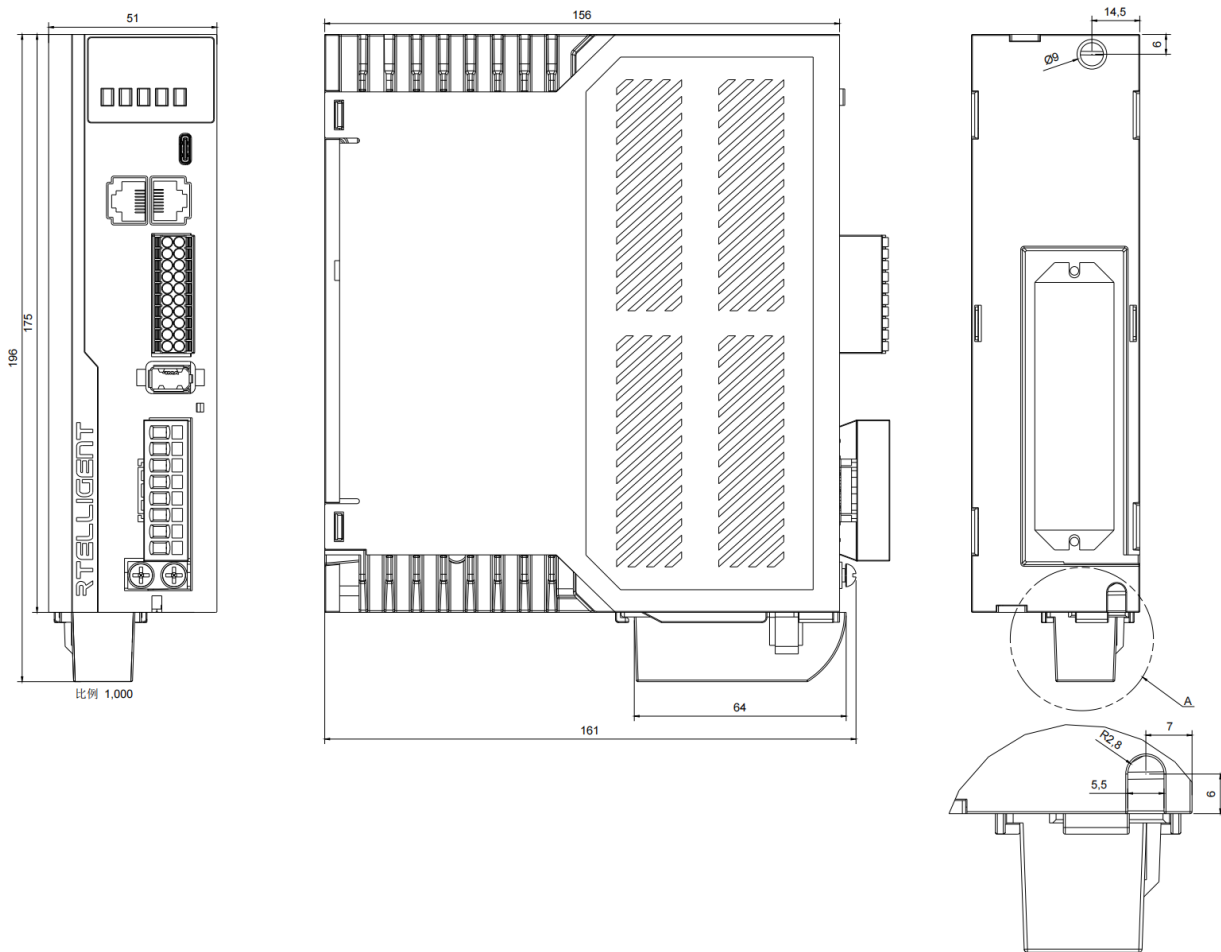
Item	Requirement
Working temperature	0℃ ~ +45℃
Storage temperature	-20℃ ~ +70℃
Ambient humidity	Work/Store ≤90% RH no condensation
Anti-Vibration	10~57Hz 3.5mm, 57~150Hz 1g
Atmospheric environment	No corrosive gas, flammable gas, oil mist or dust, etc, 86-106kpa
Altitude	Less than 1000m

3.1.2. Dimension

1. Type A: Below 400W (unit: mm)



1. Type B: 750W~2300W (unit: mm)



3.1.3. Installation Precaution

- ◆ Please install the driver in an electrical cabinet free from sunlight and rain.
- ◆ Do not place the driver in a corrosive or other harmful environment.
- ◆ Please ensure that the installation direction is perpendicular to the wall, and use natural air convection or a fan to cool the servo driver. Fix the servo driver firmly on the mounting surface through 2~4 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 driver during installation, otherwise it may cause driver failure.
- ◆ When multiple drivers are installed in the control cabinet, please note that sufficient space must be reserved for the placement position to achieve sufficient heat dissipation.
- ◆ Be sure to connect the ground terminal to the ground, otherwise there may be a risk of electric shock or interference resulting in malfunction.

- ◆ When there is a vibration source (punch) near the driver installation, if it is unavoidable, please use a vibration absorber or install an anti-vibration rubber gasket.
- ◆ When there are noise interference sources such as large magnetic switches and fusion splicers near the driver, it is easy to cause the driver to be interfered by the outside and cause malfunction. At this time, a noise filter needs to be installed, but the noise filter will increase the leakage current, therefore, it is necessary to install an insulating transformer on the input end of the driver.

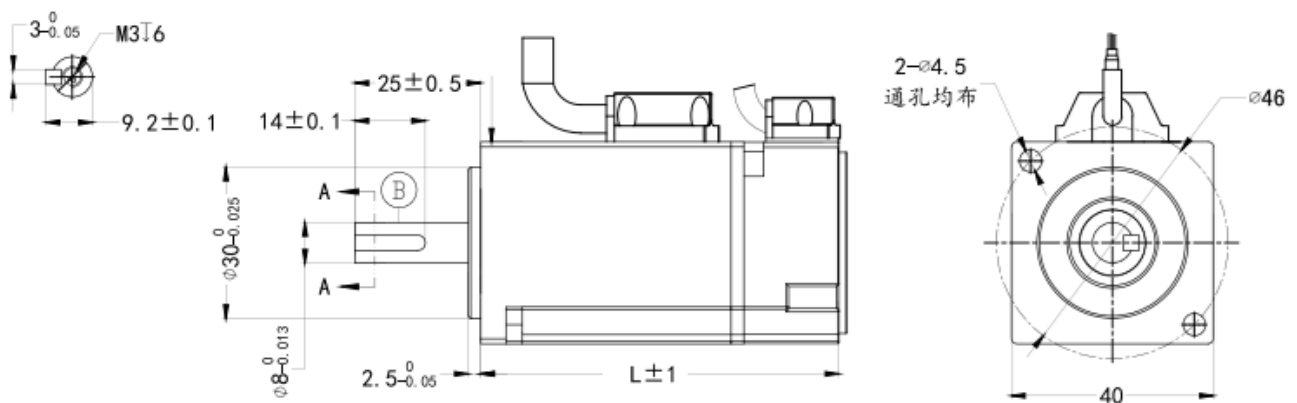
3.2. Servo Motor Installation

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/s ² /196m/s ²
Protection class	IP65
Altitude	Below 1000m

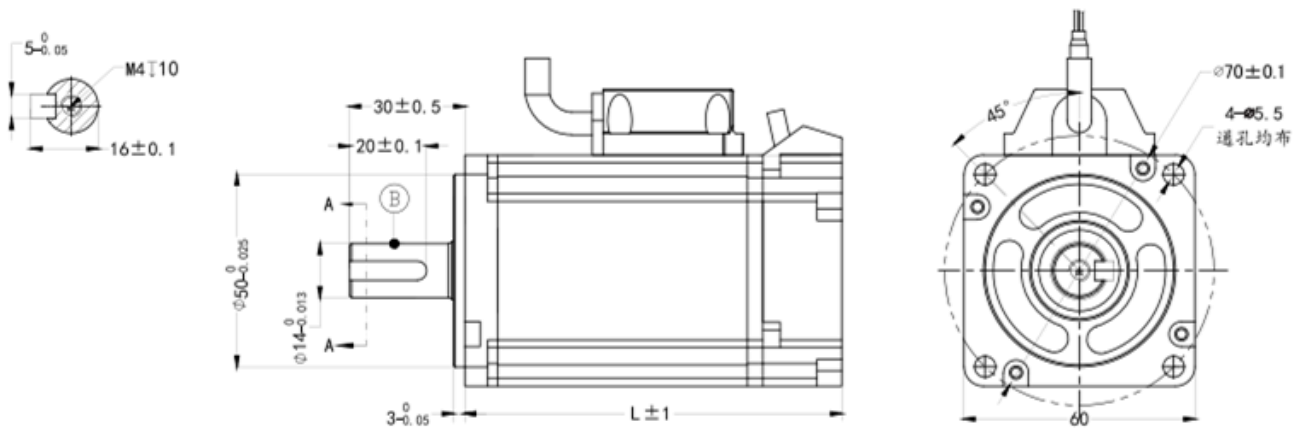
3.2.2. Dimension

1. Frame 40mm (AMP plug outlet*)



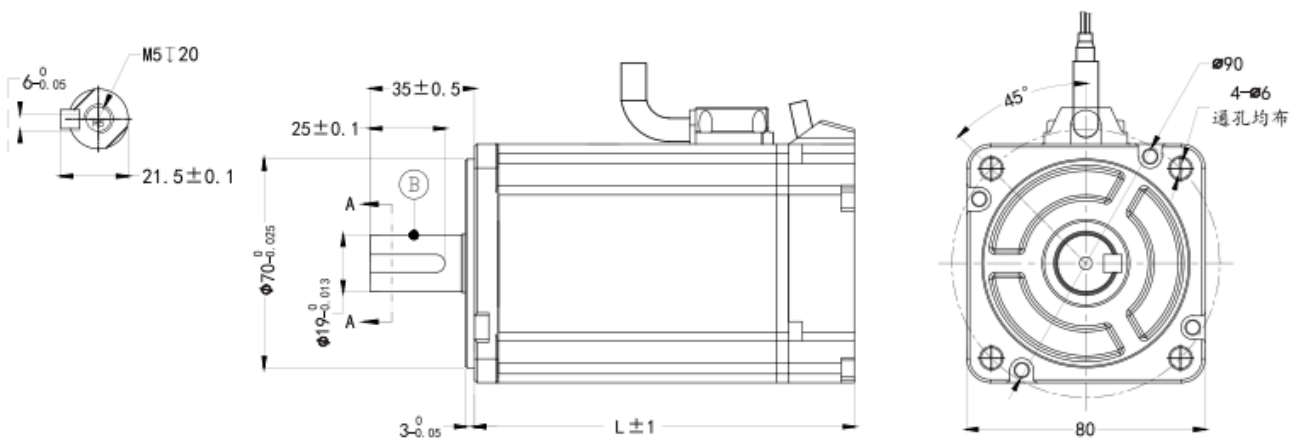
Description	Model	Length (mm)	Weight (Kg)
50W	RSNA-M04J0130A	61.5	0.35
100W	RSNA-M04J0330A	81.5	0.46
50W with brake	RSM-M04L0130A-Z-ST	93.5	0.52
100W with brake	RSNA-M04J0330A-Z	110	0.66

2. Frame 60mm (AMP plug outlet*)



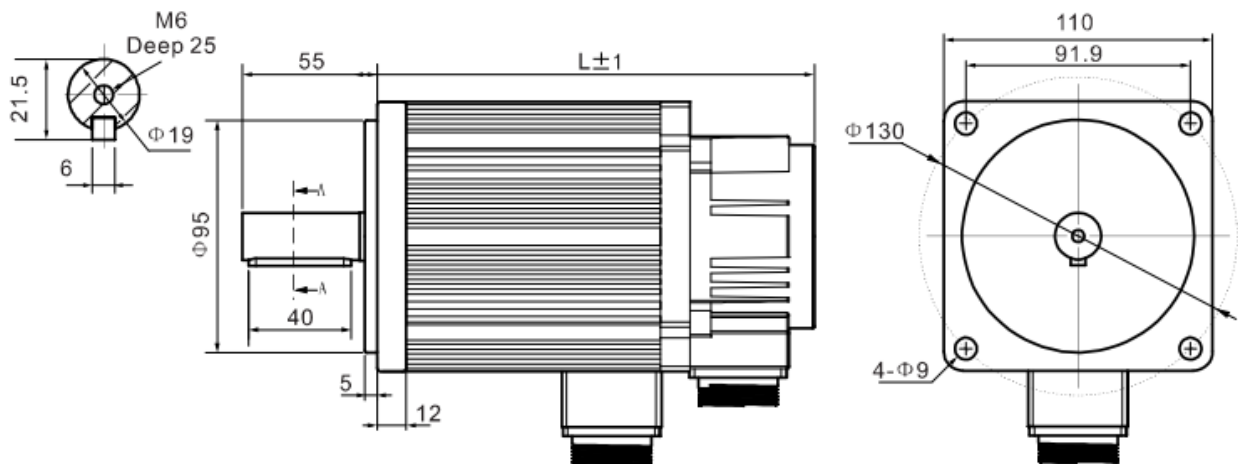
Description	Model	Length (mm)	Weight (Kg)
200W	RSNA-M06J0630A	80	0.84
400W	RSNA-M06J1330A	98	1.19
200W with brake	RSNA-M06J0630A-Z	109	1.21
400W with brake	RSNA-M06J1330A-Z	127	1.56

3. Frame 80mm (AMP plug outlet*)



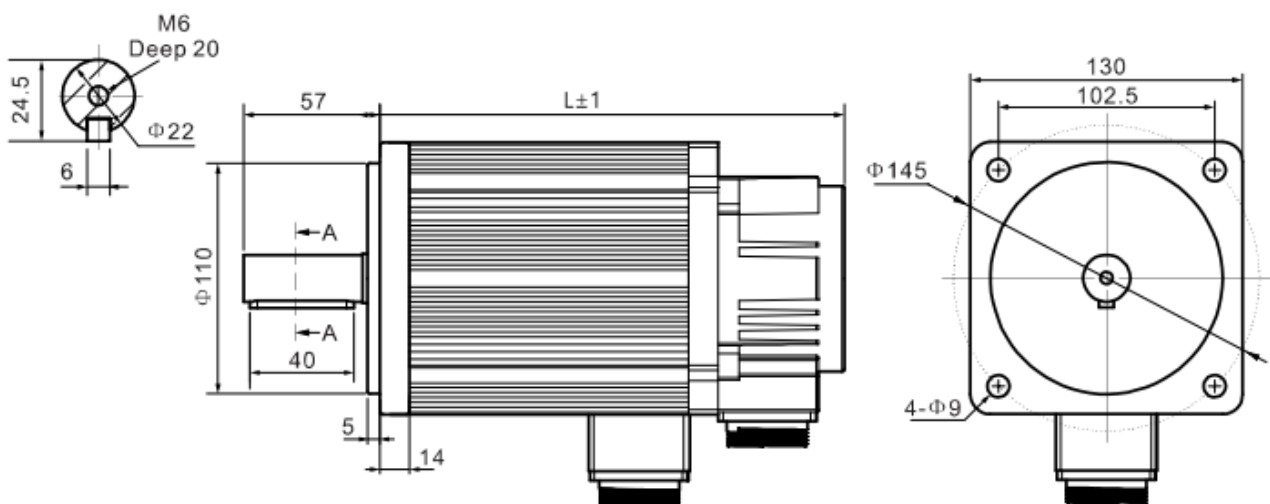
Description	Model	Length (mm)	Weight (Kg)
750W	RSNA-M08J2430A	107	2.27
1000W	RSNA-M08J3230A	127	2.95
750W with brake	RSNA-M08J2330A-Z	144	3.05
1000W with brake	RSNA-M08J3230A-Z	163	3.73

4. Frame 110mm (Aviation plug outlet*)



Description	Model	Length (mm)	Weight (Kg)
1.2KW	RS□-M11J4030A	189	6.0
1.5KW	RS□-M11J5030A	204	6.8
1.2KW	RS□-M11J6020A	219	7.9
1.8KW	RS□-M11J6030A	219	7.9
1.2KW with brake	RS□-M11J4030A-Z	294	6.5
1.5KW with brake	RS□-M11J5030A-Z	264	7.3
1.2KW with brake	RS□-M11J6020A-Z	279	8.4
1.8KW with brake	RS□-M11J6030A-Z	294	8.4

5. Frame 130mm (Aviation plug outlet*)



Description	Model	Length (mm)	Weight (Kg)
1.0KW	RS□-M13J4025A	166	6.2
1.5KW	RS□-M13J6025A	179	7.4
2.0KW	RS□-M13J7725A	192	8.3
2.6KW	RS□-M13J10025A	209	9.8
2.3KW	RS□-M13J15015A	241	12.6
3.8KW	RS□-M13J15025A	231	11.7
1.0KW with brake	RS□-M13J4025A-Z	223	7.8
1.5KW with brake	RS□-M13J6025A-Z	236	9.0
2.0KW with brake	RS□-M13J7725A-Z	249	9.9
2.6KW with brake	RS□-M13J10025A-Z	290	11.4
2.3KW with brake	RS□-M13J15015A-Z	332	14.2
3.8KW with brake	RS□-M13J15025A-Z	303	13.3

Remark:

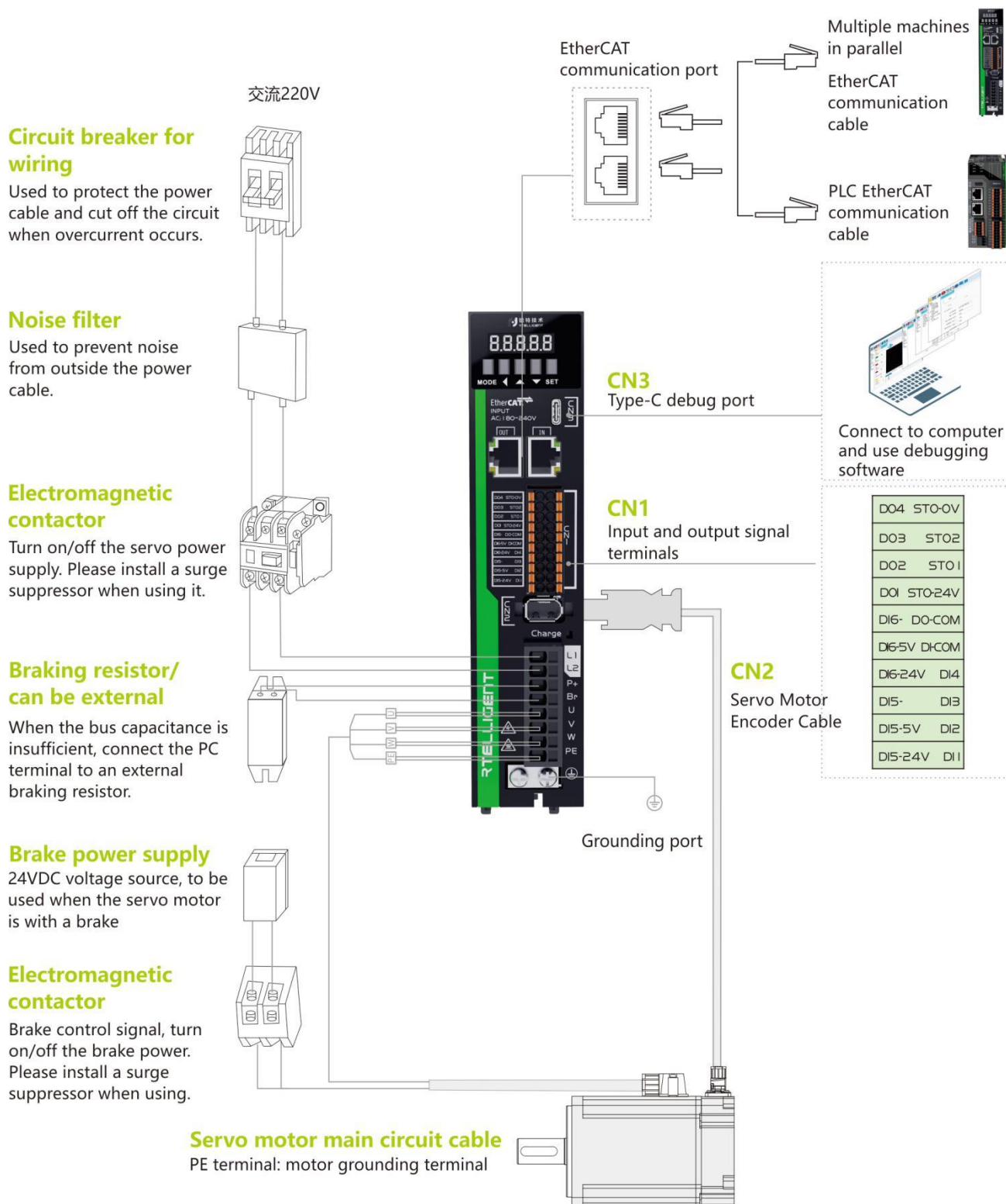
- ◆ The AMP plug outlet specification is "4 holes motor wire + 9 holes encoder wire + 2 holes brake wire".
- ◆ The aviation plug outlet specification is "4 holes motor wire + 7 holes encoder wire + 2 holes brake wire".

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 driver. 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 driver to the operator and make it perpendicular to the wall. Please pay attention to avoid drilling chips and other foreign matter from falling into the driver during installation, otherwise it may cause driver failure.
- ◆ When multiple drivers are installed in the control cabinet, please note that sufficient space must be reserved for the placement position to achieve sufficient heat dissipation.
- ◆ Be sure to connect the ground terminal to the ground, otherwise there may be a risk of electric shock or interference resulting in malfunction.
- ◆ When there is a vibration source (punch) near the driver installation, if it is unavoidable, please use a vibration absorber or install an anti-vibration rubber gasket.
- ◆ When there are noise interference sources such as large magnetic switches and fusion splicers near the driver, it is easy to cause the driver to be interfered by the outside and cause malfunction. At this time, a noise filter needs to be installed, but the noise filter will increase the leakage current, therefore, it is necessary to install an insulating transformer on the input end of the driver.

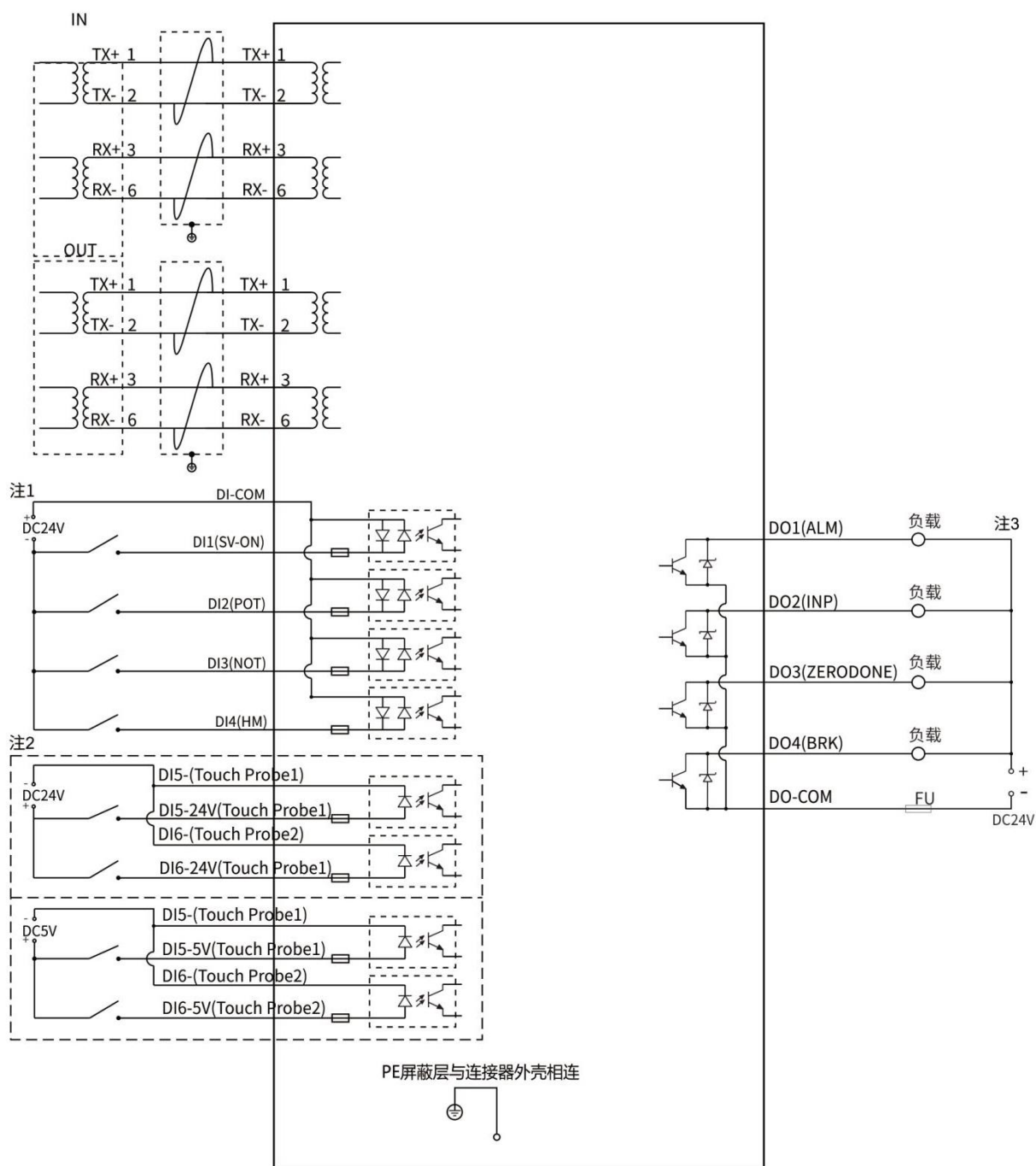
4. Wiring

4.1. Driver Interface & Connection



4.2. Control Mode Wiring Diagram

伺服驱动器



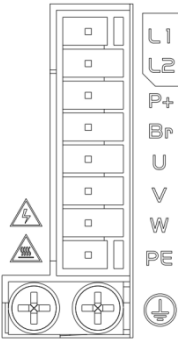
注1: 24V以下, 支持共阳极或共阴极, 不支持NPN和PNP混用;

注2: 差分输入, 24V和5V不能共用, 选用一种;

注3: 24V以下, 共阴极输出, 电流不超过200mA。

4.3. Main Circuit Input Interface

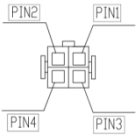
1. Type A/B servo driver main loop input interface definition

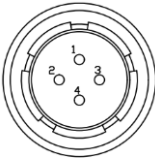
Terminal mark	Pin	Name	Description
	L1	Power supply input terminal	Servo driver power supply input terminal, single-phase 220VAC
	L2		
	P+	Braking resistor terminal	Connect to energy consumption braking resistor
	Br		
	U	Servo Motor connection terminal	Servo motor connection terminals, must be connected 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 driver 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 driver has a capacitor, when the power is turned on, a relatively large charging current will flow (charging time 0.2s). Frequent ON/OFF of the power supply will cause the performance of the main circuit components inside the servo driver to degrade.
- ◆ Please connect the servo driver 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 driver error occurs.
- ◆ Do not power on and use the servo driver when the terminal screws or cables are loose, otherwise it may cause a fire.

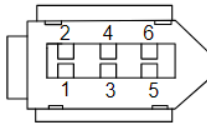
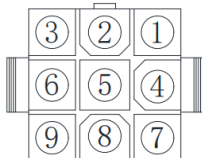
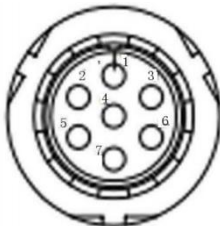

2. Face the servo motor power extension cable motor side terminals, their terminal definition serial number as shown in the following schematic diagram

Connector	Pin	Definition
 <p>Motor side (AMP connector)</p>	1	U
	2	V
	3	W
	4	PE

 Motor side (Aviation connector)	1	PE
	2	U
	3	V
	4	W

4.4. Encoder Signal - CN2

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

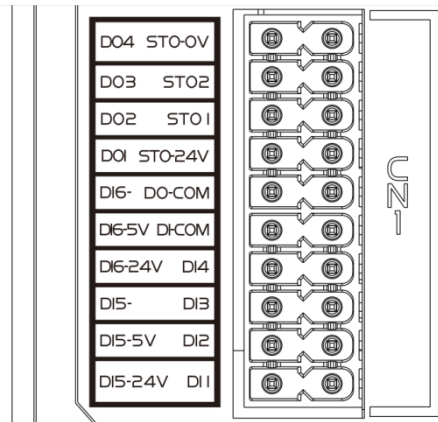
Remark:

- ◆ 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.

4.5. Control Signal Interface - CN1

4.5.1. CN1 Pin Definition

Driver control signal terminal CN1 pin figure is shown below:



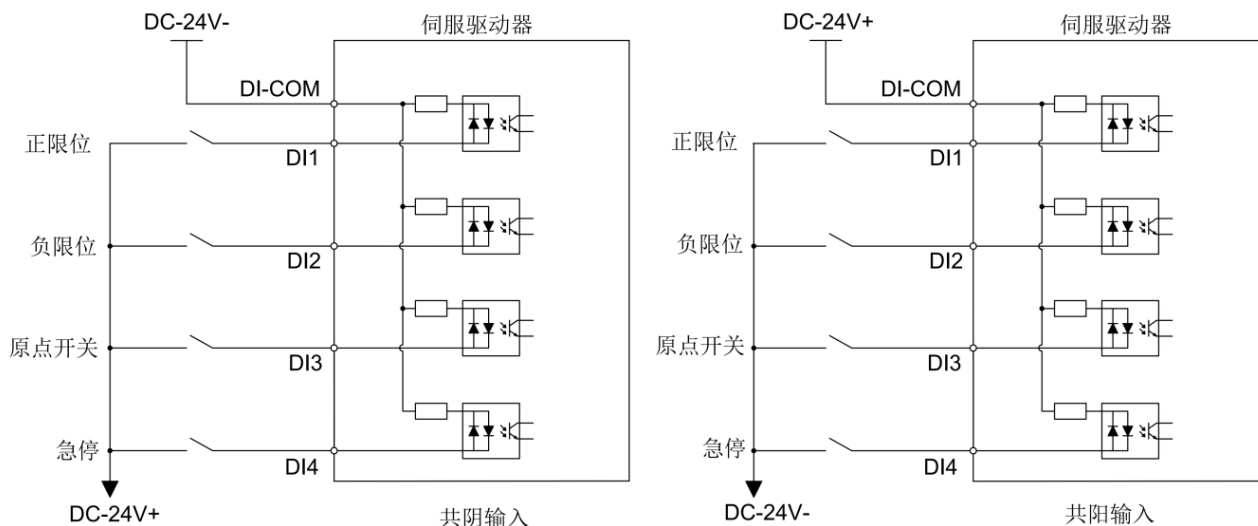
Function	Signal name	Signal definition	Default	Description
Differential interface	DI5-5V	DI5, positive	Probe 1	Differential input
	DI5-	DI5, negative		
	DI6-5V	DI6, positive	Probe 2	
	DI6-	DI6, negative		
	DI5-24V	DI5-24, positive	-	
	DI6-24V	DI6-24, positive		
Universal input interface	DI1(POT)	Input 1	Positive limit	Below 24V, support common anode or common cathode. Does not support the mixed use of NPN and PNP.
	DI2(NOT)	Input 2	Negative limit	
	DI3(HM)	Input 3	Home switch	
	DI4(EMESop)	Input 4	Emergency stop	
	DI-COM	Input common	-	
Universal common cathode output interface	DO1(ALM)	Output 1	Fault	Below 24V, common cathode output, current does not exceed 50mA.
	DO2(INP)	Output 2	Positioning completed	
	DO3(ZERODONE)	Output 3	Homing completed	
	DO4(BRK)	Output 4	Brake	
	DO-COM	Output common	-	
STO security interface	STO-24V	Internal 24V power supply	-	Disable STO function: STO connects to STO-24V; Enable STO function: STO connects to STO-0V.
	STO1	Control input for STO1		
	STO2	Control input for STO2		
	STO-0V	STO reference ground		

4.5.2. Universal Input Interface

Signal name	Signal definition	Default	Description
DI5-5V	DI5, positive	Probe 1	Differential input
DI5-	DI5, negative		
DI6-5V	DI6, positive	Probe 2	
DI6-	DI6, negative		
DI5-24V	DI5-24, positive	-	
DI6-24V	DI5-24, positive		
DI1(SV-ON)	Input 1	Servo enable	Below 24V, support common anode or common cathode. ● Note: Does not support the mixed use of NPN and PNP.
DI2(POT)	Input 2	Positive limit	
DI3(NOT)	Input 3	Negative limit	
DI4(ALMRST)	Input 4	Fault reset	
DI-COM	Input common	-	

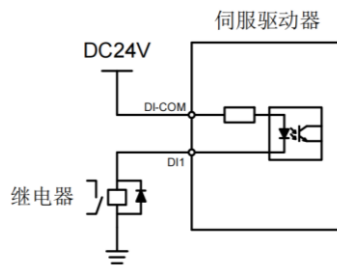
- ◆ The driver has a total of 6 input ports, and the function can be selected and set according to P02.00~P02.15.

(1) The interface circuits of IN1 to IN4 are the same, and the wiring is as shown in the following figure:

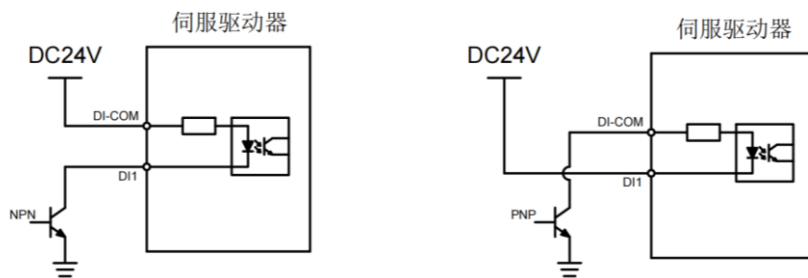


Take IN1 as an example, the wiring example is as follows:

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



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

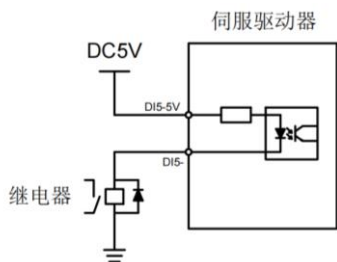


◆ Note: Mixing of NPN and PNP is not supported

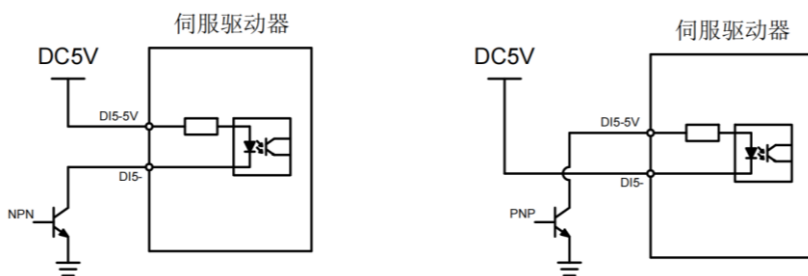
(2) The IN5 and IN6 interface circuits are the same, take IN5 as an example.

- 1) When the signal voltage is 5V

When the upper computer device is the relay output, the wiring diagram is shown as follows:

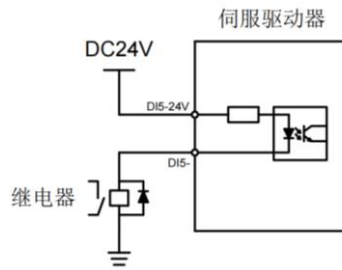


When the upper computer device is open-collector output, the wiring diagram is shown as follows:

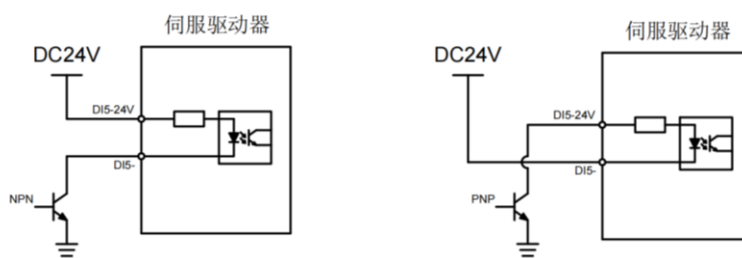


2) When the signal voltage is 24V

When the upper computer device is the relay output, the wiring diagram is shown as follows:



When the upper computer device is open-collector output, the wiring diagram is shown as follows:



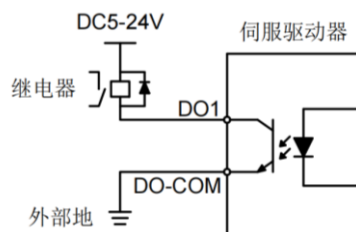
4.5.3. Universal Output Interface

Signal name	Signal definition	Default	Description
DO1(ALM)	Output 1	Fault	Below 24V, common cathode output, current does not exceed 50mA.
DO2(INP)	Output 2	Positioning completed	
DO3(ZERODONE)	Output 3	Homing completed	
DO4(BRK)	Output 4	Homing completed	
DO-COM	Output common	-	

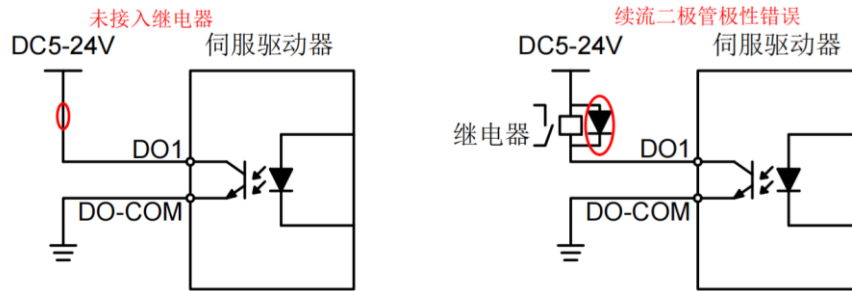
- ◆ The driver has a total of 4 output ports, the common cathode output terminal driver current is 50mA, which can be used for small current output.

The OUT1~OUT4 interface circuits are the same. Take OUT1 as an example.

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

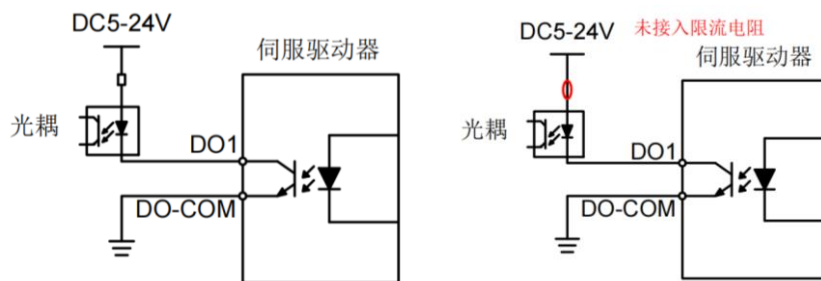


The following is the wrong wiring method:

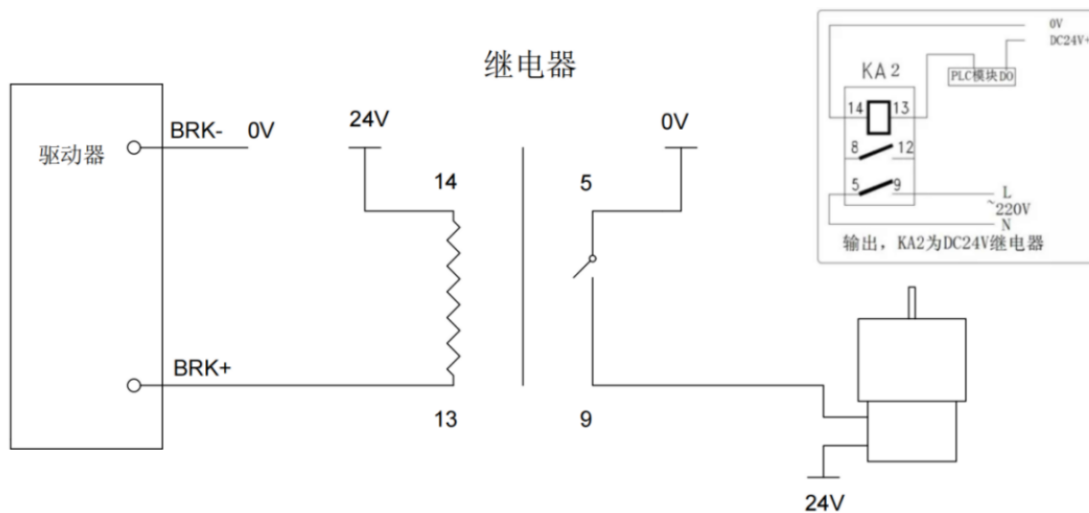


(2) When the upper device is optocoupler input

As shown in the following picture, the left picture is the correct connection, and the right picture is the wrong connection:



4.5.4. Motor Brake Wiring



4.5.5. Safe Torque Off Function (STO)

(1) Overview

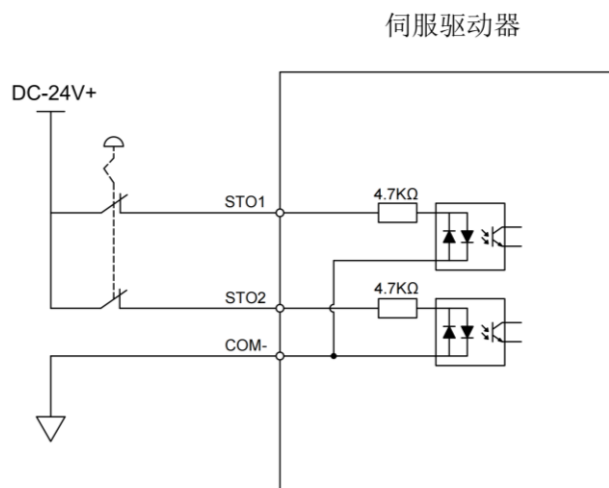
Safe Torque Off (STO) is a safety function that uses the input signal from the safety controller to cut off the input current of the motor and stop the motor from running. When the STO function is triggered, the servo driver will shut down the servo ready completed output signal (S-RDY) and enter the safe state.

(2) STO wiring instruction

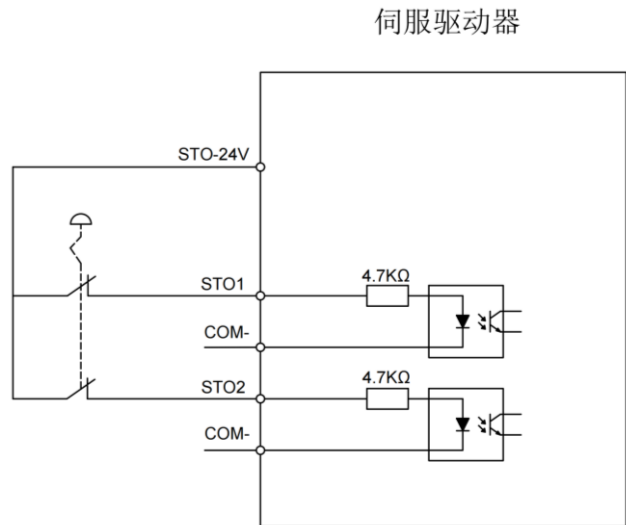
Signal name	Signal definition	Default	Description
STO-24V	Internal 24V power supply	---	Disable STO function: STO connects to STO-24V; Enable STO function: STO connects to STO-0V.
STO1	Control input for STO1		
STO2	Control input for STO2		
STO-0V	STO reference ground		

- ◆ Note: The servo driver will work properly only if the STO1 and STO2 input status are both high ("1" or "H"). One of STO1 and STO2 is high and the other is low ("0" or "L"), or both are low and neither driver is working.

1) External 24V connection example

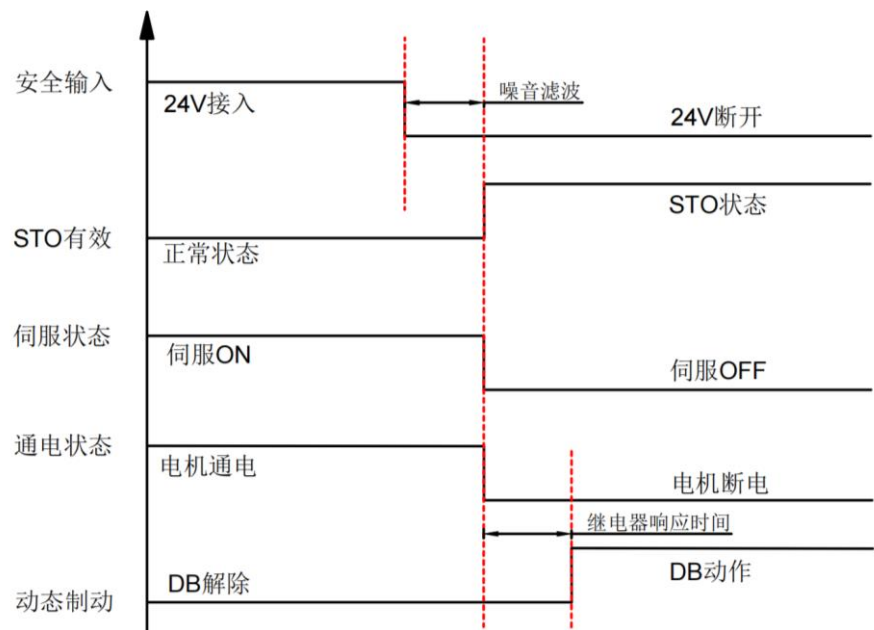


2) Internal 24V connection example

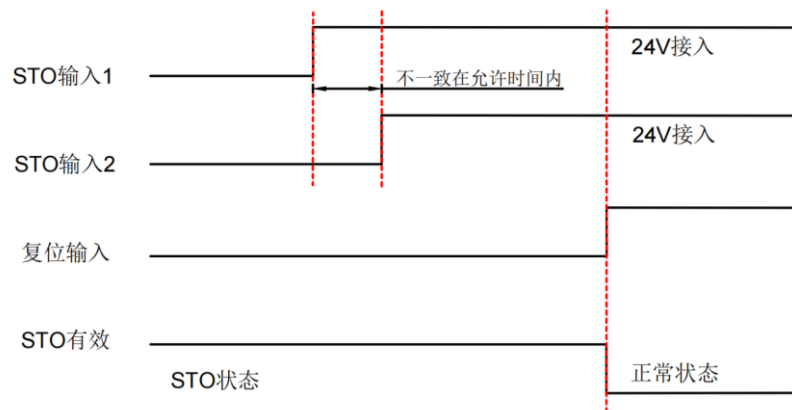


(1) Sequence diagram

1) Action sequence for entering the STO security state



2) Reset sequence for exiting the STO security state



- ◆ Note: The servo can be enabled or disabled only after the STO status exits normally.

4.6. 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 2.0mm²)
- ◆ 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 driver 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. Control Panel

5.1. Panel Overview

5.1.1. Panel Composition Introduction

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

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

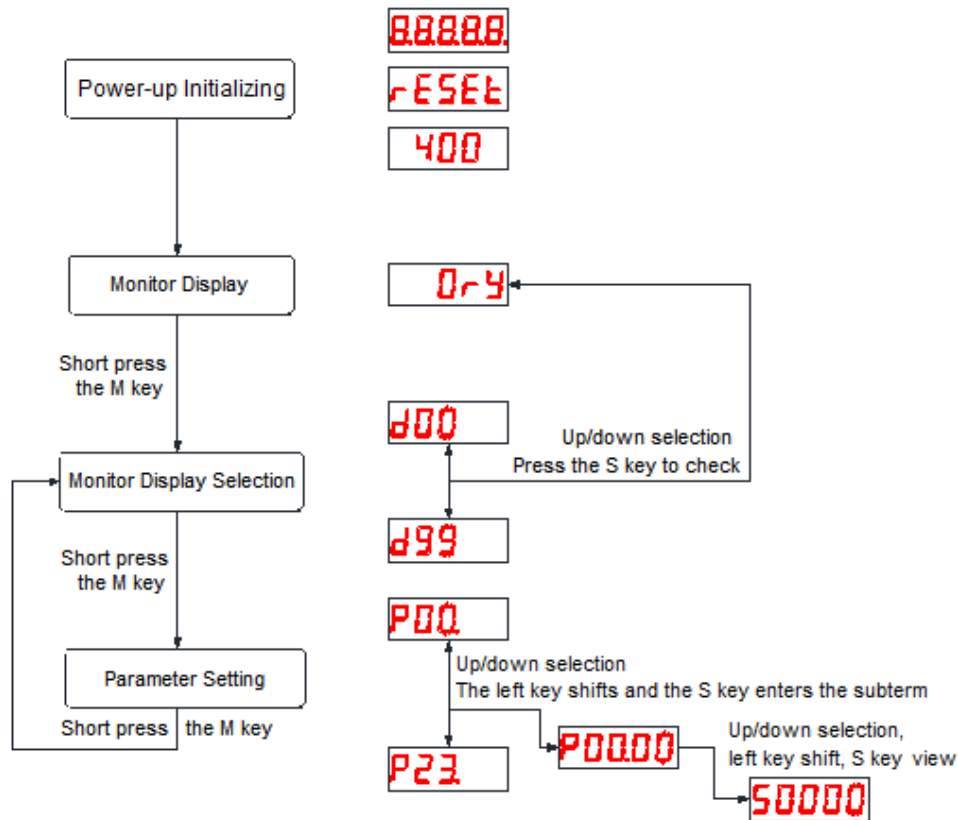
5.1.2. Panel Display Content

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

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

5.1.3. Panel Operation

The operation of the control panel of the servo driver is shown in the figure below:



- ◆ After the power is turned on and the initialization of the servo driver is completed, the panel display immediately enters the monitor display mode. The target parameter of pre-monitoring can be selected through parameter P01.35.
- ◆ Short press the "MODE" key to switch between different display modes.
- ◆ Once a fault occurs, the servo driver automatically displays the fault monitoring code.

5.1.4. Data Display

Different data length and negative number display description:

(1) 4 or less digits signed number or 5 or less digits unsigned number

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

- 1) Display example: -6666 is displayed as follows:

-6666

- 2) Display example: 65535 is displayed as follows:

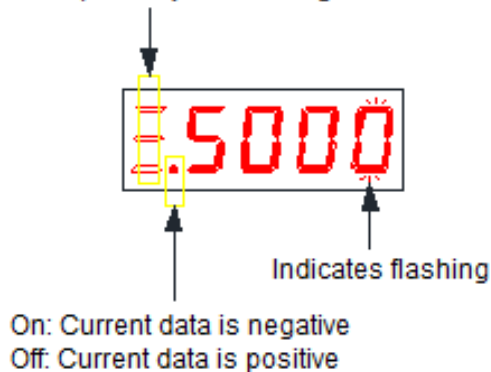
65535

(2) 4 or more digits signed number or 5 or more digits unsigned number

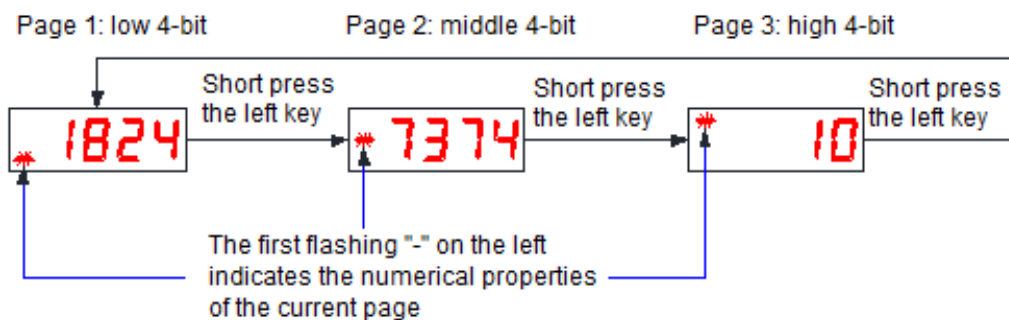
Display in pages from low to high by digits, each 4 digits is a page, display method: current page + current page value, switch the current page by long pressing the M key.

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

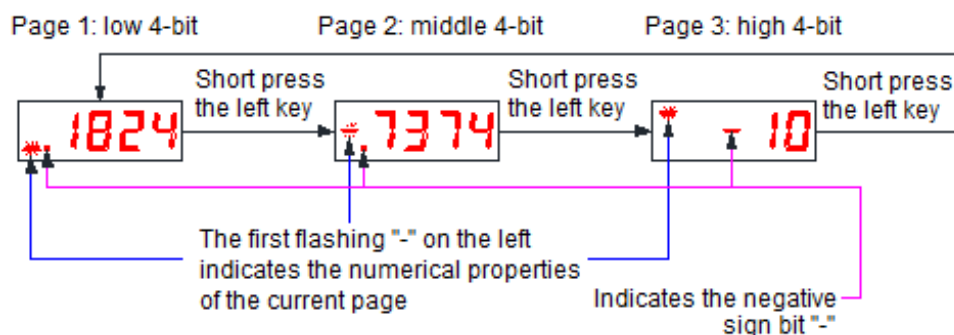
Indicates the numerical properties of the current page: "upper, middle and lower respectively indicate "high 4-bit", "middle 4-bit" and "low 4-bit".



1) Display example: 1073741824 is displayed as follows:

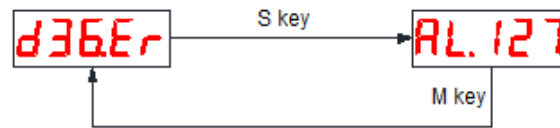


2) Display example: -1073741824 is displayed as follows:



5.1.5. Fault Display

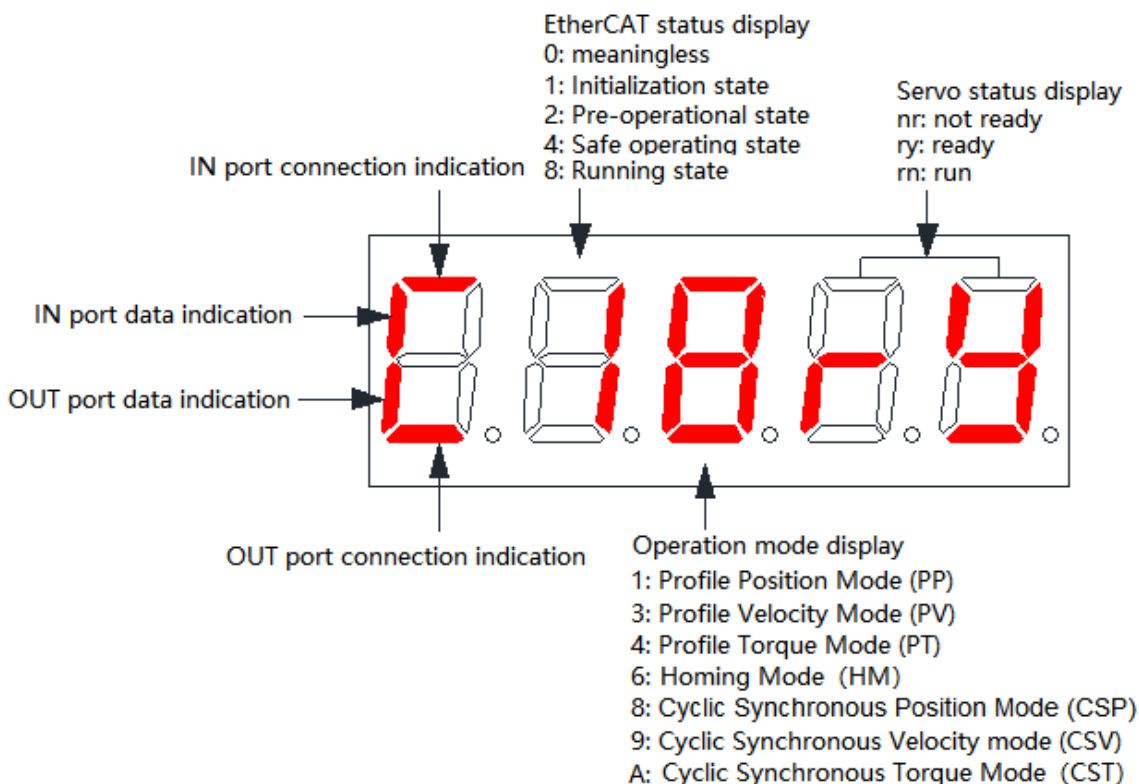
When the driver is in an error state, the LED panel can display related failure information. If the driver generates multiple fault alarms at the same time, the driver panel will jump to display each alarm in turn.



◆ For specific troubleshooting, please refer to the relevant content in [chapter 9](#).

5.1.6. Monitor Display

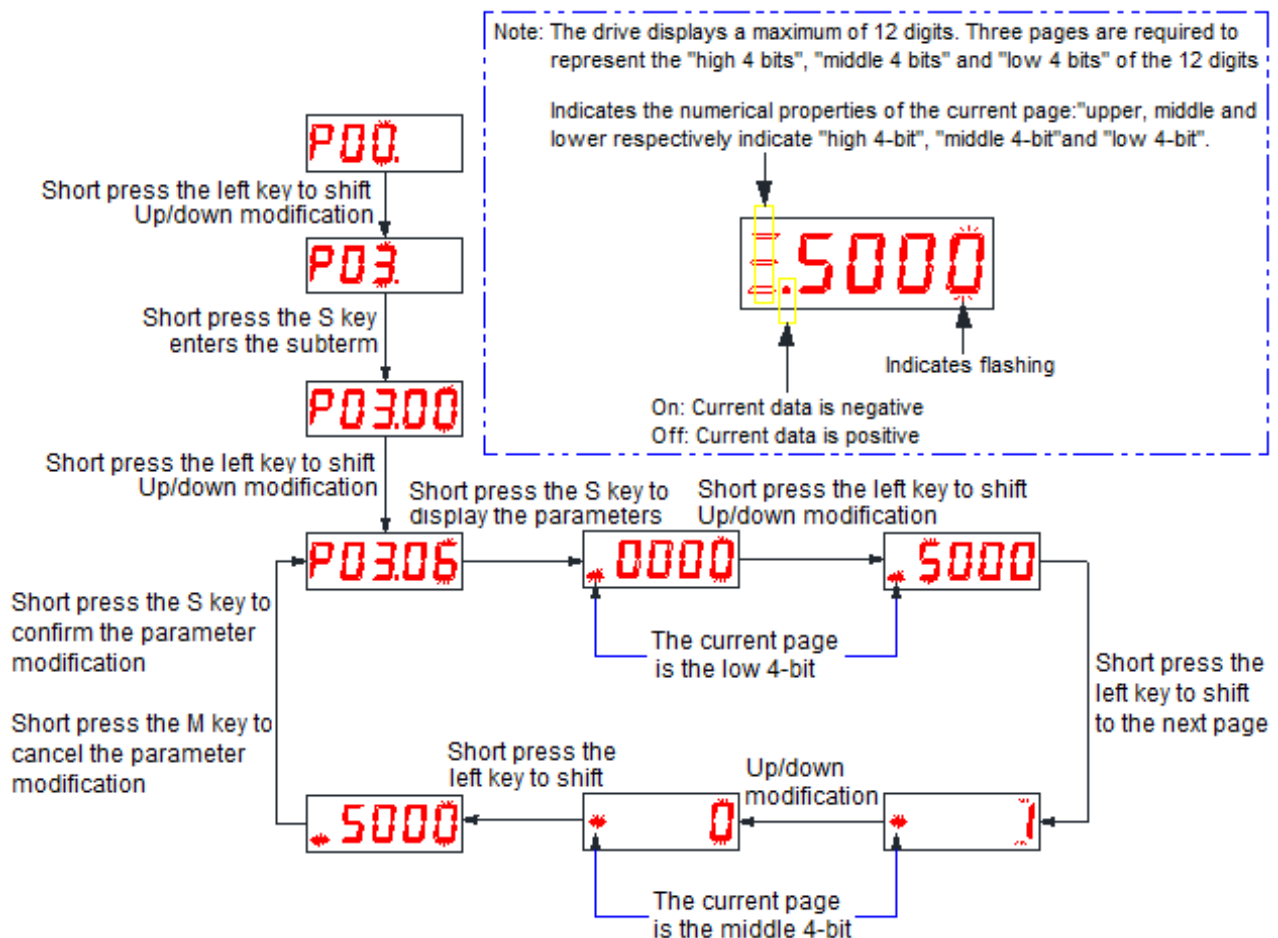
The monitor display is used to monitor the operation status of the servo driver. By setting the parameter code P01.35 (the panel default monitoring object), when the servo driver is powered on and initialized, the display will show the monitoring value of the object. The details about the monitoring display are as follows: For details about the monitoring display object, check the parameters in group P13. (Note: xx in the monitoring object dxx indicates two decimal values, ranging from 00 to 99. The value corresponds to the offset in the parameter group of group P13, that is, d00 corresponds to P13.00 and d36 corresponds to P13.36.) Only d00 objects are listed here:



5.2. Parameter Setting

Use the panel of the servo driver to set the parameters.

Take the LED display panel display parameter menu as an example, change the servo driver P03.06 (Number of position commands for one motor rotation) from the default value of 10000 to 5000 as an example, and proceed with the operation instructions:



Remark:

After confirming and modifying the parameters, they will be immediately written to the EEPROM chip of the driver, and no additional parameter saving operations are required.

5.3. Auxiliary Function

5.3.1. Parameter Management

- ◆ Factory reset:: set parameter P12.00 to 1
- ◆ Clear fault records: set parameter P12.00 to 2

5.3.2. Fault Reset

- ◆ Fault reset: set parameter P12.08 to 1.

5.3.3. Absolute Value Operation

- ◆ Clear encoder faults: set parameter P12.05 to 1.
- ◆ Clear encoder faults and multi-turn values: set parameter P12.05 to 2.

Note: Clear encoder fault and multi-turn value function is not open, please look forward to it.

5.3.4. Jog Test Machine

Through this operation, the servo driver can be tested.

Press the key to select parameter P12.10, and press the S key to enter the next page. If the driver has no alarm or is not enabled, the LED panel will display the default JOG running speed of 100. You can modify the value by pressing the key, and then press the S key to confirm. The driver LED panel will display "ready". At this time, you can control the operation of the motor by pressing the up and down keys of the key.

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

6. Communication Network Configuration

6.1. EtherCAT Protocol Overview

EtherCAT is an industrial Ethernet technology with high performance, low cost, simple application and flexible topology. It can be used in industrial field-level ultra-high-speed I/O network, using standard Ethernet physical layer, transmission media twisted pair or optical fiber (100Base-TX or 100Base-FX).

The EtherCAT system consists of a master station and a slave station. The master station only needs an ordinary network card, and the slave station needs a dedicated slave station control chip, such as: ET1100, ET1200, FPGA, etc.

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

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

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

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

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

6.2. 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

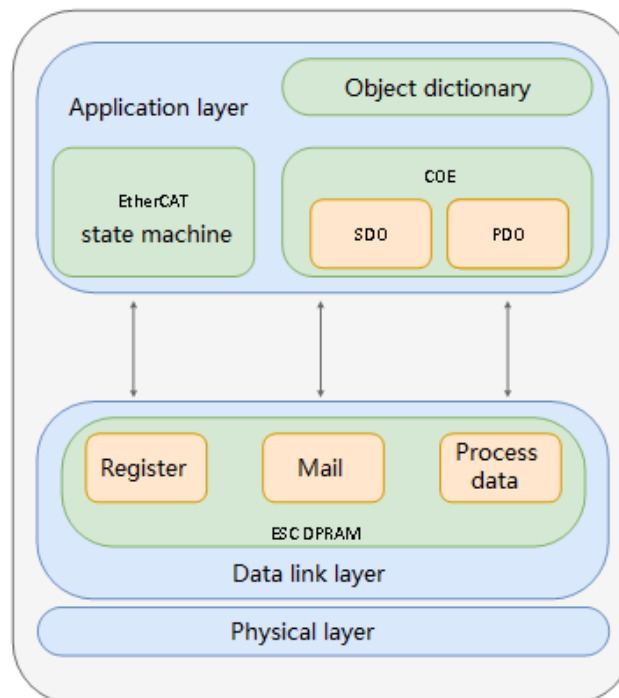
6.3. EtherCAT Communication Basics

6.3.1. EtherCAT Communication Specification

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

6.3.2. Communications Structure

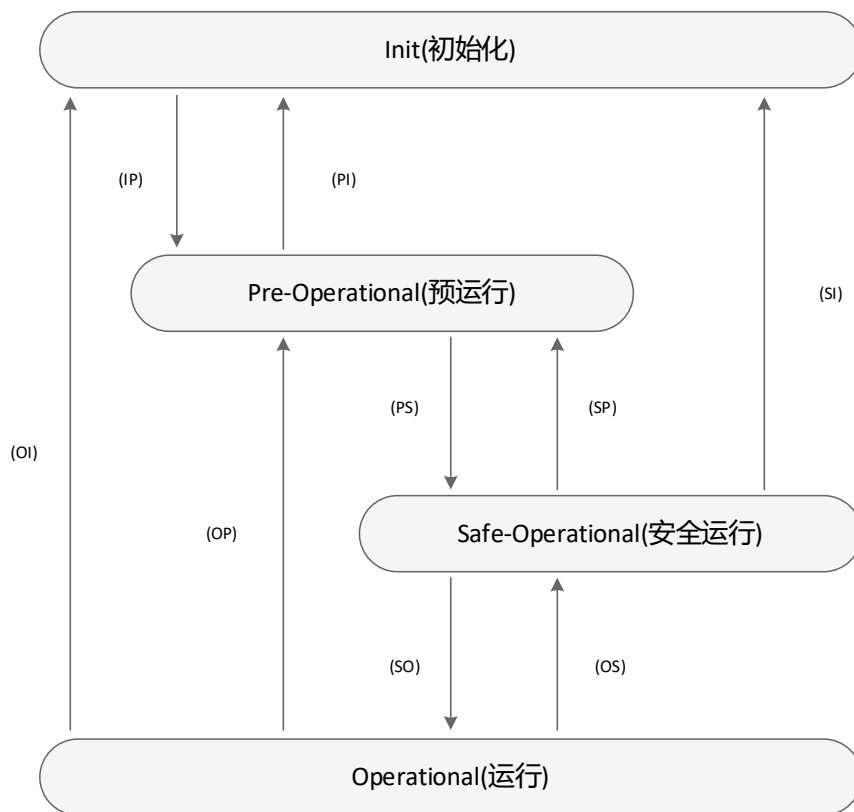
There are a variety of application layer protocols using EtherCAT communication. In the RS EtherCAT series servo drives, the IEC61800-7 (CIA402)-CANOpen motion control sub-protocol is used. The figure below is the EtherCAT communication structure based on the CANOpen application layer.



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 driver, 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.

6.3.3. 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

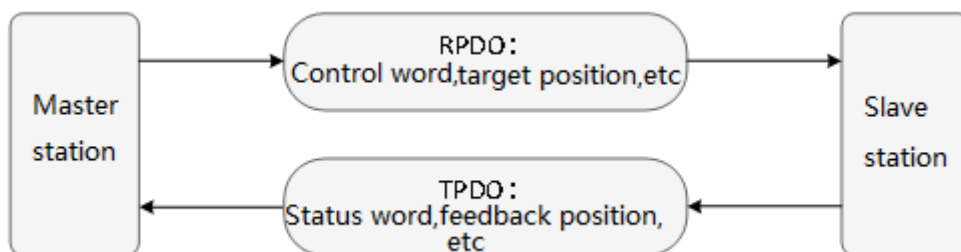
Operational: Operation, abbreviated as O.

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

6.3.4. 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 R5L EtherCAT series servo drivers as shown in the following table:

PDO	Index	Maximum number of maps	Longest byte	Default mapping object
RPDO	1600h	12	48	6040 (control word) 607A (target position) 60B8 (probe function)
RPDO1	1601h	12	48	6040 (control word) 607A (target position) 6081 (profile speed) 6083 (profile acceleration) 6084 (profile deceleration) 6060 (mode selection)
RPDO2	1602h	12	48	6040 (control word) 6083 (profile acceleration) 6084 (profile deceleration) 60FF (target speed) 6060 (mode selection)
TPDO0	1A00h	12	48	603F (error code) 6041 (status word) 6061 (mode display) 6064 (position feedback) 60B9 (probe status) 60BA (probe 1 rising edge position feedback) 60FD (DI status)
TPDO1	1A01h	12	48	6041 (status word) 6061 (mode display) 606C (speed feedback) 60FD (DI status)
TPDO2	1A02h	12	48	6041 (status word) 6064 (position feedback)

(2) Synchronization manager PDO allocation settings

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

In R5L EtherCAT series servo drivers, 1 RPDO frequency division and 1 TPDO frequency division are supported, as shown in the following table:

Index	Subindex	Elements
0x1C12	01h	Choose to use one of 0x1600, 0x1601, 0x1602 as the actual RPDO used
0x1C13	01h	Choose to use one of 0x1A00, 0x1A01, 0x1A02 as the actual TPDO used

(3) PDO configuration

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

Number of digits	31	16	15	8	7	0
Connotation	Index			Subindex			Object length		

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

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

For example, the mapping parameter that represents the 16-bit control word 6040h-00 is 604000 10h

6.3.5. Mailbox Data PDO

EtherCAT mailbox data SDO is used to transmit non-periodic data, such as the configuration of communication parameters, the configuration of servo driver operating parameters, etc.

EtherCAT's CoE service types include:

- ◆ Emergency information

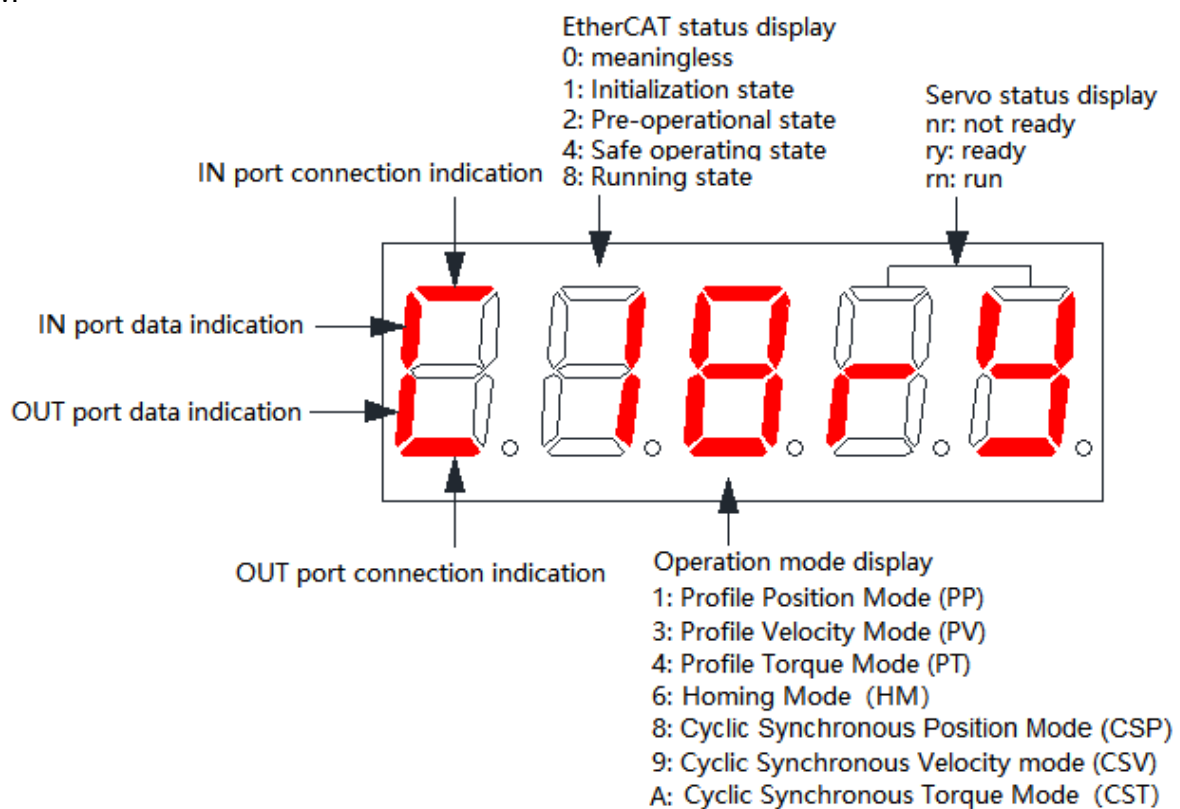
- ◆ SDO request
- ◆ SDO response
- ◆ TXPDO
- ◆ RXPDO
- ◆ Remote TXPDO sending request
- ◆ Remote RXPDO sending request
- ◆ SDO information

6.3.6. 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. R5L EtherCAT series drivers support SM synchronization mode and DC synchronization mode. The synchronization cycle is controlled by SYNC0, and the cycle range varies according to different motion modes.

6.3.7. Status Indicators

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



(1) Communication connection status

The R5L EtherCAT servo driver uses the upper and lower "-" of the first digital tube from the left in the 5-digit LED indicator on the panel to reflect the connection status of the two RJ45 ports: upper "-" (IN port), lower "-" (OUT port).

- ◆ Long dark: The physical layer does not detect the communication connection
- ◆ Steady on: The physical layer has established a communication connection

(2) Data transfer status

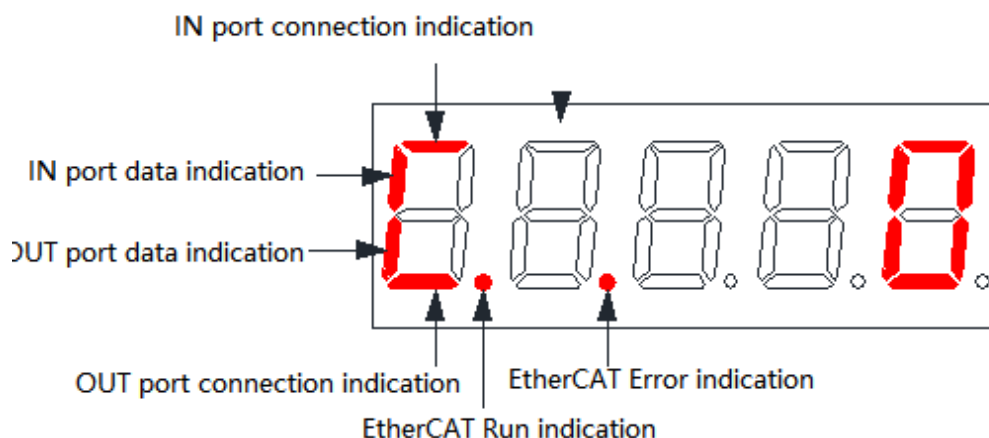
The R5L EtherCAT servo driver uses the upper and lower " | " of the first digital tube from the left in the 5-digit LED indicator on the panel to reflect the data transmission status of the two RJ45 ports: the upper " | " (IN port), the lower " | " (OUT port).

- ◆ Flashing: data is being transferred

(3) Communication operating status

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

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



LED	Statuses	Description
EtherCAT Run indicators	Not bright	Initialization status
	Slow flash	Pre-Operational status
	Single flash	Safe-Operational status
	Always bright	Operational status
EtherCAT Error indicators	Not bright	No errors
	Slow flash	General errors
	Single flash	Synchronization error
	Double flash	Watchdog error

- ◆ Fast flash: 50ms on, 50ms off (10Hz)
- ◆ Slow flash: 200ms on, 200ms off (2.5Hz)
- ◆ Single flash: 200ms on, 1000ms off
- ◆ Double flash: 200ms on, 200ms off, 200ms on, 1000ms off

(4) Servo mode display

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

Servo operation mode includes the following:

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

(5) Servo status display

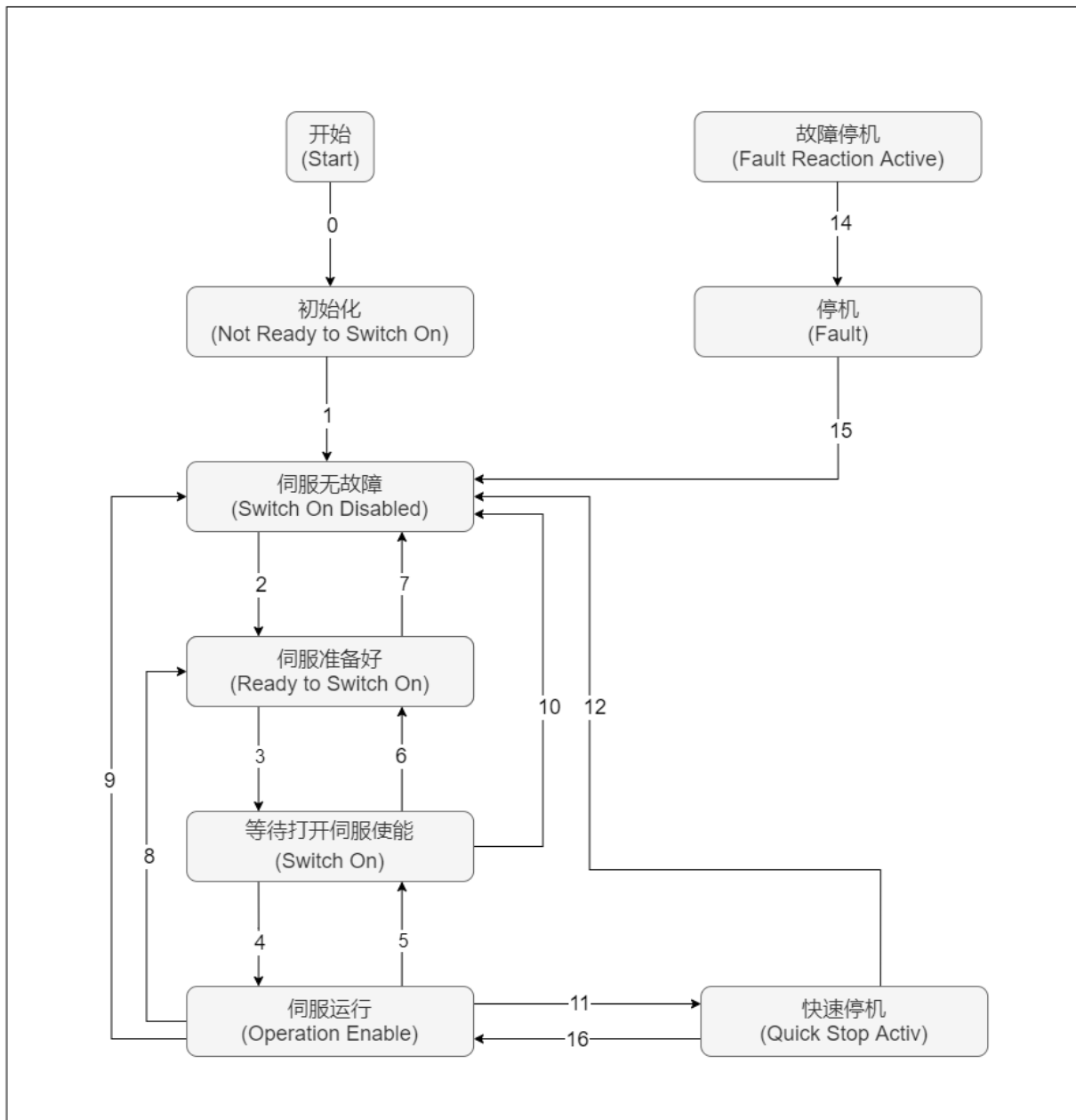
The communication and servo status and the communication connection status are displayed on the same interface. The 4th to 5th digits from the left of the 5-digit LED indicator on the panel display the slave's servo status in characters.

The servo status includes the following:

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

6.3.8. Mailbox Data PDO

To use R5L EtherCAT driver, the servo driver must be guided in accordance with the process specified in the standard CiA402 protocol, so that the servo driver can run in the specified state.



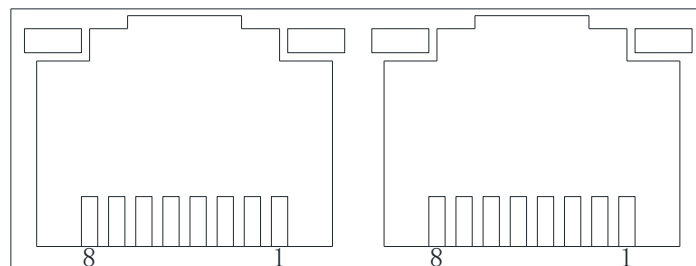
The description of each state is as follows:

Initialization	Driver initialization and internal self-check have been completed. The parameters of the driver cannot be set, nor can the driver function be executed.
Servo without failure	The servo driver has no fault or the error has been eliminated. Driver parameters can be set.
Servo ready	Servo driver is ready. Driver parameters can be set.
Waiting to turn on servo enable	The servo driver is waiting to turn on the servo enable. Driver parameters can be set.
Servo operation	The driver is operating normally, a certain servo operation mode has been enabled, the motor has been energized, and when the command is not 0, the motor will rotate. The driver parameter attribute can be set as "operational change", otherwise it cannot be set.
Quick stop	The quick stop function is activated, and the driver is executing the quick stop function. The driver parameter attribute can be set as "operational change", otherwise it cannot be set.
Fault shutdown	The driver has failed and is in the process of shutdown. The driver parameter attribute can be set as "operational change", otherwise it cannot be set.
Faults	When the fault stop is completed, all driver functions are prohibited, and the driver parameters are allowed to be changed in order to eliminate the fault.

6.3.9. Mailbox Data PDO

(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.



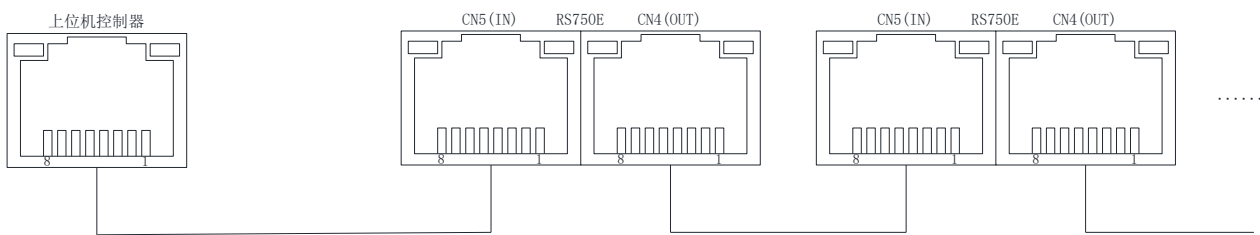
Pin	Meaning	Description
1	TX+	Data sending+
2	TX-	Data sending-
3	RX+	Data reception+
4	NULL	none
5	NULL	none

6	RX-	Data reception-
7	NULL	none
8	NULL	none

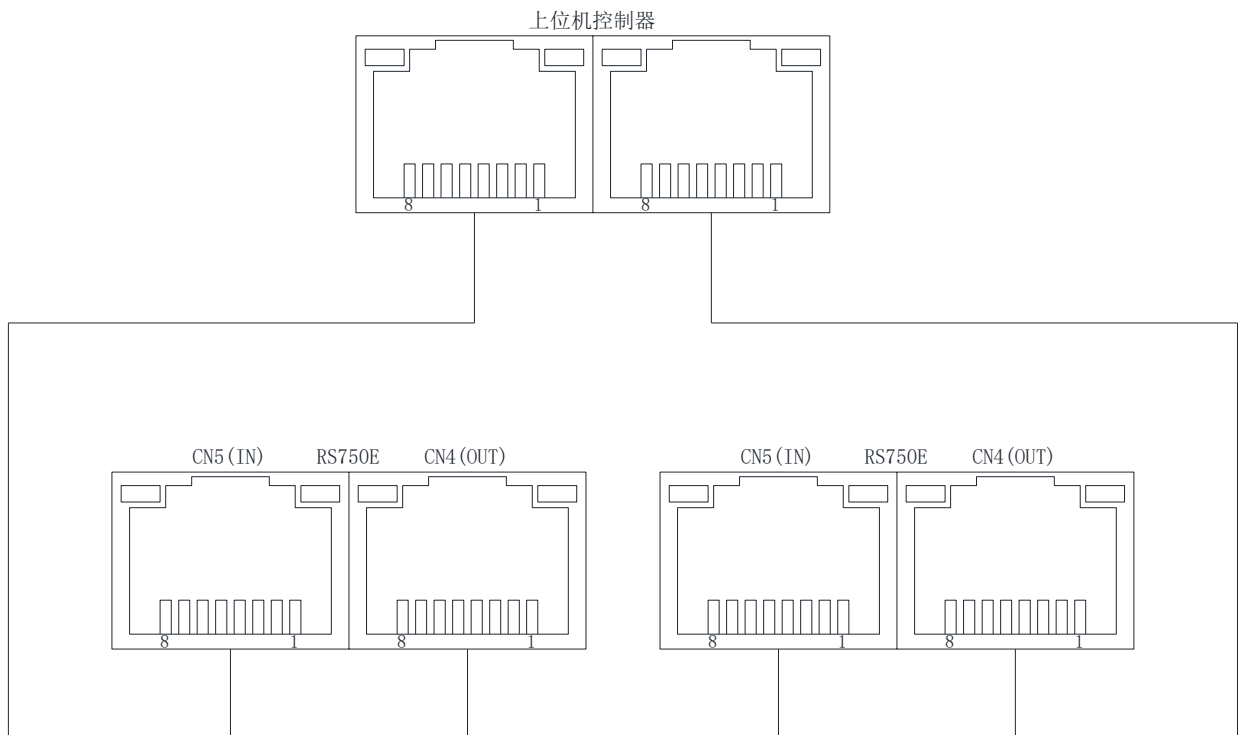
(2) Topological connection

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 drivers, a shielded network cable with a length of up to 100 M is also required. shielded network cables increase the immunity of the system

7. Control Mode

7.1. Basic Settings

7.1.1. Conversion Factor Setting

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

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

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

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):

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

3)、Motor acceleration (rpm/ms) versus load speed (command unit/s²):

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

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: $f_c = 1\text{mm}$

Lead screw: $PB = 10\text{mm/r}$

Deceleration ratio: $n = 5:1$

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

Therefore, the position factor is calculated as follows:

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

Therefore:

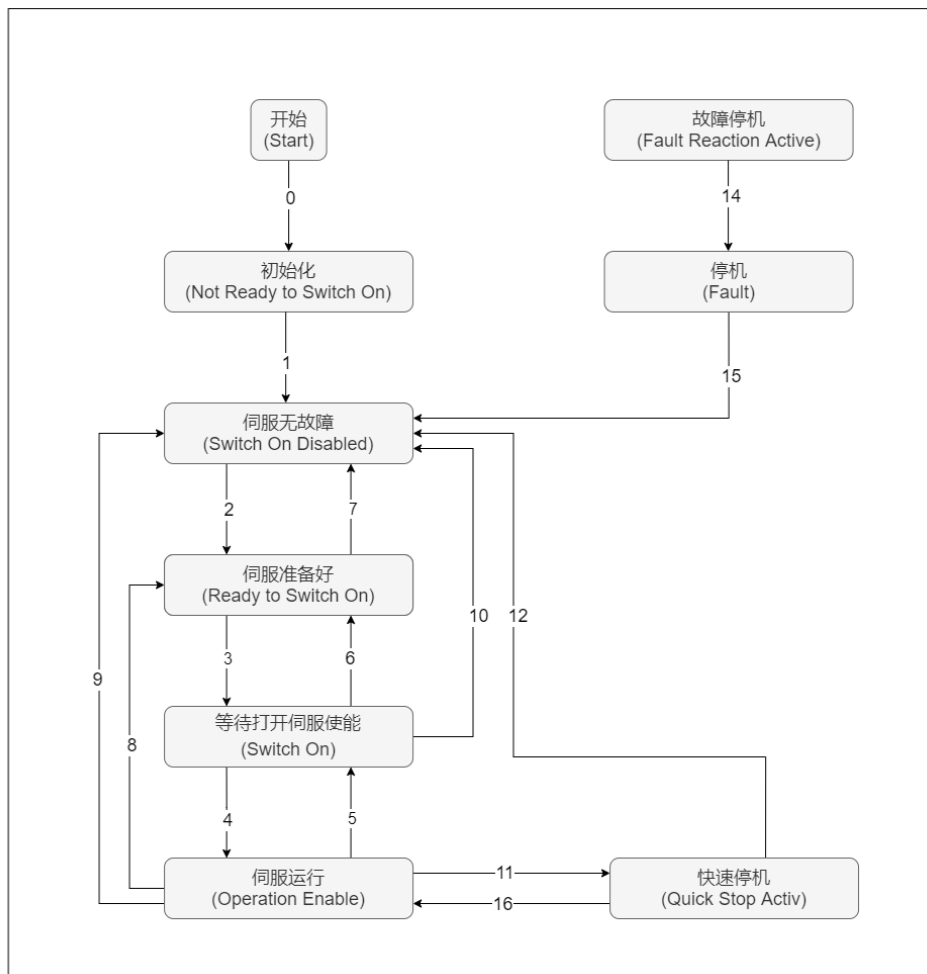
6091-01h = 65536

6091-02h = 1

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

7.2. Servo Status Setting

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



Initialization	Driver initialization and internal self-check have been completed The parameters of the driver cannot be set, nor can the driver function be executed
Servo without failure	The servo driver has no fault or the error has been eliminated Driver parameters can be set
Servo ready	Servo driver is ready Driver parameters can be set
Waiting to turn on servo enable	The servo driver is waiting to turn on the servo enable Driver parameters can be set
Servo operation	The driver is operating normally, a certain servo operation mode has been enabled, the motor has been energized, and when the command is not 0, the motor will rotate The driver parameter attribute can be set as "operational change", otherwise it cannot be set.
Quick stop	The quick stop function is activated, and the driver is executing the quick stop function The driver parameter attribute can be set as "operational change", otherwise it cannot be set
Fault shutdown	The driver has failed and is in the process of shutdown. The driver parameter attribute can be set as "operational change", otherwise it cannot be set
Faults	When the fault stop is completed, all driver functions are prohibited, and the driver parameters are allowed to be changed in order to eliminate the fault.

Control commands and status switching:

CiA402 state switching		Control word 6040h	Bit0 to Bit9 of status word 6041h
0	Power on → Initialization	Natural transition, no control commands required	0x0000
1	Initialization → No servo failure	Natural transition, no control commands required	0x0250
2	Servo is fault-free → Servo is ready	0x0006	0x0231
3	Servo ready → Wait to turn on servo enable	0x0007	0x0233
4	Wait to turn on servo enable → Servo operation	0x000F	0x0237
5	Servo operation → Wait to turn on servo enable	0x007	0x0233
6	Wait to turn on servo enable → Servo ready	0x006	0x0231
7	Servo ready → No servo failure	0x0000	0x0250
8	Servo running → Servo ready	0x0006	0x0231
9	Servo operation → No servo failure	0x0000	0x0250
10	Wait to turn on servo enable → No servo failure	0x0000	0x0250

11	Servo operation → Quick stop	0x0002	0x217
12	Quick stop → servo-free	Natural transition after shutdown is complete, no control commands required	0x0250
13	→ Failure to stop	If the servo driver fails in any state other than "fault", it will automatically switch to the fault stop state without command control.	0x021F
14	Failure to stop → Failure	Natural transition after the fault stop is done, no control commands required	0x0218
15	Fault → Servo without fault	0x80	0x0250
16	Quick stop → servo operation	When the shutdown is complete, send 0x0F	0x0237

7.2.1. 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	ReveR5L 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 driver 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

7.2.2. 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 driver:

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	Warning	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.

7.3. Servo Mode Setting

7.3.1. 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 driver:										
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				

7.3.2. Mode Switching

Precautions for the use of servo operation status switching:

- (1) When the servo driver 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.

7.4. 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 driver in a cyclic synchronous manner, and the position, speed and torque control is done internally by the servo driver.

7.4.1. 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 driver 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	Driver 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	$0 \sim 2^{32}-1$	RW	393216
6067	00	Position reach threshold (unit: encoder unit)	UInt32	$0 \sim 65535$	RW	92
6068	00	Position arrival time window (unit: ms)	UInt16	$0 \sim 65535$	RW	10
606C	00	Actual speed (unit: command unit/s)	Int32	-	RO	-
6072	00	Maximum torque (unit: 0.1%)	UInt16	$0 \sim 3000$	RW	3000
6077	00	Actual torque (unit: 0.1%)	Int16	$-5000 \sim 5000$	RO	-
607A	00	Target position (unit: command unit)	Int32	$-2^{31} \sim 2^{31}-1$	RW	0
6091	01	Gear ratio numerator	UInt32	$1 \sim 2^{32}-1$	RW	1
	02	Gear ratio denominator	UInt32	$1 \sim 2^{32}-1$	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	$0 \sim 50000$	RW	4000
	02	Speed loop integration time	UInt16	$1 \sim 30000$	RW	1500
	03	Position loop gain	UInt16	$0 \sim 50000$	RW	800

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

7.4.3. 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

7.5. Cyclic Synchronous Velocity Mode (CSV)

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

7.5.1. 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 driver 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	Driver 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	$1 \sim 2^{32}-1$	RW	1
	02	Gear ratio denominator	Uint32	$1 \sim 2^{32}-1$	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

7.5.2. 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	

7.5.3. 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

7.6. Cyclic Synchronous Torque Mode (CST)

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

7.6.1. 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 driver 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	Driver 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

7.6.2. Related Function Settings

Torque reach output setting:

Index (Hex)	Subindex (Hex)	Name	Description
2008	0A	Torque reaches reference value	Torque reaches reference value: A Torque reaches effective value: B Torque reaches invalid value: C <ul style="list-style-type: none"> When: $\text{torque actual value} > A + B$, the torque reaches DO is valid, and the status word 6041h.bit10 is set to 1. When: $\text{torque actual value} < A + C$, the torque reaches DO is invalid, and the status word 6041h.bit10 is cleared
2008	0B	Torque reaches effective value	
2008	0C	Torque reaches invalid value	

7.6.3. 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

7.7. 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 driver completes the position, velocity and torque control internally.

7.7.1. 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	Driver 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

7.7.2. Related Function Settings

(1) Positioning completion signal

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

(2) Position deviation excess threshold

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

7.7.3. 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 (bit12 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.

7.7.4. 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

7.8. Profile Velocity Mode (PV)

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

7.8.1. 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	$0 \sim 2^{32}-1$	RW	0
6091	01	Gear ratio numerator	Uint32	$1 \sim 2^{31}-1$	RW	1
	02	Gear ratio denominator	Uint32	$1 \sim 2^{31}-1$	RW	1
2006	01	Speed loop gain	Uint16	0~50000	RW	4000
	02	Speed loop integration time	Uint16	1~30000	RW	1500

7.8.2. 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	

7.8.3. 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

7.9. Profile Torque Mode (PT)

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

7.9.1. 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 driver 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

7.9.2. 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 <ul style="list-style-type: none"> 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	

7.9.3. 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

7.10. 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.

7.10.1. Related Objects

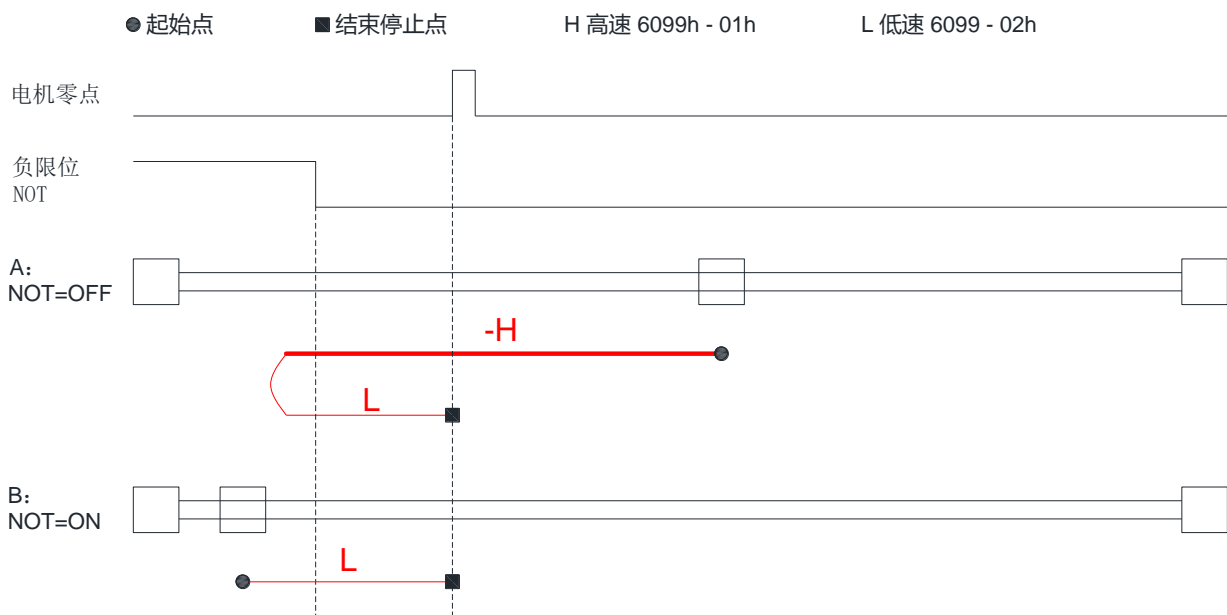
Control word 6040h		
Bit	Name	Description
0	Switch On	When the value of Bit0 to Bit3 is 1, the motor is enabled
1	Enable Voltage	
2	Quick Stop	
3	Enable Operation	
4	New Set-Point	This is the rising edge from 0 to 1 indicates the pre-triggered new target position 607Ah, profile velocity 6081h, acceleration 6083h, deceleration 6084h given
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	Driver 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

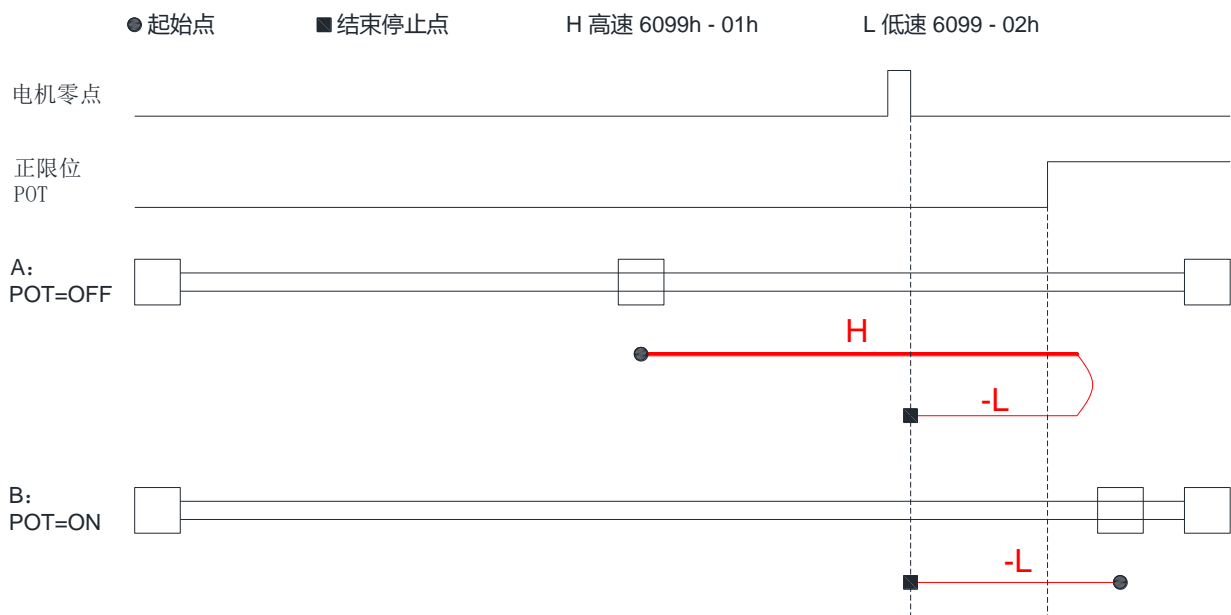
Index (Hex)	Subindex (Hex)	Name	Data type	Setting range	Accessibility	Default value
6040	00	Control word	Uint16	0~65535	RW	0
6041	00	Status word	Uint16	-	RO	0
6060	00	Operating mode	Int16	0~10	RW	8
6061	00	Mode display	Int16	-	RO	8
6062	00	Position command (unit: command unit)	Int32	-	RO	-
6063	00	Position 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	$0 \sim 2^{32}-1$	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	$1 \sim 2^{31}-1$	RW	1
	02	Gear ratio denominator	Uint32	$1 \sim 2^{31}-1$	RW	1
6099	01	Search deceleration point signal speed (unit: command unit/s)	Uint32	$1 \sim 2^{31}-1$	RW	10000
	02	Search origin signal speed (unit: command unit/s)	Uint32	$1 \sim 2^{31}-1$	RW	2000
609A	00	Acceleration (unit: command unit/s ²)	Uint32	$0 \sim 2^{32}-1$	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

7.10.2. Home Operation Instruction

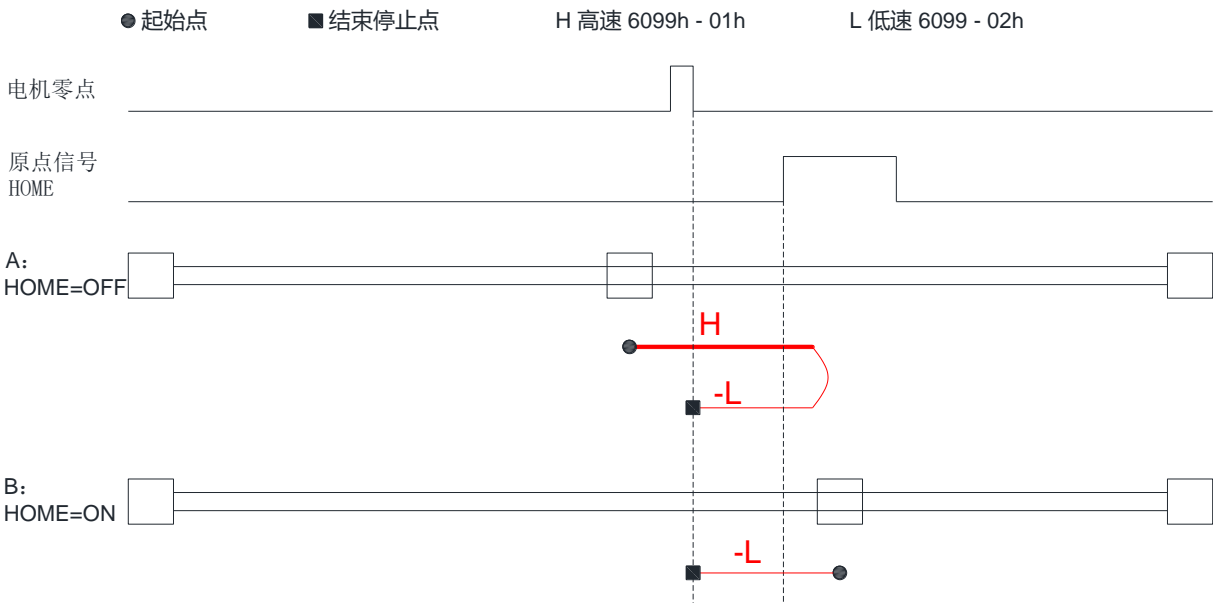
(1) Object 6098h = 1



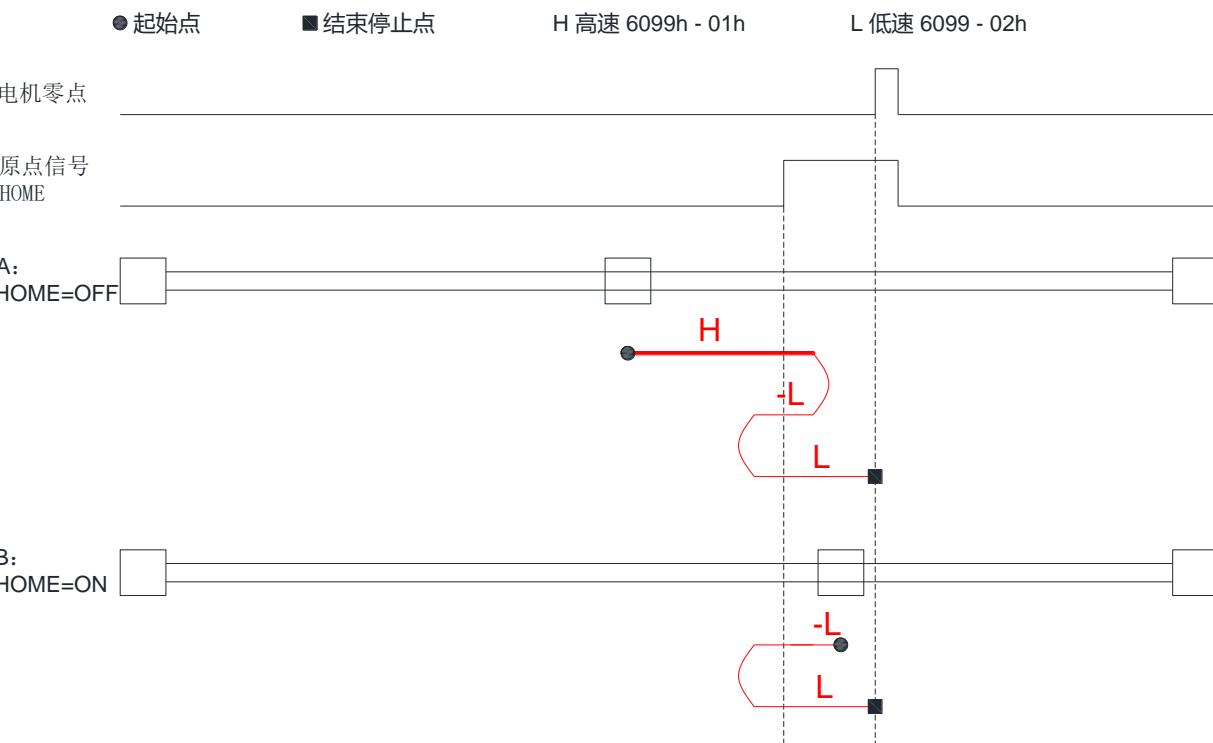
(2) Object 6098h = 2



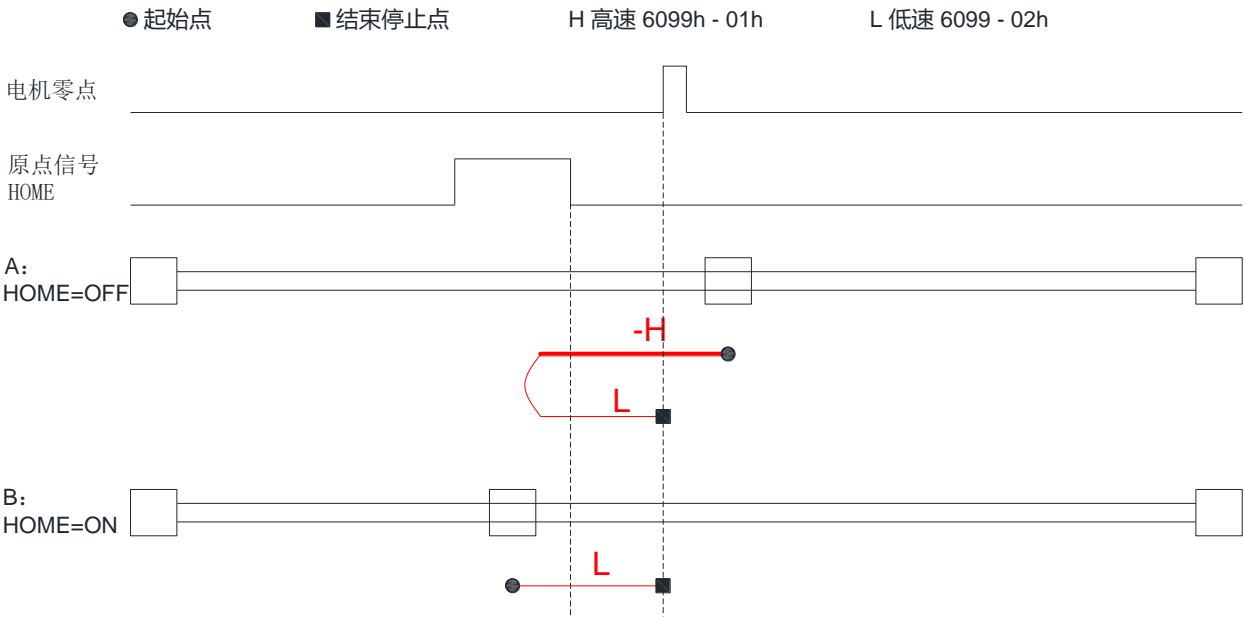
(3) Object 6098h = 3



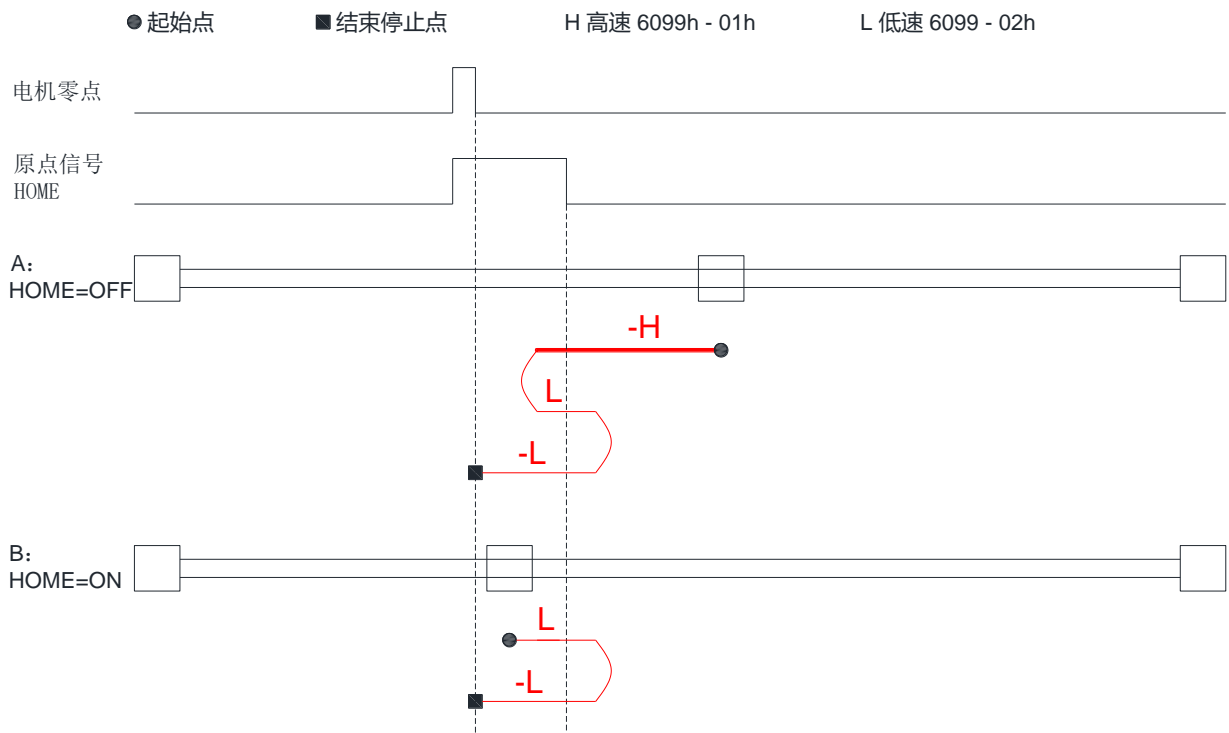
(4) Object 6098h = 4



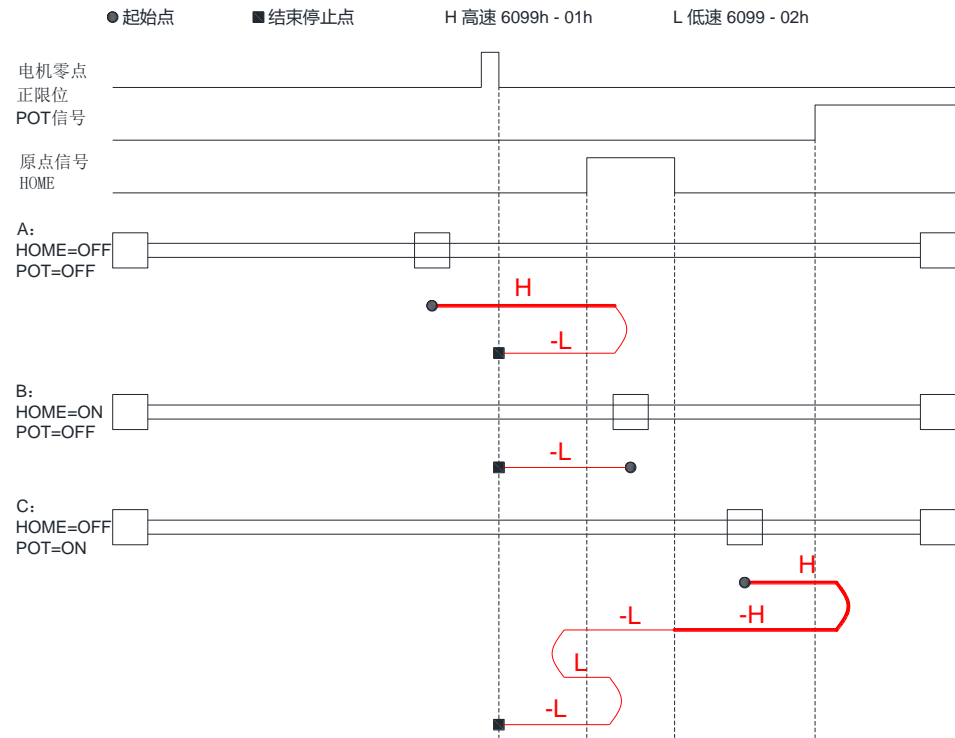
(5) Object 6098h = 5



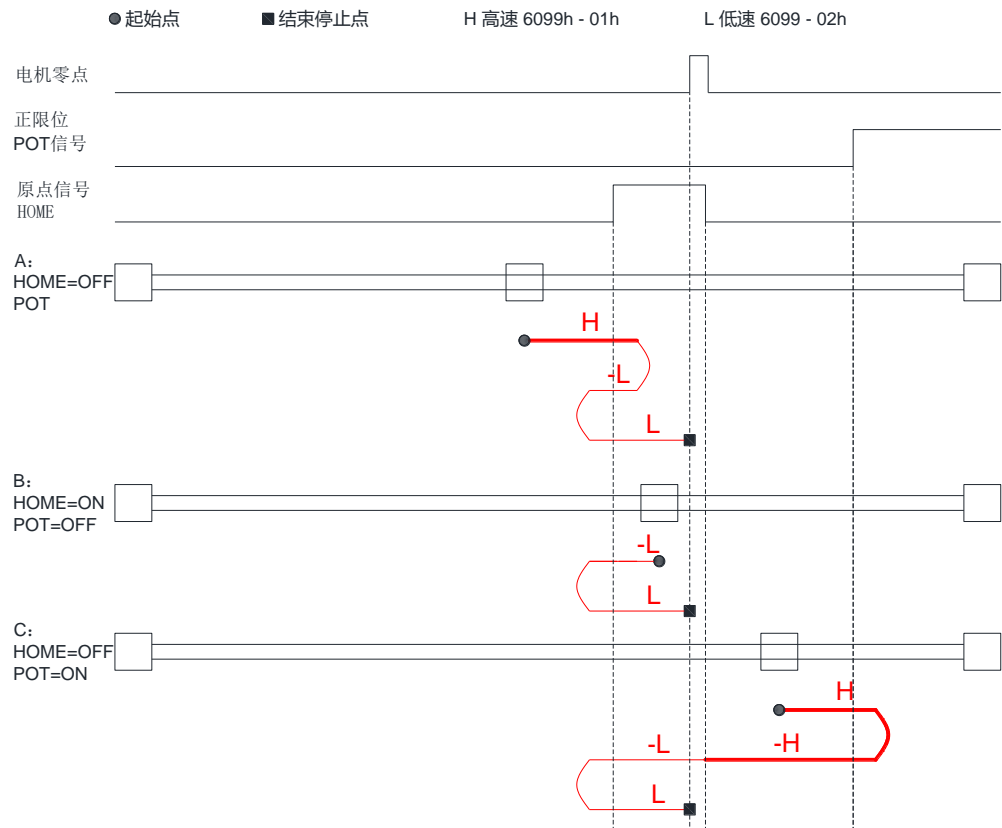
(6) Object 6098h = 6



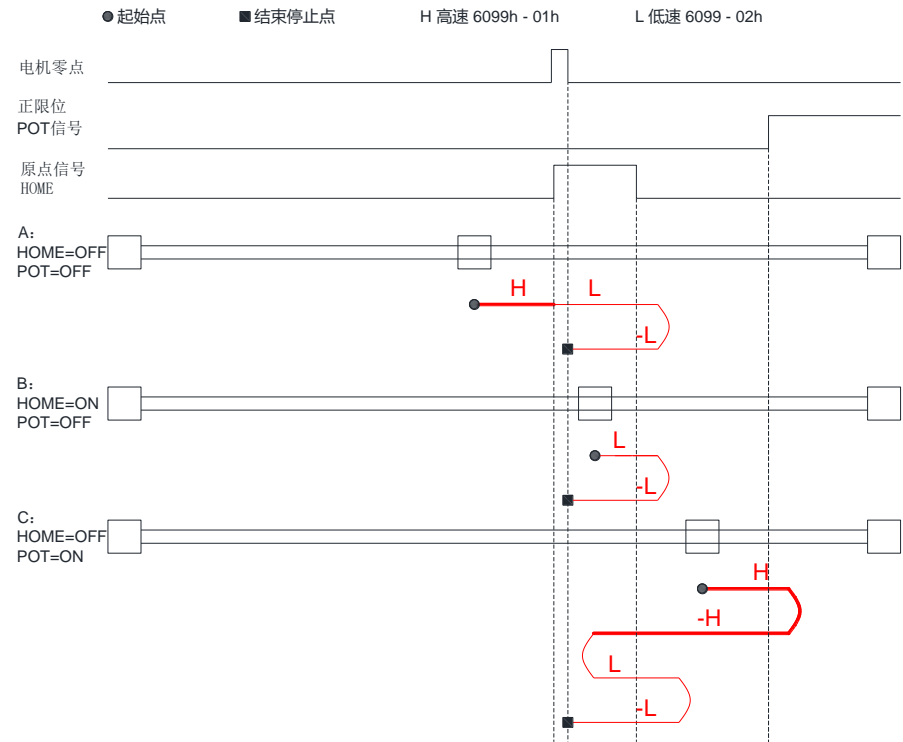
(7) Object 6098h = 7



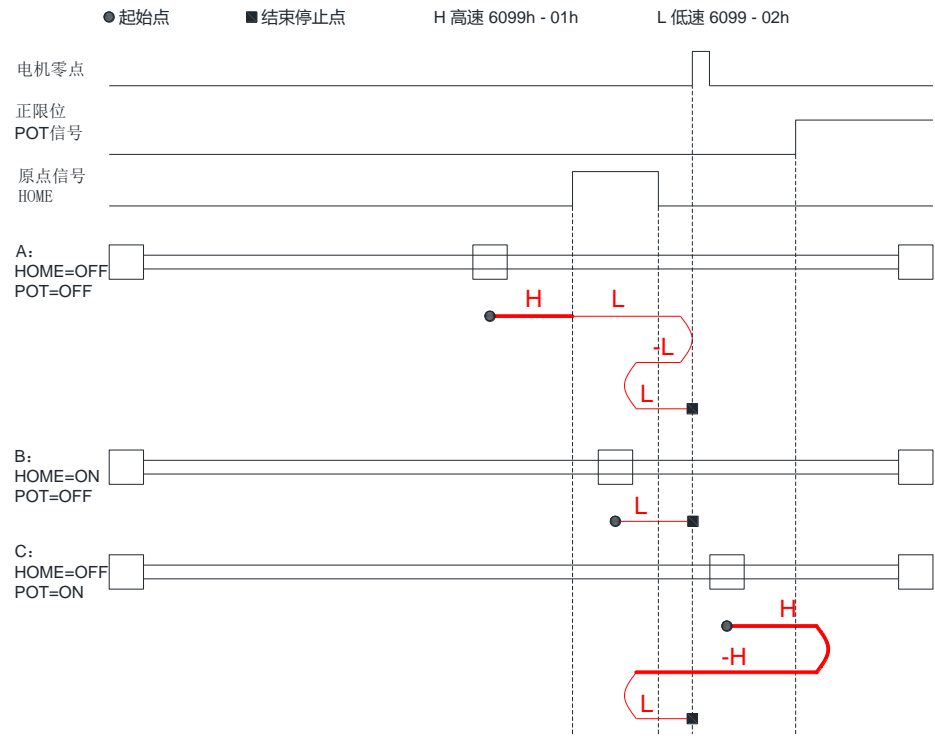
(8) Object 6098h = 8



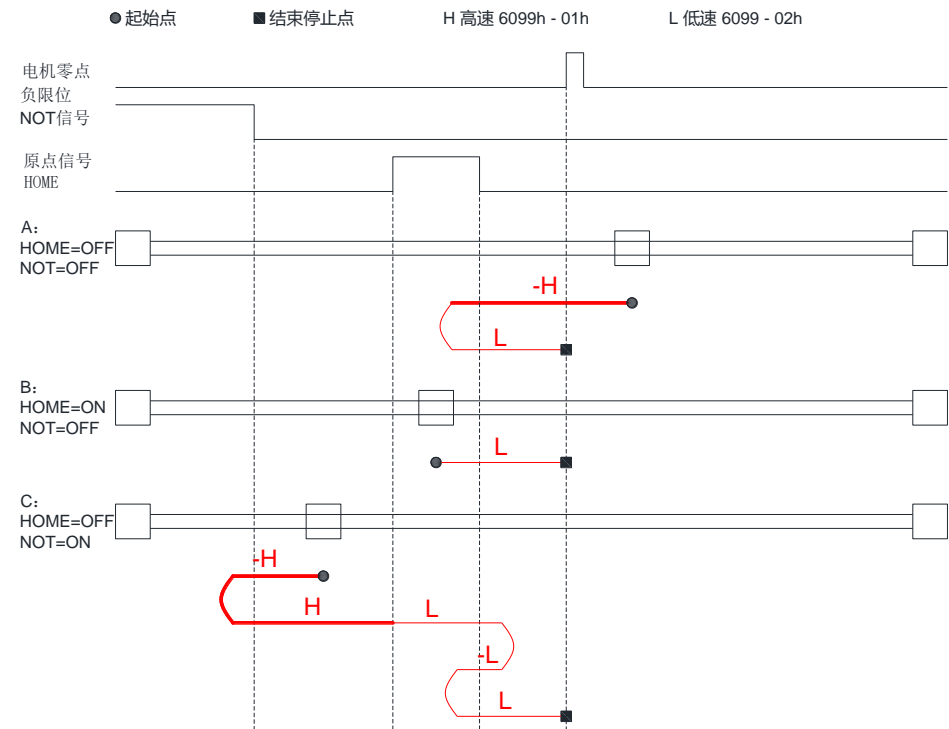
(9) Object 6098h = 9



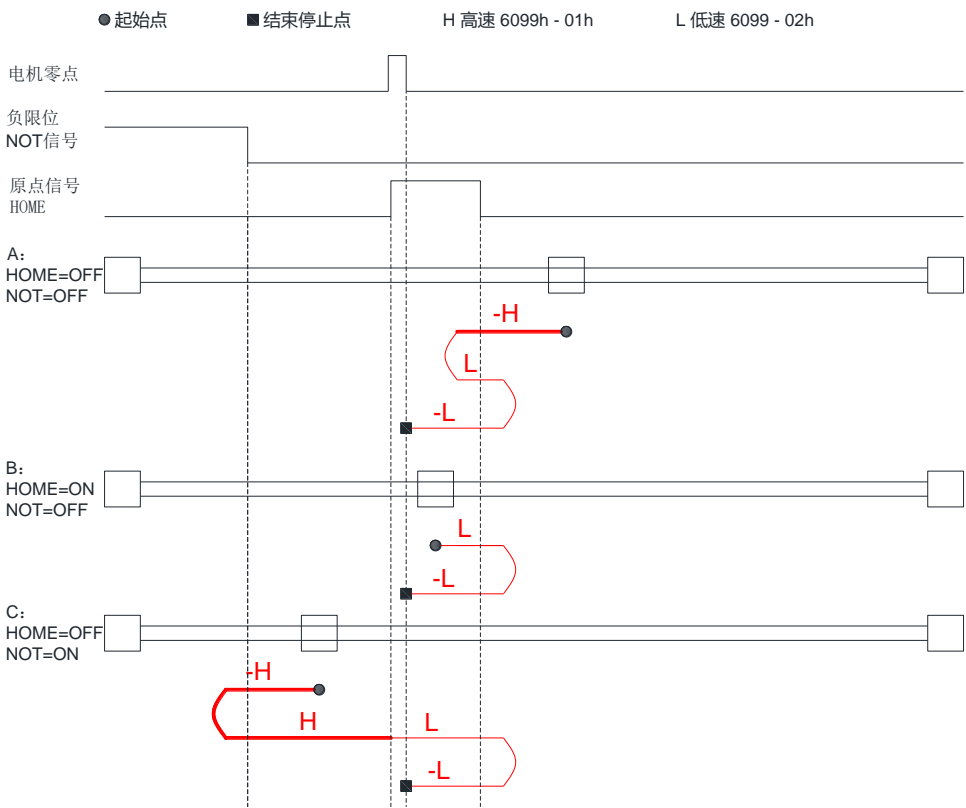
(10) Object 6098h = 10



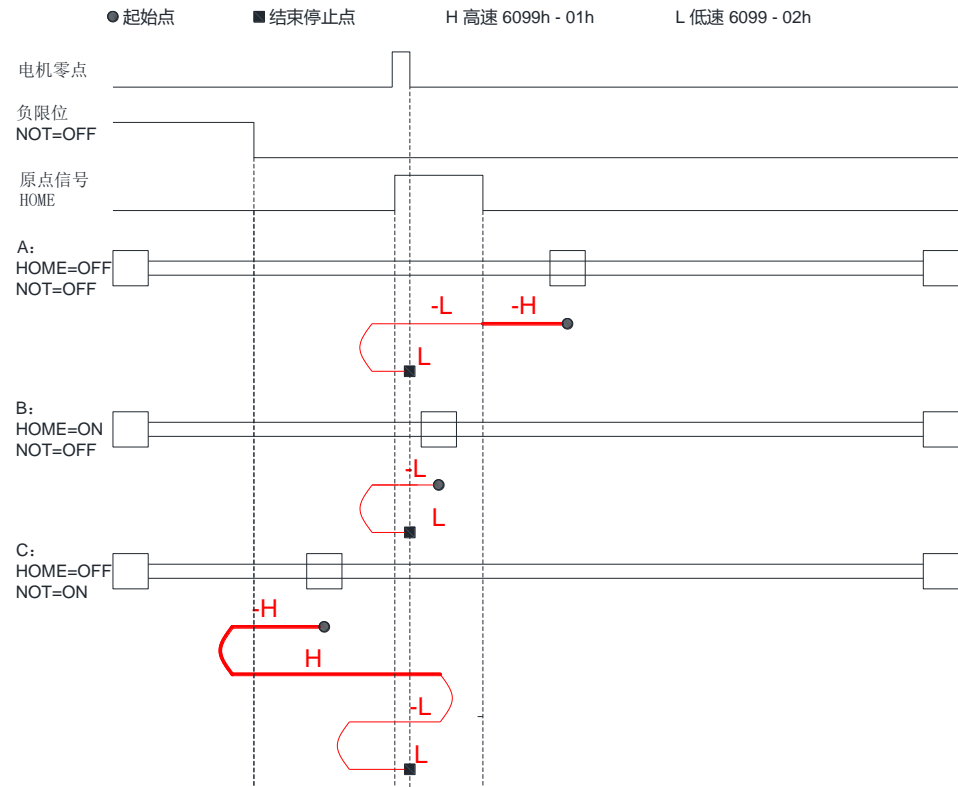
(11) Object 6098h = 11



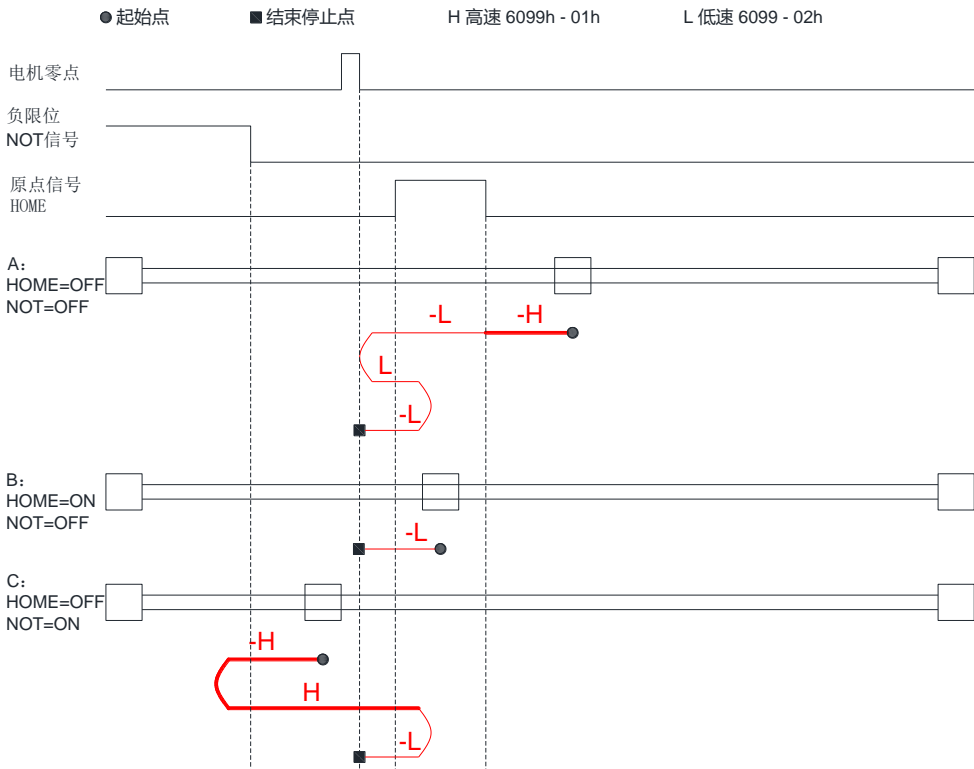
(12) Object 6098h = 12



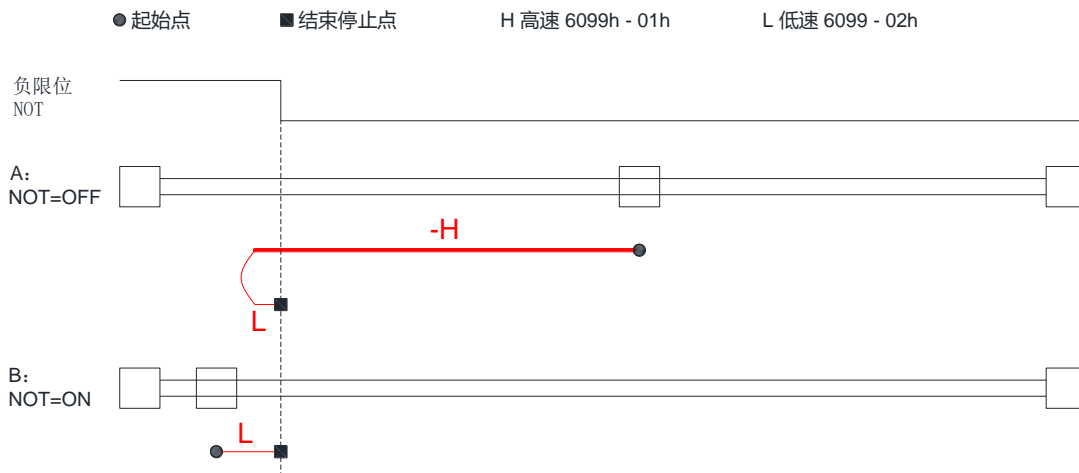
(13) Object 6098h = 13



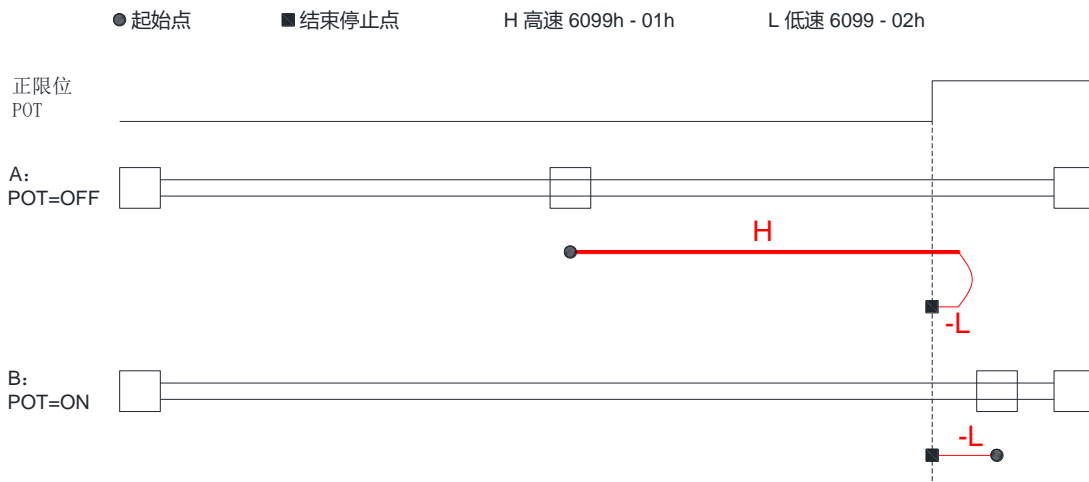
(14) Object 6098h = 14



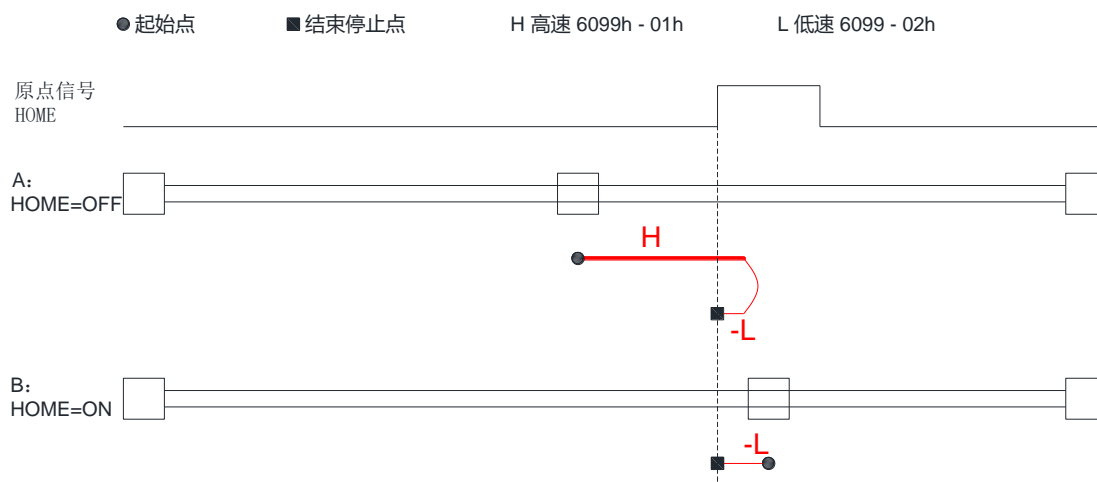
(15) Object 6098h = 17



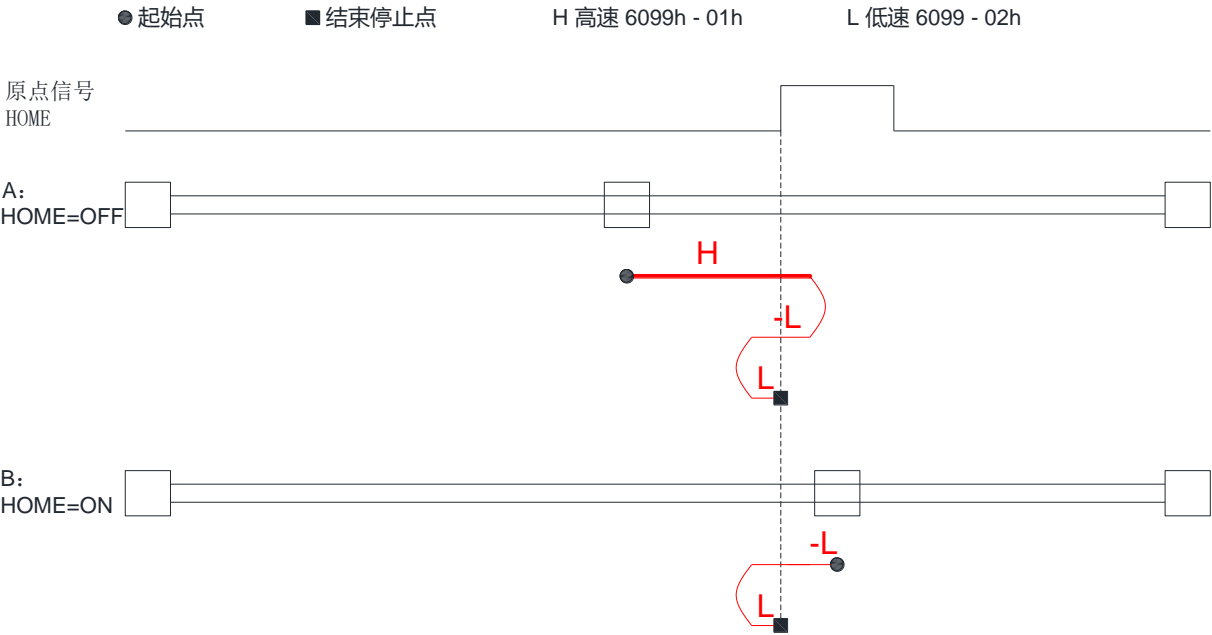
(16) Object 6098h = 18



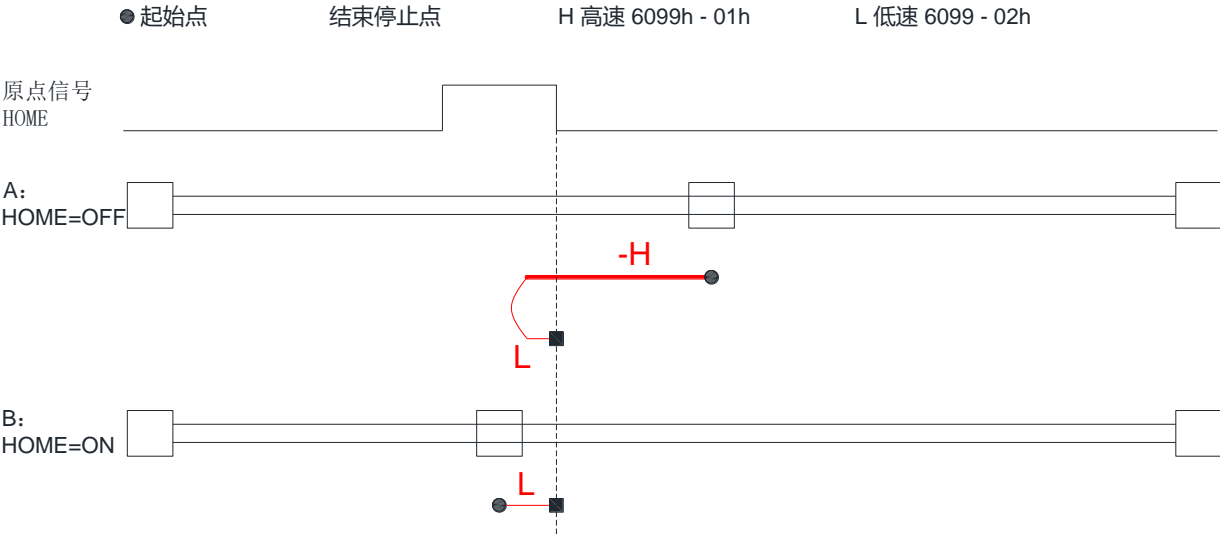
(17) Object 6098h = 19



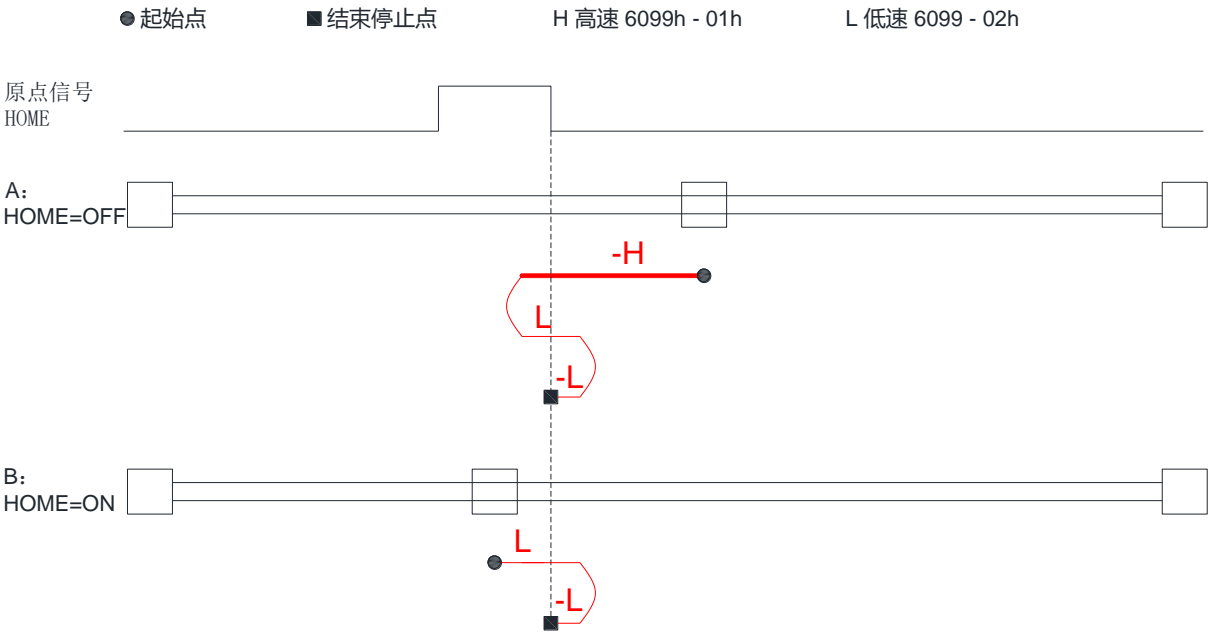
(18) Object 6098h = 20



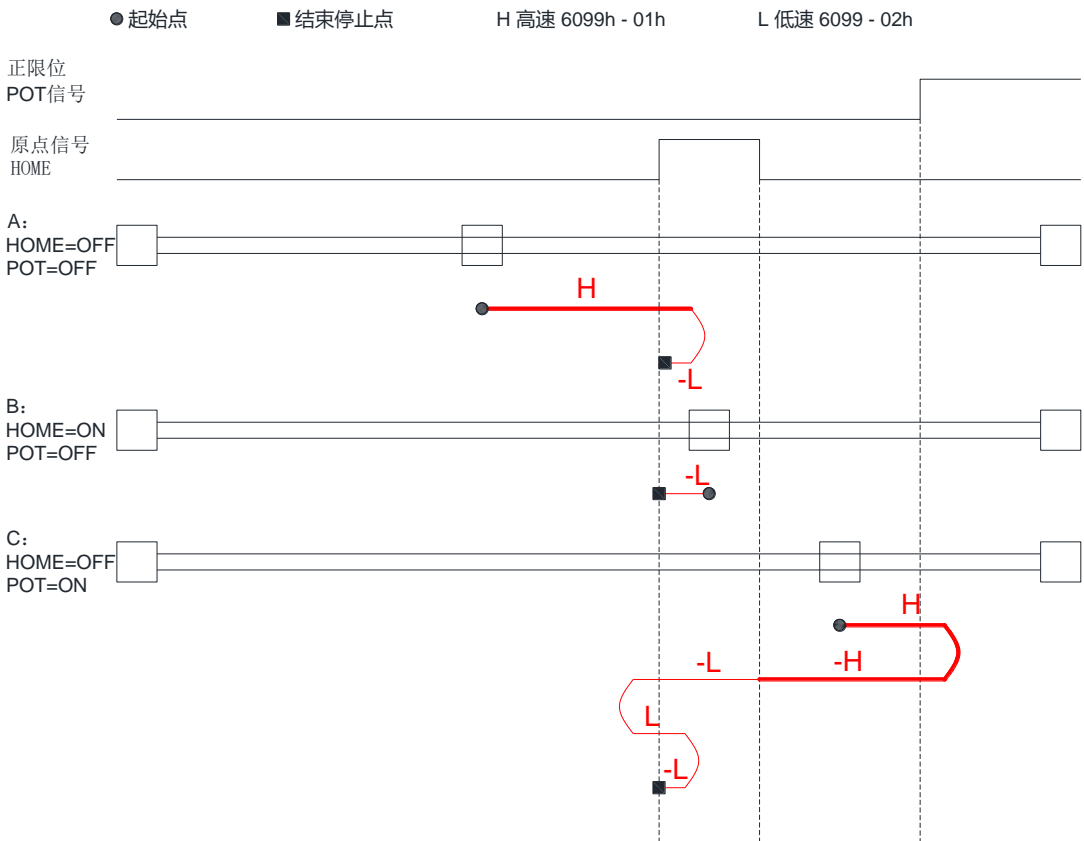
(19) Object 6098h = 21



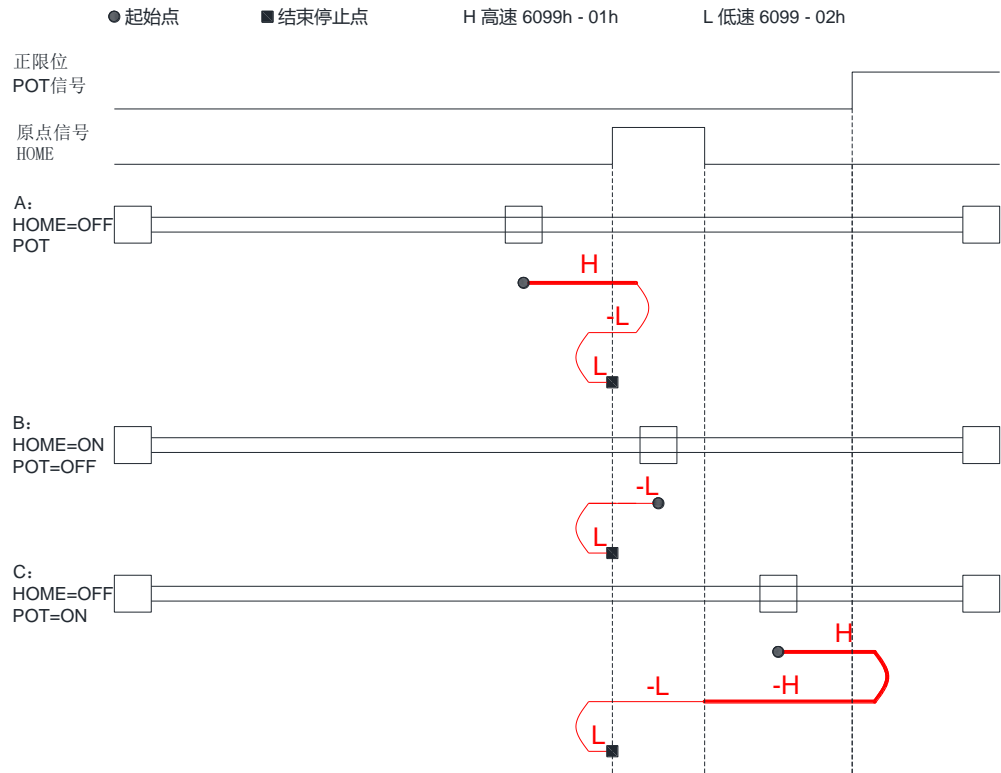
(20) Object 6098h = 22



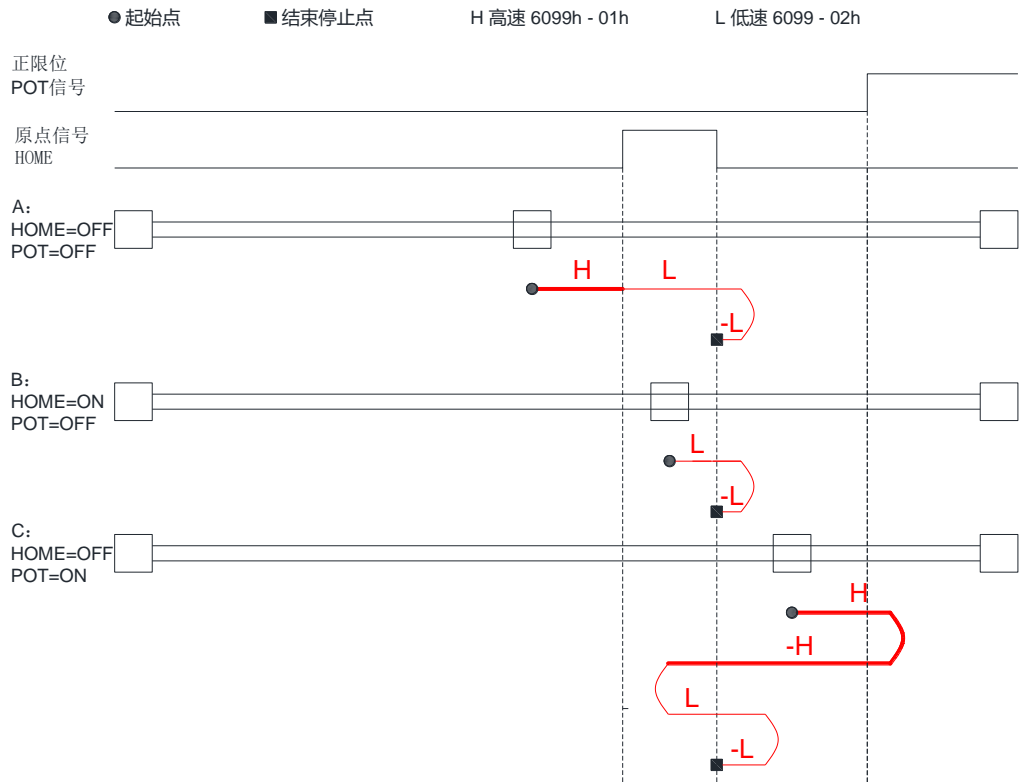
(21) Object 6098h = 23



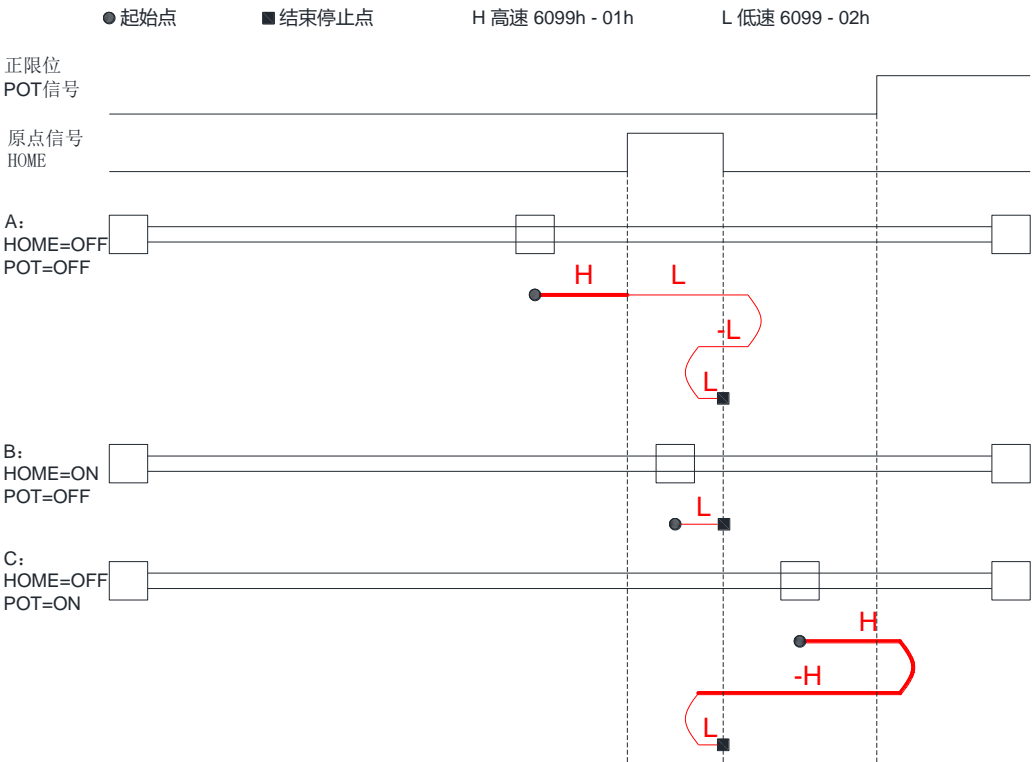
(22) Object 6098h = 24



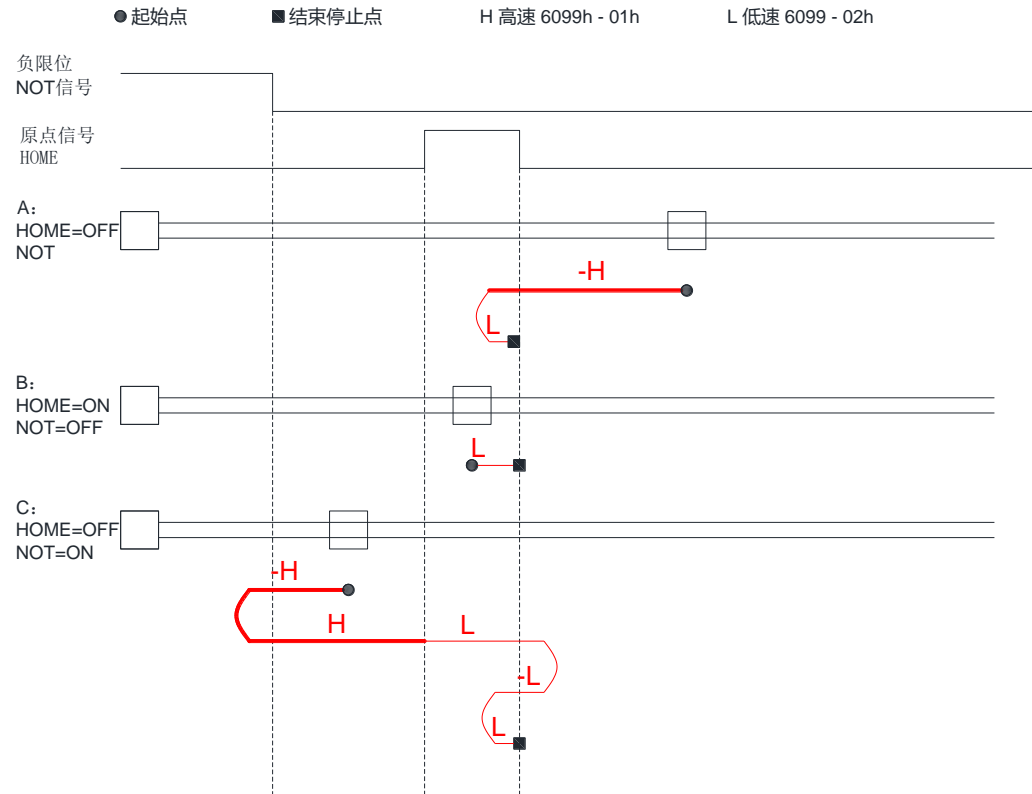
(23) Object 6098h = 25



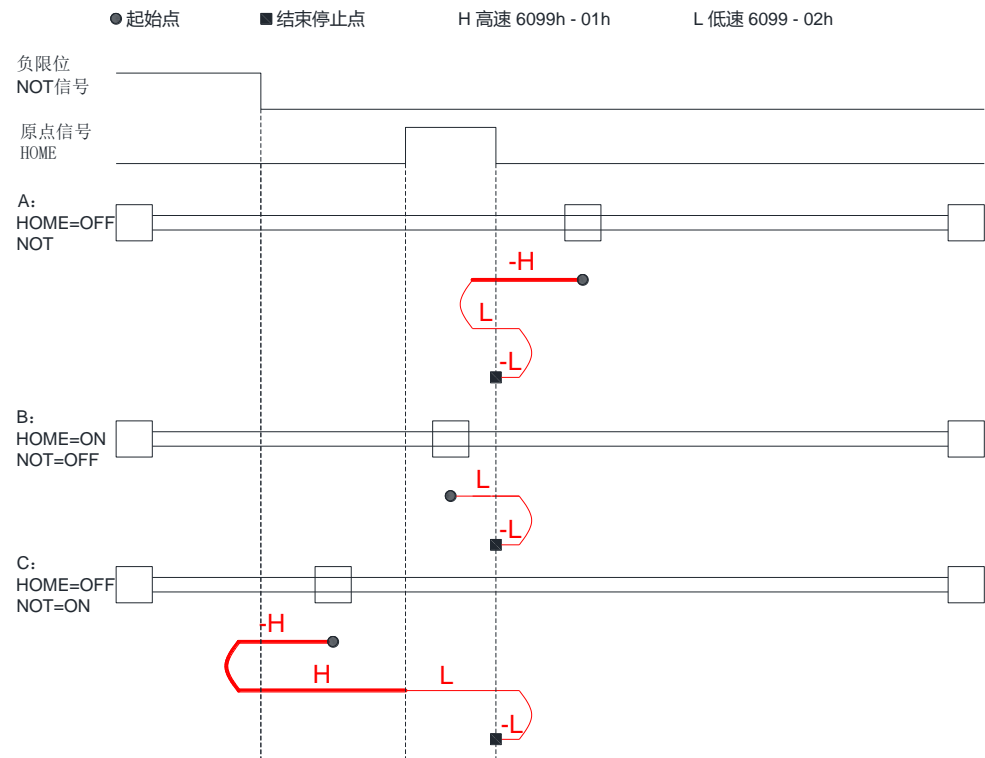
(24) Object 6098h = 26



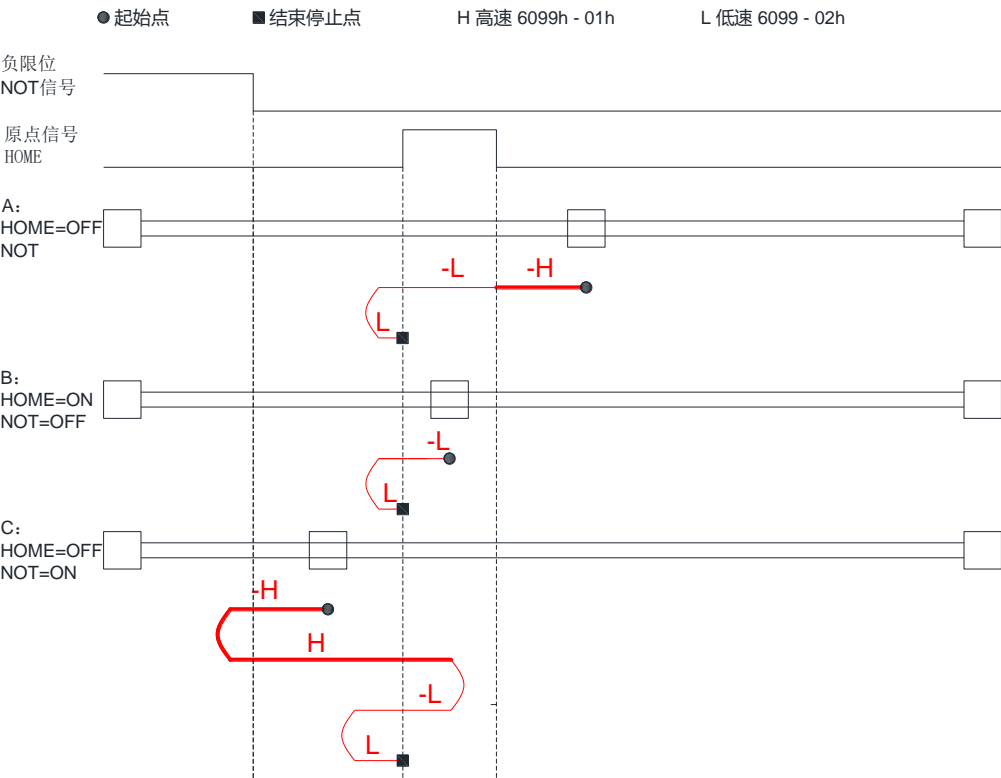
(25) Object 6098h = 27



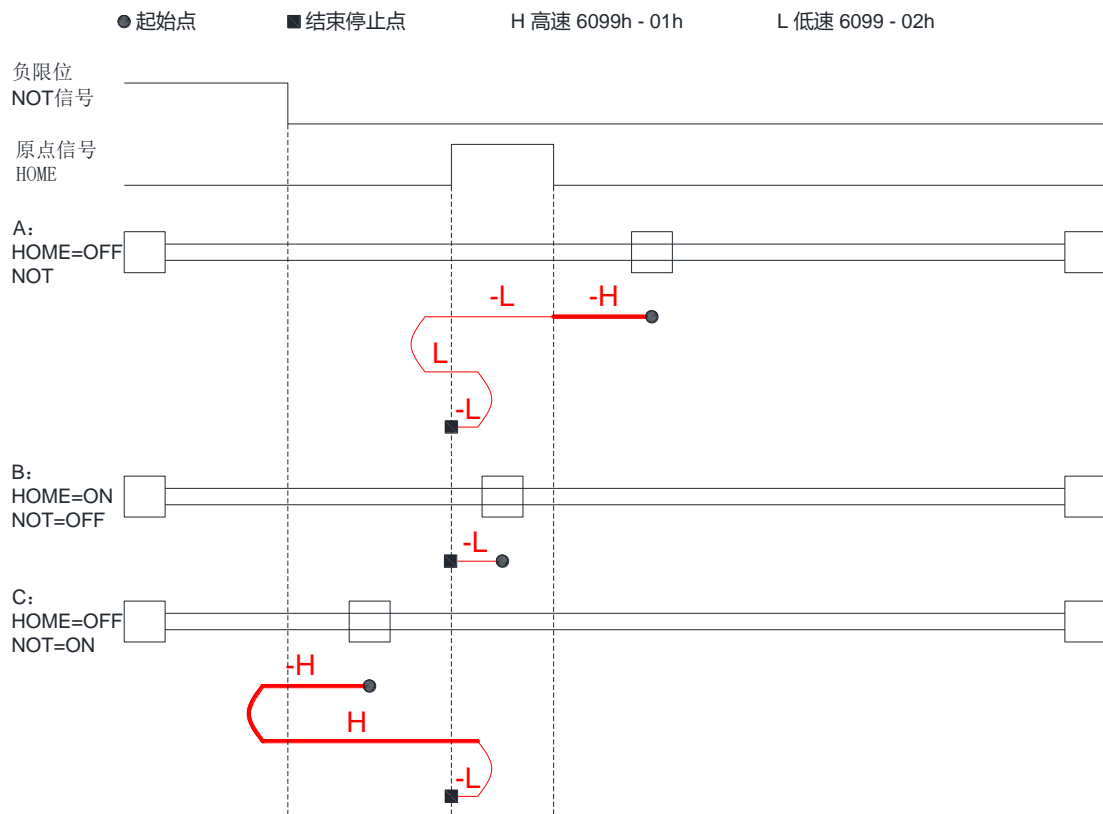
(26) Object 6098h = 28



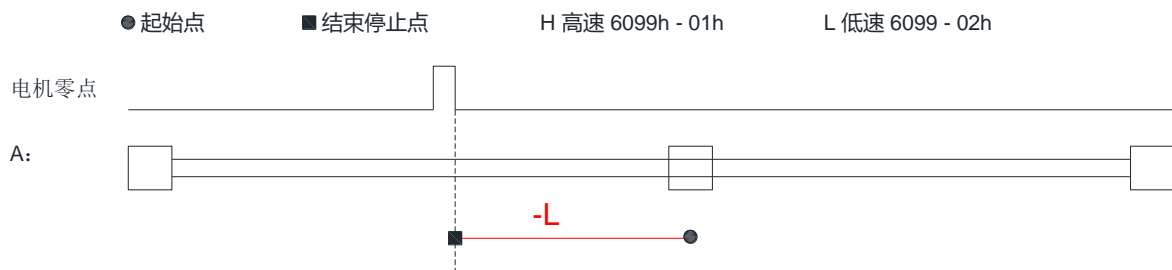
(27) Object 6098h = 29



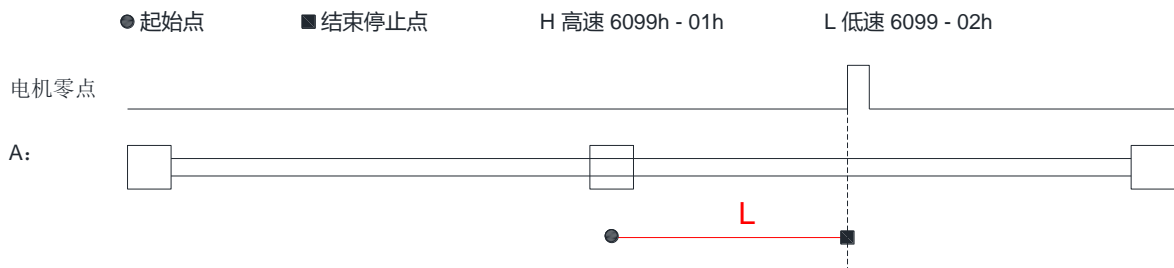
(28) Object 6098h = 30



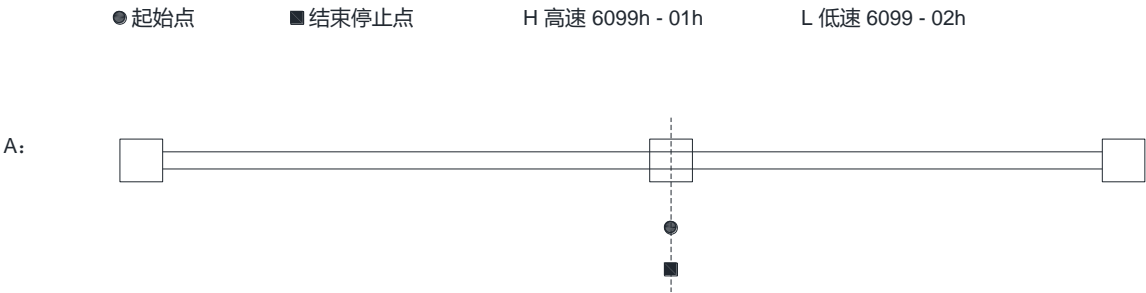
(29) Object 6098h = 33, 37



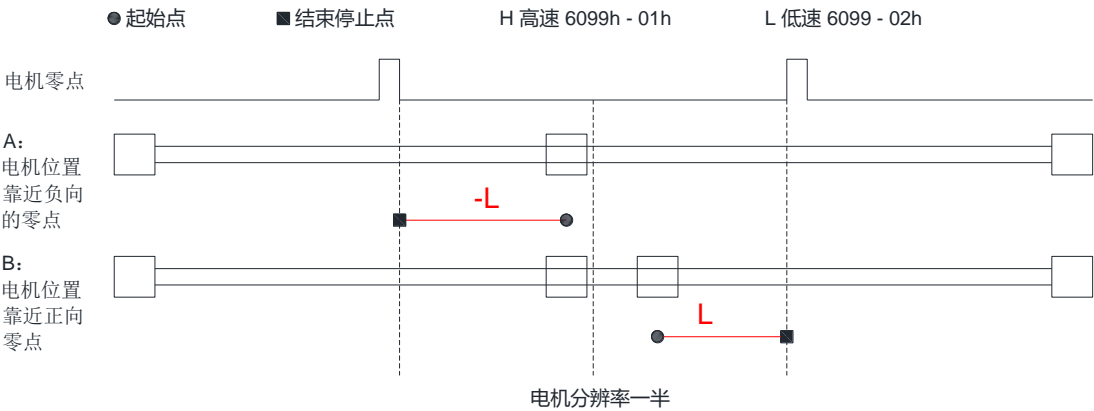
(30) Object 6098h = 34, 36



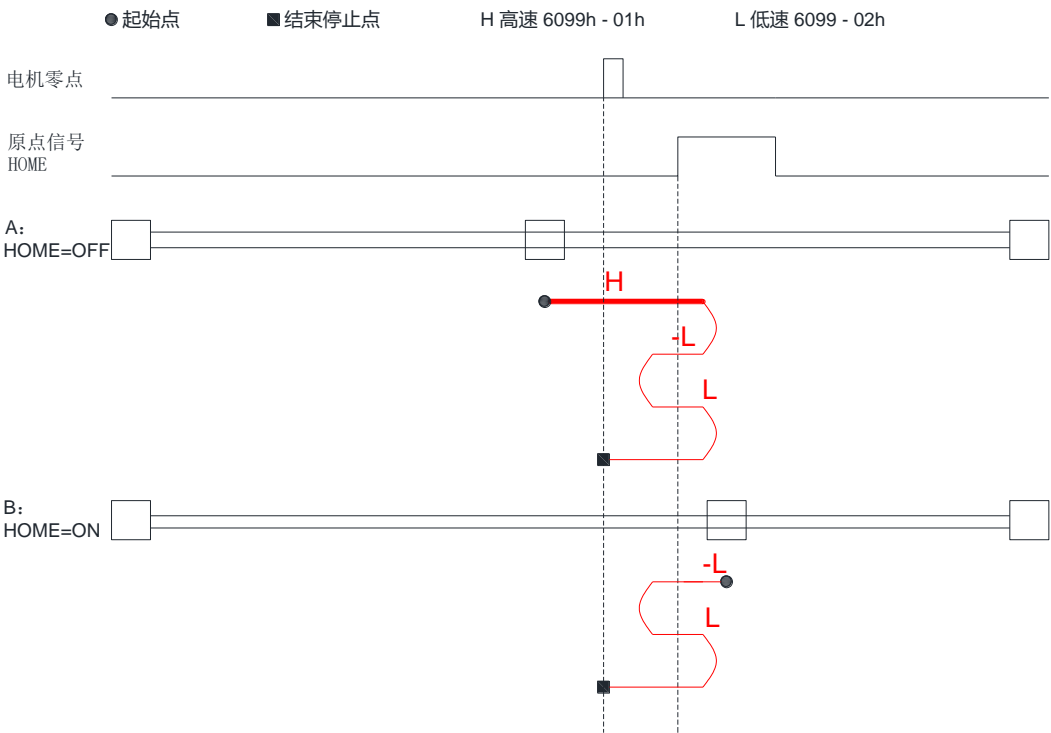
(31) Object 6098h = 35



(32) Object 6098h = 38



(33) Object 6098h = 39



7.11. Homing Mode (HM)

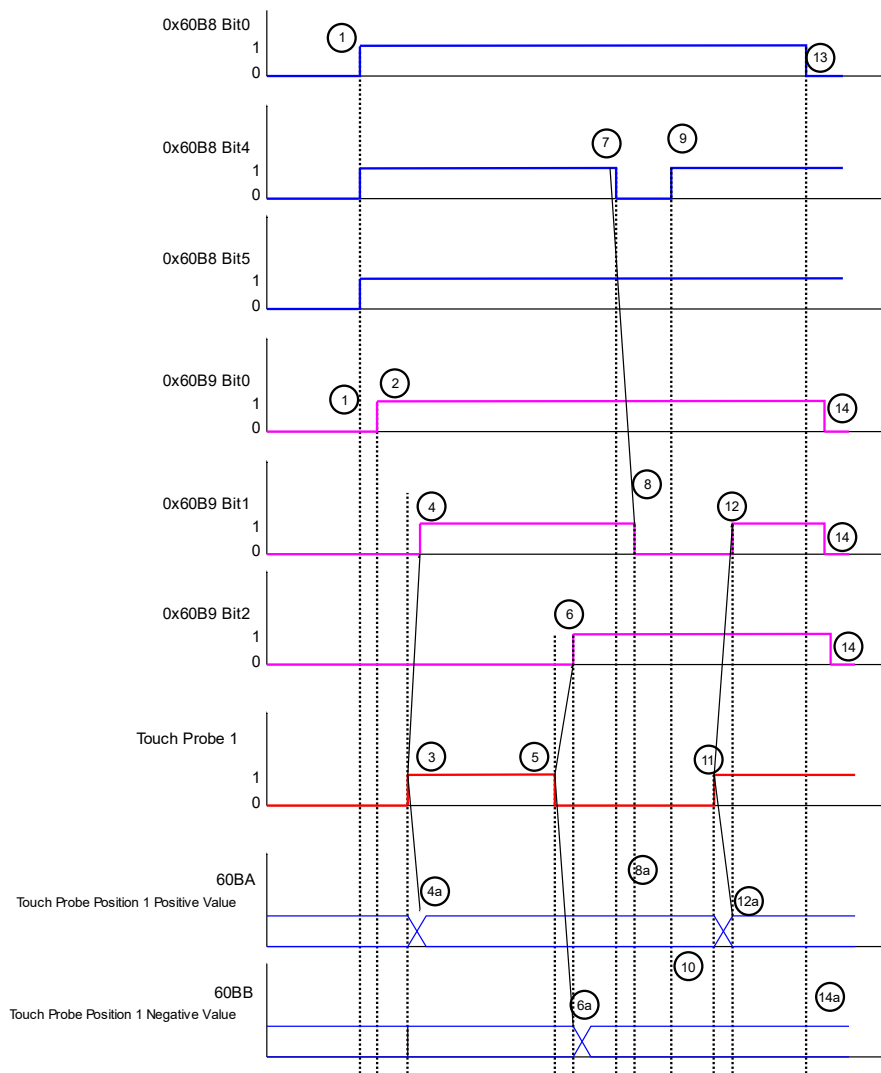
7.11.1. Probe Function

The probe function latches the motor position information through the digital input port. The function and polarity of the digital input port of R5L EtherCAT driver 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 signal rising edge	
4	-> 60B9 Bit 1 = 1	Status "Probe 1 rising edge latch" is set
4a	-> 60BA	Probe 1 positive position is latched
5	External probe signal falling edge	
6	-> 60B9 Bit 2 = 1	Status "Probe 1 falling edge latch" is set
6a	-> 60BB	Probe 1 negative position is latched
7	-> 60B8 Bit: 4	Rising edge latching function: disabled
8	-> 60B9 Bit 0 = 0	Status "Probe 1 rising edge latch" is cleared
8a	-> 60BA	Probe 1 positive position, no change in latch position
9	-> 60B8 Bit 4 = 1	Rising edge latching function: Enabled
10	-> 60BA	Probe 1 positive position, no change in latch position
11	External probe signal rising edge	
12	-> 60B9 Bit 1 = 1	Status "Probe 1 rising edge latch" is set
12a	-> 60BA	Probe 1 positive position is latched
13	-> 60B8 Bit 0 = 0	Probe 1 function: disabled
14	-> 60B9 Bit 0,1,2 = 0	Status bits are cleared
14a	-> 60BA,60BB	No change in probe 1 positive/negative latch position

8. Object Dictionary Details

8.1. 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 R5L 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 R5L EtherCAT series servo driver 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

8.2. Communication Parameters in Detail (Group 1000h)

Index	Name	Device type					Data structure	VAR	Data type	Uint32
	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 driver
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	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	Name	The maximum subindex number contained in the ID object					Data structure	-	Data type	UInt8
00h	Data range	4	Factory setting	4	Accessibility	RO	Related mode	-	Map	NO

Subindex	Name	Manufacturer ID					Data structure	-	Data type	UInt32
01h	Data range	-	Factory setting	0x0A880000	Accessibility	RO	Related mode	-	Map	NO

Subindex	Name	Product code					Data structure	-	Data type	UInt32
02h	Data range	-	Factory setting	0x00100000	Accessibility	RO	Related mode	-	Map	NO

Subindex	Name	Revision number					Data structure	-	Data type	UInt32
03h	Data range	-	Factory setting	0x00010A88	Accessibility	RO	Related mode	-	Map	NO

Subindex	Name	Serial number					Data structure	-	Data type	UInt32
04h	Data range	-	Factory setting	0x00000000	Accessibility	RO	Related mode	-	Map	NO

Index	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	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	Name	Number of mapping objects supported by RPDO1					Data structure	-	Data type	UInt8
00h	Data range	0~12	Factory setting	3	Accessibility	RW	Related mode	ALL	Map	NO

Subindex	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	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	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	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	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	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	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	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	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	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

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

8.3.1. Servo Parameters

Index	Name	Servo Parameters					Data structure	ARR	Data type	Uint16
	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

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

Subindex	Name	Driver model					Data structure	-	Data type	Uint16
	02h	Data range	0~65535	Factory setting	Determined by model	Accessibility	RW	Related mode	-	Map

Set the driver model:

Display value	Description
0x10(16)	R5L028E
0x13(19)	R5L042E
0x17(23)	R5L130E

Subindex	Name	Servo software version					Data structure	-	Data type	Uint16
	03h	Data range	-	Factory setting	-	Accessibility	RO	Related mode	-	Map

Subindex	Name	EtherCAT software version					Data structure	-	Data type	Uint16
	05h	Data range	-	Factory setting	-	Accessibility	RO	Related mode	-	Map

Subindex	Name	Servo hardware version					Data structure	-	Data type	Uint16
	06h	Data range	-	Factory setting	-	Accessibility	RO	Related mode	-	Map

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

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

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

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

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

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

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

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

Subindex	Name	Motor rated speed (unit: rpm)					Data structure	-	Data type	Uint16
15h	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 driver 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

8.3.2. Basic Control Parameters

Index	Name	Basic control parameters					Data structure	ARR	Data type	Uint16
	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
	Data range	-	Factory setting	58h	Accessibility	RO	Related mode	-	Map	NO

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

Set the driver control mode:

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

Subindex	Name	Rotation direction selection					Data structure	-	Data type	Uint16
	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

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												
<table><tr><td>Set value</td><td>Servo OFF stop mode selection</td></tr><tr><td>0</td><td>Coast to stop, keeping de-energized state</td></tr><tr><td>1</td><td>Stop at zero speed, keeping position lock state</td></tr><tr><td>2</td><td>Coast to stop, keeping DB state</td></tr><tr><td>3</td><td>Stop by DB, keeping DB state</td></tr><tr><td>4</td><td>Stop at zero speed, keeping DB state</td></tr></table>												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
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												
<table><tr><td>Set value</td><td>Overtravel stop mode selection</td></tr><tr><td>0</td><td>Coast to stop, keeping de-energized state</td></tr><tr><td>1</td><td>Coast to stop, keeping DB state</td></tr><tr><td>2</td><td>Stop by DB, keeping DB state</td></tr><tr><td>3</td><td>Stop at zero speed, keeping position lock state</td></tr><tr><td>4</td><td>Stop at zero speed, keeping de-energized state</td></tr></table>												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
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														
<table><tr><td>Set value</td><td>Fault 2 stop mode selection</td></tr><tr><td>0</td><td>Coast to stop, keeping de-energized state</td></tr><tr><td>1</td><td>Coast to stop, keeping DB state</td></tr><tr><td>2</td><td>Stop by DB, keeping DB state</td></tr><tr><td>3</td><td>Stop at zero speed, keeping de-energized state</td></tr><tr><td>4</td><td>Stop at zero speed, keeping DB state</td></tr><tr><td>5</td><td>Stop by DB, keeping de-energized state</td></tr></table>												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
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										
<table><tr><td>Set value</td><td>Fault 1 stop mode selection</td></tr><tr><td>0</td><td>Coast to stop, keeping de-energized state</td></tr><tr><td>1</td><td>Coast to stop, keeping DB state</td></tr><tr><td>2</td><td>Stop by DB, keeping DB state</td></tr><tr><td>5</td><td>Stop by DB, keeping de-energized state</td></tr></table>												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
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																								
<table><tr><td>Set value</td><td>Fan voltage control</td><td>Set value</td><td>Fan voltage control</td></tr><tr><td>0</td><td>100%</td><td>5</td><td>75%</td></tr><tr><td>1</td><td>95%</td><td>6</td><td>70%</td></tr><tr><td>2</td><td>90%</td><td>7</td><td>65%</td></tr><tr><td>3</td><td>85%</td><td>8</td><td>60%</td></tr><tr><td>4</td><td>80%</td><td></td><td></td></tr></table>											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%		
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	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	Name	Soft limit function selection					Data structure	-	Data type	Uint16
38h	Data range	0~10000	Factory setting	0	Accessibility	RW	Related mode	-	Map	NO

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

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

Subindex	Name	Enable locked rotor fault					Data structure	-	Data type	Uint16
3Bh	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 \geq positive/negative torque limit
2	Alarm when command torque is greater than P01.82 set value
3	Alarm when the commanded torque is greater than the larger of P01.82 and positive/negative torque limit values

Subindex	Name	Motor overload protection coefficient (unit: %)					Data structure	-	Data type	Uint16
3Ch	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 driver is to trigger an alarm.

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

Subindex	Name	Overload setting					Data structure	-	Data type	Uint16										
	Data range	0~3	Factory setting	3	Accessibility	RW	Related mode	-	Map	NO										
<table><tr><td>Set value</td><td>Overload setting</td></tr><tr><td>0</td><td>Disable</td></tr><tr><td>1</td><td>Enable motor overload, disable driver overload</td></tr><tr><td>2</td><td>Disable motor overload.enable driver overload</td></tr><tr><td>3</td><td>Enable motor overload.enable driver overload</td></tr></table>											Set value	Overload setting	0	Disable	1	Enable motor overload, disable driver overload	2	Disable motor overload.enable driver overload	3	Enable motor overload.enable driver overload
											Set value	Overload setting								
											0	Disable								
											1	Enable motor overload, disable driver overload								
											2	Disable motor overload.enable driver overload								
											3	Enable motor overload.enable driver 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

8.3.3. Input/Output Terminal Parameters

Index	Name	Input/output parameters					Data structure	ARR	Data type	Uint16
	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
	Data range	-	Factory setting	54h	Accessibility	RO	Related mode	-	Map	NO

Subindex	Name	IN1 function selection					Data structure	-	Data type	Uint16
	Data range	0~63	Factory setting	0	Accessibility	RW	Related mode	-	Map	YES

Set the IN function corresponding to the hardware IN1 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	IN1 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 IN1 terminal when the IN function selected by IN1 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	IN2 function selection					Data structure	-	Data type	Uint16
03h	Data range	0~63	Factory setting	0	Accessibility	RW	Related mode	-	Map	YES

Subindex	Name	IN2 logic selection					Data structure	-	Data type	Uint16
04h	Data range	0~4	Factory setting	0	Accessibility	RW	Related mode	-	Map	YES

Subindex	Name	IN3 function selection					Data structure	-	Data type	Uint16
05h	Data range	0~63	Factory setting	11	Accessibility	RW	Related mode	-	Map	YES

Subindex	Name	IN3 logic selection					Data structure	-	Data type	Uint16
06h	Data range	0~4	Factory setting	0	Accessibility	RW	Related mode	-	Map	YES

Subindex	Name	IN4 function selection					Data structure	-	Data type	Uint16
07h	Data range	0~63	Factory setting	5	Accessibility	RW	Related mode	-	Map	YES

Subindex	Name	IN4 logic selection					Data structure	-	Data type	Uint16
08h	Data range	0~4	Factory setting	0	Accessibility	RW	Related mode	-	Map	YES

Subindex	Name	IN5 function selection					Data structure	-	Data type	Uint16
09h	Data range	0~63	Factory setting	6	Accessibility	RW	Related mode	-	Map	YES

Subindex	Name	IN5 logic selection					Data structure	-	Data type	Uint16
0Ah	Data range	0~4	Factory setting	0	Accessibility	RW	Related mode	-	Map	YES

Subindex	Name	IN6 function selection					Data structure	-	Data type	Uint16
0Bh	Data range	0~63	Factory setting	23	Accessibility	RW	Related mode	-	Map	YES

Subindex 0Ch	Name	IN6 logic selection					Data structure	-	Data type	Uint16
	Data range	0~4	Factory setting	0	Accessibility	RW	Related mode	-	Map	YES

Subindex 0Dh	Name	IN7 function selection					Data structure	-	Data type	Uint16
	Data range	0~63	Factory setting	30	Accessibility	RW	Related mode	-	Map	YES

Subindex 0Eh	Name	IN7 logic selection					Data structure	-	Data type	Uint16
	Data range	0~4	Factory setting	0	Accessibility	RW	Related mode	-	Map	YES

Subindex 0Fh	Name	IN8 function selection					Data structure	-	Data type	Uint16
	Data range	0~63	Factory setting	31	Accessibility	RW	Related mode	-	Map	YES

Subindex 10h	Name	IN8 logic selection					Data structure	-	Data type	Uint16
	Data range	0~4	Factory setting	0	Accessibility	RW	Related mode	-	Map	YES

Subindex 21h	Name	OUT1 function selection					Data structure	-	Data type	Uint16
	Data range	0~31	Factory setting	0	Accessibility	RW	Related mode	-	Map	YES

Set the OUT function corresponding to the hardware OUT1 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: Fault	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 22h	Name	OUT1 logic selection					Data structure	-	Data type	Uint16
	Data range	0~1	Factory setting	0	Accessibility	RW	Related mode	-	Map	YES

When the OUT function selected for OUT1 is enabled, the output level logic of the hardware OUT1 terminal

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

Subindex	Name	OUT2 function selection					Data structure	-	Data type	Uint16
23h	Data range	0~31	Factory setting	1	Accessibility	RW	Related mode	-	Map	YES

Subindex	Name	OUT2 logic selection					Data structure	-	Data type	Uint16
24h	Data range	0~1	Factory setting	0	Accessibility	RW	Related mode	-	Map	YES

Subindex	Name	OUT3 function selection					Data structure	-	Data type	Uint16
25h	Data range	0~31	Factory setting	2	Accessibility	RW	Related mode	-	Map	YES

Subindex	Name	OUT3 logic selection					Data structure	-	Data type	Uint16
26h	Data range	0~1	Factory setting	0	Accessibility	RW	Related mode	-	Map	YES

Subindex	Name	OUT4 function selection					Data structure	-	Data type	Uint16
27h	Data range	0~31	Factory setting	0	Accessibility	RW	Related mode	-	Map	YES

Subindex	Name	OUT4 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

8.3.4. Position Control Parameters

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

Subindex	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 driver 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	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	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
	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	IN 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
	Data range	0~7	Factory setting	0	Accessibility	RW	Related mode	-	Map	NO
29h										

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	$-2^{63} \sim (2^{63} - 1)$	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	$0 \sim (2^{63} - 1)$	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						
<table><tr><td>Set value</td><td>Position out of tolerance threshold mode</td></tr><tr><td>0</td><td>Encoder Eeprom</td></tr><tr><td>1</td><td>Driver Eeprom</td></tr></table>											Set value	Position out of tolerance threshold mode	0	Encoder Eeprom	1	Driver Eeprom
Set value	Position out of tolerance threshold mode															
0	Encoder Eeprom															
1	Driver 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						
<table><tr><td>Set value</td><td>Internal tralectory actual position source</td></tr><tr><td>0</td><td>Shaft actual position</td></tr><tr><td>1</td><td>Shaft command position</td></tr></table>											Set value	Internal tralectory actual position source	0	Shaft actual position	1	Shaft command position
Set value	Internal tralectory actual position source															
0	Shaft actual position															
1	Shaft command position															

Subindex	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	$0 \sim (2^{63} - 1)$	Factory setting	0	Accessibility	RO	Related mode	-	Map	NO

8.3.5. Speed Control Parameters

Index	Name	Speed control parameters					Data structure	ARR	Data type	Uint16
	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
	Data range	-	Factory setting	63h	Accessibility	RO	Related mode	-	Map	NO

Subindex	Name	Jog speed (unit: rpm)					Data structure	-	Data type	Uint16
	Data range	0~6000	Factory setting	100	Accessibility	RW	Related mode	-	Map	YES

Set the jog operation speed command value when using the servo driver button jog function. To use the servo driver 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
	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
	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
	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
	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
	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 driver 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 driver.

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

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

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

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

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

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

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

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

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

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

8.3.6. Torque Control Parameters

Index	Name	Torque control parameters					Data structure	ARR	Data type	Uint16
	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 torque 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 IN

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: Driver 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

8.3.7. Gain Parameters

Index	Name	Gain parameters					Data structure	ARR	Data type	Uint16
	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
	Data range	-	Factory setting	52h	Accessibility	RO	Related mode	-	Map	NO

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

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

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

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

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

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

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

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

Subindex	Name	Speed feedback smoothing filtering					Data structure	-	Data type	Uint16
14h	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	Name	Speed feedback low-pass filter cut-off frequency (unit: 1Hz)					Data structure	-	Data type	Uint16
15h	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

8.3.8. Auto-tuning Parameters

Index	Name	Auto-tuning parameters					Data structure	ARR	Data type	Uint16
	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
	Data range	-	Factory setting	21h	Accessibility	RO	Related mode	-	Map	NO

Subindex	Name	Auto-tuning mode					Data structure	-	Data type	Uint16
	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
	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
	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
	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
	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
	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
	Data range	-	Factory setting	-	Accessibility	RO	Related mode	-	Map	YES

Subindex	Name	Adaptive notch mode selection					Data structure	-	Data type	Uint16										
	Data range	0~4	Factory setting	0	Accessibility	RW	Related mode	-	Map	YES										
<table><tr><th>Set value</th><th>Function</th></tr><tr><td>0</td><td>Disable adaptive notch</td></tr><tr><td>1</td><td>Adaptive notch setting Group 3</td></tr><tr><td>2</td><td>Adaptive notch setting Group 3/4</td></tr><tr><td>4</td><td>Restore default notch settings</td></tr></table>											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
											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 2nd 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 2nd 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 time (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

8.3.9. Communication Parameters

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

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

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

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

Subindex	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 CIA402 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	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 IN					Data structure	-	Data type	Uint16
12h	Data range	0~1	Factory setting	0	Accessibility	RW	Related mode	-	Map	NO

Subindex	Name	Virtual IN 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 OUT					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

8.3.10. Auxiliary Parameters

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

Subindex	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	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	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								
	Data range	0~2	Factory setting	0	Accessibility	RW	Related mode	-	Map	NO								
0Fh																		
<table><tr><td>Set value</td><td>Function</td></tr><tr><td>0</td><td>No effect</td></tr><tr><td>1</td><td>AI1 zero drift correction</td></tr><tr><td>2</td><td>AI2 zero drift correction</td></tr></table>											Set value	Function	0	No effect	1	AI1 zero drift correction	2	AI2 zero drift correction
Set value	Function																	
0	No effect																	
1	AI1 zero drift correction																	
2	AI2 zero drift correction																	

Subindex	Name	IN/OUT 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

8.3.11. Monitor Parameters

Index	Name	Monitor parameters					Data structure	ARR	Data type	Uint16
	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
	Data range	-	Factory setting	61h	Accessibility	RO	Related mode	-	Map	NO

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

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

Subindex	Name	Motor torque (unit: 0.1%)					Data structure	-	Data type	Uint16
	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
	Data range	-	Factory setting	-	Accessibility	RO	Related mode	-	Map	NO
Display the current torque command value of the servo driver, 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
	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 driver.										

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, $P13.22 = (P13.21 \div \text{Encoder pulse count}) \times 360^\circ$.

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: $\frac{1}{288}\mu s$)					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: $\frac{1}{288}\mu s$)					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: $\frac{1}{288}\mu s$)					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

8.4. 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 driver 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: 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 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	ReveR5L 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 driver 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 driver:

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	Warning	0: Invalid; 1: effective
8	Manufacturer specific	Undefined function
9	Remote	0: Invalid; 1: effective (Control word takes effect)
10	Target reach	0: Invalid; 1: effective
11	Internal limit active	0: Invalid; 1: effective
12~13	Operation limit active	Related to various servo operation modes
14	Manufacturer specific	Undefined function
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 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 driver:

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
	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
	Data range	-	Factory setting	-	Accessibility	RO	Related mode	ALL	Map	TPDO

Index	Name	Speed window (unit: rpm)					Data structure	VAR	Data type	Uint16
	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 OUTFunction signal output and is valid.

Index	Name	Speed window time (unit: ms)					Data structure	VAR	Data type	Uint16
	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
	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
	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	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	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	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	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	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	Name	The maximum number of subindex for software absolute position limitation					Data structure	-	Data type	Uint8
	Data range	-	Factory setting	2	Accessibility	RO	Related mode	-	Map	NO

Subindex	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	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	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	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	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	Name	Profile acceleration (unit: command/s ²)					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	Name	Profile deceleration (unit: command/s ²)					Data structure	VAR	Data type	Uint32
	Data range	$1 \sim (2^{32} - 1)$	Factory setting	131072	Accessibility	RW	Related mode	PP/PV/C SP/CSV	Map	RPDO

Set deceleration in profile position mode and profile velocity mode.

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

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

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

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

Index	Name	Homing method					Data structure	VAR	Data type	Int8
6098h	Data range	0~35	Factory setting	19	Accessibility	RW	Related mode	HM	Map	RPDO

Please refer to the chapter on '[Homing Mode \(HM\)](#)'

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

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

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

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

Index	Name	Position offset (unit: command unit)					Data structure	VAR	Data type	Int32
60B0h	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	Name	Speed offset (unit: command/s)					Data structure	VAR	Data type	Int32
60B1h	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	Name	Torque offset (unit: 0.1%)					Data structure	VAR	Data type	Int16
60B2h	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: IN 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: IN 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

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: IN indicates a low level 1: IN 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: IN indicates a low level 1: IN indicates a high level	Meaningless

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

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

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
	Data range	-	Factory setting	-	Accessibility	RO	Related mode	-	Map	TPDO

Reflecting the current IN terminal logic of the driver: 0-logic invalid, 1-logic valid:

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

Index	Name	Digital output					Data structure	VAR	Data type	Uint32
	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
	Data range	-	Factory setting	2	Accessibility	RO	Related mode	-	Map	NO

Subindex	Name	Output enable					Data structure	VAR	Data type	Uint32
	Data range	0~(2 ³² - 1)	Factory setting	0	Accessibility	RW	Related mode	-	Map	RPDO

Reflect the output logic of the driver OUT port:

Bit	Related output port	Description
0~15	NA	
16	OUT1	Forced output (0: OFF, 1: ON), only takes effect when Bit16 of 60FE-02h is set to 1
17	OUT2	Forced output (0: OFF, 1: ON), only takes effect when Bit17 of 60FE-02h is set to 1
18	OUT3	Forced output (0: OFF, 1: ON), only takes effect when Bit18 of 60FE-02h is set to 1
19	OUT4	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 OUT 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 OUT forced output:

Bit	Related OUT port	Description
0~15	NA	
16	OUT1	0: Prohibit forced output of OUT1 1: Enable OUT1 to force output
17	OUT2	0: Prohibit forced output of OUT2 1: Enable OUT2 to force output
18	OUT3	0: Prohibit forced output of OUT3 1: Enable OUT3 to force output
19	OUT4	0: Prohibit forced output of OUT4 1: Enable OUT4 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 driver:

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

9. Troubleshooting

When the servo fails, the servo driver LED will display the error 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	Driver warning code, which does not affect the enabled operation of the driver when it appears, is only used as a warning prompt.

9.1. Error Code

Error code	Fault content
AL.000	Normal state
AL.100	<p>System parameter error</p> <p>Most cases occur after system firmware updates, when unsupported parameters are set on the driver. It is necessary to restore the factory settings and power off for 30 seconds before restarting the driver. If the driver 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.</p>
AL.101	<p>The driver failed or timed out reading parameters stored in EEPROM</p> <p>Generally, due to abnormal communication of the EEPROM chip, please completely power off the driver for 30s before restarting it. If the alarm code still appears, please contact the manufacturer's after-sales service or replace it.</p>
AL.102	<p>Failure or timeout in writing driver parameters to EEPROM</p> <p>Generally, due to abnormal communication of the EEPROM chip, please completely power off the driver 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.</p>
AL.103	<p>The driver parameters are abnormal or the parameter range is incorrect</p> <p>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).</p>

AL.104	The parameter settings of the driver 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	<p>AL.110: Drive IPM module overcurrent</p> <p>AL.111: Drive ADC overcurrent</p> <p>A. Whether the motor collides or not causes a blockage</p> <p>B. Motor P06.00、P06.01、P06.02、P06.60、P06.61、P06.63、P06.64 improper settings caused. Try to restore the driver parameters and restart to see if the warning still exists. If a warning still appears, please contact the manufacturer for after-sales service.</p> <p>C. By setting the P05.04 parameter, try to reduce the overload multiple of the driver to test whether there is an alarm.</p>
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	<p>Drive internal voltage error</p> <p>The internal voltage fault of the drive is usually caused by the internal hardware of the driver. If the error persists after restarting the power supply, please contact the manufacturer's after-sales service.</p>
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	<p>Driver Encoder Interference</p> <p>A. Please check whether the motor PE cable connection is reliable</p> <p>B. Check that the encoder plug is connected reliably</p> <p>C. Replace the driver to check whether the fault is caused by the motor encoder</p>
AL.121	<p>Encoder communication error</p> <p>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.</p>

	B. If the driver 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	<p>Encoder EEPROM read and write failure</p> <p>It generally occurs during power on or operation of the encoder EEPROM. When power on occurs, try restarting the driver 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 driver for comparison and confirmation.</p>
AL.127	<p>Encoder failure</p> <p>A. Appears during power-on initialization, the incremental encoder reads the hall signal incorrectly when power-on, and the communication encoder shows that the driver cannot communicate with the encoder.</p> <p>B. Please check that the encoder cable connection is reliable</p>
AL.128	<p>The motor model setting is incorrect</p> <p>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.</p>
AL.129	Incremental encoder interference
AL.130	<p>Motor runaway fault</p> <p>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.</p>
AL.133	<p>The parameter value range is abnormal</p> <p>Use P13.51 to check the abnormal group number, and P13.52 to check the intra group offset of the abnormality.</p>
AL.134	Driver peripheral initialization, PHY initialization failed.
AL.135	<p>Unsupported motor encoder type</p> <p>please check if P00.00 motor model is set to 50000.</p>
AL.136	Product mismatch, unsupported motor Model
AL.137	<p>The driver model is set incorrectly</p> <p>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.</p>
AL.138	The driver and motor do not match

	The rated current of the driver is less than the rated current of the motor. Replace with a higher power driver or reduce the rated current of the motor.
AL.139	Driver 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 driver does not support.
AL.160	FPGA parameter initialization error It appears when the driver is powering on and initializing, power off the driver for 30s, then restart it to see if it still alarms, if it still alarms, please replace the driver.
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	Driver Q-axis feedback overcurrent
AL.181	Driver U-phase feedback overcurrent
AL.182	Driver V-phase feedback overcurrent
AL.183	Driver W-phase feedback overcurrent
AL.185 AL.186	Driver 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 meet 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	Driver 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 driver with a new one to check if it is caused by damage to the driver.
AL.211	Driver 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 driver.
AL.212	Driver bus voltage is high A. It occurs when the bus voltage of the driver 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

	<p>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.</p> <p>It is necessary to manually set the P12.05 parameter to 1 to clear this fault.</p>
AL.222	<p>Encoder multi-turn data alarm</p> <p>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 driver's multi turn encoder is no longer correct and needs to be reset to zero.</p> <p>It is necessary to manually set the P12.05 parameter to 1 to clear this fault.</p>
AL.223 AL.224	<p>The multi-turn encoder counts overflow</p> <p>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.</p>
AL.225 AL.226	<p>The speed feedback exceeds the maximum motor speed setting value</p>
AL.240	<p>Position is out of tolerance</p> <p>A. Check that the power cable is properly connected</p> <p>B. Check that the electronic gear ratio parameters are set correctly</p> <p>C. Check that the frequency of the pulse input exceeds the maximum speed of the motor</p>
AL.241	<p>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.</p>
AL.242	<p>The position deviation of the full closed loop is too large.</p>
AL.244	<p>Driver overload fault</p>
AL.245 AL.246	<p>Motor overload fault</p>
AL.247	<p>Motor stall fault</p>
AL.248	<p>Driver over temperature fault</p>
AL.249	<p>Motor over temperature fault</p>
AL.270	<p>Digital input port function parameter setting fault</p>
AL.271	<p>Digital output port function parameter setting fault</p>
AL.272	<p>Current D/Q axis calculation overflow</p>
AL.273	<p>Inertia identification anomaly</p>
AL.274	<p>Angle identification fault</p>

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 driver 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.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 AL.412 AL.413 AL.415 AL.416 AL.417	Parameter identification exception
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 driver 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 driver.
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.