iK3 AC Servo Drive

EtherCAT Based

User Manual 2018（V1.5）

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Chapter 1 Security Alert

Please use the servo driver and servo motor according to the specified method, otherwise it may cause fire or equipment failure.

ITEMS	METHODS	CHECK
Is the iK3 series received a product that is not ordered?	Check the model numbers on the motor and drive nameplates respectively. Refer to the model description listed in the next section.	
Is the product damaged?	Visually inspect for any appearance of any damage or scratches. If you find any kind of missing or damaged, please contact our company or your supplier.	
Is the axis of the servo motor free to rotate?	Rotate the motor shaft by hand. If it can run smoothly, it means that the motor shaft is normal. However, motors equipped with electromagnetic brakes cannot be smoothly operated by hand!	
Is the screw loose or loose?	Check visually for any screws that are not locked or detached. If so, contact the company or your supplier.	

If you find any abnormal situation, please immediately contact the sales shop or the company when you purchased the product.

1.1 Electric shock warning

Warning

- Do not open the enclosure of the machine when the drive is powered on to avoid electric shock.
- When the case is opened, do not apply power to the driver to avoid touching the exposed high-voltage parts and getting an electric shock.
- When the driver is being serviced, wait at least 5 minutes after turning off the power, and use a voltmeter to check both ends of the high-voltage capacitor and confirm that the safe voltage has been reduced before proceeding.
- Please mount the drive reliably before turning on the power.
- Servo drives and servo motors must be reliably grounded.
- Do not touch the driver when it is wet to avoid electric shock.
- Wrong voltage or power polarity may cause an explosion or an operating accident.
- Ensure that the wires are insulated and avoid squeezing the wires to avoid electric shock.

1.2 Device damage warning

Warning

- Do not connect the power supply directly to the outputs of the drives U, V, W. This will damage the drive.
- The servo motor and the servo driver must be connected directly. Do not connect capacitive components such as noise suppression filters and impulse interference limiters to the outputs of the drivers U, V, and W. This will prevent the driver from working properly.
- Please connect the input of the driver to the power supply that meets the standard as required.
- Verify the correctness and reliability of the cable connection before applying power.
- Please purchase and use the motor as required, otherwise it may damage the driver and motor.
- The rated torque of the servo motor is higher than the effective continuous load torque.
- The ratio of load inertia to servo motor inertia should be less than the recommended value.

1.3 Fire warning

Warning

- The drive must not be mounted on the surface of flammable objects and away from flammable materials. Otherwise it may cause fire.
- Do not use in a humid, corrosive gas, flammable gas environment. Otherwise it may cause fire.
- If there is an abnormal situation when the driver is working, please cut off the power immediately for maintenance. Overloading the drive for a long time may cause damage and fire.

1.4 Environmental requirements

Parameter	Condition
Humidity	≤90% (non-condensing)
Operating temperature	0 to +40°C (without frost)
Storage temperature	-40 to +55°C
Elevation	1000m below sea level
Vibration	less than 0.5G (4.9m/s) 10-60HZ (discontinuous operation) 2
Air environment	Non-corrosive, flammable gas, no oil mist

1.5 Daily inspection

Daily inspections and periodic inspections should be carried out according to the following points:

Type	Inspection period	Inspection items
Daily inspections	Daily	Confirm ambient temperature, humidity, dust, foreign matter, etc.
		Is there abnormal vibration and noise
		Is the power supply voltage normal?
		Is there any smell
		Whether the vents have fiber heads
		The front of the driver, the cleanliness of the connector
		Is there any foreign matter entering the load?
Periodic inspection	1 year	Is there a loose fastening area?
		Is there any signs of overheating?
		Terminal table is damaged
		Is the fastening of the terminal block loose?

Do not perform disassembly and repair work other than this company. Electrical and electronic components inside the servo unit are subject to mechanical wear and deterioration. To prevent and maintain servo drives and motors, replace them with the standards shown in the following table. When replacing, contact our company or our agent. We will judge whether to replace the parts after the investigation.

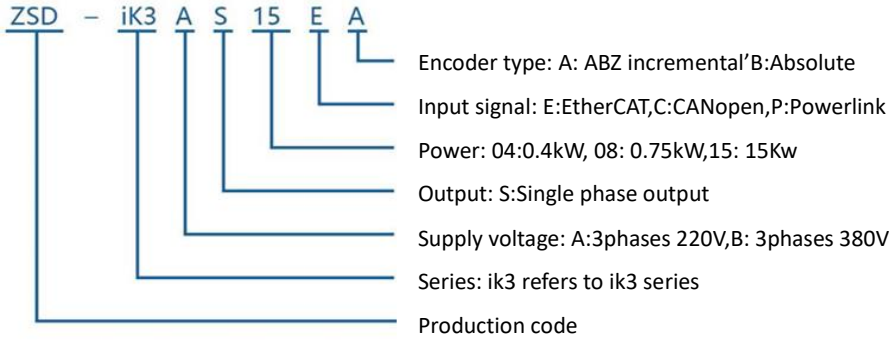
Objects	Items	Replacement period	Remark
Drive	Bus filter capacitor	About 5 years	The standard replacement cycle is for reference only. Even if the standard replacement cycle is not full, it should be replaced in the event of an abnormality.
	Cooling fan	2~3 years (1~30,000 hours)	
	Circuitboard aluminum electrolytic capacitor	About 5 years	
	Power on buffer relay	About 100,000 times (life varies depending on conditions of use)	
	Buffer resistance	About 20,000 times (life varies according to use conditions)	
Motor	Bearings	3~5 years (2~30,000 hours)	
	Oil seal	5000 hours	
	Encoder	3~5 years (2~30,000 hours)	
	Absolute encoder battery	Lifespan varies according to the conditions of use. Please refer to the instructions attached to the battery for absolute encoders	

Chapter 2 Product Information and Installation Instructions

2.1 Drive Introduction

2.1.1 Servo Drive Model Description

iK3 Series bus servo driver naming：



2.1.2 Servo drive specifications

1) 220V Servo drives

Item	220V Servo drive specifications					
Servo drive power	0.4kW	0.75kW	1.5kW	2.2kW	3kW	5kW
Continuous output current Arms	2.8	5.5	10	12	16	25
Max output current Arms	8.4	16.5	30	36	48	75
Main circuit supply	Single/three phases AC220V，+10%~-15%，50/60Hz					
Control supply	Single phase AC220V，+10%~-15%，50/60Hz					

2) 380V Servo drives

Item	380V Servo drive specifications	
Servo drive power	5.0KW	7.5KW
Continuous output current Arms	12	20
Max output current Arms	36	60
Main circuit supply	Three phases AC380V，+10%~-15%，50/60Hz	

2.1.3 Basic functions

Basic specifications	Control mode		IGBT PWM control, sinewave current drive
			220V: Single phase or three phases full wave current
	Encoder		2500lines incremental encoder
			17bits absolute encoder
	Working environment	Use/storage temperature	0~45℃(derating above 45℃, average load rate ≤80%) / 40~70℃
		Use/storage humidity	Less 90%RH(no condensation)
		Anti-vibration/ impact resistance	4.9m/s2, 19.6m/s2
		Altitude	Lower than 1000m above sea level

EtherCAT Slave Specifications	EtherCAT-Slave Basic functions	Protocol	EtherCAT
		Service supported	CoE(PDO,SDO)
		Synchronous	DC- distribution clock
		Physical layer	100BASE-TX
		Baud rate	100Mbit/s(100BASE-TX)
		Duplex mode	Full duplex mode
		Topological structure	Spherical, line type
		Transmission media	STP CAT5E(Shielded Twisted Pair) or higher standard cables
		Transmission distance	100m between two nodes(good environment and cables)
		Slave number	Support 65535 as per protocol, actual use less 100 pcs
		EtherCAT frame length	44byte~1498byte
		Process data	Max 1486byte for single Ethernet frame
		Two slaves synchronous joggle	<1us
		Refresh time	30us for 1000 switch input/output
			100us for 100 servo axis
		Error rate of communication	10-10 Ethernet standard
	EtherCAT Configuration Unit	FMMU unit	8 nos
		Storage syn-operation unit	8 nos
		Process data RAM	8KB
		Distributed clock	64bit
		EEPROM	32Kbit
Analog signals	Analog-speed command input	Input voltage	-10V ~ +10V
	Analog-torque command input	Input voltage	-10V ~ +10V
Input&output signals	Digital input Signals	Signal-allocation and functions	5 DI
			Servo enable, positive/reverse motion prohibition, positive/reverse current prohibition, positive/reverse limit switch, back to zero close switch, bus IO input, probe1, probe2, fault reset
	Digital output Signals	Signal-allocation and functions	3 DO
			Servo back to zero completion, servo operation preparation completion, servo fault, position trace overrun, aim position arrive, STO enable mark, bus IO output, brake output
Built-in functions	OT(over travel) prohibition		Immediately stop once upon P-OT,N-OT
	E-gear ratio		0.1048576≤ B/A ≤ 419430.4
	Protection		Over current, over voltage, under voltage, over load, over heat, main circuit abnormal, phase loss, over speed, encoder abnormal, CPU abnormal, parameter abnormal, etc.
	LED display		Main supply charge, 5 bit display
	RS232		Status display, parameter setting, monitor display, alarm trace display, JOG operation and auto tune, surveying and mapping of speed and torque command signals
	Others		Gain adjustment, alarm record

2.2 Installation Instructions

iK3 series servo drivers are base-mounted and improper installation may give rise to failures. Please install the servo driver properly by following the instructions below.

2.2.1 Storage conditions

The servo driver should be kept in a place with an ambient temperature of [-20~+60]℃ ,10~90%RH when not used.

2.2.2 Installation site

- Temperature: 0 ~ 55°C;
- Ambient humidity: not higher than 90% RH (no condensation);
- Sea level not higher than 1000 m;
- Maximum vibration: 4.9m/s^2;
- Maximum Impact: 19.6m/s^2;
- Other installation precautions:

- Installed in a control cabinet

Attention should be paid to the size of the control cabinet, the placement mode of servo driver and cooling mode, in order to ensure that the ambient temperature for the servo driver is under 55℃. Please refer to description in Section 1.2.2 for operation details;

- Installed near heat source

The radiation of the heat source and temperature rise caused by convection should be under control, in order to ensure that the ambient temperature for the servo driver is under 55℃;

- Installed near vibration source

A vibration isolation device should be installed to avoid vibration passing to the servo driver;

- Installed in a place exposed to corrosive air

Necessary measures should be taken to prevent the servo driver from exposing to corrosive air. Corrosive air may not immediately affect servo driver but will obviously cause the failure of electronic components and relevant elements of the contactor;

- Other occasions

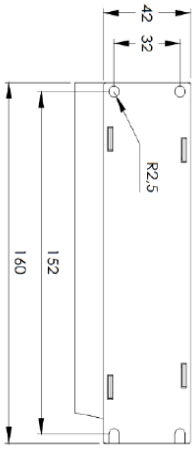
Servo driver should not be put in occasions of high temperature, high humidity, condensation dripping, oil splashing, dust, scrap iron or radiation; Note: when cutting off the power to store the servo driver, please put the driver in a place with the following environmental conditions: -20~60℃, 90% RH below (no condensation)

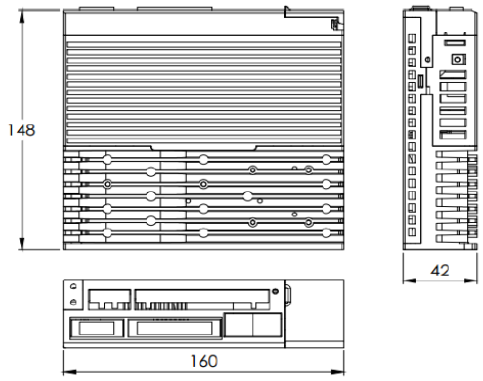
2.2.3 Installation direction

The direction of installation should be vertical to the mounting surface and two mounting holes should be used to reliably fix the servo driver on the installation base. If required, a fan should be installed to compulsorily cool the servo driver.

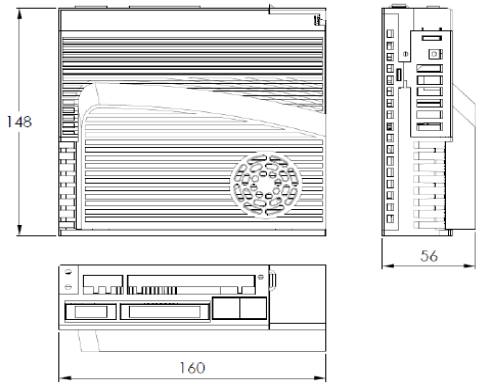
2.2.4 Size description

(1) 400W,750W Installation size



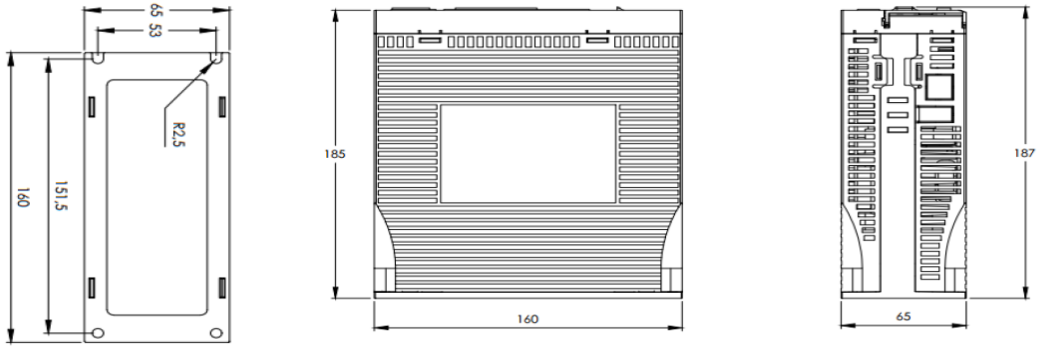


400W Drive appearance size

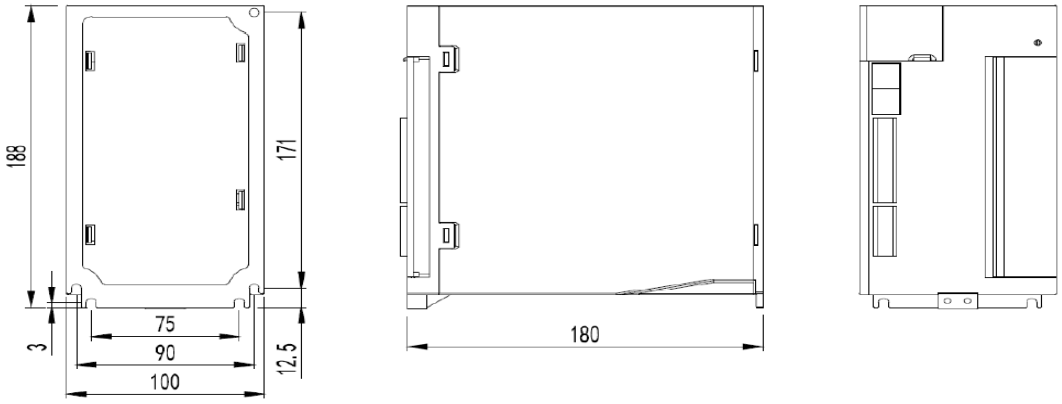


750WDrive appearance size

(2) 1.5kW 2.2kW



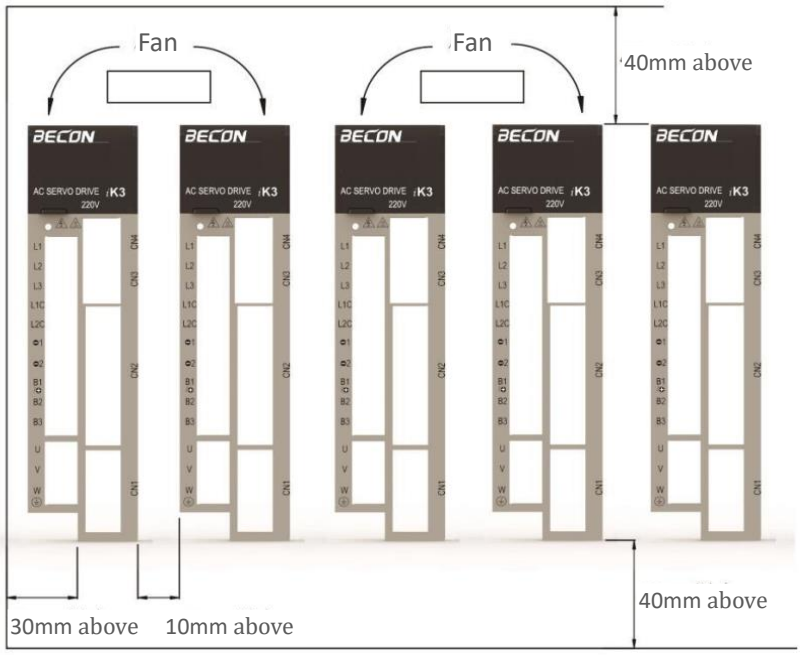
(3) 3kW 5kW



2.2.5 Multiple drive installation

If you need to install multiple servo drives side by side in the control cabinet, be sure to install and dissipate the heat as shown in the figure below.

Figure 2.2.5-1 Servo Drive Installation Diagram



■ Installation direction of servo driver

The front (wiring side) of the servo driver should face the operator and should be vertical to the mounting base.

■ Cooling Adequate space should be reserved around the servo driver to ensure cooling through a fan or free convection.

■ Parallel installation As shown above, a space of above 10 mm should be reserved at both sides of the horizontal direction and a space of above 50mm should be reserved at both sides of the vertical direction. The temperature inside the control cabinet should be kept even to avoid excess temperature in some parts of the servo driver. If necessary, a fan for compulsory cooling and convection should be installed above the servo driver.

■ Environmental condition for normal operation of servo driver

1. Temperature: 0~ 55℃
2. Humidity: below 90%RH (no condensation)
3. Vibration: below 4.9m/s2
4. To ensure long-term stable use, it is recommended to use the servo driver under an environmental temperature condition of 45℃ and below.

2.3 Wiring diagram

2.3.1 Single Phase 220V System Wiring Diagram

Line circuit breaker
Used to protect the power cord, cut off the power when overcurrent occurs

EMI filter
Install a noise filter to prevent external noise from the power cord

Electromagnetic contactor
Turn servo power on and off. Use surge suppressor when using

DC reactor
Factory default setting:short contact between "⊖1" and "⊖2".

Brake resistors
Using the internal braking resistor, short contact for B2 and B3 (factory default short contact); If the braking capacity is insufficient, connect the external braking resistors between B1/+ and B2 as well as remove the short contact between B2 and B3.

Servo motor
For the terminals of U,V and W

System ground

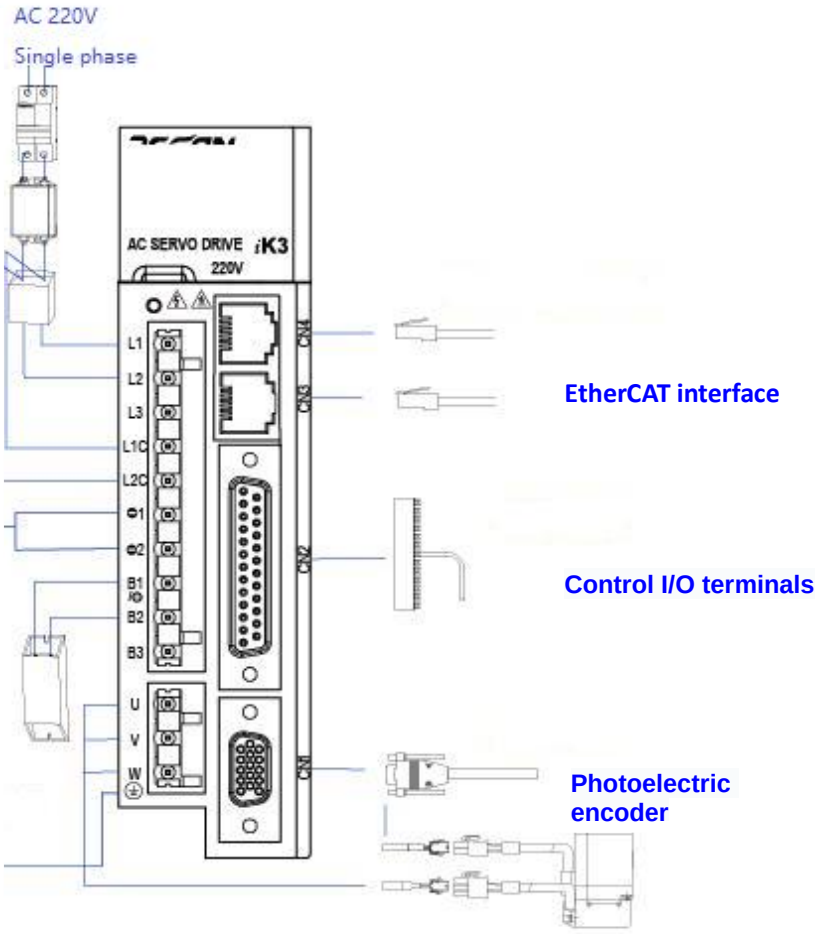


Figure 2.3.1 Single Phase 220V System Wiring Diagram

2.3.2 Three Phases 220V System Wiring Diagram

Line circuit breaker

Used to protect the power cord, cut off the power when overcurrent occurs

EMI filter

Install a noise filter to prevent external noise from the power cord

Electromagnetic contactor

Turn servo power on and off. Use surge suppressor when using

DC reactor

Factory default setting:short contact between "⊖1" and "⊖2".

Brake resistors

Using the internal braking resistor, short contact for B2 and B3 (factory default short contact); If the braking capacity is insufficient, connect the external braking resistors between B1/+ and B2 as well as remove the short contact between B2 and B3.

Servo motor

For the terminals of U,V and W

System ground

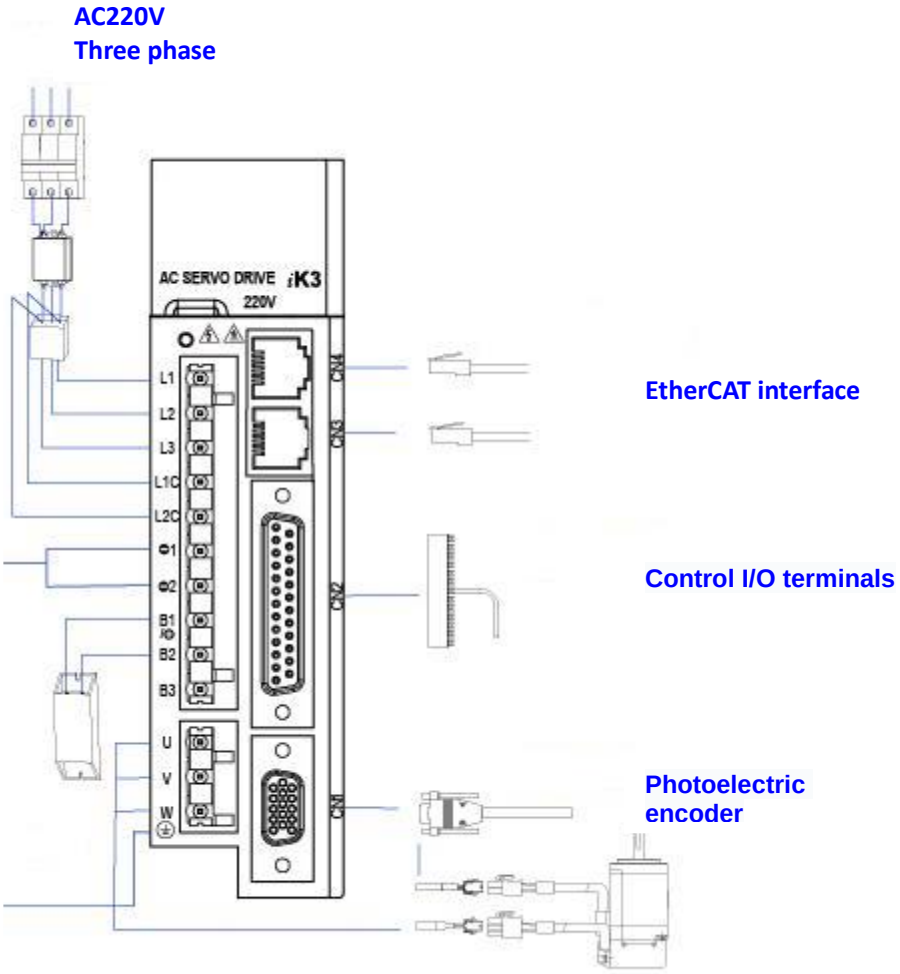


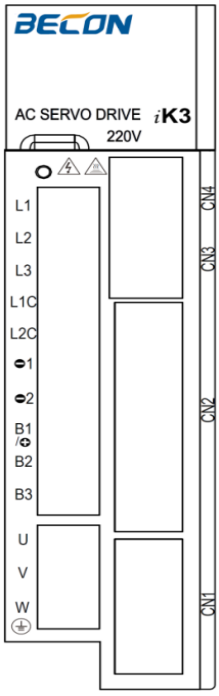
Figure 2.3.2 Three phases 220V System Wiring Diagram

Chapter 3 Wiring

Warning mark	Description
Danger	• The wiring work should be performed by professional technicians. • To prevent electric shock, turn the power off for 5 minutes or longer, and then remove the CHARGE lamp before turning on or off the drive. • Wiring should be performed after the servo driver and servo motor have been mounted. Otherwise, electric shock may occur. • Do not damage the cable, apply excessive tension, hang heavy objects, or squeeze it. Doing so may cause electric shock. • To avoid electric shock, insulate the power terminal connector. • The specifications and installation methods of external wiring need to meet the requirements of local regulations. • Be sure to ground the entire system.
Attention	• Do not pass the power cables and signal cables from the same duct and do not tie them together. When wiring, the power line and signal line should be more than 30cm away. Otherwise, it may cause malfunction. • Use multi-stranded and multi-stranded shielded wires for the signal line and encoder (PG) feedback line. For the wiring length, the longest command input line is 3m, and the longest PG feedback line is 20m. • Do not turn ON/OFF the power frequently. When it is necessary to continuously turn on/off the power repeatedly, control it within 1 minute once or less. Since there is a capacitor in the power supply section of the servo unit, a large charging current (charging time 0.2 seconds) flows when the power supply is turned on. Therefore, if the power is frequently turned ON/OFF, the performance of the main circuit components inside the servo unit may be degraded.

3.1 Terminal Introduction

iK3 Servo Drives



Terminal name	Functions	Instructions
L1、L2、L3	Main power terminal	Three phases AC220V（-15%~10%，50/60Hz）
L1C、L2C	Control power terminal	Single phase AC220V（-15%~10%，50/60Hz）
⊖1、⊖2	DC reactor terminals	At the time of delivery, ⊖1 and ⊖2 have been short-contacted. .
B1/⊕、B2、B3	Braking resistor terminal	When using an external braking resistor, connect the braking resistor between B1/⊕ and B2; when using the internal braking resistor, short-contact B2 and B3 (B2 and B3 are short-ontacted at the factory).
U、V、W、	Motor terminals and ground terminals	Must correspond to the motor UVW terminals one to one.
CN1	Motor encoder	Pay attention to the definition of the terminal. See the instruction manual 4.4
CN2	Terminals	Pay attention to the definition of the terminal. See the instruction manual 4.5
CN3	Function IO terminal	Pay attention to the definition of the terminal. See the manual 4.6 for details
CN4		

Note: The encoder terminals of the iK3 series: DB15 for CN1 and DB25 for function IO terminals.

3.2 Typical main circuit wiring example

3.2.1 iK3 Series 220V Single-Axis Main Circuit Wiring Diagram

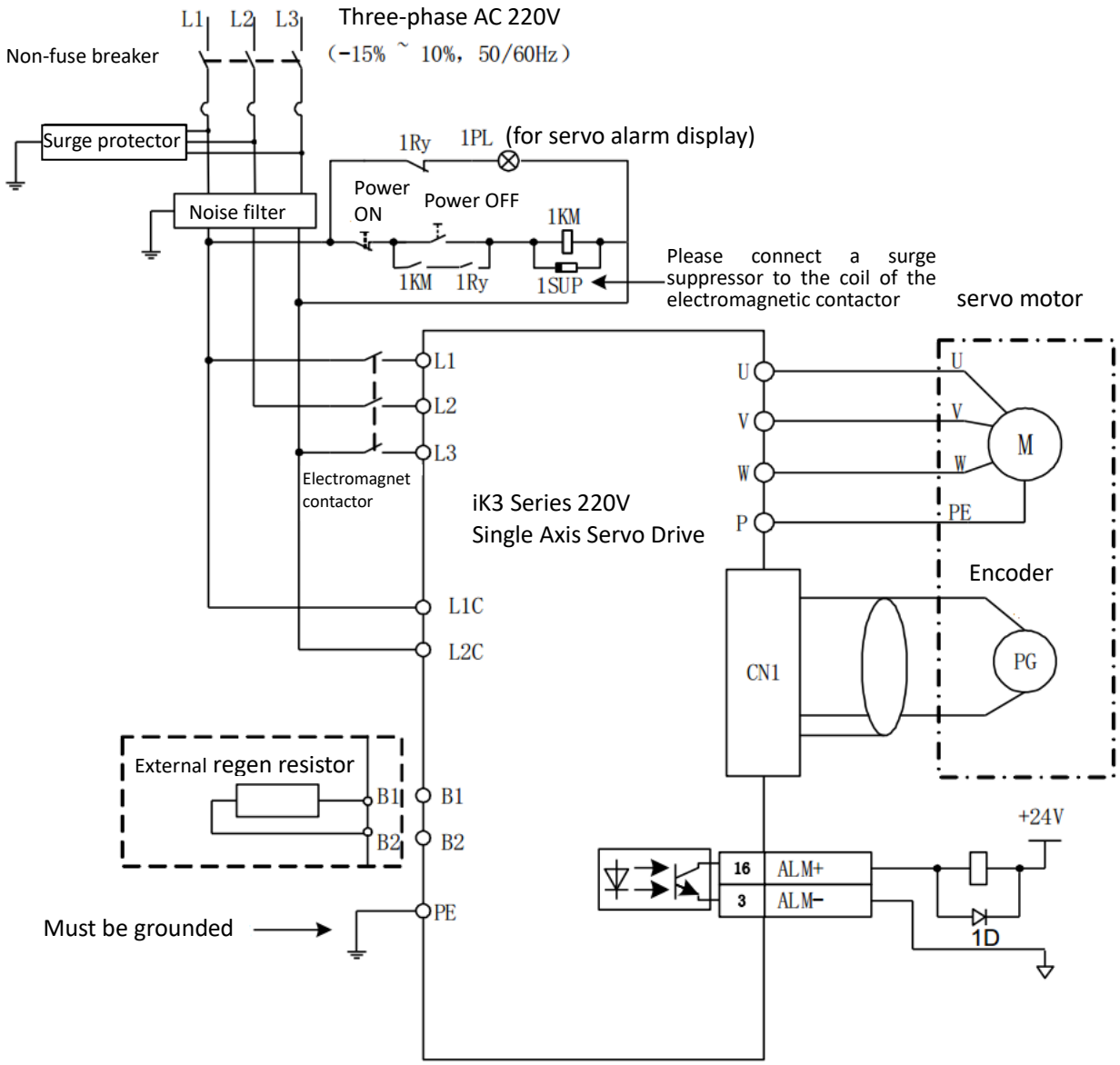


Figure 3.2.1-1 Three-phase 220V main circuit wiring

3.2.2 iK3 Series 380V single-axis main circuit wiring diagram

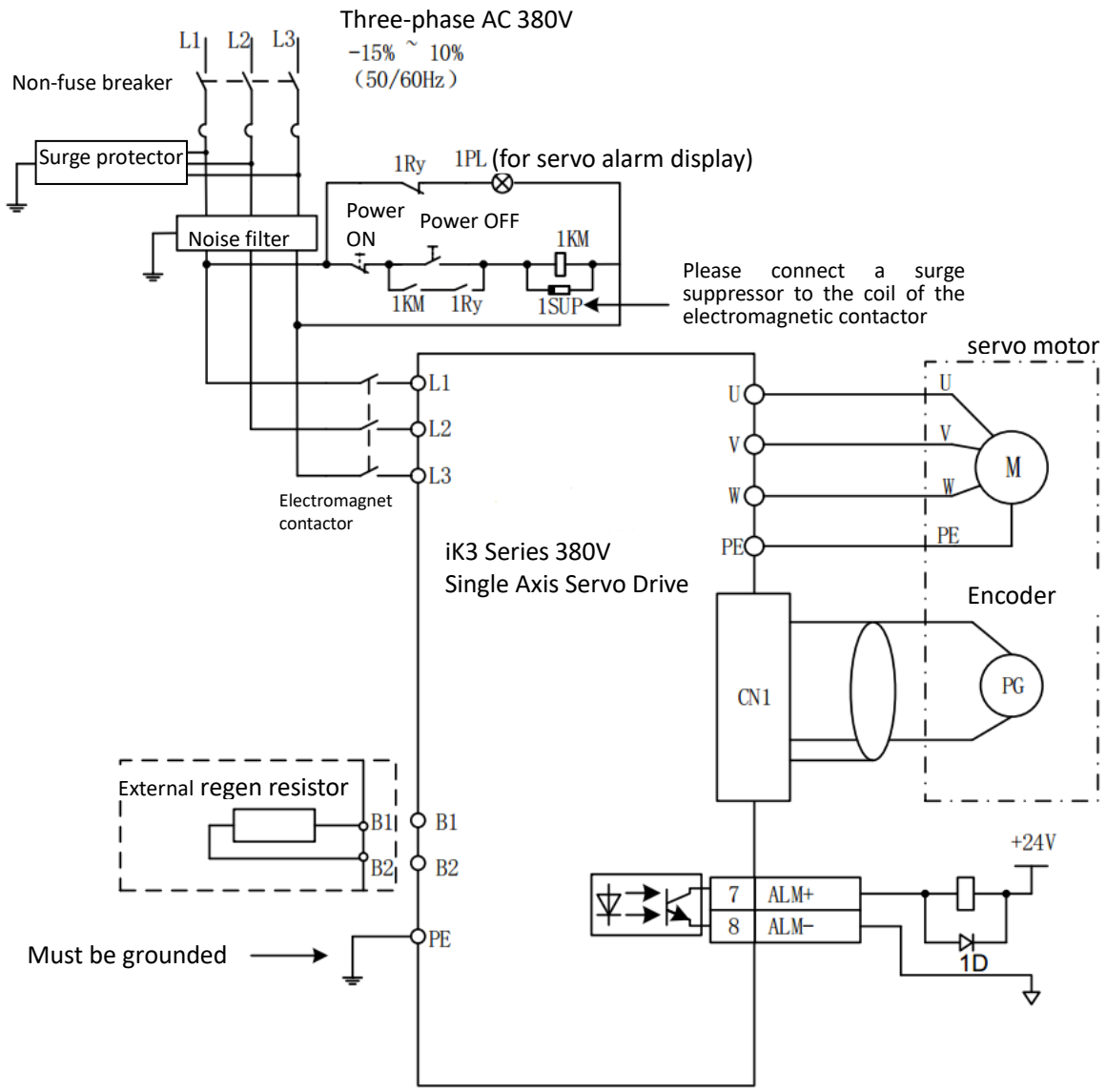
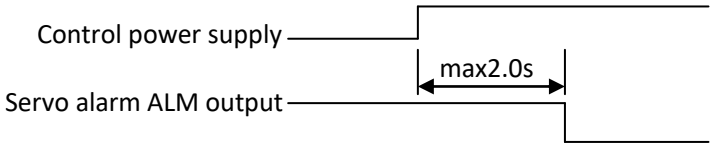


Figure 3.2.2-1 Three-phase 380V main circuit wiring

Attention：

Power ON Sequence Design - Consider the following points when designing the power ON sequence:

1. Design the power ON sequence as follows: Turn OFF the power supply after outputting the "Servo alarm" signal. (Please refer to the circuit diagram above.)
2. Keep pressing the power on button for more than 2 seconds. After the SERVOPACK control power is turned on, the "Servo alarm" signal (1Ry: OFF) is output for about 2 seconds. This is a necessary step for initial setting of the servo driver.



3. The power specifications of the parts used should be matched to the input power.

3.3 Control mode wiring diagram

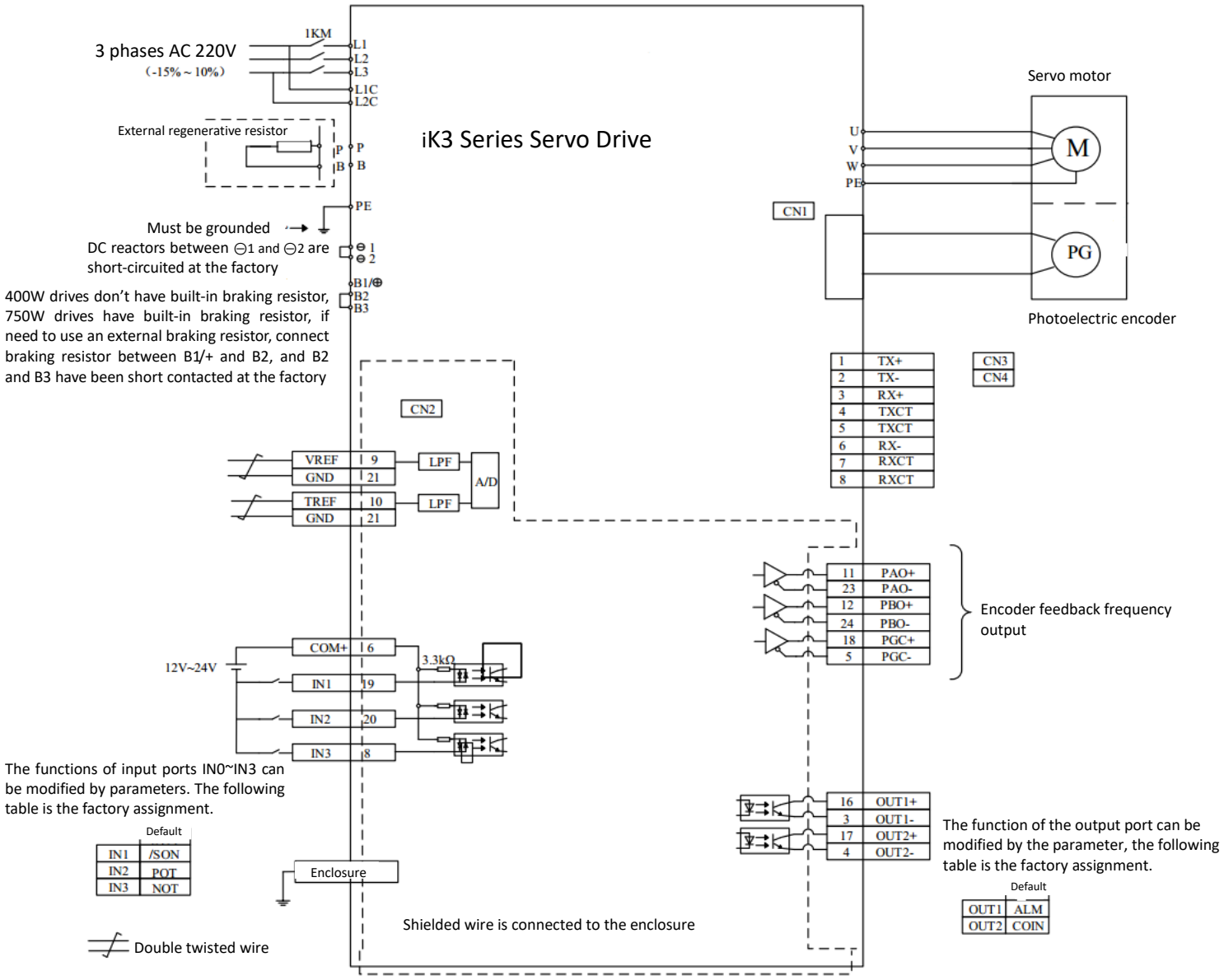
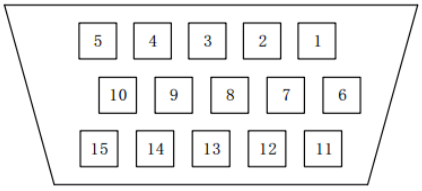


Figure 3.3-1 Speed/Torque Mode Wiring Diagram

3.4 Encoder signal wiring

The encoder and servo drive connection cables and their wiring pin numbers differ as per the servo motors.
iK3 series drive encoder definition.
The configuration diagram of the encoder connection terminal CN1 of the iK3 series drive, CN1 is a DB15 core socket.



iK3 Series Incremental Encoder Connection terminals CN1 Functions			
Terminal No.	Signal name	Mark	Function description
6	Power Output	+5V	Servo motor optical encoder +5V power supply; when the cable length is long, multiple core wires should be used in parallel.
1	Power ground	GND	
2	Encoder A+ input	A+	Connected to servo motor photoelectric encoder A+
3	Encoder A-input	A-	Connected to servo motor photoelectric encoder A-
4	Encoder B+ input	B+	Connected to servo motor photoelectric encoder B+
5	Encoder B-Input	B-	Connected to servo motor photoelectric encoder B-
10	Encoder Z+ input	Z +	Connected to servo motor photoelectric Encoder Z+
15	Encoder Z-Input	Z-	Connected to servo motor photoelectric encoder Z-,
14	Encoder U+ input	U+	Connected to servo motor photoelectric encoder U+
9	Encoder U-input	U-	Connected to servo motor photoelectric encoder U-
13	Encoder V+ input	V+	Connected to servo motor photoelectric encoder V+
8	Encoder V-input	V-	Connected to servo motor photoelectric encoder V-
12	Encoder W+ input	W+	Connected to servo motor photoelectric encoder W+
7	Encoder W-Input	W-	Connected to servo motor photoelectric encoder W-

iK3 Series Absolute Terminal Definition							
Terminal No.	Shell	6	1	12	7	10	15
Definition	Shield	PG5V	PG0V	SD+	SD-	E+	E-

iK3 Series Biss-C type connection terminal definition							
Terminal No.	Shell	6	1	10	15	12	7
Definition	Shield	5V	GND	CLK+	CLK-	PS+	PS-

3.4.1 Connection with encoder interface and output signal processing from function IO terminal

In the diagram：

- The connector wiring number differs depending on the servo motor used.
- Indicates multi-stranded shielded wire.
- The connector wiring number differs depending on the servo driver used.

(1) 2500 Incremental wire-saving encoder

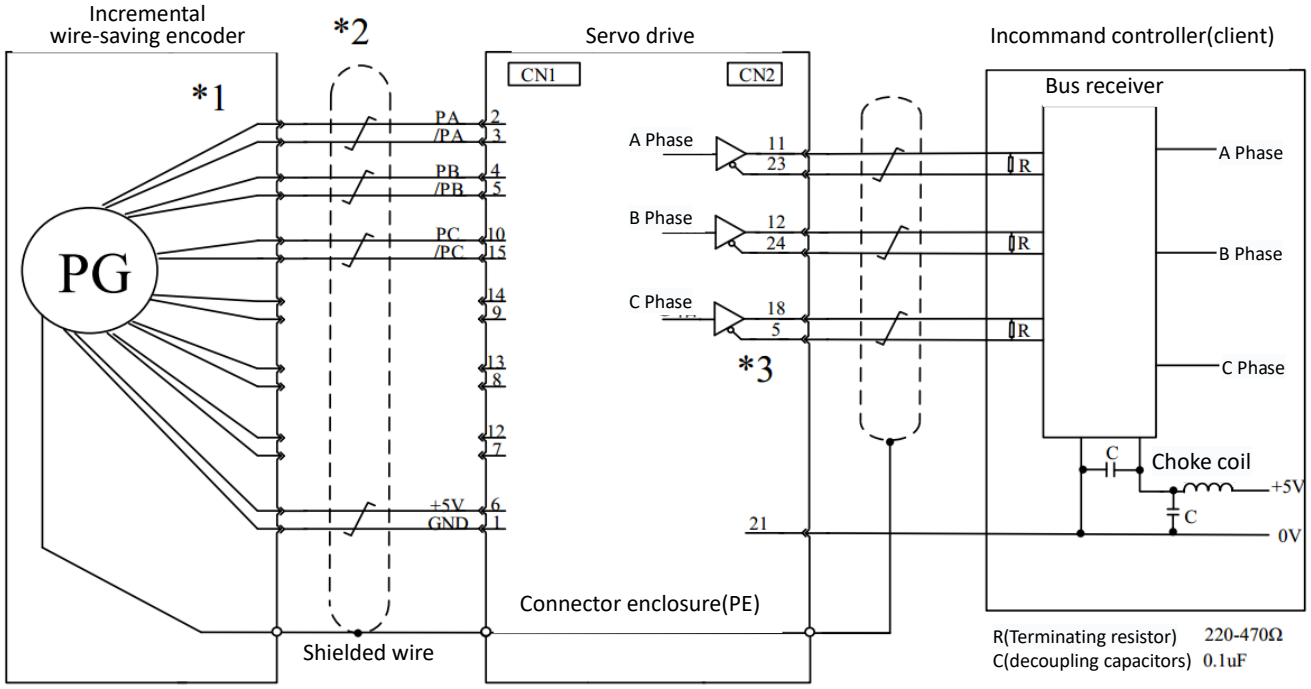


Figure 3.4.1-1 Incremental Wire-saving Encoder Wiring Diagram

(2) 2500 Incremental standard encoder

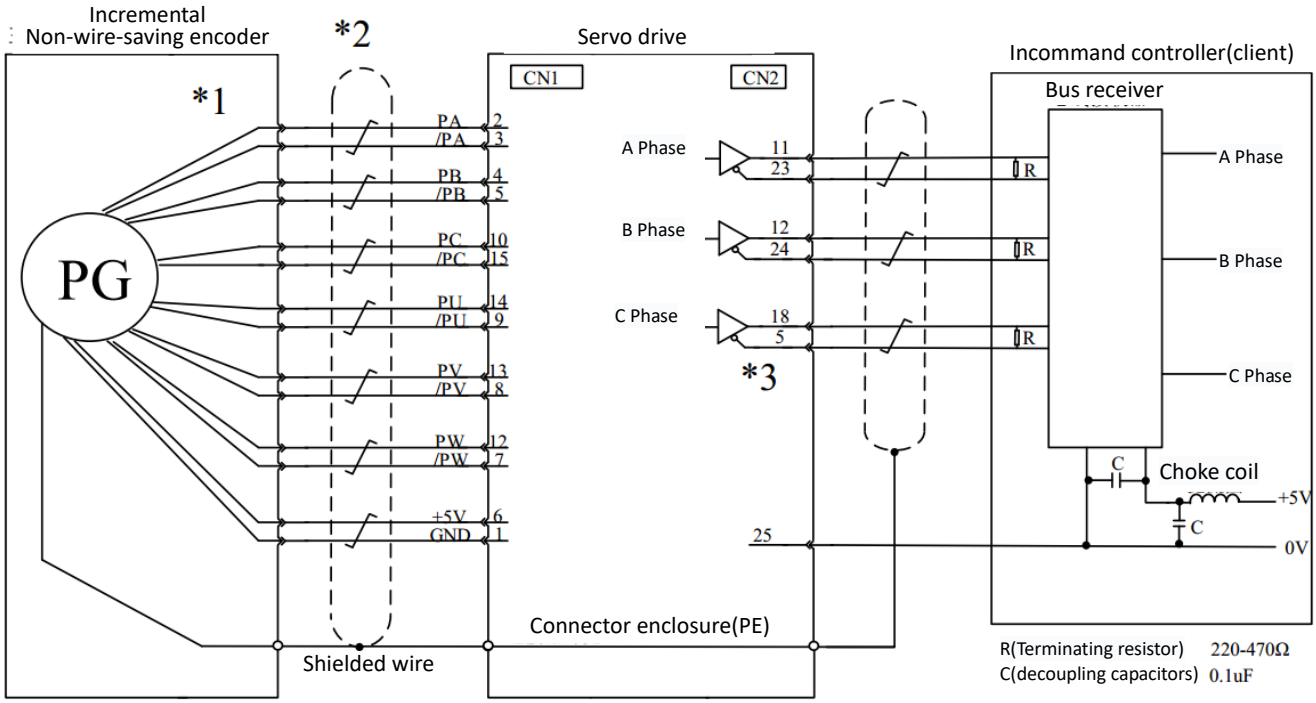


Figure 3.4.1-2 Incremental Standard Encoder Wiring Diagram

(3) Bus incremental encoder

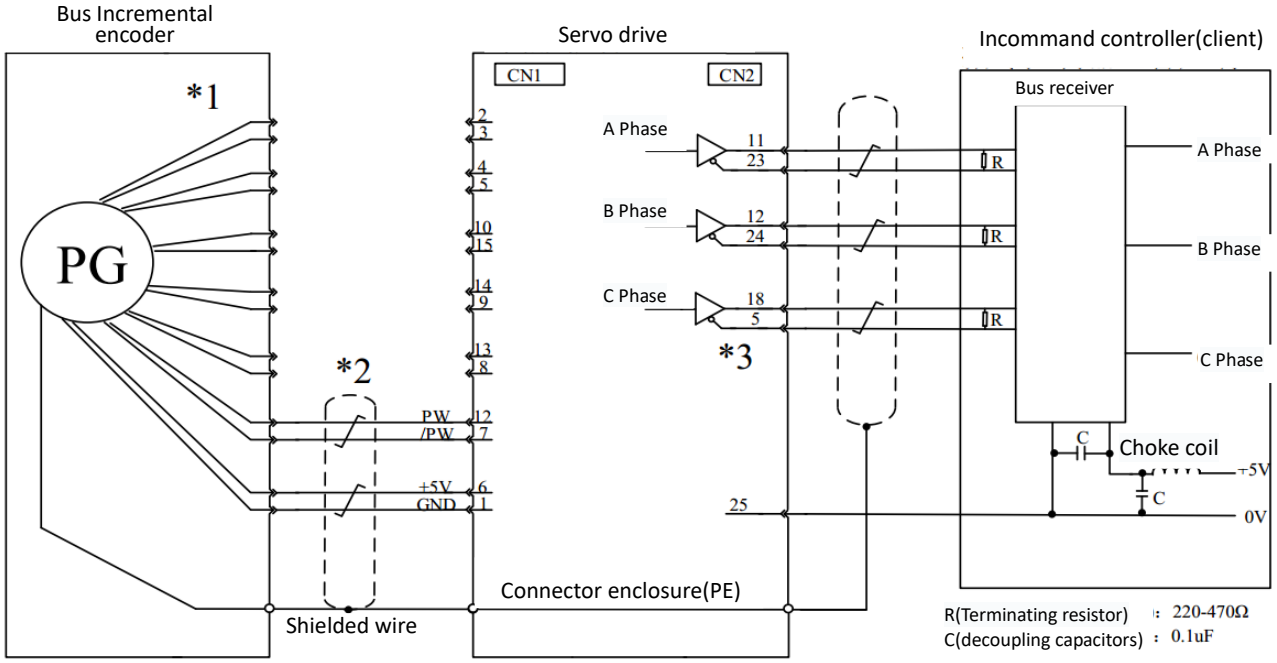


Figure 3.4.1-3 Bus Incremental Encoder Wiring Diagram

(4) Biss-C encoder

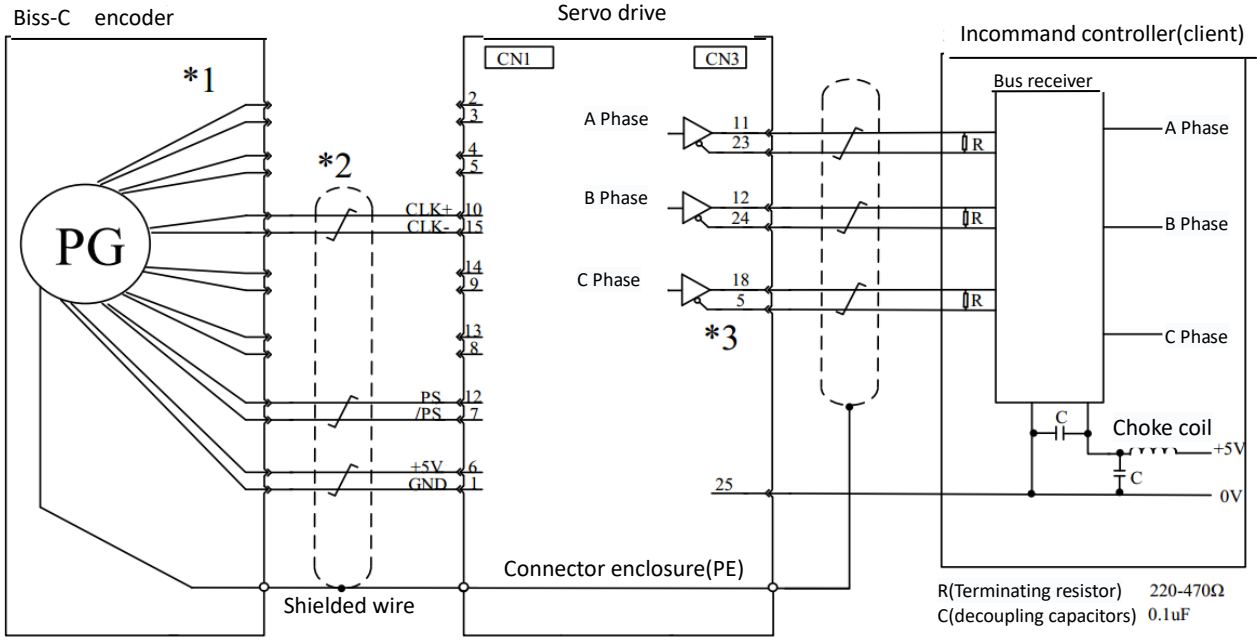
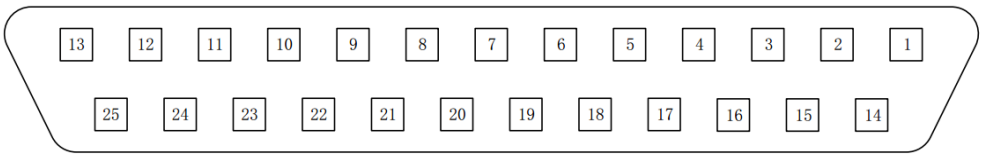


Figure 3.4.1-4 Biss-C encoder wiring diagram

3.5 Input and output connector signal names and their functions

3.5.1 Input/Output Function Terminals of iK3 Series Drivers (DB25)



iK3 Servo Drive I/O Terminal Function				
Terminal No.	Definition	Name in Manual	Signal Name	Function Description
1	I_STO1	I_STO1	Safe Torque Off 1	Safe torque off 1 input positive terminal
2	I_STO2	I_STO2	Safe torque off 2	Safe torque off 2 input positive terminal
14	STO_COM	STO_COM	Full torque off common	Safe torque off input common
7	I_PCON	DI2	Digital input signal 2	Digital input signal 2, function can be set, The default is Reverse Movement Prohibition
8	I_NOT	DI3	Digital input signal 3	Digital input signal 3, function can be set, The default is forward current limit
9	I_SPE_REF	AI0	Analog input signal 0	Analog input signal 0, function can be set, The default is the speed instruction given
10	I_TOR_REF	AI1	Analog input signal 1	Analog input signal 1, function can be set, The default is the speed instruction given
19	I_S-RUN	DI0	Digital input signal 0	Digital input signal 0, function can be set, The default is servo start
20	I_POT	DI1	Digital input signal 1	Digital input signal 1, function can be set, The default is forward movement prohibition
22	ALMRST	DI4	Digital input signal 4	Digital input signal 4, function can be set, The default is reverse current limit
6	COM+	COM+	Digital input signal common	Digital input signal common
13	I_SS	I_SS	Emergency stop signal positive	Emergency stop signal positive
25	SS_COM	SS_COM	Emergency stop signal negative	Emergency stop signal negative
11	PAO+	PAO+	Pulse frequency division output A phase positive	Pulse frequency division output A phase positive terminal
23	PAO-	PAO-	Pulse frequency division output A phase negative	Pulse frequency division output A phase negative terminal
12	PBO+	PBO+	Pulse frequency division output B phase Positive terminal	Pulse frequency division output B phase positive terminal
24	PBO-	PBO-	Pulse frequency division output B phase negative terminal	Pulse frequency division output B phase negative terminal
15	O_SCD	DO0	Digital output signal 0	Digital output signal 0, function can be set, Default is ready for servo operation
16	O_ALM	DO1	Digital output signal 1	Digital output signal 1, function can be set, The default is servo failure
3	O_/ALM/SCD	DO0/1_COM	Digital output signal 0/1 output common	Digital output signal 0/1 output common
17	O_COIN	DO2	Digital output signal 2	Digital output signal 2, function can be set, Default is Safe Torque Off Enable
4	O_/COIN	DO2_COM	Digital output signal 2 output common	Digital output signal 2 output common
18	O_PGC	PZO+	Pulse frequency division output Z phase positive terminal	Pulse frequency division output Z phase positive terminal
5	O_/PGC	PZO-	Pulse frequency division output Z phase Negative terminal	Pulse frequency division output Z phase negative terminal
21	GND	AGND	Analog signal input ground	Analog signal input ground

3.5.2 Interface Circuit

Examples of input and output signals of the SERVOPACK and its connection to the command controller are as follows.

(1) Interface with command input circuit

Analog input circuit

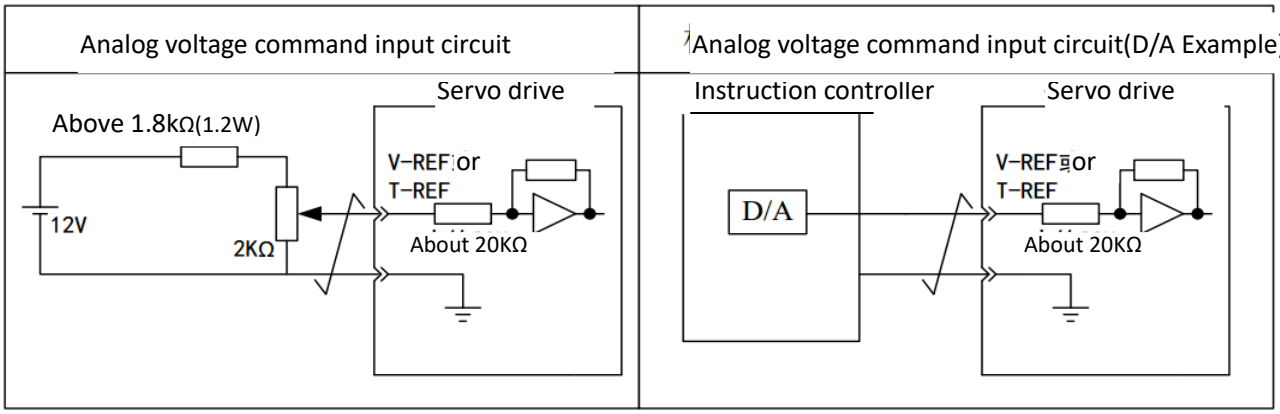
The 9-21 (speed command input) and 10-21 (torque command input) terminals of the CN2 connector will be described below. The analog signal is a speed command or a torque command signal.

The input impedance is as follows.

Speed command input: about 20kΩ

Torque command input: about 20kΩ

The maximum allowable input voltage is 12V.

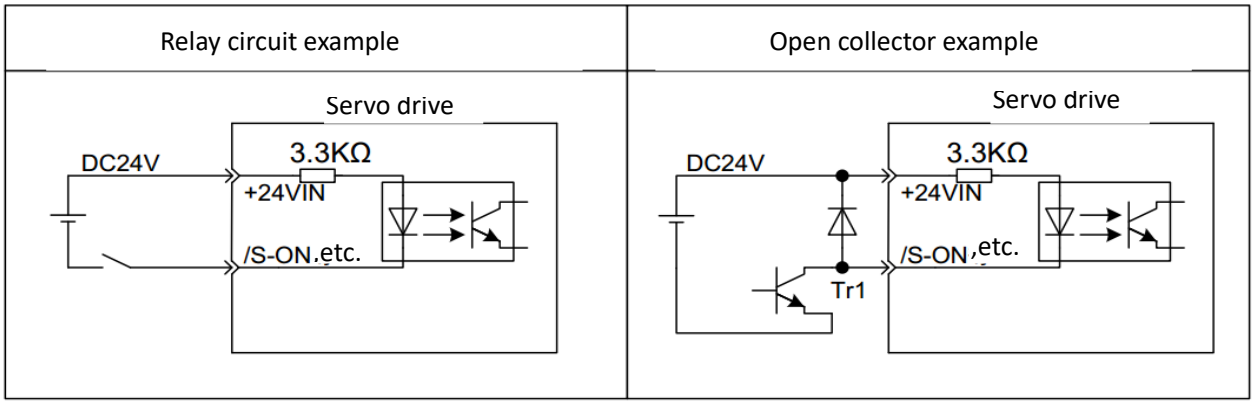


(2) Interface with sequence control input circuit

The following describes the IN1 to IN8 terminals of the CN2 connector.

Connect via relays or open collector transistor circuits.

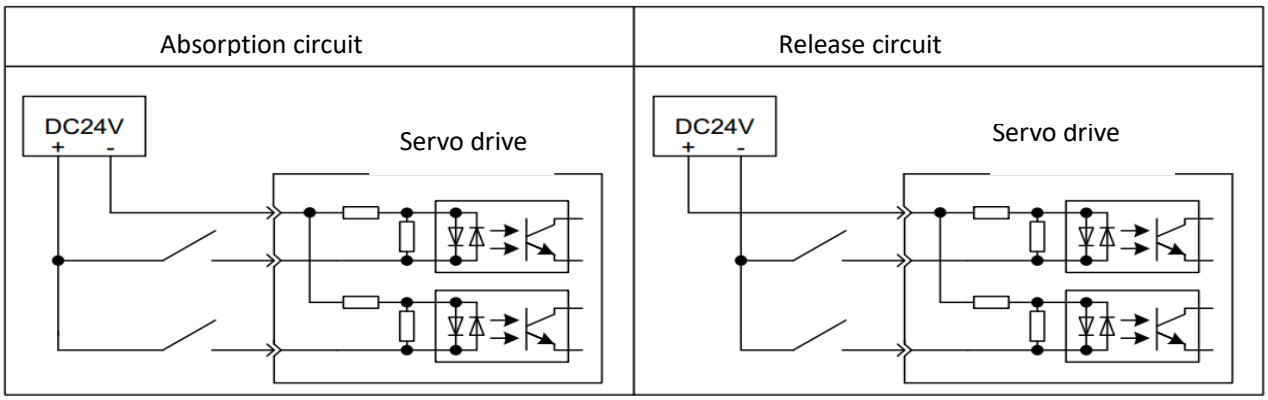
When using a relay connection, select the relay for the minute current. If you do not use a minute current relay, it will cause poor contact.



(3) Absorption loop and release circuit

The servo driver input circuit uses a bidirectional optocoupler. According to the mechanical specifications, please select the absorption circuit connection and the release circuit connection.

Absorption loop release circuit Servo driver DC24V+-Servo driver DC24V+-



Note: The maximum allowable voltage and current capacity of the optocoupler output circuit： DC30V； DC 8mA；

3.6 Communication Connection Terminals

CN3 and CN4 are EtherCAT slave communication terminals: CN3 is the input terminal and CN4 is the output terminal

Terminal No.		1	2	3	4	5	6	7	8
Name	CN3	TX1+	TX1-	RX1+	TXCT1	TXCT1	RX1-	RXCT1	RXCT1
	CN4	TX2+	TX2-	RX2+	TXCT2	TXCT2	RX2-	RXCT2	RXCT2

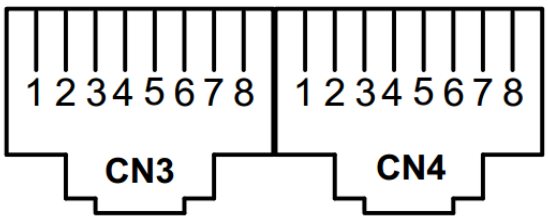


Figure 3.6-1 Communication Signal Connector Pin Definitions

3.7 Motor Wiring

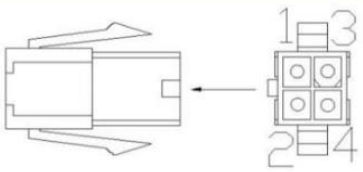
3.7.1 Power Socket

Power socket for motor with flange surface 90 and below (4-pin AMP socket)：

Terminal pin number	1	2	3	4
Signal name	U	V	W	PE

Power socket for motor with flange surface 100 and above (4-core air socket)：

Terminal pin number	1	2	3	4
Signal name	PE	U	V	0W

4 core AMP socket	4 core bend air socket	4 core straight air socket
 1-U， 2-V， 3-W，4-PE	 1-PE，2-U，3-V，4-W	 1-U，2-V，3-W，4-PE

3.7.2 Encoder Socket

Incremental non-wire-saving encoders for flange surface 90 and below (15-pin AMP socket)

Terminal No.	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
Signal Name	PE	5V	GND	B+	Z-	U+	Z+	U-	A+	V+	W+	V-	A-	B-	W-

Incremental non-wir-saving encoder for flange surface 110 and Above (15-pin Air Socket)

Terminal No.	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
Signal Name	PE	5V	GND	A+	B+	Z+	A-	B-	Z-	U+	V+	W+	U-	V-	W-

Incremental Wire-saving Encoder （3-row 9-pin AMP socket）

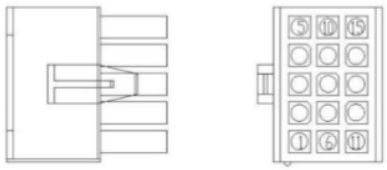
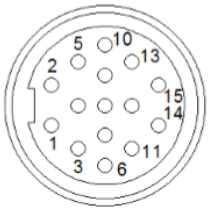
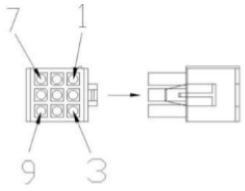
Terminal No.	1	2	3	4	5	6	7	8	9
Signal Name	5V	GND	A+	A-	B+	B-	Z+	Z-	PE

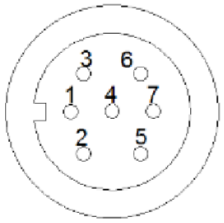
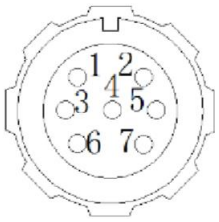
Incremental Wire-saving Encoder （15-pin air socket, 10~15 pin are not welded）

Terminal No.	1	2	3	4	5	6	7	8	9
Signal Name	PE	5V	GND	A+	B+	Z+	A-	B-	Z-

Absolute encoder socket （7 pin）：

Terminal No.	1	2	3	4	5	6	7
Signal Name	PE	E-	E+	SD-	GND	SD+	+5V

3-row 15-pin non-wire-saving AMP socket	15 pin bend wire-saving and non-wire-saving air socket	3-row 9-pin wire-saving AMP SOCKET
		

Absolute encoder	
7-pin bend air socket	7-pin straight air socket
	

Chapter 4 Panel Display and Operation

4.1 Panel Composition

Figure 4.1-1 Front panel view

iK3 servo driver panel consists of five 7-segment LED digital tubes and 5 buttons. It can monitor the status of the servo driver, set parameters and perform self-learning, JOG and other auxiliary functions. Its five key functions are as follows:

Key Icon	Name	Function
M	MODE	Used to switch basic functions: status monitoring mode, status display mode, parameter setting mode, auxiliary function mode confirmation parameter modification can also be used to return to the superior menu
∧	UP	Can change parameter group number or modify to increase parameter value
∨	DOWN	Can change parameter group number or modify to reduce parameter value
<	LEFT	Used to modify the number of parameters or to change the sub- group numbers of the parameter or terminate the self-learning process
↵	Setting	Used to enter the setting parameter state

4.2 Panel Display

When the servo driver is running, the display can be used for servo status display, monitor mode switching, parameter setting, and auxiliary function call.

- Status display: It displays the status of the current servo. If the servo is ready, the servo is running or the servo node number, etc., you can also set the parameter P10.08 to set the initial monitoring item when the servo is powered on.
- Monitoring mode switching: Switch the front panel monitoring content.
- Parameter setting: View parameters or set parameters.
- Auxiliary functions: Can perform parameter reset, auto-tuning, jog, fault history query, and fault clearing 5 auxiliary functions.

4.2.1 Panel Display Switching Method

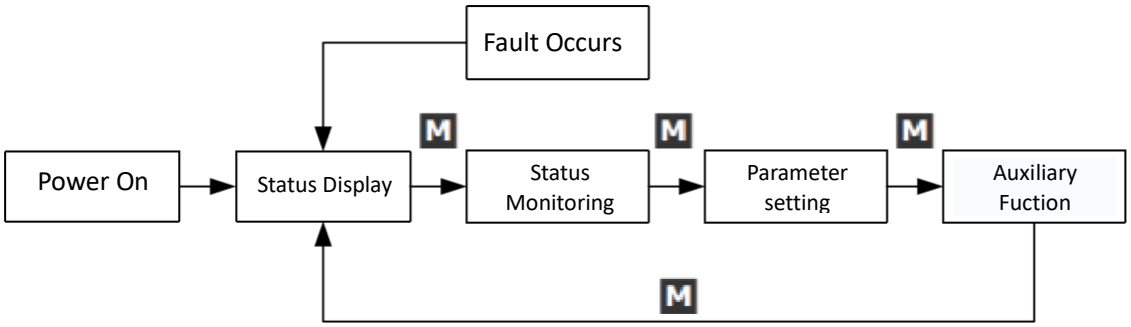


Figure 4.2.1-1 Front Panel Status Switching

1. When the power is switched on, the servo will be initialized first, and the panel display will enter the full light state for about 1 second before entering the state display mode.
2. Press the "MODE" button to switch between different modes, and the switching conditions are shown in the figure above.
3. In the mode of state display, the monitoring parameters can be selected by setting P10.08 parameters, and the monitoring parameters can be displayed automatically when the motor is running.
4. In the event of failure, no matter what modes the front panel is,it will immediately switch back to the status display, in the mean time, the five digital tube is switching back and forth between the fault codes and the status display at a fixed frequency.

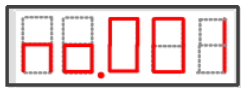
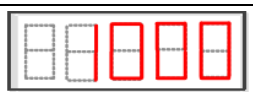
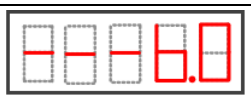
☆Related parameters:

No. P10.09	Name	Front panel monitoring parameters			Setting effective	-	Data structure	-	Data type	Int32
	Accessibility	RW	Mapping or not	-	Related pattern	-	Data range	0~6	Factory setting	0

This parameter is used to set the state information displayed on the servo front panel. The specific configuration is as follows:

0: Displays the servo operation status. When it is not enabled, “off” is displayed. When the servo is enabled, “on” is displayed. When the bus type is set, the servo node number is displayed.
1: display the servo speed given value;
2: display the servo bus voltage value;
3: Display the motor speed feedback value;
4: Display the current value of the motor;
5: Display the single-turn value of the motor encoder;
6: Display the multi-turn value of the motor encoder;

4.2.2 Status Display

DISPLAY	NAME	DISPLAY CONDITIONS	DESCRIPTION
	Servo initialization	When the servo is powered on	Indicates that the drive is in the initialization state and will automatically switch to the state display mode after completion
	Servo is not enabled	The servo is not enabled after powering on	The servo is not enabled at this time, and the servo is not running.
	Servo enable	Servo enter enable state	Indicates that the servo is now running
	Node number under Bus mode	Servo under bus mode	Indicates the node number in bus mode (taking node number 1 as an example)
	Monitor parameters after power on	Monitor the content after setting power on by setting P10.08	Take motor feedback as an example. The display shows the motor speed is 1000rpm.
	STO is not connected	STO is not connected	STO is not connected

	Emergency stop signal is valid	Emergency stop signal is valid	Emergency stop signal is valid
	Servo fault code	Servo error	Corresponding failure is displayed when a servo fault occurs. The last two digits are fault codes.

Attention：

1. When the drive fails, no matter what interface the front panel is in, it immediately jumps back to the initial state interface. The specific display mode upon the fault occuring is as follows (For the relationship of the specific fault code and fault, please refer to related documents):

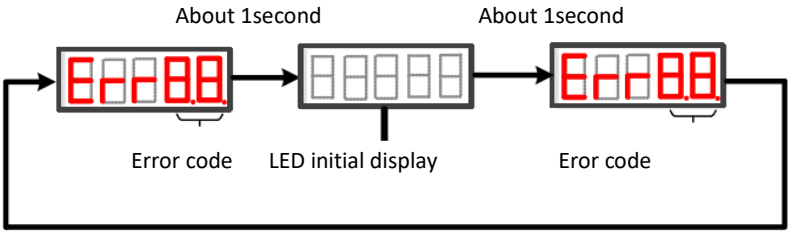


Figure 4.2.2-1 Error Display Mode

2. The set power monitoring parameters may appear with different lengths of data and negative numbers are displayed in the following two specific conditions

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

Single-page (5-digit digital) display is used. For the signed number, the most significant digit of the data "-" indicates a negative sign.

Example: 12345 is displayed as follows:

Example: -1234 is displayed as follows:

b) Numbers with more than 5 bits unsigned(as 5 bit numbers occur only under monitoring single and multi-turn value, and the two parameters are unsigned.)

Example: 1234567890 is displayed as follows:

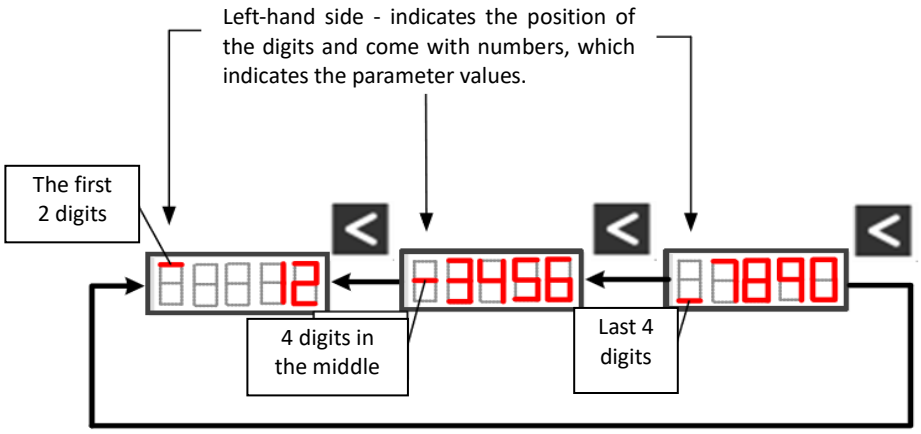


Figure 4.2.2-2 Unsigned Variable Display Method with 5 or More Characters

4.2.3 Monitor Mode

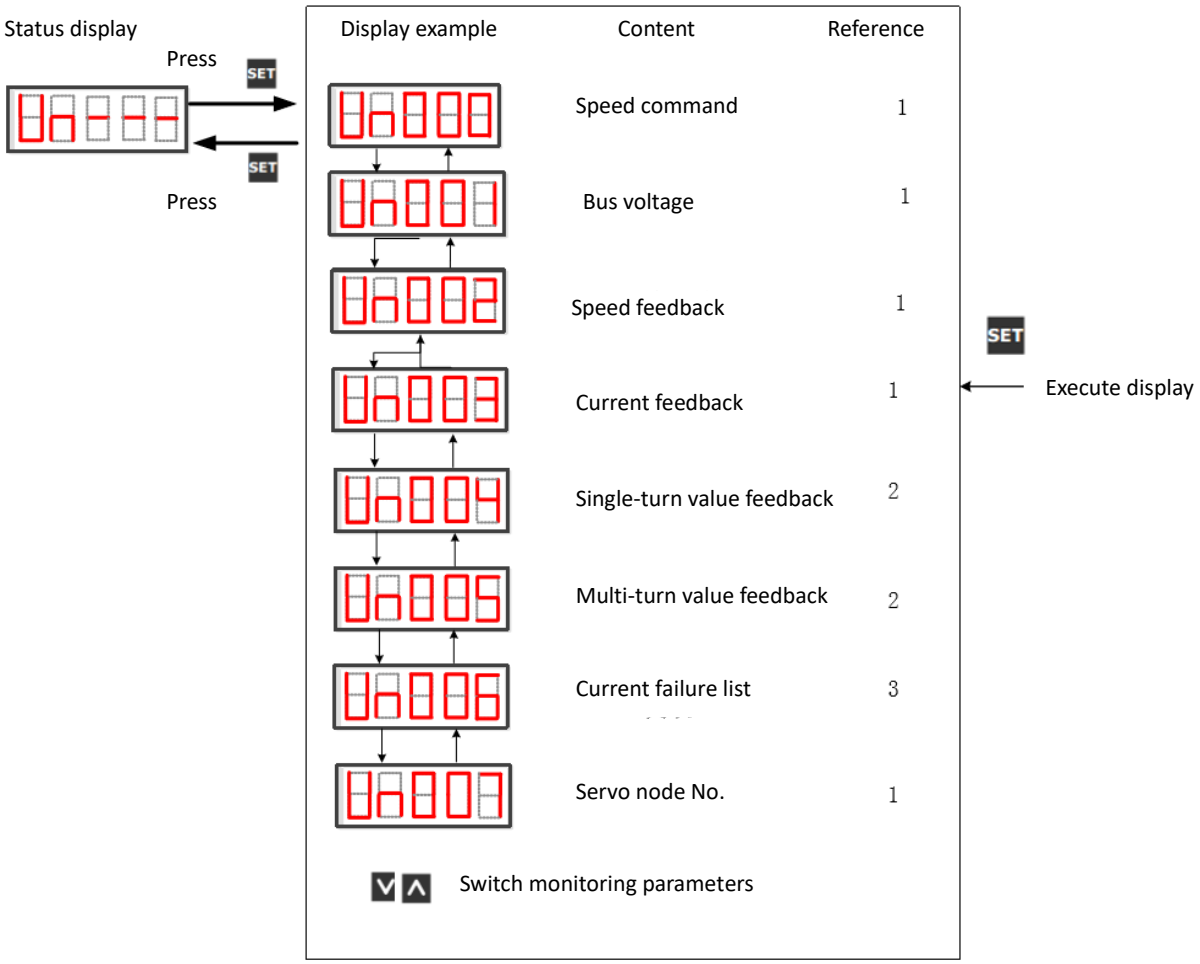
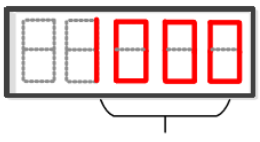
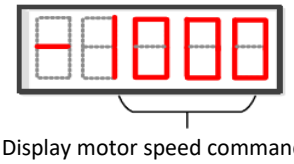
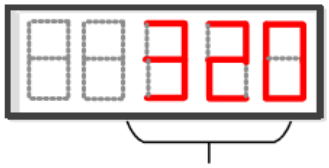
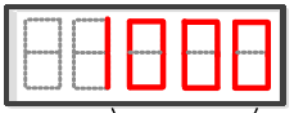
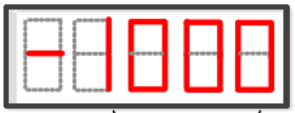
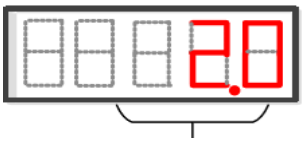
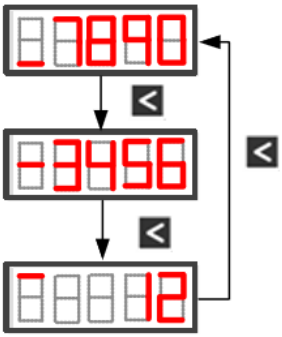
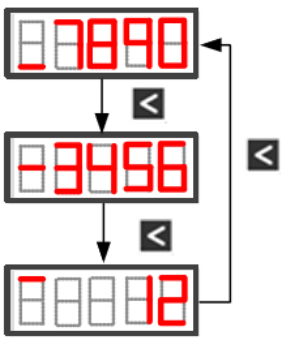
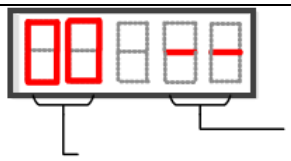
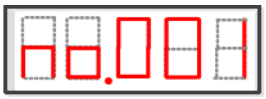


Figure 4.2.3-1 Switching mode of monitoring variables under monitoring mode

The specific operation method in the monitoring mode is as shown in the above figure. Currently, the above 7 contents can be monitored. The specific display of each item is as follows:

Function code	Name	Unit	Description	Display example
Un000	Speed command	r/min	Speed command value	1000 r/mind display:  Display motor speed command -1000 r/min display:  Display motor speed command

Un001	Bus voltage	V	Mian circuit DC bus voltage	320V diaplay:  Display bus voltage
Un002	Speed feedback	r/min	Motor actual speed	1000 r/min display:  Display motor feedback speed -1000 r/min display:  Display motor feedback speed
Un003	Current feedback	A	Current feedback value of motor Q Axis	2.0A display:  Display feedback current
Un004	Single-turn value feedback	inc	Single-turn position value of motor(units by encoder)	1073741824single-turn value feedback display: Last 4 digits  4 digits in the middle first 2 digits
Un005	Multi-turn value feedback	inc	Multi-turn value of motor(units by encoder)	1073741824 multi-turn value feedback display: Last 4 digits  4 digits in the middle first 2 digits

Un006	Current failure list		All faults currently occurring can display up to 8 faults. Press up and down button to turn the page.After troubleshooting, press the left button to clear the current fault.	 Error code (display "--" whenfault does't occur.)  ... Current failure (last occurred)  ... Current failure (farthest occurred)
Un007	Servo node Number		Display servo node number	 Take the node No.1 as example

4.3 Parameter Setting Mode

Use the servo panel to view or set the parameters through the parameter setting mode. The specific operation mode is as shown in the figure below,

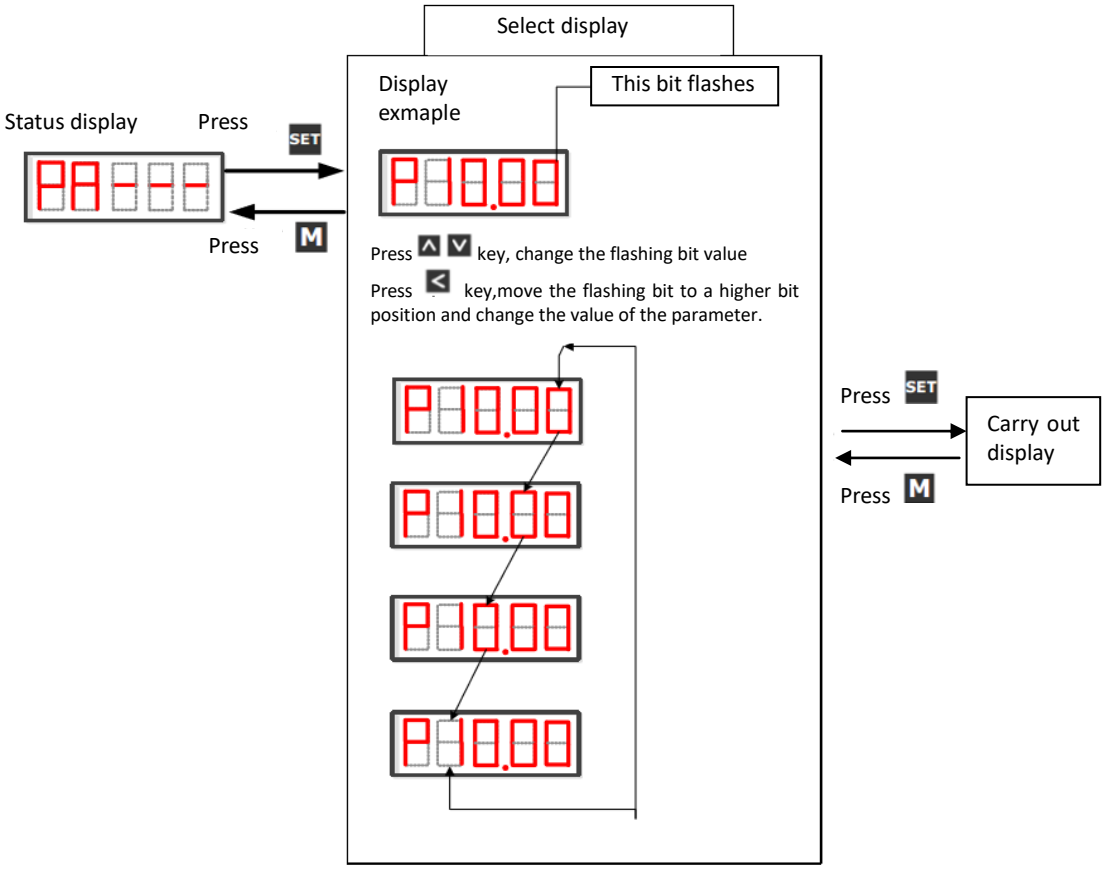


Figure 4.3-1 Parameter Modification Operation Mode

"MODE" key can be used to return to the upper interface;
"UP" / "DOWN" key can increase or decrease the current flashing bit value;
"LEFT" key can change the current flashing bit;
The setting key can store the current setting value or enter the lower level interface.

1) Parameter group display

Display	Name	Content
PXX.YY	Parameter No.	XX: parameter number group YY:Number under the parameter number group

Example: P10.00 is shown below

Display	Name	Content
	Parameter No. 10.00	10: parameter number group 00： Number under the parameter number group

Attention:

Please refer to the parameter table to input the correct parameter number. If it is an input error, the following content will be displayed after execution,

After 2S, it will automatically return to the PXX.YY parameter number input interface.

4.3.1 Parameter Display

- If you only want to view the parameter value, you can enter the corresponding parameter number and press the SET key to quey the corresponding parameter (only some parameter values can be displayed)
- When the value of the parameter to be viewed exceeds 5 digits (if there is a negative sign, it will be displayed in the highest digit), then the parameter value will be displayed in paging from low to high as per digits. The display method: current page + current page value, as shown in the figure below. Short press "LEFT" key to switch the current page

For example, when displaying 1234567890:

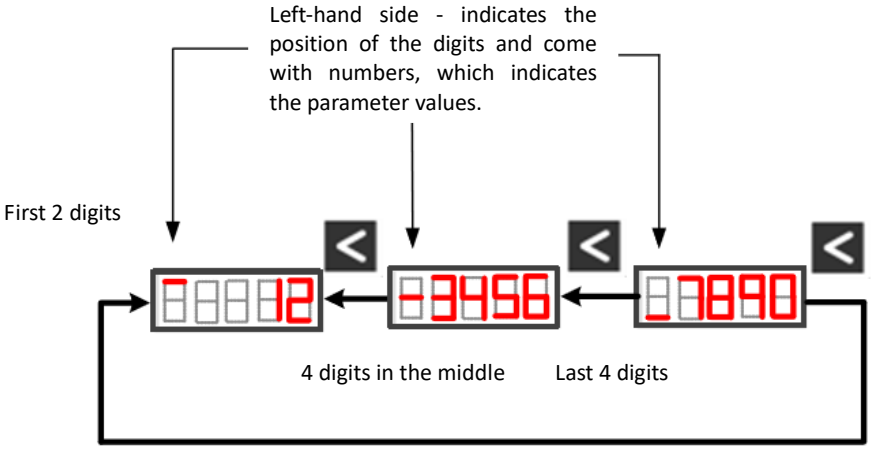


Figure 4.3.1-1 Unsigned parameter display mode with 5 or more digits

- Decimal point display

The "." in the digit tube of the digit data represents the decimal point

Display	Name	Content
	Decimal point	100.0

4.3.2 Parameter Setting

If you want to modify the parameter value, please input P10.00 parameter to enter the corresponding permission password to modify the parameter. After inputting the password, change the driver from speed mode to torque mode as an example:

Return to parameter mode after 2 seconds Input parameter number Modify parameter value, parameter setting is completed

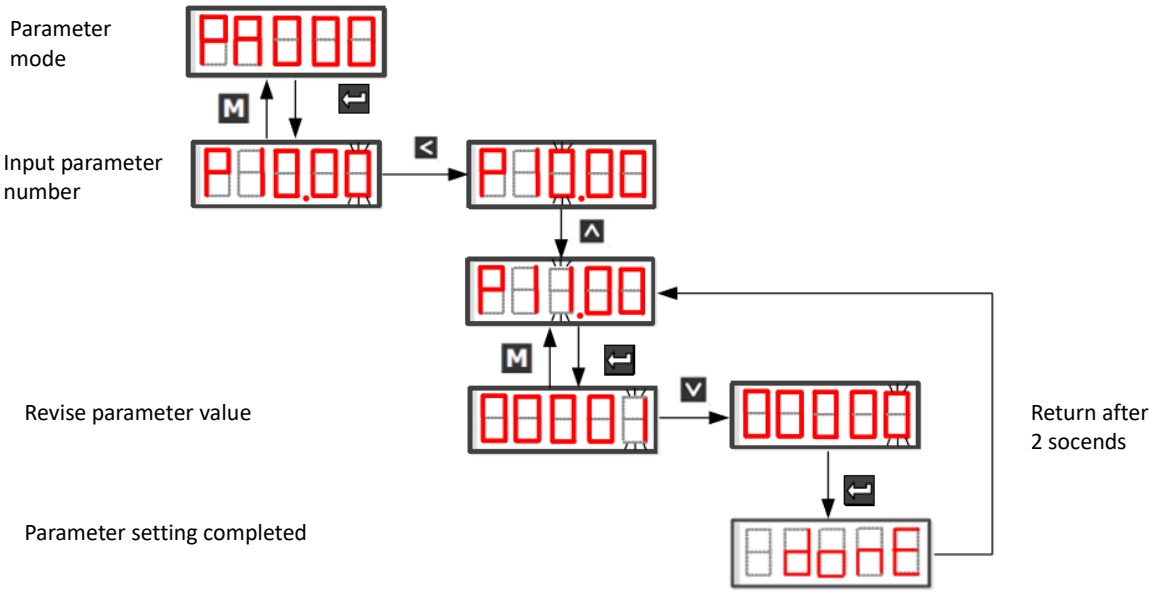


Figure 4.3.2-1 Parameter Value Setting Mode

- "MODE" key can be used to return to the upper interface;
- "UP" / "DOWN" key can increase or decrease the current flashing bit value;
- "LEFT" key can change the current flashing bit;
- The setting key can store the current setting value or enter the lower level interface.

Attention:

When there are more than 5 parameters to be set, the parameter will be displayed by the number of digits from low to high. The displayed method is the current page + current page value. Press the “LEFT” key to move the flashing digit from the lowest digit to the highest digit. This operation can be performed cyclically:

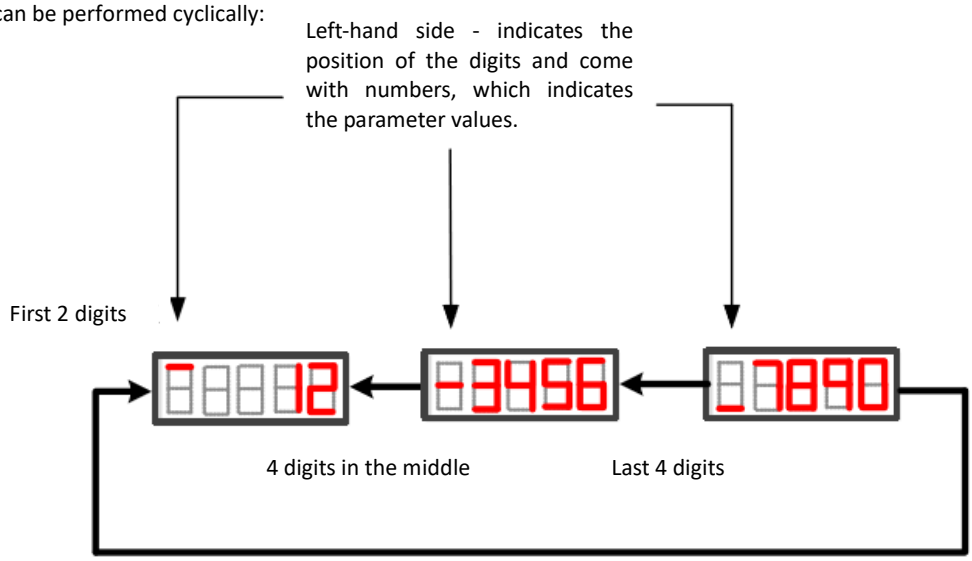


Figure 4.3.2-2 Setting method of 5 or more unsigned parameters

4.4 Auxiliary Mode

iK3 servo can perform 5 auxiliary functions for motors,including parameter reset,auto-tuning, jog, fault history query and fault history under the auxiliary function mode via the front panel. The specific auxiliary function selection operation mode is as follows:

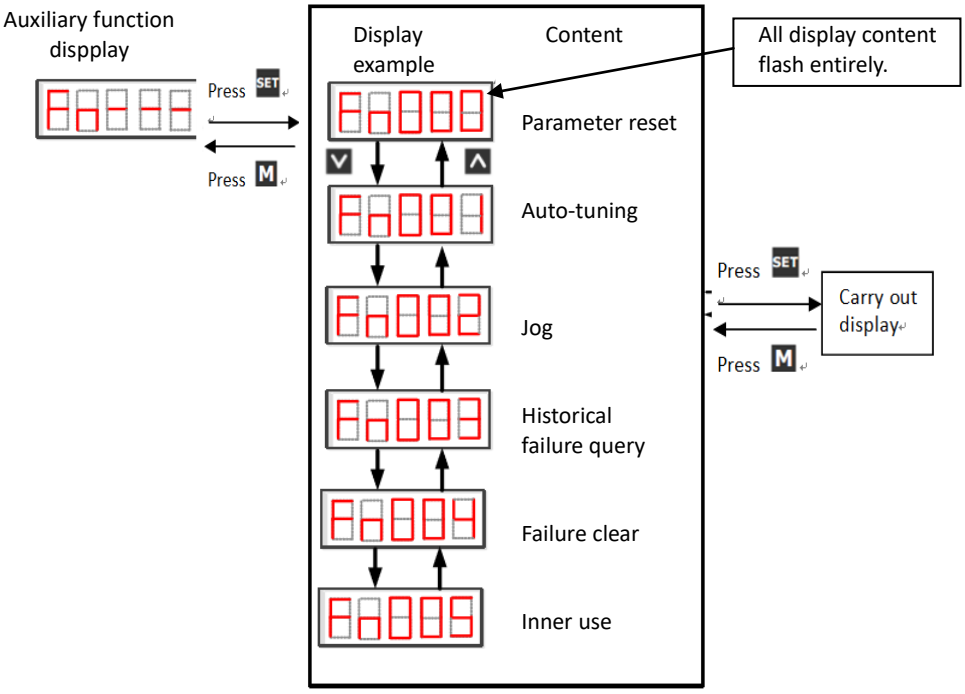


Figure 4.4-1 Auxiliary Function Switching Mode

- "MODE" key can be used to return to the upper interface;
- "UP" / "DOWN" key can increase or decrease the current flashing bit value;
- "LEFT" key can change the current flashing bit;
- The setting key can store the current setting value or enter the lower level interface.

4.4.1 Parameter Reset

The parameter reset function can be used when it is necessary to reset all servo parameters.

Opeation method ：

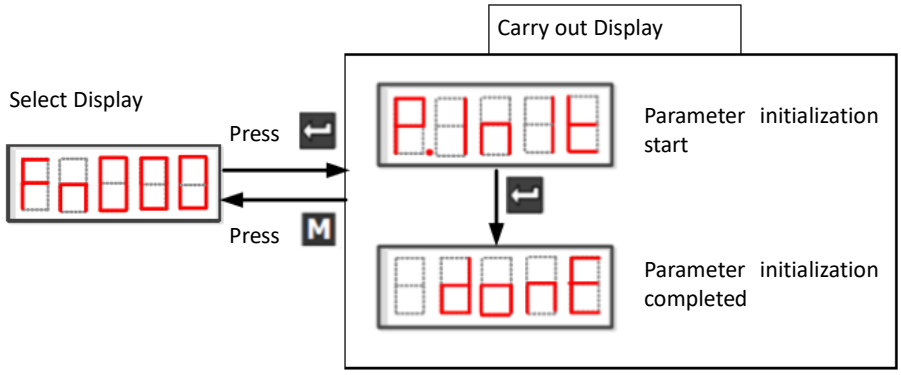


Figure 4.4.1-1 Parameter reset operation method

Exit parameter reset:

After the parameter initialization completes and show “done”, press the "MODE" key to return to the previous menu.

4.4.2 Auto-tuning function

Auto-tuning function could be performed for servo motors through the front panel. Take the auto-tuning 2 as example, the detailed operation method is as follows,

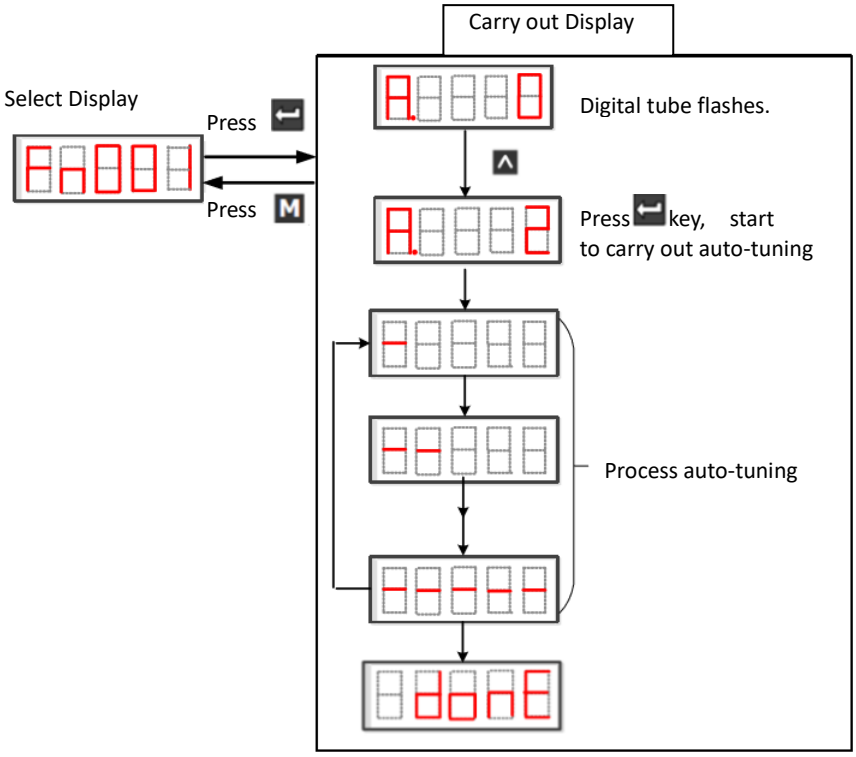


Figure 4.4.2-1 auto-tuning operation mode

If you suddenly want to interrupt the auto-tuning process during the auto-tuning process, you can interrupt the auto-tuning by pressing the "LEFT" key.

After the end of auto-tuning, press "MODE" key to return to the auxiliary function selection interface.

4.4.3 Jog Mode

If you need to test the servo motor and driver, jog operation function can be used. Before executing the self-learning function, set the JOG speed at parameter P12.07.

Press the “UP” or “DOWN” key, the servo motor will rotate in the forward or reverse direction. If you release the key, the servo motor will stop immediately.

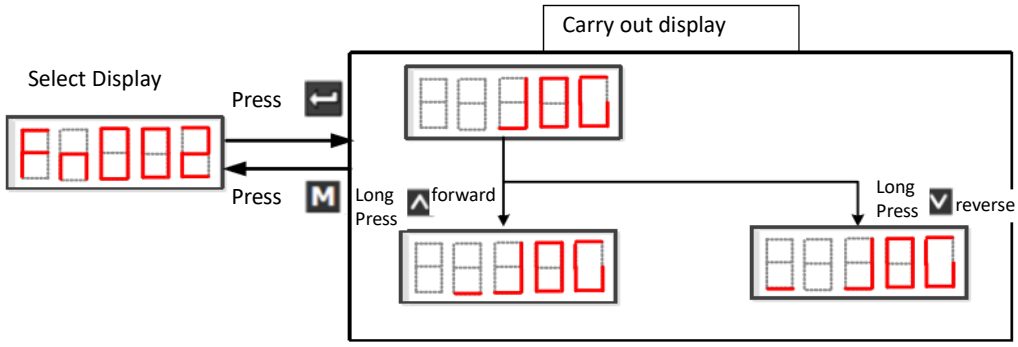
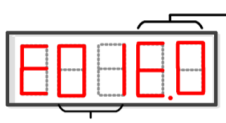


Figure 4.4.3-1 Jog mode operation mode

4.4.4 Fault History Query

iK3 The servo drive can store 10 fault histories for checking faults that occur within a certain period of time. For querying the corresponding information, the fault history query function can be executed. In this auxiliary function, the fault is displayed in the following manner (taking the first fault history, fault code E.0 as an example)

Display	Name	Content
 Fault code The fault history number, the smaller the number, is the latest failure code.	Fault history	Latest fault E.0

The specific operations for querying the fault history are as follows:

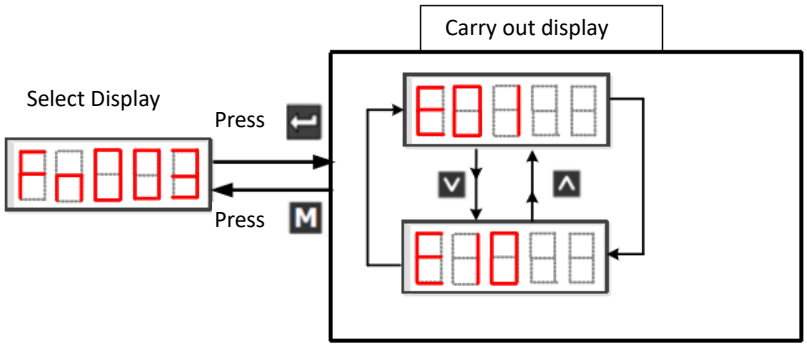


Figure 4.4.4-1 Fault History Query Operation Mode

Press "UP" and "DOWN" to scroll through the page to query the fault history; press "LEFT" to delete the page fault history; if you want to delete the fault history collectively, refer to the fault history clear function.

4.4.5 Fault History Clear

If you want to delete the fault history in batches, you can execute the fault history clearing function. The specific operation method is as follows,

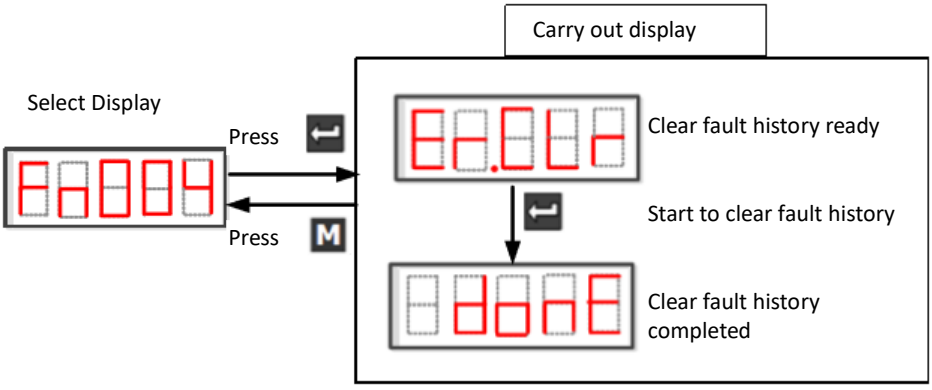


Figure 4.4.5-1 Fault Reset Operation Mode

Press the “SET” key to start the fault history clearing function; displaying “ done” after the fault history is cleared, then press the “MODE” key to return to the auxiliary function display interface.

Chapter 5 Communication Network Configuration

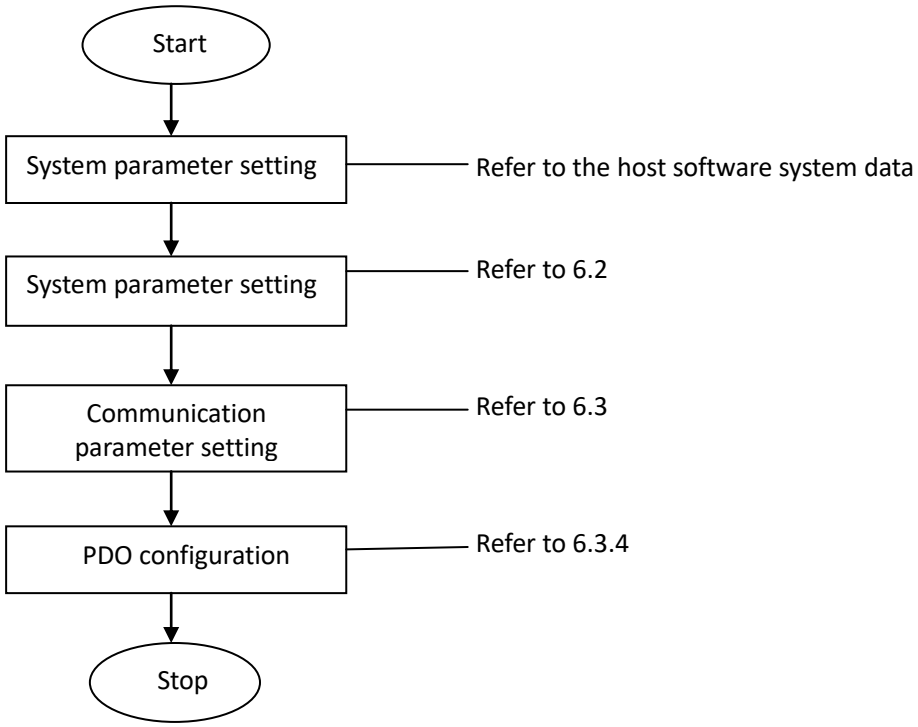


Figure 5-1 Flowchart for setting up EtherCAT

5.1 EtherCAT Protocol Overview

EtherCAT is a high-performance, low-cost, easy-to-use, topologically flexible industrial Ethernet technology that can be used in industrial field-level ultra-high-speed I/O networks. Using the standard Ethernet physical layer, the transmission medium is twisted pair or fiber (100Base-TX or 100Base-FX).

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

EtherCAT network, the protocol handles the direct I/O layer：

(1) No need for any lower sub-bus;
(2) No gateway delay;
(3) A single system can cover all devices: input and output, sensors, actuators, drives, displays...
(4) Transmission rate: 2 x 100 Mbit/s (High Speed Ethernet, full duplex mode);
(5) Synchronization: two devices with 300 nodes, cable length of 120 meters, synchronous jitter less than 1us;
(6) Refresh time: 256 digital I/O: 11 μs;

1000 switch I/O distributed at 100 nodes: 30 μs = 0.03 ms.

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

CoE (EtherCAT-based CAN Application Protocol);
SoE (Servo Drive Profile complying with IEC 61800-7-204);
EoE (EtherCAT implements Ethernet);
FoE (EtherCAT implementation file reading);

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

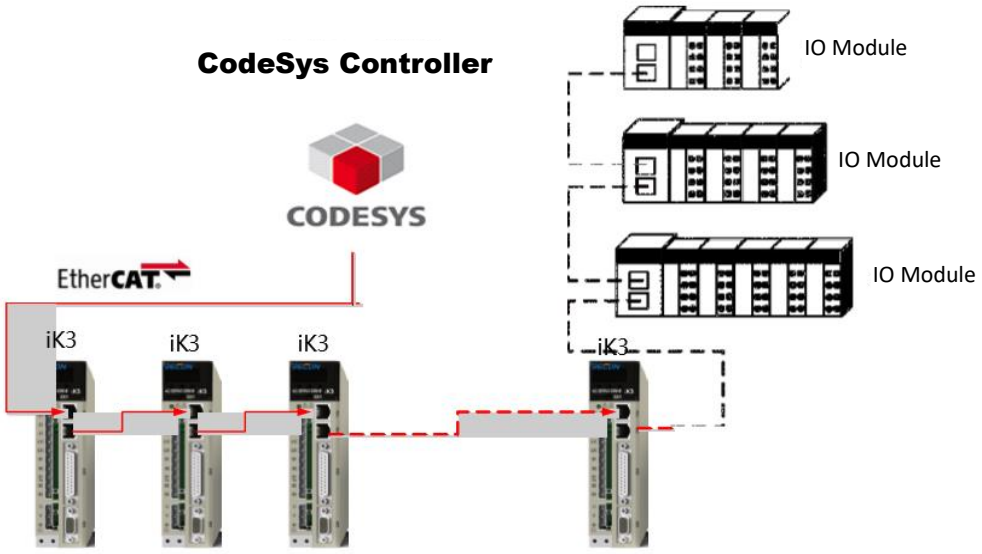


Figure 5.1-1 EtherCAT networking

5.2 System Parameter Settings

iK3 series servo drives can be connected to EtherCAT fieldbus networks， which needs to set related parameters.

Servo parameter type	Servo parameter Subindex	Name	Setting range	Default
P10	01	Command channel selection	0: Operator Control 1: bus control 2: BECON-MONITOR control 3: Analog input 0 control 4: Analog Input 1 Control 5: pulse control	0
P14	00	Bus type selection	0： No bus board 1： PowerLink 2： EtherCAT 3： CanOpen	0

Attention：

When using EtherCAT bus control, P10.01 command channel needs to be selected as bus control, P14.00 bus type is selected as EtherCAT, and power off and restar.

5.3 EtherCAT Communication basics

5.3.1 EtherCAT Communication Specification

Item		Specifications
Communication protocol		IEC 61158 Type 12, IEC 61800-7 CiA 402 Drive Profile
Application layer	SDO	SDO request、SDO answer
	PDO	Variable PDO mapping

	CiA402	Profile position mode (pp) Profile Speed Mode (pv) Profile torque mode (pt) Origin return mode (hm) Synchronous cycle position mode (csp) Synchronous cycle speed mode (csv) Synchronous cycle torque mode (cst)
Physical layer	Transfer Protocol	100BASE-TX (IEEE802.3)
	Maximum distance	100M
	Interface	RJ45 * 2 (INT、 OUT)

5.3.2 Communication Structure

There are various application layer protocols for using EtherCAT communication. However, in the iK3 series servo drives, the IEC 61800-7 (CiA402) - CANOpen motion control sub-protocol is used.

The following figure shows the EtherCAT communication structure based on the CANOpen application layer.

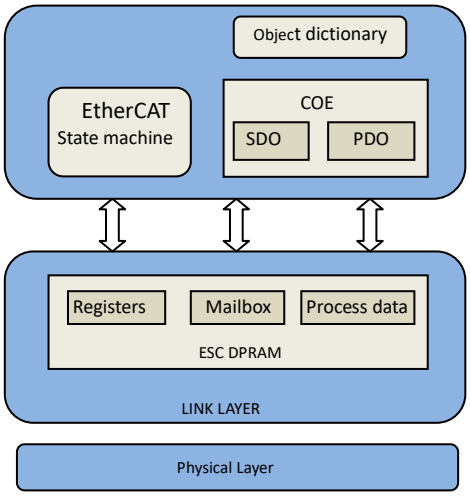


Figure 5.3.2-1 EtherCAT Communication Structure Based on CANOpen Application Layer

In the structure diagram, the application layer object dictionary contains: communication parameters, application data, and PDO mapping data. The PDO process data object contains real-time data during the operation of the servo drive, and it performs periodic read and write accesses. For SDO mailbox communication, access and modification are made to some communication parameter objects and PDO process data objects on a non-periodic basis.

5.3.3 State Machine

The following is the EtherCAT state transition diagram,

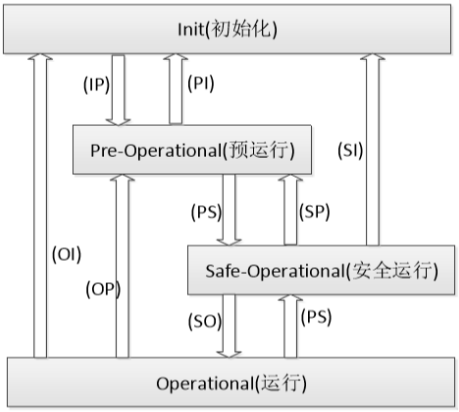


Figure 5.3.3-1 ETherCAT State Machine

The EtherCAT device must support 4 states and is responsible for coordinating the state relationships of the master and slave applications at initialization and runtime.

Init: initialization, abbreviated as I;
Pre-Operational: pre-operation, abbreviated as P;
Safe-Operational: safe operation, abbreviated as S;
Operational: Operation, abbreviated as O.

When transitioning from the initial state to the running state, it must be converted in the order of “initialization->pre-operation->safe operation->operation”. Skip is not allowed.

When you return from the running state, you can skip the conversion. The conversion operation and initialization process of the state are shown in the following table：

State and state transitions	Operation
Initialization (I)	The application layer does not communicate, the master can only read and write the ESC register
IP	The master station configures the slave site address; Configure the mailbox channel; Configure the DC distribution clock; Request "pre-run" status.
Pre-operation (P)	Application Layer Mailbox Data Communication (SDO)
PS	The master station uses the mailbox initialization process data map; Master station configure process data communication using SM channels; Master station configure FMMU; Request "safe status".
Safe operation (S)	There is process data communication, but only input data is allowed to be read, and no output signal (SDO, TPDO) is generated.
SO	The master station sends valid output data; To request "run status".
Operating status (O)	Input and output are all valid; Mailbox communication can still be used. (SDO, TPDO, RPDO)

5.3.4 Process Data PDO

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

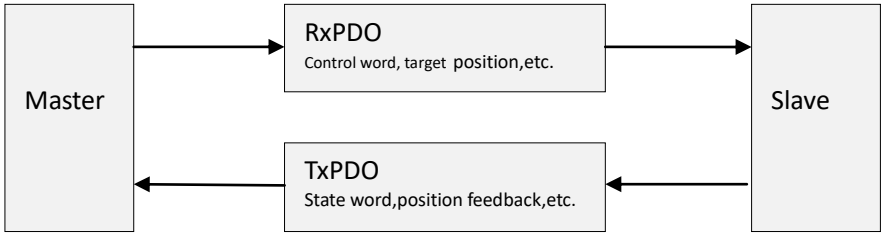


Figure 5.3.4 - PDO Transfer Model

(1) PDO Mapping parameters.

PDO mapping is used to establish the mapping relationship between the object dictionary and the PDO. 1600h~17FFh is RPDO, 1A00h~1BFFh is TPDO. iK3 series servo drives have 4 RPDOs and 4 TPDOs available for selection. The drive uses two fixed PDO mappings, an RPDO and a TPDO, using communication objects 0x1600 and 0x1A00.

Object 0x1600: RPDO1 Mapping			
Sub index	Value	Number of data bytes	Description
0	3	1	Mapping object number
1	0x60400010	2	Control Word
2	0x607A0020	4	Target Position
3	0x60FF0020	4	Targrt Velocity
Object 0x1A00：TPDO1 Mapping			
Sub index	Value	Number of data bytes	Description

0	3	1	Mapping object number
1	0x60410010	2	Status Word
2	0x60640020	4	Position Actual Value
3	0x606C0020	4	Velocity Actual Value

(2) PDO configuration

PDO mapping parameters contain process data pointers related to PDO data receiving and sending, including indexes, sub-indexes, and map object lengths.

Subindex 0 records the number of objects that the PDO specifically maps, and each PDO can be up to 4*N bytes long. It can map one or more objects at the same time. Sub-index 1~N is the mapping content. The mapping parameter content is defined as follows,

Digit number		……			……			……	
	31		16	15		8	7		0
Meaning	Index			Subindex			Object length		

The index and the 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, ie,

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

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

5.3.5 Mailbox data SDO

EtherCAT mailbox data SDO is used to transmit non-periodic data, such as the configuration of communication parameters, servo drive operation parameter configuration, and so on. EtherCAT's CoE service types include:

1) Emergency information;
2) SDO request;
3) SDO response;
4) TxPDO;
5) RxPDO;
6) Remote TxPDO sending request;
7) Remote RxPDO sending request;
8) SDO information.

In the iK3 series drives, the above are currently supported: 2) SDO request; 3) SDO response.

5.3.6 Distributed clock

The distributed clock allows all EtherCAT devices to use the same system time to control the simultaneous execution of tasks on each device. Slave devices can generate synchronization signals based on synchronized system time. In the iK3 series drive, only the DC synchronization mode is supported. The synchronization period is controlled by SYNC0. The period range varies according to the different motion modes.

Attention：

DC-disturb clock is synchronous clock. EtherCAT supports three synchronization modes, namely DC synchronization, SM2 (Sync manager) synchronization and FreeRun (free running). DC synchronization is based on the first axis clock with high precision. SM2 synchronization is based on RxPDO information time. FreeRun is not synchronized. .

6.3.7CiA402 Control Introduction

Using the iK3 series drive must follow the standard 402 protocol to guide the servo drive, the servo drive can run in the specified state.

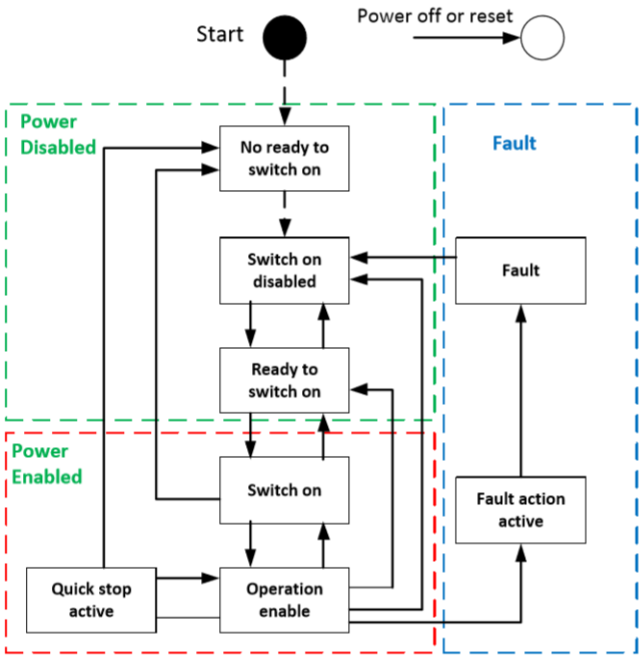


Figure 5.3.7-1 CIA402 status switch diagram

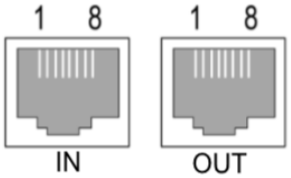
The description of each state is as follows:

Not ready to switch on	Control power on, drive initialization, internal self-test, and it is in this state until initialization is completed
Switch on disable	The servo initialization is completed, the servo driver has no fault or the error has been eliminated. Drive parameters can be set.
Ready to switch on	Servo drive is ready. Drive parameters can be set.
Switch on	The servo drive waits to turn on the servo enable. Drive parameters can be set.
Operation Enable	The drive is running normally. A certain servo operation mode is enabled. The motor is energized. When the command is not 0, the motor rotates. The drive parameter attribute should be to "run change", otherwise it cannot be set.
Quick stop active	The quick stop function is activated and the drive is performing a quick stop function. The drive parameter attribute should be to "run change", otherwise it cannot be set.
Fault action active	The drive has failed and is performing a failed shutdown. The drive parameter attribute should be to "run change", otherwise it cannot be set.
Fault	The fault stop is completed, all drive functions are disabled, and the drive parameters can be changed to eliminate the fault.

5.3.8 Basic Features

(1) Interface Information

The EtherCAT grid cable is connected to a network interface with a metal shield and is divided into an input (IN) and an output (OUT) interface. Electrical characteristics comply with IEEE 802.3, ISO 8877 standards.



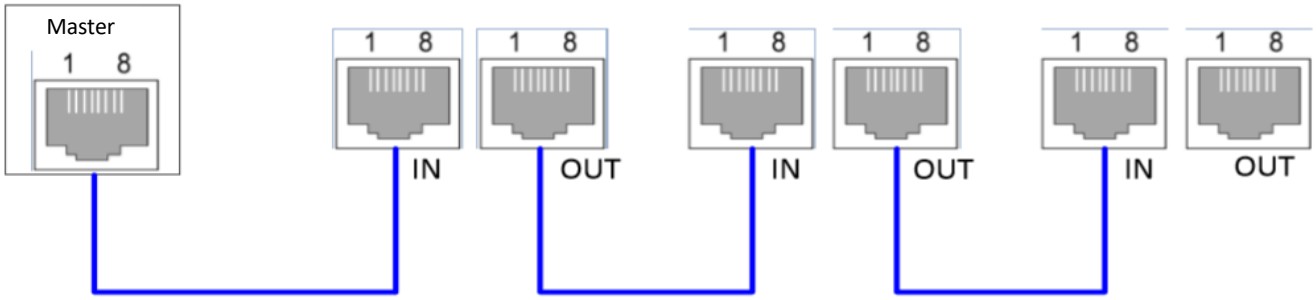
Pin	Definition	Description
1	TX+	Data sending +
2	TX-	Data sending -

3	RX+	Data reception +
4	NULL	Empty feet
5	NULL	Empty feet
6	RX-	Data reception -
7	NULL	Empty feet
8	NULL	Empty feet

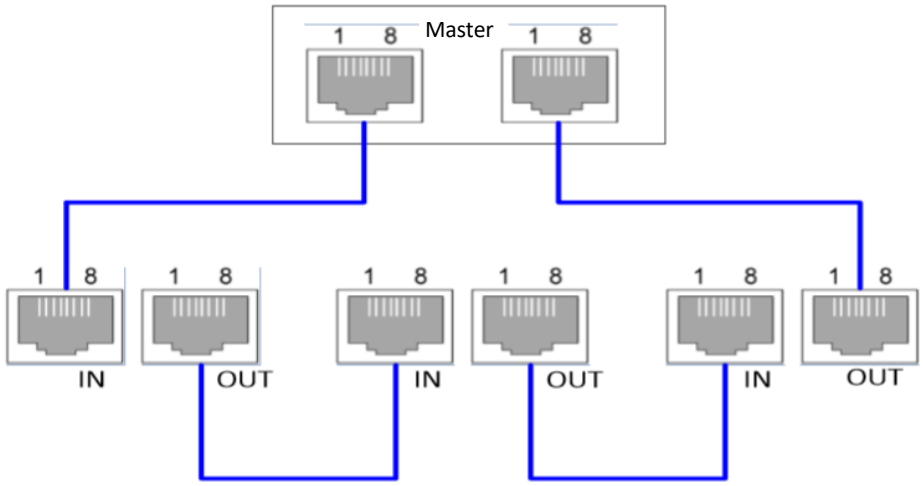
(2) Topological Connection

The EtherCAT communication topology is flexible and basically has no restrictions. This server has IN and OUT interfaces, and the topology is as follows.

Linear connection:



Redundant ring connection:



Chapter 6 Control Modes

Servo system consists of three main parts: servo drive, servo motor and encoder.

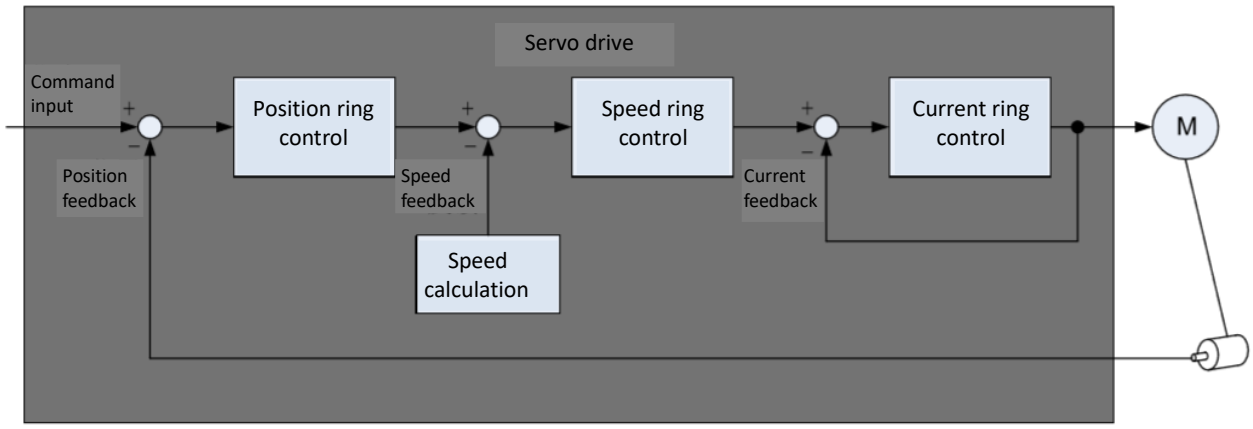


Figure 6-1 Schematic diagram of servo system control

The servo driver is the control core of the servo system. Through the processing of the input signal and the feedback signal, the servo driver can precisely control the position, speed, and torque of the servo motor, ie position, speed, torque, and a hybrid control mode. Among them, position control is the most important and most commonly used control mode of the servo system.

The brief introduction of each control mode is as follows:

- Position control means that the position of the motor is controlled by the position command. The total number of position commands determines the motor target position, and the position command frequency determines the motor rotation speed. With the encoder, the servo driver can achieve fast and accurate control of the position and speed of the machine. Therefore, the position control mode is mainly used in applications where positioning control is required, such as manipulators, placement machines, engraving and engraving (pulse sequence instructions), and numerical control machine tools.

- Velocity control refers to the speed control of the mechanical speed. By giving speed instructions via communication, the servo driver can achieve fast and accurate control of the mechanical speed. Therefore, the speed control mode is mainly used to control the speed of the occasion, or use the host computer to achieve the position control, the host computer output as the speed command input servo driver, such as engraving and milling machine.

- The current and torque of the torque control servo motor have a linear relationship. Therefore, the control of the current can realize the control of the torque. Torque control refers to the torque command to control the output torque of the motor. The torque command can be given via communication. The torque control mode is mainly used in devices with strict requirements on the force of materials, such as retracting coil devices and some other tension control applications. The torque reference value must ensure that the force of the material is not affected by changes in the winding radius.

6.1 Basic Settings

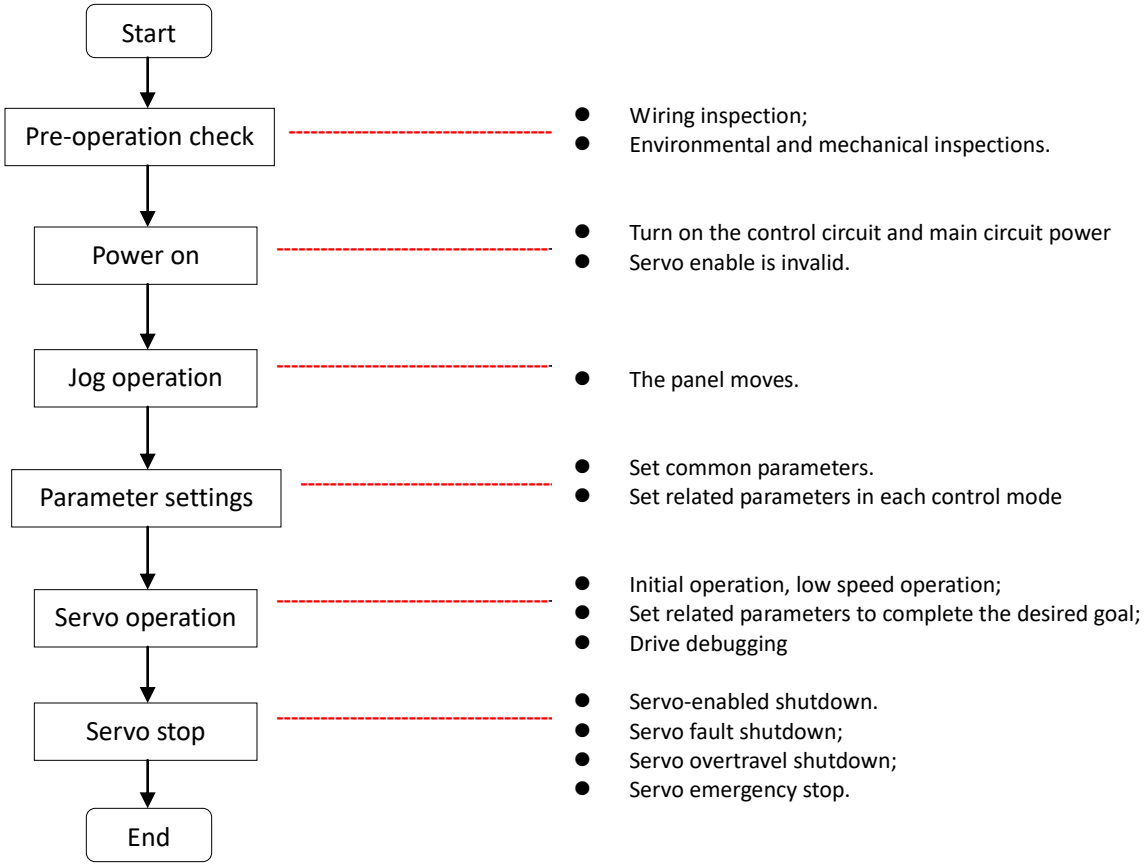


Figure 6.1-1 Servo setting process

6.1.1 Pre-Operation Check

The following checks must be performed before the servo drive and servo motor run:

Pre-Operation Check List		
Record	**No.**	**Content**
Wiring		
□	1	The control circuit power input terminals (L1C, L2C) and the main circuit power input terminals (R, S, T) of the servo drive must be connected properly.
□	2	The servo drive main circuit output terminals (U, V, W) and the motor main circuit cables (U, V, W) must be phase-aligned and correctly connected.
□	3	The main circuit power input terminals (R, S, T) of the servo drive and the main circuit output terminals (U, V, W) cannot be short-circuited.
□	4	The wiring of each control signal cable of the servo driver is correct: external signal lines such as the brake and over-travel protection have been reliably connected.
□	5	Servo drives and servo motors must be reliably grounded.
□	6	When using an external braking resistor, the short wiring between drives B2 and B3 must be removed.
□	7	The stress of all cables is within the specified range.
□	8	The wiring terminals have been insulated.
Environmental and Mechanical		
□	1	There are no foreign objects inside the servo driver, such as wire or power wires, that cause short-circuits on the signal line and the power supply line.
□	2	Servo driver and external brake resistor are not placed on flammable objects
□	3	Servo motor installation, shaft and mechanical connection must be reliable.
□	4	The servomotor and the connected machine must be ready for operation.

6.1.2 Power On

(1) Turn on the control circuit power and main circuit power

Turn on the control loop (L1C, L2C), and the main loop power supply:

For single-phase 220V main circuit power terminals are L1, L2; for three-phase 220V or 380V main circuit power terminals are R, S, T.

- After connecting the control circuit power supply and the main circuit power supply, the bus voltage indicator shows no abnormality, and the panel display shows the parameter p10.08 (the monitoring data setting), indicating that the servo driver is in a runnable state and waits for the upper computer to give a servo. Can signal.
- If the drive panel display shows "---S.S" all the time, it means that the emergency stop signal is valid. Please configure the emergency stop signal parameter correctly or correctly connect the emergency stop signal.
- If the drive panel display shows a fault, refer to "Chapter 10 Troubleshooting" to analyze and troubleshoot.

(2) Invalid servo enable

- For related process description, please refer to "6.3.7 CiA402 Control Introduction".

6.1.3 Jog Operation

Attention:

If the motor used is a custom motor, please follow the "Chapter 9 Adjustment" for encoder self-learning. Please use jog operation to confirm whether the servo motor can rotate normally and there is no abnormal vibration and abnormal sound when turning. Jog operation function can be used through the panel. The motor uses parameter P12.07 as jog speed.

(1) Panel Jog

Enter the jog operation mode through the panel operation auxiliary function Fn002, press the SET key to enter the jog state. At this time, the panel displays "JOG" state. By pressing the UP/DOWN key for a long time, the jog operation of forward and reverse can be performed. Press MODE key to exit jog operation mode.

☆Related parameters:

No. P12.07	Name	JOG speed			Effective setting	-	Data structure	-	Data type	Int32
	Accessibility	RW	Map or not	-	Related mode	-	Data range	1~1000	Factory setting	100
When jog function is used, jog running speed command value is set. The jog function can only be triggered when the driver is under "off" state, regardless of the current control mode.										

6.1.4 Rotation Direction Selection

By setting "Rotation direction selection (P55.12)", the direction of rotation of the motor can be changed without changing the polarity of the input command.

☆Reated parameters:

No. P55.12	Name	Motor rotates forward			Effective setting	-	Data structure	-	Data type	Int32
	Accessibility	RW	Map or not	-	Related mode	-	Data range	0~1	Factory setting	0

Set the motor forward rotation when viewed from the motor shaft side。

Setting value	Rotation direction	Remark
0	Take CCW direction as forward direction	When the command is forwarded, the direction of rotation of the motor is CCW as viewed from the motor shaft side, that is, the motor rotates counterclockwise.
1	Take CW direction as forward direction	When the command is forwarded, the motor rotates in the CW direction when viewed from the motor shaft side, that is, the motor rotates clockwise

6.1.5 Brake Setting

The brake is a mechanism that prevents the movement of the servo motor shaft when the servo drive is in a non-operating state, so that the motor is locked in position and the moving part of the machine will not move due to its own weight or external force.

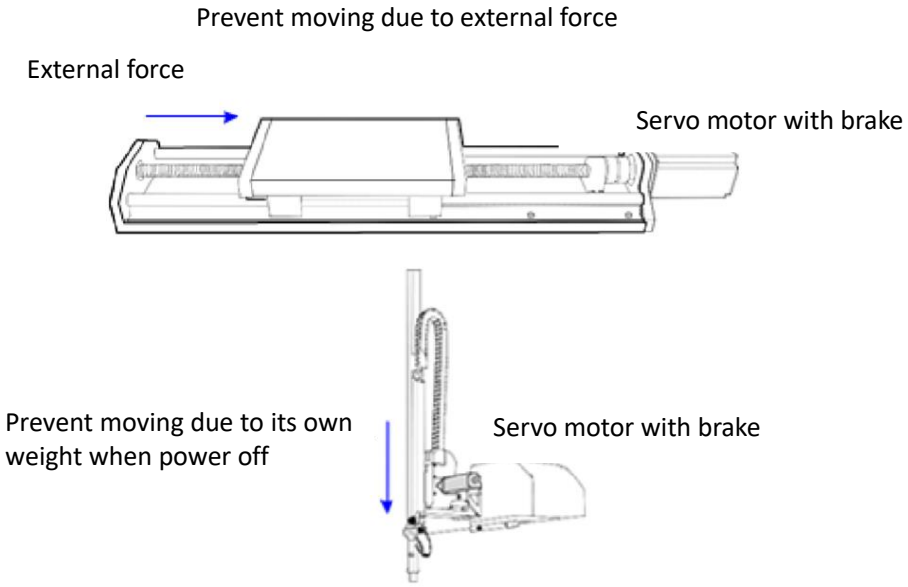


Figure 6.1.5-1 brake application

Attention

- The brake mechanism built into the servo motor is a non-active and energized fixed-purpose mechanism and cannot be used for braking purposes. It is only used when the servo motor is stopped.
- The brake coil has no polarity;
- After the servo motor stops, it should turn off the servo enable.
- When the motor with built-in brake is running, the brake may make a buzzing sound, which has no effect on the function.
- When the brake coil is energized (the brake is open), leakage of magnetic flux may occur at the shaft end. Please process cautiously when using a magnetic sensor or other device near a motor.

1) brake wiring

The connection of the brake input signal has no polarity and requires 24V power supply. The example of the standard connection of the brake signal BK and the brake power supply is as follows:

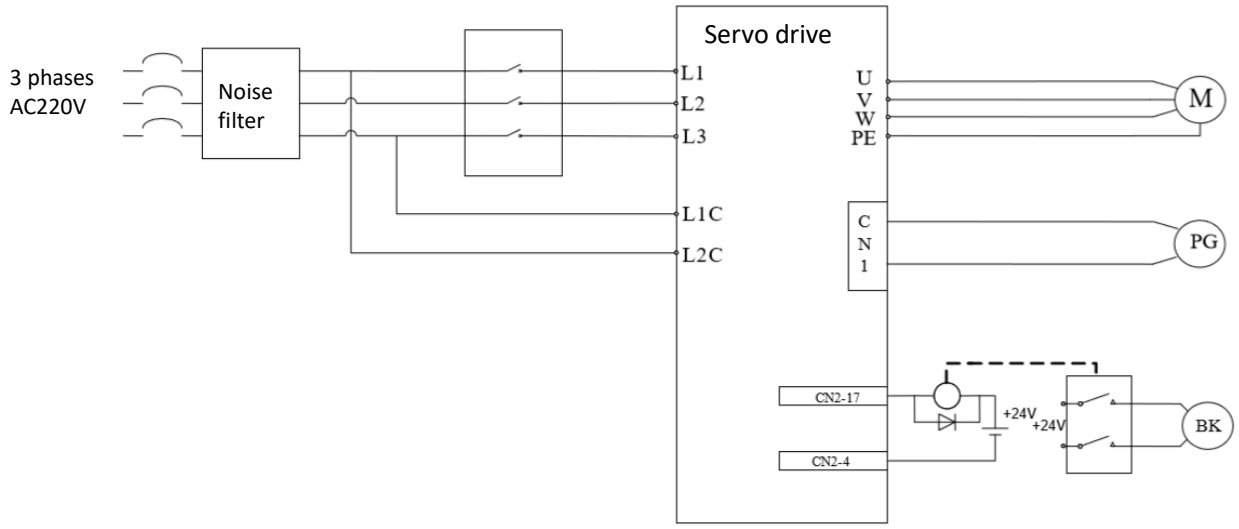


Figure 6.1.5-2 brake wiring diagram

Brake wiring precautions:

- The length of the motor brake cable needs to fully consider the voltage drop caused by the cable resistance. The input voltage should be at least 22V for the brake.
- The brake should not share the power supply with other electrical equipment to prevent from reduction of votage or current due to the operation of other electrical equipment and ultimately cause the brake to malfunction, and the impact caused by the brake can affect other electrical equipment.
- It is recommended to use 0.5mm2 or more copper cables.

2） Brake Software Settings

For a servo motor with a brake, one of the three common DO ports of the servo drive must be configured as a brake output, and valid logic must be determined.

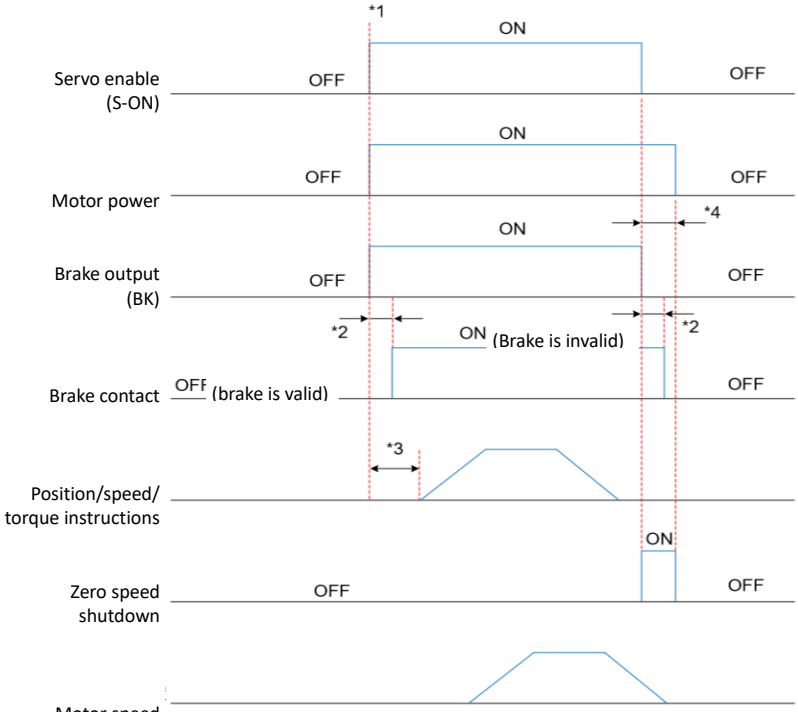
Common DO port	Corresponding configuration parameters
CN2-15、CN2-3	P31.00 output Y0 function
CN2-16、CN2-3	P31.01 output Y1 function
CN2-17、CN2-4	P31.02 output Y2 function

☆Related parameters：

No. P31.00~ P31.02	Name	Y0~Y2 terminals ouput function			Effective setting	-	Data structrue	-	Data type	Int32
	Accessibility	RW	Map or not	-	Related mode	-	Data range	0~8 101~106	Factory setting	0
Set the value of Y0~Y2 terminal output function, 8 is the brake output										

According to the current state of the servo drive, the working sequence of the brake mechanism can be divided into the servo drive normal state brake timing and the servo drive fault state brake timing.

3） Servo drive normal state brake timing



igure 6.1.5-3 Brake timing when the motor is at a standstill

Attention：

1. When servo enable is ON, the brake output is set to ON and the motor enters the power-on state.
2. For the delay time of the action of the contact part of the brake, please refer to the relevant specifications of the motor;
3. Set the brake output as ON to the input command, please set it to be longer than P21.07.
4. When the servo enable is OFF, the brake output is set to OFF at the same time. After the brake output is turned off by P21.08, the motor enters the non-energized state delay.

Attention:

● After the brake output is turned ON by OFF, do not input the position, speed, and torque commands during P21.07. Otherwise, the command will be lost or the operation error will occur.

● When used on a vertical axis, the self-weight or external force of the mechanical motion part may cause the machine

to move slightly. When the servo motor is at a standstill, the servo enable is OFF and the brake output turns off immediately. However, during P21.08, the motor is still energized to prevent the mechanical moving part from moving due to its own weight or external force.

☆Association Index：

NO. P21.07	Name	Brake open delay			Effective setting	-	Data structure	-	Data type	Int32
	Accessibility	RW	Map or not	-	Related mode	-	Data range	1~1000	Factory setting	100
Due to the slower brake response, this parameter is used to set the delay time for the brake to open or lock.										
NO. P21.08	Name	Brake open delay			Effective setting	-	Data structure	-	Data type	Int32
	Accessibility	RW	Map or not	-	Related mode	-	Data range	1~1000	Factory setting	100
Due to the slower brake response, this parameter is used to set the delay time for the brake to open or lock.										

4） Servo drive fault status brake timing

Servo faults are classified into Category 1 faults and Category 2 faults according to different shutdown modes. The servo driver fault status brake timing can be divided into the following two situations:

①Type 1 failure occurred:

The DO output condition of the brake is the same as the "sequence of the brake in the normal state of the servo drive."

②Type 2 failure occurred:

When a Category 2 fault occurs and the brake is enabled, the brake output immediately turns OFF and the motor is powered off.

6.1.6 Braking Settings

When the motor's torque and speed are in the opposite direction, energy is transmitted back to the driver from the motor terminal, causing the bus voltage to rise. When it reaches the braking point, energy can only be dissipated through the braking resistor. At this time, the braking energy must be consumed according to the braking requirements, otherwise the servo drive will be damaged. Braking resistors can be built-in or externally connected. Internal and external brake resistors cannot be used at the same time.

1) No external load torque

If the motor reciprocates back and forth, the kinetic energy of the brake will be converted into electrical energy and fed back to the bus capacitor. When the bus voltage exceeds the braking voltage, the braking resistor will consume excess feedback energy.

Take the motor no-load from 3000rpm to standstill as an example. The motor speed curve is as follows: -3000r/m-3000r/m

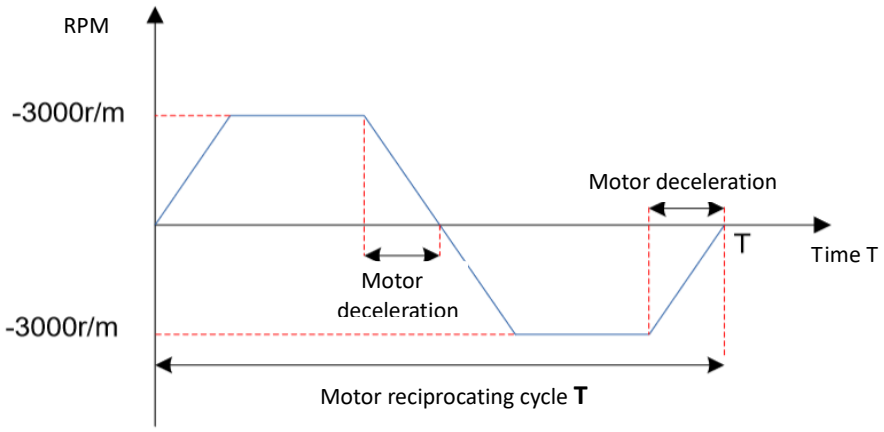


Figure 6.1.6-1 Example of motor speed curve with no external load torque

a） Braking resistor selection

Assuming that the load inertia is N times the motor inertia, the braking energy is (N+1) x EO when decelerating from 3000 rpm to 0.

To remove the EC absorbed by the capacitor, the energy required for the required braking resistor is (N+1)×EO-EC joules. Assuming that the reciprocating cycle is T, the braking resistor power is 2×[(N+1)×EO-EC]/T. Based on the above figure, it can be determined whether the braking resistor is currently used, and the built-in or external braking resistor.

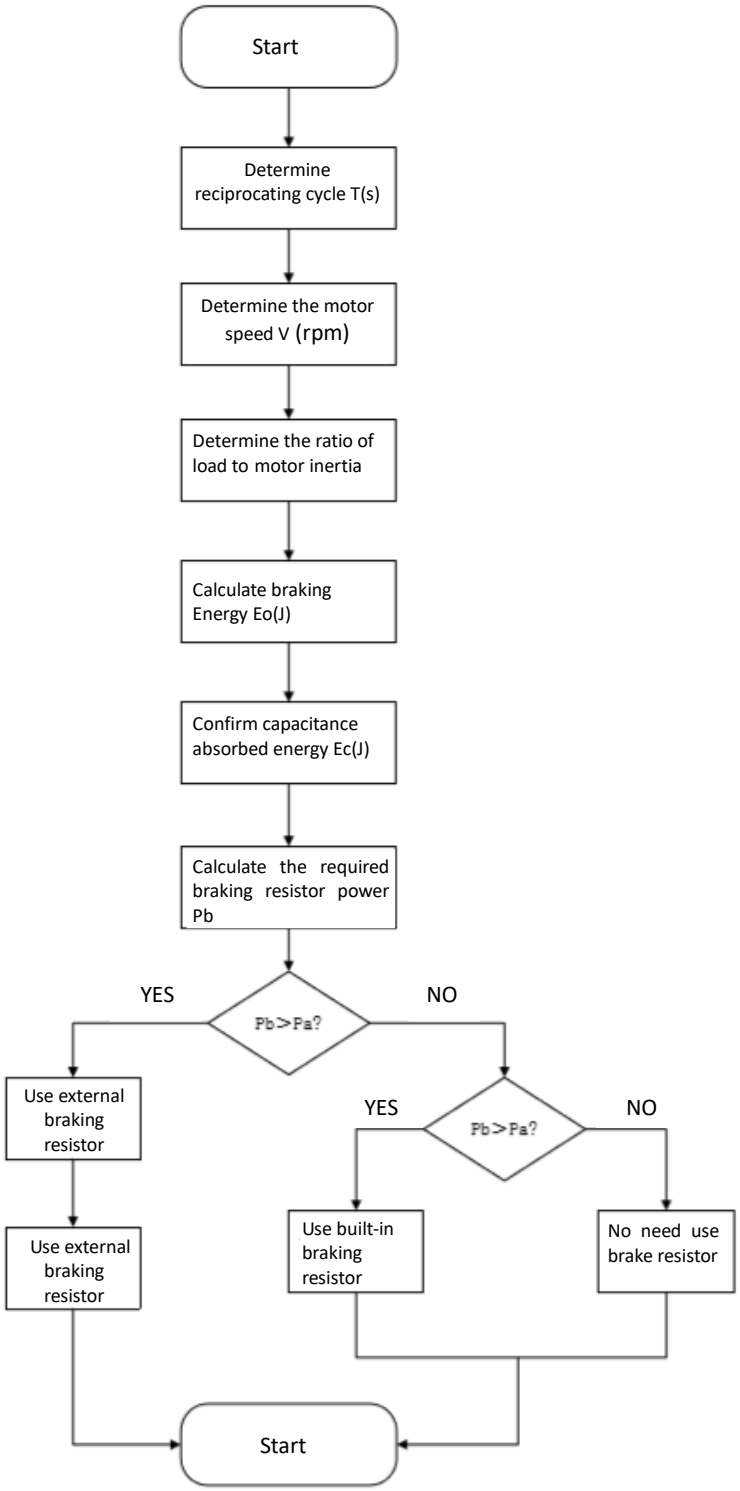


Figure 6.1.6-2 brake resistor selection flow chart

b) Braking resistor connection and setting

①Use external braking resistor:

If Pb> Pa, External braking resistor must be connected. At this time, according to the braking resistor cooling method. Use an external braking resistor with a 70% derating, ie, Pr=Pb/(1-70%), and ensure that it is greater than the minimum resistance allowed by the driver. Both ends of the external braking resistor are connected to the terminals "B1" and "B2" on the servo panel respectively, and the connection between the terminals "B2" and "B3" is removed.

②Use built-in braking resistor:

If Pb< Pa、and Pb×T> EC, Use built-in braking resistor. In this case, set P21.12 and P21.13 to 0. The driver uses a built-in braking resistor and requires a direct connection between terminals "B2" and "B3".

③No need to use brake resistor：

If Pb×T< EC， It is not necessary to connect the braking resistor. The braking energy can only be absorbed by the bus capacitance. In this case, set P21.12 and P21.13 to 3.

Attention:

- Please set the resistance (P21.12) and power (P21.13) of the external braking resistor correctly, otherwise it will affect the use of this function.
- If an external braking resistor is used, determine if the resistance meets the minimum allowable resistance limit.
- In a natural environment, when the braking resistor can process power (average) at rated capacity, the temperature of the resistor will rise above 120° C (in case of continuous braking). For safety reasons, use forced cooling to reduce the temperature of the braking resistor; or use a braking resistor with a thermal switch. About the load characteristics of brake resistor, please consult the manufacturer

2） There is external load torque, and the motor is in the power generation state.

The motor rotates in the same direction as the rotation direction, and the motor outputs energy to the outside. However, in some special applications, the motor torque output is opposite to the direction of rotation. At this time, the motor performs negative work and external energy is generated by the motor to recharge the drive.

When the load is continuous power generation, it is recommended to adopt a common DC bus scheme.

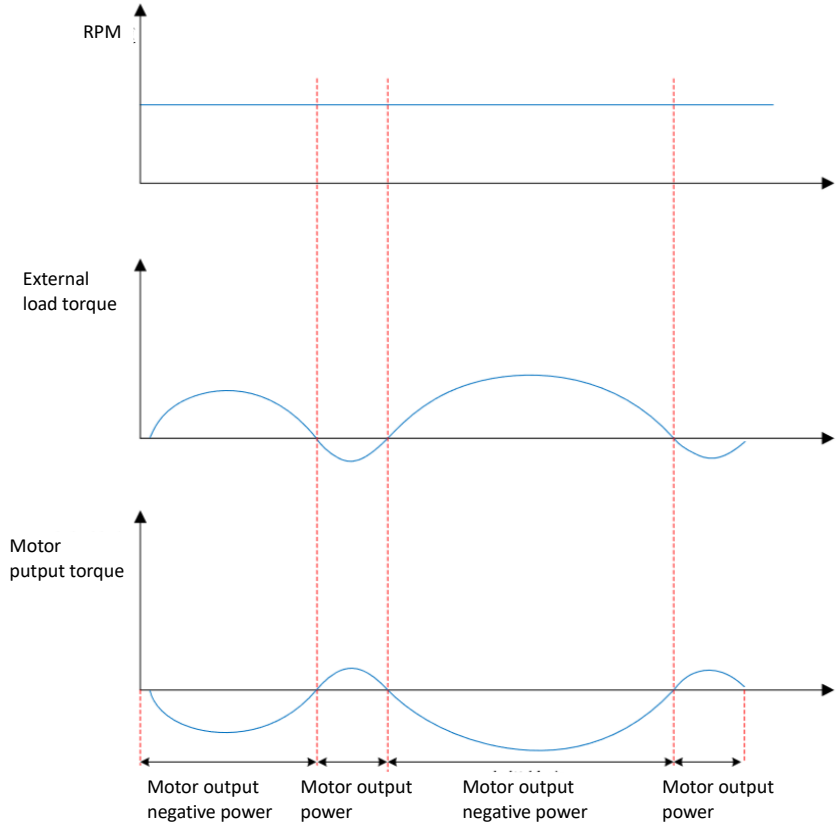


Figure 6.1.6-3 Example of Curve with External Load Torque

Take 750W (rated torque 2.39Nm) as an example. When the external load torque is 60% of rated torque and the speed reaches 1500rpm, the power fed back to the drive is (60% × 2.39) × (1500 × 2 π/ 60) = 225W, considering that the braking resistor needs to be derated by 70%, the external braking resistor power is 225/(1-70%) = 750W and the resistance is 50Ω.

☆Related parameters：

NO. P21.12	Name	Braking resistor value			Effective setting	-	Data structure	-	Data type	Int32
	Accessibility	RW	Map or not	-	Related mode	-	Data range	1~ 10000	Factory setting	0
Parameters P21.12 and P21.13 are used to set the resistance and power of the braking resistor and for its overload protection.										
NO. P21.13	Name	Braking resistor value			Effective setting	-	Data structure	-	Data type	Int32
	Accessibility	RW	Map or not	-	Related mode	-	Data range	1~ 10000	Factory setting	0
Set the value of braking resistor power										

6.1.7 Servo operation

(1) Enable servo enable

The servo drive is in the operable state. When there is no command input, the servo motor does not rotate. If the servo mode 6060h is not set or the servo torque and speed limit value is 0, the servo axis is in the free running state; otherwise, it is in the locked state.

(2) After inputting instructions, the servo motor rotates

Servo Operation Instructions		
Record	**No.**	**Content**
□	1	During the initial operation, appropriate instructions should be set to make the motor rotate at a low speed to confirm whether the motor rotation is correct.
□	2	Observe that the direction of motor rotation is correct. If you find that the motor steering is contrary to what you expected, check the input command signal and the command direction setting signal.
□	3	If the motor rotates in the correct direction, use the drive panel or BECON Monitor to observe the actual motor speed, time current, and other data.
□	4	After the above motor running status is checked, related parameters can be adjusted to make the motor work in the expected working condition.
□	5	Refer to "Chapter 9 Adjustment" to debug the servo drive.

(3) Power on timing diagram

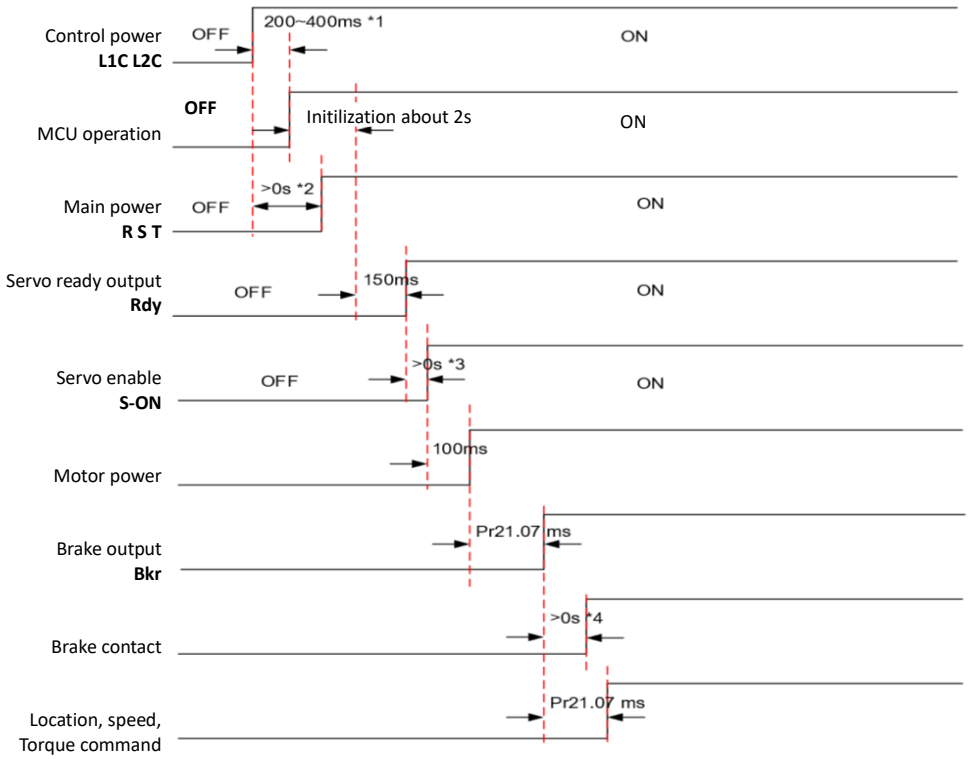


Figure 7.1.7-1 Power Supply Timing Diagram

- 1: The MCU startup time is determined by the servo power +5V power supply setup time.
- 2: The main power supply timing is recommended after the control power is on.
- 3: Servo-enabled power-on time depends on the control word's issuing time.
- 4: The delay time of the action of the contact part of the brake depends on the brake specification of the motor. The setting time of P21.07 must be greater than the delay time.

☆Related parameters:

NO. P21.07	Name	Brake open delay			Effective setting	-	Data structure	-	Data type	Int32
	Accessibility	RW	Map or not	-	Related mode	-	Data range	1~1000	Factory setting	100
Due to the slower brake response, this parameter is used to set the delay time for the brake to open or lock.										

(4) Shutdown sequence when fault or overtravel occurs

a) Fault: Zero speed shutdown

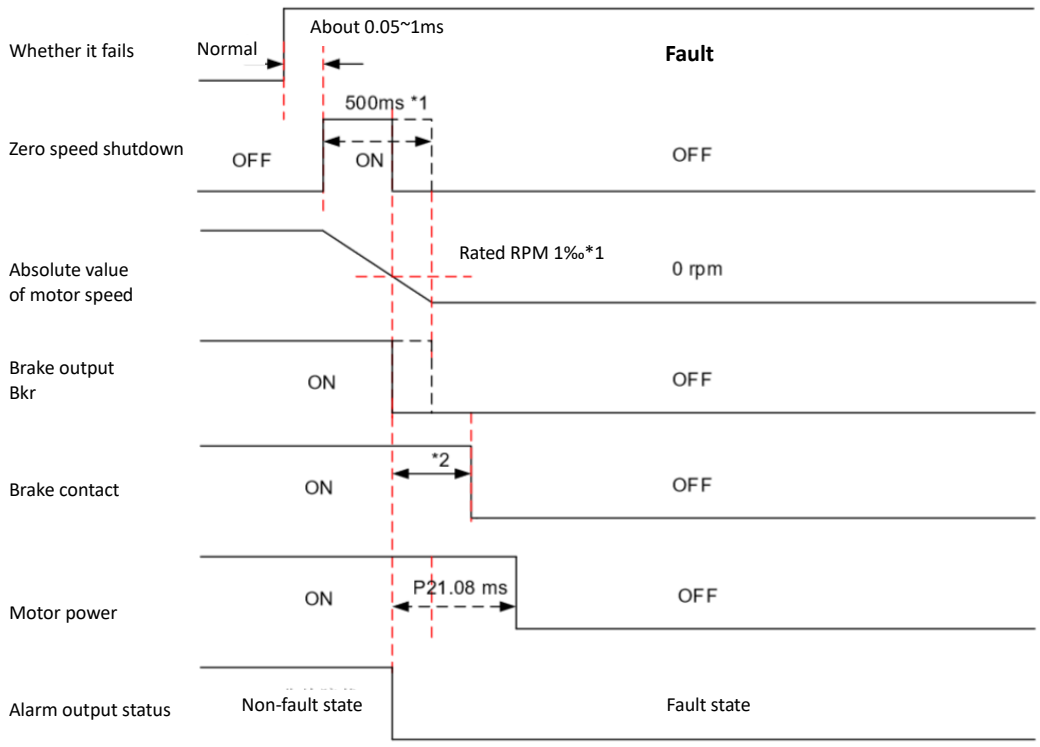


Figure 7.1.7-2 Zero-speed shutdown status in failure

● 1: If the motor speed reaches the rated speed 1‰ less than 500ms, the zero-speed stop signal becomes invalid after being 1‰ of the rated speed.

● 2: The delay time of the operation of the contact part of the brake depends on the brake specification of the motor. The set time of P21.08 must be greater than the delay time.

☆ related parameters:

NO. P21.08	Name	Brake open delay			Effective setting	-	Data structure	-	Data type	Int32
	Accessibility	RW	Map or not	-	Related mode	-	Data range	1~1000	Factory setting	100
Due to the slower brake response, this parameter is used to set the delay time for the brake to open or lock.										

b) Fault: Brake Force

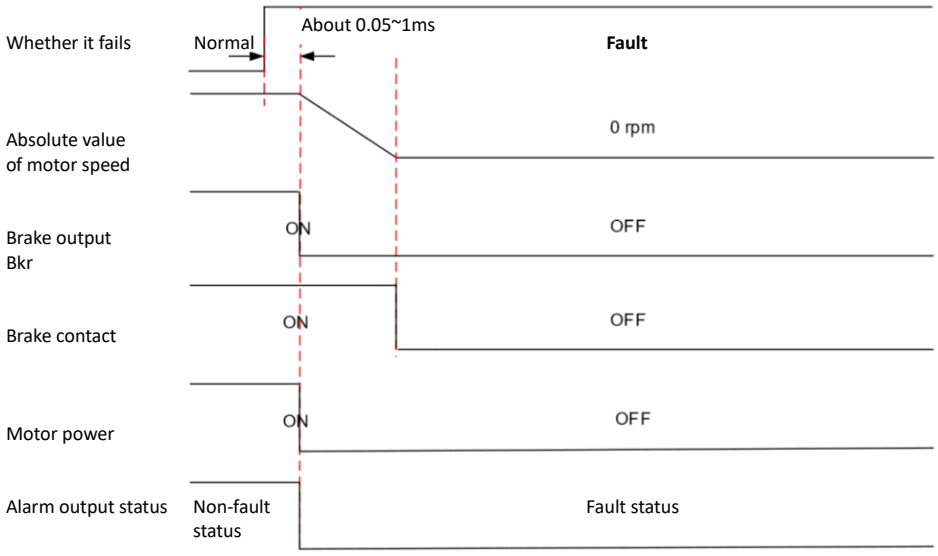


Figure 6.1.7-3 Forced brake state timing chart at fault

When the brake output is not connected, it will stop freely.

c) Overtravel: Zero speed stop, hold position latched

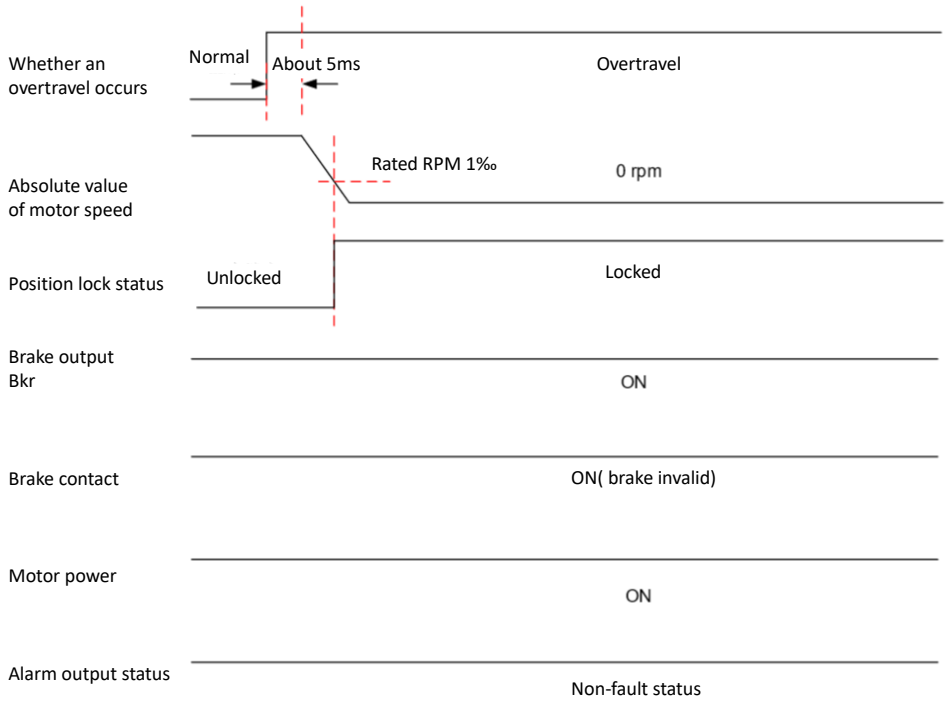


Fig. 6.1.7-4 Timing chart of zero-speed stop state during overtravel

d) Fault reset:

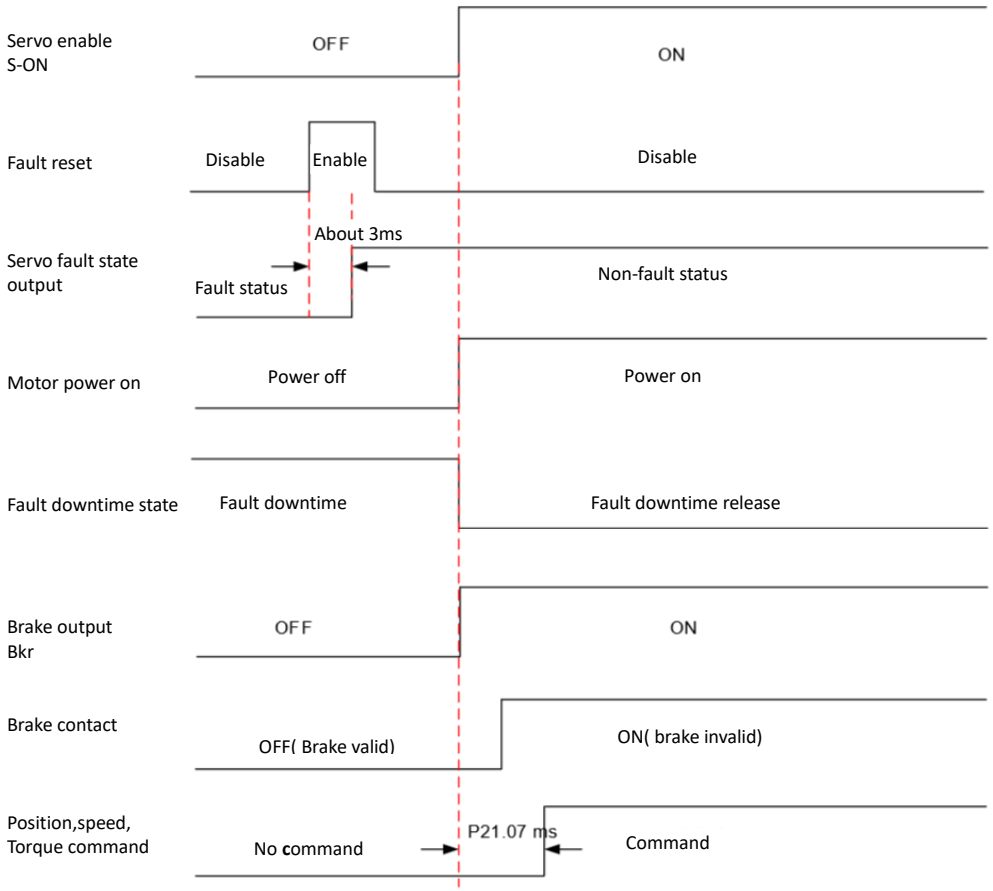


Figure 6.1.7-5 Fault Reset Timing Diagram

6.1.8 Servo Stop

According to the different stopping modes, it can be divided into a brake stop and a zero speed stop;
According to the stop state, it can be divided into the motor drive closed state and the position keeping locked state. details as follows:

Shutdown mode	Brake shutdown	Zero speed shutdown
Shutdown description	The servo motor is not energized and it is forced to stop by the brake. The deceleration time is determined by the specification of the holding brake. If there is no holding brake, it is free to stop.	The servo driver outputs reverse braking torque and the motor quickly decelerates to zero.
Shutdown features	If there is a brake, the mechanical impact is large and the deceleration process is extremely fast. If there is no brake, the deceleration is smooth and the mechanical impact is small, but the deceleration process is slow.	Rapid deceleration, there is a mechanical shock, but the deceleration process is fast.

Brake shutdown	Zero speed shutdown
After the motor stops rotating, the motor is not energized. If there is a brake, the motor shaft is locked; if there is no brake, the motor shaft can rotate freely.	After the motor stops rotating, the motor shaft is locked and it cannot rotate freely.
If there is a brake, the mechanical impact is large and the deceleration process is extremely fast. If there is no brake, the deceleration is smooth and the mechanical impact is small, but the deceleration process is slow.	Rapid deceleration, there is a mechanical shock, but the deceleration process is fast.

Servo shutdown conditions can be divided into the following categories:

(1) Servo-enabled invalid shutdown:

Under communication control mode,the servo enabled is invalid, and the servo stops via disable operation mode.

☆Related objects:

Index 605Ch	Name	Disable operation option			Effective setting	Operation setting Shutdown takes effect	Data structure	VAR	Data type	Int16
	Accessibility	RW	Map or not	NO	Related mode	ALL	Data range	0~1	Factory setting	1

The settings are as follows:

Setting value	Definition
0	Free stop, motor drive off
1	Stop at normal deceleration at zero speed,After shutdown, the motor is turned off.

Note: When the state machine switches from Operation Enable to Switched On, use 605Ch (Disable operation option code) to select the shutdown mode.

（2）Downtime:：

Depending on the type of fault, the servo-off mode is also different. For fault classification, see "Chapter 10 Troubleshooting."

☆Related objects:

Index 605Eh	Name	Fault reaction option			Effective setting	Operation setting Shutdown takes effect	Data structure	VAR	Data type	Int16
	Accessibility	RW	Map or not	NO	Related mode	ALL	Data range	0~3	Factory setting	1

The settings are as follows:

Setting value	Definition
0	Freewheel stop, motor drive off
1	Stop at normal deceleration at zero speed,After shutdown, the motor is turned off
2	Stop at zero speed with emergency stop deceleration,After shutdown, the motor is turned off
3	Stop at the maximum current zero speed,After shutdown, the motor is turned off

(3) Overtravel stop

★Glossary:：

“Overtravel”: refers to mechanical movement beyond the designed safe movement range.

“Over-travel stop”: refers to the safety function of stopping.The limit switch outputs the level change when the movement part of the machine exceeds the safe movement range, and the servo drive forcibly stops the servo motor.

When the servo motor drives the vertical axis, the workpiece may fall if it is in the overtravel state. In order to prevent the workpiece from falling, the servo program has already fixed the over-travel stop mode "zero speed stop, position locked state". In the case of linear motion of the workpiece, be sure to connect a limit switch to prevent mechanical damage. In the overtravel state, the motor (workpiece) can be reversed by inputting a reverse command.

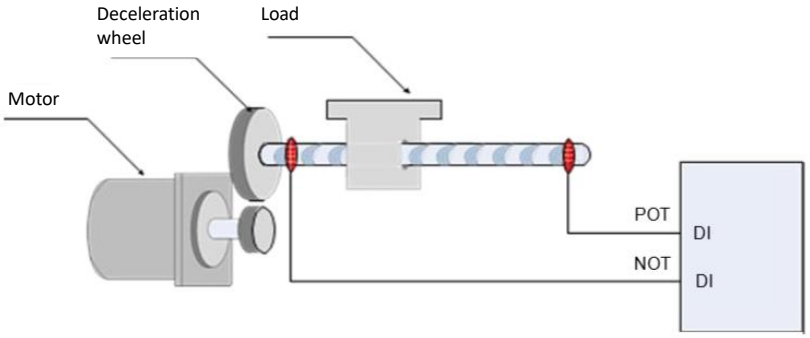


Figure 6.1.8-1 Installation of limit switch

When the overtravel stop function is used, the 2 DI terminals of the servo driver should be configured as function 2/102 (P30.00~P30.04: POT, forward motion prohibition) and function 3/103 (P30.00~P30) respectively. .04: NOT, reverse motion inhibit) to receive the limit switch input level signal. When the DI terminal active logic is positive logic, set 2 and 3, and set negative logic to 102 and 103. The driver will enable or release the over-travel stop status according to whether the DI terminal level is valid or not.

（4）Fast downtime：

Servo has 2 quick stop modes:

- Use DI function 6/106: P30.05: Emergency stop logic;
- When bit 2 (Quick stop) of the control word 6040h is 0, fast stop is performed. The stop mode is selected through the object dictionary 605Ah.

Index 605Ah	Name	Quick stop option			Effective setting	Operation setting Shutdown takes effect	Data structure	VAR	Data type	Int16
	Accessibility	RW	Map or not	NO	Related mode	ALL	Data range	0~7	Factory setting	2
Set the quick stop mode and take into effect.										

Setting value	Definition
0	Free stop, motor drive off
1	Stop at normal deceleration at zero speed, and the motor is turned off after shutdown
2	Stop at zero speed with emergency stop deceleration, and the motor is turned off after shutdown
3	Stop at the maximum current of zero speed and the motor is turned off after shutdown
4	NA
5	Zero speed at normal deceleration, position locked after shutdown
6	Stop at zero speed with emergency stop deceleration, position locked after shutdown
7	Stop at the maximum current at zero speed, position locked after shutdown

6.1.9 ConversionFactor Settings

● 6091h： Gear ratio

The gear ratio essentially means the corresponding motor displacement (unit: encoder unit) when the displacement of the load axis is 1 command unit.

The gear ratio is composed of the numerator 6091-01h and the denominator 6091-02h. Through the gear ratio, the ratio of the displacement of the load axis (command unit) to the motor displacement (encoder unit) can be established:

Motor Displacement = Load Displacement × Gear Ratio

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

$$\text{Gear ratio} = \frac{\text{Motor resolution}}{\text{Load axis resolution}}$$

Index 6091h	Name	Gear Ratio			Effective setting	-	Data structure	VAR	Data type	Uint32-
	Accessibility	RW	Map or not	YES	Related mode	-	Data range	OD data range	Factory setting	OD default value

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

Electronic gear ratio setting range：

(0.001× encoder resolution/10000, 4000× encoder resolution/10000)

- Relationship between motor position feedback (encoder unit) and load axis position feedback (command unit):

  Motor position feedback = load axis position feedback × gear ratio

- Relationship between motor speed (rpm) and load shaft speed (command unit/s):

$$\text{Motor speed(RPM)} = \frac{\text{Load axis speed(RPM) x gear ratio6091}_h}{\text{Encoder resolution}} \text{ X 60}$$

- Relationship between motor acceleration (rpm/ms) and load shaft speed (command unit/s2):

$$\text{Motor acceleration (rpm/ms)} = \frac{\text{Load axis acceleration (rpm/ms) x gear ratio6091}_h}{\text{Encoder resolution}} \text{ X } \frac{1000}{60}$$

Sub-Index 0	Name	Number of gear ratio sub-indexes			Effective setting	-	Data structure	VAR	Data type	Int16
	Accessibility	RO	Map or not	YES	Related mode	ALL	Data range	-	Factory setting	2

Sub-Index 1h	Name	Motor shaft revolutions			Effective setting	-	Data structure	VAR	Data type	Uint32
	Accessibility	RW	Map or not	RPDO	Related mode	ALL	Data range	-	Factory setting	1
Note: This object sets the number of motor shaft revolutions.										

Sub-Index 2h	Name	Driving shaft revolutions			Effective setting	-	Data structure	VAR	Data type	Uint32
	Accessibility	RW	Map or not	RPDO	Related mode	ALL	Data range	-	Factory setting	1
Note: This object dictionary sets the sub-index 1h the number of drive shaft revolutions corresponding to the number of motor shaft revolutions.										

- Take ball screw as an example:

The minimum unit of instruction is fc=1mm
Lead screw travel pB=10mm/r
Reduction ration=5:1
20bit Bus Motor Resolution P = 1048576(p/r)

Therefore, the location factor is calculated as：

$$\text{location factor} = \frac{\text{Motor resolution (P) x Reduction ratio(N)}}{\text{Lead screw travel(pB)}}$$

$$= \frac{1048576 \times 5}{10}$$

$$= 524288$$

Therefore: 6091-1h = 524288, 6091-2 h =1.
Its substantial meaning is: When the load displacement is 1mm, the motor displacement is: 524288.

Attention:

The values of 6091-1 h and 6091-2 h should be mathematically divided until there is no common denominator. Take the final value!

- 607Eh: Polarity command polarity

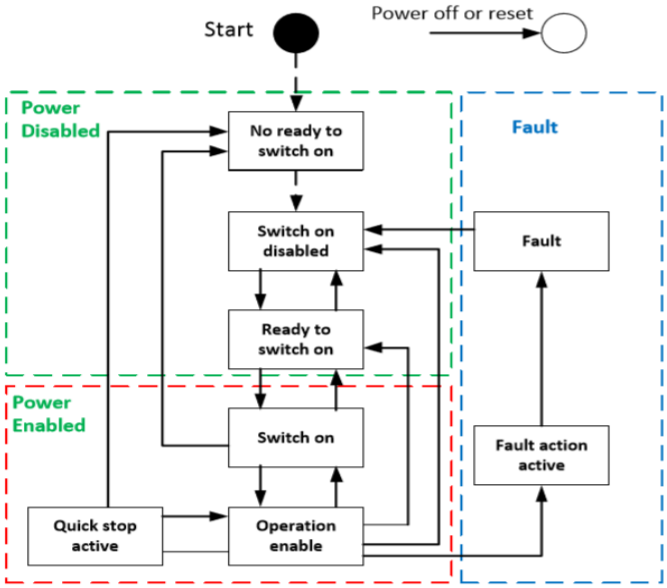
607Eh is used to set the polarity of signals such as position command, speed command and torque command.

Index 607Eh	Name	Polarity			Effective setting	Operation setting Shutdown takes effect	Data structure	VAR	Data type	Uint8
	Accessibility	RW	Map or not	RPDO	Related mode	Torque,speed-	Data range	00~FF	Factory setting	0

Bit	Description
0~5	Undefined
6	Speed command polarity 0: keep existing value 1: Instruction × (-1) PV: Apply the reverse value of the target torque 6071h CSP: Apply the reverse value of speed feed forward 60B1h CSV: Apply the reverse value of the speed command (60FFh+60B1h)
7	Position command polarity 0: keep existing value 1: Instruction × (-1) PP: Apply the reverse value of target location 607Ah CSP: Apply the reverse value of Position Instruction (607Ah+60B0h)

6.2 Servo Status Setting

Using the iK3 series driver must follow the standard 402 protocol to guide the servo drive, the servo drive can run in the specified state.



The description of each state is as follows:

Not ready to switch on	Control power on, drive initialization, internal self-test, and it is in this state until initialization is completed.
Switch on disable	The servo initialization is completed, the servo driver has no fault or the error has been eliminated. Drive parameters can be set.
Ready to switch on	Servo drive is ready. Drive parameters can be set.
Switch on	The servo drive waits to turn on the servo enable. Drive parameters can be set.
Operation Enable	The drive is running normally. A certain servo operation mode is enabled. The motor is energized. When the command is not 0, the motor rotates. The drive parameter attribute should be set to "run change", otherwise it cannot be set.
Quick stop active	The quick stop function is activated and the drive is performing a quick stop function. The drive parameter attribute should be set to "run change", otherwise it cannot be set.
Fault action active	The drive has failed and is performing a failed shutdown. The drive parameter attribute should be set to "run change", otherwise it cannot be set.

Fault	The fault stop is completed, all drive functions are disabled, and the drive parameters can be changed to eliminate the fault

Control commands and status switching：

CiA402 status switching	Control word 6040h		Status word 6041h(bit0~bit9*1)
0	Power on -> Initialize	Natural transition without control commands	0x0000
1	Initialization -> Servo error-free	Natural transition without control commands If an error occurs during initialization, go directly to 13	0x0250
2	Servo-free -> Servo Ready	0x0006	0x0231
3	Serve Ready --> Wait for Servo Enable to Turn On	0x0007	0x0233
4	Wait for servo enable --> servo operation	0x000F	0x0237
5	Servo operation --> wait for servo enable	0x0007	0x0233
6	Waiting to turn on the servo enable --> Serve ready	0x0006	0x0231
7	Servo Ready--> Servo No Fault	0x0000	0x0250
8	Servo operation-->Servo ready	0x0006	0x0231
9	Servo operation -> Servo No Fault	0x0000	0x0250
10	Waiting to turn on the servo enable --> Servo No Fault	0x0000	0x0250
11	Servo operation --> quick stop	0x0002	0x0217
12	Fast stop-->Servo without fault	The quick stop mode 605A is selected as 0~3. After the stop is completed, the natural transition will be made without control commands.	0x0250
13	Downtime	In any state other than “failure”, once the servo drive fails, it will automatically switch to the stop status without any control command.	0x021F
14	Downtime -> Failure	After the fault shutdown completes, the natural transition, no control instructions	0x0218
15	Fault-->Servo is not faulty	0x80; bit7 rising edge is valid; Bit7 is kept at 1, all other control commands are invalid.	0x0250
16	Fast stop-->Servo operation	Quick stop mode 605A selects 5~7, send 0x0F after shutdown	0x0237

Note: *1. Bit 10~bit15 of the status word 6041h (bit14 is meaningless) is related to the operation status of each servo mode and is represented by “0” in the above table. Please refer to each servo operation mode for the specific status of each bit.

6.2.1 Control Word 6040h

Index 6040h	Name	Control word			Effective setting	Operation setting Shutdown takes effect	Data structure	VAR	Data type	Uint16
	Accessibility	RW	Map or not	RPDO	Related mode	ALL	Data range	0~65535	Factory setting	0

Set control commands：

Bit	名称	描述
0	Servo ready	1- Valid, 0- Invalid
1	Switch on the main circuit	1- Valid, 0- Invalid
2	Fast Shutdown	1- Invalid，0- Valid
3	Servo operation	1- Valid, 0- Invalid
4~6		Related to servo operation mode
7	Fault reset	For resettable faults and warnings, the fault reset function is performed; the rising edge of bit7 is valid; bit7 remains at 1, and other control commands are invalid.
8	pause	For the pause mode in each mode, refer to the object dictionary 605Dh.
9~10	NA	Reserved.
1~15	Factory custom	Reserved, undefined

Note：

Each bit of the control word is assigned independently a value ,which is meaningless and must be combined with other bits to form a control instruction.

Bit0~bit3 and bit7 have the same meaning in each servo mode, and commands must be sent in order to guide the servo drive into the expected state according to the CiA402 state machine switching flow. Each command corresponds to a certain state.

Bit4~bit6 related to each servo mode (check the control instructions in different modes)

6.2.2 Status Word 6041h

Index 6041h	Name	Status word			Effective setting	-	Data structure	VAR	Data type	Uint16
	Accessibility	RO	Map or not	TPDO	Related mode	**ALL**	Data range	0~xFFFF	Factory setting	0

Feedback servo status：

Setpoint (binary)	Description
xxxx xxxx x0xx 0000	Not Ready to switch on
xxxx xxxx x1xx 0000	Swtch on dsabled
xxxxxxxx x01x 0001	Rady 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	Falt eaction ative
xxxx xxxx x0xx 1000	Fault

Note:

1) Each bit of the status word is read without meaning. It must be composed together with other bits to feedback the current status of the servo.

2) Bit0~bit9 have the same meaning in each servo mode. After the control word 6040h sends commands in sequence, the servo feedbacks a certain state.

3) Bit12~bit13 related to each servo mode (check the control command in different modes)

4) bit10bit11bit15 has the same meaning in each servo mode, and the feedback servo performs a servo mode.

6.3 Servo Mode Settings

6.3.1 Servo Mode Introduction

Servo pre-operation mode can be set by object dictionary 6060h. The current operating mode of the servo can be viewed through the object dictionary 6061h.

Mode setting 6060h:

Index 6060h	Name	Modes of operation			Effective setting	-	Data structure	VAR	Data type	Uint8
	Accessibility	RW	Map or not	RPDO	Related mode	**ALL**	Data range	0~10	Factory setting	00

Set the polarity of the position command, speed command, and torque command.

Setting value	Name	description
0	No mode setting	Reserve
1	Profile position mode (pp)	Reference profile position mode (pp)
2	No mode setting	Reserve
3	Profile Speed Mode (pv)	Reference profile speed mode (pv)
4	Profile torque mode (pt)	Reference profile torque mode (pt)
5	No mode setting	Reserve
6	Origin regression model (hm)	Reference origin regression model (hm)
7	Interpolation mode (ip)	Reference position interpolation mode (ip)
8	Cycle synchronization position mode (csp)	Reference cycle synchronization position mode (csp)
9	Cycle synchronous speed mode (csv)	Reference cycle synchronous speed mode (csv)
10	Cycle synchronous torque mode (cst)	Reference cycle synchronous torque mode (cst)

Mode display 6061h：

Index 6061h	Name	Modes of operation display			Effective setting	-	Data structure	VAR	Data type	Uint8
	Accessibility	RO	Map or not	TPDO	Related mode	**ALL**	Data range	0~10	Factory setting	00

Set the polarity of the position command, speed command, and torque command.

Setting value	Name	Description
0	No mode setting	Reserve
1	Profile position mode (pp)	Reference contour position mode (pp)
2	No mode setting	Reserve
3	Profile Speed Mode (pv)	Reference profile speed mode (pv)
4	Profile torque mode (pt)	Reference outline torque mode (pt)
5	No mode setting	Reserve
6	Return to zero mode (hm)	Reference origin regression model (hm)
7	Interpolation mode (ip)	Reference position interpolation mode (ip)
8	Cycle synchronization position mode (csp)	Reference cycle synchronization position mode (csp)
9	Cycle synchronous speed mode (csv)	Reference cycle synchronous speed mode (csv)
10	Cycle synchronous torque mode (cst)	Reference cycle synchronous torque mode (cst)

6.3.2 Mode Switching

Mode switching usage notes:

1) When the servo driver is in any state and cuts into other modes from the profile position mode or the cycle sync position mode, the unexecuted position instruction will be discarded.
2) When the Servo Drive is in any state and it cuts into other modes from Profile Speed Mode, Profile Torque Mode, Cycle Synchronous Speed Mode and Cycle Synchronous Torque Mode, ramp stop is performed first. After the stop is completed, it can be switched into other modes.
3) When the servo is in the zero return mode and it is running, it cannot be switched into other modes; when the zero return is completed or it is interrupted (fault or enable is invalid), it can be switched into other modes.
4) When the servo operation state is switched from other modes to the periodic synchronous mode operation, please send the command at least 1ms interval, otherwise, the instruction loss or error will occur.

6.3.3 Each Mode Supports Communication Cycle

Cycle time	Profile position mode (PP)	Return to zero mode (HM)	Cycle Syn-Position Mode (CSP)	Cycle Syn-Speed Mode (CSV)	Profile Speed Mode (PV)	Profile torque mode (PT)	Cycle Synchronization Torque Mode (CST)
100us	X	X	X	X	X	X	X
200us	Y	Y	Y	Y	Y	Y	Y
400us	Y	Y	Y	Y	Y	Y	Y
1ms	Y	Y	Y	Y	Y	Y	Y

The synchronization period supported by each mode of 1ms and below is as shown in the above table. If it is used outside the specifications, it may cause an operation error.

More than 1ms, the value is the position loop control period (iK3 position loop control period is 200us). An integral multiple of the synchronization period can also be supported.

6.4 Cycle Synchronization Position Mode （csp)

In cycle-synchronous position mode, the host controller completes the position command planning, and then sends the planned target position (607Ah) to the servo drive in a periodic synchronized manner. The position, speed, and torque control are completed internally by the servo driver.

6.4.1 Control Block Diagram

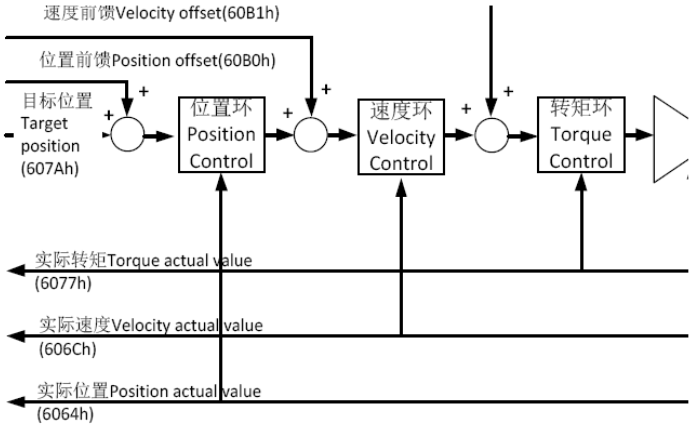


Figure 6.4.1-1 Cyclic Synchronization Position Control Block Diagram

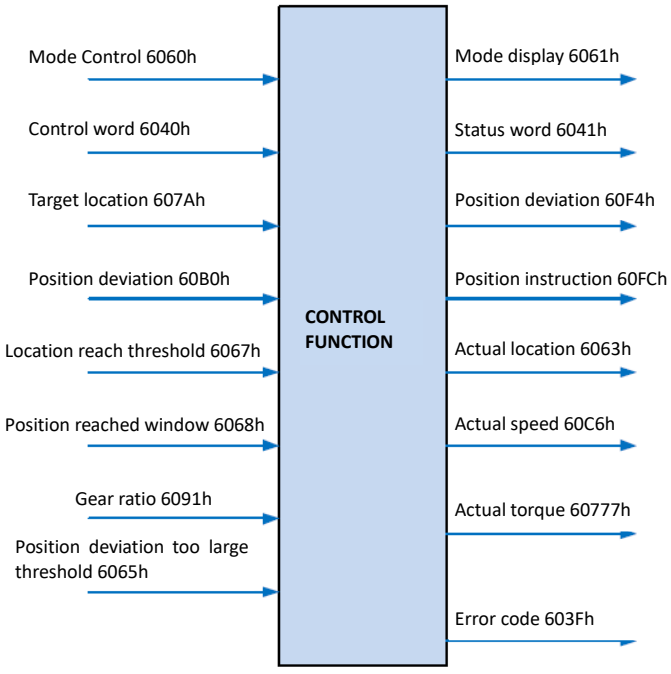


Figure 6.4.1-2 Input and Output Objects

6.4.2 Related Objects

Control word 6040h		
Bit	Name	Description
0	Switch on	Bit0~bit3 are all 1 to start the operation
1	Main Circuit- Enable voltage	
2	Quick stop	
3	Enable operation	
8	Halt	0: servo is set by Bit0~bit3 1: Servo is set to pause via 605Dh setting
Statsu word 6041h		
Bit	Name	Description
10	Target Reach	0: The target position does not arrive 1: The target location arrives
11	Software internal position limit	0: Position command and position feedback are not exceeded 1: Position command or position feedback exceeds limit
12	Drive follow the command Value	0: The slave did not follow the instruction 1: The slave follows the instruction. The slave is in the running state and starts executing the position instruction. This bit is set to 1; otherwise, it is 0.
13	Following error	0: No position deviation is too large 1: Excessive position deviation error
15	Home Find	0: Origin zero is not completed 1: Origin zero complete

Indes (hex)	Subindex(hex)	Name	Access	Data type	Unit	Setting range	Default
603F	0	Error code	RO	Uint16	-	0~65535	0
6040	0	Control word	RW	Uint16	-	0~65535	0
6041	0	Status word	RO	Uint16	-	0~65535	0
6060	0	Operation mode	RW	Int8	-	0~10	0
6061	0	Mode display	RO	Int8	-	0~10	0
6062	0	Position command	RO	Int32	Command unit	-	-
6063	0	Position feedback	RO	Int32	Encoder unit	-	-
6064	0	Position feedback	RO	Int32	Command unit	-	-
6065	0	Excessive position deviation threshold	RW	Uint32	Command unit	$0\sim(2^{32}-1)$	3145728
6067	0	Position reach threshold	RW	Uint32	Encoder unit	0~65535	734
6068	0	Position arrival window	RW	Uint16	ms	0~65535	x10
606C	0	Actual speed	RO	Int32	Command unit /s	-	-
6072	0	Max torque	RPDO	Uint16	0.10%	0~5000	5000
6077	0	Actual torque	RO	Int16	0.10%	-5000~5000	0
607A	0	Target position	RW	Int32	Command unit	$-2^{31}\sim(2^{31}-1)$	0
6091	1	Motor resolution	RW	Uint32	-	$0\sim(2^{32}-1)$	1
	2	Axis resolution	RW	Uint32	-	$1\sim(2^{32}-1)$	1
60B0	0	Position bias	RW	Int32	Command unit	$-231\sim(2^{31}-1)$	0
60B1	0	Speed bias	RW	Int32	Command unit /s	$-231\sim(2^{31}-1)$	0
60B2	0	Torque bias	RW	Int32	0.10%	-5000~5000	0
60F4	0	Position deviation	RO	Int32	Command unit	-	-

60FC	0	Position command	RO	Int32	Encoder unit	-	-

Note: For detailed instructions on the use of related objects, refer to "Chapter 8 Detailed Description of Object Dictionaries".

6.4.3 Related Function Settings

1) Positioning completed

Index	Subindex	Name	Description
6067	0	Location reach threshold	When the position deviation is in the range of ±6067h, and the time reaches 6068, the positioning DO signal is valid, and at the same time bit10 of 6041=1. Does not meet any of the conditions of the two, the location is invalid.
6068	0	Location arrival window	

2) excessive position deviation threshold

Index	Subindex	Name	Description
6065	0	Excessive position deviation threshold	When the position deviation is greater than this value, a position error is too large, the panel displays an alarm, and bit 13 of the status word is set. When 6065h = 0xFFFFFFFF, the drive does not perform excessive position deviation detection.

6.4.4 Recommended Configuration

Cycle synchronization position mode (csp), the basic configuration is as follows:

RxPDO	TxPDO	REMARK
6040：control word	6041： status word	Necessary
607A：target position	6064： position actual value	Necessary
6060： modes of operation	6061： modes of operation display	Optional

6.5 Cycle Synchronous Speed Mode （csv)

In the periodic synchronous speed mode, the upper controller sends the calculated target speed 60FF synchronously to the servo drive, and the speed and torque adjustments are executed internally by the servo.

6.5.1 Control Block Diagram

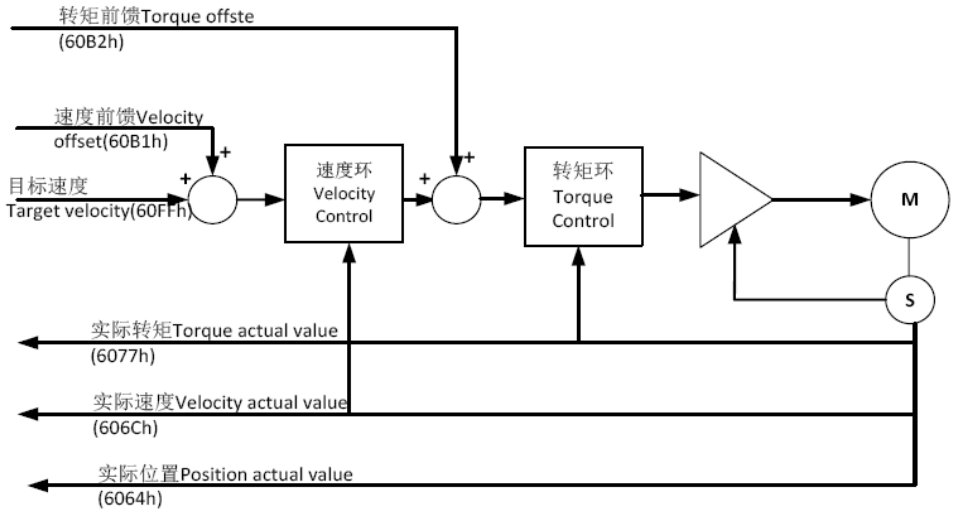


Figure 6.5.1-1 Cyclic Synchronization Speed Control Block Diagram

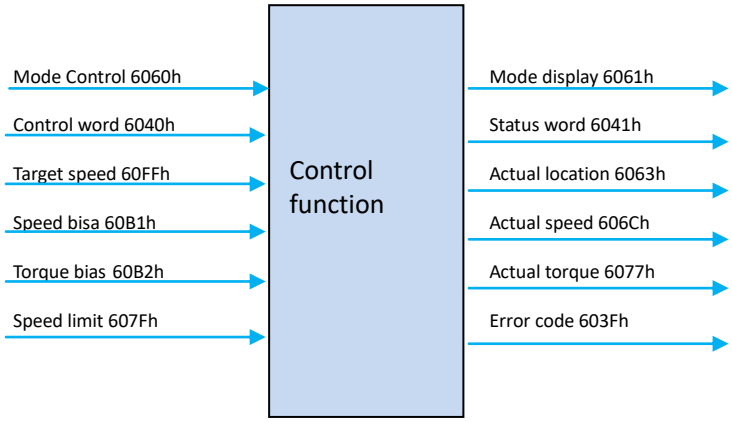


Figure 6.5.1-2 Input and Output Objects

6.5.2 Related Objects

Control word 6040h		
Bit	Name	Description
0	Switch on	Bit0~bit3 are all 1 to start the operation
1	Main circuit Enable voltage	
2	Quick stop	
3	Enable operation	
8	Halt	0: servo is set by bit0~bit3 1: Servo is set to pause by 605Dh setting.
Control word 6041h		
Bit	Name	Description
10	Target Reach	0: Target speed does not arrive 1: The target speed reaches
12	Slave drive follow the command Value	0: The slave does not follow the instruction 1: Slave follows instruction
13		Undefined
15	Home Find	0: Origin zero is not completed 1: Origin zero complete

Indes (hex)	Subindex (hex)	Name	Access	Data type	Unit	Setting range	Default
603F	0	error code	RO	Uint16	-	0~65535	0
6040	0	Control word	RW	Uint16	-	0~65535	0
6041	0	Status word	RO	Uint16	-	0~65535	0
6060	0	Mode of operation	RW	Int8	-	0~10	0
6061	0	Mode display	RO	Int8	-	0~10	0
6063	0	Position feedback	RO	Int32	Encoder unit	-	-
6064	0	Position feedback	RO	Int32	Command unit	-	-
606C	0	Actual speed	RO	Int32	Command unit /s	-	-
6077	0	Actual torque	RO	Int16	0.10%	-5000~5000	0
607F	0	Maximum speed	RW	Uint32	Command unit/s	$0\sim(2^{32}-1)$	230
6083	0	Acceleration	RW	Uint32	Command unit / S^2	$0\sim(2^{32}-1)$	100
6084	0	deceleration	RW	Uint32	Command unit / S^2	$0\sim(2^{32}-1)$	100
60B1	0	Speed bias	RW	Int32	Command unit /s	$-2^{31}\sim(2^{31}-1)$	0
60B2	0	Torque bias	RW	Int32	0.10%	-5000~5000	0

60E0	0	Forward torque limit	RW	Uint16	0.10%	0~5000	5000
60E1	0	Reverse torque limit	RW	Uint16	0.10%	0~5000	5000
60FF	0	Target speed	RW	Int32	Command unit /s	-2^{31}~(2^{31}-1)	0

Note: For detailed instructions on the use of related objects, refer to "Chapter 8 Detailed Description of Object Dictionaries".

6.5.3 Related Function Settings

1) Speed arrival function

Index	Subindex	Name	Description
606Dh	0	Speed reaches threshold	When the difference between the target speed 60FF (converted into motor speed /rpm) and the actual speed of the motor is within ±606D and the time reaches 606E, the speed is deemed to be reached, bit 10 of status word 6041=1, and the speed arrives, DO function is valid. In the profile speed mode and cycle synchronous speed mode, this flag bit is significant when the servo enable is valid; otherwise it is meaningless.
606Eh	0	Speed arrival window	

6.5.4 Recommended Configuration

Cycle synchronization speed mode (csv), the basic configuration is as follows:

RxPDO	TxPDO	REMARK
6040：control word	6041： status word	Necessary
60FF：target Velocity		
	6064： position actual value	Optional
	606C： velocity actual value	Optional
6060：modes of operation	6061： modes of operation display	Optional

6.6 Cycle SynchronousTorque Mode (cst)（cst）

In this mode, the host controller sends the calculated target torque 6071h synchronously to the servo drive. The torque adjustment is performed internally by the servo. When the speed reaches the limit value, it will enter the speed regulation phase.

6.6.1 Control Block Diagram

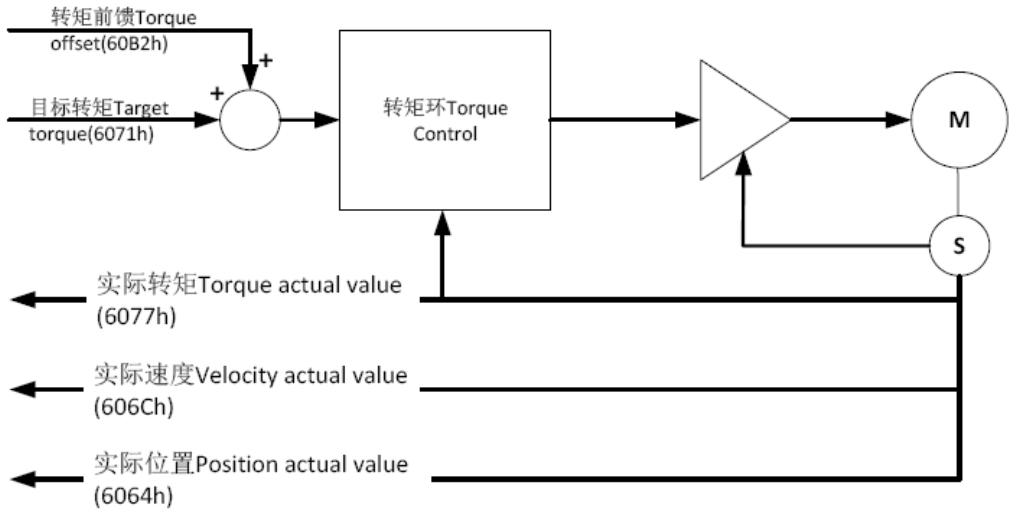


Figure 6.6.1-1 Cycle Synchronous Torque Mode Block Diagram

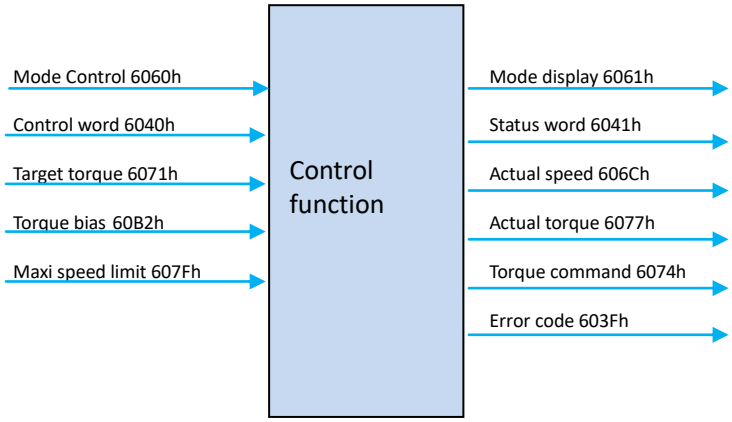


Figure 6.6.1-2 Period Synchronization Torque Mode Input/Output Object

6.6.2 Related Objects

Control Word 6040h		
Bit	Name	Description
0	Switch on	Bit0~bit3 are all 1 to start the operation
1	Main circuit Enable voltage	
2	Quick stop	
3	Enable operation	
8	Halt	0: servo is set by bit0~bit3 1: Servo is set to pause by 605Dh setting.
Bit	Name	Description
10	Target Reach	0: Target torque does not arrive 1: The target torque reaches
12	Slave drive follow the command Value	0: The slave does not follow the instruction 1: Slave follows instruction
13		Undefined
15	Home Find	0: Origin zero is not completed 1: Origin zero complete

Indes (hex)	Subindex(hex)	Name	Access	Data type	Unit	Setting range	Default
603F	0	error code	RO	Uint16	-	0~65535	0
6040	0	Control word	RW	Uint16	-	0~65535	0
6041	0	Status word	RO	Uint16	-	0~x65535	0
6060	0	Mode of operation	RW	Int8	-	0~10	0
6061	0	Mode display	RO	Int8	-	0~10	0
606C	0	Actual speed	RO	Int32	Command unit /s	-	-
6071	0	Target torque	RW	Int16	0.10%	-5000~5000	0
6074	0	Torque command	RO	Int16	0.10%	-5000~5000	0
6077	0	Actual torque	RO	Int16	0.10%	-5000~5000	0
607F	0	Maximum speed	RW	Uint32	Command unit /s	0~(2^{32}-1)	230
60B2	0	Torque bias	RW	Int32	0.10%	-5000~5000	0
60E0	0	Forward torque limit	RW	Uint16	0.10%	0~5000	5000
60E1	0	Reverse torque limit	RW	Uint16	0.10%	0~5000	5000

Note: For detailed instructions on the use of related objects, refer to "Chapter 8 Detailed Description of Object Dictionaries".

6.6.3 Recommended Configuration

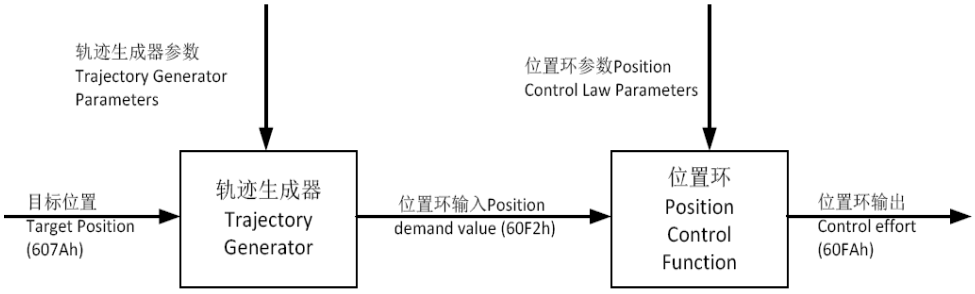
Cycle synchronization torque mode (cst), the basic configuration is as follows:

RxPDO	TxPDO	REMARK
6040： control word	6041： status word	Must
6071： target Torque		
	6064： position actual value	Optional
	606C： velocity actual value	Optional
	6077： Torque Actual Value	Optional
6060： modes of operation	6061： modes of operation display	Optional

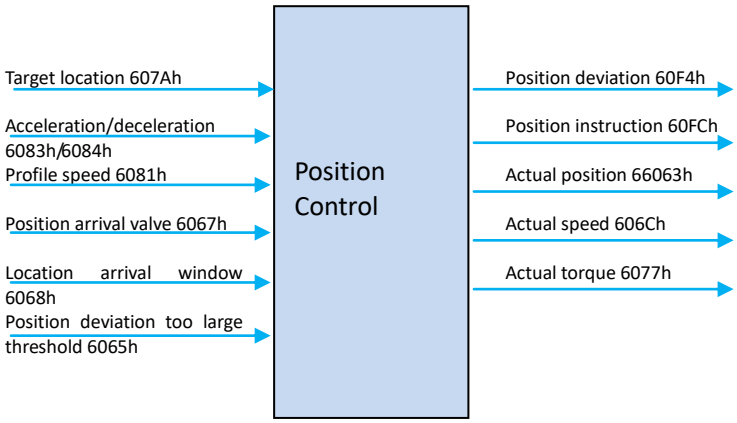
6.7 Profile Position Mode （pp）

This mode is mainly used for point-to-point positioning applications. In this mode, the host computer gives the target position (absolute or relative), position curve speed, acceleration and deceleration, and deceleration. The internal trajectory generator of the servo will generate the target position curve command according to the settings, and the drive will complete the position control and speed control and torque control.

6.7.1 Control Block Diagram



6.7.1-1 Profile Position Mode Control Block Diagram



6.7.1-2 Profile Position Mode (pp) Input/Output Block Diagram

6.7.2 Related Objects

Control Word 6040h		
Bit	Name	Description
0	Switch on	Bit0~bit3 are all 1 to start the operation
1	Main circuit Enable voltage	
2	Quick stop	
3	Enable operation	

4	New set-point	The rising edge of this bit from 0 to 1 means that the new target position 607Ah, contour speed 6081h, acceleration 6083h and deceleration 6084h are pre-triggered.
5	Change set immediately	0: Not immediately updated 1: Immediately updated
6	Absolute position command / Relative position command	0: Absolute position command for target position 1: Relative position command for target position
Status word 6041h		
Bit	Name	Description
10	Target Reach	0: The target position does not arrive 1: The target position arrives
12	Set-point acknowledge	0: Slave does not follow the instruction 1: Slave follows the instruction The slave is in the running state and starts executing the position instruction. This bit is set to 1; otherwise, it is 0.
13	Following error	0: No position error is too large. 1: Position error is too large.
15	Home Find	0: Origin zero return incomplete 1: Origin zero return completed

Indes (hex)	Subindex(hex)	Name	Access	Data type	Unit	Setting range	Default
603F	0	error code	RO	Uint16	-	0~65535	0
6040	0	Control word	RW	Uint16	-	0~65535	0
6041	0	Status word	RO	Uint16	-	0~xFFFF	0
6060	0	Mode of operation	RW	Int8	-	0~10	0
6061	0	Mode display	RO	Int8	-	0~10	0
6062	0	Position command	RO	Int32	Command unit	-	-
6063	0	Position feedback	RO	Int32	Encoder unit	-	-
6064	0	Position feedback	RO	Int32	Command unit	-	-
6065	0	Excessive position deviation threshold	RW	Uint32	Command unit	0~(2^{32}-1)	1048576
6067	0	Position reach threshold	RW	Uint32	Encoder unit	0~65535	734
6068	0	Position arrival window	RW	Uint16	ms	0~65535	x10
606C	0	Actual speed	RO	Int32	Command unit /s	-	-
6077	0	Actual torque	RO	Int16	0.10%	-5000~5000	0
607A	0	target location	RW	Int32	Command unit	-231~(2^{31}-1)	0
6083	0	Acceleration	RW	Uint32	Command unit /S^2	0~(2^{32}-1)	100
6084	0	deceleration	RW	Uint32	Command unit / S^2	0~(2^{32}-1)	100
6091	1	Motor resolution	RW	Uint32	-	0~(2^{32}-1)	1
	2	Axis resolution	RW	Uint32	-	1~(2^{32}-1)	1
60E0	0	Forward torque limit	RW	Uint16	0.10%	0~5000	5000
60E1	0	Reverse torque limit	RW	Uint16	0.10%	0~5000	5000
60F4	0	Position deviation	RO	Int32	Command unit		
60FC	0	Position command	RO	Int32	Encoder unit		

Note: For detailed instructions on the use of related objects, refer to "Chapter 8 Detailed Description of Object Dictionaries".

6.7.3 Related Function Settings

1) Positioning is completed

Index	Subindex	Name	Description
6067	0	Location reach threshold	When the position deviation is in the range of ±6067h, and the time reaches 6068, the DO signal for positioning is valid, and bit10 of 6041 is 1 at the same time. If does not meet any of the conditions of the two, the location is invalid.
6068	0	Location arrival window	

2) excessive position deviation threshold

Index	Subindex	Name	Description
6065	0	Excessive position deviation threshold	When the position deviation is greater than this value, a position error is too large, the panel displays an alarm, and bit 13 of the status word is set. When 6065h = 0xFFFFFFFF, the drive does not perform excessive position deviation detection.

6.7.4 Position Curve Generator

The curve generator contains two modes, which are divided into single-point mode and multi-point mode. When 6040h.bit5 =1, it is a single-point operation mode, ie, an immediate update mode.

When 6040.bit5=0, it is a multi-point operation mode. After setting a new point in the 607Ah object dictionary, by controlling a rising edge of 6040h.bit4, the newly created point can be enabled so that the drive control motor runs to the newly set coordinates. At the same time, the status word 6041h.bit12 will give 1 state, and only when 6041h.bit12=0 , the new setpoint can be accepted.

1) Single point operation mode

When 6040h.bit5=1, it is a single-point operation mode, as shown in the figure below. When setting a new Target position, use 6040h.bit4 to give a rising edge to trigger the setpoint operation. When this point is running, a new point is set again, and a rising edge needs to be given again by using 6040h.bit4. The drive immediately uses the trajectory parameters set by the new target point for trajectory planning, as shown in the following figure.

2) Multi-point movement mode

When 6040h.bit5=0, it is a multi-point operation mode. The mode operation is divided into two types, as follows:

The first type is 6040h.bit9=0. It is a sequential planning mode. As shown in the figure below, one point is being processed. After the point is planned, the second set point will be followed by the planning operation.

The second type is 6040h.bit9=1. The speed at the time of triggering 6040h.bit4 is maintained to complete the current location plan, and this speed is used as the starting speed for the next location plan.

As shown by the solid line in the figure, the dotted line is a plan diagram in the case where bit9=0. After the first point of planning is set up, the next point will be started for planning.

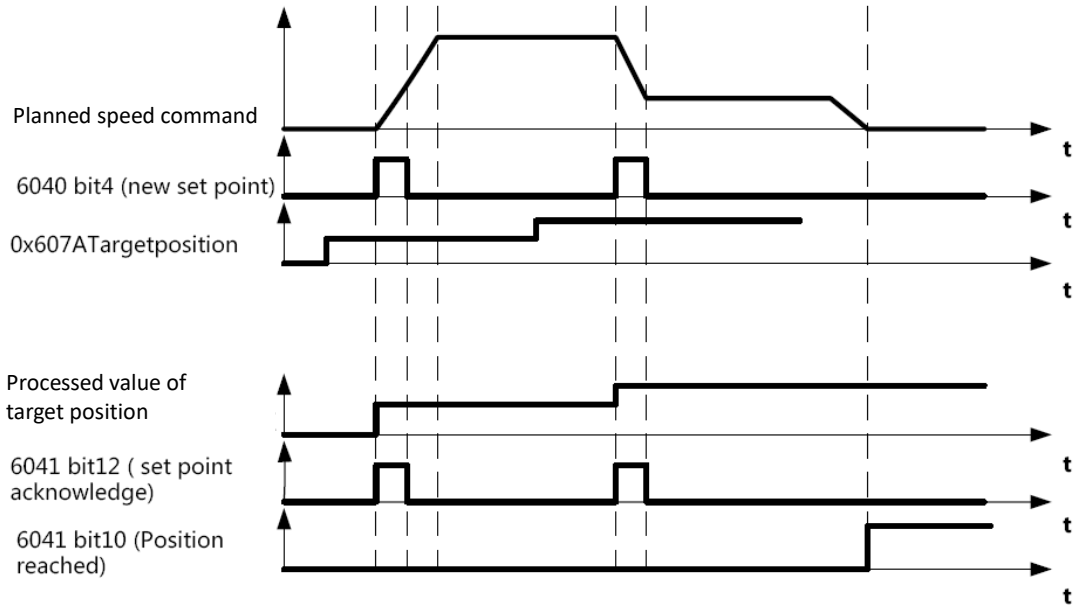


Figure 6.7.4-1 Single Point Operation Mode Update TargetPosition

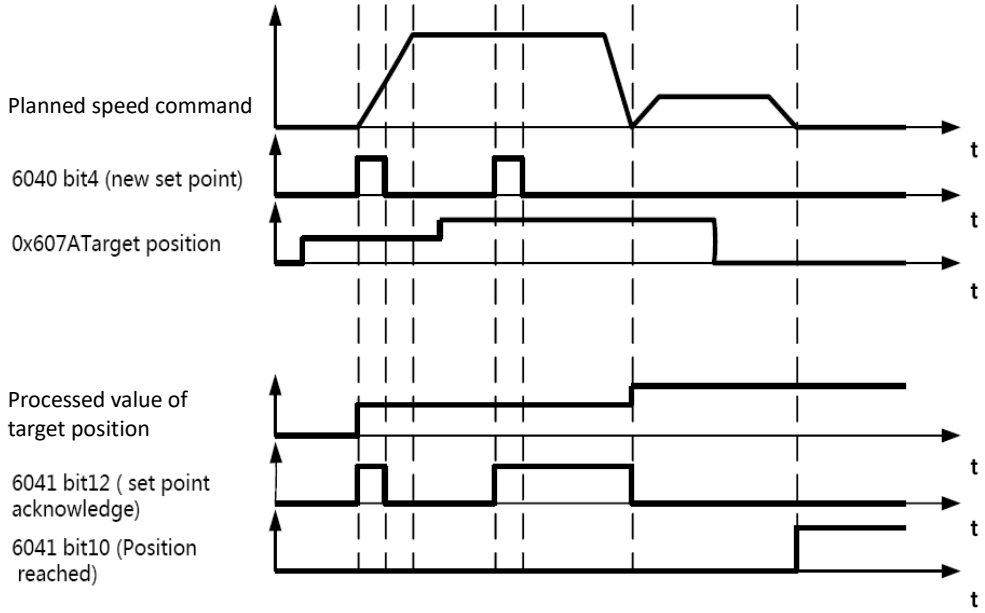


Figure 6.7.4-2 Multipoint Operation Mode 6040.bit9 =0 Operation Diagram

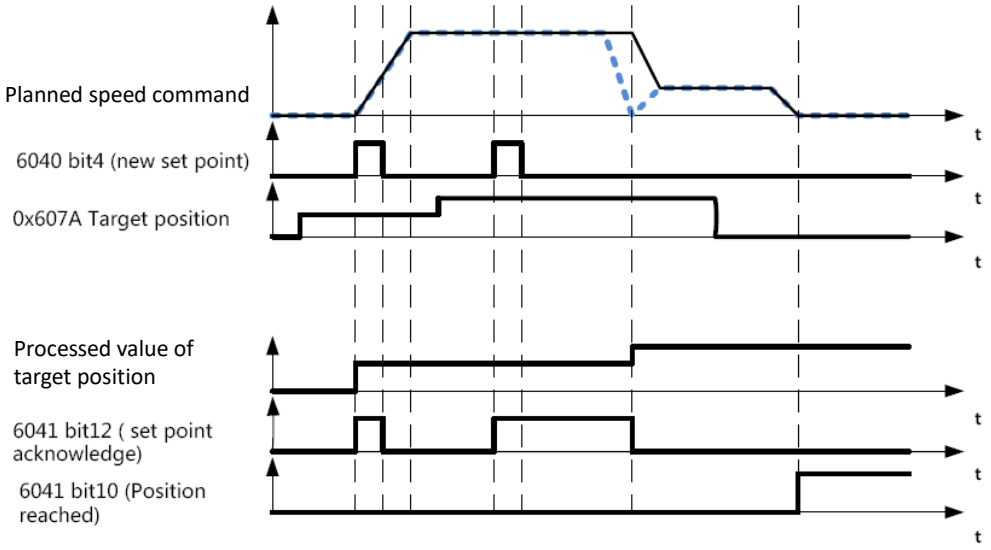


Figure 6.7.4-3 Multipoint Operation Mode 6040.bit9 =1 Operation Diagram

6.7.5 Recommended Configuration

Profile position mode (pp), basic configuration is as follows:

RxPDO	TxPDO	备注
6040： control word	6041： status word	Must
607A： target Velocity	6064： position actual value	Must
6081： profile velocity		Must
6083： profile acceleration		Optional
6084： profile deceleration		Optional
6060：modes of operation	6061： modes of operation display	Optional

6.8 Profile Speed Mode (pv)

In this mode, the host controller sends the target speed, acceleration, and deceleration to the servo drive, and the speed and torque adjustments are performed internally by the servo.

6.8.1 Control Block Ddiagram

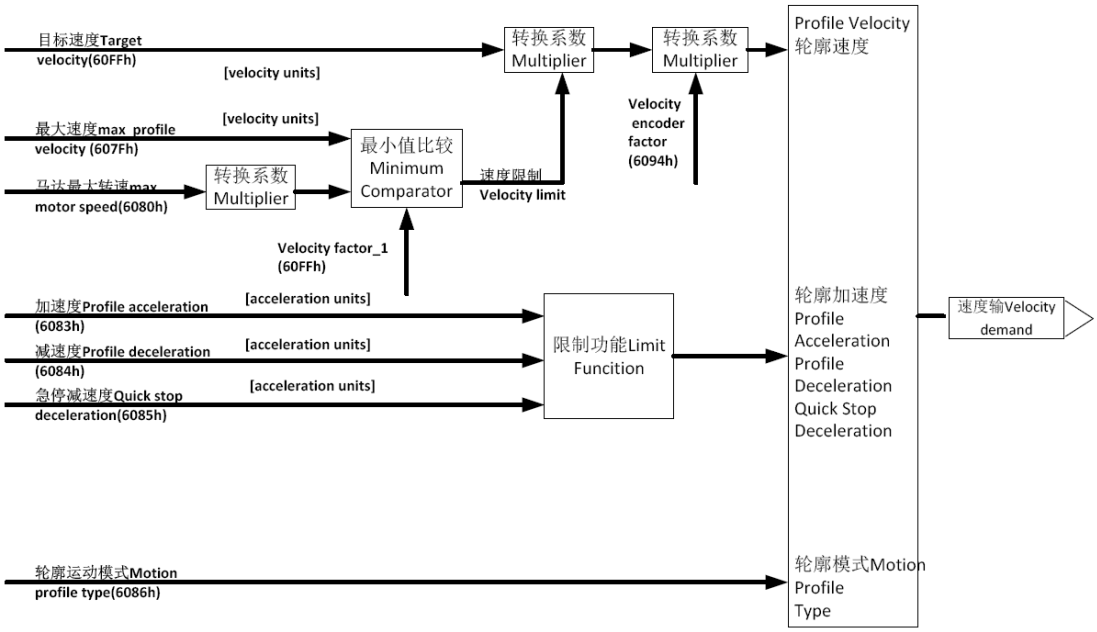


Figure 6.8.1-1 Profile Speed Mode Control Block Diagram

6.8.2 Related Objects

Control word 6040h		
Bit	Name	Description
0	Switch on	Bit0~bit3 are all 1, which means start operation
1	Enable voltage	
2	Quick stop	
3	Enable operation	
8	Halt	0: servo is set by bit0~bit3 1: Servo is set to pause by 605Dh setting.
Status word 6041h		
Bit	Name	Description
10	Target Reach	0: The target position does not arrive 1: The target position arrives
11	Software internal position limit	0: Position command and position feedback are not overrun 1: Position command or position feedback is overrun
15	Home Find	0: Origin zero return incomplete 1: Origin zero return completed

Indes (hex)	Subindex(hex)	Name	Access	Data type	Unit	Setting range	Default
603F	0	error code	RO	Uint16	-	0~65535	0
6040	0	Control word	RW	Uint16	-	0~65535	0
6041	0	Status word	RO	Uint16	-	0~65535	0
6060	0	Mode of operation	RW	Int8	-	0~10	0
6061	0	Mode display	RO	Int8	-	0~10	0

607F	0	Maximum profile speed	RW	Uint32	Command unit /s	0~(2^{32}-1)	230
6063	0	Position feedback	RO	Int32	Encoder unit	-	-
6064	0	Position feedback	RO	Int32	Command unit	-	-
60FF	0	Target speed	RW	Int32	Command unit /s	-2^{31}~(2^{31}-1)	0
60E0	0	Forward torque limit	RW	Uint16	0.10%	0~5000	5000
60E1	0	Reverse torque limit	RW	Uint16	0.10%	0~5000	5000
606C	0	Actual speed	RO	Int32	Command unit /s	-	-
6077	0	Actual torque	RO	Int16	0.10%	-5000~5000	0

Note: For detailed instructions on the use of related objects, refer to "Chapter 8 Detailed Description of Object Dictionaries".

6.8.3 Related Function Settings

1) Speed arrival function

Index	Subindex	Name	Description
606Dh	0	Speed reaches threshold	When the difference between the target speed 60FF (converted into motor speed /rpm) and the actual speed of the motor is within ±606D and the time reaches 606E, the speed is deemed to be reached, bit 10 of status word 6041=1, and the speed arrives, DO function is valid. In the contour speed mode and cycle synchronous speed mode, this flag bit is significant when the servo enable is valid; otherwise it is meaningless.
606Eh	0	Speed arrival window	

6.8.4 Recommended Configuration

Profile speed mode (pv), the basic configuration is as follows:

RxPDO	TxPDO	REMARK
6040： control word	6041： status word	MUST
60FF： target Velocity		MUST
	6064： position actual value	OPTIONAL
	606C： velocity actual value	OPTIONAL
6083： profile acceleration		OPTIONAL
6084： profile deceleration		OPTIONAL
6060： modes of operation	6061： modes of operation display	OPTIONAL

6.9 Profile Torque Mode（pt）

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

6.9.1 Control Block Diagram

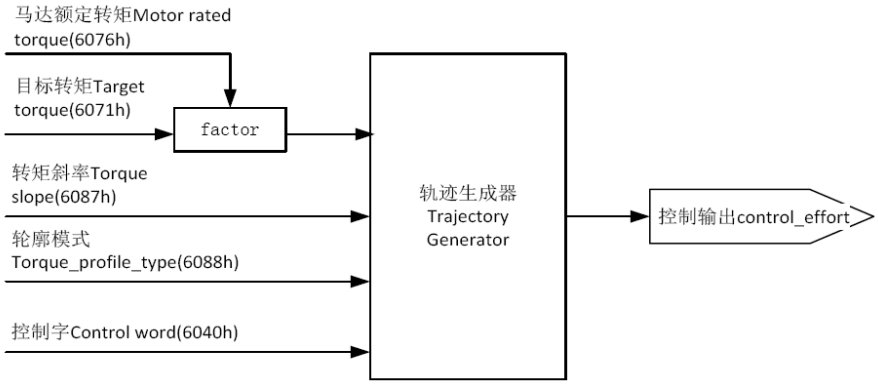


Figure 6.9.1-1 Profile Torque Mode Control Block Diagram

6.9.2 Related Object

Control Word 6040h		
BIT	NAME	DESCRIPTION
0	Switch on	Bit0~bit3 are all 1, which means start operation
1	Enable voltage	
2	Quick stop	
3	Enable operation	
8	Halt	0: servo is set by bit0~bit3 1: Servo is set to pause by 605Dh setting.
STATUS WORD 6041h		
BIT	NAME	DESCRIPTION
10	Target Reach	0: Target torque is not reached 1: Target torque arrives
12	Software internal position limit	0: No overrun position feedback 1: overrun position feedback
15	Home Find	0: Origin zero return incomplete 1: Origin zero return completed

Indes (hex)	Subindex(hex)	Name	Access	Data type	Unit	Setting range	Default
603F	0	error code	RO	Uint16	-	0~65535	0
6040	0	Control word	RW	Uint16	-	0~65535	0
6041	0	Status word	RO	Uint16	-	0~65535	0
6060	0	Operating mode	RW	Int8	-	0~10	0
6061	0	Mode display	RO	Int8	-	0~10	0
606C	0	Actual speed	RO	Int32	Command unit /s	-	-
6071	0	Target torque	RW	Int16	0.10%	-5000~5000	0
6072	0	Maximum torque	RW	Uint16	0.10%	0~5000	5000
6074	0	Torque command	RO	Int16	0.10%	-	-
6077	0	Actual torque	RO	Int16	0.10%	-	-
607F	0	Max profile speed	RW	Uint32	Command unit /s	0~(2^{32}-1)	230
6087	0	Torque ramp	RW	Uint32	0.1%/s	0~(2^{32}-1)	2^{32}-1

For details, see "Chapter 8 Detailed Description of Object Dictionary".

6.9.3 Suggested Configuration

Profile torque mode (pt), basic configuration is as follows:

RxPDO	TxPDO	Remark
6040： control word	6041： status word	MUST
6071： target Torque		MUST
6087： Torque slope		OPTIONAL
	6064： position actual value	OPTIONAL
	606C： velocity actual value	OPTIONAL
	6077： Torque ActualValue	OPTIONAL
6060： modes of operation	6061： modes of operation display	OPTIONAL

6.10 Origin Return Mode (hm)

The origin regression mode is used to find the origin of the machine and locate the positional relationship between the origin of the machine and the machine zero. Mechanical origin: A certain fixed position on the machine, which can correspond to a certain origin switch and can correspond to the Z signal of the motor. Mechanical zero: Absolute 0 position on the machine. After the origin is returned to zero, the motor stop position 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 bias). When 607Ch=0, the mechanical origin coincides with the mechanical zero.

6.10.1 Control Block Diagram

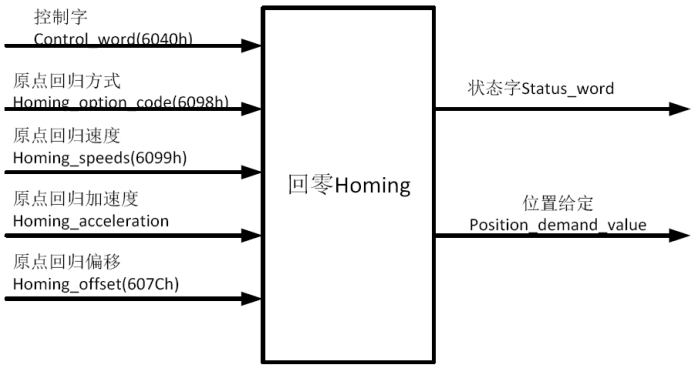
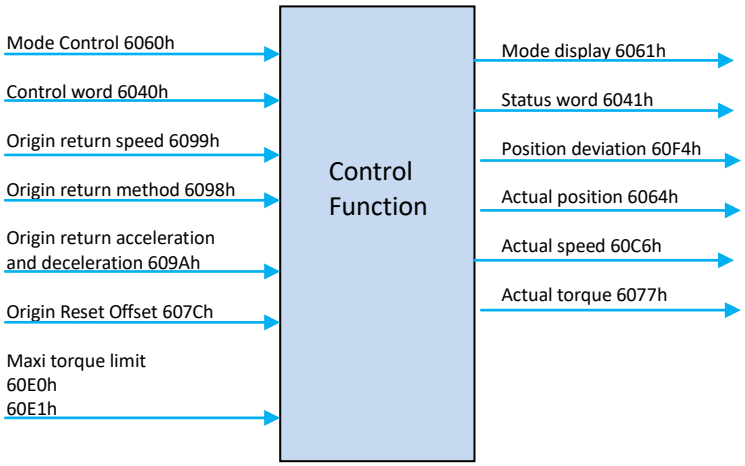


Fig. 6.10.1-1 Block Diagram of Origin Return Control



6.10.1-2 Origin Return Input/Output Objects

6.10.2 Related Objects

Control word 6040h		
Bit	Name	Description
0	Switch on	Bit0~bit3 are all 1 to start the operation
1	Enable voltage	
2	Quick stop	
3	Enable operation	
4	Homing start	0->1： Start return to zero 1: return to zero 1->0: End return to zero
8	Halt	0: servo is set by bit0~bit3 1: Servo is set to pause by 605Dh setting.

Status word 6041h		
Bit	Name	Description
10	Target Reach	0: not reached the target torque 1: arrive at target torque
12	Homing attained	0: Zero return unsuccessful 1: Zero return successful. This flag bit is valid when the servo is in the homing mode and the target reach signal is set.
13	Homing error	0: No error occurred in zero return 1: Occurrence of a zero timeout or an excessively large error
15	Home Find	0: Origin zero is not completed 1: Origin zero is completed. This flag is set when the origin signal is encountered.

Indes (hex)	Subindex(hex)	Name	Access	Data type	Unit	Setting range	Default
603F	0	error code	RO	Uint16	-	0~65535	0
6040	0	Control word	RW	Uint16	-	0~65535	0
6041	0	Status word	RO	Uint16	-	0~xFFFF	0
6060	0	Operating mode	RW	Int8	-	0~10	0
6061	0	Mode display	RO	Int8	-	0~10	0
6062	0	Actual location	RO	Int32	Command unit	-	-
6064	0	Feedback	RO	Int32	Command unit	-	-
6067	0	Location reach threshold	RW	Uint32	Encoder unit	0~65535	734
6068	0	Location arrival window	RW	Uint16	ms	0~65535	x10
6077	0	Actual torque	RO	Int16	0.10%	-5000~5000	0
606C	0	Actual speed	RO	Int32	Command unit /s	-	-
6098	0	Origin return method	RW	Int8	-	1~35	1
6099	1	High speed search deceleration point	RW	Uint32	Command unit /s	0~2^{32}--1)	100
	2	Search origin low speed	RW	Uint32	Command unit /s	10~(2^{32}--1)	100
609A	0	Acceleration	RW	Udint32	Command unit /s^2	0~(2^{32}--1)	100
60F4	0	Position deviation	RO	Dint32	Command unit	-	-

Note: For detailed instructions on the use of related objects, refer to "Chapter 8 Detailed Description of Object Dictionaries".

6.10.3 Related Function Settings

1) Current location calculation

Index	Subindex	Name	Description
60E6	0	Current location Calculation method	0E6 determines that the user is using absolute zeroing or relative zeroing in an incremental system. 60E6 = 0 (absolute return to zero): Position feedback 6064 is set to origin offset 607C after zero return is completed 60E6 = 1 (relative zero return):After the zero return is completed, the positio n bias 607C is overlaid on the position feedback 6064 on the original basis.

6.10.4 Zero Return Operation Introduction

Zero return mode introduction:

(1) Return to zero mode 1 (6098h=1) Use negative limit and motor encoder index pulse (Z phase pulse) signal
The drive drags the motor to quickly move in the negative direction at a speed of 6099H.01H until a negative limit signal is detected ,and decelerates to a stop and moves in a positive direction at a low speed of 6099H.02H to find the zero position. The zero point is the position of the first encoder index pulse (Z phase pulse) signal after detecting the negative edge of the negative limit signal. . As shown below.

(Note: Home Switch: Origin, same below)

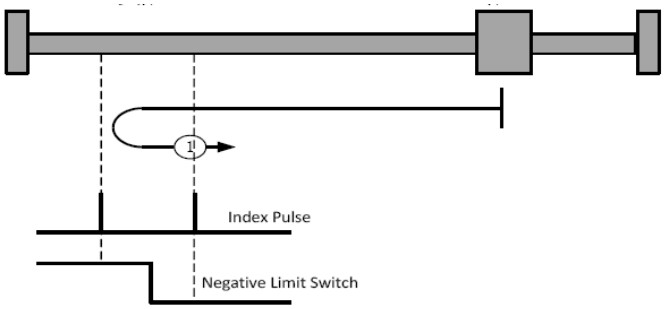


Figure 6.10.4-1 Homing /Return to Zero Method 1

(2) Return to zero mode 2 (6098h=2) uses positive limit and motor encoder index pulse (Z-phase pulse) signals.

The servo motor quickly moves in the positive direction at the speed of the 6099H.01H object until it detects the positive limit signal and decelerates to a stop. And move negatively at low speed of 6099H.02H object to find the zero position.

The zero point is the position of the first encoder index pulse (Z phase pulse) signal after the falling edge of the positive limit signal is detected. As shown below

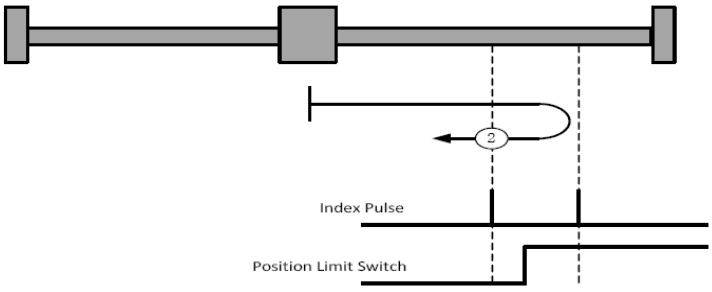


Figure 6.10.4-2 Homing /Return to Zero Method 2

(3) Homing Modes 3 and 4 (6098h = 3 OR 4) Use Origin(home switch) and Motor Encoder Index Pulses (Z Phase Pulses)

The zero return direction of the servo motor depends on the current position and the polarity of the origin signal. As shown below:

When the origin signal is OFF:

Return to zero mode 3: The servo motor moves at a high speed in the direction of 6099h.01h. It detects the rising edge of the origin signal, decelerates to a stop, and negatively moves at 6099h.02h at a low speed to find the zero point. The zero position is the position of the first encoder index pulse (Z phase pulse) signal after the falling edge of the origin signal is detected.

Return to zero mode 4: The servo motor runs at a low speed in the positive direction of the 6099h.02h object, looking for the zero point.The zero point is the position of the first encoder index pulse (Z phase pulse) signal after detecting the rising edge of the origin signal.

When the point signal is ON:

Return to zero mode 3: The servo motor runs at a low speed of 6099h.02h at the negative direction to find the zero point.

The zero point is the position of the first encoder index pulse (Z-phase pulse) signal after the falling edge of the origin signal is detected.

Return to zero mode 4: Servo motor with high-speed negative motion of 6099h.01h object, detects the falling edge of the origin signal, decelerates to a stop and moves forward at a low speed of 6099h.02h to find zero point. The zero position is the position of the first encoder index pulse (Z-phase pulse) signal after the rising edge of the origin signal is detected.

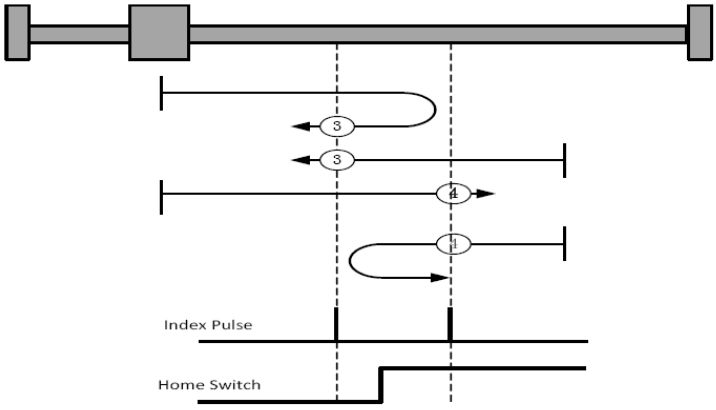


Figure 6.10.4-3 Homing/Return to Zero method 3 and 4

(4) Homing mode 17~20 does not use Motor encoder index pulse (Z phase pulse) signal
The zero return mode is the same as the 1~4 mode except that the motor encoder index pulse (Z phase pulse) signal is not used. The zero point is the zero point where the falling edge of the limit signal or the rising edge (or falling edge) of the origin signal is detected. For example: Zero return methods 19 and 20 are shown below:

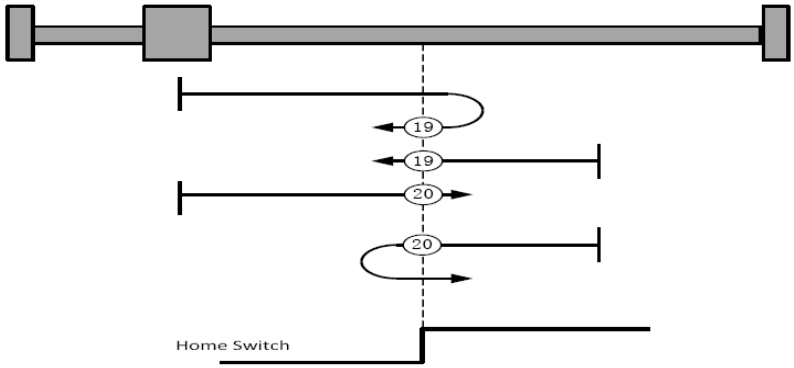


Figure 6.10.3-4 Homing/Return to Zero method 19 and20

(5) Return to zero mode 35 (6098h = 35)
The current mechanical position is set to the zero position. After the zero return is completed, the current position feedback 6064h is directly written to the origin bias 607Ch.

6.10.5 Recommended Configuration

Return to zero mode, the basic configuration is as follows:

RxPDO	TxPDO	REMARK
6040： control word	6041： status word	MUST
6098： Homing method		OPTIONAL
6099-01： speed during search for switch		OPTIONAL
6099-02： speed during search for zero		OPTIONAL
609A： Homing acceleration		OPTIONAL
	6064： position actual value	OPTIONAL
6060： modes of operation	6061： modes of operation display	OPTIONAL

6.11 Auxiliary Function

The drive provides the following auxiliary functions:
Safe Torque Off (STO) function
Input phase loss detection function
Motor protection function
Probe function
Bus forced DIDO function

6.11.1 Safe Torque Off (STO) function

iK3 bus servo has a safe torque off function. To use this function, it is necessary to correctly connect the STO1 and STO2 wirings on the CN2 terminal and set the parameter P10.07 STO detection enable to 1. When it is detected that the STO is not connected, the panel will display "---b.0" and the servo drive will not energize the motor.

☆Related parameters：

No. P10.07	Name	STO Enable Detection			Effective setting	-	Data structure	-	Data type	Int32
	Accessibility	RW	Map or not	-	Related mode	-	Data range	0~1	Factory setting	1
This parameter is used to enable the STO detection function of the servo. 0: STO detection prohibited; 1: STO detection enable.										

If no safe torque function is required, P10.07 can be set to 0.

6.11.2 Input phase loss detection function

iK3 bus servo has the main power RST input phase loss detection function. After being enabled on the servo, it is set according to parameter P10.05 to detect whether the main electrical input is missing phase.

No. P10.05	Name	Input phase loss detection			Effective setting	-	Data structure	-	Data type	Int32
	Accessibility	RW	Map or not	-	Related mode	-	Data range	0~1	Factory setting	0-
This parameter is used to enable the servo input phase loss detection function. 0：Input phase detection disabled: Disable the input phase loss detection function of the servo. When the iK3 series servo needs to operate in the single phase input power supply, this parameter must be set to 0, prevent the system from stopping due to the input phase loss e error. However, in the case of single-phase power input, the servo output power and control accuracy may be affected and need to be evaluated in advance. 1: Input phase loss detection enable: Enable the servo input phase loss detection function. This function will alarm and stop when it detects that the single-phase power input has deteriorating influence on the current running performance of the servo.										

6.11.3 Motor Protection Function

Motor overload protection:

After the servo motor is energized, heat is continuously generated due to the thermal effect of the current, and heat is released to the surrounding environment. When the amount of heat generated exceeds the amount of heat released, the temperature of the motor increases, and high temperatures will cause the motor to burn. Therefore, the drive provides motor overload protection to prevent the motor from being burned due to high temperatures. By setting the corresponding overload multiple times (related parameters: P21.10, P21.11, P21.14, P21.15), you can adjust the time when the motor overload fault (Err.L.0) is reported. P21.10, P21.11, P21.14, P21.15 are generally kept at the default values, but can be changed according to the actual heating condition of the motor when the following conditions occur:

Servo motor operating temperature higher occasions;

The servo motor is in circular motion, and the single motion cycle is short, frequent acceleration and deceleration.

☆Related parameters:

No. P21.10	Name	150% overload- time			Effective setting	-	Data structure	-	Data type	Int32
	Accessibility	RW	Map or not	-	Related mode	-	Data range	1~1000000	Factory setting	100000
This parameter is used to set the allowable running time of the motor under 150% overload. To better protect the motor from being damaged under overload conditions, this parameter needs to be set correctly according to the overload running curve of the motor.										

No. P21.11	Name	250% overload- time			Effective setting	-	Data structure	-	Data type	Int32
	Accessibility	RW	Map or not	-	Related mode	-	Data range	1~1000000	Factory setting	20000
This parameter is used to set the allowable running time of the motor under 250% overload. To better protect the motor from being damaged under overload conditions, this parameter needs to be set correctly according to the overload running curve of the motor.										

No. P21.15	Name	Max overcurrent- time			Effective setting	-	Data structure	-	Data type	Int32
	Accessibility	RW	Map or not	-	Related mode	-	Data range	0~10000	Factory setting	10
This parameter is used to set the allowable running time of the motor under the Max overload condition.										

No. P21.14	Name	The maximum overload ratio of the motor			Effective setting	-	Data structure	-	Data type	Int32
	Accessibility	RW	Map or not	-	Related mode	-	Data range	0~500	Factory setting	350
Set the maximum overload of the motor. This parameter is used together with P21.15 (maximum overload current time).										

Motor speed protection:

Excessive servo motor speed will result in motor damage or mechanical damage. Therefore, the servo drive provides protection on motors once exceeding over maximum speed and motor stall protection.

a) Protection on exceeding the maximum speed

If the motor speed exceeds the ma speed of P20.07 motor for 300ms continuously, the max speed failure Err.U.2 will be reported.

☆ Related parameters:

No. P20.07	Name	Max speed of motor			Effective setting	-	Data structure	-	Data type	Int32
	Accessibility	RW	Map or not	-	Related mode	-	Data range	1 ~ 30000	Factory setting	4000
Set the maximum motor speed										

b) Motor stall protection

The difference between the motor speed feedback and the speed command exceeds the P55.08 stall threshold with P55.09 stall filtering time , the motor stall fault Err.U.5. will be reported.

☆ Related parameters:

No. P50.08	Name	Torque given limit			Effective setting	-	Data structure	-	Data type	Int32
	Accessibility	RW	Map or not	-	Related mode	-	Data range	0~1000	Factory setting	300
This parameter refers to the percentage of forward maximum torque and limit torque that the servo drive allows. It is used for the current limit given of the speed loop output.										
No. P50.09	Name	Torque given limit			Effective setting	-	Data structure	-	Data type	Int32
	Accessibility	RW	Map or not	-	Related mode	-	Data range	-1000~0	Factory setting	-300
This parameter refers to the percentage of negative maximum torque and limit torque that the servo drive allows. It is used for the current limit given of the speed loop output.										

6.11.4 Probe Function

The probe function is the position latch function. It can latch the position information (command unit) when the external DI signal or motor Z signal (real Z signal or analog Z signal) changes.

iK3 servo drive supports simultaneous activation of two probes. The position information corresponding to the rising edge and falling edge of each probe signal can be recorded simultanously, and four position information can be latched at the same time.

Probe 1/2 can select DI or motor Z signal as the probe signal.

1) Related Objects

Indes (hex)	Subindex(hex)	Name	Access	Data type	Unit	Setting range	Default
0x60B8	00	Probe function	RW	Uint16	-	0~65535	0
0x60B9	00	Probe status	RO	Uint16	-	-	0
0x60BA	00	Probe 1 rising edge latch position	RO	Int32	inc	-	0
0x60BB	00	Probe 1 falling edge latch position	RO	Int32	inc	-	0
0x60BC	00	Probe 2 rising edge latch position	RO	Int32	inc	-	0
0x60BD	00	Probe 2 falling edge latch position	RO	Int32	inc	-	0

Note: Please refer to “Chapter 8 Detailed Description of Object Dictionary” for detailed instructions on using related objects.

1) Setting procedure

a) set DI

If an external DI signal is used as the probe trigger signal, set P30.00 to P30.04 as the probe function. When the DI terminal valid logic is positive logic, set 11 (probe 1) or 12 (probe 2), DI. When the terminal valid logic is negative logic, set to 111 (probe 1) and 112 (probe 2).

b) set probe function

The meaning of the probe function (0x60B8) is as follows:

Bit	Description	
0	Probe 1 enable ： 0-- Probe 1 disable 1-- Probe 1 enable	Bit0~bit5: Probe 1 related settings. Bit 0 of 60B8h must remain valid during probe 1 operation. For absolute encoders, the Z signal is the zero point of the motor's single-turn position feedback.
1	Probe 1 trigger mode 0—Single trigger, trigger only when the trigger signal is active for the first time 1 - continuous trigger	
2	Probe 1 trigger signal selection	

	0—DI input signal 1-Z signal	
3	NA	
4	Probe 1 rising edge enabled 0-- not latch at the rising edge 1-- latch at the rising edge	
5	Probe 1 Falling Edge Enabled 0— not latch at the falling edge 1— latch at the falling edge	
6~7	NA	
8	Probe 2 enable: 0-- Probe 2 is not enabled 1-- Probe 2 Enabled	Bit8~bit14: Probe 2 related settings. Bit 8 of 60B8h must remain valid during probe 2 operation. For absolute encoders, the Z signal is the zero point of the motor's single-turn position feedback.
9	Probe 2 trigger mode 0—Single trigger, trigger only when the trigger signal is active for the first time 1 - continuous trigger	
10	Probe 2 trigger signal selection 0—DI input signal 1-Z signal	
11	NA	
12	Probe 2 rising edge enabled 0-- not latch at the rising edge 1-- latch at the rising edge	
13	Probe 2 Falling Edge Enable 0--not latch at the falling edge 1--latch at the falling edge	
14~15	NA	

2) Read probe status 0x60B9

Bit	Description	Remark
0	Probe 1 enabled: 0-- Probe 1 is not enabled 1-- Probe 1 Enabled	bit0~bit2：indicate probe 1 status
1	Latch execution on rising edge of probe 1 0-- latch is not executed at the rising edge 1-- latch has been executed at the rising edge.	
2	Probe 1 latch execution at the falling edge 0-- latch is not executed at the falling edge 1-- latch has been executed at the falling edge	
3~7	NA	
8	Probe 2 enable: 0-- Probe 2 is not enabled 1-- Probe 2 Enabled	bit8~bit10：indicate probe 2 status
9	Latch execution on rising edge of probe 2 0-- latch is not executed at the rising edge 1-- latch has been executed at the rising edge.	

10	Probe 2 latch execution at the falling edge 0-- latch is not executed at the falling edge 1-- latch has been executed at the falling edge	
11~15	NA	

3) Reading probe latch position

The four position information of the probe are recorded in the object 0x60BA~0x60BD, respectively.
For example:
Set 0x60B8 = 0x0013, that is, the DI signal is used as the trigger signal of probe 1, and trigger once at the rising edge.
By reading bit 0 of 0x60B9, it can be determined whether the servo drive has performed the latching function of the rising edge of probe 1. If it is judged that the rising edge position latch function of the probe 1 has been performed, the position information can be read by reading 0x60BA (the position of the probe 1 rising edge position feedback latch, command unit).

●As illustrated below,

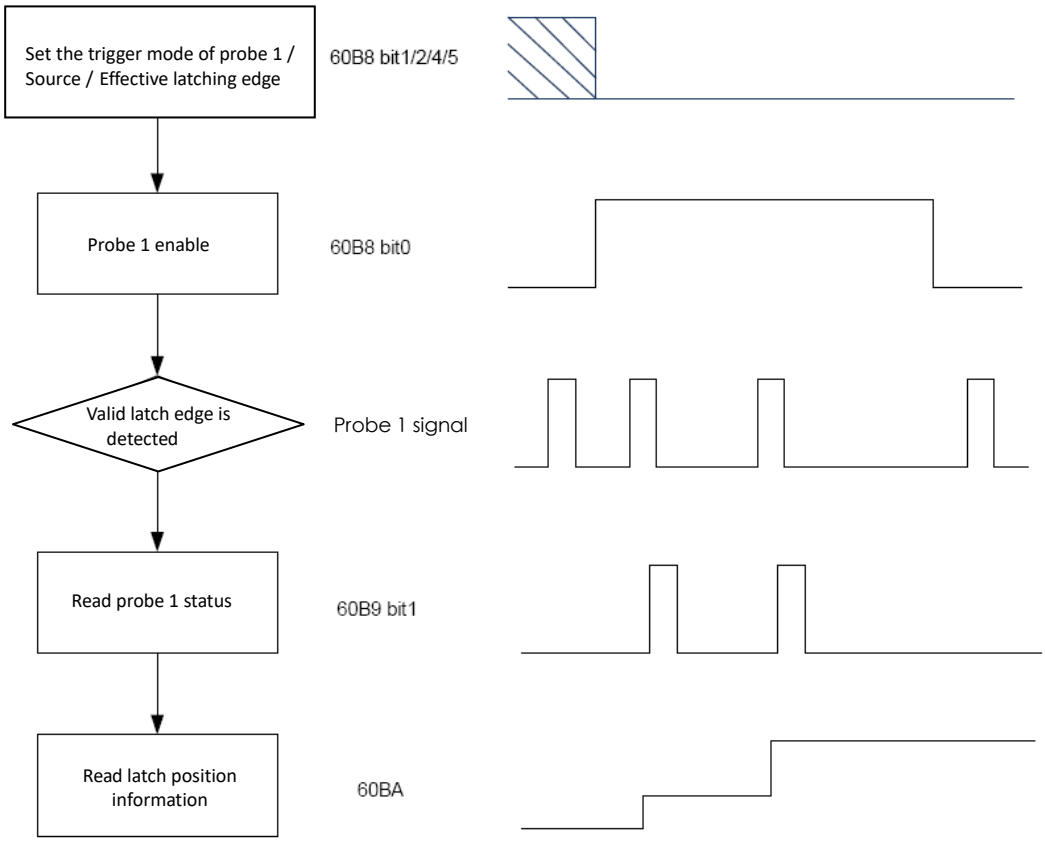


Figure 6.11.4-1 Probe Use Step Illustration

Chapter 7 Detailed Description of Parameters and Object Customization

7.1 Parameter Level Object Dictionary Description

Parameters and object dictionaries contain the following attributes:

- No.
- Index
- Subindex
- Data structure
- Type of data
- Accessible properties
- Map or not
- Setting effective
- Related patterns
- Data range
- Factory settings

"Data Structure": For more information, see the table below.

Detailed Description Data Structure	
Category	Meaning
VAR	Single simple numeric value containing data types Int8, Uint16, String, etc.
ARR	The same type of data
REC	Different types of data blocks

"Data Type": Please refer to the following table for details.

Data type description		
Data Type	Value Range	Data Length
Int8	-128~127	1 byte
Int16	-32768~+32767	2 bytes
Int32	-2147483648~+ 2147483647	4 bytes
Uint8	0~255	1 byte
Uint16	0~65535	2 bytes
Uint32	0~4294967295	4 bytes
String	ASCII	-

"Accessible attributes": See the table below for details.

Accessible attribute description	
Accessible properties	Description
RW	Read-write
WO	just write
RO	Read only
CONST	Constant, read-only

"Map or not": Please refer to the following table for details.

Map or not description	
Map or not	Description
NO	Cannot be mapped in PDO

RPDO	Can be used as RPDO
TPDO	Can be used as TPDO

"Setting effective": Please refer to the following table for details.

Setting Effective Description			
Setting condition	Description	Effective condition	Description
Shutdown settings	Parameters can be edited when the drive is not in operation	Effective immediately	After parameter editing is completed, the set value takes effect immediately
Operation settings	Drive in any state, parameters can be edited	Shutdown takes effect	After the parameter editing is completed, the drive is not in operation and the set value is effective
		Power on again	After the parameter editing is completed, turn on the power of the driver again and the set value will take effect.

"Related mode": Please refer to the following table for details.

Related mode Description	
Related mode	Description
ALL	Parameters related to all control modes
PP/PV/PT/HM/CSP/CSV/CST	The parameters are related in the corresponding mode

7.2 Detailed Parameters

7.2.1 P10 Group Parameters

No. P10.00	Name	Login password			Effective setting	-	Data structure	-	Data type	Int32
	Accessibility	WO	Map or not	-	Related mode	-	Data range	0~65535	Factory setting	0-
This parameter is used to input the login password and enter the corresponding password to modify the corresponding parameters of the servo. The user password is 4321. After the password is entered, no operation is performed for a period of time. You need to enter the password again.										

No. P10.01	Name	Command channel selection			Effective setting	-	Data structure	-	Data type	Int32
	Accessibility	RW	Map or not	-	Related mode	-	Data range	0~5	Factory setting	0-
The parameters are used to set the control command's given method in different control modes. 0: Operator control: Use the keys RUN, STOP, etc. on the hand-held operator to perform servo drive operation, stop, and other operations. The operator mode can set a torque command, a speed command and a position command. 1: Bus control: Run, stop, forward/reverse, etc. of the servo drive through PowerLink/EtherCAT bus communication. The bus set mode can set a torque command, a speed command and a position command. 2: MONITOR Control: Use the MONITOR software on the PC to perform servo drive operation, shutdown, forward/reverse operation, etc. The virtual oscilloscope mode can set a torque instruction, a speed instruction and a position instruction. 3: Analog 0 control: Through the AI0 channel in the servo control terminal to give the torque command and speed command, through a digital input channel for servo drive operation, shutdown and other operations. 4: Analog 1 control: The torque command and speed command are given through the AI1 channel in the servo control terminal, and the operation of the servo driver is performed through a digital input channel. 5: Pulse control: Control the servo operation by pulse. In position mode, the position of the motor is controlled by the number of pulses; In speed mode, the speed of the motor is controlled by the frequency of the pulses.									

No. P10.02	Name	PID setting selection			Effective setting	-	Data structure	-	Data type	Int32
	Accessibility	RW	Map or not	-	Related mode	-	Data range	0~1	Factory setting	0-
This parameter is used to set the control method of the control loop PID control parameter. 0: Local setting: Set the PID parameters of the speed and position control loop and the torque and speed limit parameters through the operator or MONITOR software. 1: Bus setting: Set the PID parameters of the speed and position control loop and the torque and speed limit parameters via the fieldbus (PowerLink/EtherCAT/CANOpen).										

No. P10.03	Name	Motor configuration selection			Effective setting	-	Data structure	-	Data type	Int32
	Accessibility	RW	Map or not	-	Related mode	-	Data range	0~1	Factory setting	0-

This parameter is used to set the motor model and motor parameter configuration.
0: Local setting: Set P20 motor basic parameters and P21 group motor advanced parameters through the operator or -MONITOR software.
1: Bus setting: Set the basic motor parameters P20.00~P20.09 and P21.00~P21.04 motor advanced parameters through fieldbus (PowerLink/EtherCAT/CANOpen).

No. P10.04	Name	Filter enable			Effective setting	-	Data structure	-	Data type	Int32
	Accessibility	RW	Map or not	-	Related mode	-	Data range	0~1	Factory setting	0-

This parameter is used to enable the servo filter.
0: Disable filter: Disables the filter function. Even if the filter parameters of P51-P54, P56-P57 and P59 groups are enabled, the servo will not enable the filter.
1: Filter enable: To enable the filter function, to enable a specific filter function, configure corresponding parameters in P51-P54, P56-P57, and P59 groups.

No. P10.05	Name	Input phase loss detection enable			Effective setting	-	Data structure	-	Data type	Int32
	Accessibility	RW	Map or not	-	Related mode	-	Data range	0~1	Factory setting	0-

This parameter is used to enable the servo input phase loss detection function.
0: Input phase detection disabled: Disable the input phase loss detection function of the servo. When the servo needs to operate in the single phase input power supply, this parameter must be set to 0 to prevent the system from shutting down due to the input phase error. However, in the case of single-phase power input, the servo output power and control accuracy may be affected and need to be evaluated in advance.
1: Input phase loss detection enable: Enable the servo input phase loss detection function. This function will alarm and stop when it detects that the single-phase power input has deteriorating influence on the current running performance of the servo.

No. P10.06	Name	Output phase loss detection enable			Effective setting	-	Data structure	-	Data type	Int32
	Accessibility	RW	Map or not	-	Related mode	-	Data range	0~1	Factory setting	1

This parameter is used to enable the servo output phase loss detection function.
0: Output phase loss detection disabled: Disable the servo output phase loss detection function. When the servo output is disconnected or missed, the servo will not report the output phase loss fault, but may report other faults and stop. When the servo drive power and the servo motor power do not match seriously, the output phase-loss error may occur. At this time, the output phase-loss detection function can be shielded by this parameter. However, it is necessary to confirm that the servo system does not have the output phase loss problem, otherwise it may affect Servo operating performance.
1: Output phase loss detection enable: Enable the servo output phase loss detection function. This function will alarm and stop when it is detected that 1-3 phases between the servo output and the motor are not connected reliably.

No. P10.07	Name	STO detection enable			Effective setting	-	Data structure	-	Data type	Int32
	Accessibility	RW	Map or not	-	Related mode	-	Data range	0~1	Factory setting	1

This parameter is used to enable the STO detection function of the servo.
0: STO detection disable;
1: STO detection enable

No. P10.08	Name	Weak magnetic enable			Effective setting	-	Data structure	-	Data type	Int32
	Accessibility	RW	Map or not	-	Related mode	-	Data range	0~1	Factory setting	0

This parameter is used to enable the servo weakening function.
0: Field weakening prohibited: When the servo output voltage reaches the terminal voltage saturation, the rotation speed can not continue to rise, the servo does not perform the weak magnetic control;
1: Field weakening enable: When the terminal voltage of the servo output is saturated, the motor rotation speed cannot be increased. The servo weak magnetic control can make the rotation speed of the motor continue to rise, but the load capacity of the motor will decrease. This function is suitable for High speed, light load operation.

No. P10.09	Name	Front panel monitoring parameters			Effective setting	-	Data structure	-	Data type	Int32
	Accessibility	RW	Map or not	-	Related mode	-	Data range	0~6	Factory setting	0
This parameter is used to set the state information displayed on the front panel of the servo. The specific configuration is as follows: 0: Displays the servo operation status. When it is not enabled, “off” is displayed. When the servo is enabled, “on” is displayed. 1: Display the servo speed given value; 2: Display the servo bus voltage value; 3: Display the motor speed feedback value; 4: Display the current value of the motor; 5: Display the single-turn value of the motor encoder; 6: Display the multi-turn value of the motor encoder;										

7.2.2 P11 Group Parameter

No. P11.00	Name	Control mode selection			Effective setting	-	Data structure	-	Data type	Int32
	Accessibility	RW	Map or not	-	Related mode	-	Data range	0~2	Factory setting	1-
When servo drive's command channel is selected as operator, BECON-MONITOR, analog 0, analog 1 and pulse control, this parameter is used to set the servo drive's control operation mode. 0: Torque control mode: The torque control mode is used in applications where torque control is required, such as printing machines and winding machines.The device has three kinds of torque command given: handheld operator, BECON-MONITOR upper computer software and external analog reference. External analog commands control the output torque of the motor from the external input voltage. 1: Speed control mode: The speed control mode is applied to the precise control of speed, such as CNC machining center. The device has four speed command given modes: handheld operator, BECON-MONITOR upper computer software, external analog reference and pulse control. The external analog command is used to control the motor speed from the external input voltage, and the pulse controls the speed through the frequency of the pulse. 2: Position control mode: The position control mode is used in precise positioning applications such as industrial robots and industrial machinery. This device has three kinds of position command given modes: handheld operator, upper computer BECON-MONITOR software and pulse control.									

No. P11.01	Name	Rreciprocating motion enable			Effective setting	-	Data structure	-	Data type	Int32
	Accessibility	RW	Map or not	-	Related mode	-	Data range	0~1	Factory setting	0
This parameter is used to set the reciprocating motion. 0: normal operation mode; 1: Into the debugging state, can achieve speed, position reciprocating										

No. P11.02	Name	Communication baud rate			Effective setting	-	Data structure	-	Data type	Int32
	Accessibility	RW	Map or not	-	Related mode	-	Data range	0~5	Factory setting	5
Parameter P11.02 is used to set the serial communication baud rate. 0：Baud rate 115.2kbps 1：Baud rate 128 kbps 2：Baud rate 230.4kbps 3：Baud rate 256 kbps 4：Baud rate 460.8kbps 5：Baud rate 921.6kbps										

7.2.3 P12 Group Parameter

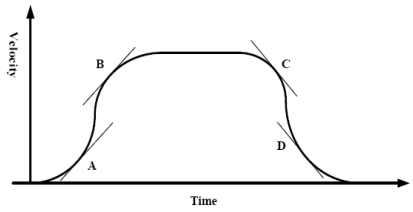
No. P12.00	Name	Curve type			Effective setting	-	Data structure	-	Data type	Int32
	Accessibility	RW	Map or not	-	Related mode	-	Data range	0~3	Factory setting	2
Parameter P12.00 currently only supports 0: trapezoidal curve; 2: S-curve.										

No. P12.01	Name	RPM/ms acceleration			Effective setting	-	Data structure	-	Data type	Int32
	Accessibility	RW	Map or not	-	Related mode	-	Data range	0~3000	Factory setting	20
This parameter gives the acceleration and deceleration of the speed curve										

No. P12.02	Name	RPM/ms deceleration			Effective setting	-	Data structure	-	Data type	Int32
	Accessibility	RW	Map or not	-	Related mode	-	Data range	0~3000	Factory setting	20
This parameter gives the acceleration and deceleration of the speed curve										

No. P12.03	Name	Accelerated fillet Jerk0			Effective setting	-	Data structure	-	Data type	Int32
	Accessibility	RW	Map or not	-	Related mode	-	Data range	1~1000	Factory setting	1000

Parameters P12.03 ~ P12.06 are used to set the type of curve planning.
The unit is ms, which indicates the time (in ms) that Jerk accelerates from 0 to acceleration and deceleration. As shown in the figure: Jerk0 represents A segment, Jerk1 represents B segment, Jerk2 represents C segment, and Jerk3 represents D segment.



No. P12.04	Name	Aecelerated fillet Jerk1			Effective setting	-	Data structure	-	Data type	Int32
	Accessibility	RW	Map or not	-	Related mode	-	Data range	1~1000	Factory setting	1000
Set the value of the aecelerated fillet Jerk1										

No. P12.05	Name	Decelerated fillet Jerk2			Effective setting	-	Data structure	-	Data type	Int32
	Accessibility	RW	Map or not	-	Related mode	-	Data range	1~1000	Factory setting	1000
Set the value of the deceleration fillit Jerk2										

No. P12.06	Name	Decelerated fillet Jerk3			Effective setting	-	Data structure	-	Data type	Int32
	Accessibility	RW	Map or not	-	Related mode	-	Data range	1~1000	Factory setting	1000
Set the value of the deceleration fillit Jerk3.										

No. P12.07	Name	JOG speed			Effective setting	-	Data structure	-	Data type	Int32
	Accessibility	RW	Map or not	-	Related mode	-	Data range	1~1000	Factory setting	100
Set the target speed in JOG mode.										

7.2.4 P13 Group Parameter

No. P13.00	Name	RPM Target Speed			Effective setting	-	Data structure	-	Data type	Int32
	Accessibility	RW	Map or not	-	Related mode	-	Data range	1~5000	Factory setting	100
The parameter is used to set the speed of the uniform segment of the position profile.										
No. P13.01	Name	RPM/ms acceleration			Effective setting	-	Data structure	-	Data type	Int32
	Accessibility	RW	Map or not	-	Related mode	-	Data range	1~1000	Factory setting	10
The parameter is used to set the acceleration/deceleration of speed curve of the position profile.										
No. P13.02	Name	RPM/ms deceleration			Effective setting	-	Data structure	-	Data type	Int32
	Accessibility	RW	Map or not	-	Related mode	-	Data range	1~1000	Factory setting	10
The parameter is used to set the acceleration/deceleration of speed curve of the position profile.										

7.2.5 P14 Group Parameter

No. P14.00	Name	Bus type selection			Effective setting	-	Data structure	-	Data type	Int32
	Accessibility	RW	Map or not	-	Related mode	-	Data range	1~3	Factory setting	0
Select the communication method used by the servo: 0: No bus board 1：PowerLink 2：EtherCAT 3：CANOpen										

No. P14.01	Name	The node number of the machine			Effective setting	-	Data structure	-	Data type	Int32
	Accessibility	RW	Map or not	-	Related mode	-	Data range	0~240	Factory setting	1
Parameter P14.01 specifies the node number of this node for bus communication.										

No. P14.02	Name	The relative position of the machine			Effective setting	-	Data structure	-	Data type	Int32
	Accessibility	RW	Map or not	-	Related mode	-	Data range	0~238	Factory setting	1
Parameter P14.02 indicates the relative position of this node relative to the end node and is used to improve the synchronization of the communication. For example, if four slave nodes are connected in series, parameter P14.02 of the first node should be set to 3.										

No. P14.03	Name	Master communication cycle			Effective setting	-	Data structure	-	Data type	Int32
	Accessibility	RW	Map or not	-	Related mode	-	Data range	50~10000000	Factory setting	1000
Parameter 14.03 shows the communication cycle during the bus communication. Powerlink and EtherCAT can automatically obtain the communication cycle of the master station without being set by the user. CANopen requires user set to match the communication cycle set by the controller.										

No. P14.04	Name	Frame loss detection enable			Effective setting	-	Data structure	-	Data type	Int32
	Accessibility	RW	Map or not	-	Related mode	-	Data range	0~1	Factory setting	0
Parameter P14.04 enables the bus communication frame loss monitoring function.										

No. P14.05	Name	CAN Communication baud rate			Effective setting	-	Data structure	-	Data type	Int32
	Accessibility	RW	Map or not	-	Related mode	-	Data range	0~7	Factory setting	0
Parameter P14.05 selects baud rate for CAN communication 0: baud rate 1000 kbps 1: baud rate 800 kbps 2: Baud rate 500 kbps 3: Baud rate 250 kbps 4: baud rate 125 kbps 5: baud rate 50 kbps 6: baud rate 20 kbps 7: baud rate 10 kbps										

7.2.6 P15 Group Parameter

No. P15.00	Name	Pulse channel selection			Effective setting	-	Data structure	-	Data type	Int32
	Accessibility	RW	Map or not	-	Related mode	-	Data range	0~1	Factory setting	0
Parameter P15.00 select pulse channel 0: pulse high speed channel 1: Pulse low speed channel										

No. P15.01	Name	Pulse direction setting			Effective setting	-	Data structure	-	Data type	Int32
	Accessibility	RW	Map or not	-	Related mode	-	Data range	0~1	Factory setting	0
Parameter P15.01 sets the pulse direction 0: pulse input in the same direction 1: Pulse reverse input										

No. P15.02	Name	Pulse mode setting			Effective setting	-	Data structure	-	Data type	Int32
	Accessibility	RW	Map or not	-	Related mode	-	Data range	0~2	Factory setting	0
Pulse mode setting										

No. P15.03	Name	Number of pulse single turn			Effective setting	-	Data structure	-	Data type	Int32
	Accessibility	RW	Map or not	-	Related mode	-	Data range	1~1073741824	Factory setting	131072
Parameter P15.03 sets the number of pulse single turn										
No. P15.04	Name	The numerator of Pulse frequency division			Effective setting	-	Data structure	-	Data type	Int32
	Accessibility	RW	Map or not	-	Related mode	-	Data range	1~1073741824	Factory setting	1000
Parameter P15.04 sets the numerator of Pulse frequency division										
No. P15.05	Name	The denominator of Pulse frequency division			Effective setting	-	Data structure	-	Data type	Int32
	Accessibility	RW	Map or not	-	Related mode	-	Data range	1~1073741824	Factory setting	1000
Parameter P15.05 sets the denominator of Pulse frequency division										
No. P15.06	Name	The number of single turn by pulse output			Effective setting	-	Data structure	-	Data type	Int32
	Accessibility	RW	Map or not	-	Related mode	-	Data range	1~1073741824	Factory setting	131072
Parameter P15.06 sets the number of pulse output when the motor rotates a circle.										

7.2.7 P20 Group Parameter

No. P20.00	Name	Motor brand			Effective setting	-	Data structure	-	Data type	Int32
	Accessibility	RW	Map or not	-	Related mode	-	Data range	0~4	Factory setting	0
This parameter is used to set the servo motor brand currently connected to the servo drive. This version supports 0:S series, 1:TH, 2:M, 3:EST and 4: Custom motor. After this parameter is changed, the P20.01 parameter is automatically changed to 0. For the motors offered by the supplier, if use an absolute encoder, the drive will automatically identify motor parameters when the encoder type parameter P22.00 is set as an absolute encoder. If the encoder type is ABZ encoder, it can be configured according to the motor brand and motor model (P20.01), so the drive will automatically select motor parameters according to the selected motor model. If the selected motor model does not has model or use a third-party motor, then this parameter can be set to 4 (custom motor brand), at this time the user can refer to the detailed motor parameters provided by the motor manufacturer.										

No. P20.01	Name	Motor model			Effective setting	-	Data structure	-	Data type	Int32
	Accessibility	RW	Map or not	-	Related mode	-	Data range	As per motor brand	Factory setting	0
This parameter is used to set the servo motor model currently connected to the servo drive.										

No. P20.02	Name	Motor Type			Effective setting	-	Data structure	-	Data type	Int32
	Accessibility	RW	Map or not	-	Related mode	-	Data range	0~2	Factory setting	0
This parameter is used to set the type of motor 0: Synchronous motor 1: Asynchronous motor 2: Linear motor										

No. P20.03	Name	Motor rated power			Effective setting	-	Data structure	-	Data type	Int32
	Accessibility	RW	Map or not	-	Related mode	-	Data range	0.01 ~ 200.00	Factory setting	0.2
Parameters P20.03 to P20.09 are the internal characteristics of the motor.When using a custom motor, these parameters need to be set correctly according to the motor nameplate. When using preset motors, these parameters are read-only.										

No. P20.04	Name	Motor rated current			Effective setting	-	Data structure	-	Data type	Int32
	Accessibility	RW	Map or not	-	Related mode	-	Data range	0.1 ~ 400.0	Factory setting	1.9
Set the value of the motor rated current										

No. P20.05	Name	Motor static current			Effective setting	-	Data structure	-	Data type	Int32
	Accessibility	RW	Map or not	-	Related mode	-	Data range	0.1 ~ 400.0	Factory setting	2.1
Set the motor static current value										

No. P20.06	Name	Motor rated speed			Effective setting	-	Data structure	-	Data type	Int32
	Accessibility	RW	Map or not	-	Related mode	-	Data range	1 ~ 30000	Factory setting	3000
Set the value of motor rated speed										

No. P20.07	Name	Maximum speed of motor			Effective setting	-	Data structure	-	Data type	Int32
	Accessibility	RW	Map or not	-	Related mode	-	Data range	1 ~ 30000	Factory setting	5000
Set the maximum motor speed										

No. P20.08	Name	Motor pole pairs			Effective setting	-	Data structure	-	Data type	Int32
	Accessibility	RW	Map or not	-	Related mode	-	Data range	1 ~ 80	Factory setting	5
Set the number of motor pole pairs										

No. P20.09	Name	Motor rated torque			Effective setting	-	Data structure	-	Data type	Int32
	Accessibility	RW	Map or not	-	Related mode	-	Data range	0.001 ~ 1000.000	Factory setting	0.64
Set the motor rated torque value										

7.2.8 P21 Group Parameter

No. P21.00	Name	Motor stator phase resistance			Effective setting	-	Data structure	-	Data type	Int32
	Accessibility	RW	Map or not	-	Related mode	-	Data range	0.00 ~ 1000.00	Factory setting	2.03
The five parameters P21.00, P21.01, P21.02, P21.03, and P21.04 are the internal characteristics of the motor. When using a custom motor, this parameter needs to be set correctly according to the motor nameplate. When using a preset motor, this parameter is read-only.										

No. P21.01	Name	Motor D-axis inductance			Effective setting	-	Data structure	-	Data type	Int32
	Accessibility	RW	Map or not	-	Related mode	-	Data range	0.00 ~ 1000.00	Factory setting	6.25
Set the value of motor D-axis inductance										
No. P21.02	Name	Motor Q-axis inductance			Effective setting	-	Data structure	-	Data type	Int32
	Accessibility	RW	Map or not	-	Related mode	-	Data range	0.00 ~ 1000.00	Factory setting	6.25
Set the value of motor Q-axis inductance										

No. P21.03	Name	Motor rotor rotation inertia			Effective setting	-	Data structure	-	Data type	Int32
	Accessibility	RW	Map or not	-	Related mode	-	Data range	0.00 ~ 1000.00	Factory setting	0.16
Set the motor rotor inertia moment value										

No. P21.04	Name	Motor Back EMF constant			Effective setting	-	Data structure	-	Data type	Int32
	Accessibility	RW	Map or not	-	Related mode	-	Data range	0 ~ 2000	Factory setting	23
Set the value of the motor back-EMF constant										

No. P21.05	Name	Auto-tuning motor pole pairs			Effective setting	-	Data structure	-	Data type	Int32
	Accessibility	RW	Map or not	-	Related mode	-	Data range	1 ~ 80	Factory setting	1
This parameter indicates the number of motor pole pairs automatically obtained after the servo drive performs an auto-tuning operation on the servo motor. This parameter will be automatically saved in the servo drive after the motor pole pairs auto-tuning process is completed, until the motor pole pairs auto-tuning is performed again.										

No. P21.06	Name	Motor brake monitoring enabled			Effective setting	-	Data structure	-	Data type	Int32
	Accessibility	RW	Map or not	-	Related mode	-	Data range	0 ~ 1	Factory setting	1
This parameter indicates whether to monitor the current and voltage of the motor holding brake to ensure the safety and reliability of the brake operation. If the connected motor does not have a brake or the custom rated current of the motor is less than 200mA, this parameter needs to be set to 0 to shield the brake monitoring; 1 corresponds to enable the motor brake detection.										

No. P21.07	Name	Brake open delay			Effective setting	-	Data structure	-	Data type	Int32
	Accessibility	RW	Map or not	-	Related mode	-	Data range	1 ~ 1000	Factory setting	100
Due to the slower brake response, this parameter is used to set the delay time for the brake to open or lock.										

No. P21.08	Name	Brake open delay			Effective setting	-	Data structure	-	Data type	Int32
	Accessibility	RW	Map or not	-	Related mode	-	Data range	1 ~ 1000	Factory setting	100
Due to the slower brake response, this parameter is used to set the delay time for the brake to open or lock.										

No. P21.09	Name	Brake timing			Effective setting	-	Data structure	-	Data type	Int32
	Accessibility	RW	Map or not	-	Related mode	-	Data range	0 ~ 1	Factory setting	1
This parameter is used to set the sequence of servo output and brake action. 0: Braking sequence brake open —> Servo output enable —> Operate —> Servo output off —> Braking lock 1: brake negative sequence Servo output enable -> brake open -> run -> brake lock -> servo output off										

No. P21.10	Name	time of 150% overload			Effective setting	-	Data structure	-	Data type	Int32
	Accessibility	RW	Map or not	-	Related mode	-	Data range	1~1000000	Factory setting	100000
This parameter is used to set the allowable running time of the motor under 150 % overload. To better protect the motor from being damaged under overload conditions, this parameter needs to be set correctly according to the overload running curve of the motor.										

No. P21.11	Name	time of 250% overload			Effective setting	-	Data structure	-	Data type	Int32
	Accessibility	RW	Map or not	-	Related mode	-	Data range	1~1000000	Factory setting	20000
This parameter is used to set the allowable running time of the motor under 250 % overload. To better protect the motor from being damaged under overload conditions, this parameter needs to be set correctly according to the overload running curve of the motor.										

No. P21.12	Name	Braking resistor resistance			Effective setting	-	Data structure	-	Data type	Int32
	Accessibility	RW	Map or not	-	Related mode	-	Data range	1~10000	Factory setting	0
Parameters P21.12 and P21.13 are used to set the resistance and power of the braking resistor and are used for braking resistor overload protection.										
No. P21.13	Name	Braking resistor power			Effective setting	-	Data structure	-	Data type	Int32
	Accessibility	RW	Map or not	-	Related mode	-	Data range	1~10000	Factory setting	0
Parameters P21.12 and P21.13 are used to set the resistance and power of the braking resistor and are used for braking resistor overload protection.										

No. P21.14	Name	Max overload ratio of the motor			Effective setting	-	Data structure	-	Data type	Int32
	Accessibility	RW	Map or not	-	Related mode	-	Data range	0~500	Factory setting	350
Set the maximum overload of the motor. This parameter is used together with P21.15 (maximum overload current time).										

No. P21.15	Name	Max overload current time			Effective setting	-	Data structure	-	Data type	Int32
	Accessibility	RW	Map or not	-	Related mode	-	Data range	1~10000	Factory setting	10
Set the allowable operating time for the maximum overload of the motor.										

7.2.9 P22 Group Parameters

No. P22.00	Name	Encoder type			Effective setting	-	Data structure	-	Data type	Int32
	Accessibility	RW	Map or not	-	Related mode	-	Data range	1~10	Factory setting	10
Set the encoder type used by the connected motor. The IK3 servo supports the following encoders: 0: TAMAGAWA encoder (single-turn/multi-turn) 1: Reserved 2: NIKON: Encoder (single-turn/multi-turn), 3: Reserved 4: Reserved 5: Reserved 6: Reserved 7: Wire-saving UVW ABZ Encoder 8: BISS encoder 9: Non-wire-saving UVW ABZ encoder 10: Yuheng encoder										

No. P22.01	Name	Encoder single-turn resolution			Effective setting	-	Data structure	-	Data type	Int32
	Accessibility	RW	Map or not	-	Related mode	-	Data range	0 ~ 24	Factory setting	17
Sets the resolution of the single-turn count used by the absolute encoder.										

No. P22.02	Name	Encoder multi-turn resolution			Effective setting	-	Data structure	-	Data type	Int32
	Accessibility	RW	Map or not	-	Related mode	-	Data range	0 ~ 99	Factory setting	16
Sets the number of revolutions of the absolute position encoder to be used. This parameter must be set to 0 for single-turn absolute encoders.										

No. P22.03	Name	ABZ encoder pulse number			Effective setting	-	Data structure	-	Data type	Int32
	Accessibility	RW	Map or not	-	Related mode	-	Data range	0 ~ 2097152	Factory setting	2500
Set the number of pulses per revolution of the encoder when using the ABZ encoder										

No. P22.04	Name	Divided output pulse number			Effective setting	-	Data structure	-	Data type	Int32
	Accessibility	RW	Map or not	-	Related mode	-	Data range	0 ~ 2097152	Factory setting	2500
Sets the number of orthogonal pulses per revolution when using the analog encoder output.										

No. P22.05	Name	Encoder position angle			Effective setting	-	Data structure	-	Data type	Int32
	Accessibility	RW	Map or not	-	Related mode	-	Data range	0 ~ 33554432	Factory setting	0
This parameter sets the encoder position angle via five types of encoder zero position auto-tuning including "Encoder jog zero calibration", "Encoder offset zero calibration", "Encoder write zero calibration", "Encoder offset zero calibration" and "Encoder write zero calibration 2, the normal use of the servo does not allow the user to modify. The servo debugger can directly input the encoder position angle through this parameter, and then write the encoder position angle into the encoder in two ways: “encoder write zero calibration” and “encoder write zero calibration 2”.										

No. P22.06	Name	Encoder failure enabled			Effective setting	-	Data structure	-	Data type	Int32
	Accessibility	RW	Map or not	-	Related mode	-	Data range	0 ~ 1	Factory setting	1
Set whether to enable the encoder's alarm except "Encoder connection error". After the servo power off, if there is no need to save the application of the motor rotor absolute position information, the encoder power supply battery may not be installed. The P22.06 parameter can mask the error alarm of under voltage and battery disconnection on the encoder.										

No. P22.07	Name	Encoder maximum acceleration			Effective setting	-	Data structure	-	Data type	Int32
	Accessibility	RW	Map or not	-	Related mode	-	Data range	50 ~ 5000	Factory setting	50
Set the maximum allowable encoder deviation value between two encoder read cycles. When the encoder is badly grounded or subjected to severe interference or static electricity, it is possible to avoid overspeed or overcurrent faults. This parameter is automatically set according to the resolution of the connected encoder and generally does not require setting.										

No. P22.08	Name	Acceleration over-tolerance enable			Effective setting	-	Data structure	-	Data type	Int32
	Accessibility	RW	Map or not	-	Related mode	-	Data range	0 ~ 1	Factory setting	1
This parameter is used to enable acceleration over-tolerance fault alarm. 0: Shield acceleration over-tolerance fault alarm; 1: Enable acceleration over-tolerance fault alarm.										

No. P22.09	Name	Auto-tuning current threshold			Effective setting	-	Data structure	-	Data type	Int32
	Accessibility	RW	Map or not	-	Related mode	-	Data range	10 ~ 300	Factory setting	100
This parameter is used to set the current value under auto-tuning. The value is the percentage of the rated current of the motor.										

No. P22.10	Name	Phase loss protection current threshold			Effective setting	-	Data structure	-	Data type	Int32
	Accessibility	RW	Map or not	-	Related mode	-	Data range	5 ~ 100	Factory setting	10
This parameter is used to set the phase loss protection current threshold value, which is the percentage of the motor rated current.										

No. P22.11	Name	number of polar pairs of Resolver			Effective setting	-	Data structure	-	Data type	Int32
	Accessibility	RW	Map or not	-	Related mode	-	Data range	1 ~ 10	Factory setting	1
This parameter is used to set the number of polar pairs of Resolver										

No.	Name	Jog zero calibration Kp	Effective setting	-	Data structure	-	Data type	Int32

P22.12	Accessibility	RW	Map or not	-	Related mode	-	Data range	0.00~1000.00	Factory setting	0.10
This parameter and parameter P22.13 are used to set Kp and Ki for jog zero calibration.										

No. P22.13	Name	Jog zero calibration Ti			Effective setting	-	Data structure	-	Data type	Int32
	Accessibility	RW	Map or not	-	Related mode	-	Data range	0.00~1000.00	Factory setting	1.00
This parameter and parameter P22.12 are used to set Kp and Ki for jog zero calibration.										

No. P22.14	Name	Jog zero calibration automatic operation			Effective setting	-	Data structure	-	Data type	Int32
	Accessibility	RW	Map or not	-	Related mode	-	Data range	0~1	Factory setting	0
This parameter is only useful for linear motors. When the motor type is set to linear motor, if P22.14 is set to 1, jog zero calibration will be automatically performed every time power is re-powered.										

7.2.10 P30 Group Parameters

No. P30.00	Name	X0 terminal input function			Effective setting	-	Data structure	-	Data type	Int32
	Accessibility	RW	Map or not	-	Related mode	-	Data range	0 ~ 10,101 ~ 109	Factory setting	1

Function input terminals are defined in the table:

No.	Functional definition	No.	Functional definition
0	Undefined function	1 or 10	Servo STAT
2 or 102	Forward movement prohibited	3 or 103	Reverse movement prohibited
4 or 104	Forward current limit	5 or 105	Reverse current limit
6 or 106	Emergency stop logic	7 or 1	Positive limit switch
8 or 108	Negative limit switch	9 or 109	Return to zero proximity switch
10	Bus IO function	11 or 111	Probe 1
12 or 11	Probe 2	13 or 13	Fault reset

Note: The setting of five parameters P30.00~P30.04 defines the functions of the five input ports X0~X4. The functions represented by the setting values are as follows:

0: No function.

1 or 101: Servo START:

1: When P10.01 command channel selection is set to 3 or 4, P11.00 control mode selection is set to 0 or 1, and the input is valid, the servo will start; otherwise it will not start;

101: When P10.01 command channel selection is set to 3 or 4, P11.00 control mode selection is set to 0 or 1, and the input is valid, the servo will not start, otherwise it will start;

2 or 102: Forward movement prohibited:

2: In the three control modes, when the input is valid, the servo is prohibited from running in the forward direction. Otherwise, the forward movement is not prohibited.

102: In the three control modes, when the input is valid, the servo is allowed to run in the forward direction, otherwise the forward movement is prohibited;

3 or 103: Reverse movement prohibited:

3: In the three control modes, when the input is valid, the servo reverse operation is prohibited, otherwise the reverse movement is not prohibited;

103: In the three control modes, when the input is valid, the servo reverse running is not prohibited, otherwise the reverse movement is prohibited;

4 or 104: Forward torque limit:

4: When the input is valid, the servo forward torque output is output according to the parameter P50.10 limit value, otherwise the function is invalid;

104: When the input is valid, this function is invalid, otherwise the servo forward torque output is output according to the parameter P50.10 limit value;

5 or 105: Reverse torque limit:

5: When the input is valid, the servo reverse torque output is output according to the parameter P50.11 limit value, otherwise the function is invalid;

105: When the input is valid, this function is invalid, otherwise the servo reverse torque output is output according to the limit value of parameter P50.11;

6 or 106: Emergency stop logic setting:

6: Emergency stop is set to normally open logic. The servo is in emergency stop state for valid input state.

106: Emergency stop is set to normally closed logic. The servo is in emergency stop state for high impedance state and valid input state.

7 or 107: Positive limit switch for zero return mode:

7: When the input is valid, the positive limit switch arrives, otherwise the positive limit switch does not arrive;
107: When the input is valid, the positive limit switch does not arrive, otherwise the positive limit switch arrives;
8 or 108: Negative limit switch for return to zero mode:
8: When the input is valid, the negative limit switch arrives, otherwise the negative limit switch does not arrive;
108: When the input is valid, the negative limit switch does not arrive, otherwise the negative limit switch arrives;
9 or 109: Zero return proximity switch for zero return mode:
9: When the input is valid, the zero return proximity switch arrives, otherwise the zero return proximity switch does not arrive;
109: When the input is valid, the zero return proximity switch does not arrive, otherwise the zero return proximity switch arrives;
10: bus IO function, the digital input state is mapped to the bus object 60FDh 20~25;
11: When the input is valid, the inactive level is low, and the rising and falling edges trigger the probe 1 function;
111: When the input is invalid, the inactive level is high, and the rising and falling edges trigger the probe 1 function;
12: When the input is valid, the inactive level is low, and the rising and falling edges trigger the probe 2 function;
112: When the input is invalid, the inactive level is high, and the rising and falling edges trigger the probe 2 function;
13: When the input is valid, the fault reset is effective, otherwise it is invalid;
113: When the input is invalid, the fault reset is invalid, otherwise the fault reset is valid;

No. P30.01	Name	X1 terminal input function			Effective setting	-	Data structure	-	Data type	Int32
	Accessibility	RW	Map or not	-	Related mode	-	Data range	0 ~ 10、101 ~ 109	Factory setting	2
Set the value of the X1 terminal input function										

No. P30.02	Name	X2 terminal input function			Effective setting	-	Data structure	-	Data type	Int32
	Accessibility	RW	Map or not	-	Related mode	-	Data range	0 ~ 10、101 ~ 109	Factory setting	3
Set the value of the X2terminal input function										

No. P30.03	Name	X3 terminal input function			Effective setting	-	Data structure	-	Data type	Int32
	Accessibility	RW	Map or not	-	Related mode	-	Data range	0 ~ 10、101 ~ 109	Factory setting	4
Set the value of the X3 terminal input function										

No. P30.04	Name	X4terminal input function			Effective setting	-	Data structure	-	Data type	Int32
	Accessibility	RW	Map or not	-	Related mode	-	Data range	0 ~ 10、101 ~ 109	Factory setting	5
Set the value of the X4 terminal input function										

No. P30.05	Name	Emergency stop logic			Effective setting	-	Data structure	-	Data type	Int32
	Accessibility	RW	Map or not	-	Related mode	-	Data range	6、106	Factory setting	6
This parameter is used to select the emergency stop logic setting: 106: Normally closed: The high impedance and inactive status correspond to the emergency stop status of the servo. 6: Normally open: The high resistance and effective state correspond to the emergency stop status of the servo.										

No. P30.06	Name	Digital input filter time			Effective setting	-	Data structure	-	Data type	Int32
	Accessibility	RW	Map or not	-	Related mode	-	Data range	0 ~ 500	Factory setting	5
This parameter is used to set the digital filter time.										

No. P31.00	Name	Y0 terminal output function			Effective setting	-	Data structure	-	Data type	Int32
	Accessibility	RW	Map or not	-	Related mode	-	Data range	0 ~ 7、101 ~ 106	Factory setting	2

Y0~Y2 terminal output can be defined as a multi-function switch output. Multifunction switch output function definition table:

Function settings	meaning	Function settings	meaning
0	Undefined function	1 or 101	Complete servo back to zero
2 or 102	Serve ready (RDY)	3 or 103	Servo failure (ERR)
4 or 104	Location tracking limit	5 or 05	Target location arrival
6 or 106	STO enable flag	7	Bus IO output
8	Brake output		

Note 1: The setting of the four parameters P31.00~P31.03 defines the functions of the three output ports Y0~Y2. The set value range and the function of the output port corresponding to each value are as follows Explanation:
0: No function
1 or 101: complete servo back to zero
1: servo zeroing is complete, the corresponding output point ON, otherwise OFF;
101: servo zeroing is complete, the corresponding output point OFF, or ON.
2 or 102: Servo operation enabled
2: When the servo is in the normal running state, or the CIA402 of the servo is under the Operation Enabled state machine, the corresponding output point is turned on; otherwise, it is disconnected;
102: The servo is in a normal running state, or the CIA402 state machine of the servo is in the state of Operation Enabled, otherwise it is turned on.
3 or 103: Servo alarm
3: When the servo is in the alarm stop state, the corresponding output point is turned on, otherwise it is disconnected;
103: When the servo is in the alarm stop state, it is correspondingly disconnected; otherwise, it is turned on.
4 or 104: Position Tracking Overrun
4: When the difference between the position control command value and the actual feedback position value of the motor exceeds the set limit value, the corresponding output point is turned on; otherwise, it is turned off;
104: When the difference between the position control command value and the actual feedback position value of the motor exceeds the set limit value, the corresponding output point is opened, otherwise it is turned on.
5 or 105: Target position arrives
5: When the actual position value of the motor is equal to the position control command value, the corresponding output point is turned on; otherwise, it is turned off;
105: When the actual position value of the motor is equal to the position control command value, the corresponding output point is opened, otherwise it is turned on.
6 or 106: STO Enable Flag
6: When the STO input is valid, the corresponding output point is on, otherwise it is off;
106: When the STO input is invalid, the corresponding output point is disconnected, otherwise it is turned on.
Note 1: The above-mentioned "ON" means that: after the output optocoupler's post stage is turned on, the above meaning of "OFF" is that the output optocoupler's post stage does not conduct.
Note 2: When the servo fails, a fault signal is output. At the same time, the servo operation enable signal is cleared. The fault signal is latched and can be cleared by the operator's reset operation, BECON-Monitor's reset operation, bus reset operation, or power failure.7：
Bus IO output: The digital output is mapped to the 16~19 bits of the bus 60FEh;
8: When the servo brake release control signal outputs, the corresponding output point is turned on, otherwise it is disconnected.

7.2.11 P31 Group Parameters

No. P31.01	Name	Y1 terminal output function			Effective setting	-	Data structure	-	Data type	Int32
	Accessibility	RW	Map or not	-	Related mode	-	Data range	0～7、101～106	Factory setting	3
Set the value of Y1 terminal output function										

No. P31.02	Name	Y2 terminal output function			Effective setting	-	Data structure	-	Data type	Int32
	Accessibility	RW	Map or not	-	Related mode	-	Data range	0～7、101～106	Factory setting	6
Set the value of Y2 terminal output function										

No. P31.03	Name	Y0 open filter time			Effective setting	-	Data structure	-	Data type	Int32
	Accessibility	RW	Map or not	-	Related mode	-	Data range	0 ~ 500	Factory setting	0
Output signal turn-on and turn-off filter time setting P31.03~P31.08 set three outputs Y0~Y2.										

No. P31.04	Name	Y1 open filter time			Effective setting	-	Data structure	-	Data type	Int32
	Accessibility	RW	Map or not	-	Related mode	-	Data range	0 ~ 500	Factory setting	0
Set the value of Y1 turn on filter time										

No. P31.05	Name	Y2 open filter time			Effective setting	-	Data structure	-	Data type	Int32
	Accessibility	RW	Map or not	-	Related mode	-	Data range	0 ~ 500	Factory setting	0
Set the value of Y2 turn on filter time										

No. P31.06	Name	Y0 close filter time			Effective setting	-	Data structure	-	Data type	Int32
	Accessibility	RW	Map or not	-	Related mode	-	Data range	0 ~ 500	Factory setting	0
Set the value of Y0 turn off filter time										

No. P31.07	Name	Y1 close filter time			Effective setting	-	Data structure	-	Data type	Int32
	Accessibility	RW	Map or not	-	Related mode	-	Data range	0 ~ 500	Factory setting	0
Set the value of Y1 turn off filter time										

No. P31.08	Name	Y2 close filter time			Effective setting	-	Data structure	-	Data type	Int32
	Accessibility	RW	Map or not	-	Related mode	-	Data range	0 ~ 500	Factory setting	0
Set the value of Y2 turn off filter time										

7.2.12 P32 Group Parameters

No. P32.00	Name	Ai0 function			Effective setting	-	Data structure	-	Data type	Int32
	Accessibility	RW	Map or not	-	Related mode	-	Data range	0 ~ 4	Factory setting	1

Parameters P32.00, P32.06 set the analog AI input function:
0: Undefined function
1: target speed input
2: Target torque input
3: Bus analog input 1
4: Bus Analog Input 2
P32.01~P32.05 and P32.07~P32.11 respectively set the bias, gain, filter time, and limit of the two analog input ports.
Gain is a proportional coefficient, generally 100%
The appropriate adjustment of the filter time can improve the anti-jamming capability of the terminal input, because the analog input through the A0, A1 terminal in the field application usually has a certain interference signal, but the longer the terminal filtering time is, the longer the response delay of the terminal action is. .
Limiting only limits the final processing signal of the analog input to a certain control range
Actual input = (analog input - bias) * gain
Example 1: Analog input 0~10V as speed reference actually corresponds to input frequency 0~, Motor maximum speed P32.02 needs to set gain 100% and bias 0.000V
The bus analog input 1 is mapped to the 5000h.01h of the bus, and the external input is ±10V corresponding to the internal digital value 0-4096;
The bus analog input 2 is mapped to the 5000h.02h of the bus, and the external input is ±10V corresponding to the internal digital value 0-4096;

No. P32.01	Name	Ai0 bias			Effective setting	-	Data structure	-	Data type	Int32
	Accessibility	RW	Map or not	-	Related mode	-	Data range	-10.000 ~ +10.000	Factory setting	0．000
Set the value of Ai0 bias										

No. P32.02	Name	Ai0 gain			Effective setting	-	Data structure	-	Data type	Int32
	Accessibility	RW	Map or not	-	Related mode	-	Data range	0.0 ~ 300.0	Factory setting	100.0
Set the value of Ai0 gain										

No. P32.03	Name	Ai0 filter			Effective setting	-	Data structure	-	Data type	Int32
	Accessibility	RW	Map or not	-	Related mode	-	Data range	0.0 ~ 32.0	Factory setting	0.0
Set the value of Ai0 filter										

No. P32.04	Name	Ai0 upper limit			Effective setting	-	Data structure	-	Data type	Int32
	Accessibility	RW	Map or not	-	Related mode	-	Data range	0.00 ~ 10.50	Factory setting	10.00
Set the value of Ai0 upper limit										

No. P32.05	Name	Ai0 lower limit			Effective setting	-	Data structure	-	Data type	Int32
	Accessibility	RW	Map or not	-	Related mode	-	Data range	-10.50 ~ 0.00	Factory setting	-10.00
Set the value of Ai0 lower limit										

No. P32.06	Name	Ai0 function			Effective setting	-	Data structure	-	Data type	Int32
	Accessibility	RW	Map or not	-	Related mode	-	Data range	0 ~ 4	Factory setting	1
Set the value of Ai0 function										

No. P32.07	Name	Ai0 bias			Effective setting	-	Data structure	-	Data type	Int32
	Accessibility	RW	Map or not	-	Related mode	-	Data range	-10.000 ~ +10.000	Factory setting	0．000
Set the value of Ai0 bias										

No. P32.08	Name	Ai0 gain			Effective setting	-	Data structure	-	Data type	Int32
	Accessibility	RW	Map or not	-	Related mode	-	Data range	0.0 ~ 300.0	Factory setting	100.0
Set the value of Ai0 gain										

No. P32.09	Name	Ai0 filter			Effective setting	-	Data structure	-	Data type	Int32
	Accessibility	RW	Map or not	-	Related mode	-	Data range	0.0 ~ 32.0	Factory setting	0.0
Set the value of Ai0 filter										

No. P32.10	Name	Ai0 upper limit			Effective setting	-	Data structure	-	Data type	Int32
	Accessibility	RW	Map or not	-	Related mode	-	Data range	0.00 ~ 10.50	Factory setting	10.00
Set the value of Ai0 upper limit										

No. P32.11	Name	Ai0 lower limit			Effective setting	-	Data structure	-	Data type	Int32
	Accessibility	RW	Map or not	-	Related mode	-	Data range	-10.50 ~ 0.00	Factory setting	-10.00
Set the value of Ai0 lower limit										

7.2.13 P40 Group Parameters

No. P40.00	Name	Fault record 1			Effective setting	-	Data structure	-	Data type	Int32
	Accessibility	RW	Map or not	-	Related mode	-	Data range	0 ~ 255	Factory setting	0
Reading the historical failure of the servo, a total of 10 historical faults can be stored, and fault 1 to fault 10 can be recorded in turn. The user can learn the fault history records of the servo through this set of parameters.										

No. P40.01	Name	Fault record 2			Effective setting	-	Data structure	-	Data type	Int32
	Accessibility	RW	Map or not	-	Related mode	-	Data range	0 ~ 255	Factory setting	0
Read the history of the servo fault record 2 .										

No. P40.02	Name	Fault record 3			Effective setting	-	Data structure	-	Data type	Int32
	Accessibility	RW	Map or not	-	Related mode	-	Data range	0 ~ 255	Factory setting	0
Read the history of the servo fault record 3 .										

No. P40.03	Name	Fault record 4			Effective setting	-	Data structure	-	Data type	Int32
	Accessibility	RW	Map or not	-	Related mode	-	Data range	0 ~ 255	Factory setting	0
Read the history of the servo fault record 4.										

No. P40.04	Name	Fault record 5			Effective setting	-	Data structure	-	Data type	Int32
	Accessibility	RW	Map or not	-	Related mode	-	Data range	0 ~ 255	Factory setting	0
Read the history of the servo fault record 5.										

No. P40.05	Name	Fault record 6			Effective setting	-	Data structure	-	Data type	Int32
	Accessibility	RW	Map or not	-	Related mode	-	Data range	0 ~ 255	Factory setting	0
Read the history of the servo fault record 6.										

No. P40.06	Name	Fault record 7			Effective setting	-	Data structure	-	Data type	Int32
	Accessibility	RW	Map or not	-	Related mode	-	Data range	0 ~ 255	Factory setting	0
Read the history of the servo fault record 7.										

No. P40.07	Name	Fault record 8			Effective setting	-	Data structure	-	Data type	Int32
	Accessibility	RW	Map or not	-	Related mode	-	Data range	0 ~ 255	Factory setting	0
Read the history of the servo fault record 8.										

No. P40.08	Name	Fault record 9			Effective setting	-	Data structure	-	Data type	Int32
	Accessibility	RW	Map or not	-	Related mode	-	Data range	0 ~ 255	Factory setting	0
Read the history of the servo fault record 9.										

No. P40.09	Name	Fault record 10			Effective setting	-	Data structure	-	Data type	Int32
	Accessibility	RW	Map or not	-	Related mode	-	Data range	0 ~ 255	Factory setting	0
Read the history of the servo fault record 10.										

7.2.14 P50 Group Parameters

No. P50.00	Name	Carrier frequency			Effective setting	-	Data structure	-	Data type	Int32
	Accessibility	RW	Map or not	-	Related mode	-	Data range	1000~20000	Factory setting	10000
This parameter shows the PWM carrier frequency and cannot be modified. The greater the carrier frequency, the faster the transient response of the current, but the greater the heat generated by the power module, the greater the heat loss. The smaller the carrier frequency, the smaller the heat generated by the power module and the smaller the heat loss, but the slower current transient response.										

No. P50.01	Name	Modulation mode			Effective setting	-	Data structure	-	Data type	Int32
	Accessibility	RW	Map or not	-	Related mode	-	Data range	0~1	Factory setting	0
This parameter sets the PWM modulation mode: 0: bilateral modulation; 1: unilateral modulation. The bilateral modulation mode can extend the current loop bandwidth and is mainly used to adjust the control performance of the current loop. Generally, it does not adjust and is set according to the default value.										

No. P50.02	Name	ACR Kp			Effective setting	-	Data structure	-	Data type	Int32
	Accessibility	RW	Map or not	-	Related mode	-	Data range	0.00~99.99	Factory setting	0.54
The three parameters P50.02, P50.03, and P50.04 mainly adjust the PID of the current loop. Generally, they are not adjusted and are set according to the default values. The bigger Kp is, the quicker the response is, but if it is too large, it is easy to produce oscillation. Kp cannot eliminate the deviation completely. To eliminate the residual deviation, Ti can be used. The smaller Ti is, the faster the servo responds to the deviation change. However, if it is too small, it will easily cause oscillation. If there are often jumping feedback in the system, You need to use Kd, Kd can quickly respond to system feedback and given deviation changes. The bigger the Kd, the quicker the response, but the bigger the Kd is, also easilyto cause oscillation.										

No. P50.03	Name	ACR Ti			Effective setting	-	Data structure	-	Data type	Int32
	Accessibility	RW	Map or not	-	Related mode	-	Data range	0.0~9999.9	Factory setting	16.0
Set the ACR Kp value										
No. P50.04	Name	ACR Kd			Effective setting	-	Data structure	-	Data type	Int32
	Accessibility	RW	Map or not	-	Related mode	-	Data range	0.000~9.999	Factory setting	0.000
Set the ACR Kd value										

No. P50.05	Name	Dead time			Effective setting	-	Data structure	-	Data type	Int32
	Accessibility	RW	Map or not	-	Related mode	-	Data range	2000~20000	Factory setting	4000
This parameter is used to set the dead time										

No. P50.06	Name	Dead zone compensation coefficient			Effective setting	-	Data structure	-	Data type	Int32
	Accessibility	RW	Map or not	-	Related mode	-	Data range	0.0~200.0	Factory setting	50.0
The two parameters of P50.06 and P50.07 mainly affect the compensation effect of dead zone compensation in current control. Increasing the dead-zone compensation coefficient helps to reduce the torque ripple in the motor high-speed segment. The dead-zone compensation threshold mainly affects the sine of the current zero-crossing point. These two parameters are mainly used to adjust the current loop control performance, and generally do not adjust. Follow the default settings.										

No. P50.07	Name	Dead zone compensation threshold			Effective setting	-	Data structure	-	Data type	Int32
	Accessibility	RW	Map or not	-	Related mode	-	Data range	0.0~100.0	Factory setting	10.0
Set the value of dead zone compensation threshold										

No. P50.08	Name	Torque given upper limit			Effective setting	-	Data structure	-	Data type	Int32
	Accessibility	RW	Map or not	-	Related mode	-	Data range	0~1000	Factory setting	300
This parameter refers to the percentage of the forward maximum torque allowed by the servo drive and the rated torque of the servo drive. Used for the current given limit for the speed loop output.										

No. P50.09	Name	Torque given lower limit			Effective setting	-	Data structure	-	Data type	Int32
	Accessibility	RW	Map or not	-	Related mode	-	Data range	-1000~0	Factory setting	-300
This parameter refers to the percentage of the reverse maximum torque allowed by the servo drive and the rated torque of the servo drive. Used for the current given limit for the speed loop output.										

No. P50.10	Name	Torque limitation upper limit			Effective setting	-	Data structure	-	Data type	Int32
	Accessibility	RW	Map or not	-	Related mode	-	Data range	0~1000	Factory setting	300
Torque limitation upper limit refers to the percentage of positive limit torque and the rated torque, and is used with parameter P50.11 for digital input function 4 or 104 forward torque limit, 5 or 105 reverse torque limit, for Limited torque output. For example: When a digital input port is set to 4 and the input is valid, when the torque output exceeds the upper limit of the torque limit, it is output according to the upper limit of the torque limit.										

No. P50.11	Name	Torque limitation lower limit			Effective setting	-	Data structure	-	Data type	Int32
	Accessibility	RW	Map or not	-	Related mode	-	Data range	-1000~0	Factory setting	-300
Torque limitation upper limit refers to the percentage of reverse limit torque and the rated torque, and is used with parameter P50.10 for digital input function 4 or 104 forward torque limit, 5 or 105 reverse torque limit, for Limited torque output. For example: When a digital input port is set to 4 and the input is valid, when the torque output exceeds the upper limit of the torque limit, it is output according to the upper limit of the torque limit.										

No. P50.12	Name	Torque acceleration limit			Effective setting	-	Data structure	-	Data type	Int32
	Accessibility	RW	Map or not	-	Related mode	-	Data range	5~1000	Factory setting	50
The torque acceleration limit is the incremental limit of the torque reference command. The set value is the percentage of the rated motor torque. This parameter affects the servo's response speed and anti-jamming capability. Increasing the set value will speed up the servo response and reduce the servo anti-jamming capability. Decreasing the set value will slow down the servo response and improve the servo anti-jamming capability. This parameter is generally not adjusted, set by default.										

No. P50.13	Name	Flux-Weaken Kp			Effective setting	-	Data structure	-	Data type	Int32
	Accessibility	RW	Map or not	-	Related mode	-	Data range	1~99.99	Factory setting	1
Set weak magnetic control control parameters, current loop parameters, generally do not modify										

No. P50.14	Name	Flux-Weaken Ti			Effective setting	-	Data structure	-	Data type	Int32
	Accessibility	RW	Map or not	-	Related mode	-	Data range	1.0~9999.9	Factory setting	15
Set weak magnetic control control parameters, current loop parameters, generally do not modify										

7.2.15 P51 Group Parameters

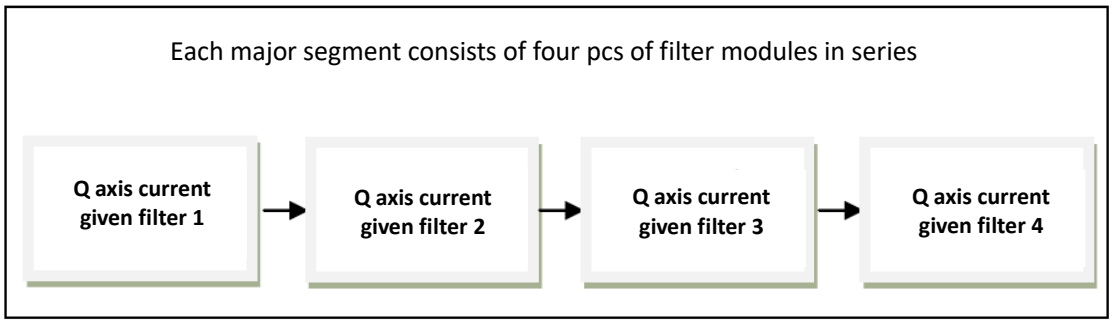
No. P51.00	Name	IqRef1 filter type			Effective setting	-	Data structure	-	Data type	Int32
	Accessibility	RW	Map or not	-	Related mode	-	Data range	0~4	Factory setting	0

P51 Q axis current given filter control parameters

To enable a filter function for the current loop, first set the filter enable (P10.04) to 1; if P10.04 is 0, even if the P51 to P54 group of current loop related filters are configured, The servo will not respond.

In the current loop of the servo system, there are altogether 4 major segments configured with the filter function, namely Q-axis current given filtering, Q-axis current feedback filtering, D-axis current given filtering, and D-axis current feedback filtering. The function of the filter is consistent. , put together to explain. Four filters in the current loop are equipped with filters, each of which is formed by connecting four separate filter modules in series.

Taking the Q-axis current as an example, the Q-axis current given segment consists of four pcs of separate Q-axis current given filter modules 1, 2, 3 and 4 in series, as shown.



Each filter module has four control parameters, which are described by the Q axis current given filter 1 (the Q axis current given filters 2, 3, and 4 will not be repeated):

IqRef1 represents the Q-axis current given filter module 1. This parameter is used to select the type of Q-axis current given filter module 1. The meaning of the parameters is as follows:

0: This module does not have a filter

1: The module is configured as a first-order low-pass filter

2: The module is configured as a second-order low-pass filter

3: The module is configured as a third-order low-pass filter

4: This module is configured as a notch filter

No. P51.01	Name	IqRef1LP cutoff frequency			Effective setting	-	Data structure	-	Data type	Int32
	Accessibility	RW	Map or not	-	Related mode	-	Data range	200~ 5000	Factory setting	3500

IqRef1 represents the Q axis current given filter module 1 and LP represents the low pass. This parameter is used to set the low pass cutoff frequency of the Q axis current given filter module 1 (when the IqRef1 filter type is selected as 1 or 2 or 3, this parameter is valid; when the IqRef1 filter type is selected as 0 or 4, the value of this parameter is invalid)

The low-pass filter is used to filter out high-frequency clutter. When the frequency of the input signal is higher than the low-pass cutoff frequency, the amplitude of the signal output by the filter will be greatly attenuated;

For a fixed frequency input signal, the lower the cutoff frequency of the filter, the greater the phase delay to the signal. The default current loop filter low pass cutoff frequency is 3500Hz.

No. P51.01	Name	IqRef1BS Notch frequency			Effective setting	-	Data structure	-	Data type	Int32
	Accessibility	RW	Map or not	-	Related mode	-	Data range	3~ 5000	Factory setting	100

IqRef1 represents the Q axis current given filter module 1, BS represents the band stop, IqRef1BS notch frequency is used to set the notch center frequency of the Q axis current given filter module 1, and IqRef1BS notch depth is used to Sets the notch depth of the Q-axis current given filter module 1 (when the IqRef1 filter type is selected as 4, these two parameters are significant; when the IqRef1 filter type is selected as 0, 1, 2, and 3, The values of these two parameters have no meaning)

Notch filters, also known as band-reject filters, are filters that pass most of the frequency components but attenuate certain ranges of frequency components to very low levels; the notch filters sharply attenuate signals near the center frequency. basically no effect on the signal far away from the center frequency; the greater the notch depth, the stronger the attenuation effect on the center frequency point. In general, the notch filter is enabled only after the motor is vibrating and the frequency of vibration is detected. For detailed configuration methods, please refer to the “Filter Instruction Document”.

No. P51.03	Name	IqRef1BS notch depth			Effective setting	-	Data structure	-	Data type	Int32
	Accessibility	RW	Map or not	-	Related mode	-	Data range	3~50	Factory setting	5
Set the value of IqRef1BS notch depth										

No. P51.04	Name	IqRef2 filter type			Effective setting	-	Data structure	-	Data type	Int32
	Accessibility	RW	Map or not	-	Related mode	-	Data range	0~4	Factory setting	0

No. P51.05	Name	IqRef2LP cutoff frequency			Effective setting	-	Data structure	-	Data type	Int32
	Accessibility	RW	Map or not	-	Related mode	-	Data range	200~5000	Factory setting	3500

No. P51.06	Name	IqRef2BS notch frequency			Effective setting	-	Data structure	-	Data type	Int32
	Accessibility	RW	Map or not	-	Related mode	-	Data range	3~5000	Factory setting	100

No. P51.07	Name	IqRef2BS notch depth			Effective setting	-	Data structure	-	Data type	Int32
	Accessibility	RW	Map or not	-	Related mode	-	Data range	3~50	Factory setting	5

No. P51.08	Name	IqRef3 filter type			Effective setting	-	Data structure	-	Data type	Int32
	Accessibility	RW	Map or not	-	Related mode	-	Data range	0~4	Factory setting	0

No. P51.09	Name	IqRef3LP cutoff frequency			Effective setting	-	Data structure	-	Data type	Int32
	Accessibility	RW	Map or not	-	Related mode	-	Data range	200~5000	Factory setting	3500

No. P51.10	Name	IqRef3BS notch frequency			Effective setting	-	Data structure	-	Data type	Int32
	Accessibility	RW	Map or not	-	Related mode	-	Data range	3~5000	Factory setting	100

No. P51.11	Name	IqRef3BS notch depth			Effective setting	-	Data structure	-	Data type	Int32
	Accessibility	RW	Map or not	-	Related mode	-	Data range	3~50	Factory setting	5

No. P51.12	Name	IqRef4 filter type			Effective setting	-	Data structure	-	Data type	Int32
	Accessibility	RW	Map or not	-	Related mode	-	Data range	0~4	Factory setting	0

No. P51.13	Name	IqRef4LP cutoff frequency			Effective setting	-	Data structure	-	Data type	Int32
	Accessibility	RW	Map or not	-	Related mode	-	Data range	200~5000	Factory setting	3500

No. P51.14	Name	IqRef4BS notch frequency			Effective setting	-	Data structure	-	Data type	Int32
	Accessibility	RW	Map or not	-	Related mode	-	Data range	3~5000	Factory setting	100

No. P51.15	Name	IqRef4BS notch depth			Effective setting	-	Data structure	-	Data type	Int32
	Accessibility	RW	Map or not	-	Related mode	-	Data range	3~50	Factory setting	5

7.2.16 P52 Group Parameters

No. P52.00	Name	IqFbk1 filter type			Effective setting	-	Data structure	-	Data type	Int32
	Accessibility	RW	Map or not	-	Related mode	-	Data range	0~4	Factory setting	0
Group P52 Q axis current feedback filter control parameters, the parameters of which are described in detail in P51 group parameters.										

No. P52.01	Name	IqFbk1LP cutoff frequency			Effective setting	-	Data structure	-	Data type	Int32
	Accessibility	RW	Map or not	-	Related mode	-	Data range	200~ 5000	Factory setting	3500

No. P52.02	Name	IqFbk1BS notch frequency			Effective setting	-	Data structure	-	Data type	Int32
	Accessibility	RW	Map or not	-	Related mode	-	Data range	3~5000	Factory setting	100

No. P52.03	Name	IqFbk1BS notch depth			Effective setting	-	Data structure	-	Data type	Int32
	Accessibility	RW	Map or not	-	Related mode	-	Data range	3~50	Factory setting	5

No. P52.04	Name	IqFbk2 filter type			Effective setting	-	Data structure	-	Data type	Int32
	Accessibility	RW	Map or not	-	Related mode	-	Data range	0~4	Factory setting	0

No. P52.05	Name	IqFbk2LP cutoff frequency			Effective setting	-	Data structure	-	Data type	Int32
	Accessibility	RW	Map or not	-	Related mode	-	Data range	200~ 5000	Factory setting	3500

No. P52.06	Name	IqFbk2BS notch frequency			Effective setting	-	Data structure	-	Data type	Int32
	Accessibility	RW	Map or not	-	Related mode	-	Data range	3~5000	Factory setting	100

No. P52.07	Name	IqFbk2BS notch depth			Effective setting	-	Data structure	-	Data type	Int32
	Accessibility	RW	Map or not	-	Related mode	-	Data range	3~50	Factory setting	5

No. P52.08	Name	IqFbk3 filter type			Effective setting	-	Data structure	-	Data type	Int32
	Accessibility	RW	Map or not	-	Related mode	-	Data range	0~4	Factory setting	0

No. P52.09	Name	IqFbk3LP cutoff frequency			Effective setting	-	Data structure	-	Data type	Int32
	Accessibility	RW	Map or not	-	Related mode	-	Data range	200~ 5000	Factory setting	3500

No. P52.10	Name	IqFbk3BS notch frequency			Effective setting	-	Data structure	-	Data type	Int32
	Accessibility	RW	Map or not	-	Related mode	-	Data range	3~5000	Factory setting	100

No. P52.11	Name	IqFbk3BS notch depth			Effective setting	-	Data structure	-	Data type	Int32
	Accessibility	RW	Map or not	-	Related mode	-	Data range	3~50	Factory setting	5

No. P52.12	Name	IqFbk4 filter type			Effective setting	-	Data structure	-	Data type	Int32
	Accessibility	RW	Map or not	-	Related mode	-	Data range	0~4	Factory setting	0

No. P52.13	Name	IqFbk4LP cutoff frequency			Effective setting	-	Data structure	-	Data type	Int32
	Accessibility	RW	Map or not	-	Related mode	-	Data range	200~ 5000	Factory setting	3500

No. P52.14	Name	IqFbk4BS notch frequency			Effective setting	-	Data structure	-	Data type	Int32
	Accessibility	RW	Map or not	-	Related mode	-	Data range	3~5000	Factory setting	100

No. P52.15	Name	IqFbk4BS notch depth			Effective setting	-	Data structure	-	Data type	Int32
	Accessibility	RW	Map or not	-	Related mode	-	Data range	3~50	Factory setting	5

7.2.17 P53 Group Parameters

No. P53.00	Name	IdRef1 filter type			Effective setting	-	Data structure	-	Data type	Int32
	Accessibility	RW	Map or not	-	Related mode	-	Data range	0~4	Factory setting	0
Group P53 D axis current given filter control parameters, the parameters of which are described in detail in P51 group parameters.										

No. P53.01	Name	IdRef1LP cutoff frequency			Effective setting	-	Data structure	-	Data type	Int32
	Accessibility	RW	Map or not	-	Related mode	-	Data range	200~ 5000	Factory setting	3500

No. P53.02	Name	IdRef1BS notch frequency			Effective setting	-	Data structure	-	Data type	Int32
	Accessibility	RW	Map or not	-	Related mode	-	Data range	3~5000	Factory setting	100

No. P53.03	Name	IdRef1BS notch depth			Effective setting	-	Data structure	-	Data type	Int32
	Accessibility	RW	Map or not	-	Related mode	-	Data range	3~50	Factory setting	5

No. P53.04	Name	IdRef2 filter type			Effective setting	-	Data structure	-	Data type	Int32
	Accessibility	RW	Map or not	-	Related mode	-	Data range	0~4	Factory setting	0

No. P53.05	Name	IdRef2LP cutoff frequency			Effective setting	-	Data structure	-	Data type	Int32
	Accessibility	RW	Map or not	-	Related mode	-	Data range	200~ 5000	Factory setting	3500

No. P53.06	Name	IdRef2BS notch frequency			Effective setting	-	Data structure	-	Data type	Int32
	Accessibility	RW	Map or not	-	Related mode	-	Data range	3~5000	Factory setting	100

No. P53.07	Name	IdRef2BS notch depth			Effective setting	-	Data structure	-	Data type	Int32
	Accessibility	RW	Map or not	-	Related mode	-	Data range	3~50	Factory setting	5

No. P53.08	Name	IdRef3 filter type			Effective setting	-	Data structure	-	Data type	Int32
	Accessibility	RW	Map or not	-	Related mode	-	Data range	0~4	Factory setting	0

No. P53.09	Name	IdRef3LP cutoff frequency			Effective setting	-	Data structure	-	Data type	Int32
	Accessibility	RW	Map or not	-	Related mode	-	Data range	200~ 5000	Factory setting	3500

No. P53.10	Name	IdRef3BS notch frequency			Effective setting	-	Data structure	-	Data type	Int32
	Accessibility	RW	Map or not	-	Related mode	-	Data range	3~5000	Factory setting	100

No. P53.11	Name	IdRef3BS notch depth			Effective setting	-	Data structure	-	Data type	Int32
	Accessibility	RW	Map or not	-	Related mode	-	Data range	3~50	Factory setting	5

No. P53.12	Name	IdRef4 filter type			Effective setting	-	Data structure	-	Data type	Int32
	Accessibility	RW	Map or not	-	Related mode	-	Data range	0~4	Factory setting	0

No. P53.13	Name	IdRef4LP cutoff frequency			Effective setting	-	Data structure	-	Data type	Int32
	Accessibility	RW	Map or not	-	Related mode	-	Data range	200~ 5000	Factory setting	3500

No. P53.14	Name	IdRef4BS notch frequency			Effective setting	-	Data structure	-	Data type	Int32
	Accessibility	RW	Map or not	-	Related mode	-	Data range	3~5000	Factory setting	100

No. P53.15	Name	IdRef4BS notch depth			Effective setting	-	Data structure	-	Data type	Int32
	Accessibility	RW	Map or not	-	Related mode	-	Data range	3~50	Factory setting	5

7.2.18 P54 Group Parameters

No. P54.00	Name	IdFbk1 filter type			Effective setting	-	Data structure	-	Data type	Int32
	Accessibility	RW	Map or not	-	Related mode	-	Data range	0~4	Factory setting	0
Group P54 D axis current feedback filter control parameters, the parameters of which are described in detail in P51 group parameters.										

No. P54.01	Name	IdFbk1LP cutoff frequency			Effective setting	-	Data structure	-	Data type	Int32
	Accessibility	RW	Map or not	-	Related mode	-	Data range	200~ 5000	Factory setting	3500

No. P54.02	Name	IdFbk1BS notch frequency			Effective setting	-	Data structure	-	Data type	Int32
	Accessibility	RW	Map or not	-	Related mode	-	Data range	3~5000	Factory setting	100

No. P54.03	Name	IdFbk1BS notch depth			Effective setting	-	Data structure	-	Data type	Int32
	Accessibility	RW	Map or not	-	Related mode	-	Data range	3~50	Factory setting	5

No. P54.04	Name	IdFbk2 filter type			Effective setting	-	Data structure	-	Data type	Int32
	Accessibility	RW	Map or not	-	Related mode	-	Data range	0~4	Factory setting	0

No. P54.05	Name	IdFbk2LP cutoff frequency			Effective setting	-	Data structure	-	Data type	Int32
	Accessibility	RW	Map or not	-	Related mode	-	Data range	200~ 5000	Factory setting	3500

No. P54.06	Name	IdFbk2BS notch frequency			Effective setting	-	Data structure	-	Data type	Int32
	Accessibility	RW	Map or not	-	Related mode	-	Data range	3~5000	Factory setting	100

No. P54.07	Name	IdFbk2BS notch depth			Effective setting	-	Data structure	-	Data type	Int32
	Accessibility	RW	Map or not	-	Related mode	-	Data range	3~50	Factory setting	5

No. P54.08	Name	IdFbk3 filter type			Effective setting	-	Data structure	-	Data type	Int32
	Accessibility	RW	Map or not	-	Related mode	-	Data range	0~4	Factory setting	0

No. P54.09	Name	IdFbk3LP cutoff frequency			Effective setting	-	Data structure	-	Data type	Int32
	Accessibility	RW	Map or not	-	Related mode	-	Data range	200~ 5000	Factory setting	3500

No. P54.10	Name	IdFbk3BS notch frequency			Effective setting	-	Data structure	-	Data type	Int32
	Accessibility	RW	Map or not	-	Related mode	-	Data range	3~5000	Factory setting	100

No. P54.11	Name	IdFbk3BS notch depth			Effective setting	-	Data structure	-	Data type	Int32
	Accessibility	RW	Map or not	-	Related mode	-	Data range	3~50	Factory setting	5

No. P54.12	Name	IdFbk4 filter type			Effective setting	-	Data structure	-	Data type	Int32
	Accessibility	RW	Map or not	-	Related mode	-	Data range	0~4	Factory setting	0

No. P54.13	Name	IdFbk4LP cutoff frequency			Effective setting	-	Data structure	-	Data type	Int32
	Accessibility	RW	Map or not	-	Related mode	-	Data range	200~ 5000	Factory setting	3500

No. P54.14	Name	IdFbk4BS notch frequency			Effective setting	-	Data structure	-	Data type	Int32
	Accessibility	RW	Map or not	-	Related mode	-	Data range	3~5000	Factory setting	100

No. P54.15	Name	IdFbk4BS notch depth			Effective setting	-	Data structure	-	Data type	Int32
	Accessibility	RW	Map or not	-	Related mode	-	Data range	3~50	Factory setting	5

7.2.19 P55Group Parameters

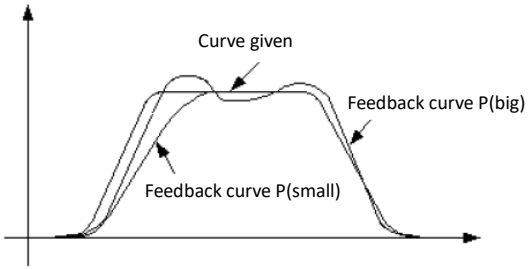
No.	Name	ASR Kp			Effective setting	-	Data structure	-	Data type	Int32
P55.00	Accessibility	RW	Map or not	-	Related mode	-	Data range	0.01~99.99	Factory setting	0.60

P55.00 P55.01 P55.02, the three parameters mainly adjust the proportional gain, integral time constant and differential constant of the speed regulator.

Proportional gain Kp:

Please adjust Kp according to the mechanical inertia connected to the motor. Increase Kp for a machine with a large moment of inertia, and decrease Kp for a machine with a small moment of inertia.

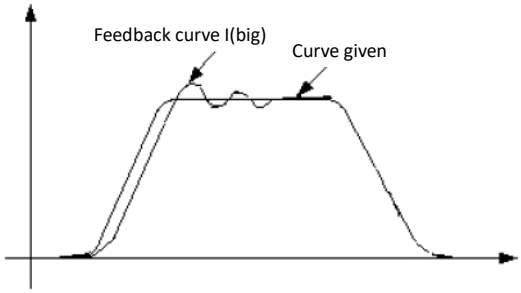
When Kp is larger than the inertia, although the control response can be quickened, the motor may oscillate or overshoot. Conversely, if the Kp is smaller than the inertia, the control response becomes slower and the time for adjusting the speed to a stable value becomes longer. The effect of proportional constant Kp on feedback tracking is shown in the figure:



Integration time Ti:

When set to 9999.9, it means that the integral is invalid (Kp alone control). To make the steady state speed command and the actual speed deviation be 0, set the integral time constant reasonably.

When the Ti setting value is small, the system response is fast, but if it is too small, oscillation may occur. When the Ti setting value is large, the system response is slow. The effect of the integral time constant Ti on speed tracking is shown in the figure:



The derivative time Kd: generally does not adjust, according to the default settings, this parameter can quickly respond to system feedback and given deviation changes. The faster the Kd value is, the faster the response, but the larger the Kd value is, the easier it is to cause oscillation. When set to 0, the differential is invalid.

No.	Name	ASR Ti			Effective setting	-	Data structure	-	Data type	Int32
P55.01	Accessibility	RW	Map or not	-	Related mode	-	Data range	0.1 ~ 9999.9	Factory setting	100.0

Set the ASR Ti value

No.	Name	ASR Kd			Effective setting	-	Data structure	-	Data type	Int32
P55.02	Accessibility	RW	Map or not	-	Related mode	-	Data range	0.000 ~ 9.999	Factory setting	0.000

Set the ASR Kd value

No.	Name	ASR control period			Effective setting	-	Data structure	-	Data type	Int32
P55.03	Accessibility	RW	Map or not	-	Related mode	-	Data range	2 ~ 40	Factory setting	4

Set the ratio of the speed control period to the current control period. This parameter is mainly used to adjust the control cycle of the speed loop.

Speed loop cycle = (P55.03 * 1000000) / (P50.00 * (2 – P50.01)) microseconds

When using bus control, the master communication cycle P14.03 needs to be an integral multiple of the speed loop cycle.

No.	Name	Speed given upper limit			Effective setting	-	Data structure	-	Data type	Int32
P55.04	Accessibility	RW	Map or not	-	Related mode	-	Data range	0~1000	Factory setting	200

This parameter is used to set the upper limit of the speed reference value as the percentage of the rated motor speed. In the position control and speed control modes, the speed reference during forward rotation is limited to the range of this parameter.

No. P55.05	Name	Speed given lower limit			Effective setting	-	Data structure	-	Data type	Int32
	Accessibility	RW	Map or not	-	Related mode	-	Data range	-1000~0	Factory setting	-200
This parameter is used to set the lower limit of the speed reference value as the percentage of the rated motor speed. In the position control and speed control modes, the speed reference during reverse rotation is limited to the range of this parameter.										

No. P55.06	Name	Speed tracking error threshold			Effective setting	-	Data structure	-	Data type	Int32
	Accessibility	RW	Map or not	-	Related mode	-	Data range	0.0 ~ 100.0	Factory setting	50.0
This parameter is used to set the speed tracking error threshold. The base value is the current speed reference. When the difference between the speed reference and speed feedback reaches or exceeds the threshold set by P55.06 (eg runaway), the servo drive will stop and report a fault.										

No. P55.07	Name	Tracking error filter time			Effective setting	-	Data structure	-	Data type	Int32
	Accessibility	RW	Map or not	-	Related mode	-	Data range	0~2000	Factory setting	500
This parameter is used to set the filter time for speed tracking error protection. Normally it is not adjusted. It is set according to the default value.										

No. P55.08	Name	Stall threshold			Effective setting	-	Data structure	-	Data type	Int32
	Accessibility	RW	Map or not	-	Related mode	-	Data range	0~2000	Factory setting	100
This parameter is used to set the stall protection threshold and the base value is the current speed reference. When the difference between the speed reference and speed feedback reaches or exceeds the threshold set in P55.08 (eg, runaway), the servo drive will stop and report the fault.										

No. P55.09	Name	Stall filter time			Effective setting	-	Data structure	-	Data type	Int32
	Accessibility	RW	Map or not	-	Related mode	-	Data range	0~2000	Factory setting	100
This parameter is used to set the filtering time of stall protection. Generally, it is not adjusted, and it is set according to the default value.										

No. P55.10	Name	Stall protection enabled			Effective setting	-	Data structure	-	Data type	Int32
	Accessibility	RW	Map or not	-	Related mode	-	Data range	0~1	Factory setting	1
This parameter is used to set whether to detect stall protection faults. When this parameter is set to 1, stall detection fault detection is enabled.										

No. P55.11	Name	Overspeed filtering time			Effective setting	-	Data structure	-	Data type	Int32
	Accessibility	RW	Map or not	-	Related mode	-	Data range	0~2000	Factory setting	5
This parameter is used to set the filtering time of overspeed protection. Generally, it is not adjusted. It is set according to the default value.										

No. P55.12	Name	Motor rotation positive direction			Effective setting	-	Data structure	-	Data type	Int32
	Accessibility	RW	Map or not	-	Related mode	-	Data range	0~1	Factory setting	1
This parameter is used to set the positive direction of motor rotation. 0 represents CW is a forward rotation ,viewing from the side of the shaft 1 represents CCW is a forward rotation, viewing from the side of the shaft										

No. P55.13	Name	Sweep vibration frequency 1			Effective setting	-	Data structure	-	Data type	Int32
	Accessibility	RW	Map or not	-	Related mode	-	Data range	0~2000	Factory setting	0
Parameters P55.13, P55.14, and P55.15 are read-only. For motors without limit, the servo will analyze the frequency of the clutter that causes vibration after performing the acceleration/deceleration sweep (auto-tuning 9). Then the frequency of the three strongest clutters causing the vibration is written to these three parameters. The sweep vibration frequency 1 corresponds to the clutter frequency with the strongest vibration. For example, after performing acceleration and deceleration sweep, upload the parameters via BECON-Monitor software . the parameter of sweep vibration frequency 1 is read out, 115, in the speed feedback link where we can configure a 115 Hz center frequency, and a 40 db notch filter (The notch depth is adjusted from small to large.)										

No. P55.14	Name	Sweep vibration frequency 2			Effective setting	-	Data structure	-	Data type	Int32
	Accessibility	RW	Map or not	-	Related mode	-	Data range	0~2000	Factory setting	0
Set the value of sweep vibration frequency 2.										

No. P55.15	Name	Sweep vibration frequency 3			Effective setting	-	Data structure	-	Data type	Int32
	Accessibility	RW	Map or not	-	Related mode	-	Data range	0~2000	Factory setting	0
Set the value of the sweep vibration frequency 3.										

7.2.20 P56 Group Parameter

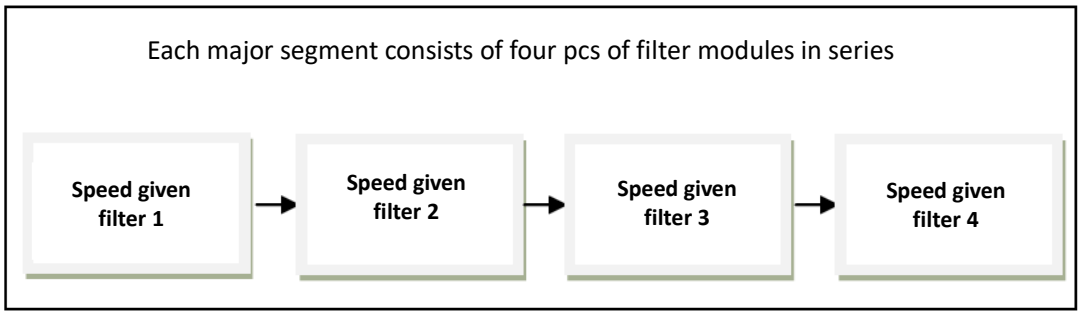
No. P56.00	Name	VRef1滤波器类型			Effective setting	-	Data structure	-	Data type	Int32
	Accessibility	RW	Map or not	-	Related mode	-	Data range	0~4	Factory setting	0

Group P56 speed given filter control parameters

To enable the speed loop filter function, first set the filter enable (P10.04) to 1; if P10.04 is 0, even if the relevant filter of the speed loop of P56 and P57 group is configured, servo Will not respond.

The speed loop of the servo system has a total of two major segments configuring filter function, namely, the speed given filtering and the speed feedback filtering, and the functions of the filters are consistent.

The two segments of the speed loop are equipped with filters, each of which is composed of four separate filter modules connected in series. The speed reference is used as an example. The speed segment consists of four separate filter module 1 , 2, 3 and 4 connected in series, as shown in the figure.



Each filter module has four control parameters, which are described with the speed given filter 1 (the speed given filters 2, 3, 4 will not be repeated):

VRef1 represents the speed given filter module 1, this parameter is used to select the type of speed given filter module 1, the meaning of the parameters is as follows:

0: This module does not have a filter

1: The module is configured as a first-order low-pass filter

2: The module is configured as a second-order low-pass filter

3: The module is configured as a third-order low-pass filter

4: This module is configured as a notch filter

No. P56.01	Name	VRef1LP cutoff frequency			Effective setting	-	Data structure	-	Data type	Int32
	Accessibility	RW	Map or not	-	Related mode	-	Data range	200~5000	Factory setting	2500

VRef1 represents the speed given filter module 1 and LP represents the low pass. This parameter is used to set the low pass cutoff frequency of the speed given filter module 1 (when the VRef1 filter type is selected as 1 or 2 or 3 This parameter is meaningful only when the VRef1 filter type is 0 or 4. The value of this parameter has no meaning.)

The low-pass filter is used to filter out high-frequency clutter. When the frequency of the input signal is higher than the low-pass cutoff frequency, the amplitude of the signal output by the filter will be greatly attenuated;

For a fixed frequency input signal, the lower the cutoff frequency of the filter, the greater the phase delay to the signal. The default speed loop filter low pass cutoff frequency is 2500Hz.

No. P56.02	Name	VRef1BS notch frequency			Effective setting	-	Data structure	-	Data type	Int32
	Accessibility	RW	Map or not	-	Related mode	-	Data range	3~5000	Factory setting	100

VRef1 represents the speed given filter module 1, BS represents the band stop, VRef1BS notch frequency is used to set the notch center frequency of the speed given filter module 1, and VRef1BS notch depth is used to set the speed to Determine the notch depth of filter module 1 (when the VRef1 filter type is selected as 4, these two parameters make sense; when the VRef1 filter type is selected as 0, 1, 2, 3, the values of these two parameters pointless)

Notch filters, also known as band-reject filters, are filters that pass most of the frequency components but attenuate certain ranges of frequency components to very low levels; the notch filters attenuate signals near the center frequency sharply, basically no effect on the signal far away from the center frequency; the greater the notch depth, the stronger the attenuation effect on the center frequency point. In general, the notch filter is enabled only after the motor has vibrated and the vibration frequency is detected. For detailed configuration methods, please refer to the “Filter documentation”.

No. P56.03	Name	VRef1BS notch depth			Effective setting	-	Data structure	-	Data type	Int32
	Accessibility	RW	Map or not	-	Related mode	-	Data range	3~50	Factory setting	5
Sets the value of VRef1BS notch depth										

No. P56.04	Name	VRef2 filter type			Effective setting	-	Data structure	-	Data type	Int32
	Accessibility	RW	Map or not	-	Related mode	-	Data range	0~4	Factory setting	0

No. P56.05	Name	VRef2LP cutoff frequency			Effective setting	-	Data structure	-	Data type	Int32
	Accessibility	RW	Map or not	-	Related mode	-	Data range	200~ 5000	Factory setting	2500

No. P56.06	Name	VRef2BS notch frequency			Effective setting	-	Data structure	-	Data type	Int32
	Accessibility	RW	Map or not	-	Related mode	-	Data range	3~ 5000	Factory setting	100

No. P56.07	Name	VRef2BS notch depth			Effective setting	-	Data structure	-	Data type	Int32
	Accessibility	RW	Map or not	-	Related mode	-	Data range	3~ 50	Factory setting	5

No. P56.08	Name	VRef3 filter type			Effective setting	-	Data structure	-	Data type	Int32
	Accessibility	RW	Map or not	-	Related mode	-	Data range	0~4	Factory setting	0

No. P56.09	Name	VRef3LP cutoff frequency			Effective setting	-	Data structure	-	Data type	Int32
	Accessibility	RW	Map or not	-	Related mode	-	Data range	200~ 5000	Factory setting	2500

No. P56.10	Name	VRef3BS notch frequency			Effective setting	-	Data structure	-	Data type	Int32
	Accessibility	RW	Map or not	-	Related mode	-	Data range	3~ 5000	Factory setting	100

No. P56.11	Name	VRef3BS notch depth			Effective setting	-	Data structure	-	Data type	Int32
	Accessibility	RW	Map or not	-	Related mode	-	Data range	3~ 50	Factory setting	5

No. P56.12	Name	VRef4 filter type			Effective setting	-	Data structure	-	Data type	Int32
	Accessibility	RW	Map or not	-	Related mode	-	Data range	0~4	Factory setting	0

No. P56.13	Name	VRef4LP cutoff frequency			Effective setting	-	Data structure	-	Data type	Int32
	Accessibility	RW	Map or not	-	Related mode	-	Data range	200~ 5000	Factory setting	2500

No. P56.14	Name	VRef4BS notch frequency			Effective setting	-	Data structure	-	Data type	Int32
	Accessibility	RW	Map or not	-	Related mode	-	Data range	3~ 5000	Factory setting	100

No. P56.15	Name	VRef4BS notch depth			Effective setting	-	Data structure	-	Data type	Int32
	Accessibility	RW	Map or not	-	Related mode	-	Data range	3~ 50	Factory setting	5

7.2.21 P57 Group Parameters

No. P57.00	Name	VFbk1 filter type			Effective setting	-	Data structure	-	Data type	Int32
	Accessibility	RW	Map or not	-	Related mode	-	Data range	0~4	Factory setting	0
Group P57 speed feedback filter control parameters, please refer to P56 Group										

No. P57.01	Name	VFbk1LP cutoff frequency			Effective setting	-	Data structure	-	Data type	Int32
	Accessibility	RW	Map or not	-	Related mode	-	Data range	200~ 5000	Factory setting	2500

No. P57.02	Name	VFbk1BS notch frequency			Effective setting	-	Data structure	-	Data type	Int32
	Accessibility	RW	Map or not	-	Related mode	-	Data range	3~ 5000	Factory setting	100

No. P57.03	Name	VFbk1BS notch depth			Effective setting	-	Data structure	-	Data type	Int32
	Accessibility	RW	Map or not	-	Related mode	-	Data range	3~ 50	Factory setting	5

No. P57.04	Name	VFbk2 filter type			Effective setting	-	Data structure	-	Data type	Int32
	Accessibility	RW	Map or not	-	Related mode	-	Data range	0~4	Factory setting	0

No. P57.05	Name	VFbk2LP cutoff frequency			Effective setting	-	Data structure	-	Data type	Int32
	Accessibility	RW	Map or not	-	Related mode	-	Data range	200~ 5000	Factory setting	2500

No. P57.06	Name	VFbk2BS notch frequency			Effective setting	-	Data structure	-	Data type	Int32
	Accessibility	RW	Map or not	-	Related mode	-	Data range	3~ 5000	Factory setting	100

No. P57.07	Name	VFbk2BS notch depth			Effective setting	-	Data structure	-	Data type	Int32
	Accessibility	RW	Map or not	-	Related mode	-	Data range	3~ 50	Factory setting	5

No. P57.08	Name	VFbk3 filter type			Effective setting	-	Data structure	-	Data type	Int32
	Accessibility	RW	Map or not	-	Related mode	-	Data range	0~4	Factory setting	0

No. P57.09	Name	VFbk3LP cutoff frequency			Effective setting	-	Data structure	-	Data type	Int32
	Accessibility	RW	Map or not	-	Related mode	-	Data range	200~ 5000	Factory setting	2500

No. P57.10	Name	VFbk3BS notch frequency			Effective setting	-	Data structure	-	Data type	Int32
	Accessibility	RW	Map or not	-	Related mode	-	Data range	3~ 5000	Factory setting	100

No. P57.11	Name	VFbk3BS notch depth			Effective setting	-	Data structure	-	Data type	Int32
	Accessibility	RW	Map or not	-	Related mode	-	Data range	3~ 50	Factory setting	5

No. P57.12	Name	VFbk4 filter type			Effective setting	-	Data structure	-	Data type	Int32
	Accessibility	RW	Map or not	-	Related mode	-	Data range	0~4	Factory setting	0

No. P57.13	Name	VFbk4LP cutoff frequency			Effective setting	-	Data structure	-	Data type	Int32
	Accessibility	RW	Map or not	-	Related mode	-	Data range	200~ 5000	Factory setting	2500

No. P57.14	Name	VFbk4BS notch frequency			Effective setting	-	Data structure	-	Data type	Int32
	Accessibility	RW	Map or not	-	Related mode	-	Data range	3~ 5000	Factory setting	100

No. P57.15	Name	VFbk4BS notch depth			Effective setting	-	Data structure	-	Data type	Int32
	Accessibility	RW	Map or not	-	Related mode	-	Data range	3~ 50	Factory setting	5

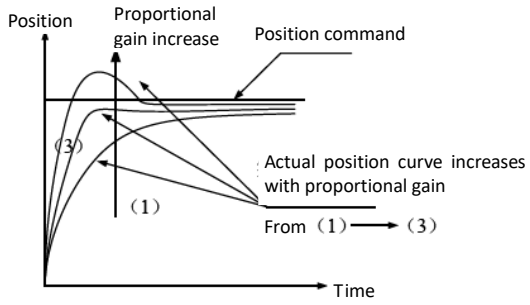
7.2.22 P58 Group Parameters

No. P58.00	Name	APR Kp			Effective setting	-	Data structure	-	Data type	Int32
	Accessibility	RW	Map or not	-	Related mode	-	Data range	0.0 ~ 1000.0	Factory setting	150.0

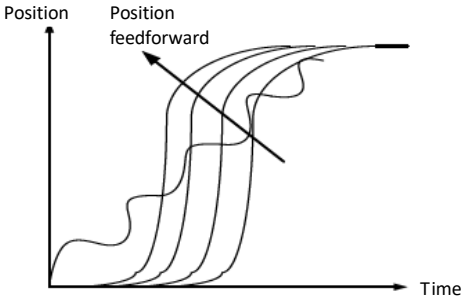
P58.00 and P58.01 parameters mainly adjust the proportional gain and feedforward gain of the position regulator.

Proportional gain Kp:

When the position control gain value increases, the position response can be improved and the position control error amount can be reduced. However, if the setting is too large, vibration and noise may easily occur. The effect of proportional gain is shown in the figure:



Feedforward gain Kpre:
In position control mode, the increase of feedforward value can improve the position following error. Decreasing the feed-forward value can reduce the operating vibration of the mechanism.
When the proportional gain is too large, the rotor of the motor will oscillate and the proportional gain will be reduced until the rotor of the motor no longer oscillates. When the external torque increases, an excessively low proportional gain cannot satisfy a reasonable position tracking error requirement. At this time, the feedforward gain can effectively reduce the position tracking error. The role of feedforward gain is shown in the figure:

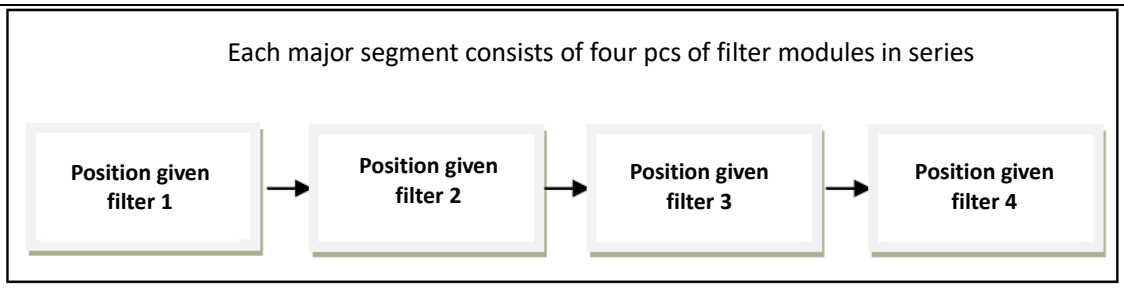


No. P58.01	Name	APR Kpre			Effective setting	-	Data structure	-	Data type	Int32
	Accessibility	RW	Map or not	-	Related mode	-	Data range	0.0 ~ 1000.0	Factory setting	50.0
Set the value of APR Kpre										

No. P58.02	Name	Position tracking error threshold			Effective setting	-	Data structure	-	Data type	Int32
	Accessibility	RW	Map or not	-	Related mode	-	Data range	0 ~ 2097152	Factory setting	10000
This parameter sets the position tracking error threshold in the position control loop. The basic value is the encoder single-turn resolution. When the difference between the position reference and the position feedback reaches or exceeds the threshold (for example, runaway, a motor shaft is stuck), the servo driver will stop and report the fault.										

7.2.23 P59 Group Parameters

No. P59.00	Name	PRef1 filter type			Effective setting	-	Data structure	-	Data type	Int32
	Accessibility	RW	Map or not	-	Related mode	-	Data range	0~4	Factory setting	0
P59 group position filter control parameters The parameters of the entire 59 groups are all reserved, users do not need to set; The servo now has no position loop filtering function, and the parameter description of this group is only reserved. To enable the position loop for some filter function, first set the filter enable (P10.04) to 1; if P10.04 is 0, even if the relevant filter of the P59 group position loop is configured, the servo will not will respond. The position loop of the servo system has a total of two major segments of configuring the filter function, namely the position given filtering and the position feedback filtering, and the functions of the filters are consistent. The position reference corresponds to the 16 parameters P59.00 to P59.15. The prefix PRef represents the position reference. The position feedback corresponds to the 16 parameters from P59.16 to P59.31. The prefix PFbk represents the position feedback. The two major segments of the position loop are equipped with filters. Each of the major segments is composed of four separate filter modules connected in series. Taking the position reference as an example, the position given segment consists of filter module 1, 2, 3 and 4 connected in series ,as shown in the figure.										



Each filter module has four control parameters, which are described by the position given filter 1 (the position given filters 2, 3, 4 and position feedback filters 1, 2, 3, 4 will not be further described):
PRef1 represents the position given filter module 1, this parameter is used to select the type of position given filter module 1, the meaning of the parameters is as follows:
0: This module does not have a filter
1: The module is configured as a first-order low-pass filter
2: The module is configured as a second-order low-pass filter
3: The module is configured as a third-order low-pass filter
4: This module is configured as a notch filter

No. P59.01	Name	PRef1LP cutoff frequency			Effective setting	-	Data structure	-	Data type	Int32
	Accessibility	RW	Map or not	-	Related mode	-	Data range	200~ 5000	Factory setting	1500

PRef1 represents the position given filter module 1 and LP represents the low pass. This parameter is used to set the low pass cutoff frequency of the position given filter module 1 (when the PRef1 filter type is selected as 1 or 2 or 3). The parameter is meaningful only when the PRef1 filter type is 0 or 4. The value of this parameter has no meaning.)
The low-pass filter is used to filter out high-frequency clutter. When the frequency of the input signal is higher than the low-pass cutoff frequency, the amplitude of the signal output by the filter will be greatly attenuated; For a fixed frequency input signal, the lower the cutoff frequency of the filter, the greater the phase delay to the signal. The default position loop filter low pass cutoff frequency is 1500Hz.

No. P59.02	Name	PRef1BS notch frequency			Effective setting	-	Data structure	-	Data type	Int32
	Accessibility	RW	Map or not	-	Related mode	-	Data range	3~ 5000	Factory setting	100

PRef1 represents the position given filter module 1, BS represents the notch (Band Stop), and the PRef1BS notch frequency is used to set the notch center frequency of the given filter module 1 in the position.
The PRef1BS notch depth is used to set the notch depth of the given filter block 1 (when the PRef1 filter type is selected as 4, these two parameters only make sense; when the PRef1 filter type is selected as 0, 1, 2 , 3, the value of these two parameters does not make sense). Notch filters, also known as band-stop filters, are filters that pass most of the frequency components but attenuate some range of frequency components to very low levels; The notch filter has a very strong attenuation effect on the signal near the center frequency, and has almost no influence on the signal far from the center frequency; the larger the notch depth, the stronger the attenuation effect on the center frequency point. In general, the notch filter is enabled only after the motor is vibrating and the frequency of vibration is detected. For detailed configuration methods, please refer to the “Filter Instruction Document”.

No. P59.03	Name	PRef1BS notch depth			Effective setting	-	Data structure	-	Data type	Int32
	Accessibility	RW	Map or not	-	Related mode	-	Data range	3~ 50	Factory setting	5

Set the value of PRef1BS notch depth

No. P59.04	Name	PRef2 filter type			Effective setting	-	Data structure	-	Data type	Int32
	Accessibility	RW	Map or not	-	Related mode	-	Data range	0~ 4	Factory setting	0

No. P59.05	Name	PRef2LP cutoff frequency			Effective setting	-	Data structure	-	Data type	Int32
	Accessibility	RW	Map or not	-	Related mode	-	Data range	200~ 5000	Factory setting	1500

No. P59.06	Name	PRef2BS notch frequency			Effective setting	-	Data structure	-	Data type	Int32
	Accessibility	RW	Map or not	-	Related mode	-	Data range	3~ 5000	Factory setting	100

No. P59.07	Name	PRef2BS notch depth			Effective setting	-	Data structure	-	Data type	Int32
	Accessibility	RW	Map or not	-	Related mode	-	Data range	3~ 50	Factory setting	5

No. P59.08	Name	PRef3 filter type			Effective setting	-	Data structure	-	Data type	Int32
	Accessibility	RW	Map or not	-	Related mode	-	Data range	0~ 4	Factory setting	0

No. P59.09	Name	PRef3LP cutoff frequency			Effective setting	-	Data structure	-	Data type	Int32
	Accessibility	RW	Map or not	-	Related mode	-	Data range	200~ 5000	Factory setting	1500

No. P59.10	Name	PRef3BS notch frequency			Effective setting	-	Data structure	-	Data type	Int32
	Accessibility	RW	Map or not	-	Related mode	-	Data range	3~ 5000	Factory setting	100

No. P59.11	Name	PRef3BS notch depth			Effective setting	-	Data structure	-	Data type	Int32
	Accessibility	RW	Map or not	-	Related mode	-	Data range	3~ 50	Factory setting	5

No. P59.12	Name	PRef4 filter type			Effective setting	-	Data structure	-	Data type	Int32
	Accessibility	RW	Map or not	-	Related mode	-	Data range	0~ 4	Factory setting	0

No. P59.13	Name	PRef4LP cutoff frequency			Effective setting	-	Data structure	-	Data type	Int32
	Accessibility	RW	Map or not	-	Related mode	-	Data range	200~ 5000	Factory setting	1500

No. P59.14	Name	PRef4BS notch frequency			Effective setting	-	Data structure	-	Data type	Int32
	Accessibility	RW	Map or not	-	Related mode	-	Data range	3~ 5000	Factory setting	100

No. P59.15	Name	PRef4BS notch depth			Effective setting	-	Data structure	-	Data type	Int32
	Accessibility	RW	Map or not	-	Related mode	-	Data range	3~ 50	Factory setting	5

No. P59.16	Name	PFbk1 filter type			Effective setting	-	Data structure	-	Data type	Int32
	Accessibility	RW	Map or not	-	Related mode	-	Data range	0~ 4	Factory setting	0

No. P59.17	Name	PFbk1LP cutoff frequency			Effective setting	-	Data structure	-	Data type	Int32
	Accessibility	RW	Map or not	-	Related mode	-	Data range	200~ 5000	Factory setting	1500

No. P59.18	Name	PFbk1BS notch frequency			Effective setting	-	Data structure	-	Data type	Int32
	Accessibility	RW	Map or not	-	Related mode	-	Data range	3~ 5000	Factory setting	100

No. P59.19	Name	PFbk1BS notch depth			Effective setting	-	Data structure	-	Data type	Int32
	Accessibility	RW	Map or not	-	Related mode	-	Data range	3~ 50	Factory setting	5

No. P59.20	Name	PFbk2filter type			Effective setting	-	Data structure	-	Data type	Int32
	Accessibility	RW	Map or not	-	Related mode	-	Data range	0~ 4	Factory setting	0

No. P59.21	Name	PFbk2LP cutoff frequency			Effective setting	-	Data structure	-	Data type	Int32
	Accessibility	RW	Map or not	-	Related mode	-	Data range	200~ 5000	Factory setting	1500

No. P59.22	Name	PFbk2BS notch frequency			Effective setting	-	Data structure	-	Data type	Int32
	Accessibility	RW	Map or not	-	Related mode	-	Data range	3~ 5000	Factory setting	100

No. P59.23	Name	PFbk2BS notch depth			Effective setting	-	Data structure	-	Data type	Int32
	Accessibility	RW	Map or not	-	Related mode	-	Data range	3~ 50	Factory setting	5

No. P59.24	Name	PFbk3filter type			Effective setting	-	Data structure	-	Data type	Int32
	Accessibility	RW	Map or not	-	Related mode	-	Data range	0~ 4	Factory setting	0

No. P59.25	Name	PFbk3LP cutoff frequency			Effective setting	-	Data structure	-	Data type	Int32
	Accessibility	RW	Map or not	-	Related mode	-	Data range	200~ 5000	Factory setting	1500

No. P59.26	Name	PFbk3BS notch frequency			Effective setting	-	Data structure	-	Data type	Int32
	Accessibility	RW	Map or not	-	Related mode	-	Data range	3~ 5000	Factory setting	100

No. P59.27	Name	PFbk3BS notch depth			Effective setting	-	Data structure	-	Data type	Int32
	Accessibility	RW	Map or not	-	Related mode	-	Data range	3~ 50	Factory setting	5

No. P59.28	Name	PFbk4filter type			Effective setting	-	Data structure	-	Data type	Int32
	Accessibility	RW	Map or not	-	Related mode	-	Data range	0~ 4	Factory setting	0

No. P59.29	Name	PFbk4LP cutoff frequency			Effective setting	-	Data structure	-	Data type	Int32
	Accessibility	RW	Map or not	-	Related mode	-	Data range	200~ 5000	Factory setting	1500

No. P59.30	Name	PFbk4BS notch frequency			Effective setting	-	Data structure	-	Data type	Int32
	Accessibility	RW	Map or not	-	Related mode	-	Data range	3~ 5000	Factory setting	100

No. P59.31	Name	PFbk4BS notch depth			Effective setting	-	Data structure	-	Data type	Int32
	Accessibility	RW	Map or not	-	Related mode	-	Data range	3~ 50	Factory setting	5

7.2.24 P90 Group Parameters

No. P90.00	Name	Servo rated power			Effective setting	-	Data structure	-	Data type	Int32
	Accessibility	RW	Map or not	-	Related mode	-	Data range	0~200.00	Factory setting	Based model No.
This parameter mainly displays the fixed parameters of the servo and is generally set by the manufacturer. Users do not need to set.										

No. P90.01	Name	Servo rated current			Effective setting	-	Data structure	-	Data type	Int32
	Accessibility	RW	Map or not	-	Related mode	-	Data range	0~500.00	Factory setting	Based model No.
This parameter mainly displays the fixed parameters of the servo and is generally set by the manufacturer. Users do not need to set.										

No. P90.02	Name	Servo rated voltage			Effective setting	-	Data structure	-	Data type	Int32
	Accessibility	RW	Map or not	-	Related mode	-	Data range	0~1000	Factory setting	Based model No.
This parameter mainly displays the fixed parameters of the servo and is generally set by the manufacturer. Users do not need to set.										

No. P90.03	Name	Max sampling current			Effective setting	-	Data structure	-	Data type	Int32
	Accessibility	RW	Map or not	-	Related mode	-	Data range	0~2000.0	Factory setting	Based model No.
This parameter mainly displays the fixed parameters of the servo and is generally set by the manufacturer. Users do not need to set.										

No. P90.04	Name	IGBT module rated current			Effective setting	-	Data structure	-	Data type	Int32
	Accessibility	RW	Map or not	-	Related mode	-	Data range	0~2000.0	Factory setting	Based model No.
This parameter mainly displays the fixed parameters of the servo and is generally set by the manufacturer. Users do not need to set.										

No. P90.05	Name	3 phase current balance coefficient			Effective setting	-	Data structure	-	Data type	Int32
	Accessibility	RW	Map or not	-	Related mode	-	Data range	0~200.0	Factory setting	1.000
This parameter mainly displays the fixed parameters of the servo and is generally set by the manufacturer. Users do not need to set.										

No. P90.06	Name	Servo power code			Effective setting	-	Data structure	-	Data type	Int32
	Accessibility	RW	Map or not	-	Related mode	-	Data range	0~200.0	Factory setting	Based model No.
This parameter mainly displays the fixed parameters of the servo and is generally set by the manufacturer. Users do not need to set.										

No. P90.07	Name	Software version No.			Effective setting	-	Data structure	-	Data type	Int32
	Accessibility	RW	Map or not	-	Related mode	-	Data range	0~200.0	Factory setting	Based model No.
This parameter mainly displays the fixed parameters of the servo and is generally set by the manufacturer. Users do not need to set.										

No. P90.08	Name	Hardware version No.			Effective setting	-	Data structure	-	Data type	Int32
	Accessibility	RW	Map or not	-	Related mode	-	Data range	0~200.0	Factory setting	Based model No.
This parameter mainly displays the fixed parameters of the servo and is generally set by the manufacturer. Users do not need to set.										

No. P99.00	Name	Debugging parameters			Effective setting	-	Data structure	-	Data type	Int32
	Accessibility	RW	Map or not	-	Related mode	-	Data range	0~65535	Factory setting	0
This parameter is set and debugged by the manufacturer. Users do not need to set.										

No. P99.01	Name	Debugging parameters			Effective setting	-	Data structure	-	Data type	Int32
	Accessibility	RW	Map or not	-	Related mode	-	Data range	0~65535	Factory setting	0
This parameter is set and debugged by the manufacturer. Users do not need to set.										

7.3 Detailed Description of EtherCAT Communication Parameters

1600h	Name	RxPDO1 mapping object			Effective setting	-	Data structure	ARR	Data type	-
	Accessibility	RW	Map or not	-	Related mode	-	Data Width	-	Factory setting	-
Indicates the mapping of RxPDO; the object value is changed only under PreOP; when the sub-index 00h is not 0, the change is invalid										

Subindex 00h	Name	Sets the number of RxPDO objects for this image object			Effective setting	-	Data structure	ARR	Data type	Uint8
	Accessibility	RW	Map or not	NO	Related mode	ALL	Data Width	0~32	Factory setting	3

Subindex 01h	Name	The first mapping object			Effective setting	-	Data structure	ARR	Data type	Uint32
	Accessibility	-	Map or not	NO	Related mode	ALL	Data Width	-	Factory setting	60400010h
Subindex 02h	Name	The second mapping object			Effective setting	-	Data structure	ARR	Data type	Uint32
	Accessibility	-	Map or not	NO	Related mode	ALL	Data Width	-	Factory setting	60600010h
Subindex 03h	Name	The third mapping object			Effective setting	-	Data structure	ARR	Data type	Uint32
	Accessibility	-	Map or not	NO	Related mode	ALL	Data Width	-	Factory setting	607A0020h

Subindex 04~20h	Name	Set No.4~32 mapping object			Effective setting	-	Data structure	ARR	Data type	Uint32
	Accessibility	-	Map or not	NO	Related mode	ALL	Data Width	-	Factory setting	-
Not yet set										

Index 1601h	Name	RxPDO2 mapping object			Effective setting	-	Data structure	-	Data type	-
	Accessibility	-	Map or not	-	Related mode	-	Data Width	-	Factory setting	-
The definition is the same as 1600h										

Index 1602h	Name	RxPDO3 mapping object			Effective setting	-	Data structure	-	Data type	-
	Accessibility	-	Map or not	-	Related mode	-	Data Width	-	Factory setting	-
The definition is the same as 1600h										

Index 1603h	Name	RxPDO4 mapping object			Effective setting	-	Data structure	-	Data type	-
	Accessibility	-	Map or not	-	Related mode	-	Data Width	-	Factory setting	-
The definition is the same as 1600h										

Index 1A00h	Name	TxPDO1 mapping object			Effective setting	-	Data structure	-	Data type	-
	Accessibility	-	Map or not	-	Related mode	-	Data Width	-	Factory setting	-
Indicates the mapping of RxPDO; the object value is changed only under PreOP; when the sub-index 00h is not 0, the change is invalid										

SubIndex 00h	Name	Sets the number of TxPDO objects for this image object			Effective setting	-	Data structure	VAR	Data type	Uint8
	Accessibility	RW	Map or not	NO	Related mode	ALL	Data Width	0~32	Factory setting	3

SubIndex 01h	Name	The first mapping object			Effective setting	-	Data structure	VAR	Data type	Uint32
	Accessibility	-	Map or not	NO	Related mode	ALL	Data Width	-	Factory setting	60410010h

SubIndex 02h	Name	The second mapping object			Effective setting	-	Data structure	VAR	Data type	Uint32
	Accessibility	-	Map or not	NO	Related mode	ALL	Data Width	-	Factory setting	60610010h

SubIndex 03h	Name	The third mapping object			Effective setting	-	Data structure	VAR	Data type	Uint32
	Accessibility	-	Map or not	NO	Related mode	ALL	Data Width	-	Factory setting	60640020h-

Subindex 04~20h	Name	Set No.4~32 mapping object			Effective setting	-	Data structure	ARR	Data type	Uint32
	Accessibility	-	Map or not	NO	Related mode	ALL	Data Width	-	Factory setting	-
Not yet set										

Index 1A01h	Name	TxPDO2 mapping object			Effective setting	-	Data structure	-	Data type	-
	Accessibility	-	Map or not	-	Related mode	-	Data Width	-	Factory setting	-
The definition is the same to 1A00h.										

Index 1A02h	Name	TxPDO3 mapping object			Effective setting	-	Data structure	-	Data type	-
	Accessibility	-	Map or not	-	Related mode	-	Data Width	-	Factory setting	-
The definition is the same to 1A00h.										

Index 1A03h	Name	TxPDO4 mapping object			Effective setting	-	Data structure	-	Data type	-
	Accessibility	-	Map or not	-	Related mode	-	Data Width	-	Factory setting	-
The definition is the same to 1A00h.										

Index 1C12h	Name	SM2 RxPDO object			Effective setting	-	Data structure	-	Data type	-
	Accessibility	-	Map or not	-	Related mode	-	Data Width	-	Factory setting	-
Set Sync Manager 2 upper PDO mapping object entry; SM2 is used as RxPDO; The value change is valid only when the ESM is PreOP; Subindex 00h is not 0, 01h~04h change does not execute.										

SubIndex 00h	Name	Indicates the number of objects allocated to this object			Effective setting	-	Data structure	VAR	Data type	Uint8
	Accessibility	RW	Map or not	NO	Related mode	ALL	Data Width	0~4	Factory setting	1

SubIndex 01h	Name	Specifies the RxPDO map object to use			Effective setting	-	Data structure	VAR	Data type	Uint16
	Accessibility	RW	Map or not	NO	Related mode	ALL	Data Width	1600h - 1603h	Factory setting	1600h

SubIndex 02h	Name	Specifies the RxPDO map object to use			Effective setting	-	Data structure	VAR	Data type	Uint16
	Accessibility	RW	Map or not	NO	Related mode	ALL	Data Width	1600h - 1603h	Factory setting	

SubIndex 03h	Name	Specifies the RxPDO map object to use			Effective setting	-	Data structure	VAR	Data type	Uint16
	Accessibility	RW	Map or not	NO	Related mode	ALL	Data Width	1600h - 1603h	Factory setting	

SubIndex 04h	Name	Specifies the RxPDO map object to use			Effective setting	-	Data structure	VAR	Data type	Uint16
	Accessibility	RW	Map or not	NO	Related mode	ALL	Data Width	1600h - 1603h	Factory setting	

Index 1C13h	Name	SM3 TxPDO object			Effective setting	-	Data structure	-	Data type	-
	Accessibility	-	Map or not	-	Related mode	-	Data Width	-	Factory setting	-
Set Sync Manager 3 upper PDO mapping object entry; SM3 is used as TxPDO; The value change is valid only when the ESM is PreOP; Subindex 00h is not 0, 01h~04h change does not execute.										

SubIndex 00h	Name	Indicates the number of objects allocated to this object			Effective setting	-	Data structure	VAR	Data type	Uint8
	Accessibility	RW	Map or not	NO	Related mode	ALL	Data Width	0~4	Factory setting	1

SubIndex 01h	Name	Specifies the TxPDO map object to use			Effective setting	-	Data structure	VAR	Data type	Uint16
	Accessibility	RW	Map or not	NO	Related mode	ALL	Data Width	1A00h – 1A03h	Factory setting	1A00h

SubIndex 02h	Name	Specifies the TxPDO map object to use			Effective setting	-	Data structure	VAR	Data type	Uint16
	Accessibility	RW	Map or not	NO	Related mode	ALL	Data Width	1A00h – 1A03h	Factory setting	

SubIndex 03h	Name	Specifies the TxPDO map object to use			Effective setting	-	Data structure	VAR	Data type	Uint16
	Accessibility	RW	Map or not	NO	Related mode	ALL	Data Width	1A00h – 1A03h	Factory setting	

SubIndex 04h	Name	Specifies the TxPDO map object to use			Effective setting	-	Data structure	VAR	Data type	Uint16
	Accessibility	RW	Map or not	NO	Related mode	ALL	Data Width	1A00h – 1A03h	Factory setting	

7.4 Custom Protocol Object Dictionary Detailed Description

Index 5000h	Name	Analogue Input			Effective setting	-	Data structure	VAR	Data type	-
	Accessibility	-	Map or not	YES	Related mode	-	Data range	-	Factory setting	-

Note: The IO signal is mapped on the bus. The cooperation of specific values is related to the parameter Ai0 (P32.00) and parameter Ai1 (P32.06) setting. The specific relationship is as follows:

AI0 (P32.00)	Object dictionary	AI1(P32.06)	Object dictionary
Bus analog input 1	Sub-index01	Bus analog input 1	Sub-index01
Bus analog input 2	Sub-index02	Bus analog input 2	Sub-index02

Sub index 0	Name	Number of AI Sub-index			Effective setting	-	Data structure	VAR	Data type	int16
	Accessibility	-	Map or not	YES	Related mode	-	Data range	16	Factory setting	16

Sub index 1h	Name	Analog input 1 - AI1			Effective setting	-	Data structure	VAR	Data type	int16
	Accessibility	RO	Map or not	TPDO	Related mode	ALL	Data range	-	Factory setting	0

Sub index 2h	Name	Analog input 2 – AI2			Effective setting	-	Data structure	VAR	Data type	int16
	Accessibility	RO	Map or not	TPDO	Related mode	ALL	Data range	-	Factory setting	0

Index 5008h	Name	AccDecExpand			Effective setting	-	Data structure	VAR	Data type	-
	Accessibility	-	Map or not	YES	Related mode	-	Data range	-	Factory setting	-
Note: Set the highest 32 bits of different acceleration and deceleration. See the sub index for details.										

Sub index 0	Name	Number of Acc Dec Expand Sub-index			Effective setting	-	Data structure	VAR	Data type	int16
	Accessibility	-	Map or not	YES	Related mode	ALL	Data range	6	Factory setting	6

Sub index 1h	Name	High 32-bit of Max-Acc			Effective setting	-	Data structure	VAR	Data type	Uint 32
	Accessibility	RW	Map or not	RPDO	Related mode	ALL	Data range	-	Factory setting	0
Sub index 2h	Name	High 32-bit of Max-Dec			Effective setting	-	Data structure	VAR	Data type	Uint 32
	Accessibility	RW	Map or not	RPDO	Related mode	ALL	Data range	-	Factory setting	0

Sub index 3h	Name	High 32-bit of Profile-Acc			Effective setting	-	Data structure	VAR	Data type	Uint 32
	Accessibility	RW	Map or not	RPDO	Related mode	ALL	Data range	-	Factory setting	0

Sub index 4h	Name	High 32-bit of Profile-Dec			Effective setting	-	Data structure	VAR	Data type	Uint 32
	Accessibility	RW	Map or not	RPDO	Related mode	ALL	Data range	-	Factory setting	0

Sub index 5h	Name	High 32-bit of Emergency stop-Dec			Effective setting	-	Data structure	VAR	Data type	Uint 32
	Accessibility	RW	Map or not	RPDO	Related mode	ALL	Data range	-	Factory setting	0

Sub index 6h	Name	High 32-bit of homing Acc			Effective setting	-	Data structure	VAR	Data type	Uint 32
	Accessibility	RW	Map or not	RPDO	Related mode	ALL	Data range	-	Factory setting	0

Index 5009h	Name	Home encoder position			Effective setting	-	Data structure	VAR	Data type	-
	Accessibility	-	Map or not	YES	Related mode	-	Data range	-	Factory setting	-
Note: Detailed information on the position of the servo motor encoder is displayed, including: current single turn value of the encoder, current multi-turn value, zero-turn single-turn value, zero-point multi-turn value										

Sub-Index 0	Name	Number of home encoder position Sub-index			Effective setting	-	Data structure	VAR	Data type	int16
	Accessibility	-	Map or not	YES	Related mode	ALL	Data range	4	Factory setting	4

Sub-Index 1h	Name	Current single-turn value			Effective setting	-	Data structure	VAR	Data type	Uint 32
	Accessibility	RW	Map or not	RPDO	Related mode	ALL	Data range	Command unit	Factory setting	0

Sub-Index 2h	Name	Current multi-turn value			Effective setting	-	Data structure	VAR	Data type	Uint 32
	Accessibility	RW	Map or not	RPDO	Related mode	ALL	Data range	-	Factory setting	0

Sub-Index 3h	Name	Single-turn value of home			Effective setting	-	Data structure	VAR	Data type	Uint 32
	Accessibility	RW	Map or not	RPDO	Related mode	ALL	Data range	Command unit	Factory setting	0

Sub-Index 4h	Name	Multi-turn value of home			Effective setting	-	Data structure	VAR	Data type	Uint 32
	Accessibility	RW	Map or not	RPDO	Related mode	ALL	Data range	-	Factory setting	0

Index 6040h	Name	Control word			Effective setting	Operation settings Shutdown takes effect	Data structure	VAR	Data type	Uint 16
	Accessibility	RW	Map or not	RPDO	Related mode	ALL	Data range	0~65535	Factory setting	00

Set the polarity of the position command, speed command, and torque command.

Bit	Name	Description
0	Servo ready	1- valid, 0 is invalid
1	Switch on the main circuit	1- valid, 0 is invalid
2	Emergency stop	1- valid, 0 is invalid
3	Servo enable	1- valid, 0 is invalid
4	New location point	1- valid, 0 is invalid
5	New location takes effect immediately	1- valid, 0 is invalid
6	Relative/absolute	1-relative value, 0-absolute value
7	Fault reset	For resettable faults and warnings, the bit 7 rising edge of the fault reset function is active;
8	Halt	The pause mode in each mode is based on object dictionary 605Dh
9	Change according to location	1- valid, 0 is invalid
10	Reserved	Reserved
11-15	Factory custom	Reserved, undefined

Bit4, 5, 9 are defined as follows：

Bit9	Bit5	Bit4	Definition
0	0	0->1	Run the current set point's positioning, then start the new setting point's positioning
*	1	0->1	Immediately locate the new setpoint
1	0	0->1	Run the current set point's position at this speed, then stahe new set point's position

Bit6、8 are defined as follows：

Bit	Value	Definition
6	0	607Ah Target positon is an absolute positioning value
	1	607Ah Target positon **is** an absolute positioning value
8	0	is an absolute positioning value
	1	The axis will stop axis operation as per 605Dh (Halt option code)

Index 6041h	Name	Status word			Effective setting	-	Data structure	VAR	Data type	Uint 16
	Accessibility	RO	Map or not	TPDO	Related mode	ALL	Data range	0~FFFF	Factory setting	00

Status Word definiation as below：

Bit	Name
0	Ready to switch on
1	Switched on
2	Operation enabled
3	Fault
4	Voltage enabled
5	Quick stop
6	Switch on disabled
7	Warning
8	Manufacturer specific
9	Remote
10	Target reached
11	Internal limit active
12-13	Operation mopecific
14-15	Manufacturer specific

Bits 0~3 and bits 5 and 6 represent the state of the drive's state machine:

Set value (binary)	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	Switched 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

Note：

1) Each bit of the status word is meaningless. It must be composed together with other bits to feedback the current status of the servo.
2) Bit0~bit9 have the same meaning in each servo mode. After the control word 6040h sends commands in sequence, the servo feedbacks a certain state.
3) Bit12~bit13 related to each servo mode (check the control command in different modes)
4) bit10 bit11 bit15 has the same meaning in each servo mode and the feedback servo performs a servo mode.

Index 605Ah	Name	Quick stop option code			Effective setting	Operation settings Shutdown takes effect	Data structure	VAR	Data type	Int16
	Accessibility	RW	Map or not	NO	Related mode	ALL	Data range	0~7	Factory setting	2

The settings are as follows：

Set value	Definition
0	Turn off the servo unit output, motor free stop
1	After the motor stops with the deceleration slope, it then jumps to the Switch on disabled state.
2	The motor stops with the fast stop slope and then jumps to the Switch osabled state
3	After the motor stops with the maximum current, jump to Switch on disableSwitch on disable (speed loop control, given command is 0)
4	Undefined
5	After the motor stops with the deceleration slope, still remain in the state QuickStop
6	After the motor stops with quick stop slope, still remain in the state QuickStop
7	The motor stops with the maximum current, jump to the Quick Stop state

Note: When the state machine jumps from the Operation Enable to the Quick reaction active state, use 605Ah (Quick stop option code) to select the stop mode.

Index 605Bh	Name	Shut down option code			Effective setting	Operation settings Shutdown takes effect	Data structure	VAR	Data type	Int16
	Accessibility	RW	Map or not	NO	Related mode	ALL	Data range	0~1	Factory setting	1

The settings are as follows:

Setting value	Definition
0	Turn off the servo unit output, motor free stop
1	After the motor stops with the deceleration slope, turn off the output of the servo unit

Note: When the OPERATION ENABLE jumps to the READY TO SWITCH ON state, the servo unit stops according to this object dictionary.

Index 605Ch	Name	Disable operation option code			Effective setting	Operation settings Shutdown takes effect	Data structure	VAR	Data type	Int16
	Accessibility	RW	Map or not	NO	Related mode	ALL	Data range	0~1	Factory setting	1

The settings are as follows:

Setting value	Definition
0	Turn off the servo unit output, motor free stop
1	After the motor stops with the deceleration slope, turn off the output of the servo unit

Note: When the state machine switches from Operation Enable to Switched On state, use 605Ch (Disable operation option code) to select the shutdown mode.

Index 605Dh	Name	Halt option code			Effective setting	Operation settings Shutdown takes effect	Data structure	VAR	Data type	Int16
	Accessibility	RW	Map or not	NO	Related mode	ALL	Data range	1~3	Factory setting	1

The settings are as follows:

Setting value	Definition
0	Turn off the servo unit output, motor free stop
1	After the motor stops with the deceleration ramp, it stays in the Operation Enable state.
2	After the motor stops with the fast stop slope, it stays in the Operation Enable state.
3	After the motor stops with the maximum current, it stays in the Operation Enable Operation Enable state (speed control, speed reference command is 0)

Note: When bit 8 of ControlWord is set to 1, 605Dh (Halt option code) is used to select the shutdown mode.

Index 605Eh	Name	Fault reaction option code			Effective setting	Operation settings Shutdown takes effect	Data structure	VAR	Data type	Int16
	Accessibility	RW	Map or not	NO	Related mode	ALL	Data range	0~2	Factory setting	1

The settings are as follows:

Setting value	Definition
0	Turn off the servo unit output, motor free stop
1	The motor stops with the deceleration ramp
2	The motor stops with the fast stop slope
3	The motor stops with the maximum current, (speed control, speed reference command is 0)

Note: When an alarm occurs, before the system jumps to the Fault state machine, use the 605Eh (Fault reaction option code) to select the shutdown mode.

Index 6060h	Name	Modes of operation			Effective setting	-	Data structure	VAR	Data type	Int8
	Accessibility	RO	Map or not	TPDO	Related mode	ALL	Data range	0~10	Factory setting	00

Set the polarity of the position command, speed command, and torque command.

Setting value	Name	Description
0	No mode setting	Reserve
1	Profile position mode (pp)	Reference profile position mode (pp)
2	No mode setting	Reserve
3	Profile Speed Mode (pv)	Reference profile speed mode (pv)
4	Profile torque mode (pt)	Reference profile torque mode (pt)
5	No mode setting	Reserve
6	Return to zero mode (hm)	Reference origin regression model (hm)
7	Interpolation mode (ip)	Reference position interpolation mode (ip)
8	Cycle synchronization position mode (csp)	Reference cycle synchronization position mode (csp)
9	Cycle synchronous speed mode (csv)	Reference cycle synchronous speed mode (csv)
10	Cycle synchronous torque mode (cst)	Reference cycle synchronous torque mode (cst)

Index 6061h	Name	Modes of operation display			Effective setting	-	Data structure	VAR	Data type	Int8
	Accessibility	RW	Map or not	RPDO	Related mode	ALL	Data range	0~10	Factory setting	00

Set the polarity of the position command, speed command, and torque command.

Setting value	Name	Description

0	No mode setting	Reserve
1	Profile position mode (pp)	Reference profile position mode (pp)
2	No mode setting	Reserve
3	Profile Speed Mode (pv)	Reference profile speed mode (pv)
4	Profile torque mode (pt)	Reference profile torque mode (pt)
5	No mode setting	Reserve
6	Return to zero mode (hm)	Reference origin regression model (hm)
7	Interpolation mode (ip)	Reference position interpolation mode (ip)
8	Cycle synchronization position mode (csp)	Reference cycle synchronization position mode (csp)
9	Cycle synchronous speed mode (csv)	Reference cycle synchronous speed mode (csv)
10	Cycle synchronous torque mode (cst)	Reference cycle synchronous torque mode (cst)

Index 6062h	Name	Position command Position demand value			Effective setting	-	Data structure	VAR	Data type	Int32
	Accessibility	RO	Map or not	TPDO	Related mode	PP,HM.CSP,IP	Data range	Command unit	Factory setting	0
Note: This object dictionary provides the position command plan of user unit.										

Index 6063h	Name	Position feedback Position actual internal value			Effective setting	-	Data structure	VAR	Data type	Int32
	Accessibility	RO	Map or not	TPDO	Related mode	ALL	Data range	Encoder unit	Factory setting	0
Note: The object dictionary provides the encoding table is the actual position value measured by the internal encoder										

Index 6064h	Name	Position feedback Position actual value			Effective setting	-	Data structure	VAR	Data type	Int32
	Accessibility	RO	Map or not	TPDO	Related mode	ALL	Data range	Command unit	Factory setting	0
Note: The object dictionary provides the actual position value measured by the encoder and needs to convert the value of 6063 h into a user position list.										

Index 6065h	Name	Position deviation excessive threshold Following error window			Effective setting	-	Data structure	VAR	Data type	Uint 32
	Accessibility	RW	Map or not	RPDO	Related mode	PP,HM, CSP,IP	Data range	0~2^{32}-1 Command unit	Factory setting	0
Set the position deviation excessive threshold (command unit): When the position deviation (command unit) exceeds ±6065h, an excessive position error occurs. When 6065h is set to 0xFFFFFFFF, the servo does not monitor excessive position deviation. Please use this function with caution.										

Index 6066h	Name	Excessive position deviation alarm time Following error time out			Effective setting	-	Data structure	VAR	Data type	Uint 16
	Accessibility	RW	Map or not	RPDO	Related mode	PP,HM, CSP,IP	Data range	ms	Factory setting	0
Under the position control mode,the object dictionary provides the max continuously cumulative alarm time value when the following error exceeds 6065h threshold. (unit: ms)										

Index 6067h	Name	Position arrival threshold Position window			Effective setting	-	Data structure	VAR	Data type	Uint32
	Accessibility	RW	Map or not	RPDO	Related mode	PP,HM, CSP,IP	Data range	0~65535	Factory setting	50
Set the threshold of position arrival, command unit. When the position deviation is within ±6067h and the time reaches 6068h, the position is deemed to be reached. In position mode, if bit10 of the status word 6041 is set to 1 in position mode, this flag is significant when the servo enable is valid; otherwise, it is meaningless. If this value is set to 0xFFFF then the function is turned off.										

Index 6068h	Name	Position arrival time window Position window time			Effective setting	-	Data structure	VAR	Data type	Uint16
	Accessibility	RW	Map or not	RPDO	Related mode	PP,HM, CSP,IP	Data range	Unit:ms	Factory setting	4
Note: When the difference between the user position command 6062 and the user's actual position feedback 6064 is within ±6067 and the time reaches 6068, the position is deemed to have arrived.										

Index 6069h	Name	Motor speed Velocity sensor actual value			Effective setting	-	Data structure	VAR	Data type	Int32
	Accessibility	RO	Map or not	TPDO	Related mode	ALL	Data range	Inc/s	Factory setting	0
Note: The master can obtain the motor speed by reading the object dictionary, unit Inc/s.										

Index 606Bh	Name	Motor speed given Velocity demand value			Effective setting	-	Data structure	VAR	Data type	Int32
	Accessibility	RO	Map or not	TPDO	Related mode	PV,CSV	Data range	UU/s	Factory setting	0
Note: The current speed given value, the unit is user's speed unit, unit UU/s										

Index 606Ch	Name	Motor actual speed Velocity Actual Value			Effective setting	-	Data structure	VAR	Data type	Int32
	Accessibility	RO	Map or not	TPDO	Related mode	ALL	Data range	UU/s	Factory setting	0
Note: The current speed feedback value, the unit is user's speed unit, unit UU/s										

Index 606Dh	Name	Motor speed arrival threshold Velocity window			Effective setting	-	Data structure	VAR	Data type	Uint16
	Accessibility	RW	Map or not	RPDO	Related mode	PV,CSV	Data range	0~65535 UU/s	Factory setting	4369
Note: This value is the speed arrival threshold, which is consistent with the function defined by 6067h (position windows). This value is compared with the difference between 606Ch Velocity actual value and 60FFh Target velocity to judge whether the target speed is reached. If it arrives within the time defined by 606Eh Velocity window time, then StatusWord.bit10 (Target reached) is set to 1.										

Index 606Eh	Name	Motor speed arrival time window Velocity window			Effective setting	-	Data structure	VAR	Data type	Uint16
	Accessibility	RW	Map or not	RPDO	Related mode	PV,CSV	Data range	0~65535 ms	Factory setting	4
Note: This value is the speed arrival threshold, which is the same as 6068h (position windows time), and the unit is milliseconds, ie ms.										

Index 606Fh	Name	0 speed threshold Velocity threshold			Effective setting	-	Data structure	VAR	Data type	Uint16
	Accessibility	RW	Map or not	RPDO	Related mode	PV,CSV	Data range	0~65535 ms	Factory setting	4369
Note: This object dictionary defines a zero speed threshold, which refers to a range of speeds approaching zero speed to determine if the motor has stopped rotating. If the size of the 606Ch Velocity actual value is greater than the size of the 606Fh Velocity threshold within the time defined by 6070h Velocity threshold time, StatusWord.bit12 (Target reached) is set to 1.										

Index 6070h	Name	0 speed threshold judgement time Velocity threshold time			Effective setting	-	Data structure	VAR	Data type	Uint16
	Accessibility	RW	Map or not	RPDO	Related mode	PV,CSV	Data range	0~65535 ms	Factory setting	10
Note: This value is used to define the zero speed threshold judgment time in milliseconds, ie ms.										

Index 6071h	Name	Target torque			Effective setting	-	Data structure	VAR	Data type	Int16
	Accessibility	RW	Map or not	RPDO	Related mode	PT,CST	Data range	-32768~32767 (unit:0.1%)	Factory setting	0
Note: This object dictionary is used in the Torque Profile Mode to set the input value of the torque controller. This value is expressed in units of one thousandth of the rated torque.										

Index 6072h	Name	Max torque			Effective setting	-	Data structure	VAR	Data type	Uint16
	Accessibility	RW	Map or not	RPDO	Related mode	ALL	Data range	0~32767 (unit:0.1%)	Factory setting	3000
Note: Set the maximum allowable torque of the servo, if the value is greater than the maximum torque limited by the servo itself, The servo-limited maximum torque is output.										

Index 6074h	Name	Target torque Torque Demand Value			Effective setting	-	Data structure	VAR	Data type	Int16
	Accessibility	RO	Map or not	TPDO	Related mode	PT,CST	Data range	(unit:0.1%)	Factory setting	3000
Note: This object dictionary is used to display the output value of the trajectory generator. The unit of this value is 1‰ rated torque.										

Index 6075h	Name	Motor rated current			Effective setting	-	Data structure	VAR	Data type	Uint16
	Accessibility	RW	Map or not	RPDO	Related mode	ALL	Data range	(unit:mA)	Factory setting	0
Note: This object dictionary is used to indicate the rated current, and the relative values of all currents refer to this value. The value is in mA.										

Index 6076h	Name	Motor rated torque			Effective setting	-	Data structure	VAR	Data type	Uint32
	Accessibility	RW	Map or not	RPDO	Related mode	ALL	Data range	(unit: mN.m)	Factory setting	0
Note: This object dictionary is used to indicate the rated torque. The relative values of all torques refer to this value. The unit of this value is mNm.										

Index 6077h	Name	Torque feedback Torque actual value			Effective setting	-	Data structure	VAR	Data type	Int16
	Accessibility	RO	Map or not	TPDO	Related mode	ALL	Data range	(unit: .0.1%)	Factory setting	0
Note: This object dictionary is used to provide the actual torque value of the motor. The unit of this value is the rated torque of 1‰										

Index 6078h	Name	Feedback current Current actual value			Effective setting	-	Data structure	VAR	Data type	Int16
	Accessibility	RO	Map or not	TPDO	Related mode	ALL	Data range	(unit: .0.1%)	Factory setting	0
Note: This object dictionary is used to provide the actual current value of the motor. The unit of this value is the rated current of 1‰										

Index 6079h	Name	Bus voltage DC link circuit voltage			Effective setting	-	Data structure	VAR	Data type	Int16
	Accessibility	RO	Map or not	TPDO	Related mode	ALL	Data range	(unit: .mV)	Factory setting	0
Note: This object dictionary is used to provide the actual bus voltage of the servo bus in mV										

Index 607Ah	Name	Target position			Effective setting	-	Data structure	VAR	Data type	Int32
	Accessibility	RW	Map or not	RPDO	Related mode	PP,CSP,IP	Data range	command unit	Factory setting	0
Note: This object dictionary is used to provide the target position(unit: command unit).										

Index 607Bh	Name	Position range limit			Effective setting	-	Data structure	VAR	Data type	Int32
	Accessibility	-	Map or not	YES	Related mode	PP,CSP,IP	Data range	-	Factory setting	-
Set the minimum and maximum of the input position limit Minimum absolute position limit = (607B-1h) Maximum absolute position limit = (607B-2h) Set the maximum and minimum position of input position by 607B, If the input position value is greater than the maximum position, then the servo will use the input position and the maximum value to perform a remainder operation, first perform the remainder										

position as the issued position, and wait until the remainder position is completed and then use the maximum position as the issued position until positioning is complete.
Similarly, when the input position is less than the minimum position setting, the issued position is positioned with the same execution principle.

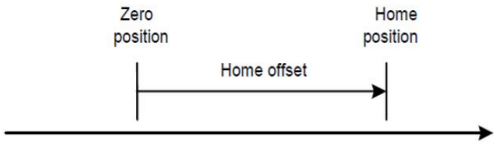
Sub-index 0	Name	Number of Position range limit Sub-index			Effective setting	-	Data structure	VAR	Data type	Uint16
	Accessibility	RO	Map or not	NO	Related mode	PP,CSP,IP	Data range	-	Factory setting	2

Sub-index 1h	Name	Min position limit			Effective setting	-	Data structure	VAR	Data type	Int32
	Accessibility	RW	Map or not	RPDO	Related mode	PP,CSP,IP	Data range	-2^{31}~(2^{31}-1) command unit	Factory setting	-5242880
Note: Set the minimum absolute position limit, the minimum absolute position limit = 607B-1h										

Sub-index 2h	Name	Max position limit			Effective setting	-	Data structure	VAR	Data type	Int32
	Accessibility	RW	Map or not	RPDO	Related mode	PP,CSP,IP	Data range	-2^{31}~(2^{31}-1) command unit	Factory setting	5242880
Note: Set the max absolute position limit, the max absolute position limit = 607B-2h										

Index 607Ch	Name	Zero point position bias Home offset			Effective setting	-	Data structure	VAR	Data type	Int32
	Accessibility	RW	Map or not	RPDO	Related mode	PP,CSP,IP	Data range	-	Factory setting	0

The object dictionary is used to set the position between the reference point and the home point as follows:



Index 607Dh	Name	Software position limit			Effective setting	-	Data structure	VAR	Data type	Int32
	Accessibility	-	Map or not	YES	Related mode	PP,CSP	Data range	-	Factory setting	-

Set the minimum and maximum value of software absolute position limits.
Minimum software absolute position limit = (607D-1h)
Maximum software absolute position limit = (607D-2h)
The software internal position overrun is used to judge the absolute position. When the issued position command passes the 607B limit, it is limited by the 607D setting range.
If the position command is within the limit of 607D, the servo will perform positioning according to the issued position command. If the position command is out of the limit of 607D, the servo will not respond to the position command and issue an alarm.

Sub-Index 0	Name	Number of software absolute position limit Sub-index			Effective setting	-	Data structure	VAR	Data type	Uint16
	Accessibility	RO	Map or not	NO	Related mode	PP,CSP	Data range	-	Factory setting	2

Sub-Index 2h	Name	Max software absolute position limit			Effective setting	-	Data structure	VAR	Data type	Int32
	Accessibility	RW	Map or not	RPDO	Related mode	PP,CSP	Data range	-2^{31}~(2^{31}-1) command unit	Factory setting	5242880
Note: Set the Max software absolute position limit, referring to the position relative to the mechanical zero point, the Max software absolute position limit= (607D-2h)										

Index 607Eh	Name	Polarity			Effective setting	-	Data structure	VAR	Data type	Uint8
	Accessibility	RW	Map or not	RPDO	Related mode	PP,CSP,PV,CSV	Data range	0,1	Factory setting	8

Note: This object dictionary is used to set whether the Position demand value is multiplied by 1 or -1.
Position Polarity is only used internally within the Profile position and cyclic sync position modes and has no effect on the zero return mode.
Velocity polarity is only used in profile velocity mode and cyclic sync velocity mode. The definition is as follows:

Bit	Name	Description
0~5	Undefined	Reserved
	Velocity polarity	Speed command polarity: 0: keep the existing value unchanged 1: Instruction * (-1) PV: Invert the target torque 6071h CSV: Invert the speed command (60FFh+60B1h)
7	Position Polarity	Speed command polarity: 0: keep the existing value unchanged 1: Instruction * (-1) PV: Invert the target torque 6071h CSV: Invert the speed command (60FFh+60B1h)

Index 607Fh	Name	Max profile velocity			Effective setting	-	Data structure	VAR	Data type	Uint32
	Accessibility	RW	Map or not	RPDO	Related mode	ALL	Data range	UU/s	Factory setting	6553600
Note: This object dictionary is used to set the maximum allowable movement speed in units of UU/s, ie user units per second. In the torque mode (CST, PT), the 607Fh value can be set in real time for speed limit in torque mode.										

Index 6080h	Name	Max motor velocity			Effective setting	-	Data structure	VAR	Data type	Uint32
	Accessibility	RW	Map or not	RPDO	Related mode	ALL	Data range	RPM	Factory setting	5000
Note: This object dictionary is used to configure the maximum operating speed of the motor, this value can be obtained from the motor nameplate parameters; the value of the unit of rotation per minute, that is rpm.										

Index 6081h	Name	Profile velocity			Effective setting	-	Data structure	VAR	Data type	Uint32
	Accessibility	RW	Map or not	RPDO	Related mode	PP	Data range	UU/s	Factory setting	2621440
Note: This object dictionary is used to set the maximum speed value that can be reached after the acceleration is completed. The unit is: UU/s, ie user unit per second.										

Index 6082h	Name	End profile velocity			Effective setting	-	Data structure	VAR	Data type	Uint32
	Accessibility	RW	Map or not	RPDO	Related mode	PP	Data range	UU/s	Factory setting	0
Note: This object dictionary is used to set the speed value after reaching the target position. After completing the target location planning, when the motor needs to be stopped, the value of this object dictionary is often set to 0. The unit is: UU/s, ie, units per second.										

Index 6083h	Name	profile acceleration			Effective setting	-	Data structure	VAR	Data type	Uint32
	Accessibility	RW	Map or not	RPDO	Related mode	PP	Data range	UU/S^2	Factory setting	1310720
Note: This object dictionary is used to set the acceleration value of the given position curve, the unit is UU/s^2 (User units per square second)										

Index 6084h	Name	profile deceleration			Effective setting	-	Data structure	VAR	Data type	Uint32
	Accessibility	RW	Map or not	RPDO	Related mode	PP	Data range	UU/S^2	Factory setting	1310720
Note: This object dictionary is used to set the deceleration value of the given position curve, the unit is UU/s^2 (User units per square second)										

Index 6085h	Name	quick stop deceleration			Effective setting	-	Data structure	VAR	Data type	Uint32
	Accessibility	RW	Map or not	RPDO	Related mode	PP,PV,CSP, CSV,IP,HM	Data range	UU/S^2	Factory setting	32768000
Note: This object dictionary is used to set the deceleration value for emergency stop.										

Index 6086h	Name	Motor operation curve type motion profile type			Effective setting	-	Data structure	VAR	Data type	Int16
	Accessibility	RW	Map or not	RPDO	Related mode	-	Data range	-	Factory setting	2

Note: This object dictionary is used to select the type of speed curve planning

Value	Definition
0	Linear Slope (trapezoidal planning)
2	Jerk-free slope
3	Jerk-limited slope

Supports 0, 2, and 3 types of planning in profile velocity mode.
Only 0 plan types are supported in profile position mode.

Index 6087h	Name	Torque Slope			Effective setting	-	Data structure	VAR	Data type	Uint32
	Accessibility	RW	Map or not	RPDO	Related mode	-	Data range	0.1%/s	Factory setting	10000
Note: To set the torque command acceleration in profile torque mode, this object dictionary is used to configure the torque change rate in units of one thousandth of the rated torque per second. Named Rated Torque / 1000 /S										

Index 6088h	Name	Torque profile type			Effective setting	-	Data structure	VAR	Data type	Int16
	Accessibility	RW	Map or not	RPDO	Related mode	-	Data range	-	Factory setting	0
Note: This object dictionary is used to set a given form of the torque curve. Servo drives only provide linear curve planning.										

Index 608Fh	Name	Position encoder resolution			Effective setting	-	Data structure	VAR	Data type	-
	Accessibility	-	Map or not	YES	Related mode	-	Data range	-	Factory setting	-

Note: This object dictionary is used to configure the number of pulses per revolution of the encoder. For example, if the servo motor uses a 17-bit resolution encoder, it corresponds to 131072 pulses per revolution. The calculation equation is as follows,

$$\text{Position encoder resolution} = \frac{\text{Encoder increments}}{\text{Motor revolutions}}$$

Sub-Index 0	Name	Number of Position encoder resolution Sub-index			Effective setting	-	Data structure	VAR	Data type	Int16
	Accessibility	RO	Map or not	YES	Related mode	ALL	Data range	-	Factory setting	2

Sub-Index 1h	Name	Encoder increments			Effective setting	-	Data structure	VAR	Data type	Uint32
	Accessibility	RW	Map or not	RPDO	Related mode	ALL	Data range	-	Factory setting	131072
Note: This object sets the incremental value of the encoder.										

Sub-Index 2h	Name	Motor revolutions			Effective setting	-	Data structure	VAR	Data type	Uint32
	Accessibility	RW	Map or not	RPDO	Related mode	ALL	Data range	-	Factory setting	1
Note: The number of motor revolutions corresponding to the encoder increment of the sub-index 1h is set in this object dictionary.										

Index 6090h	Name	Velocity encoder resolution			Effective setting	-	Data structure	VAR	Data type	-
	Accessibility	-	Map or not	YES	Related mode	-	Data range	-	Factory setting	-

Note: This object dictionary is used to configure the resolution of the speed encoder. Since the servo motor encoder can be used for testing, the object dictionary setting needs to be set to servo motor encoder resolution. The calculation equation is as follows,

$$\text{Velocity encoder resolution} = \frac{\text{Encoder increments per second}}{\text{Motor revolutions per second}}$$

Sub-Index 0	Name	Number of sub-indexes for speed encoder resolution			Effective setting	-	Data structure	VAR	Data type	Int16
	Accessibility	RO	Map or not	YES	Related mode	ALL	Data range	-	Factory setting	2

Sub-Index 1h	Name	Encoder increments/s			Effective setting	-	Data structure	VAR	Data type	Uint32
	Accessibility	RW	Map or not	RPDO	Related mode	ALL	Data range	-	Factory setting	131072
Note: This object sets the rotational speed of the motor speed in encoder units. The unit is Inc/s										

Sub-Index 2h	Name	Motor revolutions /s			Effective setting	-	Data structure	VAR	Data type	Uint32
	Accessibility	RW	Map or not	RPDO	Related mode	ALL	Data range	-	Factory setting	1
Note: This object dictionary sets the sub-index 1h -motor speed in revolutions per second										

Index 6091h	Name	Gear Ratio			Effective setting	-	Data structure	VAR	Data type	-
	Accessibility	-	Map or not	YES	Related mode	-	Data range	-	Factory setting	-

Note: This object dictionary is used to set the external gear ratio. The gear ratio is equal to the revolution of the motor shaft to the output driving shaft evolution of the gear. The formula is as follows:

$$\text{Gear ratio} = \frac{\text{Motor Shaft revolutions}}{\text{Driving Shaft revolutions}}$$

Relationship between motor position feedback (encoder unit) and load axis position feedback (command unit):
Motor position feedback = load axis position feedback × gear ratio (6091)

Sub-Index 0	Name	Number of gear ratio sub-indexes			Effective setting	-	Data structure	VAR	Data type	Int16
	Accessibility	RO	Map or not	YES	Related mode	ALL	Data range	-	Factory setting	2

Sub-Index 1h	Name	Motor shaft revolutions			Effective setting	-	Data structure	VAR	Data type	Uint32
	Accessibility	RW	Map or not	RPDO	Related mode	ALL	Data range	-	Factory setting	1
Note: This object sets the number of motor shaft revolutions										

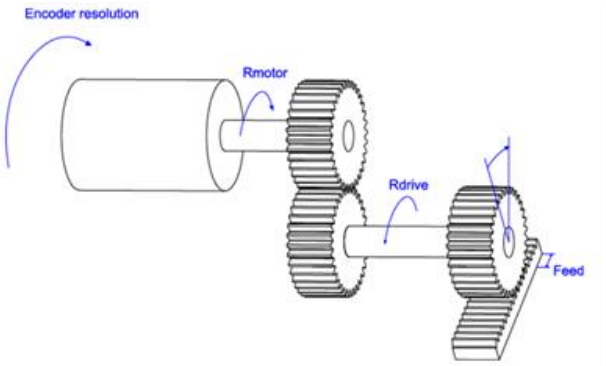
Sub-Index 2h	Name	Driving shaft revolutions			Effective setting	-	Data structure	VAR	Data type	Uint32
	Accessibility	RW	Map or not	RPDO	Related mode	ALL	Data range	-	Factory setting	1
Note: This object dictionary sets the number of revolutions of the drive shaft corresponding to the number of motor shaft revolutions in the sub-index 1h.										

Index 6092h	Name	Feed constant			Effective setting	-	Data structure	ARR	Data type	-
	Accessibility	-	Map or not	YES	Related mode	-	Data range	-	Factory setting	-

Note: This object dictionary is used to set the measurement length corresponding to one rotation of the drive shaft output by the gear box (this length is user unit). The formula is as follows:

$$\text{Feed constant} = \frac{\text{Feed}}{\text{Driving Shaft revolutions}}$$

According to the definition of 608Fh, 6090h, 6091h, 6092h, specific examples are as follows:



As shown in the above figure, assume Encoder resolution = 131072. When Rdriv = 1rpm, Rmotor = 5rpm and Feed = 1000 mm / r. From the above conditions, it can be seen that the distance of 1000 units on the ruler requires that the motor go 5*131072 pulses, that is, the motor rotates 5 circles. The set parameters can be calculated according to the following formula:

$$\text{Position encoder resolution} = \frac{\text{Encoder increments}}{\text{Motor revolutions}} = \frac{131072}{1} = 131072$$

$$\text{Velocity encoder resolution} = \frac{\text{Encoder increments per second}}{\text{Motor revolutions per second}} = \frac{131072}{1} = 131072$$

$$\text{Gear ratio} = \frac{\text{Motor Shaft revolutions}}{\text{Driving Shaft revolutions}} = \frac{5rpm}{1rpm} = 5$$

$$\text{Feed constant} = \frac{\text{Feed}}{\text{Driving Shaft revolutions}} = \frac{1000}{1} = 1000$$

From the above formula, the setting values of each object dictionary of the unit conversion unit can be obtained as follows:

Index	Sub-Index	Set value
68Fh (Position encoder resolution)	01h	131072
	02h	1
6090h (Velocity encoder resolution)	01h	131072
	02h	1
6091h (Gear ratio)	01h	5
	02h	1
6092h (Feed constant)	01h	1000
	02h	1

Sub-Index 0	Name	Number of feedback constant sub-indexes			Effective setting	-	Data structure	VAR	Data type	Int16
	Accessibility	RO	Map or not	YES	Related mode	ALL	Data range	-	Factory setting	2

Sub-Index 1h	Name	Gearbox output metering length			Effective setting	-	Data structure	VAR	Data type	Uint32
	Accessibility	RW	Map or not	RPDO	Related mode	ALL	Data range	-	Factory setting	131072
Note : Gearbox output metering length										

Sub-Index 2h	Name	Driving shaft revolutions			Effective setting	-	Data structure	VAR	Data type	Uint32
	Accessibility	RW	Map or not	RPDO	Related mode	ALL	Data range	-	Factory setting	1
Note: The number of drive shaft revolutions corresponding to the measurement length of the gear box output sub-index 1h is set in this object dictionary.										

Index 6098h	Name	Homing method			Effective setting	-	Data structure	VAR	Data type	Int8
	Accessibility	RW	Map or not	RPDO	Related mode	HM	Data range	-	Factory setting	35

Note: There are four kinds of signals required in the zero return mode, which are as follows:
Positive Limit Signal ----------Positive Limit Switch
Negative Limit Signal ----------Negative Limit Switch
Reference Point Signal ---------- Home Switch
Encoder index pulse ----------Index Pulse

Currently, there are 9 types of zero return modes supported by the servo driver:

1	Reverse back to zero, the deceleration point is the reverse limit switch, and the origin is the motor Z signal. Before the Z signal is met, the negative limit falling edge must be met.
2	Positive return to zero, the deceleration point is the positive limit switch, the origin is the Z signal of the motor, and the positive limit falling edge must be met before the Z signal is met.
3	Positive return to zero, the deceleration point is the origin switch, and the origin is the Z signal of the motor. Before encountering the Z signal, it must meet the falling edge of the same side of the origin switch.
4	Reverse return to zero, the deceleration point is the origin switch, and the origin is the motor Z signal. Before encountering the Z signal, it must meet the rising edge of the same side of the origin switch.
17	Similar to Method 1, but the deceleration point coincides with the far point
18	Similar to Method 2, but the deceleration point coincides with the far point
19	Similar to method 3, but the deceleration point coincides with the far point
20	Similar to Method 4, but the deceleration point coincides with the far point
35	Take the current position as the origin

Index 6099h	Name	Homing method			Effective setting	-	Data structure	ARR	Data type	Uint32
	Accessibility	-	Map or not	YES	Related mode	HM	Data range	-	Factory setting	-
Set the two speed values in zero return mode: 1, search for deceleration signal speed 2, search origin signal speed.										

Sub-Index 0	Name	Number of homing speed sub-indexes			Effective setting	-	Data structure	VAR	Data type	Uint16
	Accessibility	RO	Map or not	YES	Related mode	HM	Data range	2	Factory setting	2

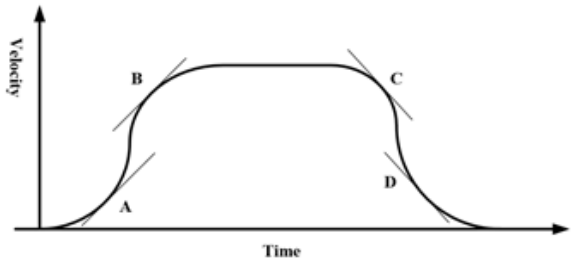
Sub-Index 1h	Name	Search for deceleration signal speed			Effective setting	-	Data structure	VAR	Data type	Int32
	Accessibility	RW	Map or not	RPDO	Related mode	HM	Data range	Command unit/s	Factory setting	1310720
Note: Set the search for deceleration point signal speed. This speed can be set to a higher value to prevent the zero return time from being too long. Note: After a slave drive finds the deceleration point, the deceleration operation will be performed. During the deceleration process, the change of the origin signal of the slave station will be shielded. In order to avoid the original point signal during the deceleration process, the switch position of the deceleration point signal should be reasonably set, leaving enough distance for deceleration, or increase the return to zero acceleration to shorten the deceleration time										

Index 609Ah	Name	Homing acceleration			Effective setting	-	Data structure	ARR	Data type	Uint32
	Accessibility	RW	Map or not	RPDO	Related mode	HM	Data range	Command unit/s^2	Factory setting	5000
Note: Set the acceleration in origin homing mode. After the origin homing starts, the set value takes effect. The meaning of this object dictionary is the position instruction (instruction unit) increments per second										

Index 60A3h	Name	Profile jerk use			Effective setting	-	Data structure	VAR	Data type	Uint8
	Accessibility	RW	Map or not	RPDO	Related mode	-	Data range	0~4	Factory setting	1
Note: This object dictionary setting is used for 60A4h Profile jerk usage patterns										

Index 60A4h	Name	Profile jerk time			Effective setting	-	Data structure	ARR	Data type	Uint32
	Accessibility	-	Map or not	YES	Related mode	-	Data range	-	Factory setting	-

Note: The setting of this object dictionary is used to set the type of curve plan. The unit is ms, which indicates the time (in ms) that Jerk accelerates from 0 to maximum acceleration.



60A3h Profile jerk use value	The illustrated part is the Jerk value of the selected 60A4h sub-index			
	A	B	C	D
1	sub-index 01h	sub-index 01h	sub-index 01	sub-index 01h
2	sub-index 01h	sub-index 01h	sub-index 02h	sub-index 02h
4	sub-index 01h	sub-index 03h	sub-index 02h	sub-index 04h

Sub-Index 0	Name	Number of profile jerk sub-index			Effective setting	-	Data structure	VAR	Data type	Uint16
	Accessibility	RO	Map or not	YES	Related mode	PV,CSV	Data range	6	Factory setting	6

Sub-Index 1h	Name	Profile jerk 1 time			Effective setting	-	Data structure	VAR	Data type	Int32
	Accessibility	RW	Map or not	RPDO	Related mode	PV,CSV	Data range	ms	Factory setting	500
Note: set profile jerk1 value.										

Sub-Index 2h	Name	Profile jerk 2 time			Effective setting	-	Data structure	VAR	Data type	Int32
	Accessibility	RW	Map or not	RPDO	Related mode	PV,CSV	Data range	ms	Factory setting	500
Note: set profile jerk2 value.										

Sub-Index 3h	Name	Profile jerk3 time			Effective setting	-	Data structure	VAR	Data type	Int32
	Accessibility	RW	Map or not	RPDO	Related mode	PV,CSV	Data range	ms	Factory setting	500
Note: set profile jerk3 value.										

Sub-Index 4h	Name	Profile jerk4 time			Effective setting	-	Data structure	VAR	Data type	Int32
	Accessibility	RW	Map or not	RPDO	Related mode	PV,CSV	Data range	ms	Factory setting	500
Note: set profile jerk4 value.										

Sub-Index 5h	Name	Profile jerk5 time			Effective setting	-	Data structure	VAR	Data type	Int32
	Accessibility	RW	Map or not	RPDO	Related mode	PV,CSV	Data range	ms	Factory setting	500
Note: set profile jerk5 value.										

Sub-Index 6h	Name	Profile jerk6 time			Effective setting	-	Data structure	VAR	Data type	Int32
	Accessibility	RW	Map or not	RPDO	Related mode	PV,CSV	Data range	ms	Factory setting	500
Note: set profile jerk6 value.										

Index 60B2h	Name	Torque bias(offset)			Effective setting	-	Data structure	VAR	Data type	Int32
	Accessibility	RW	Map or not	RPDO	Related mode	ALL	Data range	0.1%	Factory setting	0
Note: The object dictionary provides the torque bias (offset) value, which is the user unit of speed (Rated torque/1000). The object dictionary represents the torque feed forward control in the position cycle synchronous control mode.										

Index 60B8h	Name	Touch probe function			Effective setting	-	Data structure	VAR	Data type	Uint16
	Accessibility	RW	Map or not	RPDO	Related mode	-	Data range	0~65535	Factory setting	0

Note: This object dictionary sets the functions of probe 1 and probe 2:

Bit	Description	Scope
0	Probe 1 enabled	0-- Probe 1 Disabled 1-- Probe 1 Enabled
1	Probe 1 trigger mode	0-- Single trigger, triggered only when the trigger signal is valid for the first time 1-- Continuous trigger
2	Probe 1 trigger signal selection	0--DI8 input signal 1--Z signal
3	Undefined	Reserved
4	Probe 1 rising edge enabled	0--rising edge does not latch 1--rising latch
5	Probe 1's falling edge enabled	0--The falling edge is not latched 1-- The falling edge latch
6-7	Custom	Custom
8	Probe 2 enabled	0-- Probe 2 Disabled 1-- Probe 2 Enabled
9	Probe 2 trigger mode	0-- Single trigger, triggered only when the trigger signal is valid for the first time 1-- Continuous trigger
10	Probe 2 trigger signal selection	0--0DI9 input signal 1--Z signal
11	Undefined	Reserved
12	Probe 2 rising edge enabled	0--rising edge does not latch 1--rising edge latch

13	Probe 2 falling edge enable	0--The falling edge is not latched 1-- The falling edge latch
14-5	Custom	Custom

Index 60B9h	Name	Touch probe status			Effective setting	-	Data structure	VAR	Data type	Uint16
	Accessibility	RO	Map or not	TPDO	Related mode	-	Data range	0~65535	Factory setting	0

Note: This object dictionary sets the functions of probe 1 and probe 2:

Bit	Description
0	Probe 1 enabled: 0-- Probe 1 disabled 1-- Probe 1 Enabled
1	Probe 1 on rising edge latch execution 0-- Rising latch is not executed 1-- rising latch has been executed
2	Probe 1 falling edge latch execution 0-- Falling edge latch is not executed 1-- Falling latch has been executed
3-5	Reserved
6-7	User-defined probe 1
8	Probe 2 enable: 0-- Probe 2 dsiabled 1-- Probe 2 Enabled
9	Probe 2 on rising edge latch execution 0-- Rising edge latch is not executed 1-- Rising edge latch has been executed
10	Probe 2 falling edge latch execution 0-- Falling edge latch is not executed 1—Falling edge latch has been executed
11-13	Reserved
14-15	User-defined probe 2

Index 60BAh	Name	Probe 1 rising edge position feedback			Effective setting	-	Data structure	VAR	Data type	Int32
	Accessibility	RO	Map or not	TPDO	Related mode	-	Data range	Command unit	Factory setting	0

Note: The time of rising edge of probe 1 signal is displayed, position feedback (command unit).

Index 60BBh	Name	Probe 1 falling edge position feedback			Effective setting	-	Data structure	VAR	Data type	Int32
	Accessibility	RO	Map or not	TPDO	Related mode	-	Data range	Command unit	Factory setting	0

Note: The time of falling edge of probe 1 signal is displayed, position feedback (command unit).

Index 60BCh	Name	Probe 2 rising edge position feedback			Effective setting	-	Data structure	VAR	Data type	Int32
	Accessibility	RO	Map or not	TPDO	Related mode	-	Data range	Command unit	Factory setting	0
Note: The time of rising edge of probe 2 signal is displayed, position feedback (command unit).										

Index 60BDh	Name	Probe 2 falling edge position feedback			Effective setting	-	Data structure	VAR	Data type	Int32
	Accessibility	RO	Map or not	TPDO	Related mode	-	Data range	Command unit	Factory setting	0
Note: The time of falling edge of probe 2 signal is displayed, position feedback (command unit).										

Index 60C1h	Name	Position interpolation data record			Effective setting	-	Data structure	ARR	Data type	-
	Accessibility	-	Map or not	YES	Related mode	-	Data range	-	Factory setting	-
Note: This object dictionary provides position interpolation data sent by the master station. Linear interpolation uses only sub-index 01h data for interpolation; this drive supports linear interpolation mode.										

Sub-Index 0	Name	Number of interpolation data record Sub-index			Effective setting	-	Data structure	VAR	Data type	Uint16
	Accessibility	RO	Map or not	YES	Related mode	IP	Data range	10	Factory setting	10

Sub-Index 1h	Name	Interpolation data record 1			Effective setting	-	Data structure	VAR	Data type	Int32
	Accessibility	RW	Map or not	RPDO	Related mode	IP	Data range	-	Factory setting	0
Note: Set the value of Interpolation data record 1.										

Sub-Index 2h	Name	Interpolation data record 2			Effective setting	-	Data structure	VAR	Data type	Int32
	Accessibility	RW	Map or not	RPDO	Related mode	IP	Data range	-	Factory setting	0
Note: Set the value of Interpolation data record 2.										

Sub-Index 3h	Name	Interpolation data record 3			Effective setting	-	Data structure	VAR	Data type	Int32
	Accessibility	RW	Map or not	RPDO	Related mode	IP	Data range	-	Factory setting	0
Note: Set the value of Interpolation data record 3.										

Sub-Index 4h	Name	Interpolation data record 4			Effective setting	-	Data structure	VAR	Data type	Int32
	Accessibility	RW	Map or not	RPDO	Related mode	IP	Data range	-	Factory setting	0
Note: Set the value of Interpolation data record 4.										

Sub-Index 5h	Name	Interpolation data record 5			Effective setting	-	Data structure	VAR	Data type	Int32
	Accessibility	RW	Map or not	RPDO	Related mode	IP	Data range	-	Factory setting	0
Note: Set the value of Interpolation data record 5.										

Sub-Index 6h	Name	Interpolation data record 6			Effective setting	-	Data structure	VAR	Data type	Int32
	Accessibility	RW	Map or not	RPDO	Related mode	IP	Data range	-	Factory setting	0
Note: Set the value of Interpolation data record 6.										

Sub-Index 7h	Name	Interpolation data record 7			Effective setting	-	Data structure	VAR	Data type	Int32
	Accessibility	RW	Map or not	RPDO	Related mode	IP	Data range	-	Factory setting	0
Note: Set the value of Interpolation data record 7.										

Sub-Index 8h	Name	Interpolation data record 8			Effective setting	-	Data structure	VAR	Data type	Int32
	Accessibility	RW	Map or not	RPDO	Related mode	IP	Data range	-	Factory setting	0
Note: Set the value of Interpolation data record 8.										

Sub-Index 9h	Name	Interpolation data record 9			Effective setting	-	Data structure	VAR	Data type	Int32
	Accessibility	RW	Map or not	RPDO	Related mode	IP	Data range	-	Factory setting	0
Note: Set the value of Interpolation data record 9.										

Sub-Index 10h	Name	Interpolation data record 10			Effective setting	-	Data structure	VAR	Data type	Int32
	Accessibility	RW	Map or not	RPDO	Related mode	IP	Data range	-	Factory setting	0
Note: Set the value of Interpolation data record 10.										

Index 60C4h	Name	Interpolation data configuration			Effective setting	-	Data structure	ARR	Data type	-
	Accessibility	-	Map or not	YES	Related mode	-	Data range	-	Factory setting	-

Note: This object's dictionary sets some configuration of interpolation data. The specific configuration is as follows:

Sub-index	Description
Sub-index01	Set the maximum data buffer size
Sub-index02	Actual data buffer size
Sub-index03	0- Indicates FIFO buffer organization 1- 1- Indicates a circular buffer organization Other values reserved, undefined
Sub-index04	Entry point for next buffer data,
Sub-index05	Data size record
Sub-index06	0--- clear buffer input, close buffer transfer, clear all IP data records 1--- Open input buffer Other data reservation

Sub-Index 0	Name	Number of Interpolation data configuration Sub-index			Effective setting	-	Data structure	VAR	Data type	Uint16
	Accessibility	RO	Map or not	YES	Related mode	IP	Data range	6	Factory setting	6

Sub-Index 1h	Name	Max data buffer size			Effective setting	-	Data structure	VAR	Data type	Int32
	Accessibility	RW	Map or not	RPDO	Related mode	IP	Data range	-	Factory setting	0
Note: set the value of Max data buffer size.										

Sub-Index 2h	Name	Actual data buffer size			Effective setting	-	Data structure	VAR	Data type	Int32
	Accessibility	RW	Map or not	RPDO	Related mode	IP	Data range	-	Factory setting	0
Note: set the value of actual data buffer size.										

Sub-Index 3h	Name	Buffer organization			Effective setting	-	Data structure	VAR	Data type	Uint8
	Accessibility	RW	Map or not	RPDO	Related mode	IP	Data range	-	Factory setting	0
Note: set the value of Buffer organization										

Sub-Index 4h	Name	Buffer position			Effective setting	-	Data structure	VAR	Data type	Uint16
	Accessibility	RW	Map or not	RPDO	Related mode	IP	Data range	-	Factory setting	0
Note: set the value of Buffer position.										

Sub-Index 5h	Name	Size of data record			Effective setting	-	Data structure	VAR	Data type	Uint8
	Accessibility	RW	Map or not	RPDO	Related mode	IP	Data range	-	Factory setting	0
Note: set the Size of data record										
Sub-Index 6h	Name	Buffer clear			Effective setting	-	Data structure	VAR	Data type	Uint8
	Accessibility	RW	Map or not	RPDO	Related mode	IP	Data range	-	Factory setting	0
Note: set the value of Buffer clear										

Index 60C5h	Name	Max acceleration			Effective setting	-	Data structure	VAR	Data type	Uint32
	Accessibility	RW	Map or not	RPDO	Related mode	IP,PP,PV	Data range	-	Factory setting	655360001
Note: This object dictionary sets the maximum acceleration of the curve plan under profile speed, profile position, and interpolation position mode.										
Index 60C6h	Name	Max deceleration			Effective setting	-	Data structure	VAR	Data type	Uint32
	Accessibility	RW	Map or not	RPDO	Related mode	IP,PP,PV	Data range	-	Factory setting	655360001
Note: This object dictionary sets the maximum deceleration of the curve plan under profile speed, profile position, and interpolation position mode.										

Index 60F2h	Name	Positioning option code			Effective setting	-	Data structure	VAR	Data type	Uint16
	Accessibility	RW	Map or not	RPDO	Related mode	-	Data range	-	Factory setting	0

Note: The object dictionary sets the positioning mode of the profile position and interpolation position mode. The bit of each bit is defined as follows:

Bit	Name	Description
0-1	Relativeoption	When bit 6 of the control word 6040 is set to 1, a detailed positioning method is set, as shown in the following table.
2-3	Chnge immediately option	When bit 5 of the control word 6040 is set to 1, a detailed positioning method is set, as shown in the following table.
4-5	request-response opton	The detailed definition is shown in the table below.
6-7	reserved	Reserve
8-11	Ip option	The detailed definition is shown in the table below.
12-14	reserved	Reserve
15	manufacturer-specific	Manufacturer customization

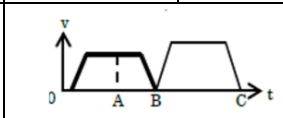
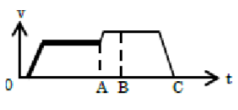
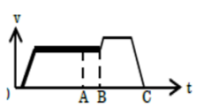
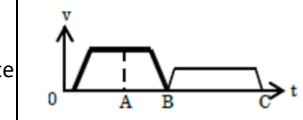
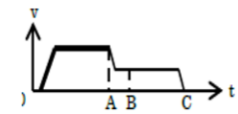
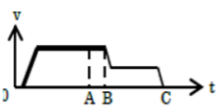
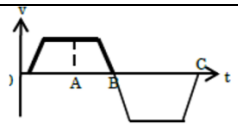
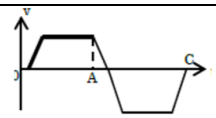
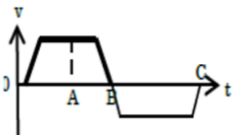
Relative option

Bit1	Bit0	Relative positioning mode	Definition
0	0	Mode 0	Relative operation is performed on the target position (absolute coordinate value) of the previous action. If there is no target position under the previous action, and after execution in other control modes, relative motion is performed for absolute coordinate 0. After execution in other control modes, the previous target position is invalidated.
0	1	Mode 1	6062h relative operation
1	0	Mode 2	6064h relative operation.
1	1	Mode 3	Reserved

Change Immediately Option

Bit3	Bit2	Definition
0	0	Immediately update actions to new positioning tasks (changes in profile speed, acceleration, etc. are included)
0	1	New positioning tasks (changes in profile speed, acceleration, etc. are all included) continue to operate under the currently executing positioning task. (The target position of the currently executed positioning task does not stop and continues to operate.)
1	0	Reserved.
1	1	Reserved.

The combination of actions according to 6040h bit5 and 60F2 bit2-3 is as follows:

6040h-00h Bit5	0		1	
60F2h-00h Bit2-3	00	01	00	01
Update the target position in the same direction and accelerate				
Update the target position in the same direction and decelerate				
When updating the reverse target position			 *not reach the last target position	

Note: A command change time from the host; B target position (before update) reach time; C target position (updated) arrival time. The thick line is the action under the condition before the command is changed; the thin line is the action under the condition after the command is changed

Index 60F4h	Name	Position deviation Following error actual value			Effective setting	-	Data structure	VAR	Data type	Int32
	Accessibility	RO	Map or not	TPDO	Related mode	PP,HM,CSP	Data range	Command unit	Factory setting	0
Note: Display position deviation (command unit).										

Index 60F6h	Name	Torque control parameters			Effective setting	-	Data structure	VAR	Data type	-
	Accessibility	RO	Map or not	TPDO	Related mode	-	Data range	-	Factory setting	-
Note: Display Torque control parameters										

Sub-Index 0	Name	Num of Torque control parameters Sub-index			Effective setting	-	Data structure	VAR	Data type	Uint16
	Accessibility	RO	Map or not	YES	Related mode	ALL	Data range	4	Factory setting	4

Sub-Index 1h	Name	Q axis current feedback value after coordinate transformation			Effective setting	-	Data structure	VAR	Data type	Int32
	Accessibility	RO	Map or not	TPDO	Related mode	ALL	Data range	-	Factory setting	0
Note: Display the current feedback value of the Q axis after the coordinate transformation										

Sub-Index 2h	Name	D axis current feedback value after coordinate transformation			Effective setting	-	Data structure	VAR	Data type	Int32
	Accessibility	RO	Map or not	TPDO	Related mode	ALL	Data range	-	Factory setting	0
Note: Display the current feedback value of the D axis after the coordinate transformation										

Sub-Index 3h	Name	Temperature of Motor			Effective setting	-	Data structure	VAR	Data type	Int32
	Accessibility	RO	Map or not	TPDO	Related mode	ALL	Data range	-	Factory setting	0
Note: Display Temperature of Motor										

Sub-Index 4h	Name	Temperature of IGBT			Effective setting	-	Data structure	VAR	Data type	Int32
	Accessibility	RO	Map or not	TPDO	Related mode	ALL	Data range	-	Factory setting	0
Note: Display Temperature of IGBT										

Index 60F7h	Name	Power stage parameters			Effective setting	-	Data structure	VAR	Data type	-
	Accessibility	RO	Map or not	TPDO	Related mode	-	Data range	-	Factory setting	-
Note: Display power stage parameters										

Sub-Index 0	Name	Number of power stage parameters Sub-index			Effective setting	-	Data structure	VAR	Data type	Uint16
	Accessibility	RO	Map or not	YES	Related mode	ALL	Data range	4	Factory setting	4

Sub-Index 1h	Name	Output power			Effective setting	-	Data structure	VAR	Data type	Int32
	Accessibility	RO	Map or not	TPDO	Related mode	ALL	Data range	-	Factory setting	0
Note: display servo drive's output power										

Sub-Index 2h	Name	Output voltage			Effective setting	-	Data structure	VAR	Data type	Int32
	Accessibility	RO	Map or not	TPDO	Related mode	ALL	Data range	-	Factory setting	0
Note: display servo drive's output voltage										

Index 60F9h	Name	Velocity control parameter set			Effective setting	-	Data structure	VAR	Data type	-
	Accessibility	-	Map or not	TPDO	Related mode	-	Data range	-	Factory setting	-
Note: When the PID parameter selection is set via the bus, the speed loop PI control parameters are set via the bus.										

Sub-Index 0	Name	Number of velocity loop control parameter Sub-index			Effective setting	-	Data structure	VAR	Data type	Uint16
	Accessibility	RO	Map or not	YES	Related mode	PP,CSP,IP,PV,CSV	Data range	5	Factory setting	5

Sub-Index 1h	Name	Gain of speed loop			Effective setting	-	Data structure	VAR	Data type	Int32
	Accessibility	RW	Map or not	RPDO	Related mode	PP,CSP,IP,PV,CSV	Data range	-	Factory setting	0
Note: Set the gain of speed loop PID.										

Sub-Index 2h	Name	Intergral time of speed loop			Effective setting	-	Data structure	VAR	Data type	Int32
	Accessibility	RW	Map or not	RPDO	Related mode	PP,CSP,IP,PV,CSV	Data range	-	Factory setting	0
Note: Set the Intergral time of speed loop PID										

Sub-Index 3h	Name	Derivative time constant of speed loop			Effective setting	-	Data structure	VAR	Data type	Int32
	Accessibility	RW	Map or not	RPDO	Related mode	PP,CSP,IP,PV,CSV	Data range	-	Factory setting	0
Note: Set the Derivative time constant of speed loop PID										

Sub-Index 4h	Name	Max output of speed loop			Effective setting	-	Data structure	VAR	Data type	Int32
	Accessibility	RW	Map or not	RPDO	Related mode	PP,CSP,IP,PV,CSV	Data range	-	Factory setting	0
Note: Set the Max output of speed loop PID										

Sub-Index 5h	Name	Min output of speed loop			Effective setting	-	Data structure	VAR	Data type	Int32
	Accessibility	RW	Map or not	RPDO	Related mode	PP,CSP,IP,PV,CSV	Data range	-	Factory setting	0
Note: Set the Min output of speed loop PID										

Index 60FBh	Name	Position control parameters set			Effective setting		Data structure	VAR	Data type	-
	Accessibility	-	Map or not	TPDO	Related mode		Data range	-	Factory setting	-
Note: When the PID parameter of the servo is set to the bus mode, the control parameters of the position loop can be modified through the bus										

Sub-Index 0	Name	Number of position control parameters Sub-index			Effective setting	-	Data structure	VAR	Data type	Uint16
	Accessibility	RO	Map or not	YES	Related mode	PP,CSP,IP	Data range	6	Factory setting	6

Sub-Index 1h	Name	Proportional gain of position loop			Effective setting	-	Data structure	VAR	Data type	Int32
	Accessibility	RW	Map or not	RPDO	Related mode	PP,CSP,IP	Data range	-	Factory setting	0
Note: Setting the proportional gain of position loop control parameters										

Sub-Index 2h	Name	Velocity feedforward			Effective setting	-	Data structure	VAR	Data type	Int32
	Accessibility	RW	Map or not	RPDO	Related mode	PP,CSP,IP	Data range	-	Factory setting	0
Note: Setting the percent gain of Velocity feedforward										

Index 60FCh	Name	Position command			Effective setting	-	Data structure	VAR	Data type	Int32
	Accessibility	RO	Map or not	TPDO	Related mode	PP,CSP,IP	Data range	Command unit	Factory setting	0
Note: The position command of the 607C is a position command sent to the local position closeloop of the servo drive.										

Index 60FDh	Name	Digital Input			Effective setting	-	Data structure	VAR	Data type	Uint32
	Accessibility	RO	Map or not	TPDO	Related mode	ALL	Data range	0~FFFFFFFF	Factory setting	0

Note: The current DI terminal logic of the drive:
0- Invalid logic
1- Valid logic

The DI signal represented by each bit is as follows:

Bit	Definition
0	Reverse limit switch
1	Positive limit switch
2	Homing switch

3-15	Reserved	
16	Forward movement prohibited	
17	Reverse movement prohibited	
18	Emergency stop	
19	STO status	
20-25	Digital DI input	
26	Z signal	
27	Probe 1	
28	Probe 2	
29-31	Factory custom	

Index 60FEh	Name	Digital Output			Effective setting	-	Data structure	VAR	Data type	-
	Accessibility	-	Map or not	YES	Related mode	-	Data range	-	Factory setting	-
Note: the drive's current DO terminal logic										

Sub-Index 0	Name	Number of digital output sub-indexes			Effective setting	-	Data structure	VAR	Data type	Int16
	Accessibility	RO	Map or not	YES	Related mode	-	Data range	2	Factory setting	2

Sub-Index 1h	Name	Physical Output			Effective setting	-	Data structure	VAR	Data type	Int32
	Accessibility	RW	Map or not	RPDO	Related mode	-	Data range	-	Factory setting	0
Note: DO terminal output logic										

Sub-Index 2h	Name	Physical output enable			Effective setting	-	Data structure	VAR	Data type	Int32
	Accessibility	RW	Map or not	RPDO	Related mode	-	Data range	-	Factory setting	0
Note: Note: Set whether enable DO forced output										

Index 60FFh	Name	Target Velocity			Effective setting	-	Data structure	VAR	Data type	-
	Accessibility	RW	Map or not	RPDO	Related mode	PV,CSV	Data range	Command unit	Factory setting	0
Set user speed command in profile speed mode and cycle sync speed mode										

Index 6403h	Name	Motor TYPE			Effective setting	-	Data structure	VAR	Data type	Char
	Accessibility	RO	Map or not	TPDO	Related mode	-	Data range	-	Factory setting	“IK3”

Index 6404h	Name	Motor manufacturer			Effective setting	-	Data structure	VAR	Data type	Char
	Accessibility	RO	Map or not	TPDO	Related mode	-	Data range	-	Factory setting	“BECON”

Index 6405h	Name	motor catalog address			Effective setting	-	Data structure	VAR	Data type	Char
	Accessibility	RO	Map or not	TPDO	Related mode	-	Data range	-	Factory setting	becon.com

Index 6406h	Name	motor catalog address			Effective setting	-	Data structure	VAR	Data type	Char
	Accessibility	RO	Map or not	TPDO	Related mode	-	Data range	-	Factory setting	becon.com

Index 6410h	Name	Motor Data			Effective setting	-	Data structure	VAR	Data type	-
	Accessibility	-	Map or not	YES	Related mode	-	Data range	-	Factory setting	-

Sub-Index 0	Name	Number of digital output sub-indexes			Effective setting	-	Data structure	VAR	Data type	Int16
	Accessibility	RO	Map or not	YES	Related mode	-	Data range	32	Factory setting	32

Sub-Index 1h	Name	Motor brand			Effective setting	-	Data structure	VAR	Data type	Int32
	Accessibility	RW	Map or not	RPDO	Related mode	-	Data range	-	Factory setting	-
Set the brand of motor										

Sub-Index 2h	Name	Motor model			Effective setting	-	Data structure	VAR	Data type	Int32
	Accessibility	RW	Map or not	RPDO	Related mode	-	Data range	-	Factory setting	-
Set the model of motor										

Sub-Index 3h	Name	Motor rated power Pe			Effective setting	-	Data structure	VAR	Data type	Int32
	Accessibility	RW	Map or not	RPDO	Related mode	-	Data range	kW	Factory setting	-
Set the rated power of motor, Unit kW, 2 decimal places										

Sub-Index 4h	Name	Motor rated RPM			Effective setting	-	Data structure	VAR	Data type	Int32
	Accessibility	RW	Map or not	RPDO	Related mode	-	Data range	RPM	Factory setting	-
Set the rated RPM of motor, Unit rpm, 0 decimal places										

Sub-Index 5h	Name	Motor Max RPM			Effective setting	-	Data structure	VAR	Data type	Int32
	Accessibility	RW	Map or not	RPDO	Related mode	-	Data range	RPM	Factory setting	-
Set the Max RPM of motor, Unit rpm, 0 decimal places										

Sub-Index 6h	Name	Motor rated current Ie			Effective setting	-	Data structure	VAR	Data type	Int32
	Accessibility	RW	Map or not	RPDO	Related mode	-	Data range	A	Factory setting	-
Set the rated current of motor, Unit A, 1 decimal places										
Sub-Index 7h	Name	Motor rated torque Tn			Effective setting	-	Data structure	VAR	Data type	Int32
	Accessibility	RW	Map or not	RPDO	Related mode	-	Data range	N.m	Factory setting	-
Set the rated torque of motor, Unit Nm, 3 decimal places										

Sub-Index 8h	Name	Motor phase resistance Rs			Effective setting	-	Data structure	VAR	Data type	Int32
	Accessibility	RW	Map or not	RPDO	Related mode	-	Data range	Ω	Factory setting	-
Set the phase resistance of motor, Unit Ω, 2 decimal places										

Sub-Index 9h	Name	Motor pole pairs			Effective setting	-	Data structure	VAR	Data type	Int32
	Accessibility	RW	Map or not	RPDO	Related mode	-	Data range	-	Factory setting	-
Note: Set the number of motor pole pairs, 0 decimal places										

Sub-Index 10h	Name	Motor static current Is			Effective setting	-	Data structure	VAR	Data type	Int32
	Accessibility	RW	Map or not	RPDO	Related mode	-	Data range	A	Factory setting	-
Note: Set the motor static current, unit A, 2 decimal places										

Sub-Index 11h	Name	D-axis phase inductance Ld			Effective setting	-	Data structure	VAR	Data type	Int32
	Accessibility	RW	Map or not	RPDO	Related mode	-	Data range	mH	Factory setting	-
Note: Set the motor equivalent d-axis phase inductance, unit mH, 2 decimal places										

Sub-Index 12h	Name	Q-axis phase inductance Lq			Effective setting	-	Data structure	VAR	Data type	Int32
	Accessibility	RW	Map or not	RPDO	Related mode	-	Data range	mH	Factory setting	-
Note: Set the motor equivalent q-axis phase inductance, unit mH, 2 decimal places										

Sub-Index 13h	Name	motor inertia J			Effective setting	-	Data structure	VAR	Data type	Int32
	Accessibility	RW	Map or not	RPDO	Related mode	-	Data range	kg.cm^2	Factory setting	-
Note: Set the motor inertia, unit kg.cm^2, 2 decimal places										

Sub-Index 14h	Name	back-emf constant Ke			Effective setting	-	Data structure	VAR	Data type	Int32
	Accessibility	RW	Map or not	RPDO	Related mode	-	Data range	V/Krpm	Factory setting	-
Note: Set the motor's back-emf constant, unit V/Krpm, 0 decimal places										

Index 6503h	Name	Drive catalog			Effective setting	-	Data structure	VAR	Data type	Int32
	Accessibility	RO	Map or not	TPDO	Related mode	-	Data range	-	Factory setting	"IK3-1"

Index 6504h	Name	Drive manufacturer			Effective setting	-	Data structure	VAR	Data type	Int32
	Accessibility	RO	Map or not	TPDO	Related mode	-	Data range	-	Factory setting	"BECON"

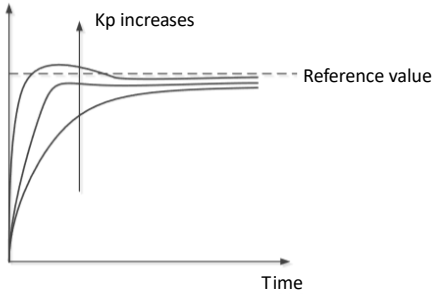
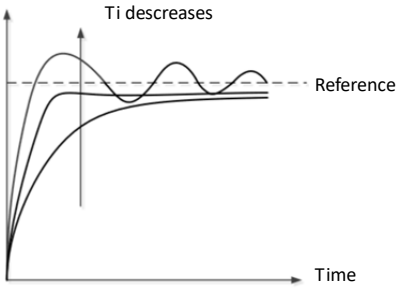
Chapter 8 Adjustment

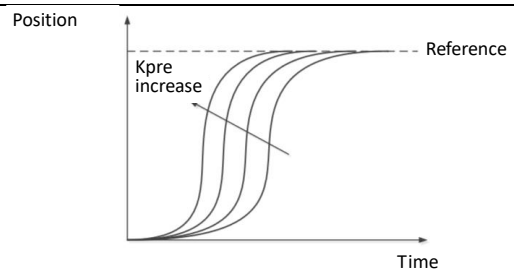
In the servo system, the current loop related parameters have been auto-tuned according to the characteristic parameters of the motor used, and generally do not need to be modified.

The default parameters of the speed loop and the position loop are tuned according to the motor optical axis characteristics. After the motor is loaded, the corresponding parameters need to be manually adjusted according to the load characteristics.

8.1 Basic Principles of PID Parameter Setting

The tuning of PID parameters is a reasonable selection of PID parameters. From the aspects of stability, response speed, overshoot and steady state accuracy of the system, the role of each parameter is as follows:

PID adjustment instructions	
Name	Adjustment instructions
Proportional gain parameter Kp **Position loop gain parameter P58.00** **Speed loop gain parameter P55.00** **Current loop gain parameter 50.02**	**The role of parameters: t**o speed up the system's response speed, improve the system's adjustment accuracy **Adjustment method:** With the increase of Kp, the response speed of the system is quickened, and the adjustment accuracy of the system is improved, but the system is prone to overshoot, the stability of the system is deteriorated, and even the system is unstable. If the value of Kp is too small, the adjustment accuracy decreases, the response speed becomes slower, and the adjustment time lengthens, causing the system's dynamic and static performance to deteriorate. When the proportional gain changes, the step response trend is as shown below 
Integral time parameter Ti **Speed loop integral time parameter P55.01** **Current loop integral time parameter P50.03**	The role of parameters: to eliminate the system's steady-state error. Adjustment method: The smaller the Ti, the faster the steady-state error of the system is eliminated, but Ti cannot be too small. Otherwise, the integral saturation will occur in the initial stage of the response process. If Ti is too large, the system's steady-state error will be difficult to eliminate, affecting the system's regulation accuracy. In addition, in the forward channel of the control system, as long as there is an integral link, it is always possible to achieve a steady state without static difference. From a phase point of view, there is a 90° phase delay in an integral link, which may undermine the stability of the system. When the integral time constant changes, the step response trend is as shown in the figure below. 
Differential parameter Kd **Speed loop differential parameter P55.02;** **Current loop differential parameter P50.04**	The role of parameters: to improve the dynamic performance of the system, its main role is to suppress deviations in any direction during the response process, and to predict changes in deviations in advance. Adjustment method: Since the control loop of the IK3 servo system has a high-speed refresh rate, it is generally unnecessary to use a differential link.
Feedforward gain coefficient **Kpre (P58.01)**	The role of parameters: to improve the position response of the servo system and eliminate the steady-state error. Adjustment method: Increasing the feed forward coefficient can improve the position tracking performance and eliminate the steady state error more quickly, but too large feed forward coefficient will still cause the instability of the system. Decreasing Kpre can improve system stability, but the system response will be slower. The influence of the feed-forward ratio coefficient on the position tracking performance is shown in the figure below.



iK3 servo system features BECON Monitor, a graphical real-time monitoring and configuration tool that allows PID parameters to be quantified. For the configuration and use of the BECON Monitor software, refer to the appendix "BECON -MONITOR User's Manual".

☆Related parameters：

No. P58.00	Name	APR Kp			Effective setting	-	Data structure	-	Data type	Int32
	Accessibility	RW	Map or not	-	Related mode	-	Data range	0.0 ~ 1000.0	Factory setting	150.0
P58.00 and P58.01 parameters mainly adjust the proportional gain and feedforward gain of the position regulator.										
No. P58.01	Name	APR Kpre			Effective setting	-	Data structure	-	Data type	Int32
	Accessibility	RW	Map or not	-	Related mode	-	Data range	0.0 ~ 1000.0	Factory setting	50.0
Set the value of APR Kpre										

No. P55.00	Name	ASR Kp			Effective setting	-	Data structure	-	Data type	Int32
	Accessibility	RW	Map or not	-	Related mode	-	Data range	0.01 ~ 99.99	Factory setting	0.60
Set the value of ASR Kp										

No. P55.01	Name	ASR Ti			Effective setting	-	Data structure	-	Data type	Int32
	Accessibility	RW	Map or not	-	Related mode	-	Data range	0.1 ~ 9999.9	Factory setting	100.0
Set the value of ASR Ti										

No. P55.02	Name	ASR Kd			Effective setting	-	Data structure	-	Data type	Int32
	Accessibility	RW	Map or not	-	Related mode	-	Data range	0.000 ~ 9.999	Factory setting	0.000
Set the value of ASR Kd										

No. P50.02	Name	ACR Kp			Effective setting	-	Data structure	-	Data type	Int32
	Accessibility	RW	Map or not	-	Related mode	-	Data range	0.00 ~ 99.99	Factory setting	0.54
Set the value of ACR Kp										

No. P50.03	Name	ACR Ti			Effective setting	-	Data structure	-	Data type	Int32
	Accessibility	RW	Map or not	-	Related mode	-	Data range	0.0 ~ 9999.9	Factory setting	16.0
Set the value of ACR Ti										

No. P50.04	Name	ACR Kd			Effective setting	-	Data structure	-	Data type	Int32
	Accessibility	RW	Map or not	-	Related mode	-	Data range	0.000 ~ 9.999	Factory setting	0.000
Set the value of ACR Kd										

8.2 Speed Loop Parameter Setting

In order to ensure that the speed loop PID parameter setting can also be performed under the condition in which the load cannot perform the rotatory motion for a long time, it is recommended to use the speed reciprocating mode to set the speed loop PID parameter.

Specific steps are as follows:

Step 1: Set the P12.01 acceleration and P12.02 deceleration to the maximum value of 3000 rpm/ms to obtain the step speed reference (these two parameters need to be restored after parameter tuning is completed).
Step 2: Set P11.01 reciprocating motion enable to 1 (reset this parameter to 0 when parameter tuning is completed).
Step 3: Select monitoring variables Asr.Ref (speed reference) and Asr.Fdb (speed feedback) in the acquisition configuration screen of BECON Monitor.
Step 4: Set 50% speed reference value in the control interface of BECON Monitor, make the motor reciprocate at the speed of 50% of rated speed, and then observe the speed tracking situation in the monitoring interface, as shown in Figure 9.2.2-1 and 9.2.2-2 As shown.
Step 5: Gradually adjust the speed loop proportional gain Kp and the integral time constant Ti according to the tuning principle described in Section 8.1. The speed step response rise time is less than 20ms and the speed accuracy is stable under the condition that the speed tracking is stable. When the speed is within ±1 ,, the speed loop parameter can be set well.
Step 6: Restore the parameters P12.01 Acceleration, P12.02 Deceleration, and P11.01 Reciprocation.
Note: The physical significance of the proportional gain Kp:The speed feedback differs from the speed reference by 1Hz (60 RPM), and the speed loop will output 1A of current.

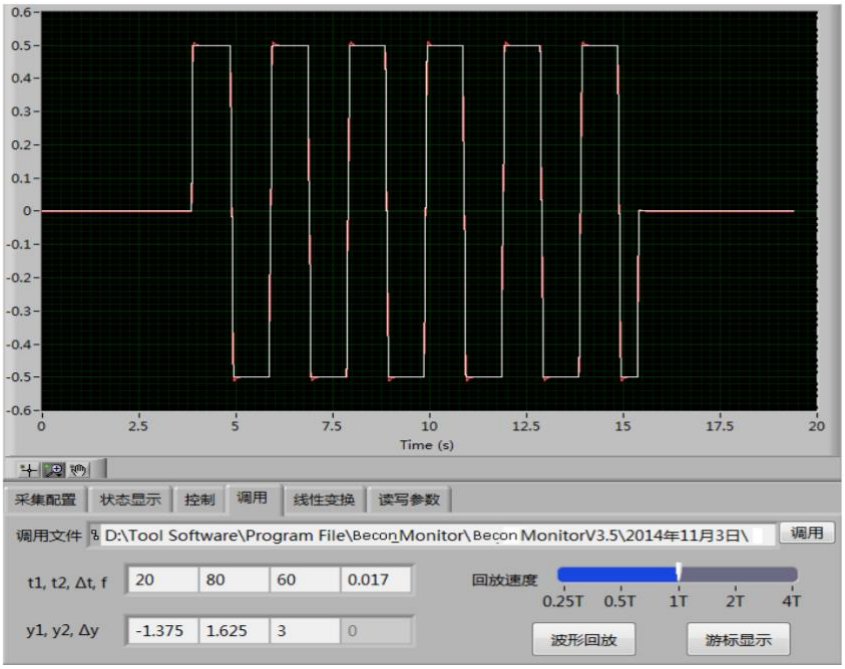


Figure 9.2.2-1 Speed Response Curve (White: Speed Reference; Red: Speed Feedback)

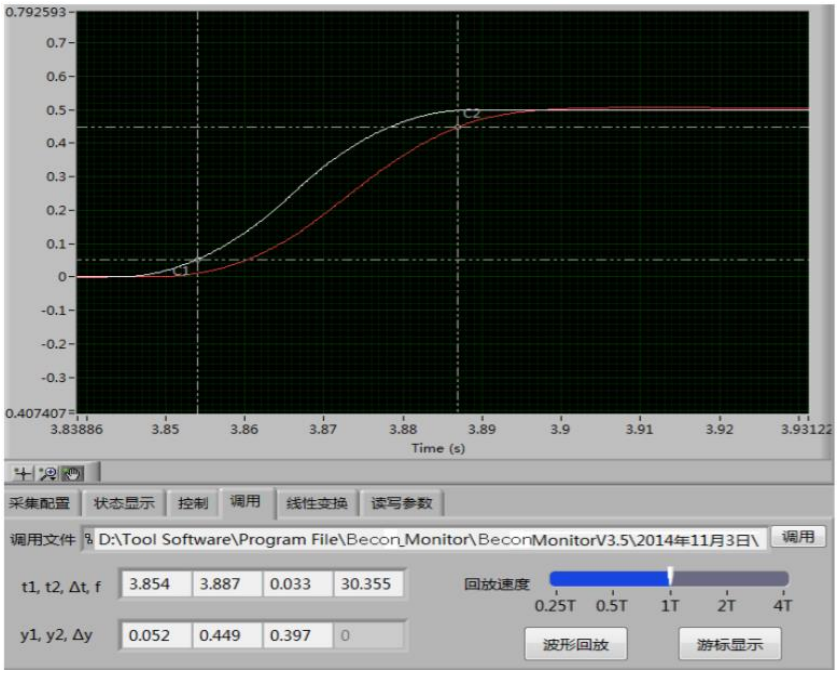


Figure 9.2.2-2 Speed Response Curve (White: Speed Reference; Red: Speed Feedback)

☆Associated parameters:

No. P12.01	Name	Acceleration rpm/ms			Effective setting	-	Data structure	-	Data type	Int32
	Accessibility	RW	Map or not	-	Related mode	-	Data range	0 ~ 3000	Factory setting	20
This parameter sets the acceleration and deceleration of the speed curve										

No. P12.02	Name	deceleration rpm/ms			Effective setting	-	Data structure	-	Data type	Int32
	Accessibility	RW	Map or not	-	Related mode	-	Data range	0 ~ 3000	Factory setting	20
This parameter sets the acceleration and deceleration of the speed curve										

No. P11.01	Name	Reciprocating motion enable			Effective setting	-	Data structure	-	Data type	Int32
	Accessibility	RW	Map or not	-	Related mode	-	Data range	0 ~ 1	Factory setting	0
This parameter is used to set the reciprocating motion. 0: normal operation mode; 1: Into the debugging state, can achieve speed, position reciprocating										

8.3 Position Loop Parameter Setting

If the position loop PID parameter setting cannot be performed by the controller issuing a position command, it is recommended to use position reciprocating motion mode to perform position loop PID parameter tuning as the outer loop of the speed loop.
Before setting loop parameters in the position, it is necessary to complete the tuning of the speed control parameters. Otherwise, good position loop parameters may not be obtained.

Specific steps are as follows:
Step 1: Set parameter P11.01 reciprocation enable to 1 (reset this parameter to 0 when parameter tuning is completed).

Step 2: Select the monitoring variable Asr.Ref (speed reference) in the acquisition configuration screen of BECON Monitor.
Step 3: Preset position reference Pref (considering mechanical limit) in the control interface of BECON Monitor, make the motor reciprocate within ±Pref position, then observe the position loop output in the monitoring interface (speed loop given by Asr. Ref), as shown in Figure 9.2.3-1.

Step 4: Gradually adjust the position loop proportional gain Kp and the feed forward gain Kpre to ensure that the Asr.Ref output from the position loop is not oscillated and the uniform velocity fluctuates within 1‰ ,. The position loop parameter can be considered as well set.

Step 5: The parameter P11.01 reciprocation enable setting is 0.
Note: The physical significance of the proportional gain Kp:
When the position feedback differs from the position reference by 1r, the position loop will output a speed of 1r/s (60r/min).
The physical meaning of the feed-forward gain Kpre:
The position value is divided by the position loop period to obtain the speed value which is multiplied by Kpre to be as the speed reference.

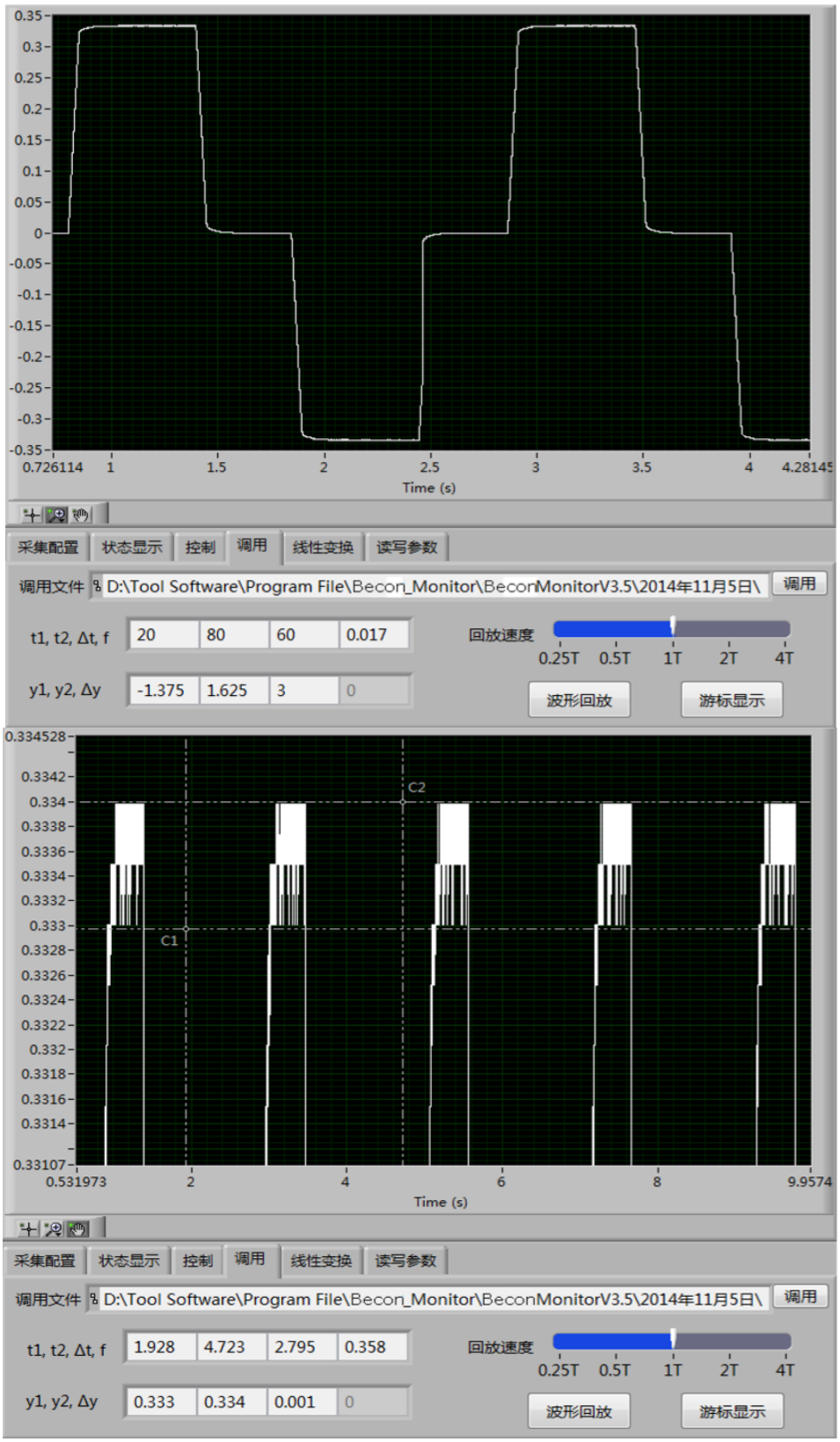


Figure 9.2.3-1 Position Output Curve Asr.Ref

☆Related parameters：

No. P11.01	Name	Reciprocating motion enable			Effective setting	-	Data structure	-	Data type	Int32
	Accessibility	RW	Map or not	-	Related mode	-	Data range	0 ~ 1	Factory setting	0
This parameter is used to set the reciprocating motion. 0: normal operation mode; 1: Into the debugging state, can achieve speed, position reciprocating										

Chapter 9 Troubleshooting

9.1 Fault Code Table

9.1.1 Fault Classification

In order to better protect the servo driver and classify faults according to severity, they can be divided into two categories. For the faults at the two levels, the processing methods are different. That is, 0 types of general faults control the shutdown and 1 type of serious fault occurs. Shut down immediately.

9.1.2 Failure and Warning Records

The servo drive has a fault recording function that can record the name of the fault for the last 10 times and the status parameters of the servo drive at the time of the fault.

1) View fault record from the panel

Press M key first to enter the auxiliary function  , press SET and V to enter the fault history query  , and then press SET to see the most recent fault record  . With ∧ and V, you can refer to other fault records,among these,  are the earliest fault records.

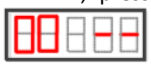
2) View fault record from the host computer
View fault record via upload parameters.

☆Related parameters：

P40.00~ P40.09	Name	Fault record			Effective setting	-	Data structure	-	Data type	Int32
	Accessibility	RO	Map or not	-	Related mode	-	Data range	0 ~ 255	Factory setting	0
Reading the historical failure of the servo, a total of 10 historical faults can be stored, and fault 1 to fault 10 can be recorded in turn. The user can learn the history of the fault occurred by the servo through this set of parameters.										

9.1.3 Fault Code Table

When the servo is faulty, the digital signal of the servo panel flashes and displays the latest fault code of the servo. Through the panel operation, all the current fault codes can be viewed. The specific operations are as follows:

Press M key first to enter the status display function interface  , press SET and V to enter the fault history query  , and then press SET to see the most recent fault record  . Through ∧ and V, other current faults can be viewed.

After connecting the handheld operator, the fault code based on the CiA402/301 standard will be displayed above the operator. The [Fault Check] screen will display all the alarm information that has occurred. After connecting the PC software, the [Fault Display] window will show all the occurrences. malfunction. The following types of fault protection are available on the iK3:

Display	Fault name	Fault type	If reset	CiA402 fault code
---b.0 Note1	STO disable	NO.0	Yes	/
---S.S Note 2	Servo is in emergency stop	NO.0	Yes	/
ErrC.0	Busbar overcurrent	NO.1	Yes	2230h
ErrC.1	Output overcurrent	NO.1	Yes	2320h
ErrC.4	Continuous overcurrent	NO.1	Yes	2310h
ErrC.A	Powerlink communication fail	NO.0	Yes	7580h
ErrC.B	EtherCAT communication fail	NO.0	Yes	7581h
ErrC.C	PowerLink Board error	NO.0	Yes	7590h

ErrC.D	EtherCAT Board error	NO.0	Yes	7591h
ErrU.0	Overspeed in the same direction	NO.1	Yes	8480h
ErrU.1	Reverse overspeed	NO.1	Yes	8481h
ErrU.2	More than the maximum speed	NO.1	Yes	8482h
ErrU.3	Speed tracking error is too large	NO.1	Yes	8483h
ErrU.4	Acceleration oversize	NO.1	Yes	8484h
ErrU.5	Motor stall	NO.1	Yes	8485h
ErrU.7	Motor type mismatch	NO.1	Yes	8487h
ErrE.0	Encoder connection error	NO.1	Yes	7380h
ErrE.1	Encoder battery undervoltage	NO.0	Yes	7381h
ErrE.2	Encoder battery disconnected	NO.0	Yes	7382h
ErrE.3	Encoder overheating	NO.0	Yes	7383h
ErrE.4	Encoder count error	NO.1	Yes	7384h
ErrE.5	Encoder speeding	NO.1	Yes	7385h
ErrE.6	Internal encoder failure	NO.1	Yes	7386h
ErrP.0	Excessive position deviation	NO.0	Yes	8611h
ErrS.0	Servo under voltage	NO.1	Yes	3220h
ErrS.1	Servo over voltage	NO.0	Yes	3210h
ErrS.2	Servo over temperature	NO.0	Yes	4310h
ErrS.3	Module overload (I2T)	NO.1	Yes	2350h
ErrS.4	Servo overload	NO.1	Yes	5480h
ErrS.5	Encoder zero calibration failed	NO.1	Yes	3380h
ErrS.6	Output phase loss	NO.1	Yes	3381h
ErrS.7	Input phase loss	NO.0	Yes	3130h
ErrS.8	Internal connection error	NO.1	Yes	5441h
ErrS.9	Internal error 1	NO.1	Yes	5280h
ErrS.A	PowerID error	NO.1	Yes	5210h
ErrS.B	Internal error 2	NO.1	Yes	5281h
ErrS.C	EEPROM error	NO.0	Yes	5282h
ErrS.D	Brake circuit failure	NO.0	Yes	5283h
ErrS.E	Power segment does not match	NO.0	Yes	5284h
ErrL.0	Motor overload (I2T)	NO.0	Yes	7180h
ErrL.3	Brake resistor overload	NO.0	Yes	7182h

Note 1: --- b.0 is only used to indicate that STO is disabled and does not represent a servo fault.
Note 2: -S.S is only used to indicate that the servo is in an emergency stop state and does not represent a servo failure.

9.2 Troubleshooting Method

When servo alarm occurs, please refer to the following possible causes to check the servo and solve the servo fault according to the corresponding strategy.

1) --- b.0: STO is disabled, mechanism:

- STO is not connected or high and low level logic error;

Cause	Countermeasure
STO input failure	◆ Check whether the STO enable signal is valid ◆ Check whether the STO terminal is correctly wired

2）---S.S：Servo emergency stop, mechanism:：

●Servo emergency stop input is valid；

Cause	Countermeasure
Servo emergency stop	◆ Check whether the external emergency stop button is pressed ◆ Check whether the external emergency stop line is disconnected ◆ Check whether the emergency stop IO input signal logic matches the emergency stop valid logic setting

3）ErrC.0：Busbar overcurrent, mechanism:

● The servo detects that the current on the bus is greater than the overcurrent point specified by the drive.

Cause	Countermeasure
DC bus voltage too high	◆ Check if the grid voltage is too high ◆ Check whether the high inertia load stops quickly without energy consumption braking.
Peripheral short circuit	◆ Check whether the servo power output wiring is short-circuited, whether it is short-circuited to ground, and whether the braking resistor is short-circuited
Encoder failure	◆ Check whether the encoder is damaged and the wiring is correct; ◆ Check if the cable shield of the encoder cable is well grounded and if there is a strong interference source near the cable
Servo internal device is damaged	◆ Ask professional and technical personnel to maintain

4）ErrC.1：Output overcurrent, mechanism:

● The servo detects that the phase current is greater than the overcurrent point specified by the drive.

Cause	Countermeasure
DC bus voltage too high	◆Check if the grid voltage is too high ◆Check whether the high inertia load stops quickly without energy consumption braking.
Peripheral short circuit	◆ Check whether the servo power output wiring is short-circuited, whether it is short-circuited to ground, and whether the braking resistor is short-circuited
Encoder failure	◆ Check whether the encoder is damaged and the wiring is correct; ◆ Check if the cable shield of the encoder cable is well grounded and if there is a strong interference source near the cable
Servo internal device is damaged	◆ Ask professional and technical personnel to maintain

5）ErrC.4：Continuous overcurrent, mechanism:

● Module overcurrent occurs many times in a row;

Cause	Countermeasure
Peripheral short circuit	◆ Check whether the servo power output wiring is short-circuited, whether it is short-circuited to ground,
Servo internal device is damaged	◆ Ask professional and technical personnel to maintain

6）ErrC.A：PowerLink communication failure, mechanism：

●PowerLink Communication error;

Cause	Countermeasure
Abnormal controller	◆ Check the controller
Communication settings are wrong	◆ Check PowerLink communication settings
Communication cable is bad or disconnected	◆ Check whether the communication cable is connected reliably
The communication cable is not grounded or is badly grounded	◆ Use a shielded communication cable, the shield is well grounded

7）ErrC.B：EtherCAT communication failure, mechanism：

●EtherCAT Communication error;

Cause	Countermeasure
Abnormal controller	◆ Check the controller
Communication cable is bad or disconnected	◆ Check whether the communication cable is connected reliably
The communication cable is not grounded or is badly grounded	◆ Use a shielded communication cable, the shield is well grounded

8）ErrC.C：PowerLink Board error, mechanism：

● PowerLink Communication error;

Cause	Countermeasure
Communication settings are wrong	◆ Check PowerLink communication settings
PowerLink board is damaged	◆ Replace PowerLink Board
Servo internal device is damaged	◆ Ask professional and technical personnel to maintain

9）ErrC.D：Board error, mechanism：

● EtherCAT Board error

Cause	Countermeasure
Communication settings are wrong	◆ Check whether the servo uses EtherCAT board
EtherCAT board damage	◆ Replace EtherCAT board
Servo internal device is damaged	◆ Ask professional and technical personnel to maintain

10）ErrU.0：Speed up in the same direction, mechanism:

● When the actual speed and the set speed are in the same direction, the speed error exceeds the set value by 20%

Cause	Countermeasure
Motor runaway	◆ Check whether the phase sequence of the motor power cable is correct
Incorrect motor parameters	◆Check motor parameter settings
Encoder parameters are incorrect	◆ Check the encoder parameter settings
Encoder failure	◆ Check whether the encoder is damaged and the wiring is correct;
Positive load is too large	◆ Check whether the cable shield of the encoder cable is well grounded and whether there is a strong interference source near the cable.
Incorrect parameter settings	◆Check whether the selected motor power meets the load requirements

11）ErrU.1：Reverse overspeed, mechanism：

● The actual speed is opposite to the set speed and exceeds 20% of the rated speed;

Cause	Countermeasure
Motor runaway	◆ Check whether the phase sequence of the motor power cable is correct
Incorrect motor parameters	◆Check motor parameter settings
Encoder parameters are incorrect	◆ Check the encoder parameter settings
Encoder failure	◆ Check whether the encoder is damaged and the wiring is correct;
Positive load is too large	◆ Check whether the cable shield of the encoder cable is well grounded and whether there is a strong interference source near the cable.
Incorrect parameter settings	◆Check whether the selected motor power meets the load requirements

12）ErrU.2：Exceed the maximum speed, mechanism:

● The actual speed of continuous overspeed (filter time) exceeds the maximum speed,

Cause	Countermeasure
Incorrect motor parameters	◆ Check motor parameter settings
Encoder parameters are incorrect	◆ Check the encoder parameter settings
Encoder failure	◆ Check whether the encoder is damaged and the wiring is correct;
Motor runaway	◆ Check whether the cable shield of the encoder cable is well grounded and whether there is a strong interference source near the cable.
Instruction given error	◆ Check whether the phase sequence of the motor power cable is correct
Load mutation	◆ Check position/speed/torque command given

13）ErrU.3：The speed tracking error is too large and the mechanism is:

● The absolute value of the speed error is still greater than the speed error threshold after filtering by the filter time;

Cause	Countermeasure

Excessive acceleration	◆ Check if the given acceleration of the instruction exceeds the load's response
Incorrect parameter settings	◆ Appropriately increase parameter P55.00 "ASR Kp"
Excessive load	◆ Check if the parameters P55.06 "Speed tracking error threshold" and P55.07 "Tracking error filtering time" setting are correct
Output phase loss	◆Check whether the selected motor power meets the load requirements
Excessive acceleration	◆ Refer to S.6 output phase loss fault strategy processing

14) ErrU.4: Acceleration overshoot, mechanism:

● The current encoder's feedback value and the previous cycle's feedback value calculate a current speed. The current speed minus the speed of the previous cycle to give the acceleration. This acceleration is greater than the acceleration threshold within continuous 300 current loop cycles. Or encoder data frame reports errors 300 consecutive times;

Cause	Countermeasure
Excessive acceleration	◆ Check whether the acceleration given by the command is too large
Encoder failure	◆ Check if the encoder is damaged and the wiring is correct
Short circuit of encoder interface	◆ Check if the cable shield of the encoder cable is well grounded and if there is a strong interference source near the cable

15) ErrU.5: Motor stall, mechanism:

● The continuous stall filter time of the motor speed exceeds the stall threshold (cannot be detected in the torque mode and auto-tuning conditions, and the stall threshold is 30% of the rated speed when the speed is less than 10%);

Cause	Countermeasure
Motor power cable failure	◆ Check the wiring condition of the servo output side according to the operating rules, and eliminate the leakage, disconnection, and phase sequence reversal
Motor stalled	◆ Check if the motor is overloaded or the motor is stuck
Servo internal device is damaged	◆ Ask professional and technical personnel to maintain

16) ErrU.7: Motor type mismatch, mechanism:

● When the encoder type is set as an absolute encoder, and the motor brand is set as a custom motor, the servo driver will automatically read the data in the encoder EEPROM to identify the motor model, if the read data does not match the supported by servo drives. The fault will be reported.

Cause	Countermeasure
Motor encoder type set wrong	◆Please confirm whether the encoder is an absolute encoder
Motor branding is wrong	◆ Please confirm whether the motor brand used is a motor supported by the iK3 servo driver. If not, set it as a custom motor and set it correctly according to the actual motor parameters.
Servo internal device is damaged	◆ Ask professional and technical personnel to maintain

17) ErrE.0: Encoder connection error, mechanism:

● Servo and encoder cannot communicate properly, encoder parameters are wrong or wiring is wrong;

Cause	Countermeasure
Encoder parameters are incorrect	◆ Check the encoder parameter settings
Encoder cable failure	◆ Check whether the cable sequence of the encoder is correct
Encoder cable is not connected	◆ Connect the encoder cable
Servo internal device is damaged	◆ Ask professional and technical personnel to maintain

18) ErrE.1: Encoder battery undervoltage, mechanism:

● encoder battery under voltage;

Cause	Countermeasure
Encoder battery voltage is too low	◆ replace the battery

19) ErrE.2: Encoder battery disconnected, mechanism:

● The encoder battery is disconnected;

Cause	Countermeasure
Encoder battery voltage is too low or the battery is disconnected from the encoder	◆ Check whether the encoder battery and encoder are in good contact ◆ replace the battery

20) ErrE.3: Encoder Overheating, Mechanism:

● encoder overheat;

Cause	Countermeasure
Encoder temperature is too high	◆ Improve motor cooling conditions or reduce ambient temperature

21) ErrE.4: Encoder count error, mechanism:

● encoder count error;

Cause	Countermeasure
Encoder count error	◆ Servo power off and restart, if the fault cannot be cleared, replace the encoder

22) ErrE.5: Encoder Overspeed, Mechanism:

● encoder overspeeding;

Cause	Countermeasure
Servo speed is too high before powering on	◆ If you use Tamagawa or Panasonic encoders, reduce the speed or keep the motor still before the servo is powered on.
Motor runaway	◆ Check whether the phase sequence of the motor power cable is correct
Instruction given error	◆ Check position/speed/torque command given
Load change abruptly	◆ Check the external load change abruptly
Encoder internal error	◆ Servo power off and restart, if the fault cannot be cleared, replace the encoder

23) ErrE.6: Internal encoder failure, mechanism:

● encoder internal error;

Cause	Countermeasure
Encoder count error	◆ Servo power off and restart, if the fault cannot be cleared, replace the encoder

24) ErrP.0: Positional deviation is too large, mechanism:

● The position deviation value is greater than the set position deviation threshold and continues for 100ms;

Cause	Countermeasure
Excessive acceleration	◆ Check if the given acceleration of the instruction exceeds the load's response
Incorrect parameter settings	◆ Properly increase parameter P58.00 "APR Kp" and parameter P58.01 "APR Kpre"
Motor stalled	◆ Check if the parameter P58.02 “Position tracking error threshold” setting is correct
Excessive load	◆Check if the motor is stuck or the brake does not open properly
Output phase loss	◆Check whether the selected motor power meets the load requirements

25) ErrS.0: servo undervoltage, mechanism:

● Servo bus voltage is less than 160V, and lasts 2ms;

Cause	Countermeasure
The supply voltage is lower than the minimum operating voltage of the device	◆ Check input power
Instant power failure	◆ Check the input power, wait until the input voltage is normal, restart after reset
Power supply voltage fluctuates too much	◆ Check the input power, wait until the input voltage is normal, restart after reset
Loose terminal block of power supply	◆ Check the input wiring
Large starting current loads in the same power system	◆ Improve the power system to meet the specifications

26) ErrS.1: Servo overpressure, generating mechanism:

● For 400V servo bus voltage greater than 810V, 200V servo is greater than 410V, and lasts 6ms;

Cause	Countermeasure
The power supply voltage is higher than the maximum operating voltage of the device	◆ Check input power
Power supply voltage fluctuates too much	◆ Check the input power, wait until the input voltage is normal,

	restart after reset
Unconnected brake resistor or brake resistor is too large	◆ Use suitable braking resistor

27) ErrS.3: Module overload (I2T), generation mechanism:

● The temperature rise of the module is greater than 75 degrees, and when the derating is greater than 60 degrees;

Cause	Countermeasure
Power module overload	◆Replace higher power servo
Motor power cable failure	◆ Check the wiring condition of the servo output side according to the operating rules, and eliminate the leakage, disconnection, and phase sequence reversal
Motor stalled	◆ Check if the motor is overloaded or the motor is stuck

28) ErrS.4: Servo overload, mechanism:

● The servo output power exceeds the rated power by 1.1 times and continues for 120s;

Cause	Countermeasure
Servo output power exceeds 1.1 times the rated power	◆Replace higher power servo
Motor power cable failure	◆ Check the wiring condition of the servo output side according to the operating rules, and eliminate the leakage, disconnection, and phase sequence reversal
Motor stalled	◆ Check if the motor is overloaded or the motor is stuck

29) ErrS.5: Encoder zero calibration failure, mechanism:

● The encoder zero calibration was not successful;

Cause	Countermeasure
Motor power cable failure	◆ The phase sequence of the power cable is wrong, and the two cable sequences are arbitrarily swapped in the U/V/W three cables;
Incorrect motor parameters	◆ Check whether the power cable is connected reliably
Motor brake failure	◆Check motor parameter settings
Encoder wiring error	◆Check the brake mechanism and brake power

30) ErrS.6: Output Phase Loss, Mechanism:

● Servo three-phase current output is abnormal;

Cause	Countermeasure
The servo output circuit wiring is abnormal, missing or disconnected	◆ Check the wiring of servo output circuit according to the operation rules, and eliminate the missing connection and disconnection
Loose servo output terminals	◆ Check the wiring of servo output circuit according to the operation rules, and eliminate the missing connection and disconnection
Three-phase output imbalance	◆Check whether the motor winding is in good condition and whether the three-phase winding resistance is balanced

31) ErrS.7: Input phase loss, mechanism:

● The servo input error;

Cause	Countermeasure
The main power input circuit is abnormally connected, missing or disconnected	◆When it is only a single-phase input application, please check whether the parameters are set correctly ◆ Check the wiring of servo output circuit according to the operation rules, and eliminate the missing connection and disconnection
Loose servo main power input terminal	◆ Check the wiring of servo output circuit according to the operation rules, and eliminate the missing connection and disconnection

32) ErrS.8: Internal connection error, mechanism:

● Servo internal connection error；

Cause	Countermeasure
Servo internal connection fault	◆ Ask professional and technical personnel to maintain

33) ErrS.9: Internal error 1, mechanism:

● Servo drive internal fault;

Cause	Countermeasure
Servo driver internal fault	◆ Ask professional and technical personnel to maintain

34) ErrS.A: PowerID error, mechanism:

● PowerID detection circuit failure;

Cause	Countermeasure
PowerID detection circuit failure	◆ Ask professional and technical personnel to maintain

34) ErrS.B: Internal error 2, mechanism:

● Servo drive internal fault;

Cause	Countermeasure
Servo drive internal fault	◆ Ask professional and technical personnel to maintain

35) ErrS.C: EEPROM error, mechanism:

● EEPROM failure in the servo drive;

Cause	Countermeasure
Servo drive failure	◆ Ask professional and technical personnel to maintain

36) ErrS.D: Brake circuit failure, mechanism:

● The brake circuit in the servo drive is abnormal;

Cause	Countermeasure
Brake resistor is not connected	◆Please connect the correct braking resistor
Brake circuit failure	◆ Ask professional and technical personnel to maintain

37) ErrS.E: The power segments do not match and the mechanism is:

● The servo driver power does not match the configured motor power.

Cause	Countermeasure
Motor and drive power do not match	◆Please select the appropriate motor or drive again
Motor parameter setting error	◆Please set the appropriate motor parameters

38) ErrL.0: Motor overload (I2T), mechanism:

Perform I2T calculation on the servo phase current. Calculate the energy accumulated threshold that is greater than the energy generated in the corresponding overload time, in the case of 1.5 times overload, 2.5 times overload or 5 times overload.

Cause	Countermeasure
Motor power and load do not match	◆ Check whether the motor power meets the load requirements
Motor stalled	◆ Check if the load is stuck or overloaded
Motor power cable phase sequence fault	◆ Check whether the phase sequence of the motor power cable is correct

39) ErrL.3: Braking resistor overload, mechanism:

● The servo drive calculates the energy accumulated threshold of braking resistor I2T that is greater than the braking resistor overload power 20 times lasting for 1s.

Cause	Countermeasure
Motor winding overheating	◆ Select the appropriate brake resistor according to the selection instructions in the servo instructions
Motor power and load do not match	◆ Check whether the value of P21.12 braking resistor and P21.13 braking resistor are correct.

Motor Adaptation Table

The ik3 servo driver can be equipped with the following motors. The user can modify the motor model according to the following motor adaptation table.

(1) E Series

Production Code P20.00	Motor Code P20.01	Motor Model	Rated Torque N.m	Rated RPM r/min	Rated Current A	Rated Power kW
8	1	40ED-A1013030	0.318	3000	1.1	0.10
2	94	60ED-A2013030	0.64	3000	1.7	0.20
8	2	60ED-A4013030	1.27	3000	3.3	0.40
2	95	80ED-A7513030	2.39	3000	5	0.75
8	22	130ED-A1022030	4.8	2000	6	1
8	23	130ED-A1021520	6.4	1500	5	1
8	24	130ED-A1521520	9.6	1500	9.1	1.5
8	25	130ED-A1921520	11.9	1500	10.9	1.9

(2) Panasonic Motor

Production Code P20.00	Motor Code P20.01	Motor Model	Rated Torque N.m	Rated RPM r/min	Rated Current A	Rated Power kW
1	80	MDMF102L1G6M	4.77	2000	5.2	1
1	81	MDMF152L1G6M	7.16	2000	8	1.5
1	82	MDMF202L1G6M	9.55	2000	9.9	2
1	83	MDMF302L1G6M	14.3	2000	16.4	3
1	84	MHMF5AL1U2M	0.16	3000	1.1	0.05
1	85	MHMF022L1C2M	0.64	3000	1.4	0.2
1	86	MHMF012L1U2M	0.32	3000	1.1	0.1
1	87	MHMF042L1U2M	1.27	3000	2.1	0.4
1	88	MHMF082L1U2M	2.39	3000	3.8	0.75
1	89	MHMF152L1G6M	7.16	2000	8	1.5
1	90	MHMF202L1G6M	9.55	2000	12.5	2
1	91	MHMF302L1G6M	14.3	2000	17	3
1	92	MGMF182L1G6M	11.5	1500	11.8	1.8
1	93	MGMF292L1G6M	18.5	1500	19.3	2.9
1	94	MSMF022L1G6M	0.64	3000	1.5	0.2
1	95	MSMF012L1U2M	0.32	3000	1.1	0.1
1	96	MSMF042L1U2M	1.27	3000	2.4	0.4
1	97	MSMF102L1G6M	3.18	3000	6.6	1
1	98	MSMF082L1G6M	2.39	3000	4.1	0.75
1	99	MSMF5AZL1U2M	0.16	3000	1.1	0.05

(3) Tamagawa Motor

Production Code P20.00	Motor Code P20.01	Motor Model	Rated Torque N.m	Rated RPM r/min	Rated Current A	Rated Power kW
7	40	TS4602-E200	0.159	3000	0.5	0.05
7	41	TS4603-E200	0.318	3000	1	0.1
7	42	TS4607-E200	0.64	3000	1.6	0.2
7	43	TS4609-E200	1.27	3000	3.2	0.4
7	44	TS4614-E200	2.39	3000	4.8	0.75
7	45	TS1306-E716	6.4	1500	5.4	1
7	46	TS1308-E716	9.6	1500	8.7	1.5
7	47	TS1308-E726	9.6	2000	13.2	2

(4) S -series motor

Production Code P20.00	Motor Code P20.01	Motor Model	Rated Torque N.m	Rated RPM r/min	Rated Current A	Rated Power kW
6	84	60SS-A2013050	0.64	3000	1.9	0.2
6	80	60SS-A4013050	1.27	3000	2.8	0.4
6	81	80SS-A7513050	2.4	3000	4.0	1.0
6	95	80SS-A1023045	3.18	3000	4.9	1.0
6	74	86SD-A1023030	3.18	3000	4.5	1.5
6	96	110SD-A6013030	2.0	3000	2.5	0.6
6	97	110SD-A1223030	4.0	3000	5.2	1.2
6	98	110SD-A1523030	5.0	3000	5.4	1.5
6	99	110SD-A1823030	6.0	3000	6.9	1.8
6	75	110SD-A2022528	7.7	2500	8.9	2.0
6	82	130SD-A1022030	4.77	2000	6.2	1.0
6	86	130SD-A1522030	7.16	2000	8.4	1.5
6	83	130SD-A2022030	9.55	2000	10.5	2.0
6	85	130SD-A3022030	14.3	2000	13.9	3.0
6	76	130SH-A9511530	10.0	1500	7.0	0.95
6	77	130SH-A1321530	5.0	1500	10.7	1.3

(5) S1 series motor

Production Code P20.00	Motor Code P20.01	Motor Model	Rated Torque N.m	Rated RPM r/min	Rated Current A	Rated Power kW
7	68	60S1S-A2013050	0.64	3000	1.8	0.2
7	67	60S1D-A2013050	0.64	3000	1.8	0.2
7	62	60S1S-A4013050	1.27	3000	2.8	0.4
7	61	60S1D-A4013050	1.27	3000	2.8	0.4
7	64	80S1S-A7513050	2.39	3000	4.2	0.75
7	66	80S1D-A7513050	2.39	3000	4.2	0.75
7	65	80S1S-A1023050	3.18	3000	5.8	1

(6) M series motor

Production Code P20.00	Motor Code P20.01	Motor Model	Rated Torque N.m	Rated RPM r/min	Rated Current A	Rated Power kW
2	41	40ST-M00130	0.16	3000	0.4	0.05
2	42	40ST-M00330	0.32	3000	0.6	0.1
2	0	60ST-M00630	0.64	3000	1.2	0.2
2	1	60ST-M01330	1.27	3000	2.8	0.4
2	2	60ST-M01930	1.91	3000	3.5	0.6
2	3	80ST-M01330	1.27	3000	2	0.4
2	4	80ST-M02430	2.39	3000	3	0.75
2	5	80ST-M03520	3.5	2000	3	0.73
2	6	80ST-M04025	4	2500	4.4	1.0
2	7	90ST-M02430	2.4	3000	3	0.75
2	8	90ST-M03520	3.5	2000	3	0.73
2	9	90ST-M04025	4	2500	4	1.0
2	10	110ST-M02030	2	3000	2.5	0.6

2	11	110ST-M04020	4	2000	3.5	0.8
2	12	110ST-M04030	4	3000	5.0	1.2
2	13	110ST-M05030	5	3000	6.0	1.5
2	14	110ST-M06020	6	2000	4.5	1.2
2	15	110ST-M06/030	6	2500	6.0	1.8
2	16	130ST-M04025	4	2500	4.0	1.0
2	17	130ST-M05025	5	2500	5.0	1.3
2	18	130ST-M06025	6	2500	6.0	1.5
2	19	130ST-M07725	7.7	2500	7.5	2.0
2	20	130ST-M10010	10	1000	4.5	1.0
2	21	130ST-M10015	10	1500	6	1.5
2	22	130ST-M10025	10	2500	10	2.6
2	23	130ST-M15015	15	1500	9.5	2.3
8	26	130ST-M15020	15	2000	14	3

(7) M1 series motor

Production Code P20.00	Motor Code P20.01	Motor Model	Rated Torque N.m	Rated RPM r/min	Rated Current A	Rated Power kW
5	0	60ST-M00630Z	0.64	3000	1.3	0.2
5	1	60ST-M01330Z	1.27	3000	2.6	0.4
5	2	60ST-M01930Z	1.91	3000	3.1	0.6
5	3	80ST-M01330Z	1.27	3000	2	0.4
5	4	80ST-M02430Z	2.39	3000	3	0.75
5	5	80ST-M03520Z	3.5	2000	3	0.73
5	6	80ST-M04025Z	4	2500	4.4	1.0
5	8	90ST-M02430Z	2.4	3000	3	0.75
5	9	90ST-M03520Z	3.5	2000	3	0.73
5	11	90ST-M04025Z	4	2500	4	1.0

Production Code P20.00	Motor Code P20.01	Motor Model	Rated Torque N.m	Rated RPM r/min	Rated Current A	Rated Power kW
5	12	110ST-M02030Z	2	3000	2.5	0.6
5	13	110ST-M04020Z	4	2000	3.5	0.8
5	14	110ST-M04030Z	4	3000	5.0	1.2
5	16	110ST-M05030Z	5	3000	6.0	1.5
5	17	110ST-M06020Z	6	2000	4.5	1.2
5	18	110ST-M06030Z	6	2500	6.0	1.8
5	19	130ST-M04025Z	4	2500	4.0	1.0
5	20	130ST-M05025Z	5	2500	5.0	1.3
5	21	130ST-M06025Z	6	2500	6.0	1.5
5	22	130ST-M07725Z	7.7	2500	7.5	2.0
5	26	130ST-M10010Z	10	1000	4.5	1.0
5	24	130ST-M10015Z	10	1500	6	1.5
5	25	130ST-M10025Z	10	2500	10	2.6
5	28	130ST-M15015Z	15	1500	9.5	2.3

(8) M2 series motor

Production Code P20.00	Motor Code P20.01	Motor Model	Rated Torque N.m	Rated RPM r/min	Rated Current A	Rated Power kW
3	89	40S2S-A0513060	0.16	3000	0.6	0.05
3	70	40S2S-A1013060	0.32	3000	1.1	0.1

Version information

Date	Version
2017.7.13	1.0
2017.7.31	1.1
2018.3.28	1.5