DEALOUR 德欧技术

DEALOUR Technology

AC SERVO SYSTEM FOR
MOTION CONTROL INDUSTRY

伺服驱动
Servo drive

EX 系列 总线型

EX Series Bus-type

说明书 · V2601

Instruction Manual - V2601

Safety Instructions

This section describes important instructions that users must follow, including inspection upon product delivery, storage, handling, installation, wiring, operation, inspection, and disposal.

DANGER

- When installing the product on machinery and starting operation, ensure the motor is in a state where emergency stop can be activated at any time in advance. Failure to do so may result in personal injury or equipment damage.
- When power is on, be sure to install the cover for the power terminal block. Failure to do so may result in electric shock.
- After turning off the power or performing a withstand voltage test, do not touch the power terminals while the CHARGE indicator is lit. Failure to do so may result in electric shock due to residual voltage.
- Perform trial operation in accordance with the procedures and instructions described in the user manual corresponding to the product. If the servo motor is installed on machinery and an operational error occurs, it may not only cause equipment damage but also lead to personal injury.
- Never modify this product. Settings, disassembly, or repair must not be performed by non-designated personnel. Failure to do so may result in personal injury, equipment damage, or fire.
- Provide a stop device on the machinery side to ensure safety. The holding brake of servo motors with brakes is not intended as a safety stop device. Failure to do so may result in injury.
- Be sure to connect the ground terminal of the servo drive to a grounding electrode (the grounding resistance for the power input servo drive shall be 100 Ω or less). Failure to do so may result in electric shock or fire.

Storage and Handling Precautions

- Do not store or install the product in the following environments. Failure to do so may result in fire, electric shock, or equipment damage.
  - Locations exposed to direct sunlight
  - Locations where the ambient temperature exceeds the specified storage and installation temperature range
  - Locations where the relative humidity exceeds the specified storage and installation humidity range
  - Locations with corrosive or flammable gases
  - Locations with large amounts of dust, dirt, salt, or metal powder
  - Locations where water, oil, chemicals, or similar substances may splash onto the product
  - Locations where vibration or shock is transmitted to the main Unit
- Do not carry the product by holding the cables, motor shaft, or detector. Doing so may cause injury or malfunction.

Installation Precautions

- Do not block the air intake and exhaust vents. Also, do not allow foreign objects to enter the product. Otherwise, aging of internal components may cause malfunctions or fire.
- Be sure to follow the required installation orientation. Failure to do so may result in malfunctions.
- During installation, ensure that there is a specified clearance between the servo drive and the inner surface of the control cabinet as well as other equipment. Otherwise, fire or malfunctions may occur.
- Do not apply excessive shock. Failure to do so may result in malfunctions.

Wiring Precautions

- Wire correctly and securely. Otherwise, it may cause motor runaway, personal injury, or equipment failure.
- Do not connect commercial power to the servo motor connection terminals U, V, W of the servo drive. Otherwise, it may cause injury or fire.
- Securely connect the power terminals and motor connection terminals. Otherwise, it may cause a fire.
- Do not route the main circuit cables in the same conduit as I/O signal cables / encoder cables, and do not bundle them together. When wiring, keep the main circuit cables at least 30 cm away from I/O signal cables.

- Use twisted-pair cables or multi-core twisted-pair overall shielded cables for I/O signal cables and encoder cables.
- Wiring length for I/O signal cables: maximum 3 m; encoder cables: maximum 30 m.
- High voltage may remain inside the servo drive even after the power is turned off. Therefore, do not touch the power terminals while the CHARGE indicator is lit.

· Perform wiring and inspection work only after confirming that the CHARGE indicator has turned off.

- Install safety devices such as circuit breakers to prevent short circuits in external wiring. Otherwise, fire may occur.
- Take appropriate shielding measures when using the product in the following locations.

· Areas subject to interference from static electricity, or areas with strong electric or magnetic fields,and areas where radiation may be present. Otherwise, equipment damage may occur.

- When connecting batteries, pay attention to the polarity. Otherwise, it may cause damage or explosion to the battery, servo drive, and servo motor.

Operation Precautions

To prevent accidents, perform a trial run on the servo motor alone (with the machine not connected to the servo motor drive shaft). After confirming correct operation, connect the machine and start operation. Failure to do so may result in injury.

- When installing the product on the associated machine and starting operation, set the parameters suitable for the machine in advance. Starting operation without parameter setting may result in uncontrolled machine operation or malfunction.
- Do not turn the power ON/OFF frequently. Since the power supply section of the servo drive contains capacitors, a large charging current flows when the power is turned ON. Therefore, frequent power ON/OFF operations will degrade the performance of the main circuit components inside the servo drive.
- Please note that the emergency stop function triggered by forward overtravel and reverse overtravel is disabled during JOG operation (Fn001) and manual load inertia detection (Fn008).Otherwise, equipment damage may occur.
- When using the servo motor on a vertical axis, install safety devices to prevent the workpiece from falling in the event of an alarm, overtravel, or other abnormal conditions. In addition, set the system to stop at the home position when overtravel occurs. Otherwise, the workpiece may fall during overtravel.

Extreme parameter adjustments or setting changes can cause unstable operation of the servo system. Do not perform such operations under any circumstances. Otherwise, personal injury or equipment damage may occur.

- When an alarm occurs, resolve the cause, confirm safety, reset the alarm, and then restart operation. Otherwise, equipment damage, fire, or injury may occur.
- Do not use the brake of servo motors with a holding brake for stopping the machine. Otherwise, malfunction may occur.
- Use servo motors and servo drives only in the specified combinations. Otherwise, fire or malfunction may occur.

Maintenance Precautions

- Do not change wiring while power is on. Otherwise, electric shock or injury may occur.

When replacing the servo drive, copy the parameters from the old servo drive to the new one before restarting operation. Otherwise, equipment damage may occur.

Other Precautions

For detailed illustration purposes, some diagrams in this manual are depicted with the cover or safety guards removed. During actual operation, be sure to reinstall the cover or safety guards to their original positions as specified, then operate the product in accordance with the instructions in this manual.

The illustrations in this manual are representative examples and may differ from the actual product you receive.

This manual is subject to change without notice due to product improvements, specification changes, and enhancements to improve usability. The document version of this manual will be updated accordingly.

Our company does not guarantee the quality of products modified by the customer. We shall not be liable for any injury or damage resulting from the modification of the product.

Maintenance and Inspection

Please perform regular maintenance and inspection on the drive and motor to ensure safe use.

Precautions for Maintenance and Inspection

(1) The operator must turn off the power by themselves. Do not approach the motor or the machinery it drives if incorrect operation occurs while power is on.

(2) For a short time after the power is turned off, the internal circuits remain charged with high voltage. Before inspection, be sure to turn off the power, wait 10 minutes, and confirm that the charge indicator lamp is completely off.

(3) If it is necessary to perform an insulation resistance test on the drive, all connections to the drive must be disconnected. Performing an insulation resistance test with wires, the motor, and the drive connected may damage the drive.

(4) Do not use gasoline, thinners, acidic or alkaline cleaners, as they may cause discoloration or damage to the housing.

Inspection Items and Cycle

Normal operating conditions: The environmental conditions are an annual average temperature of 30°C, an average load rate below 80%, and a daily operating time of less than 20 hours.

Routine inspections and periodic inspections shall be carried out in accordance with the following items.

Inspect	period	Check items
Daily inspection	daily	● Check the operating environment (temperature, humidity, dust, foreign objects) ● Check for abnormal vibration and noise ● Verify that the power supply voltage is within the normal range ● Check for unusual odors ● Inspect the vents for fiber adhesion ● Ensure all connections are clean and securely fastened
Regular inspection	1 year	● Check for loose fasteners ● Check for signs of overheating ● Check the transmission mechanism for oil leakage and contamination on the motor shaft extension ● Check that the terminal block is intact ● Check for loose fasteners between the wires and the driver

目录

Chapter 1 Installation

1.1 Product Inspection

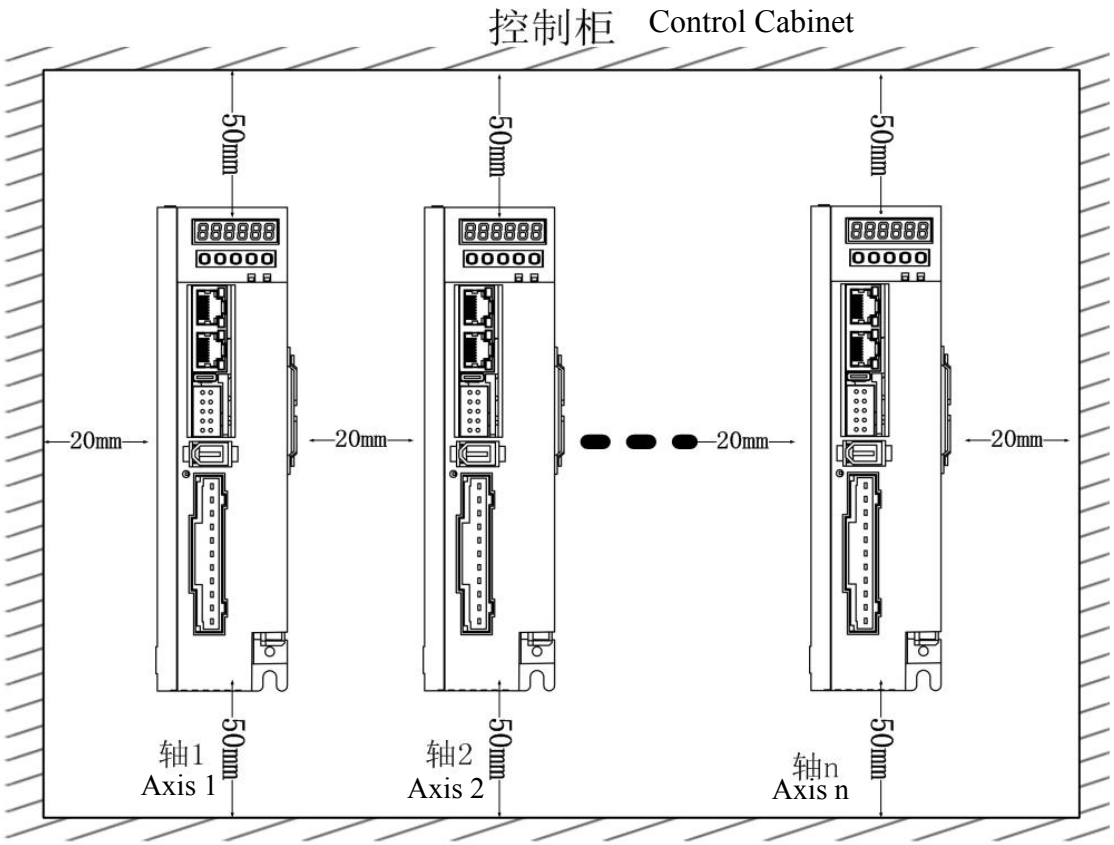
To prevent any oversights during the purchase and delivery of this product, please carefully check the items listed in the table below.

Item	**Reference**
Is the delivered product the model you ordered?	Check the product model on the nameplates of the motor and drive separately. Refer to the model description in the next section.
Does the motor shaft rotate smoothly?	Rotate the motor shaft by hand. Smooth rotation indicates the shaft is normal. **Note: Motors with electromagnetic brake cannot be rotated smoothly by hand!**
Is there any external damage?	Visually inspect the product for any external damage.
Are there any loose screws?	Use a screwdriver to check if the mounting screws of the servo drive are loose.

1.2 Installation

The installation direction must comply with the specifications; otherwise, it may cause malfunctions.To ensure effective cooling circulation, maintain sufficient clearance between the AC servo drive and adjacent objects or baffles (walls) on all sides during installation; otherwise, it may cause malfunctions.When installing the AC servo drive, do not block the air intake and exhaust vents; otherwise, it may cause malfunctions.

To ensure low wind resistance for the cooling fan and efficient heat dissipation, please follow the recommended installation clearance values for single and multiple AC servo drives (as shown in the figure below).



1.3 Noise Interference and High-Order Harmonic Countermeasures

Since the main circuit of the servo driver uses high-speed switching elements, noise interference from these switching elements may occur during external wiring and grounding of the servo driver. To prevent such noise, the following noise countermeasures can be adopted as needed.

- Install a noise filter on the input side of the drive's main circuit cable.
- Connect an AC/DC reactor for suppressing higher harmonics.
- Install the command input device and noise filter as close to the servo drive as possible.
- When wiring, keep the main circuit cable (for motor main circuit) at least 30 cm away from the input/output signal cables. Do not route them in the same conduit or bundle them together.
- Do not use the same power supply as welding machines, electric discharge machines (EDM), etc. Even with a separate power supply, connect a noise filter to the input side of the main circuit cable if high-frequency generators are nearby.
- Perform proper grounding.

1.4 Installing the Noise Filter

To ensure that the EMI Filter achieves the maximum effect in suppressing interference from the servo drive, in addition to installing and wiring the servo drive in accordance with the user manual, the following points should also be noted:

Item	Content
1	Both the servo drive and the noise filter must be installed on the same metal plane.
2	Wiring should be as short as possible.
3	The metal plane must have a good ground connection.
4	The metal plane must have a good ground connection.
5	The metal housing or ground terminal of the servo drive and noise filter must be securely fixed to the metal plane, and the contact area between them should be as large as possible.
6	Use cables with a shielded copper mesh for the motor power lines (double-layer shielding is preferred if available).
7	The shielded copper mesh at both ends of the motor cables must be grounded over the shortest distance and with the largest possible contact area.

1.5 Connection of AC/DC Reactors for Higher Harmonic Suppression

When countermeasures against higher harmonics are required, AC/DC reactors for higher harmonic suppression can be connected to the servo drive.

1.6 Recommended Circuit Breakers and Fuses

If an earth leakage circuit breaker is installed on the driver for earth leakage fault protection, select a model with a **sensitivity current of 200 mA or more** and an **operating time of 0.1 second or more** to prevent malfunction.
Use **fast- acting fuses**, with a rated current approximately **1.5 times the driver capacity**.

1.7 Selection of Regenerative Resistor

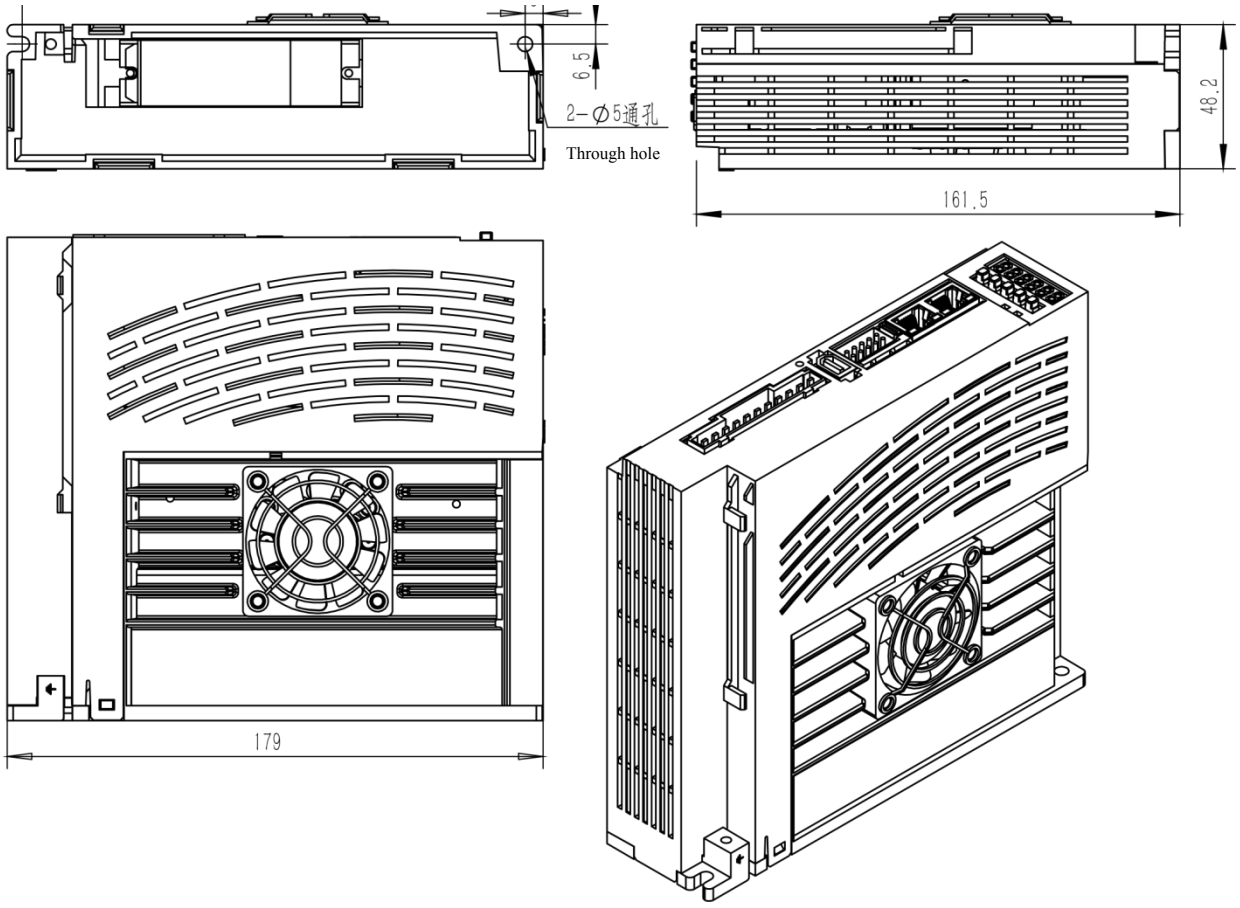
Servo Drive Model	**Built-in Brake Resistor Specifications**		**Minimum Allowable Resistance Value (Ω)**	**Maximum Braking Energy Absorbable by Capacitor (J)**
	Resistance Value (Ω)	Capacity (W)		
Single-phase 220V EX	–	–	30	18
	–	–	30	26

Note: Some models are not equipped with a built-in brake resistor. If you need to use this function, please configure an external brake resistor by yourself. For the power selection of the external brake resistor, please consult our technical support.

Series	Model
EX Ether CAT	EX-15L
	EX-20L
	EX-30L

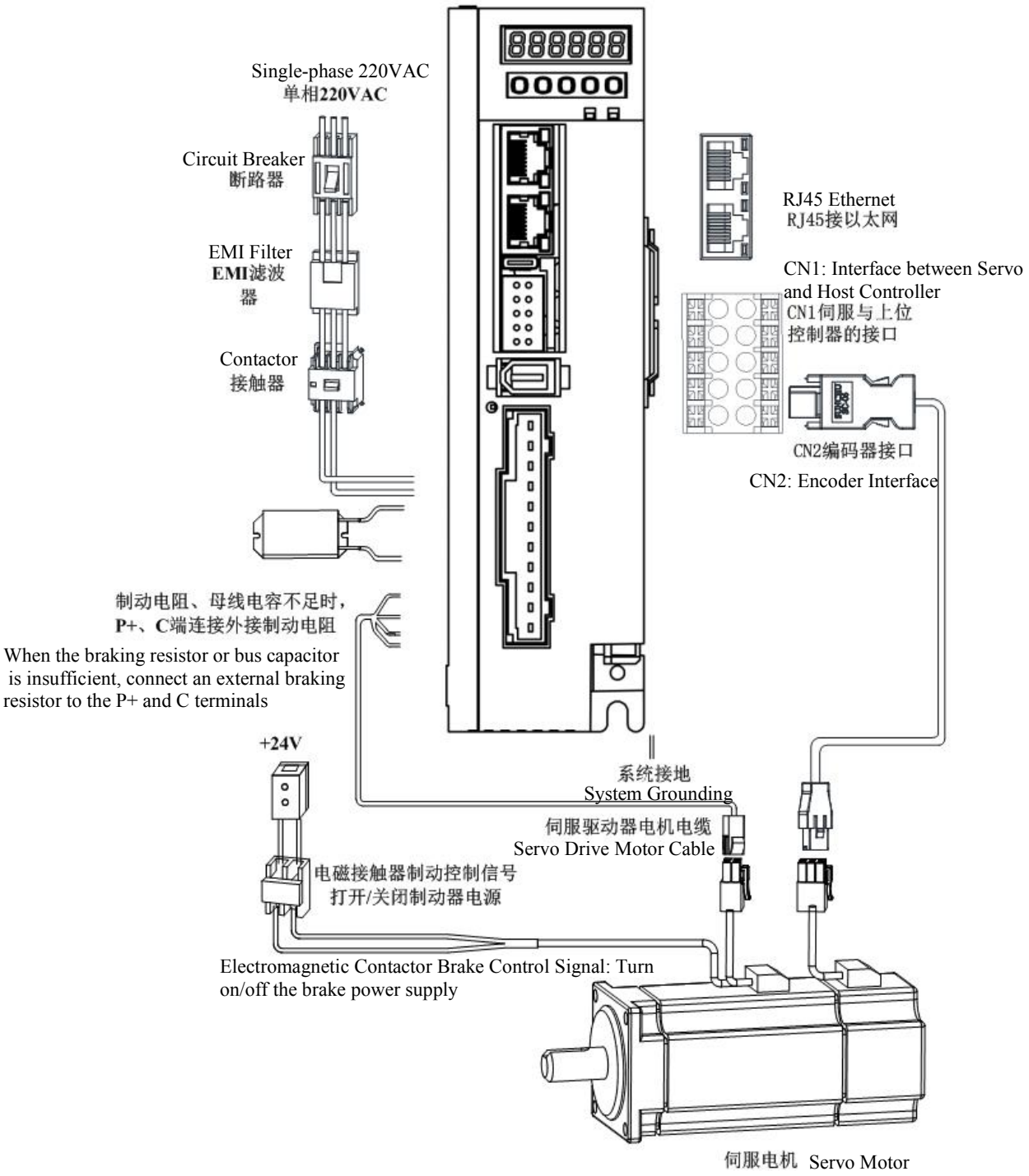
1.8 Outline and Mounting Dimensions of Servo Drive (Unit: mm)

Type A:



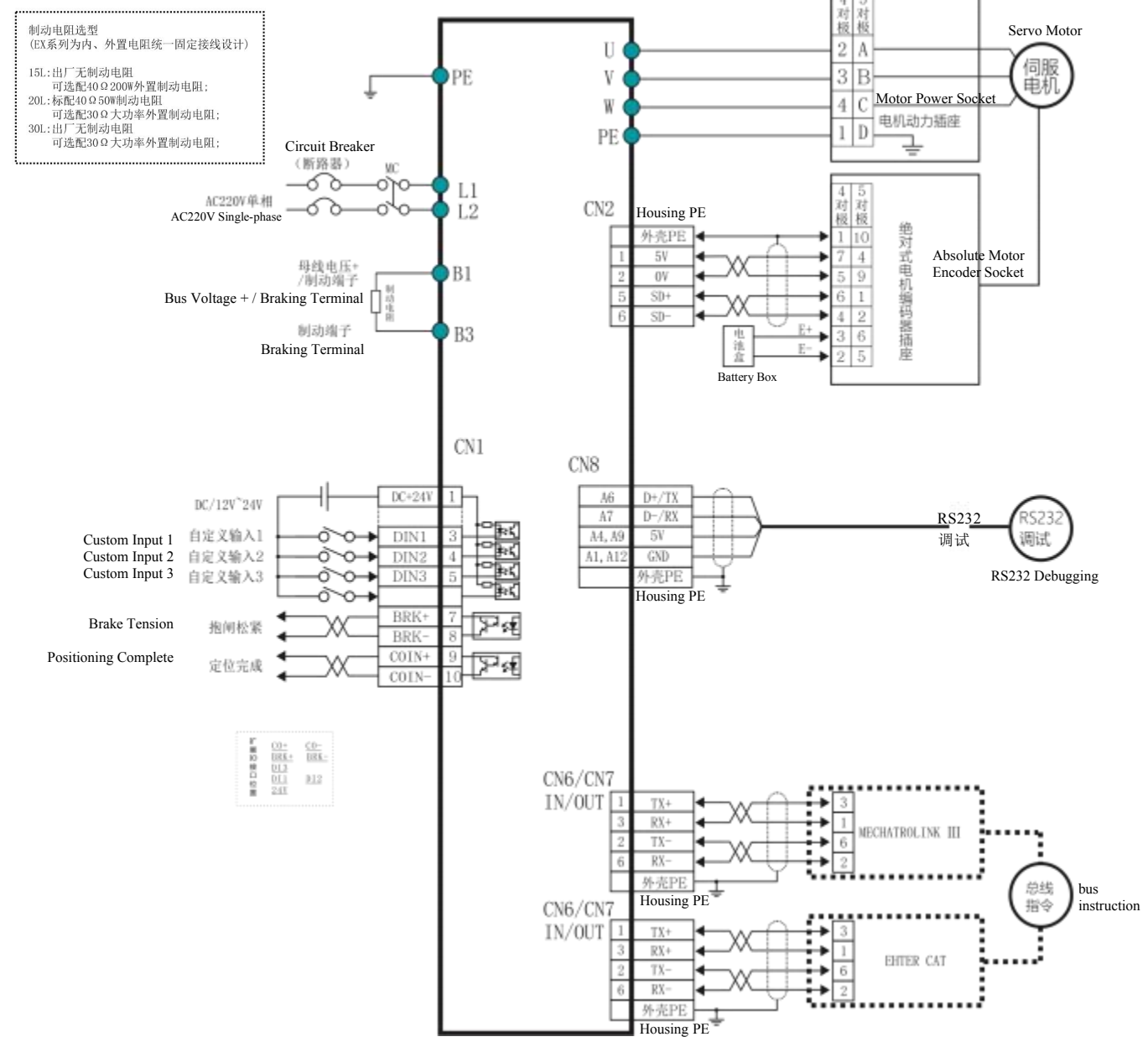
Chapter 2 System Structure and Wiring

2.1 General Assembly Drawing

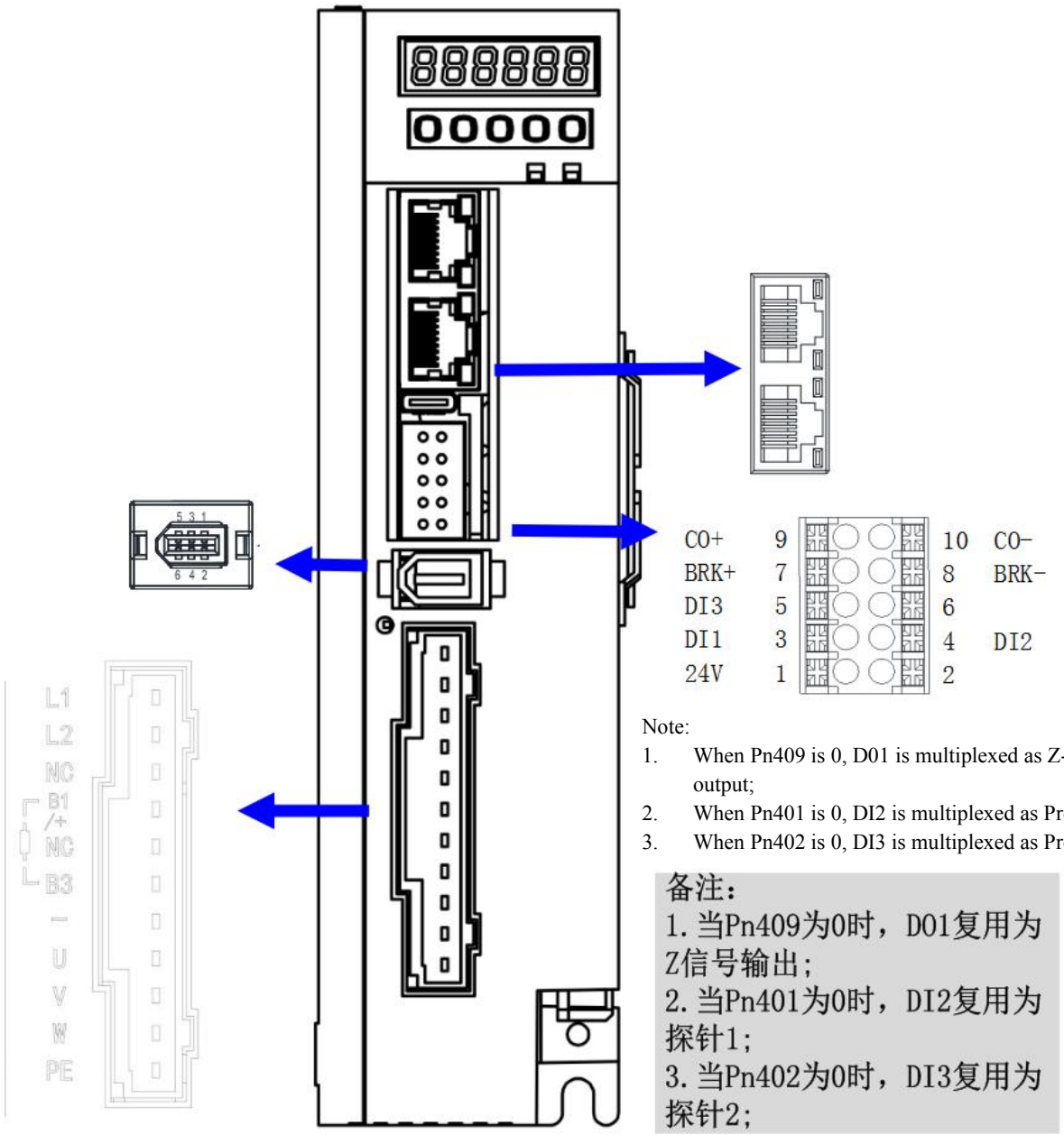


Braking Resistor Selection
（EX series is designed for unified wiring of internal and external resistors）

15L: No factory-installed braking resistor
Optional 40Ω external braking resistor
20L: Standard 40Ω 50W braking resistor
Optional 40Ω high-power external braking resistor
30L: No factory-installed braking resistor
Optional 40Ω high-power external braking resistor



2.2 Pin Assignment Diagram



Note:

1. When Pn409 is 0, D01 is multiplexed as Z-signal output;
2. When Pn401 is 0, DI2 is multiplexed as Probe 1;
3. When Pn402 is 0, DI3 is multiplexed as Probe 2;

备注：
1.当Pn409为0时，DO1复用为Z信号输出；
2.当Pn401为0时，DI2复用为探针1；
3.当Pn402为0时，DI3复用为探针2；

Main circuit wiring

- Wiring shall be performed by a professional electrical engineer.
- Do not connect power before wiring is completed to avoid electric shock hazards.

2.2.1 Main Circuit Wiring Points

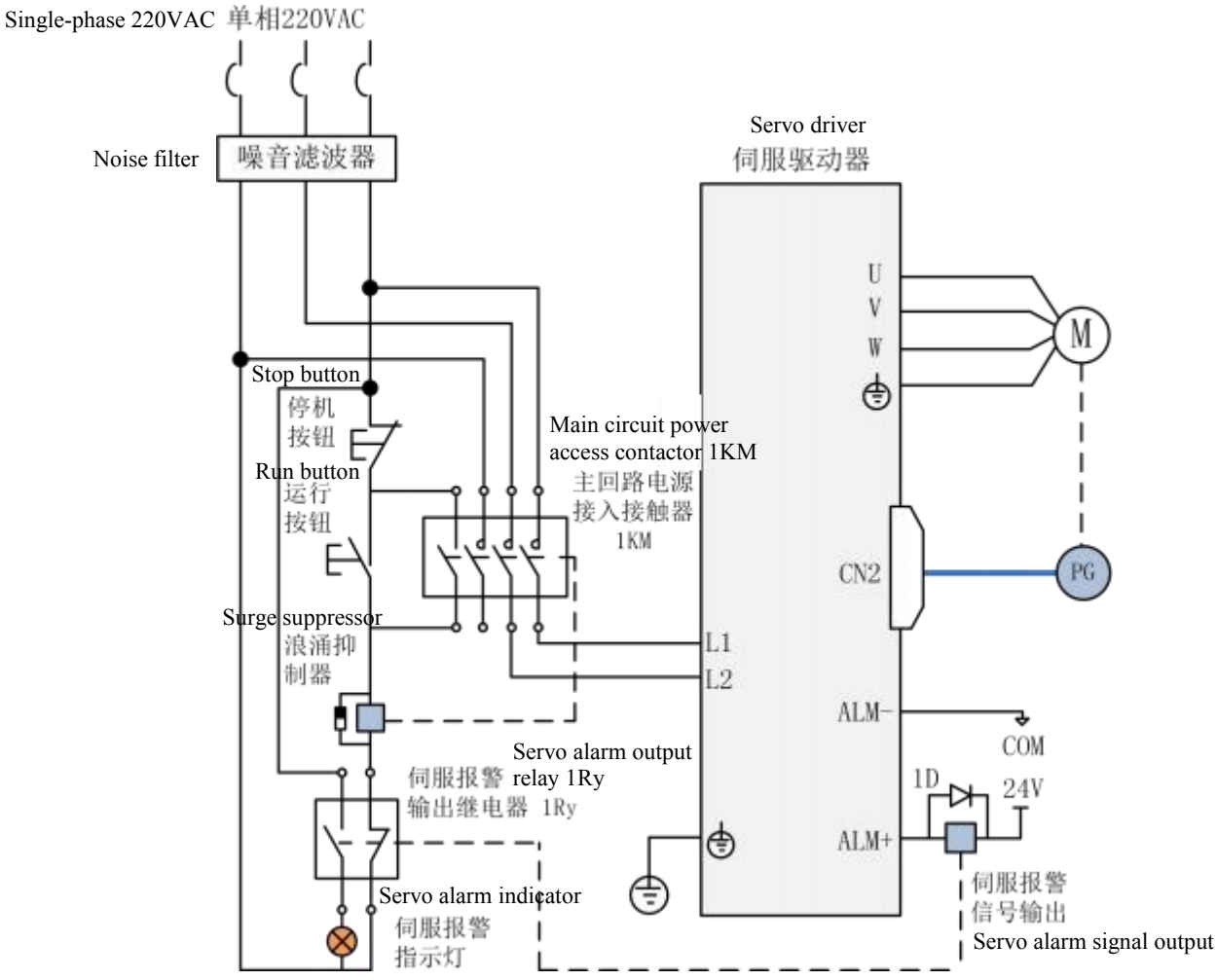
- Check the power supply specifications against the nameplate on the driver.
- Install a circuit breaker or residual current circuit breaker (for protecting the power supply circuit, which cuts off the circuit in case of overcurrent).
- Install a noise filter (prevents external noise from entering the power supply circuit and reduces noise interference from the driver).
- Install an AC contactor (switches the main power supply of the driver on/off; shall be used together with a surge absorber). Do NOT use the AC contactor for motor run/stop operations.
- Install an AC reactor (reduces high-harmonic current in the power supply).
- Use insulated crimp terminals for terminal wiring, and select appropriate cable size and crimp terminal dimensions

2.2.2 Main Circuit Terminal Definition

Terminal View	Terminal Marking	Signal Name	Description

	L1、L2	Main Circuit Power Input Terminal	Main circuit single-phase 220V power input
	B1、B3	Brake Resistor Connection Terminal	Connect an external brake resistor between B1 and B3.
	U、V、W	Servo Motor Connectio n Terminal	Servo motor connection terminals, connected to U, V, W phases of the motor.
	PE	Grounding	Two grounding terminals, connected to the power supply grounding terminal and the motor grounding terminal.Be sure to ground the entire system.

2.2.3 Main Power Wiring Method



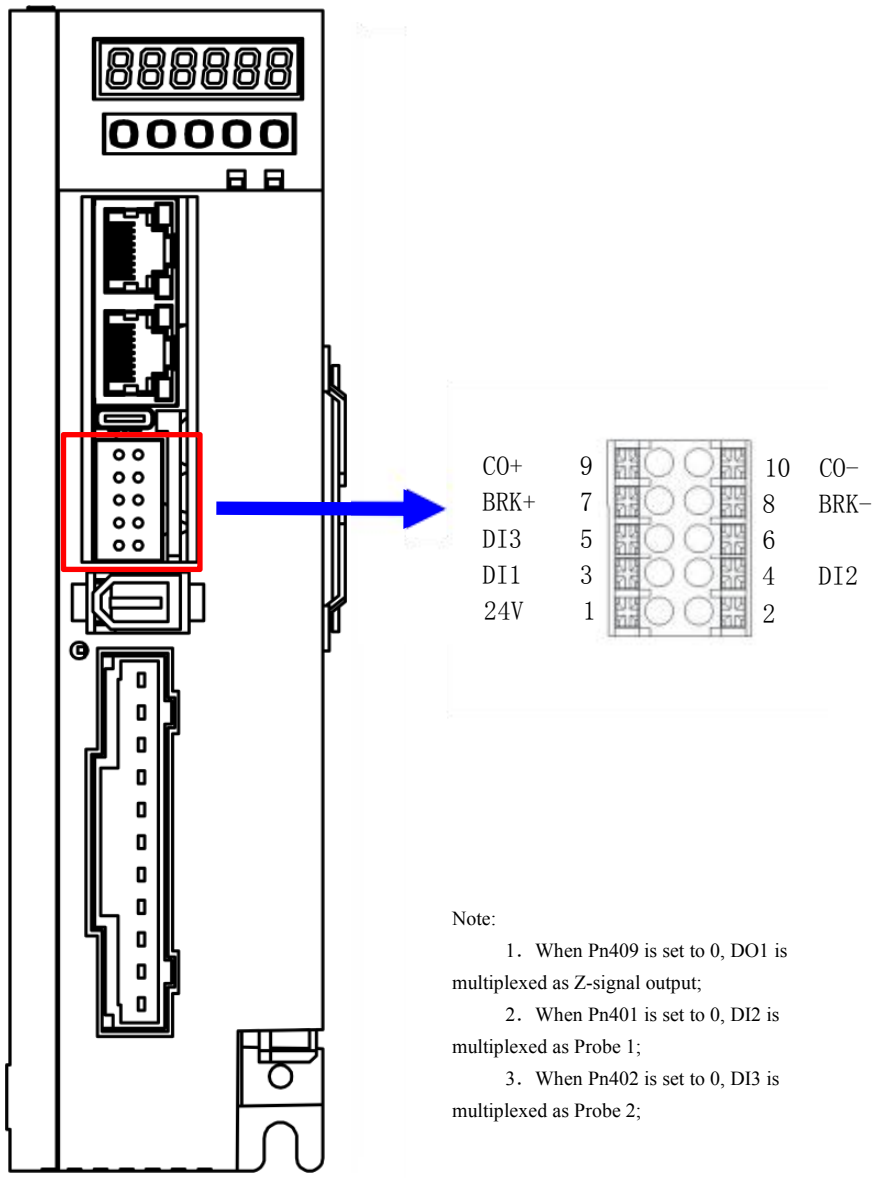
Note 1: Correspondence table between power input type and drive model:

Power input type	Drive model	Remarks

Single-phase 220VAC	EX-16L	
	EX-20L	
	EX-30L	

2.3 Connector Definition

2.3.1 Connector Definition for CN1 Port



Note:

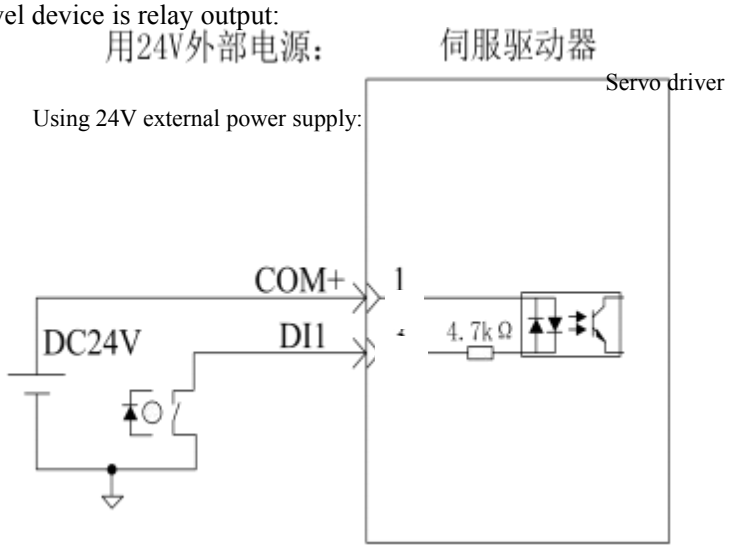
1. When Pn409 is set to 0, DO1 is multiplexed as Z-signal output;
2. When Pn401 is set to 0, DI2 is multiplexed as Probe 1;
3. When Pn402 is set to 0, DI3 is multiplexed as Probe 2;

Pin No.	Signal Name	Function	Pin No.	Signal Name	Function
1	COM+	External 24V power input	7	External digital input 2+	Digital output
2			8	External digital output 2−	Digital output
3	External digital input 1	Digital input	9	External digital output 4+	Digital output
4	External digital input 2	Digital input	10	External digital output 4−	Digital output
5	External digital input 3	Digital input			
6					

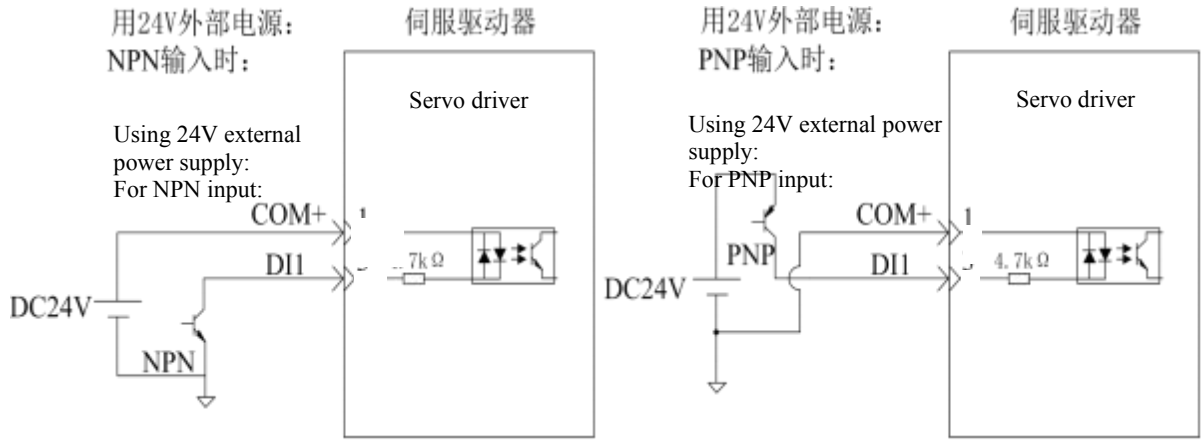
2.3.1.1 General Input Terminal Wiring Method

Take external digital input 1 as an example. The interface circuits for external digital input 1 to external digital input 4 are identical.

1）When the upper-level device is relay output:



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

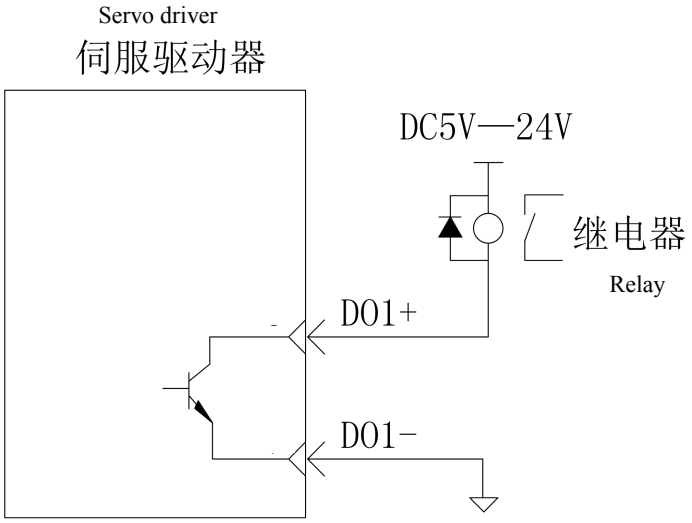


Note: ■ PNP and NPN input mixed use is not supported.

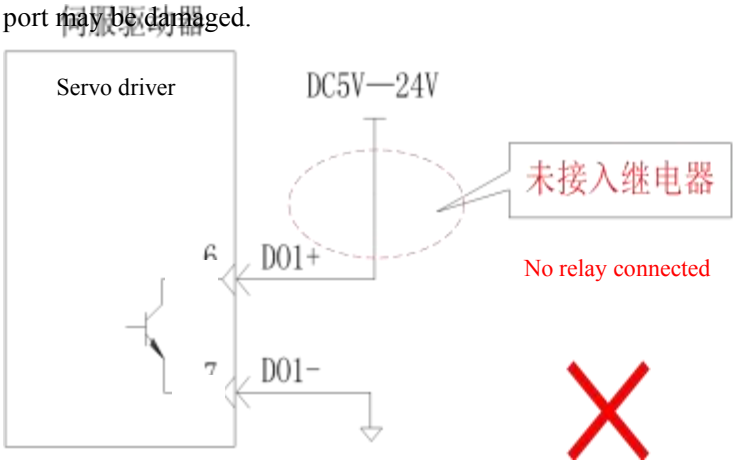
2.3.1.2 General Output Terminal Wiring Method

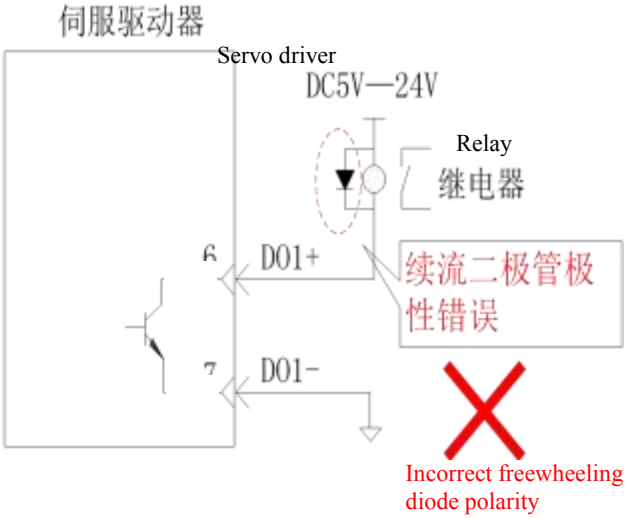
Take external digital output 1 as an example.The interface circuits for external digital output 1 to external digital output 2 are identical.

When the upper-level device is relay input:

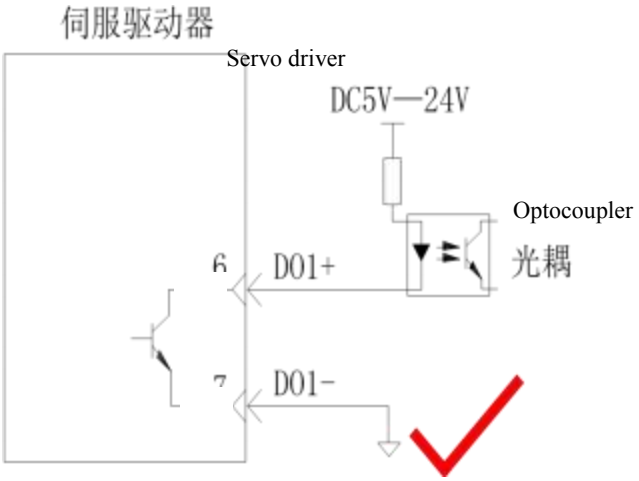

Servo driver
伺服驱动器
DC5V—24V
继电器
Relay
DO1+
DO1-

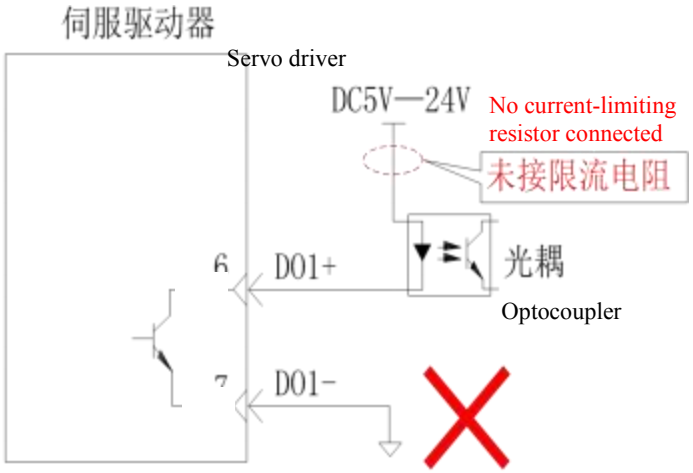
Note: ■When the upper-level device is relay input, be sure to connect a freewheeling diode, otherwise the external digital output port may be damaged.





当上级装置为光耦输入时：



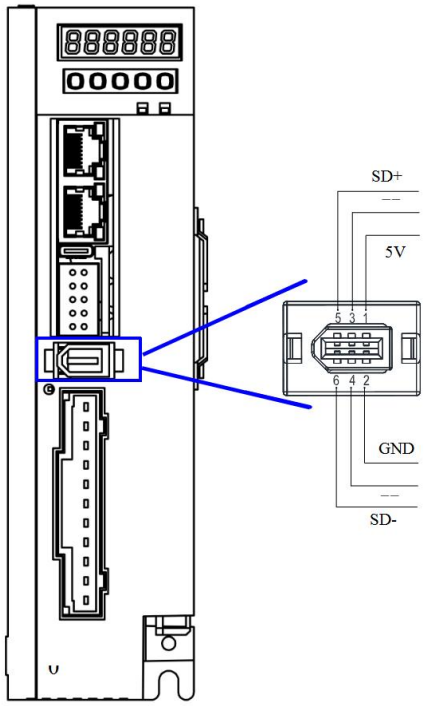


The maximum allowable voltage and current capacity of the optocoupler output circuit inside the servo driver are as follows:

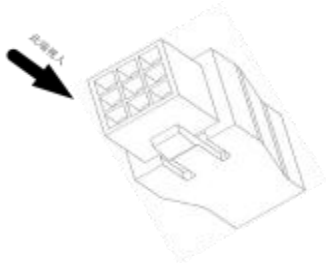
Voltage: DC30V (max.)

Current: DC50mA (max.)

2.3.2 Connection Method between Servo Driver Output and Motor Cable



2.3.2.1 Encoder Cable Connection at Servo Motor Side

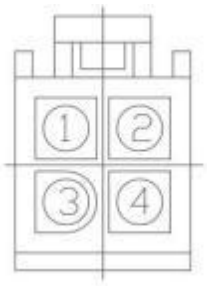
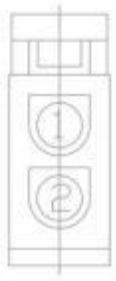
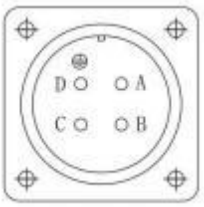
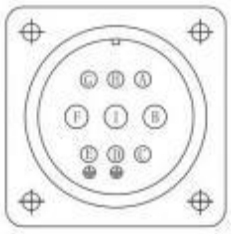
<table>
<tr><th>Encoder type</th><th>Connector outline drawing</th><th>Terminal pin distribution</th><th>Adapt to the motor frame size</th></tr>
<tr><td rowspan="2">17/23-bit serial encoder</td><td>  </td><td> 
<table>
<tr><th>Pin number</th><th>Signal Name</th></tr>
<tr><td>7</td><td>+5V</td></tr>
<tr><td>8</td><td>GND</td></tr>
<tr><td>4</td><td>SD+</td></tr>
<tr><td>5</td><td>SD-</td></tr>
<tr><td>3</td><td>PE</td></tr>
</table></td><td>40
60
80
90</td></tr>
<tr><td>  </td><td> 
<table>
<tr><th>Pin number</th><th>Signal Name</th></tr>
<tr><td>7</td><td>+5V</td></tr>
<tr><td>5</td><td>GND</td></tr>
<tr><td>6</td><td>SD+</td></tr>
<tr><td>4</td><td>SD-</td></tr>
<tr><td>1</td><td>PE</td></tr>
</table></td><td>110
130
180
200</td></tr>
</table>

Note：

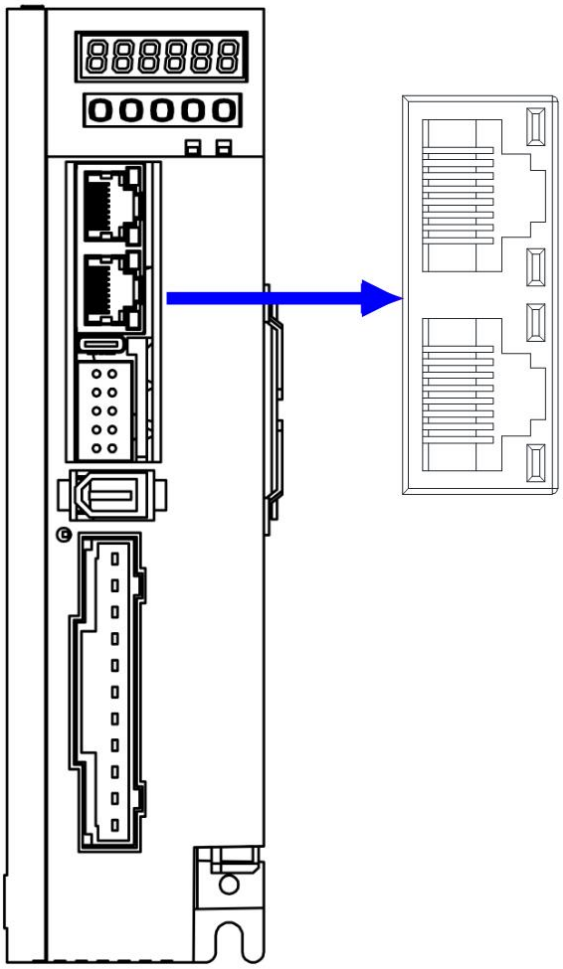
1. It is recommended to use shielded twisted pair for encoder cables. Each signal wire should have a diameter of 0.2mm² or larger, with more than 18 strands of copper wire, and the shield should be grounded at a single point;
2. The minimum distance between the encoder cable and the motor power supply is recommended to be more than 30cm;
3. The length of the encoder cable should be less than 20m. If it exceeds 20m, please contact the manufacturer or agent.

4. When using a 17/23bit encoder, if the wire length is less than 5 meters, a cable with a cross-sectional area of 0.2mm² should be used. If it exceeds 5 meters, the cross-sectional area of the wire core should be increased by 0.05mm² for each additional meter.

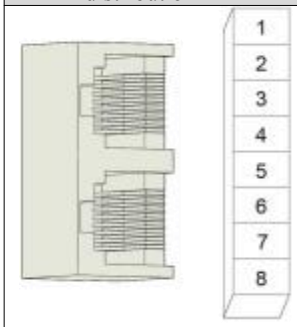
2.3.3 Connection Method between Servo Driver Output and Motor Cable

Terminal Diagram	Item	Description						Applicable Motor Model
	Label	1	2	3	4			40, 60, 80 Flange
	Usage	U Phase	V Phase	W Phase	Ground			
	Label	1	2					40, 60, 80 Flange
	Usage	Brake	Brake					
	Label	A	B	C	D			110, 130 Flange 110, 130 Flange
	Usage	U Phase	V Phase	W Phase	Ground			
	Label	F	I	B	D/E	H	G	
	Usage	U Phase	V Phase	W Phase	Ground	Brake	Brake	

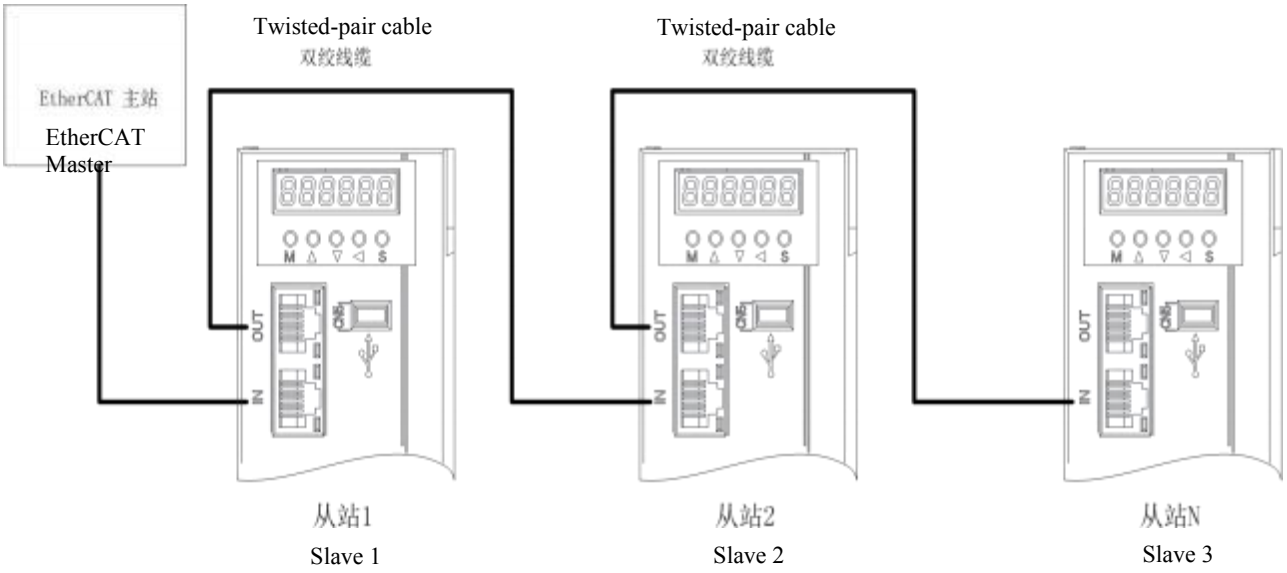
2.3.4 Ethernet Communication Signal Terminal Wiring



Communication Signal Connector Wiring Table

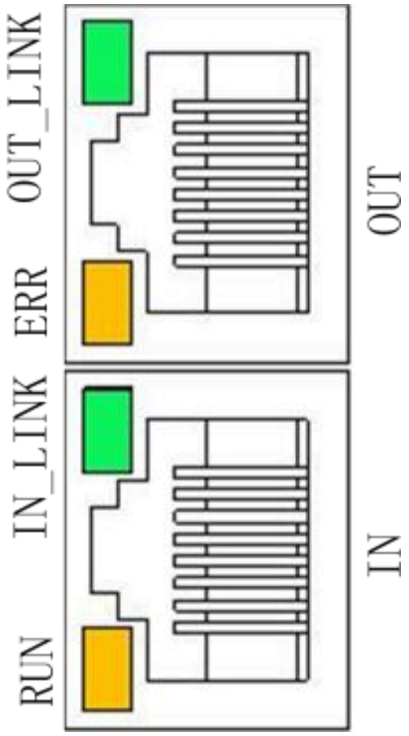
Terminal pin distribution	Serial number	definition	Function
	1	TX+	Data transmission+
	2	TX-	Data transmission—
	3	RX+	Data reception+
	4	—	Unused
	5	—	
	6	RX-	Data reception—
	7	—	Unused
	8	—	
	shell	FG	Shell protective ground

This is the connector for the EtherCAT port.The interface cable of the master station is connected to **IN**,and **OUT** is connected to the next slave device.



Status Indicator

The following figure shows the definition of each LED indicator on the RJ45 terminal:



IN_LINK and OUT_LINK indicators

IN_LINK or OUT_LINK	**Indication Status**
Off	Communication not connected
Blinking	Communication connected and active
On (steady)	Communication connected but not active

RUN Indicator

RUN Indicator	**Indication Status**
Off	State machine INIT
Fast blinking (interval 0.2s)	State machine Pre-Operational

Slow blinking (interval 1s)	State machine Safe-Operational
On (steady)	State machine Operational

ERR Indicator

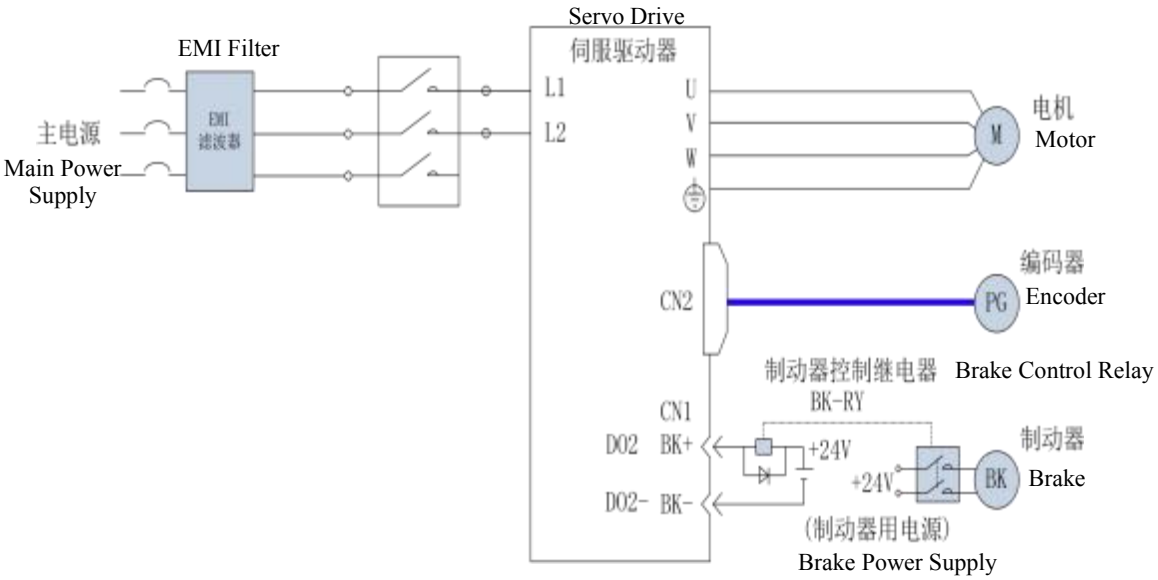
ERR Indicator	Indication Status
Off	Bus communication normal
Fast blinking (interval 0.2s)	State machine transition cannot be completed
Slow blinking (interval 1s)	Synchronization fault
On (steady)	PDO monitoring timeout

2.4 Holding Brake Wiring

When the motor is used to drive a vertical axis or in similar scenarios, a motor with a built-in holding brake must be adopted to prevent moving components from shifting due to gravity in the event of a power outage.

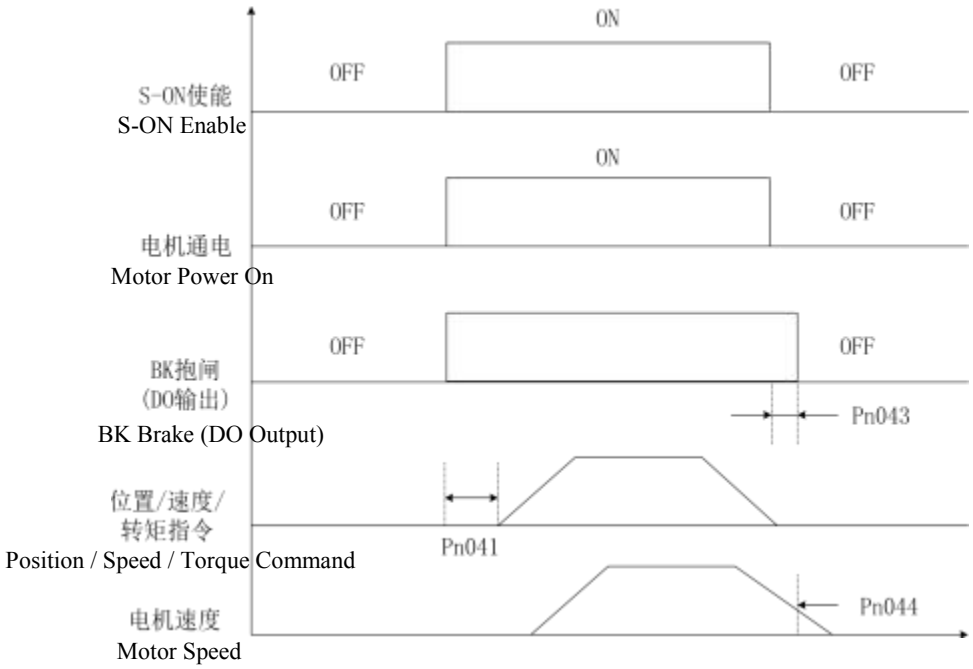
■ The built-in holding brake of the motor is exclusively designed to maintain the stopped state and must not be used to stop motor operation.
■ The brake coil has no polarity.
■ During the operation of a motor with a built-in brake, a clicking sound may be emitted from the brake, which does not affect its normal function.
■ When the brake coil is energized (brake released state), magnetic flux leakage may occur at the shaft end and other parts. Please exercise caution when using magnetic sensors and similar instruments near the motor.

1. Holding Brake Wiring ExampleThe connection of the holding brake input signal has no polarity, and the user is required to prepare a 24V power supply. The standard wiring example for the brake signal /BK and the brake power supply is shown as follows:



2) Precautions for Holding Brake Wiring:

a) The cable length on the motor safety brake side must fully account for the voltage drop caused by cable resistance. The brake operation requires an input voltage of at least 21.6V.
b) It is best not to share the power supply with other electrical devices to prevent the brake from malfunctioning due to reduced voltage or current caused by the operation of other devices.
c) Cables with a cross-sectional area of 0.5mm² or above are recommended.

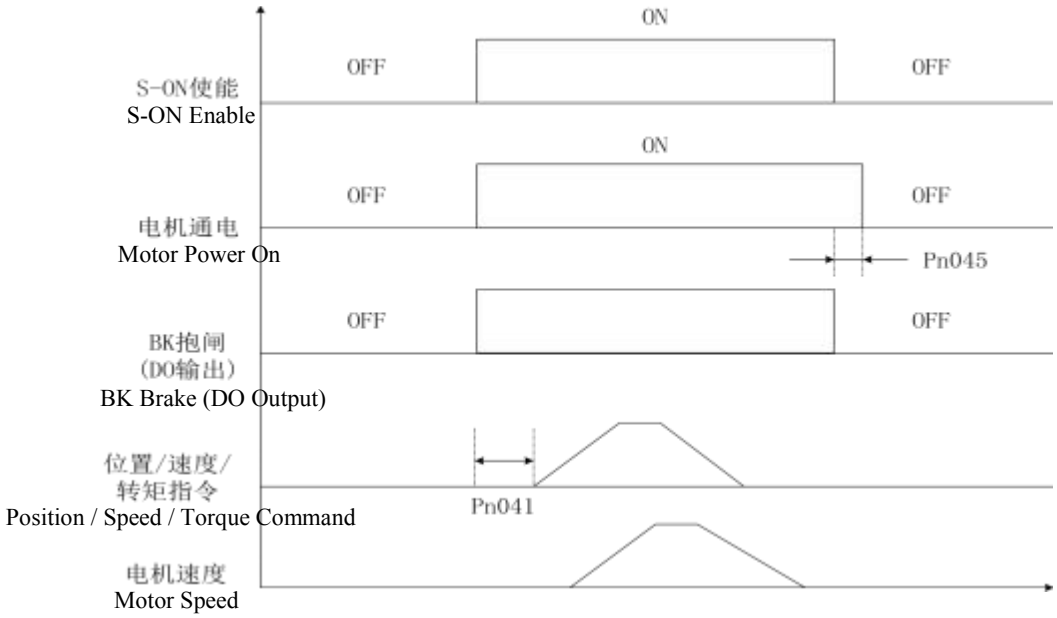


3) Motor movement when Servo is OFF

BK Brake Output Timing Specification:

- After Servo ON is activated, send commands to the servo drive only after the interval set by Pn041; otherwise, the drive will not respond.
- After Servo OFF, when the time set by Pn043 has elapsed or the motor speed falls below the speed set by Pn044, BK output turns OFF (brake engaged, motor stops moving).

4) Motor Standstill When Servo is OFF



BK Brake Output Timing Description:

■ After Servo ON is activated, send commands to the servo drive only after the interval set by Pn041; otherwise, the drive will not respond.

■ After Servo OFF, the brake signal is issued immediately, and the motor remains powered for the duration set by Pn045 to prevent the load from sliding under gravity.

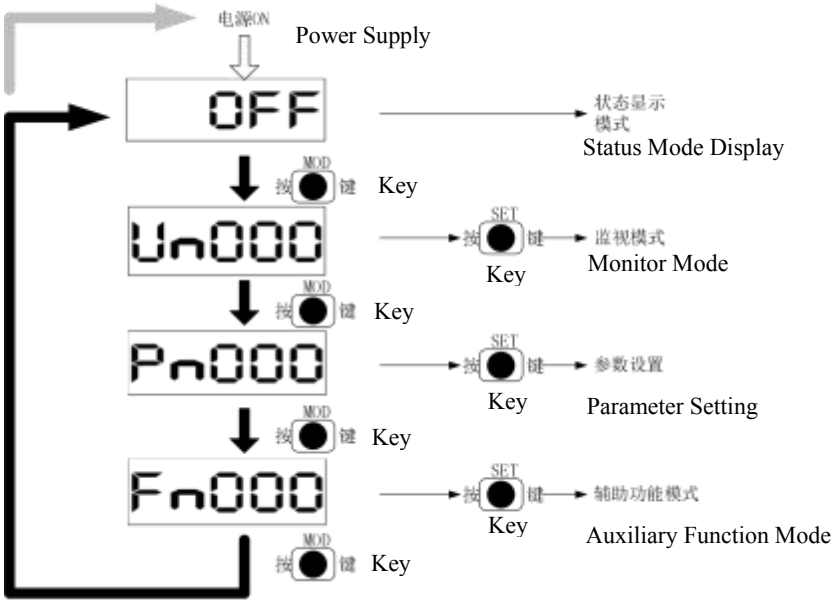
Chapter 3 Panel Operation

3.1 Panel Operator

The panel operator consists of a display section and keys. It can be used to display status, execute auxiliary functions, set parameters, and monitor the operation of the servo drive.The names and functions of the panel operator keys are shown below.

Key	Function & Description
M	Switches between different modes or acts as a cancel button to exit layer by layer
▲	Increases the value at the current cursor position
▼	Decreases the value at the current cursor position
◄	Shifts the cursor to move its position
S	Enters the parameter or display menu, equivalent to ENTER

3.2 Mode Switching



3.3 Initialization Mode

After power-on, 88888 is displayed, and the system automatically enters the status monitor mode after 1 second.

3.4 Status Monitor

Bit Data 位数据 缩略符号 Abbreviation Symbol

缩略符号 Abbreviation Symbol	意义 Meaning
0FF	表示伺服OFF状态 Indicates servo OFF status
ndc	表示伺服母线电压不足，请检查母线电路 Indicates insufficient servo bus voltage; please check the bus circuit
run	表示伺服处于使能运行状态 Indicates servo is in enabled running state
pot	禁止正转驱动 Prohibit forward drive
not	禁止反向驱动 Prohibit reverse drive

显示 Display	意义 Meaning
8.8	电机保持继电器输出无效（制动器闭合，抱闸）时，亮灯； 电机保持继电器输出有效（制动器释放，松闸）时，熄灭； Lights up when the motor hold relay output is inactive (brake engaged); Turns off when the motor hold relay output is active (brake released);
8.8.	制动单元放电时，亮灯； 制动单元不放电时，熄灭 Lights up when the brake Unit is discharging; Turns off when the brake Unit is not discharging
-8 8	位置控制模式时，位置指令和电机实际位置的偏差在规定范围内时亮灯，否则熄灭； 速度控制模式时，速度指令与电机实际速度的偏差在规定范围内时亮灯，否则熄灭； 转矩控制模式时，始终亮灯 In position control mode: lights up when the deviation between position command and actual motor position is within the specified range, otherwise turns off; In speed control mode: lights up when the deviation between speed command and actual motor speed is within the specified range, otherwise turns off; In torque control mode: always lights up
-8 8	伺服**ON**时熄灭； 伺服**OFF**时亮灯 Turns off when servo is ON; Lights up when servo is OFF
8 8-	伺服旋转显示，速度高于规定值时亮灯，低于规定值时熄灭 Servo rotation indicator: lights up when speed is above the specified value, turns off when below
8 8-	位置控制模式时，中间和下方两行指示灯均熄灭； 速度控制模式时，中间指示灯亮灯； 转矩控制模式时，下方指示灯亮灯； In position control mode: both middle and bottom indicator lines are off; In speed control mode: middle indicator line is on; In torque control mode: bottom indicator line is on:

3.5 Parameter Monitor

In monitor mode, this function can monitor (display) the command values set in the servo drive, the status of input/output signals, and the internal status of the servo drive.
Numbers starting with Un are displayed on the panel operator.

3.5.1 Display Content

For display contents in monitor mode, refer to Chapter 8.1.The operation method of monitor display is explained below using motor speed (Un000) as an example.

Step	Panel Display After Operation	Keys Used	Operation
1	Un000	MOD	Press the MOD key to select auxiliary function
2	Un000	▲▼	If the parameter number displayed is not Un000, use the ▲▼ keys to adjust to Un000
3	-1500	SET	Press the SET key to enter the monitor interface. The display shows the motor speed as -1500 rpm (as shown in the left figure)
4	Un000	MOD	Press the SET or MOD key to return to the display in Step 1
5	—	—	Operation completed

3.6 Parameter Mode

3.6.1 Related Description

Set the parameters of the servo drive.Numbers starting with **Pn** are displayed on the panel operator.After pressing the parameter setting key, whether the current parameter takes effect immediately and what is displayed on the third level depend on the parameter attributes.

Parameter Attribute	Display after SET key	Effect Description
○	-End-	Can be set at any time and takes effect immediately
●	rESta	If the value is different from before: can be set at any time and takes effect after power cycling

3.6.2 Operation Example for Parameter Setting (Pn027)

The operation method for modifying parameters is explained using maximum speed Pn027 as an example.Change the maximum speed value from 3000 to 2000.

Step	Panel Display After Operation	Keys Used	Operation
1	Pn000	MOD	Press the MOD key to select parameter setting mode
2	Pn027	▲▼◄◄	Press the "▲", "▼", "◄◄" keys to display "Pn027"
3	3000	SET	Press the SET key to display "3000"
4	2000	▲▼◄◄	Use the "▲", "▼", "◄◄" keys in combination to shift and increment/decrement to display "2000"

Step	Panel Display After Operation	Keys Used	Operation
5	Pn027	SET	Press the SET key to return to "Pn027"
6	—	—	Operation completed

3.7 Auxiliary Function

Numbers starting with Fn are displayed on the panel operator.The auxiliary function is used to perform functions related to the setting and adjustment of the servo drive.

3.7.1 Operation Example of Auxiliary Function Fn000

The usage of the auxiliary function is explained below by taking servo soft reset Fn006 as an example.

Step	Panel Display After Operation	Keys Used	Operation
1	Fn000	MOD	Press the MOD key to select auxiliary function
2	Fn006	▲▼◄◄	Press the "▲", "▼", "◄◄" keys to display "Fn006"
3	0	SET	Press the SET key to display "0"
4	rESEt	▲	Use the "▲" key to display "rESEt"
5	88888	SET	Press the SET key to restart the system and return to the main restart interface "88888"
6	—	—	Operation completed

Chapter 4 Trial Operation

4.1 Inspection and Precautions Before Trial Operation

To ensure safe and correct trial operation, inspect and confirm the following items in advance.

Item	Content
Servo Motor	Is the motor disconnected from the load?
	Are the wiring and connections correct?
	Are there any loose fasteners?
	For servo motors with holding brakes, has the brake been released in advance? When releasing the brake, apply the specified voltage (DC24V or DC90V) to it.
Servo Drive	Are the wiring and connections correct?
	Is the power supply voltage to the servo drive normal?

4.2 JOG Operation via Panel Operator

The operation steps for JOG operation via the panel operator are explained below.JOG operation is a function to confirm the servo motor operation through speed control without connecting an upper-level controller.The overtravel prevention function is disabled during JOG operation.The operating range of the machine used must be taken into account during operation.

4.3 Items to Be Set Before Operation

To perform JOG operation, the following settings must be made in advance.When the S-ON input signal is ON, switch it to OFF.Set the JOG speed via Pn512.

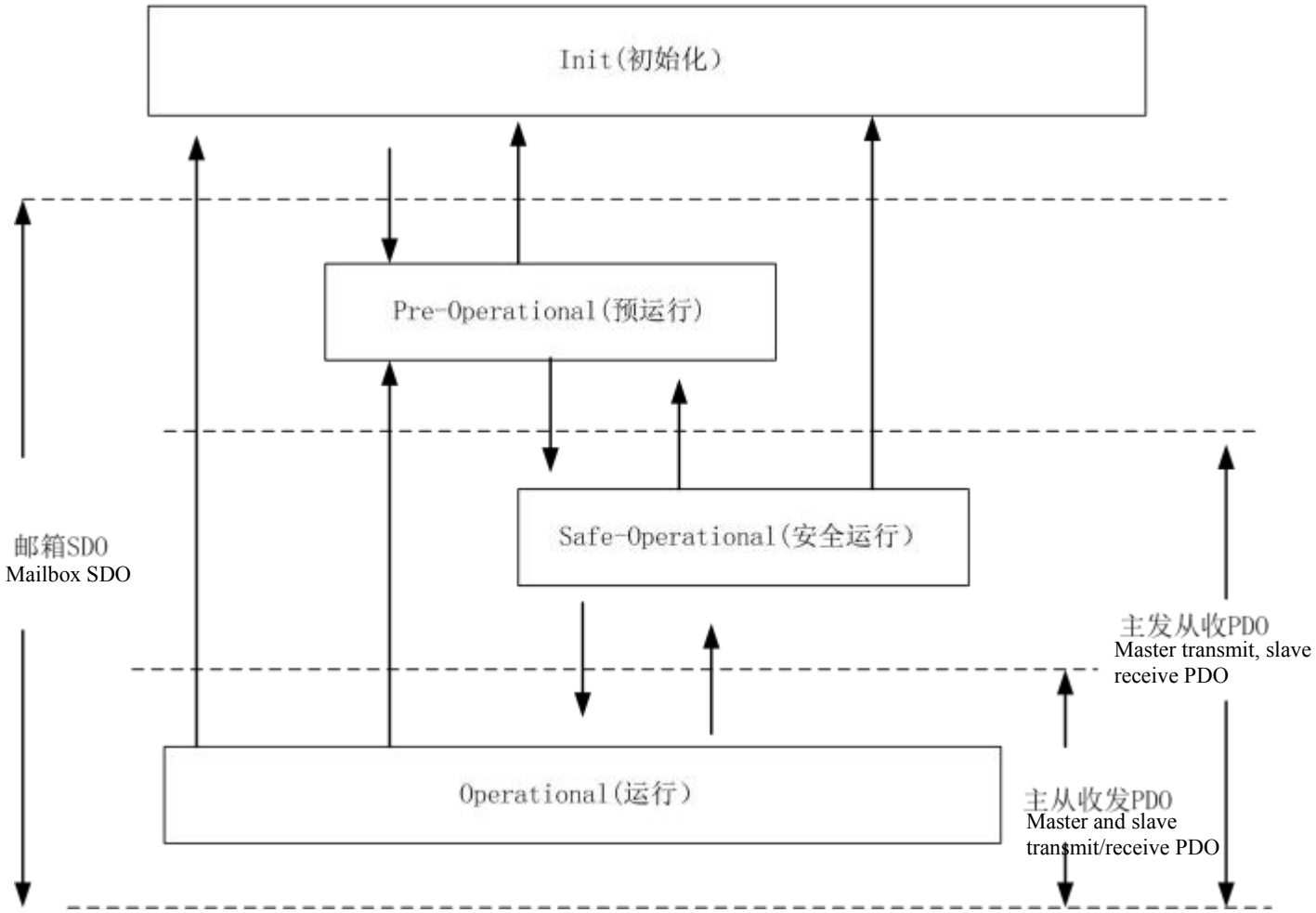
4.4 Operation Procedure

Step	Panel Display After Operation	Keys Used	Operation
1	Fn000	MOD	Press the MOD key to select the auxiliary function
2	Fn001	▲▼◄◄	Press the "▲", "▼", "◄◄" keys to display "Fn001"
3	Jog	SET	Press the SET key to display "Jog", and the motor will be magnetized and wait for rotation commands
4	Jog	▲	Use the "▲" key to rotate the motor in the forward direction
5	Jog	▼	Use the "▼" key to rotate the motor in the reverse direction
6	Operation completed		

Chapter 5 EtherCAT Communication

5.1 Data Transmission

EtherCAT State Machine and COE Communication.



Communication Condition	State Machine State
No application layer communication; master can only read/write ESC registers	Init state
SDO mailbox communication	PreOP state
SDO mailbox communication	SafeOP state
SDO mailbox communication	OP state
Slave receives PDO, master sends PDO	SafeOP state
Slave receives PDO, master sends PDO	OP state
Master and slave transmit/receive PDO	OP state

5.2 Features of COE

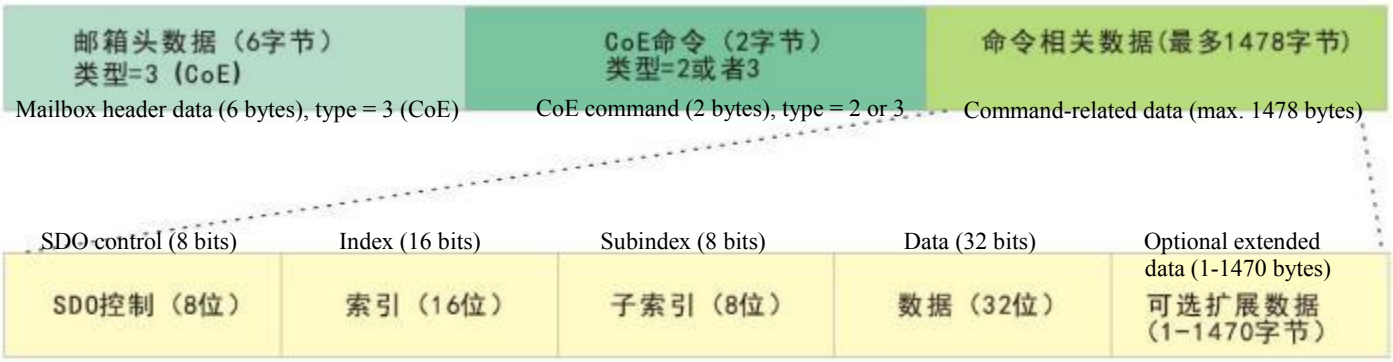
CANopen was originally an application layer protocol developed for systems based on the CAN (Control Area Network) bus.The EtherCAT protocol supports the CANopen protocol at the application layer with corresponding extensions. Its main functions are as follows:

- Access the CANopen object dictionary and its objects using mailbox communication to implement network initialization.
- Implement network management using CANopen emergency objects and optional time-driven PDO messages.
- Map process data using the object dictionary, and transmit command data and status data periodically.

5.3 SDO Frame

The EtherCAT master implements non-periodic data communication by reading and writing mailbox data through the SM channel.SDO mainly uses SM0 (master to slave) and SM1 (slave to master).

CoE communication service type 2 is SDO request, type 3 is SDO response service. The SDO data format is as follows:



SDO Mailbox Operation Format

- Quick Transmission Service: Same as the standard CANopen protocol. Only 8 bytes are used, transmitting up to 4 bytes of valid data.
- Normal Transmission Service: Uses more than 8 bytes and can transmit more than 4 bytes of valid data.
- Segmented Transmission Service: For data exceeding the mailbox capacity, transmission is performed in segments.

5.3.1 CoE Service Type Code

The CoE service type code is mainly used to indicate the current operation type during mailbox communication.

CoE Service Type Code

Data Element	**Description**
PDO Number	PDO number when PDO is transmitted
Type	0 Reserved 1 Emergency event 1 SDO request 2 SDO response 3 TxPDO 4 RxPDO 5 Remote TxPDO transmission reques t6 Remote RxPDO transmission request 7 SDO information 9-15 Reserved

CoE Command Code CCS

Request	**Response**	**Meaning**
0x00	0x01	Segmented download
0x01	0x03	Download
0x02	0x02	Upload
0x03	0x00	Segmented upload

5.3.2 SDO Request Format

SDO Request Data Description

Data Area	Bytes	Bits	Name	Value and Description
Mailbox Header	2 bytes	16 bits	Length n	n ≥ 0x0a; Length of subsequent mailbox service data
	2 bytes	16 bits	Address	Master-to-slave communication: slave addressSlave-to-slave communication: data destination address
	1 byte	Bits 0-5	Channel	0x00 Reserved
		Bits 6-7	Priority	0x00 Lowest, 0x03 Highest
	1 byte	Bits 0-3	Type	0x03 (CoE)
		Bits 4-7	Reserved	0x00 Reserved
CoE Command	2 bytes	Bits 0-8	PDO Number	0x00
		Bits 9-11	Reserved	0x00
		Bits 12-15	Service Type	0x02 SDO
SDO Data	1 byte (Control Word)	Bit 0	Data Indication	0x00 No transmission byte count set0x01 Transmission byte count set
		Bit 1	Transfer Type	0x01 Expedited transfer0x00 Normal/segmented transfer
		Bits 2-3	Number of Transfer Bytes	4-x for expedited transfer (x is the value of bits 2-3)0 for normal/segmented transfer (invalid)
		Bit 4	Complete Operation	0x00 Operation determined by index and subindex0x01 Operate on complete data object; subindex should be 0 or 1
		Bits 5-7	CoE Command Code	0x01 Download request0x00 Segmented download request
	2 bytes	16 bits	Index	Data object index
	1 byte	8 bits	Subindex	Data object subindex
	4 bytes	32 bits	Data	Expedited transfer: DataNormal transfer: Valid data length
	n-10		Extended Data	Extended data for normal transfer; valid data transmitted

5.3.3 SDO Response Format

Data Area	Bytes	Bits	Name	Value and Description
Mailbox Header	2 bytes	16 bits	Length n	n ≥ 0x0a; Length of subsequent mailbox service data
	2 bytes	16 bits	Address	Master-to-slave communication: slave addressSlave-to-slave communication: data destination address
	1 byte	Bits 0-5	Channel	0x00 Reserved

Data Area	Bytes	Bits	Name	Value and Description
		Bits 6-7	Priority	0x00 Lowest, 0x03 Highest
	1 byte	Bits 0-3	Type	0x03 (CoE)
		Bits 4-7	Reserved	0x00 Reserved
CoE Command	2 bytes	Bits 0-8	PDO Number	0x00
		Bits 9-11	Reserved	0x00
		Bits 12-15	Service Type	0x03 SDO Response
Expedited and Normal Download Response SDO				
Expedited and Normal Download Response SDO Data	1 byte	Bit 0	Number Indication	0x00
		Bit 1	Transfer Type E	0x00
		Bits 2-3	Number of Transfers	0
		Bit 4	Complete Operation	Synchronous SDO request table
		Bits 5-7	CoE Command Code CCS	0x03 Download response0x01 Segmented download response
	2 bytes	16 bits	Index	Data object index
	1 byte	8 bits	Subindex	Operation parameter subindex
	4 bytes	32 bits	Reserved	Reserved
Segmented Download Response SDO				
Segmented Download Response SDO Data	1 byte	Bits 0-3	Reserved	0x00
		Bit 4	Toggle bit	Same as corresponding segmented download request
		Bits 5-7	CoE Command Code CCS	0x03 Download response
	7 bytes		Reserved	Reserved

5.3.4 Segmented Download Request

Data Area	Bytes	Bits	Name	Value and Description
Mailbox Header	2 bytes	16 bits	Length n	n ≥ 0x0a; Length of subsequent mailbox service data
	2 bytes	16 bits	Address	Master-to-slave communication: slave addressSlave-to-slave communication: data destination address
	1 byte	Bits 0-5	Channel	0x00 Reserved
		Bits 6-7	Priority	0x00 Lowest, 0x03 Highest
	1 byte	Bits 0-3	Type	0x03 (CoE)
		Bits 4-7	Reserved	0x00 Reserved
CoE Command	2 bytes	Bits 0-8	PDO Number	0x00
		Bits 9-11	Reserved	0x00
		Bits 12-15	Service Type	0x02 SDO Request
SDO Control Data	1 byte	Bit 0	More Segments	0x00 Yes 0x01 Last segment
		Bits 1-3	Segment Data Count	7-x, where x is the value represented by bits 1-3
		Bit 4	Toggle Bit	Toggles on each SDO download request, starting from 0x00gavc
		Bits 5-7	CoE Command Code	0x01 Download request 0x00 Segmented download request
	n-3		Data	Segmented transfer data

5.3.5 SDO Abort Transfer Request

Data Area	Bytes	Bits	Name	Value and Description
Mailbox Header	2 bytes	16 bits	Length n	n ≥ 0x0a; Length of subsequent mailbox service data
	2 bytes	16 bits	Address	Master-to-slave communication: slave addressSlave-to-slave communication: data destination address
	1 byte	Bits 0-5	Channel	0x00 Reserved
		Bits 6-7	Priority	0x00 Lowest, 0x03 Highest
	1 byte	Bits 0-3	Type	0x03 (CoE)
		Bits 4-7	Reserved	0x00 Reserved
CoE Command	2 bytes	Bits 0-8	PDO Number	0x00
		Bits 9-11	Reserved	0x00
		Bits 12-15	Service Type	0x02 SDO Request
SDO Data Area	1 byte	Bit 0	Number Indication	0x00
		Bit 1	Transfer Type	0x00
		Bits 2-3	Number of Transfers	0x00
		Bit 4	Reserved	
		Bits 5-7	CoE Command Code	0x04 Abort transfer
	2 bytes	16 bits		
	1 byte	8 bits		
	4 bytes	32 bits		

5.3.6 SDO Abort Transfer Code Table

No.	Code Value	Meaning
1	0x05030000	Toggle bit unchanged during segmented transfer
2	0x05040000	SDO transfer timeout
3	0x05040001	Invalid or unknown command code
4	0x05040005	Memory overflow
5	0x06010000	Operation on a specific object not supported
6	0x06010001	Reading a write-only data object
7	0x06030002	Writing to a read-only data object
8	0x06020000	Data object does not exist in the object dictionary
9	0x06040041	Data object cannot be mapped to PDO
10	0x06040042	Mapped data and length exceed PDO data length
11	0x06040043	Incompatible general parameters
12	0x06040047	Incompatible with device's internal general settings
13	0x06060000	Operation failed due to hardware error
14	0x06070010	Service parameter length mismatch
15	0x06070012	Service parameter length too long

No.	Code Value	Meaning
16	0x06070013	Service parameter length too short
17	0x06090011	Subindex does not exist
18	0x06090030	Write data value out of range during write operation
19	0x06090031	Write value too large
20	0x06090032	Write value too small
21	0x06090036	Maximum value less than minimum value
22	0x08000000	General error
23	0x08000020	Data cannot be transmitted or saved to application program
24	0x08000021	Data cannot be saved to application due to local control reasons
25	0x08000022	Data cannot be saved to application due to current device reasons
26	0x08000023	Object dictionary dynamic generation error

5.3.7 Emergency Event Frame

Data Area	Bytes	Bits	Name	Value and Description
Mailbox Header	2 bytes	16 bits	Length n	n ≥ 0x0a; Length of subsequent mailbox service data
	2 bytes	16 bits	Address	Master-to-slave communication: slave addressSlave-to-slave communication: data destination address
	1 byte	Bits 0-5	Channel	0x00 Reserved
		Bits 6-7	Priority	0x00 Lowest, 0x03 Highest
	1 byte	Bits 0-3	Type	0x03 (CoE)
		Bits 4-7	Reserved	0x00 Reserved
CoE Command	2 bytes	Bits 0-8	PDO Number	0x00
		Bits 9-11	Reserved	0x00
		Bits 12-15	Service Type	0x01 Emergency data
SDO Control Data	2 bytes	16 bits	Emergency Error Code	See SDO Abort Transfer Code Table
	1 byte	8 bits	Error Register	Mapped to data object 0x1001
	5 bytes	40 bits	Data	Manufacturer-defined error information

5.4 PDO Frame

PDO data transmission uses SM3 (master to slave) and SM4 (slave to master).

RPDO mapping index: 0x1600 to 0x1603

TPDO mapping index: 0x1A00 to 0x1A03

5.5 Control Word 6040h

Index	Name	Control Word			Data Structure	VAR	Data Type	Uint16
6040h	Accessibility	RW	Mappable	YES	Data Range	0~65535	Factory Settings	0

Set Control Command:

bit	Name	Description
0	Servo Ready	0 - Inactive 1 - Active
1	Main Circuit Power On	0 - Inactive 1 - Active
2	Quick Stop	0 - Active 1 - Inactive
3	Servo Operation	0 - Inactive 1 - Active
4~6	-	Related to each servo operation mode
7	Fault Reset	For resettable faults and warnings, execute the fault reset function. ■ Rising edge of bit7 is active. ■ If bit7 is held at 1, all other control commands are inactive.
8	Pause	Not supported
9~10	NA	Reserved
12	Clear Multi-turn and All Encoder Faults	0: Inactive 1: Active
13	Clear All Faults	0: Inactive 1: Active
14~15	Manufacturer Custom	Reserved, undefined

Note:

- Assigning a value to each individual bit of the control word is meaningless; it must be combined with other bits to form a specific control command.
- Bits 0 to 3 and bit 7 have the same meaning in all servo modes. Commands must be sent in sequence to guide the servo drive into the pre-planned state according to the CiA402 state machine switching process, with each command corresponding to a definite state.
- Bits 4 to 6 are related to each servo mode (please refer to the control commands under different modes).

5.6 Status Word 6041h

Index	Name	Control Word			Data Structure	VAR	Data Type	Uint16
6041h	Accessibility	RO	Mappable	YES	Data Range	0~65535	Factory Settings	-

Reflect servo status:

bit	Name	Description
0	No Servo Fault	-
1	Waiting to Enable Servo	-
2	Servo Running	-

3	Fault	-
4	Main Circuit Power On	-
5	Quick Stop	-
6	Servo Ready	-
7	Warning	-
8	Manufacturer Custom	Reserved, undefined
9	Remote Control	0 - Non-CANopen mode 1 - CANopen remote control mode
10	Target Reached	0 - Target position or speed not reached 1 - Target position or speed reached
11	Software Internal Position Limit Exceeded	0 - Position command or feedback does not reach software internal position limit 1 - Position command or feedback reaches software internal position limit
12~13	-	Related to each servo mode
14	NA	Reserved
15	Homing Completed	0: Homing not completed 1: Homing completed

Note:

- Reading each individual bit of the status word is meaningless; it must be combined with other bits to reflect the current status of the servo.
- Bits 0 to 9 have the same meaning in all servo modes. After sending commands in sequence via control word 6040h, the servo will feedback a definite status.
- Bits 12 to 13 are related to each servo mode (please refer to the control commands under different modes).
- Bits 10, 11, and 15 have the same meaning in all servo modes, reflecting the status of the servo after executing a certain servo mode.

5.7 Supported Operation Modes of Servo Drive 6502h

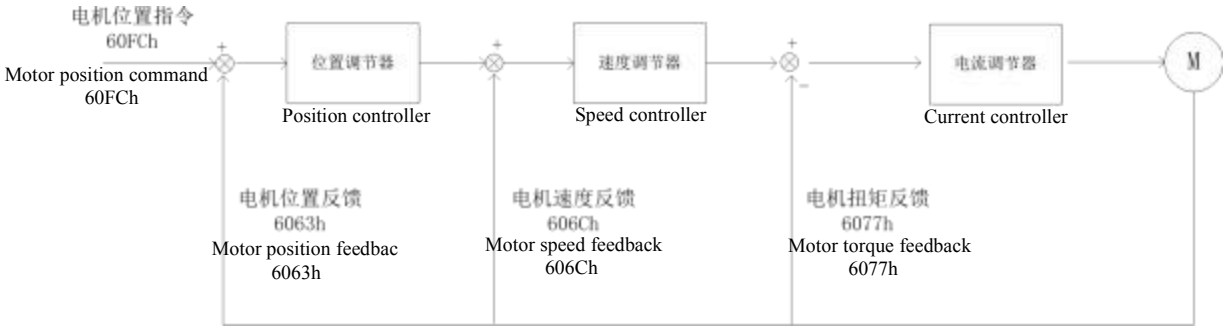
Index	**Name**	**Supported Drive Modes**			**Data Structure**	**VAR**	**Data Type**	Uint16
6502h	Accessibility	RO	Mappable	NO	Data Range	0~4294967295	Factory Setting	0X3ED

Reflect servo status：

bit	Description	Supported (0 - Not supported, 1 - Supported)
0	PP (Profile Position mode)	1
1	VI (Variable Frequency Speed mode)	0
2	PV (Profile Velocity mode)	1
3	Tq (Profile Torque mode)	1
4	NA	0
5	HM (Homing mode)	1
6	IP (Interpolated Position mode)	1
7	CSP (Cyclic Synchronous Position mode)	1
8	CSV (Cyclic Synchronous Velocity mode)	1
9	CST (Cyclic Synchronous Torque mode)	1
10~31	Manufacturer Custom	Reserved, undefined

5.8 Profile Position Control Mode (PP-1)

Under certain conditions, the Profile Position mode can receive user displacement commands in real time. The acceleration time, deceleration time, maximum running speed, and displacement of each segment can be controlled independently, and the connection mode between segments can also be modified in real time. Profile Position mode is mostly used for point-to-point positioning operation, and the motion profile is planned by the servo drive itself. Position, velocity, and torque control are implemented internally within the servo drive.



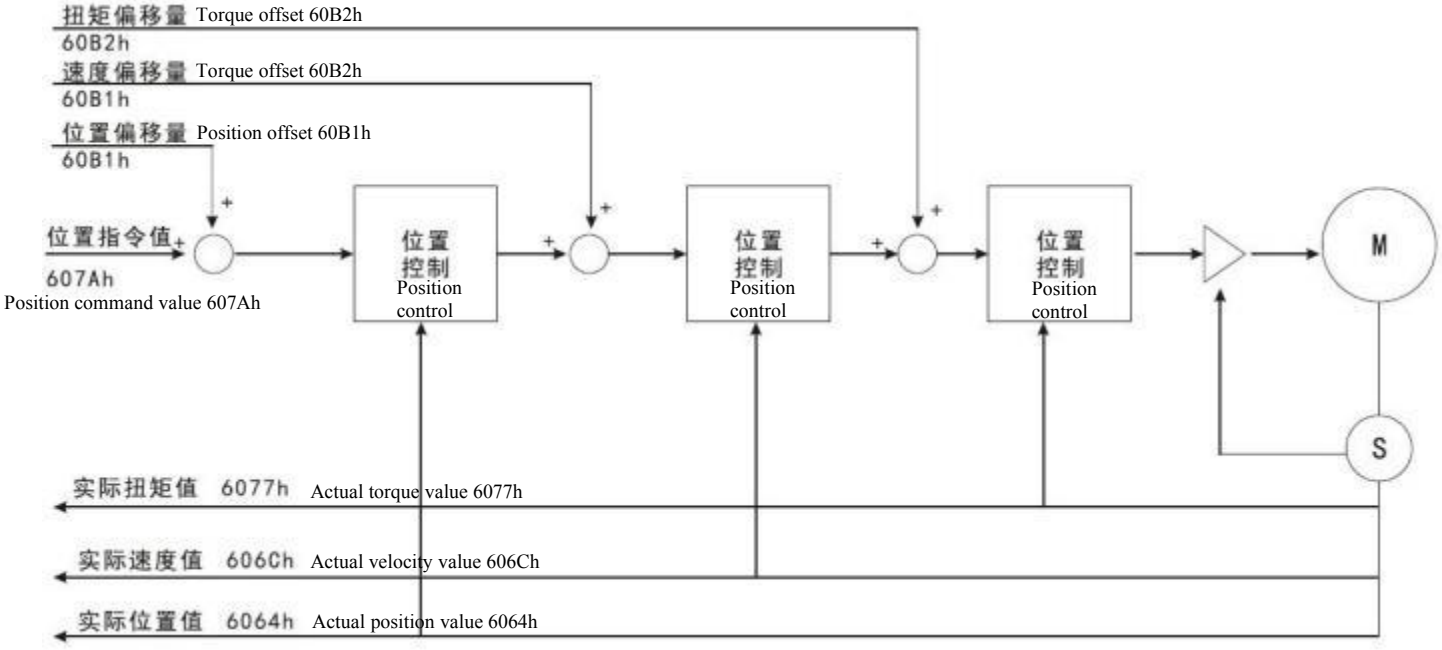
Relevant Object Index

Index	Sub-index	Name	Accessibility	PDO mapping	Data type	Unit	Data range	Factory setting
603Fh	00h	Error code	RO	TPDO	Uint16	-	0~65535	-
6040h	00h	Control word	RW	YES	Uint16	-	0~65535	0
6041h	00h	Status word	RO	TPDO	Uint16	-	0~65535	-
6060h	00h	Mode of operation	RW	YES	Int8	-	0~10	8
6061h	00h	Mode display	RO	TPDO	Int8	-	0~10	8
607Ah	00h	Target position	RW	YES	Int32	Instruction Unit	-2^{31}~(2^{31}-1)	0
6081h	00h	Profile velocity	RW	YES	Uint32	Instruction Unit/s	0~(2^{32}-1)	13981013

Index	Sub-index	Name	Accessibility	PDO mapping	Data type	Unit	Data range	Factory setting
6083h	00h	Profile acceleration	RW	YES	Uint32	Instruction Unit/s²	0~(2³²-1)	83886080
6084h	00h	Profile deceleration	RW	YES	Uint32	Instruction Unit/s²	0~(2³²-1)	83886080
6093h	01h	Position factor numerator	RW	YES	Uint32	-	0~(2³²-1)	1
	02h	Position factor denominator	RW	YES	Uint32	-	1~(2³²-1)	1

5.9 Periodic Synchronous Position Mode (CSP-8)

In CSP mode, the position is generated by the master controller, which sends periodically synchronized position command values to the drive device.The drive performs position control, speed control, and torque control.In this way, multiple servo drives can operate in strict synchronization and coordination, achieving precise contour trajectory control.



Structure diagram of the periodic synchronous position control operating mode

Related Object Index：

Index	Sub-index	Name	Access	Data type	PDO mapping	Unit	Setting range	Default value
6040		Control word	RW	UINT	RPDO	-	0~65535	0
6041		Status word	RO	UINT	TPDO	-	0~xFFFF	0
6060		Mode of operation	RW	SINT	RPDO	-	0~10	0
6061		Mode display	RO	SINT	TPDO	-	0~10	0
6062		Position feedback	RO	DINT	NO	Instruction Unit	-	-
6063		Position feedback	RO	DINT	NO	Encoder Unit	-	-
6064		Position feedback	RO	DINT	NO	Instruction Unit	-	-
6065		Position following error threshold	RW	UDINT	NO	Instruction Unit	0~(2³¹-1)	0
6066		Position following error timeout	RW	UINT	NO	ms	0~(2³¹-1)	200000

6067		Position reached threshold	RW	UDINT	RPDO	Encoder Unit	0~(2^{31}-1)	30
6068		Position reached window	RW	UINT	NO	ms	0~65535	0
6072		Max torque	RW	UINT	RPDO	0.1%	0~65535	3000
607D	01	Min position limit	RW	DINT	NO	Instruction Unit	-2^{31}~2^{31}	2^{31}
	02	Max position limit	RW	DINT	NO	Instruction Unit	-2^{31}~2^{31}	2^{31}
6085		Quick stop deceleration	RW	UDINT	RPDO	Instruction Unit/s²	0~(2^{31}-1)	1000

5.10 Homing Mode (HM-6)

This mode is used to find the mechanical home and determine the positional relationship between the mechanical home and the mechanical zero.

- **Mechanical home**: A fixed position on the machine, which can correspond to a defined home switch or the motor Z signal.
- **Mechanical zero**: The absolute 0 position on the machine.

After homing is completed, the motor stops at the mechanical home. The relationship between the mechanical home and the mechanical zero can be set via **607Ch**:

Mechanical home = Mechanical zero + 607C (Home offset)

When **607C = 0**, the mechanical home coincides with the mechanical zero.

In homing mode, the upper controller should first select the homing method (6098h), set the homing speed (6099-1h, 6099-2h) and homing acceleration (609Ah). After the homing trigger signal is given, the servo will automatically search for the mechanical home according to the settings and finish setting the relative position between the mechanical home and the mechanical zero.

Position, speed, and torque control are performed internally in the servo drive.

5.10.1 Operation Steps

- Set the value of 6060h (Operation Mode) to 06h to select the homing mode.
- Set 607C (Homing Offset).
- Set 6098h (Homing Mode), with a range from -2 to 35.
- Set 6099h-01 to configure the speed for searching the home switch.
- Set 6099h-02 to configure the speed for finding the home position.
- Set 609Ah to configure the homing acceleration.
- Set the control word 6040h to (0x06 > 0x07 > 0x0F > 0x1F) to enable the drive and start homing.
- Read the status word 6041h to obtain the drive status.

Related Object Index

Index	Sub-index	Name	Accessibility	PDO mapping	Data type	Unit	Setting range	Factory setting
603Fh	00h	Error code	RO	TPDO	Uint16	-	0~65535	-
6040h	00h	Control word	RW	YES	Uint16	-	0~65535	0
6041h	00h	Status word	RO	TPDO	Uint16	-	0~65535	-
6060h	00h	Mode of operation	RW	YES	Int8	-	0~10	8
6061h	00h	Mode display	RO	TPDO	Int8	-	0~10	8
607Ch	00h	Home offset	RW	YES	Int32	Instruction Unit	-2^{31}~(2^{31}-1)	0
6098h	00h	Homing mode	RW	YES	Int8	-	-2~35	34
6099h	01h	Speed for searching zero signal	RW	YES	Uint32	Instruction Unit	0~(2^{32}-1)	6990567
6099h	02h	Speed for searching home signal	RW	YES	Int32	Instruction Unit	0~(2^{32}-1)	6990567
609Ah	00h	Homing acceleration	RW	YES	Uint32	Instruction Unit/s²	0~(2^{32}-1)	419430400

5.11 Profile Velocity Mode (PV-3)

In Profile Velocity mode, after the user sets the velocity, acceleration and deceleration, the servo drive will plan the velocity profile of the motor according to these settings and achieve smooth switching between different velocity commands.

5.11.1 Operation Steps

- Set 6060h (Mode of operation) to 03h to select Profile Velocity mode.
- Set 6083h to configure the profile acceleration.
- Set 6084h to configure the profile deceleration.
- Set 60FFh to set the target velocity.
- Set the control word 6040h to (0x06 > 0x07 > 0x0F) to enable the drive for operation.
- Read the status word 6041h to obtain the drive status.

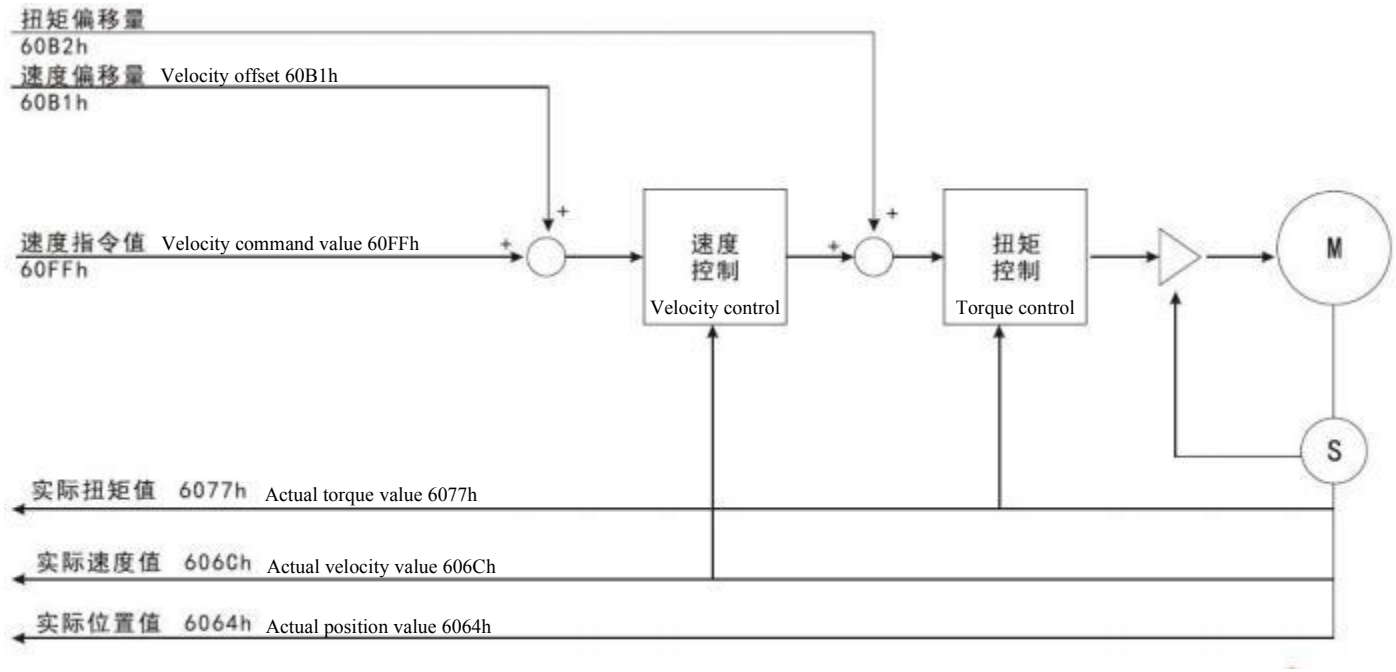
Related Object Index：

Index	Sub-index	Name	Accessibility	PDO mapping	Data type	Unit	Data range	Factory setting
603Fh	00h	Error code	RO	TPDO	Uint16	-	0~65535	-
6040h	00h	Control word	RW	YES	Uint16	-	0~65535	0
6041h	00h	Status word	RO	TPDO	Uint16	-	0~65535	-
6060h	00h	Mode of operation	RW	YES	Int8	-	0~10	8
6061h	00h	Mode display	RO	TPDO	Int8	-	0~10	8
606Dh	00h	Velocity reached threshold	RW	YES	Uint16	rpm	0~65535	20
606Eh	00h	Velocity reached window	RW	YES	Uint16	ms	0~65535	0
606Fh	00h	Zero velocity threshold	RW	YES	Uint16	rpm	0~65535	10
6070h	00h	Zero velocity window	RW	YES	Uint16	ms	0~65535	0
607Fh	00h	Max profile velocity	RW	YES	Uint32	Instruction Unit	0~(2^{32}-1)	2147483647
6083h	00h	Profile acceleration	RW	YES	Uint32	Instruction Unit/s²	0~(2^{32}-1)	83886080
6084h	00h	Profile deceleration	RW	YES	Uint32	Instruction Unit/s²	0~(2^{32}-1)	83886080
6094h	01h	Velocity encoder factor numerator	RW	YES	Uint32	-	0~(2^{32}-1)	1
	02h	Velocity encoder factor denominator	RW	YES	Uint32	-	1~(2^{32}-1)	1
60C5h	00h	Max profile acceleration	RW	YES	Uint32	rpm/ms	0~(2^{32}-1)	1000
60C6h	00h	Max profile deceleration	RW	YES	Uint32	rpm/ms	0~(2^{32}-1)	1000
60FFh	00h	Target velocity	RW	YES	Uint32	Instruction Unit	-2^{32}~(2^{32}-1)	0

5.12 Periodic Synchronous Velocity Mode (CSV-9)

In CSV mode, the master controller periodically sends target velocity commands to the drive.The drive performs velocity control and torque control. If required, the position loop can be closed via the master controller.

Torque offset 60B2h



Structure Diagram of Periodic Synchronous Velocity Control Operating Mode

Related Object Index：

Index	Name	Access	Data type	PDO mapping	Unit	Setting range	Default value
6040	Control word	RW	UINT	RPDO	-	0~65535	0
6041	Status word	RO	UINT	TPDO	-	0~xFFFF	0
6060	Mode of operation	RW	SINT	RPDO	-	0~10	0
6061	Mode display	RO	SINT	TPDO	-	0~10	0
607F	Max profile velocity	RW	UDINT	RPDO	Instruction Unit	0~(2^{31}-1)	0
6063	Position feedback	RO	DINT	NO	-	-	-
6064	Position feedback	RO	DINT	NO	-	-	-
60B1	Velocity offset	RW	DINT	NO	Instruction Unit/s	-2^{31}~(2^{31}-1)	0
60B2	Torque offset	RW	DINT	NO	0.1%	-5000~5000	0
60E0	Positive torque limit	RW	UINT	NO	0.1%	0~5000	3000
60E1	Negative torque limit	RW	UINT	NO	0.1%	0~5000	3000
60FF	Target velocity	RW	DINT	RPDO	Instruction Unit/s	-2^{31}~(2^{31}-1)	0
606C	Actual velocity	RO	DINT	TPDO	Instruction Unit/s	-	-
606D	Velocity reached threshold	RW	UINT	NO	Instruction Unit/s	0~65535	20
606E	Velocity reached window	RW	UINT	NO	ms	0~65535	0
6083	Profile acceleration	RW	UDINT	RPDO	Instruction Unit/s²	0~(2^{31}-1)	1310720
6084	Profile deceleration	RW	UDINT	RPDO	Instruction Unit/s²	0~(2^{31}-1)	1310720

5.13 Torque Control Mode (CSV-4)

The drive accepts torque commands and generates the control profile.

5.13.1 Operation Steps

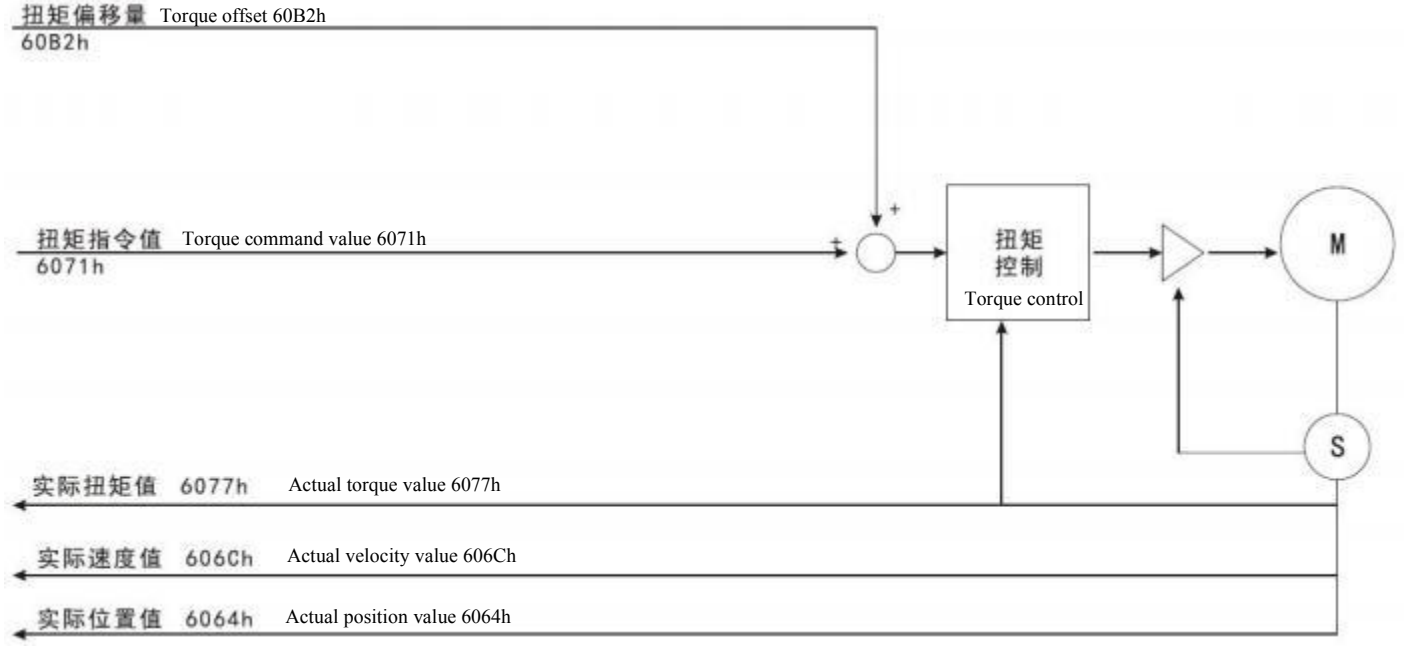
- Set 6060h (Mode of operation) to 04h to select **Torque Control mode**.
- Set 6087h to configure the torque slope.
- Set 6071h to set the target torque.
- Set the control word 6040h to (0x06 > 0x07 > 0x0F) to enable the drive for operation.
- Read the status word 6041h to obtain the drive status.

Related Object Index

Index	Sub-index	Name	Accessibility	PDO mapping	Data type	Unit	Data range	Factory setting
603Fh	00h	Error code	RO	TPDO	Uint16	-	0~65535	-
6040h	00h	Control word	RW	YES	Uint16	-	0~65535	0
6041h	00h	Status word	RO	TPDO	Uint16	-	0~65535	-
6060h	00h	Mode of operation	RW	YES	Int8	-	0~10	0
6061h	00h	Mode display	RO	TPDO	Int8	-	0~7	-
6071h	00h	Target torque	RW	RPDO	INT	0.1%	-32767~32767	0
6087h	00h	Torque slope	RW	RPDO	UDINT	0.1%/ms	0~(2^{32}-1)	1
6077h	00h	Actual torque	RO	TPDO	INT	0.1%	-32767~32767	0
6072h	00h	Max torque	RW	RPDO	INT	0.1%	-32767~32767	3000
60E0h	00h	Positive torque limit	RW	NO	Uint16	0.1%	0~5000	3000
60E1h	00h	Negative torque limit	RW	NO	Uint16	0.1%	0~5000	3000

5.14 Periodic Synchronous Torque Mode (CST-A)

In CST mode, the master controller periodically sends target torque commands to the drive, and the drive performs torque control.



Structure Diagram of Periodic Synchronous Torque Control Operating Mode

Related Object Index:

Index	Name	Access	Data type	PDO mapping	Unit	Setting range	Default value
6040	Control word	RW	UINT	RPDO	-	0~65535	0
6041	Status word	RO	UINT	TPDO	-	0~xFFFF	0
6060	Mode of operation	RW	SINT	RPDO	-	0~10	0
6061	Mode display	RO	SINT	TPDO	-	0~10	0
6071	Target torque	RW	INT	RPDO	0.1%	-32768~32768	0
6074	Torque command	RO	INT	TPDO	0.1%	-32768~32768	-
6077	Actual torque	RO	INT	TPDO	0.1%	-32768~32768	-
6072	Max torque	RW	INT	RPDO	0.1%	-32768~32768	3000
60E0	Positive torque limit	RW	UINT	NO	0.1%	0~5000	3000
60E1	Negative torque limit	RW	UINT	NO	0.1%	0~5000	3000

5.15 Probe Function

Related Object Index:

Index	Name	Access	Data type	PDO mapping	Unit	Setting range	Default value
60B8h	Probe function switch	RW	UINT	RPDO	-	0~65535	0 Usage notes: [bit3~bit0]>1: Probe 1 enable [bit7~bit4]>1: Probe 1 latches position on falling edge [bit11~bit8]>1: Probe 2 enable [bit5~bit12]>1: Probe 2 latches position on falling edge
60B9h	Probe status	RW	UINT	TPDO	-	0~65535	0
60BAh	Probe 1 rising edge latch value	RW	DINT	TPDO	Instruction Unit position value	-2^{31}~$(2^{31}-1)$	0
60BBh	Probe 1 falling edge latch value	RW	DINT	TPDO	Instruction Unit position value	-2^{31}~$(2^{31}-1)$	0
60BCh	Probe 2 rising edge latch value	RW	DINT	TPDO	Instruction Unit position value	-2^{31}~$(2^{31}-1)$	0
60BDh	Probe 2 falling edge latch value	RW	DINT	TPDO	Instruction Unit position value	-2^{31}~$(2^{31}-1)$	0
60D5h	Probe 1 rising edge count	RW	UINT	TPDO	-	0~65535	0
60D6h	Probe 1 falling edge count	RW	UINT	TPDO	-	0~65535	0
60D7h	Probe 2 rising edge count	RW	UINT	TPDO	-	0~65535	0
60D8h	Probe 2 falling edge count	RW	UINT	TPDO	-	0~65535	0
60D9h	Probe digital filter times	RW	UINT	RPDO	-	0~65535	128 Usage notes:This parameter can set the filter times for high-speed probe input to prevent jitter; the Unit is 62.5μs.

Chapter 6 Object Dictionary

6.1 Glossary

6.1.1 Data Type Description

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

6.1.2 Read/Write Type Description

Read/Write Type	Description
RW	Read/Write
WO	Write Only
RO	Read Only
CONST	Constant, Read Only

6.1.3 Object Classification

Category	Meaning	DS301 value
VAR	Single simple value, including data types such as Int8, Uint16, String, etc.	7
ARR	Data block with the same type	8
REC	Data block with different types	9

6.2 Object Group 1000h List

Object group 1000h contains the parameters required for CANopen communication.None of the communication parameters can be mapped to PDO.

Index	Sub-index	Name	Accessibility	Data type	Category	Unit	Data range	Factory setting
1000h	-	Device type	RO	Uint32	VAR	-	Uint32	0x20192
1001h	-	Error register	RO	Uint8	VAR	-	Uint8	0x0
1003h	-	Predefined error field	RO	Uint32	ARR	-	-	-
	1~4h	Error field	RW	Uint32	-	-	Uint32	0
1005h	-	Sync message COB-ID	RW	Uint32	VAR	-	Uint32	0x80
1006h	-	Sync cycle period	RW	Uint32	VAR	-	Uint32	0

Index	Sub-index	Name	Accessibility	Data type	Category	Unit	Data range	Factory setting
1008h	-	Device name	CONST	String	VAR	String	-	-
1009h	-	Hardware version	CONST	String	VAR	String	-	-
100Ah	-	Software version	CONST	String	VAR	String	-	-
1010h	-	Save parameters	RW	Uint32	ARR	-	Uint8	0
	1h	Save all object parameters	RW	Uint32	-	-	-	1
	2h	Save communication object parameters	RW	Uint32	-	-	-	1
	3h	Save subprotocol area object parameters	RW	Uint32	-	-	-	1
1011h	0h	Restore default parameters	RW	Uint32	ARR	-	-	-
	1h	Restore all object default parameters	RW	Uint32	-	-	-	1
	2h	Restore communication object default parameters	RW	Uint32	-	-	-	1
	3h	Restore subprotocol area default parameters	RW	Uint32	-	-	-	1
1014h	-	Emergency message COB-ID	RW	Uint32	VAR	-	Uint32	0x80_Node_ID
1016h	-	Consumer heartbeat time	RW	Uint32	ARR	-	-	0
	1~5h	Consumer heartbeat time	RW	Uint32	-	-	Uint32	0
1017h	-	Producer heartbeat time	RW	Uint16	VAR	-	Uint16	0
1018h	-	Device identity description	RO	Device-dependent	REC	-	-	-
	1h	Vendor ID	RO	Uint32	-	-	Uint32	-
	2h	Product code	RO	Uint32	-	-	Uint32	-
	3h	Revision number	RO	Uint32	-	-	Uint32	-
1029h	-	Error behavior object	RW	Uint8	ARR	-	-	-
	1h	Communication error	RW	Uint8	-	-	Uint8	0
1200h	-	SDO server parameters	RO	SDO parameters	REC	-	-	-
	1h	Client-to-server COB-ID	RO	Uint32	-	-	Uint32	0x600+Node_ID
	2h	Server-to-client COB-ID	RO	Uint32	-	-	Uint32	0x580+Node_ID
1400h	-	RPDO1 parameters	RW	PDO parameters	REC	-	-	-
	1h	RPDO1 COB-ID	RW	Uint32	-	-	Uint32	0x00000200+Node_ID
	2h	RPDO1 transmission type	RW	Uint8	-	-	Uint8	255
1401h		RPDO2 parameters	RW	PDO parameters	REC	-	-	-
	1h	RPDO2 COB-ID	RW	Uint32	-	-	Uint32	0x00000300+Node_ID
	2h	RPDO2 transmission type	RW	Uint8	-	-	Uint8	255
1402h		RPDO3 parameters	RW	PDO parameters	REC	-	-	-
	1h	RPDO3 COB-ID	RW	Uint32	-	-	Uint32	0x00000400+Node_ID

Index	Sub-index	Name	Accessibility	Data type	Category	Unit	Data range	Factory setting
	2h	RPDO3 transmission type	RW	Uint8	-	-	Uint8	255
1403h		RPDO4 parameters	RW	PDO parameters	REC	-	-	-
	1h	RPDO4 COB-ID	RW	Uint32	-	-	Uint32	0x00000500+Node_ID
	2h	RPDO4 transmission type	RW	Uint8	-	-	Uint8	255
1404h		RPDO5 parameters	RW	PDO parameters	REC	-	-	-
	1h	RPDO5 COB-ID	RW	Uint32	-	-	Uint32	0x00000440+Node_ID
	2h	RPDO5 transmission type	RW	Uint8	-	-	Uint8	255
1405h		RPDO6 parameters	RW	PDO parameters	REC	-	-	-
	1h	RPDO6 COB-ID	RW	Uint32	-	-	Uint32	0x00000540+Node_ID
	2h	RPDO6 transmission type	RW	Uint8	-	-	Uint8	255
1600h		RPDO1 mapping parameters	RW	RPDO mapping parameters	REC	-	-	-
	1~8h	RPDO1 mapping objects	RW	Uint32	-	-	Uint32	-
1601h		RPDO2 mapping parameters	RW	RPDO mapping parameters	REC	-	-	-
	1~8h	RPDO2 mapping objects	RW	Uint32	-	-	Uint32	-
1602h		RPDO3 mapping parameters	RW	RPDO mapping parameters	REC	-	-	-
	1~8h	RPDO3 mapping objects	RW	Uint32	-	-	Uint32	-
1603h		RPDO4 mapping parameters	RW	RPDO mapping parameters	REC	-	-	-
	1~8h	RPDO4 mapping objects	RW	Uint32	-	-	Uint32	-
1604h		RPDO5 mapping parameters	RW	RPDO mapping parameters	REC	-	-	-
	1~8h	RPDO5 mapping objects	RW	Uint32	-	-	Uint32	-
1605h		RPDO6 mapping parameters	RW	RPDO mapping parameters	REC	-	-	-
	1~8h	RPDO6 mapping objects	RW	Uint32	-	-	Uint32	-
1800h		TPDO1 communication parameters	RW	PDO communication parameters	REC	-	-	-
	1h	TPDO1 COB-ID	RW	Uint32	-	-	Uint32	0x40000180+Node_ID
	2h	TPDO1 transmission type	RW	Uint8	-	-	Uint8	255
	3h	Inhibit time	RW	Uint16	-	-	Uint16	0
	5h	Event timer	RW	Uint16	-	-	Uint16	0
1801h		TPDO2 communication parameters	RW	PDO communication parameters	REC	-	-	-
	1h	TPDO2 COB-ID	RW	Uint32	-	-	Uint32	0xC0000280+Node_ID
	2h	TPDO2 transmission type	RW	Uint8	-	-	Uint8	255
	3h	Inhibit time	RW	Uint16	-	-	Uint16	0

Index	Sub-index	Name	Accessibility	Data type	Category	Unit	Data range	Factory setting
	5h	Event timer	RW	Uint16	-	-	Uint16	0
1A00h		TPDO1 mapping parameters	RW	PDO mapping parameters	REC	-	-	-
	1~8h	TPDO1 mapping objects	RW	Uint32	-	-	Uint32	-
1A01h		TPDO2 mapping parameters	RW	PDO mapping parameters	REC	-	-	-
	1~8h	TPDO2 mapping objects	RW	Uint32	-	-	Uint32	-

6.3 Object Group 2000h-5000h List

Object group 2000h is the object table defined by our company, corresponding to the driver function codes.

Index	Name	Accessibility	Data type	Category	Unit	Data range	Factory setting
2002h	Gain adjustment mode selection	RW	Uint16	VAR	-	0~2	1
2003h	Stiffness	RW	Uint16	VAR	-	0~31	13
2004h	Load inertia ratio	RW	Uint16	VAR	-	100~12000	250
2008h	Command pulses per motor revolution	RW	Uint32	VAR	-	0~8388608	10000
200Ah	Electronic gear ratio numerator 1	RW	Uint32	VAR	-	0~2^{30}	0
200Ch	Electronic gear ratio denominator	RW	Uint32	VAR	-	0~2^{30}	10000
200Eh	Electronic gear ratio numerator 2	RW	Uint32	VAR	-	0~2^{30}	0
2010h	Electronic gear ratio numerator 3	RW	Uint32	VAR	-	0~2^{30}	0
2012h	Electronic gear ratio numerator 4	RW	Uint32	VAR	-	0~2^{30}	0
2019h	Positive direction maximum torque limit	RW	Uint16	VAR	-	0~5000	3000
201Ah	Negative direction maximum torque limit	RW	Uint16	VAR	-	0~5000	3000
201Bh	Maximum speed setting	RW	Uint16	VAR	-	0~10000	8000
2020h	Absolute encoder usage method selection	RW	Uint16	VAR	-	0~1	0
2021h	Absolute encoder rotation count limit	RW	Uint16	VAR	-	1~32767	32767
2022h	Brake resistor resistance setting	RW	Uint16	VAR	-	20~30000	50
2023h	Brake resistor power setting	RW	Uint16	VAR	-	10~30000	100
2024h	Brake duty cycle	RW	Uint16	VAR	-	0~100	100
2025h	Brake resistor derating percentage	RW	Uint16	VAR	-	1~100	40
202Ah	Stop mode selection	RW	Uint16	VAR	-	1~1311h	200h
202Bh	Brake delay time when servo is disabled	RW	Uint16	VAR	-	1~3000	500
202Ch	Brake engagement speed threshold	RW	Uint16	VAR	-	1~1000	20
202Dh	Motor power-off delay time when brake is engaged	RW	Uint16	VAR	-	1~1000	20
202Fh	Zero-speed stop deceleration time	RW	Uint16	VAR	-	1~65535	200
2030h	Overtravel protection deceleration time	RW	Uint16	VAR	-	1~65535	200
2031h	Emergency stop time	RW	Uint16	VAR	-	1~65535	50

Index	Name	Accessibility	Data type	Category	Unit	Data range	Factory setting
2100h	Position loop gain	RW	Uint16	VAR	-	10~20000	320
2101h	Velocity loop gain	RW	Uint16	VAR	-	1~50000	180
2102h	Velocity loop integral time constant	RW	Uint16	VAR	-	1~50000	310
2103h	Second position loop gain	RW	Uint16	VAR	-	10~20000	32
2104h	Second velocity loop gain	RW	Uint16	VAR	-	10~50000	18
2106h	Velocity feedforward gain	RW	Uint16	VAR	-	0~1000	300
2107h	Velocity feedforward filter time constant	RW	Uint16	VAR	-	0~100	5
2108h	Torque feedforward gain	RW	Uint16	VAR	-	0~2000	0
2109h	Velocity feedforward filter time constant	RW	Uint16	VAR	-	0~100	5
210Ah	Velocity feedback low-pass smoothing constant	RW	Uint16	VAR	-	0~2000	0
210Bh	Current feedback low-pass smoothing constant	RW	Uint16	VAR	-	0~10000	0
210Ch	Gain switching condition	RW	Uint16	VAR	-	0~18	0
210Dh	Gain switching time	RW	Uint16	VAR	-	0~3000	5
210Fh	Gain switching threshold	RW	Uint16	VAR	-	0~32767	100
2110h	Control loop coefficient	RW	Uint16	VAR	-	10~100	75
2111h	Stiffness adjustment coefficient	RW	Uint16	VAR	-	5~10	5
2112h	PDFF control coefficient	RW	Uint16	VAR	-	0~100	100
2113h	Performance extension 1	RW	Uint16	VAR	-	0~111111B	0
2114h	Torque command addition value	RW	Int16	VAR	-	-1000~1000	0
2115h	Positive torque compensation value	RW	Int16	VAR	-	-1000~1000	0
2116h	Negative torque compensation value	RW	Int16	VAR	-	-1000~1000	0
2117h	Friction compensation smoothing time constant	RW	Uint16	VAR	-	10~1000	50
2118h	Viscous friction compensation gain	RW	Uint16	VAR	-	0~1000	0
211Bh	External disturbance rejection gain	RW	Uint16	VAR	-	0~1000	0
211Ch	Torque command low-pass smoothing constant	RW	Uint16	VAR	-	0~10000	84
211Dh	Velocity observer cutoff frequency grade	RW	Uint16	VAR	-	0~13	13
2217h	Position FIR filter	RW	Uint16	VAR	-	0~1280	0
230Eh	Torque direction speed limit during torque control	RW	Uint16	VAR	-	0~10000	100
2316h	External pulse train low-pass smoothing filter time	RW	Uint16	VAR	-	0~30000	0
2400h	DI1 function number	RW	Uint16	VAR	-	0~99	20
2401h	DI2 function number	RW	Uint16	VAR	-	0~99	19
2402h	DI3 function number	RW	Uint16	VAR	-	0~99	23
2403h	DI4 function number	RW	Uint16	VAR	-	0~99	0
2408h	DI level logic	RW	Uint16	VAR	-	0~11111111B	0
2409h	DO1 function number	RW	Uint16	VAR	-	0~99	1

Index	Name	Accessibility	Data type	Category	Unit	Data range	Factory setting
2410h	DO2 function number	RW	Uint16	VAR	-	0~99	6
240Bh	DO3 function number	RW	Uint16	VAR	-	0~99	3
240Ch	DO4 function number	RW	Uint16	VAR	-	0~99	5
240Eh	DO level logic	RW	Uint16	VAR	-	0~1111B	0
240Fh	DI input forced enable	RW	Uint16	VAR	-	0~11111111B	0
2410h	DO forced enable output	RW	Uint16	VAR	-	0~1111B	0
2411h	DI filter time	RW	Uint16	VAR	-	0~20	2
2412h	DO1 active delay time	RW	Uint16	VAR	-	0~65535	0
2413h	DO1 inactive delay time	RW	Uint16	VAR	-	0~65535	0
2414h	DO2 active delay time	RW	Uint16	VAR	-	0~65535	0
2415h	DO2 inactive delay time	RW	Uint16	VAR	-	0~65535	0
2416h	DO3 active delay time	RW	Uint16	VAR	-	0~65535	0
2417h	DO3 inactive delay time	RW	Uint16	VAR	-	0~65535	0
2418h	DO4 active delay time	RW	Uint16	VAR	-	0~65535	0
2419h	DO4 inactive delay time	RW	Uint16	VAR	-	0~65535	0
2438h	Zero-speed signal output value	RW	Uint16	VAR	-	10~1000	10
2439h	Rotation signal output value	RW	Uint16	VAR	-	10~1000	20
2500h	Function switch 1	RW	Uint16	VAR	-	0~1111B	0
2504h	Torque limit value during main circuit voltage drop	RW	Uint16	VAR	-	10~1000	500
2505h	Torque limit release time during main circuit voltage drop	RW	Uint16	VAR	-	10~1000	100
2506h	Instantaneous power failure hold time	RW	Uint16	VAR	-	10~1000	100
2507h	External torque limit	RW	Uint16	VAR	-	0~5000	100
2508h	Torque limit switching rate 1	RW	Uint16	VAR	-	0~5000	300
2509h	Torque limit switching rate 2	RW	Uint16	VAR	-	0~5000	300
250Ah	Position deviation alarm monitoring mask when torque limit active	RW	Uint16	VAR	-	0~1	0
250Bh	Alarm mask invalid delay after torque limit invalid	RW	Uint16	VAR	-	1~10000	10000
250Ch	Jog speed	RW	Uint16	VAR	-	0~10000	100
250Dh	Jog acceleration/deceleration time	RW	Uint16	VAR	-	1~65535	200
250Eh	Offline inertia identification self-learning torque	RW	Uint16	VAR	-	10~200	50
250Fh	Offline inertia identification maximum revolutions	RW	Uint16	VAR	-	1~20	10
2512h	Driver overload warning threshold	RW	Uint16	VAR	-	20~100	80
2513h	Motor overload warning threshold	RW	Uint16	VAR	-	20~100	80
2514h	Motor stall detection minimum load	RW	Uint16	VAR	-	100~2500	1500
2515h	Motor stall detection speed	RW	Uint16	VAR	-	0~500	0

Index	Name	Accessibility	Data type	Category	Unit	Data range	Factory setting
2516h	Motor stall detection time	RW	Uint16	VAR	-	50~3000	100
2517h	Motor stall limit torque	RW	Uint16	VAR	-	0~1500	1000
251Eh	Homing failure alarm time	RW	Uint16	VAR	-	0~1500	1000
260Ah	CANopen node address	RW	Uint16	VAR	-	1~63	1
260Bh	CANopen bus baud rate	RW	Uint16	VAR	-	0~4	4
260Ch	CANopen status monitoring	RW	Uint16	VAR	-	0~127	0
260Dh	CANopen control mode monitoring	RW	Uint16	VAR	-	0~7	0
260Eh	CANopen polarity setting	RW	Uint16	VAR	-	0~11	0
260Fh	CANopen disconnection fault enable bit	RW	Uint16	VAR	-	0~1	1
4000h	Motor speed	RO	Int16	-	rpm	-10000~10000	0
4001h	Motor speed command	RO	Int16	-	rpm	-10000~10000	0
4002h	Motor torque command	RO	Int16	-	%	-500.0~500.0	0
4004h	Motor current electrical angle	RO	Uint16	-	°	0~3599	0
4005h	Serial encoder rotation count	RO	Int16	-	-	-32767~32767	0
4006h	Serial encoder current position value	RO	Uint32	-	Pulse	$0\sim2^{31}-1$	0
4008h	Received external pulse frequency	RO	Int32	-	KHz	-10000.00~10000.00	0
400Ah	Collected external pulse total (non-resettable)	RO	Int32	-	Pulse	$-2^{31}\sim2^{31}-1$	0
400Ch	Feedback pulse count (based on encoder, non-resettable)	RO	Int32	-	Pulse	$-2^{31}\sim2^{31}-1$	0
400Eh	Feedback pulse count (based on command, non-resettable)	RO	Int32	-	Pulse	$-2^{31}\sim2^{31}-1$	0
4012h	Collected external pulse total (power-on retention)	RO	Int32	-	Pulse	$-2^{31}\sim2^{31}-1$	0
4014h	Feedback pulse count (based on encoder, power-on retention)	RO	Int32	-	Pulse	$-2^{31}\sim2^{31}-1$	0
4016h	Feedback pulse count (based on command, power-on retention)	RO	Int32	-	Pulse	$-2^{31}\sim2^{31}-1$	0
401Ah	Pulse command corresponding speed	RO	Int16	-	rpm	-10000~10000	0
401Bh	Motor load rate	RO	Int16	-	%	-500.0~500.0	0
401Ch	Motor instantaneous maximum load rate	RO	Int16	-	%	-500.0~500.0	0
401Eh	Brake load rate	RO	Uint16	-	%	0~400.0	0
401Fh	DO output status	RO	Uint16	-	-	0~1111B	0
4020h	DI input status	RO	Uint16	-	-	0~11111111B	0
4025h	IPM module temperature	RO	Uint16	-	°C	0~200	0
4027h	EEPROM initialization operation time	RO	Uint16	-	ms	0~65535	0
4028h	Total system operation time	RO	Uint32	-	min	$0\sim2^{31}-1$	0
402Ch	Positioning status	RO	Uint16	-	-	0~1	0

Index	Name	Accessibility	Data type	Category	Unit	Data range	Factory setting
402Dh	Bus voltage	RO	Uint16	-	V	0~1000	0
402Eh	Current RMS value	RO	Uint16	-	A	0.00~655.35	0
4100h	Current fault code	RO	Uint16	-	-	0~FFh	0
4101h	Motor speed at current fault	RO	Int16	-	rpm	-10000~10000	0
4102h	Bus voltage at current fault	RO	Uint16	-	V	0~1000	0
4103h	Current RMS value at current fault	RO	Uint16	-	A	0.00~655.35	0
4104h	Operation time at current fault	RO	Uint32	-	min	$0\sim2^{31}-1$	0
4106h	Previous fault code	RO	Uint16	-	-	0~FFh	0
4107h	Motor speed at previous fault	RO	Int16	-	rpm	-10000~10000	0
4108h	Bus voltage at previous fault	RO	Uint16	-	V	0~1000	0
4109h	Current RMS value at previous fault	RO	Uint16	-	A	0.00~655.35	0
410Ah	Operation time at previous fault	RO	Uint32	-	min	$0\sim2^{31}-1$	0
410Ch	Fault code 2 times ago	RO	Uint16	-	-	0~FFh	0
410Dh	Motor speed at fault 2 times ago	RO	Int16	-	rpm	-10000~10000	0
410Eh	Bus voltage at fault 2 times ago	RO	Uint16	-	V	0~1000	0
410Fh	Current RMS value at fault 2 times ago	RO	Uint16	-	A	0.00~655.35	0
4110h	Operation time at fault 2 times ago	RO	Uint32	-	min	$0\sim2^{31}-1$	0
4112h	Fault code 3 times ago	RO	Uint16	-	-	0~FFh	0
4113h	Motor speed at fault 3 times ago	RO	Int16	-	rpm	-10000~10000	0
4114h	Bus voltage at fault 3 times ago	RO	Uint16	-	V	0~1000	0
4115h	Current RMS value at fault 3 times ago	RO	Uint16	-	A	0.00~655.35	0
4116h	Operation time at fault 3 times ago	RO	Uint32	-	min	$0\sim2^{31}-1$	0
4200h	Driver type	RO	Uint16	-	-	0~31h	31h
4201h	Current motor code	RO	Uint16	-	-	0~999	0
4202h	Chip 1 software serial number 1	RO	Uint16	-	-	0~65535	0
4203h	Chip 1 software serial number 2	RO	Uint16	-	-	0~65535	0
4204h	Chip 2 software serial number 1	RO	Uint16	-	-	0~65535	0
4205h	Chip 2 software serial number 2	RO	Uint16	-	-	0~65535	0
5E00h	Servo drive status	RO	Uint16	-	-	0~65535	0

6.4 Object Group 6000h List

Index	Sub-index	Name	Accessibility	Data type	Unit	Data range	Factory setting
603Fh	-	Error code	RO	Uint16	-	0~65535	0
6040h	-	Control word	RW	Uint16	-	0~65535	0

Index	Sub-index	Name	Accessibility	Data type	Unit	Data range	Factory setting
6041h	-	Status word	RO	Uint16	-	0~65535	-
605Ah	-	Quick stop mode selection	RW	Int16	-	0~7	2
605Dh	-	Halt stop mode selection	RW	Int16	-	0~4	1
605Eh	-	Fault reaction selection	RW	Int16	-	0~2	2
6060h	-	Mode selection	RW	Int8	-	0~10	0
6061h	-	Mode display	RO	Int8	-	0~7	-
6062h	-	User position command	RO	Int32	User Unit	-2^{31}~(2^{31}-1)	-
6063h	-	Motor position feedback	RO	Int32	Encoder Unit	-2^{31}~(2^{31}-1)	-
6064h	-	User position feedback	RO	Int32	User Unit	-2^{31}~(2^{31}-1)	-
6065h	-	User position deviation threshold	RW	Uint32	User Unit	0~(2^{32}-1)	3145728p
6066h	-	Following error timeout	RW	Uint16	User Unit	0~65535	0
6067h	-	Position reached threshold	RW	Uint32	User Unit	0~(2^{32}-1)	734
6068h	-	Position reached time window	RW	Uint16	ms	0~65535	0
606Bh	-	User actual velocity command	RO	Int32	rpm	-2^{31}~(2^{31}-1)	-
606Ch	-	User actual velocity feedback	RO	Int32	rpm	-2^{31}~(2^{31}-1)	-
606Dh	-	Velocity reached threshold	RW	Uint16	rpm	0~65535	10
606Eh	-	Velocity reached time window	RW	Uint16	ms	0~65535	0
606Fh	-	Zero speed threshold	RW	Uint16	rpm	0~65535	10
6070h	-	Zero speed time window	RW	Uint16	ms	0~65535	0
6071h	-	Target torque	RW	Int16	0.1%	-5000~5000	0
6072h	-	Max torque	RW	Uint16	0.1%	0~65535	3000
6074h	-	Torque command	RW	Int16	0.1%	-5000~5000	0
6077h	-	Actual torque	RW	Int16	0.1%	-5000~5000	0
607Ah	-	Target position	RW	Int32	User Unit	-2^{31}~(2^{31}-1)	0
607Ch	-	Home offset	RW	Int32	User Unit	-2^{31}~(2^{31}-1)	0
607Dh		Software position limit					
	1h	Min position limit	RW	Int32	User Unit	-2^{31}~(2^{31}-1)	-2^{31}
	2h	Max position limit	RW	Int32	User Unit	-2^{31}~(2^{31}-1)	(2^{31}-1)
607Eh	-	Command polarity	RW	Uint8	-		0
607Fh	-	Max profile velocity	RW	Uint32	rpm	0~(2^{32}-1)	6000
6081h	-	Profile velocity	RW	Uint32	rpm	0~(2^{32}-1)	100
6083h	-	Profile acceleration	RW	Uint32	rpm/ms	0~(2^{32}-1)	100
6084h	-	Profile deceleration	RW	Uint32	rpm/ms	0~(2^{32}-1)	100
6085h	-	Quick stop deceleration	RW	Uint32	rpm/ms	0~(2^{32}-1)	100
6087h	-	Torque slope	RW	Int16	0.1%/s	0~(2^{32}-1)	100
6094h		Velocity encoder factor					

Index	Sub-index	Name	Accessibility	Data type	Unit	Data range	Factory setting
	1h	Numerator	RW	Uint32	-	0~(2^{32}-1)	1048576
	2h	Denominator	RW	Uint32	-	1~(2^{32}-1)	60
6097h		Acceleration factor					
	1h	Numerator	RW	Uint32		0~(2^{32}-1)	1048576000
	2h	Denominator	RW	Uint32		1~(2^{32}-1)	60
6098h	-	Homing mode	RW	Int8	-	-2~35	0
6099h		Homing velocity					
	1h	Search deceleration point signal velocity	RW	Uint32	rpm	0~(2^{32}-1)	100
	2h	Search zero signal velocity	RW	Uint32	rpm	0~(2^{32}-1)	10
609Ah	-	Homing acceleration	RW	Uint32	rpm/ms	0~(2^{32}-1)	100
60B0h	-	Position offset	RW	Int32	Command Unit	2^{31}~(2^{31}-1)	0
60B1h	-	Velocity offset	RW	Int32	Command Unit/s	2^{31}~(2^{31}-1)	0
60B2h	-	Torque offset	RW	Int32	0.1%	2^{31}~(2^{31}-1)	0
60B8h	-	Probe function switch	RW	Uint16	-	0~65535	0
60B9h	-	Probe status	R	Uint16	-	0~65535	0
60BAh	-	Probe 1 rising edge latch value	RW	Int32	User Unit	2^{31}~(2^{31}-1)	0
60BBh	-	Probe 1 falling edge latch value	RW	Int32	User Unit	2^{31}~(2^{31}-1)	0
60BCh	-	Probe 2 rising edge latch value	RW	Int32	User Unit	2^{31}~(2^{31}-1)	0
60BDh	-	Probe 2 falling edge latch value	RW	Int32	User Unit	2^{31}~(2^{31}-1)	0
60D5h	-	Probe 1 rising edge count	R	Uint16	-	0~65535	0
60D6h	-	Probe 1 falling edge count	R	Uint16	-	0~65535	0
60D7h	-	Probe 2 rising edge count	R	Uint16	-	0~65535	0
60D8h	-	Probe 2 falling edge count	R	Uint16	-	0~65535	0
60D9h	-	Probe digital filter times	R	Uint16	-	0~65535	128
60C1h		Interpolation data record					
	1h	Interpolation displacement	RW	Int32	-	-2^{31}~(2^{31}-1)	0
60C2h		Interpolation time					
	1h	Interpolation time Unit	RW	Uint8	10^(time index) s	1~20	1
	2h	Interpolation time index	RW	Int8	-	-3	-3
60C5h	-	Max profile acceleration	RW	Uint32	rpm/ms	0~(2^{32}-1)	1000
60C6h	-	Max profile deceleration	RW	Uint32	rpm/ms	0~(2^{32}-1)	1000
60F4h	-	User position deviation	RO	Int32	User Unit	-2^{31}~(2^{31}-1)	-
60FCh	-	Motor position command	RO	Int32	Encoder Unit	-2^{31}~(2^{31}-1)	-
60FDh	-	DI status	RO	Uint32	-	0~(2^{32}-1)	-
60FEh		Digital output					
	1h	DO status	RW	Uint32	-	0~(2^{32}-1)	0

Index	Sub-index	Name	Accessibility	Data type	Unit	Data range	Factory setting
60FFh	-	Target velocity	RW	Int32	pulse/s	-2^{31}~$(2^{31}-1)$	0
6502h	-	Supported servo operation modes	RO	Uint32	-	0~$(2^{32}-1)$	101

Chapter 7 Fault Diagnosis and Troubleshooting

7.1 Fault and Warning List

Fault code	Alarm name	Fault action content	Clearable
E01	Hardware (short circuit) protection	Motor current is too high.	No
E02	Encoder fault	Encoder wire break.	No
E03	Encoder fault	Encoder AB phase interference.	No
E04	Encoder fault	Encoder Z phase interference.	No
E05	Encoder fault	Multi-turn data out-of-range error.	No
E06	Encoder fault	Absolute encoder overheating.	No
E07	Encoder fault	Absolute encoder battery voltage below 3.1V, low battery voltage.	No
E08	Encoder fault	Absolute encoder battery voltage below 2.5V, multi-turn position information lost.	No
E09	Motor overload fault	Motor load is too heavy.	Yes
E0A	Driver overload	Driver overload.	Yes
E0b	Brake resistor overload fault	Brake resistor capacity insufficient.	Yes
E0C	Motor overheating	Motor temperature is too high.	Yes
E0d	Driver overheating	Driver temperature is too high.	Yes
E0E	Bus fault	Bus undervoltage fault.	No
E0F	Bus fault	Bus overvoltage fault.	No
E10	Main power loss	Main power loss.	No
E11	Software overcurrent fault	Motor current is too large.	No
E12	Positive position limit fault	Motor travel exceeds positive limit.	No
E13	Negative position limit fault	Motor travel exceeds reverse limit.	No
E14	Electronic gear ratio out-of-range error	Electronic gear ratio set too large or too small.	Yes
E15	Input pulse frequency error	Input pulse frequency too high error.	Yes
E16	Position deviation too large fault	Position deviation too large fault.	Yes
E17	Overspeed	Overspeed.	Yes
E18	Homing failure	Homing failure.	Yes
E19	Input phase loss fault	Input phase loss fault.	Yes
E1A	Motor phase sequence error	Motor phase sequence error.	No
E1b	Ground short circuit fault	Ground short circuit fault.	No
E1C	Inertia identification failure	Inertia identification failure.	Yes
E1d	Encoder EEPROM read/write failure	Encoder EEPROM read/write failure.	Yes
E1E	HOC	Hardware overcurrent.	No
E1F	AD module initial calibration fault	AD module initial calibration fault.	No
E20	Parameter storage exception	Parameter storage exception.	No

Fault code	Alarm name	Fault action content	Clearable
E21	System parameter exception	System parameter exception.	No
E22	AD sampling module fault	AD sampling module fault.	No
E23	ESC (bus slave control chip) initialization failure	Hardware fault.	No
E24	CPU and ESC communication interruption	Hardware fault or communication interference.	Yes
E25	Communication interruption with master station	Communication line open or master station fault.	Yes
E26	Emergency stop alarm	Controller presses emergency stop, servo stops running.	Yes
E27	PDO communication has no index and sub-index to find	Master station communication configuration error.	Yes
E28	PDO communication set synchronization time too short	Synchronization time set too short.	Yes
E29	Gantry synchronization position error too large	Gantry synchronization position error too large.	No
E2A	Fan abnormality (no such fault)	Fan abnormality (no such fault).	No
E2b	Driver rated current input error	Driver rated current input error.	Yes
E2C	Driver and motor mismatch	Driver and motor mismatch.	No
E2d	Offset angle learning failure	Offset angle learning failure.	No
E2E	Servo power-off and restart	Servo power-off and restart, generally used after parameter self-learning, requiring system restart to complete a lot of initialization.	Yes
E2F	Zero drift correction error	Zero drift correction error.	Yes
E30	System command over-frequency alarm	System command over-frequency alarm.	No
E31	Material break fault	Material break fault.	No
E32	ID error	ID error.	No
E33	Parameter tuning failure	Parameter tuning failure.	No
E34	AB phase sequence error	AB phase sequence error.	No
E35	Magnetic pole detection failure	Magnetic pole detection failure.	No
E36	Pole pitch or resolution input error	Pole pitch or resolution input error.	No
E37	Hall wiring error	Hall wiring error.	No
E38	Control system out-of-control risk	Control system out-of-control risk.	No
E39	Position control system disorder	Position control system disorder.	No
E3A	Average load rate too large error	Motor average load rate too large.	Yes
E3b	Save all parameters error when motor is enabled	Save all parameters error when motor is enabled.	No
E3c	Entered internal multi-segment position error before position command	Entered internal multi-segment position error before position command.	No
E3d	CPUB not found error	CPUB not found error.	No
E3E	Unsupported control mode	Unsupported control mode.	No
E3F	STO restriction in progress	STO restriction in progress.	No

Fault code	Alarm name	Fault action content	Clearable
E40	Hall wire break	Hall wire break.	No

7.2 Warning List

The warning list is shown below.

Warning code	Warning name	Warning content
A01	Motor overload warning	Motor overload warning
A02	Driver overheating warning	Driver overheating warning
A03	Driver overload warning	Driver overload warning
A04	Positive overtravel warning	Positive overtravel warning
A05	Reverse overtravel warning	Reverse overtravel warning
A06	Brake overload warning	Brake overload warning
A07	Motor overheating warning	Motor overheating warning
A08	Power-on reset enable function changed, request power cycle	Power-on reset enable function changed, request power cycle
A09	Excessive EEPROM write operations via communication warning	Excessive EEPROM write operations via communication warning
A0A	Position deviation too large warning	Position deviation too large warning
A0B	Battery voltage below 3.1V warning	Battery voltage below 3.1V warning

7.3 Fault Causes and Corrective Actions

Fault code	Alarm name	Abnormal check	Corrective actions
E01 E1E E11	Short circuit faultHardware overcurrentSoftware overcurrent	1. Check motor-drive wiring for short circuits or exposed conductors. 2. Verify motor wiring sequence. 3. Check if settings exceed factory defaults. 4. Check if control input changes too abruptly.	1. Eliminate short circuits and prevent exposed conductors. 2. Rewire according to manual. 3. Restore factory defaults and adjust gradually. 4. Reduce input rate or enable filtering.
E0E	Undervoltage fault	1. Check main circuit input voltage wiring. 2. Measure main circuit voltage with voltmeter. 3. Verify power supply matches specifications.	1. Reconfirm voltage wiring. 2. Recheck power switch. 3. Use correct voltage source or series transformer.
E0F	Overvoltage fault	1. Measure main circuit input voltage with voltmeter (check if within rated range). 2. Verify power supply matches specifications. 3. If voltage is within range but fault persists, return for repair.	1. Use correct voltage source or series stabilizer. 2. Use correct voltage source or series transformer. 3. Return to manufacturer for repair.
E1A	Phase sequence error	Check motor U, V, W wiring for incorrect connections.	Reconnect U, V, W per manual and ensure proper grounding.
E19	Input phase loss	1. Check L1/L2/L3 power lines for loose connections or single-phase input. 2. Set single-phase drive to three-phase if applicable.	1. Ensure proper three-phase input; if still abnormal, return to dealer/manufacturer. 2. Set parameters correctly.
E22	AD sampling module fault	Initialize parameters and power cycle.	Return to dealer/manufacturer for repair.
E09	Motor overload fault	Continuous use exceeding rated load of servo drive.	Monitor parameters Un002 and Un027 to confirm motor load.

Fault code	Alarm name	Abnormal check	Corrective actions
E0A	Driver overload fault	1. Check motor/encoder wiring for errors. 2. Check for motor stalling. 3. Check for excessive load. 4. Verify overload characteristics and operation commands.	1. Reconfirm wiring. 2. Eliminate motor blockage .3. Increase motor capacity or reduce load. 4. Revise load/operation conditions and motor capacity.
E0C E0d	Motor overheatingDriver overheating	1. Check if ambient temperature is too high. 2. Check servo drive installation direction and connections to other equipment.	1. Measure ambient temperature and improve working environment. 2. Check servo drive installation for compliance with regulations.
E20 E21	Parameter storage exception	1. Check if host device frequently modifies servo drive parameters. 2. Modify a parameter, power cycle, and check if it is saved.	1. Change parameter writing method and rewrite. 2. Rewrite and check if saved; if multiple writes fail, return to manufacturer.
E17	Motor overspeed fault	1. Check motor U/V/W wiring sequence. 2. Check if speed command is too large. 3. Check motor speed regulation. 4. Verify functional zero angle settings.	1. Check motor wiring for issues. 2. Reduce speed command or increase gain. 3. Check motor speed waveform and reduce regulator gain. 4. Restore functional zero angle to factory values.
E02 E03 E04	Encoder wire breakEncoder ABZ interference	1. Check encoder U/V/W/A/B/Z wiring. 2. Verify encoder connector contacts. 3. Check encoder signal soldering. 4. Check encoder shielding. 5. Check if encoder runs with AC power lines.	Reconfirm wiring and power cycle; if alarm persists after multiple checks, return to manufacturer for repair.
E06	Encoder overheating	Check if motor ambient temperature is too high.	Reduce ambient temperature or force-cool the motor.
E07	Low battery voltage	Measure battery voltage.	Replace battery (ensure encoder-drive terminal connection is good and drive is powered on; replacing without power may trigger E08 alarm on re-power).
E08	Encoder battery voltage too low	Measure battery voltage.	Replace battery, clear multi-turn fault information via Fn004 function after power-on, then re-power.
E14	Electronic gear ratio out-of-range error	Check if electronic gear ratio parameters are set appropriately.	Adjust parameters.
E0b	Brake resistor overload	1. Confirm brake resistor connection and calculate resistance value. 2. Check if braking IGBT is damaged. 3. Verify brake resistor (Pn034) and capacity (Pn035) settings.	1. Reconnect brake resistor or use appropriate one. 2. Return to dealer/manufacturer for repair. 3. Set parameters correctly.
E10	Main power loss	Check if power supply logic is correct.	Adjust power supply logic, or maintain status if main circuit power must be cut.
E16	Position deviation too large fault	1. Confirm gain settings are appropriate. 2. Verify torque limit is not too low. 3. Check if external load is excessive or motor is stalled.	1. Adjust gain values correctly. 2. Adjust torque limit correctly. 3. Reduce external load or re-evaluate motor capacity.

Chapter 8 Appendix

8.1 Monitoring Parameter List

Monitor No.	Display content	Unit
Un000	Motor speed	[r/min]
Un001	Speed command	[r/min]
Un002	Torque command value	[0.1%]
Un003	Incremental encoder sector number	[seg]
Un004	Current electrical angle	[0.1°]
Un005	Serial encoder rotation count	[round]
Un006	Serial encoder current position (single-turn value)	[ppr]
Un008	Received external pulse frequency	[0.01KHz]
Un010	Collected external pulse total (resets to zero when command Unit is disabled)	[Pulse]
Un012	Total feedback pulses (based on encoder)	[ppr]
Un014	Total feedback pulses (based on command pulses)	[Pulse]
Un016	Position deviation	[Pulse/ppr]
Un018	Collected external pulse total (non-resettable in command Unit)	[Pulse]
Un020	Servo current position (based on command pulses)	[Pulse]
Un022	Servo current position (based on encoder)	[ppr]
Un024	Encoder line count	[ppr]
Un026	Pulse command corresponding speed	[r/min]
Un027	Motor load rate	[0.1%]
Un028	Motor instantaneous maximum load rate	[0.1%]
Un029	Motor average load rate	[0.1%]
Un030	Brake load rate	[%]
Un031	DO output status	[-]
Un032	DI input status	[-]
Un033	AI1 final processed value	[MV]
Un034	AI2 final processed value	[MV]
Un035	AI1 physical voltage value	[MV]
Un036	AI2 physical voltage value	[MV]
Un037	IPM module temperature	[°C]
Un038	Switching power supply bus voltage	[V]
Un039	EEPROM initialization operation times	[times]
Un040	Total system operation time	[times]
Un042	Current active segment of multi-segment position	[seg]
Un043	Current active segment of multi-segment speed	[seg]

Monitor No.	Display content	Unit
Un044	Positioning status	[-]
Un045	Bus voltage	[V]
Un046	Current RMS value	[0.01A]
Un047	DC time	[0.001ms]
Un048	Vibration flag	[-]
Un049	Settling time	[ms]
Un050	Encoder feedback frequency	[KHz]
Un052	Target electrical angle	[0.1°]
Un053	Maximum electrical angle error in magnetic pole detection scan mode	[-]
Un054	Current status of motor parameter auto-tuning	[-]
Un055	Current status of magnetic pole detection	[-]
Un056	Electrical angle error in magnetic pole detection scan mode	[0.1°]
Un057	Electrical angle from parameter result	[0.1°]
Un058	Servo enable status	[-]
Un059	Magnetic pole detection success	[-]
Un060	Position deviation of gantry synchronous control command Unit	[Pulse]
Un062	Absolute encoder CRC check error times	[times]
Un063	Electrical angle corresponding to Hall sensor	[0.1°]
Un064	Actual position value for comparison output	[ppr]
Un066	AB encoder count of rising edges	[times]
Un068	Position command intermediate stop time	[ms]
Un069	Position command acceleration time	[ms]
Un070	Position command constant speed time	[ms]
Un071	Position command deceleration time	[ms]
Un072	Position command cycle time	[ms]
Un073	Number of coin breaks during positioning	[times]
Un074	Positioning overshoot flag	[-]
Un075	Positioning overshoot counter	[times]
Un076	Positioning overshoot oscillation amplitude increase counter	[times]
Un077	AAT status	[-]
Un078	Driver load rate	[0.1%]
Un079	EtherCAT state machine (1:INIT, 2:PREOP, 3:BOOT, 4:SAFEOP, 5:OP)	[-]
Un080	Actual AB frequency division count	[-]
Un082	NN pole pitch learning distance error	[-]
Un083	Capture times	[-]
Un084	Vibration flag (0: no vibration, 1: vibration)	[-]

Monitor No.	Display content	Unit
Un085	Inertia ratio	[0.01times]
Un086	Position command increment too large times	[times]
Un087	Communication error times	[times]
Un088	EtherCAT DC synchronous PWM cycle value	[-]
Un100	Last fault code	[-]
Un101	Motor speed at last fault	[r/min]
Un102	Bus voltage at last fault	[V]
Un103	Current at last fault	[A]
Un104	Timestamp of last fault	[minutes]
Un106	1st previous fault code	[-]
Un107	Motor speed at 1st previous fault	[r/min]
Un108	Bus voltage at 1st previous fault	[V]
Un109	Current at 1st previous fault	[A]
Un110	Timestamp of 1st previous fault	[minutes]
Un112	2nd previous fault code	[-]
Un113	Motor speed at 2nd previous fault	[r/min]
Un114	Bus voltage at 2nd previous fault	[V]
Un115	Current at 2nd previous fault	[A]
Un116	Timestamp of 2nd previous fault	[minutes]
Un118	3rd previous fault code	[-]
Un119	Motor speed at 3rd previous fault	[r/min]
Un120	Bus voltage at 3rd previous fault	[V]
Un121	Current at 3rd previous fault	[A]
Un122	Timestamp of 3rd previous fault	[minutes]
Un124	Fault code	[-]
Un200	Servo type	[-]
Un201	Current motor code	[-]
Un202	CPUA software serial number 1	[-]
Un203	CPUA software serial number 2	[-]
Un204	CPUB software serial number 1	[-]
Un205	CPUB software serial number 2	[-]
Un206	CPUC software serial number 1	[-]
Un207	CPUC software serial number 2	[-]
Un208	Product serial number 1	[-]
Un209	Product serial number 2	[-]
Un210	Product serial number 3	[-]

8.2 Auxiliary Function List

Code	Function
Fn000	Internal S-ON command 0: No operation 1: Servo enable ON
Fn001	JOG function Enter this function code to enable JOG mode; Press ∧ key: motor rotates forward at P512, release to stop; Press ∨ key: motor rotates reverse at P512, release to stop; Press MOD key to exit JOG mode
Fn002	System parameter initialization 0: No operation 65535: Perform initialization
Fn003	Alarm reset 0: No operation 1: Alarm reset
Fn004	Absolute encoder multi-turn data and fault handling 0: No operation 1: Clear fault information 2: Clear multi-turn and fault information
Fn006	Software reset 0: No operation 1: System software reset
Fn007	FFT 0: Disabled 1: Enabled
Fn008	Offline inertia identification switch 0: No operation 1: Perform identification
Fn009	Power-on default display status 0: Display running status on power-on XXXX: Display corresponding address parameter (communication address)

8.3 User Parameter List

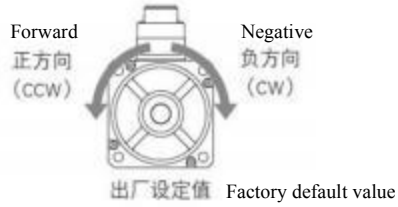
8.3.1 Basic Setting Parameters

Pn000	Direction polarity setting				Initial value	0
	Scope	0~1	Unit	—	Effective time	Take effect after re-powering on.

Relationship between command direction setting and motor rotation direction:

0: Motor rotates **CW** (clockwise when viewed from the shaft end) for forward command.

1: Motor rotates **CCW** (counterclockwise when viewed from the shaft end) for forward command.



Pn002	Gain adjustment mode selection				Initial value	1
	Range	0~14	Unit	—	Effective time	Take effect after re-powering on.

Select the gain adjustment method.

Pn002 = 0: Manual Mode

Auto-tuning is disabled. Gain parameters are adjusted manually.

Pn002 = 1: Auto-tuning Mode 1

Auto-tuning mode that automatically adjusts gain parameters based on the rigidity setting.

Suitable for applications where the load inertia ratio is nearly constant.

Before using this mode, estimate the system inertia (using auxiliary function **Fn008 Offline Inertia Identification**) and appropriate rigidity, then set them in **load inertia ratio (Pn004)** and **rigidity (Pn003)**.

The system automatically calculates related gain parameters: **Pn100, Pn101, Pn102, Pn128**. These parameters become read-only and are modified by the system.

Pn002 = 2: Auto-tuning Mode 2

Auto-tuning mode suitable for applications where the load inertia ratio changes frequently.

In this mode, the servo system automatically identifies load inertia online, saves the result every 30 minutes, and updates **load inertia ratio (Pn004)**.

The user only needs to set the appropriate rigidity in **Pn003**.

The system automatically calculates related gain parameters: **Pn100, Pn101, Pn102, Pn128**. These parameters become read-only and are modified by the system.

Use Manual Mode in the following cases:

- When auto-tuning does not provide satisfactory performance.
- Mechanical connections are loose, there is backlash, or mechanical rigidity is very low.
- Load inertia ratio is too large (> 20 times), too small (< 3 times), or fluctuates.
- Continuous low-speed operation (< 100 rpm), or speed ≥ 100 rpm and acceleration ≥ 2000 rpm/s does not last at least 50 ms.
- Acceleration/deceleration time ≤ 2000 rpm/s, or acceleration/deceleration torque is smaller than friction torque.

Settings outside the above ranges are reserved functions.

Pn003	Rigidity				Initial value	13
	Range	1~31	Unit	—	Effective time	Take effect immediately

Select the rigidity level.The table below shows the relationship between the rigidity setting and gain parameters.Higher rigidity results in faster servo response, but excessive rigidity may cause oscillation or other abnormalities.(Note: Rigidity = 0 is **not available**.)

Pn003	Pn100 Position Regulator Proportional Gain	Pn101 Speed Regulator Proportional Gain	Pn102 Speed Regulator Integral Time Constant	Pn128 Torque Command Low-pass Smoothing Constant
0	2.0	1.5	37.00	15.00
1	2.5	2.0	28.00	11.00
2	3.0	2.5	22.00	9.00
3	4.0	3.0	19.00	8.00
4	4.5	3.5	16.00	6.00
5	5.5	4.5	12.00	5.00
6	7.5	6.0	9.00	4.00
7	9.5	7.5	7.00	3.00
8	11.5	9.0	6.00	3.00
9	14.0	11.0	5.00	2.00
10	17.5	14.0	4.00	2.00
11	32.0	18.0	3.10	1.26
12	39.0	22.0	2.50	1.03
13	48.0	27.0	2.10	0.84
14	63.0	35.0	1.60	0.65
15	72.0	40.0	1.40	0.57
16	90.0	50.0	1.20	0.45
17	108.0	60.0	1.10	0.38
18	135.0	75.0	0.90	0.30
19	162.0	90.0	0.80	0.25
20	206.0	115.0	0.70	0.20
21	251.0	140.0	0.60	0.16
22	305.0	170.0	0.50	0.13
23	377.0	210.0	0.40	0.11
24	449.0	250.0	0.40	0.09
25	500.0	280.0	0.35	0.08
26	560.0	310.0	0.30	0.07
27	610.0	340.0	0.30	0.07
28	660.0	370.0	0.25	0.06
29	720.0	400.0	0.25	0.06

Pn004	1st Load Inertia Ratio				Initial value	1
	Range	1.0~120.0	Unit	—	Effective time	Take effect immediately

Sets the ratio of total inertia to motor rotor inertia.Total inertia is the sum of load inertia and motor rotor inertia.
When the gain adjustment mode is set to **Manual Mode (Pn002=0)** or **Auto-tuning Mode 1 (Pn002=1)**,the system inertia ratio can be identified by **Offline Inertia Identification (Fn008)**,or can be entered manually by the user.
When the gain adjustment mode is set to **Auto-tuning Mode 2 (Pn002=2)**,the system automatically identifies the inertia ratio online.

Pn008	The number of command pulses per rotation of the motor				Initial value	0
	scope	0~8388608	Unit	Scope	0~8388608	Unit

Sets the number of command pulses required for one revolution of the servo motor, including external pulse commands and multi-segment position commands.The setting range varies according to different encoder types.

Encoder type	Set the range
17bit	0~131072
23bit	0~8388608

When this parameter is set to **0**, parameters **Pn-010** and **Pn-012** are enabled.The relationship between command pulses and motor revolutions is determined by the **electronic gear ratio** settings.

Pn010	lectronic gear ratio numerator 1		Initial value		1	
	Scope	$0\sim2^{30}$	Unit	—	scope	$0\sim2^{30}$

Sets the **numerator of the electronic gear ratio**.If set to **0**, the system uses the **encoder resolution** by default.

Pn012	Denominator of electronic gear ratio				Initial value	1
	Scope	$1\sim2^{30}$	Unit	—	Effective time	Takes effect immediately

Sets the **denominator of the electronic gear ratio.**

Pn008	Pn010	Pn012	Instruction input and motor output
1~8388608	- No impact	- No impact	指令脉冲输入 Command pulse input × Encoder resolution 编码器分辨率 / Pn012设定值 Pn012 setting → 位置指令 Position command
0	0	1~1073741824	指令脉冲输入 Command pulse input × Encoder resolution 编码器分辨率 / Pn012设定值 Pn012 setting → 位置指令 Position command
	1~1073741824	1~1073741824	指令脉冲输入 Command pulse input × Pn010 setting Pn010设定值 / Pn012设定值 Pn012 setting → 位置指令 Position command

Pn014	Electronic gear ratio numerator 1				Initial value	0
	Range	$0\sim2^{30}$	**Unit**	—	Effective time	Takes effect immediately
Pn016	Electronic gear ratio numerator 2				Initial value	0
	Range	$0\sim2^{30}$	**Unit**	—	Effective time	Takes effect immediately
Pn018	Electronic gear ratio numerator 3				Initial value	0
	Range	$0\sim2^{30}$	**Unit**	—	Effective time	Takes effect immediately

When different gear ratios need to be switched during servo operation,two external digital input terminal signals can be configured to select different electronic gear ratios in combination.

External Digital Input Signal 1	**External Digital Input Signal 2**	**Active Gear Ratio Numerator**
0	0	Pn010
1	0	Pn014
0	1	Pn016
1	1	Pn018

*Note: The electronic gear ratio is valid for both external pulse commands and internal multi-segment position commands.The setting range

of the electronic gear ratio is: **0.001 ~ 64000**.If the setting is out of range, the drive will generate an **E14 fault**.

Pn024	Selection of the 1st Torque Limit Source				**Initial value**	0
	Range	0~8	**Unit**	__	**Effective time**	Takes effect immediately

Selects the source for limiting the motor output torque:

Pn024=0: Pn025 limits positive torque; Pn026 limits negative torque.
Pn024=1: AI1 limits both positive and negative torque.
Pn024=2: AI2 limits both positive and negative torque.
Pn024=3: AI1 limits positive torque; Pn026 limits negative torque.
Pn024=4: AI2 limits positive torque; Pn027 limits negative torque.
Pn024=5: Pn025 limits positive torque; AI1 limits negative torque.
Pn024=6: Pn026 limits positive torque; AI2 limits negative torque.
Pn024=7: AI1 limits positive torque; AI2 limits negative torque.
Pn024=8: AI1 limits negative torque; AI2 limits positive torque.
Example: When Pn024=1 and AI1 limits both positive and negative torque, the meaning is shown in the figure below:

$$\text{正方向转矩限制值} = \left|\frac{AI1}{12V}\right| * Pn025$$

Positive direction torque limit value

$$\text{负方向转矩限制值} = \left|\frac{AI1}{12V}\right| * Pn026$$

Negative direction torque limit value

Torque limit can be switched to **Torque Limit 2** at any time by controlling the relevant external digital input terminals. For details, refer to parameters Pn507–Pn511.

Pn025	1st torque limit, maximum forward rotation				**Initial value**	300
	Range	0.0~350.0	**Unit**	__	**Effective time**	Takes effect immediately
Pn026	1st torque limit, maximum reverse rotation				**Initial value**	300
	Range	0.0~350.0	**Unit**	__	**Effective time**	Takes effect immediately

Sets the maximum output torque in both positive and negative directions, with the reference being the motor rated torque.

Pn027	Maximum speed setting				**Initial value**	8000
	Range	0~10000	**Unit**	rpm	**Effective time**	Take effect after powering on again

Sets the maximum allowable speed of the servo motor.The system command shall not exceed this set value.If the motor operating speed exceeds this set value, an overspeed alarm will occur.

Pn028	Position error following warning value				**Initial value**	80000
	Range	0~1073741824	**Unit**	pulse	**Effective time**	Takes effect immediately

Sets the position following error warning threshold. When the position deviation reaches or exceeds the set value, a "position following error excessive" warning signal will be output.

Pn030	Position error follows the fault value				**Initial value**	100000
	Range	0~1073741824	**Unit**	pulse	**Effective time**	Takes effect immediately

Sets the position following error fault alarm threshold.When the position deviation reaches or exceeds the set value,the **E16 following error excessive fault** will be triggered.

Pn032	Selection of Usage Methods for Absolute Encoders				**Initial value**	0
	Range	0~1	**Unit**	pulse	**Effective time**	Takes effect after power-on reset.

Selects the operating mode of the absolute encoder.
Pn032=0: Operate as incremental encoder
Pn032=1: Operate as absolute encoder

Pn033	Maximum number of rotations for absolute encoder.				**Initial value**	32767
	Range	1~32767	**Unit**	Rev	**Effective time**	Takes effect immediately

Sets the upper limit of the rotation count for the absolute encoder.If the rotation count of the absolute encoder exceeds the set value, an overtravel warning will be issued.

Pn034	Setting of braking resistor resistance value				Initial value	50
	Range	20~700	**Unit**	**Ω**	**Effective time**	Takes effect immediately

Sets the resistance value of the braking resistor.Do not modify this setting when using the built-in braking resistor.

Pn035	Braking resistor power setting				Initial value	3000
	Range	20~30000	**Unit**	**W**	**Effective time**	Takes effect immediately

Sets the power of the braking resistor.Do not modify this setting when using the built-in braking resistor.

Pn036	Brake discharge duty cycle				Initial value	50
	Range	0~100	**Unit**	**%**	**Effective time**	Takes effect immediately

Duty cycle of the brake transistor during braking.Set to 0: the brake transistor is fully disabled during braking.Set to 100: the brake transistor is fully enabled during braking.

Pn037	Brake resistor derating percentage				Initial value	40
	Range	1~100	**Unit**	**%**	**Effective time**	Takes effect immediately

Sets the derating of the braking resistor.Do not modify this setting when using the built-in braking resistor.

Pn041	Enable ON receive command delay time				Initial value	200
	Range	20~rated speed of the motor	**Unit**	**ms**	**Effective time**	Takes effect immediately

After the servo enable ON signal remains valid for the time set by this parameter,the drive can accept position, speed, and torque commands.。

Pn042	Stop mode selection				Initial value	200
	Range	0~1311	**Unit**	—	**Effective time**	Takes effect immediately

This parameter is displayed in hexadecimal format and is used to set the stop mode.

Right 4th digit	**Right 3rd digit**	**Right 2nd digit**	**Right 1st digit**	**Meaning**
—	—	—	0	When servo enable is OFF, coast to stop; motor is in free state after stop.
—	—	—	1	When servo enable is OFF, decelerate to stop within the time set in Pn047; motor is in free state after stop.
—	—	0	—	When a level 2 alarm occurs, coast to stop; motor is in free state after stop.
—	—	1	—	When a level 2 alarm occurs, decelerate to stop within the time set in Pn047; motor is in free state after stop.
—	0	—	—	When overtravel occurs, coast to stop; motor is in free state after stop.
—	1	—	—	When overtravel occurs, decelerate to stop within the time set in Pn048; motor is in free state after stop.
—	2	—	—	When overtravel occurs, decelerate to stop within the time set in Pn048; motor is in position-hold state after stop.
0	—	—	—	Disable dynamic braking function.
1	—	—	—	Enable dynamic braking function (only valid for Type A chassis drives).

Pn043	Enable OFF – brake command wait time				Initial value	500
	Range	1~30000	**Unit**	**ms**	**Effective time**	Takes effect immediately
When the motor is rotating, if the servo enable turns OFF or a fault occurs, the brake will engage after this wait time.						
Pn044	Speed threshold for brake release command				Initial value	20
	Range	1~1000	**Unit**	**rpm**	**Effective time**	Takes effect immediately
When the motor is rotating, if the servo enable is turned off or a fault occurs, the brake will release when the motor speed drops to or below this set value.						
Pn045	Brake command – motor power-off delay time				Initial value	200
	Range	1~500	**Unit**	**ms**	**Effective time**	Takes effect immediately
When the motor is stationary, if the servo enable is turned OFF, the brake will engage immediately, and the motor will be powered off after the delay time set by this parameter.						
Pn047	Zero-speed stop deceleration time				Initial value	200
	Range	1~30000	**Unit**	ms	**Effective time**	Takes effect immediately
When the stop mode is set to zero-speed stop (set by Pn042), this parameter defines the deceleration time after receiving the servo enable OFF command or when a level 2 alarm occurs.						
Pn048	Overtravel protection deceleration time				Initial value	200
	Range	1~30000	**Unit**	ms	**Effective time**	Takes effect immediately
When an overtravel warning (P-OT, N-OT) occurs and Pn042 is set to overtravel zero-speed stop, this parameter sets the time for the motor to decelerate to a stop.						
Pn049	Emergency stop deceleration time				Initial value	50
	Range	1~30000	**Unit**	ms	**Effective time**	Takes effect immediately
Time for the motor to decelerate to a stop when an emergency stop occurs in the servo system.						

8.3.2 Gain Parameters

Pn100	Position loop gain				Initial value	32.0
	Range	1.0~2000.0	**Unit**	rad/s	**Effective time**	Takes effect immediately
Sets the gain of the position regulator, which determines the responsiveness of the position control system. The larger the parameter value, the higher the position response frequency, the better the tracking performance for position commands, the smaller the position error, and the shorter the positioning settling time. However, note that an excessively large setting will cause vibration.						
Pn101	Velocity loop gain				Initial value	18.0
	Range	0.1~5000.0	**Unit**	Hz	**Effective time**	Takes effect immediately
Sets the gain of the speed regulator, which determines the responsiveness of the speed control loop. The larger the parameter value, the higher the response frequency of the speed loop and the better the tracking performance for speed commands. To increase the position loop gain and improve the response performance of the servo system, it is necessary to increase the setting of the speed loop gain. However, note that an excessively large setting will cause vibration. The response frequency of the speed loop must be **4 to 6 times higher** than that of the position loop; otherwise, vibration will occur. Position loop response frequency fp = Position loop gain / 2π Speed loop response frequency = Speed loop gain × Load inertia ratio						

Pn102	Velocity loop integral time constant				Initial value	31.0
	Range	0.1~5000.0	**Unit**	ms	**Effective time**	Takes effect immediately

Sets the velocity loop integral time constant.
When the set value is 3000.0, the integral action is disabled.
The smaller the setting, the faster the deviation at standstill approaches zero.
However, an excessively small value will cause vibration.
Generally, the larger the load inertia, the larger the velocity loop integral time constant should be set.
If the load inertia ratio Pn004 is set to match the actual value,the velocity loop integral time constant ≧ 5000/(2πfv)

Pn103	Second position loop gain				Initial value	32.0
	Range	1.0~2000.0	**Unit**	%	**Effective time**	Takes effect immediately

Sets the gain of the position regulator, which determines the responsiveness of the position control system.
The larger the parameter value, the higher the position response frequency, the better the tracking performance for position commands, the smaller the position error, and the shorter the positioning settling time.
However, note that an excessively large setting will cause vibration.
This parameter is valid during gain switching.

Pn104	Second speed loop gain				Initial value	18.0
	Range	0.1~5000.0	**Unit**	%	**Effective time**	Takes effect immediately

Sets the gain of the velocity regulator, which determines the responsiveness of the velocity control loop.
The larger the parameter value, the higher the response frequency of the velocity loop and the better the tracking performance for velocity commands. To increase the position loop gain and improve the response performance of the servo system, it is necessary to increase the velocity loop gain setting. However, note that an excessively large setting will cause vibration.
The response frequency of the velocity loop must be 4 to 6 times higher than that of the position loop; otherwise, vibration will occur.
Position loop response frequency fp = Position loop gain / 2π
Velocity loop response frequency = Velocity loop gain × Load inertia ratio
This parameter is active during gain switching.

Pn106	Speed feedforward gain				Initial value	30
	Range	0.0~100.0	**Unit**	%	**Effective time**	Takes effect immediately

Sets the velocity feedforward gain.
When the position control command changes smoothly, increasing this gain can reduce the position following error and improve position tracking performance.
When the position control command changes unsmoothly, the machinery may vibrate, and decreasing this gain can reduce the vibration.

Pn107	Velocity feedforward smoothing filter time				Initial value	5
	Range	0~100	**Unit**	ms	**Effective time**	Takes effect immediately

Sets the first-order filter time constant for the velocity feedforward gain.
When the position control command changes smoothly, reducing this filter time can decrease the position following error and improve position tracking performance.
When the position control command changes unsmoothly, increasing this filter time can reduce vibration of the mechanism during operation, but the position following error will increase.

Pn108	Torque feedforward gain				Initial value	0
	Range	0.0~200.0	**Unit**	%	**Effective time**	Takes effect immediately

Sets the torque feedforward gain value.
Acceleration (torque) is obtained by differentiating the velocity command.Multiplying it by this parameter and adding it to the torque command output from the velocity regulator can speed up the motor response.The reference is the rated torque.

Pn109	Torque feedforward filter time constant				Initial value	5
	Range	0.0~100.0	**Unit**	ms	**Effective time**	Takes effect immediately

Time constant for the first-order low-pass filter applied to the torque.
The acceleration (torque) obtained by differentiating the velocity command contains a large amount of high-order harmonics.
When added to the torque command, it will cause high-frequency vibration of the motor torque.
By applying a low-pass filter to the acceleration torque before adding it to the torque command, high-frequency harmonics can be eliminated and vibration reduced.

Pn110	Velocity Feedback Low-pass Filter Time Constant				Initial value	0
	Range	0.0~20.0	**Unit**	ms	**Effective time**	Takes effect immediately

Sets the time constant of the first-order filter applied to the velocity feedback.
The motor rotational speed is obtained by differentiating the position feedback from the encoder.The speed signal contains resonance and high-frequency interference components.This parameter can suppress noise, but it also introduces a delay and slows down the loop response.

Pn112	Gain Switching Condition				Initial value	0
	Range	00~18	**Unit**	__	**Effective time**	Takes effect immediately

This parameter is valid when **Pn002 (Gain Adjustment Mode)** is set to **Manual Mode**.This parameter is displayed in **hexadecimal**.

Right 2 bits	Right 1 bit	Meaning	Remarks
0	0	~~Disable gain switching function~~	Only switches position loop gain
	1	When the external digital input signal changes from OFF → ON;	
	2	In position control mode, when the position deviation is greater than the set value of parameter Pn115 (with a 100ppr command unit delay);	
	3	When the speed command corresponding to the position command frequency is greater than the set value of parameter Pn115 (with a 10rpm delay);	
	4	When the servo motor rotation speed is greater than the set value of parameter Pn115 (with a 10rpm delay);	
	5	When the external digital input signal changes from ON → OFF (invalid);	
	6	In position control mode, when the position error is less than the set value of parameter Pn115 (with a 100ppr command unit delay);	
	7	When the position command frequency (converted to the corresponding speed command) is less than the set value of parameter Pn115 (with a 10rpm delay);	
	8	When the servo motor rotation speed is less than the set value of parameter Pn115 (with a 10rpm delay);	
1	0	Disable integral switching function	Only switches speed loop integral
	1	When the external digital input signal changes from OFF → ON;	
	2	In position control mode, when the position deviation is greater than the set value of parameter Pn115 (with a 100ppr command unit delay);	
	3	When the speed command corresponding to the position command frequency is greater than the set value of parameter Pn115 (with a 10rpm delay);	
	4	When the servo motor rotation speed is greater than the set value of parameter Pn115 (with a 10rpm delay);	
	5	When the external digital input signal changes from ON → OFF (invalid);	
	6	In position control mode, when the position error is less than the set value of parameter Pn115 (with a 100ppr command unit delay);	
	7	When the position command frequency (converted to the corresponding speed command) is less than the set value of parameter Pn115 (with a 10rpm delay);	
	8	When the servo motor rotation speed is less than the set value of parameter Pn115 (with a 10rpm delay);	

Pn113	Gain Switching Time				Initial value	5
	Range	0~3000	**Unit**	ms	**Effective time**	Takes effect immediately
When the gain switching condition is met, the gain changes linearly and smoothly to the target gain value within this time.(0: This function is disabled.)						

Pn114	Gain switching delay time				Initial value	5
	Range	0~3000	**Unit**	ms	**Effective time**	Takes effect immediately
When the gain switching condition is satisfied, switching will start only after the delay time set by this parameter to prevent erroneous switching caused by interference and other factors, which may lead to system instability.						

Pn115	Gain switching threshold				Initial value	100
	Range	0~32767	**Unit**	—	**Effective time**	Takes effect immediately
Sets the threshold for gain switching.						

Pn116	Control loop coefficient				Initial value	75
	Range	10~100	**Unit**	—	**Effective time**	Takes effect immediately
Effective in **automatic gain tuning mode (Pn002 = 1 or 2)**.Used to determine the relationship between velocity bandwidth and position bandwidth. This parameter is based on automatic control theory:the velocity bandwidth should be at least **4 times** the position bandwidth.In general, **do not adjust** this parameter, especially **do not decrease** it.						

Pn117	**Low-Frequency Stiffness Coefficient**				Initial value	0.5
	Range	0.5~4.0	**Unit**	—	**Effective time**	Takes effect immediately

Effective in **automatic gain tuning mode (Pn002 = 1 or 2)**.Used to set the rigidity of the speed loop at low frequencies, i.e., the integral time constant of the speed loop at low frequencies.Its meaning is:

Low-frequency speed loop integral time constant 低频时速度环积分时间常数= $\frac{Pn102}{Pn117}$

In automatic tuning mode, increasing the setting value can improve the servo response in low-rigidity applications.However, an excessively large setting will cause vibration.

Pn118	PDFF Control Coefficient				Initial value	100
	Range	0~100	**Unit**	—	**Effective time**	Takes effect immediately
When set to **0**, it operates as an **IP controller**.When set to **100**, it operates as a **PI controller**.When set to **1–99**, it operates as a **PDFF controller**.						

Pn119	Performance Extension 1				Initial value	000000
	Range	000000~111111	**Unit**	—	**Effective time**	Takes effect immediately

This parameter is displayed in hexadecimal and is used to control the on/off of advanced suppression functions.

Right 1/2/3/5 bits	**Reserved**
Right 4 bits	Speed observer function: Estimates the state changes of the controlled object through software. When the mechanical system resonates at a frequency higher than 100Hz, it is used to remove high-frequency vibration components and stabilize the speed loop.
Right 6 bits	Low-noise mode: When enabled, the current gain is appropriately reduced to improve noise

		performance.
	Right 7 bits	When set to 1, the gravity compensation function is activated, which is mostly used for vertical loads.

Pn120	Torque Command Addition Value				Initial value	0
	Range	-100.0~100.0	**Unit**	%	**Effective time**	Takes effect immediately
When the servo system is used for a **vertical axis**, due to the continuous load caused by gravity, this value can be converted into a given torque and added to the torque command.Please note the setting of the motor rotation direction; the set value of this parameter is applied in the **positive direction** of motor rotation.						
Pn121	**Forward Torque Compensation Value**				Initial value	0
	Range	-100.0~100.0	**Unit**	%	**Effective time**	Takes effect immediately
Sliding friction compensation value during **forward motor rotation**.						
Pn122	Reverse Torque Compensation Value				Initial value	0
	Range	-100.0~100.0	**Unit**	%	**Effective time**	Takes effect immediately
Sliding friction compensation value during **reverse motor rotation**.						
Pn123	Friction Compensation Smoothing Time Constant				Initial value	50
	Range	10~1000	**Unit**	ms	**Effective time**	Takes effect immediately
Applies a first-order filter to the friction compensation value to prevent system vibration caused by sudden changes in the compensation value.						
Pn124	Viscous Friction Compensation Gain				Initial value	0
	Range	0~1000	**Unit**	0.1%/Krpm	**Effective time**	Takes effect immediately
Sets the torque compensation value for viscous friction load.The higher the speed, the greater the viscous friction.Setting this parameter can improve response.						
Pn127	External Disturbance Rejection Gain				Initial value	0
	Range	-100.0~100.0	**Unit**	%	**Effective time**	Takes effect immediately
External disturbance compensation after disturbance observation.Used to reduce speed variation during load disturbance.						
Pn128	Torque Command Low-Pass Smoothing				Initial value	0
	Range	-100.0~100.0	**Unit**	%	**Effective time**	Takes effect immediately
Sets the time constant for applying a first-order low-pass filter to the torque command output from the speed regulator. The torque command from the speed regulator may contain high-order harmonic components due to speed feedback fluctuations, which can cause motor vibration.Low-pass filtering removes these harmonics but introduces phase delay and slows down the motor response.						
Pn129	Speed Observer Cutoff Frequency Level				Initial value	13

	Range	0~13	**Unit**	—	**Effective time**	Takes effect immediately
Sets the cutoff level of the built-in speed observer.The larger the setting value, the higher the cutoff frequency of the speed observer and the wider the vibration suppression range, but the suppression strength will decrease.						
Pn130	Speed Observer Cutoff Frequency Level				Initial value	13
	Range	0~13	**Unit**	—	**Effective time**	Takes effect immediately
Sets the cutoff level of the built-in speed observer.The larger the set value, the higher the cutoff frequency of the speed observer and the wider the vibration suppression range, but the suppression intensity will be reduced.						
Pn131	Model Tracking Control Switch 1				Initial value	100
	Range	0000~1211	**Unit**	—	**Effective time**	Takes effect immediately

This parameter is displayed in hexadecimal format and is used to control the on/off of the model tracking control function.

Right 1st bit	**Model Tracking Control Selection** **0: Model tracking control not applied** **1: Model tracking control applied**
Right 2nd bit	Vibration Suppression Selection 0: No vibration suppression 1: Add vibration suppression for a specific frequency 2: Add vibration suppression for 2 different frequencies
Right 3rd bit	Vibration Suppression Function Adjustment Selection 0: Vibration suppression function is not automatically adjusted via auxiliary functions 1: Vibration suppression function is automatically adjusted via auxiliary functions
Right 4th bit	Speed Feedforward/Torque Feedforward Selection0: Model tracking control and speed/torque feedforward not applied simultaneously1: Model tracking control and speed/torque feedforward applied simultaneously

Pn132	Model Tracking Control Gain				Initial value	50.0
	Range	1.0~2000.0	**Unit**	1/s	**Effective time**	Takes effect immediately
Pn133	Model Tracking Control Gain Compensation				Initial value	100.0
	Range	50.0~200.0	**Unit**	%	**Effective time**	Takes effect immediately
Pn134	Model Tracking Control Offset (Forward Direction)				Initial value	100.0
	Range	0.0~1000.0	**Unit**	%	**Effective time**	Takes effect immediately
Pn135	Model Tracking Control Offset (Reverse Direction)				Initial value	100.0
	Range	0.0~1000.0	**Unit**	%	**Effective time**	Takes effect immediately
Pn136	Vibration Suppression 1 Frequency A				Initial value	50.0
	Range	1.0~250.0	**Unit**	Hz	**Effective time**	Takes effect immediately
Pn137	Vibration Suppression 1 Frequency B				Initial value	50.0
	Range	1.0~250.0	**Unit**	Hz	**Effective time**	Takes effect immediately

Pn138	Model Tracking Control Speed Feedforward Compensation				Initial value	100.0
	Range	0.0~1000.0	**Unit**	%	**Effective time**	Takes effect immediately
Pn139	Model Tracking Control Gain				Initial value	50.0
	Range	1.0~2000.0	**Unit**	1/s	**Effective time**	Takes effect immediately
Pn140	Model Tracking Control Gain Compensation				Initial value	100.0
	Range	50.0~200.0	**Unit**	%	**Effective time**	Takes effect immediately
Pn141	Vibration Suppression 2 Frequency				Initial value	80.0
	Range	1.0~200.0	**Unit**	Hz	**Effective time**	Takes effect immediately
Pn142	Vibration Suppression 2 Compensation				Initial value	100
	Range	10~1000	**Unit**	%	**Effective time**	Takes effect immediately
Pn142	Vibration Suppression 2 Compensation				Initial value	100
	Range	10~1000	**Unit**	%	**Effective time**	Takes effect immediately

8.3.3 Vibration Suppression Parameters

Pn200	Adaptive Filter Mode Setting				Initial value	0
	Range	0~2	**Unit**	__	**Effective time**	Takes effect immediately
Selects the mode of the adaptive filter. Pn200 = 0: 4 notch filters set manually; Pn200 = 1: Notch filter 3 and 4 automatically adjust depth online, width set manually; Pn200 = 2: Clear notch filter 3 and 4.						
Pn201	1st Notch Frequency				Initial value	5000
	Range	50~5000	**Unit**	Hz	**Effective time**	Takes effect after power cycle
Sets the center frequency of the 1st notch filter.						
Pn202	1st Notch Width				Initial value	2
	Range	0~20	**Unit**	__	**Effective time**	Takes effect after power cycle
Width of the 1st notch filter. The larger the value, the stronger the suppression near the center frequency.						
Pn203	2nd Notch Depth				Initial value	0
	Range	0~99	**Unit**	__	**Effective time**	Takes effect after power cycle
Notch depth of the 2nd notch filter. The larger the value, the stronger the suppression at this point.						
Pn204	2nd Notch Frequency				Initial value	5000

	Range	50~5000	**Unit**	Hz	**Effective time**	Takes effect after power cycle
Sets the center frequency of the 2nd notch filter.						
Pn205	2nd Notch Width				Initial value	2
	Range	0~20	**Unit**	__	**Effective time**	Takes effect after power cycle
Width of the 2nd notch filter. The larger the value, the stronger the suppression near the center frequency.						
Pn206	2nd Notch Depth				Initial value	0
	Range	0~99	**Unit**	__	**Effective time**	Takes effect after power cycle
Notch depth of the 2nd notch filter. The larger the value, the stronger the suppression at this point.						
Pn207	3rd Notch Frequency				Initial value	5000
	Range	50~5000	**Unit**	Hz	**Effective time**	Takes effect after power cycle
Sets the center frequency of the 3rd notch filter.						
Pn208	3rd Notch Width				Initial value	2
	Range	0~20	**Unit**	__	**Effective time**	Takes effect after power cycle
Width of the 3rd notch filter. The larger the value, the stronger the suppression near the center frequency.						
Pn209	3rd Notch Depth				Initial value	0
	Range	0~99	**Unit**	__	**Effective time**	Takes effect after power cycle
Notch depth of the 3rd notch filter. The larger the value, the stronger the suppression at this point.						
Pn210	4th Notch Frequency				Initial value	5000
	Range	50~5000	**Unit**	Hz	**Effective time**	Takes effect after power cycle
Sets the center frequency of the 4th notch filter.						
Pn211	4th Notch Width				Initial value	2
	Range	0~20	**Unit**	__	**Effective time**	Takes effect after power cycle
Width of the 4th notch filter. The larger the value, the stronger the suppression near the center frequency.						
Pn212	4th Notch Depth				Initial value	0
	Range	0~99	**Unit**	__	**Effective time**	Takes effect after power cycle

Notch depth of the 4th notch filter. The larger the value, the stronger the suppression at this point.
Notch Width Setting Table：

Notch Width	Bandwidth / Center Frequency	Notch Width	Bandwidth / Center Frequency
0	0.1	11	3.36
1	0.59	12	4.0
2	0.71	13	4.76
3	0.84	14	5.66
4	1.0	15	6.73
5	1.19	16	8.0
6	1.41	17	9.51
7	1.68	18	11.31
8	2.0	19	13.45

9	2.38	20	16.0	
10	2.83			

Pn222	Automatic Vibration Detection Level Sensitivity				Initial value	100
	Range	10~30000	**Unit**	—	**Effective time**	Takes effect after power cycle
Set the amplitude of the speed error. Resonance frequencies with vibration amplitude greater than this value can be regarded as a resonance point.						
Pn223	Position FIR Filter				Initial value	0
	Range	0.0~128.0	**Unit**	ms	**Effective time**	Takes effect after power cycle
Set the time constant of the Position FIR Filter.						

8.3.4 Speed, Torque and Position Control Parameters

Pn314	Torque Direction Speed Limit				Initial value	100
	Range	0~6000	**Unit**	rpm	**Effective time**	Takes effect immediately
In torque control mode, set the speed limit value in the direction of the torque command.						
Pn329	Position Command Maximum Speed				Initial value	0
	Range	0~6000	**Unit**	rpm	**Effective time**	Takes effect after power cycle
When Pn329 equals 0, this function is disabled.When Pn329 is not equal to 0, this function is enabled.When Pn329 is set to 3000 (unit: rpm), the driver will trigger alarm **E30 (Position Command Error)** if the speed of the position command exceeds 3000 rpm set by Pn329.						

8.3.5 Input and Output Parameters

Pn400	External Digital Input 1 Function Selection				Initial value	20
	Range	0~99	**Unit**	—	**Effective time**	Takes effect after power cycle

Set the function of the external digital input 1 terminal, as shown in the table below：

Function No.	Code	Function Name	Description	Trigger Type
0	DIDisable	No function definition	No function definition, terminal not used	—
2	EMGS	Emergency Stop	ON: Emergency stopOFF: No function	Level trigger
19	POT	Prohibit forward drive	ON: Allow forward driveOFF: Prohibit forward drive	Level trigger
20	NOT	Prohibit reverse drive	ON: Allow reverse driveOFF: Prohibit reverse drive	Level trigger
23	ORGP	External detector input	Rising edge: External detector activeFalling edge: External detector inactive	Edge trigger

Pn401	External Digital Input 2 Function Selection				Initial value	19
	Range	0~99	**Unit**		**Range**	0~99
Pn402	External Digital Input 3 Function Selection				Initial value	23
	Range	0~99	**Unit**		**Effective time**	Takes effect after power cycle
Pn403	External Digital Input 4 Function Selection				Initial value	0
	Range	0~99	**Unit**		**Effective time**	Takes effect after power cycle
Same as the function description of parameter Pn400.						
Pn408	External Digital Input Level Logic				Initial value	00000000
	Range	00000000~11111111	**Unit**	—	**Effective time**	Takes effect immediately
This parameter is displayed in binary format to set the level logic for each external digital input terminal.From right to left, it corresponds to external digital input 1 to external digital input 8.Setting **0** means the external input is active at low level; setting **1** means active at high level.Each terminal can be set individually.						
Pn409	External Digital Output 1 Function Selection				Initial value	1

	Range	0~99	Unit	—	Effective time	Takes effect after power cycle

Set the corresponding event for External Digital Output 1.When the relevant conditions are met, the terminal output is active.The output definitions are shown in the table below:

Function No.	Code	Function Name	Description
0	External Digital Output Disable	Reset to motor Z signal	Reset to motor Z signal
1	S-RDY	Servo Ready	Active: Servo is ready to accept S-ON commandInactive: Servo is not ready, cannot accept S-ON command
2	ZERO	Motor Zero Speed	Active: Motor speed is zeroInactive: Motor speed is not zero
3	INP	Position Reached	Active: In position control mode, position deviation pulse count is less than positioning completion width set in Pn454, and conditions in Pn452 are met
4	PNEAR	Position Near	Active: In position control mode, position deviation pulse count is less than positioning near width set in Pn453
5	ALM	Alarm Output	Active: Alarm event occursInactive: No alarm event
6	BRK-OFF	Brake Control	Active: Release holding brake (brake energized)Inactive: Engage holding brake (brake de-energized)
7	TGON	Motor Rotating	Active: Motor is rotatingInactive: Motor is stopped
8	WARN	Warning Output	Active: Warning event occursInactive: No warning event
9	V-COIN	Speed Near	Active: In speed control mode, actual motor speed reaches or exceeds the set value in Pn459
10	AT-SPEED	Speed Match	Active: In speed control mode, actual motor speed reaches or exceeds the set value in Pn460
11	TCL	Torque Limit	Active: Motor torque is limitedInactive: Motor torque is not limited
12	V-LIMIT	Speed Limit	Active: Motor speed is limitedInactive: Motor speed is not limited
13	T_CMP	Torque Match	Active: Motor output torque reaches the set valueInactive: Motor output torque has not reached the set value
14	Home	Home Return	Active: Home return completedInactive: Home return not yet completed
15	S_RUN	Servo Enable	Active: Servo ONInactive: Servo OFF

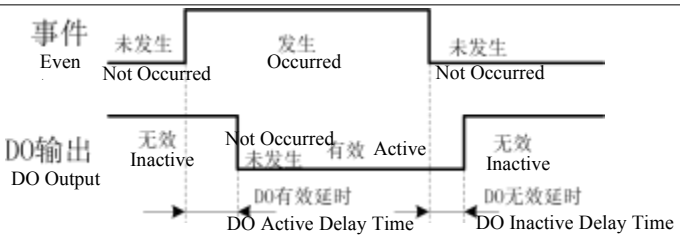
Pn410	External Digital Output 2 Function Selection				Initial value	6
	Range	0~99	Unit	—	Effective time	Takes effect after power cycle

Refer to the function description of parameter Pn409.

Pn414	External Digital Output Terminal Conducting Logic				Initial value	1000
	Range	0000~1111	**Unit**	—	**Effective time**	Takes effect immediately
This parameter is displayed in binary format to set the level logic for each external digital output terminal.From right to left, it corresponds to external digital output 1 to external digital output 4.Setting **0** means the terminal conducts when the event is active and turns off when inactive.Setting **1** means the terminal conducts when the event is inactive and turns off when active.						
Pn415	External Digital Input Force Active				Initial value	00000000
	Range	00000000~11111111	**Unit**	—	**Effective time**	Takes effect immediately
This parameter is displayed in binary format to force each external digital input terminal to be active.From right to left, it corresponds to external digital input 1 to external digital input 8.Setting **0** means the input is determined by the external circuit.Setting **1** means the external digital input terminal is forced active and the corresponding function is enabled.The parameter will be cleared after restart.						
Pn416	External Digital Output Force Output				Initial value	0000
	Range	0000~1111	**Unit**	—	**Effective time**	Takes effect immediately
This parameter is displayed in binary format to force each external digital output terminal to be active.From right to left, it corresponds to external digital output 1 to external digital output 4.Setting **0** means the output is determined by the set function.Setting **1** means the external digital output terminal is forced to conduct.The parameter will be cleared after restart.						
Pn417	External Digital Input Filter Time				Initial value	2
	Range	0~20	**Unit**	ms	**Effective time**	Takes effect immediately
Sets the filter time for the external digital input terminals.When strong external interference exists, a filter time can be set to prevent false triggering caused by interference. It means the signal at the external digital input terminal must be maintained for longer than the time set in **Pn417** before the driver recognizes a state change (OFF→ON or ON→OFF).						
Pn418	External Digital Output 1 Active Delay Time				Initial value	0
	Range	0~30000	**Unit**	ms	**Effective time**	Takes effect immediately
Pn419	External Digital Output 1 Inactive Delay Time				Initial value	0
	Range	0~30000	**Unit**	ms	**Effective time**	Takes effect immediately
Pn420	External Digital Output 2 Active Delay Time				Initial value	2
	Range	0~30000	**Unit**	ms	**Effective time**	Takes effect immediately
Pn421	External Digital Output 2 Inactive Delay Time				Initial value	0
	Range	0~30000	**Unit**	ms	**Effective time**	Takes effect immediately
Pn422	External Digital Output 3 Active Delay Time				Initial value	2
	Range	0~30000	**Unit**	ms	**Effective time**	Takes effect immediately
Pn423	External Digital Output 3 Inactive Delay Time				Initial value	2
	Range	0~30000	**Unit**	ms	**Effective time**	Takes effect immediately

Pn424	External Digital Output 4 Active Delay Time				Initial value	2
	Range	0~30000	**Unit**	ms	**Effective time**	Takes effect immediately
Pn425	External Digital Output 4 Inactive Delay Time				Initial value	2
	Range	0~30000	**Unit**	ms	**Effective time**	Takes effect immediately

Sets the active and inactive delay time for each external digital output channel, as shown in the figure below:



Pn453	Positioning Approach Width				Initial value	20
	Range	1~65535	**Unit**	ppr	**Effective time**	Takes effect immediately
Pn454	Positioning Completion Width				Initial value	10
	Range	1~6335	**Unit**	ppr	**Effective time**	Takes effect immediately

Sets the criteria for positioning approach and completion.
When the position deviation count is less than the value set in **Pn453**, the relevant external digital output terminals will output an active signal.
When the position deviation count is less than the value set in **Pn454**, and the conditions selected in **Pn452** are met, the relevant external digital output terminals will output an active signal.

Pn455	Positioning Completion Hold Time				Initial value	0
	Range	0~3000	**Unit**	ms	**Effective time**	Takes effect immediately

Sets the hold time when **Pn452 = 3/4/5/6**.

Pn456	Zero Speed Signal Output Value				Initial value	10
	Range	10~1000	**Unit**	rpm	**Effective time**	Takes effect immediately

Sets the criteria for zero-speed detection.When the absolute value of the motor speed is less than the value set in this parameter, the configured external digital output terminal will be active.

Pn457	Rotation Signal Output Value				Initial value	10
	Range	10~1000	**Unit**	rpm	**Effective time**	Takes effect immediately

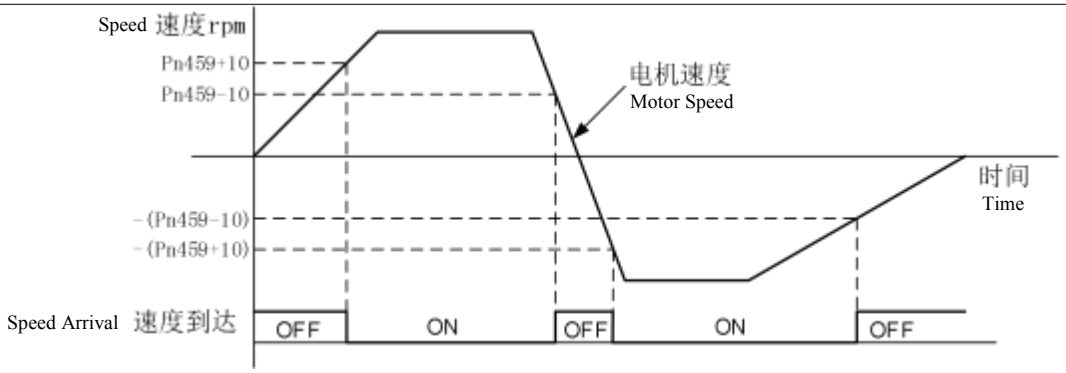
Sets the criteria for motor rotation status detection.When the absolute value of the motor speed exceeds the set value of this parameter, the configured external digital output terminal will be active.

Pn458	Speed Command Zero Fixed Threshold				Initial value	10
	Range	0~300	**Unit**	rpm	**Effective time**	Takes effect immediately

Analog speed command zero fixed value setting, i.e., zero clamp.
When the servo is set to speed mode and the speed command is given by an external analog signal, the motor may fail to stop even if the analog voltage is 0 V due to external electromagnetic interference, zero drift, or other factors. This function can be used to ensure the motor remains stationary when the external analog input voltage is near 0 V.
This function is enabled when the following two conditions are met:
The absolute value of the speed command corresponding to the input analog voltage (after deadband, hysteresis, and filtering processing) is less than Pn458.
The external digital input terminal defined as the zero fixed signal by the drive is active.
When the above conditions are satisfied, the servo automatically switches from speed mode to position mode, locking the motor within the range specified by Pn454 at that position. Even under external force, the motor will return to the zero-clamp position.
Once the speed command exceeds Pn458, the servo immediately returns to speed mode to follow the command, regardless of the state of the zero fixed signal terminal.

Pn459	Reached Speed				Initial value	100
	Range	20~6000	**Unit**	rpm	**Effective time**	Takes effect immediately

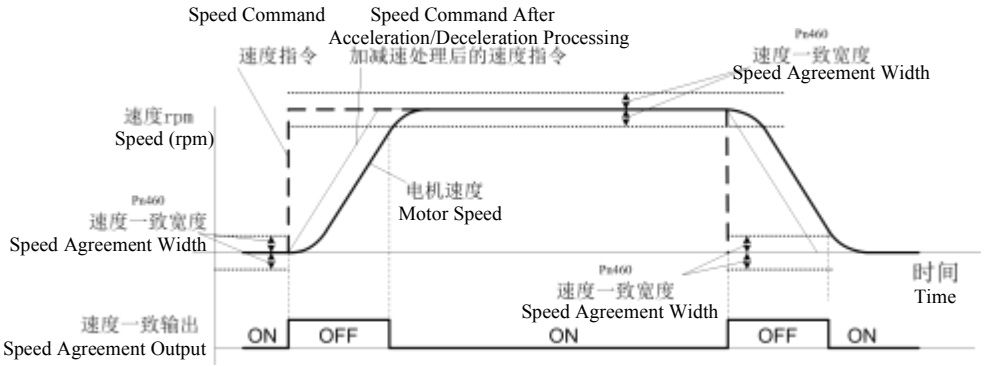
Sets the threshold for speed arrival signal output.When the motor speed reaches and exceeds this set value, the external digital output terminal becomes active.



*Note: With a hysteresis of 10 rpm, the actual values for the speed arrival signal are:OFF→ON: Pn459 + 10 rpmON→OFF: Pn459 − 10 rpm

Pn460	Speed Agreement Threshold				Initial value	10
	Range	10~100	**Unit**	rpm	**Effective time**	Takes effect immediately

When the absolute value of the difference between the command speed and the current speed is less than or equal to the value of Pn460, the external digital output terminal becomes active.

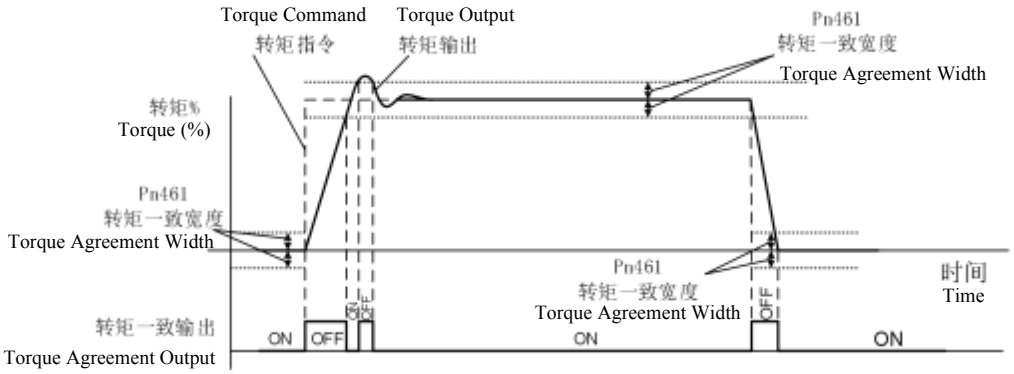


*Note: With a hysteresis of 10 rpm, the actual detection width for speed agreement is:OFF→ON: Pn460 + 10 rpmON→OFF: Pn460 − 10 rpm

Pn461	Torque Agreement Threshold	Initial value	5.0

	Range	3.0~100.0	**Unit**	%	**Effective time**	Takes effect immediately

When the absolute value of the difference between the command torque and the current torque is less than or equal to the value of Pn461, the external digital output terminal becomes active.



*Note: With a hysteresis of 3%, the actual detection width for torque agreement is:

OFF→ON:Pn461+10rpm ON→OFF: Pn461-10rpm

Pn464	Motor Rotation Output Function Selection				Initial value	0
	Range	0~2	**Unit**	—	**Effective time**	Takes effect immediately

When set to **0**, output is active for both forward and reverse rotation.When set to **1**, output is active for forward rotation only, inactive for reverse rotation.When set to **2**, output is active for reverse rotation only, inactive for forward rotation.

8.3.6 Extended Function Parameters

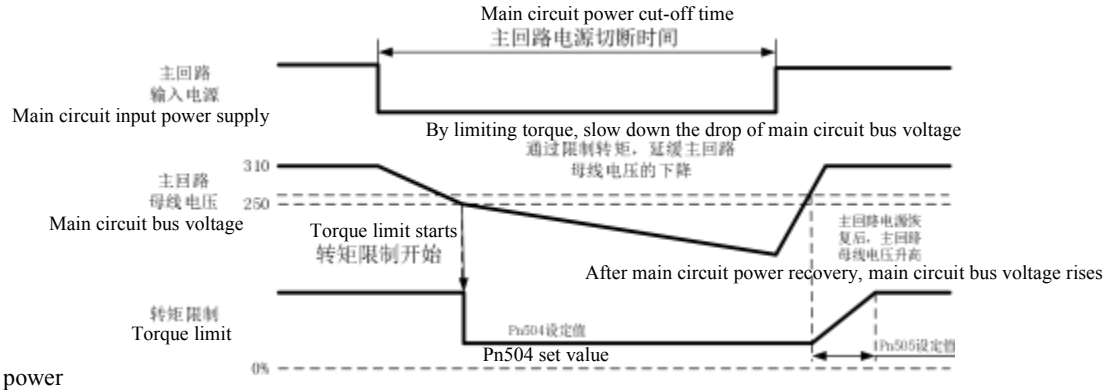
Pn500	Function Switch 1				Initial value	00100
	Range	00000~11111	**Unit**	—	**Effective time**	Takes effect immediately

This parameter is displayed in binary format. Each bit represents the functions as follows:

Bit0：Torque limit function during main circuit voltage drop

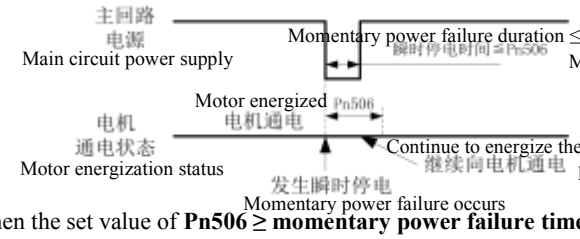
Bit0=0: Disables the torque limit function during main circuit voltage drop. Pn504 and Pn505 are invalid.

Bit0=1: Enables the torque limit function during main circuit voltage drop. When the bus voltage is detected to be lower than 80% of the rated value, the motor output torque will be limited to the value set in Pn504. Used in combination with the momentary power failure hold function, this allows continuous operation even when the power supply voltage drops, preventing shutdown due to alarms.

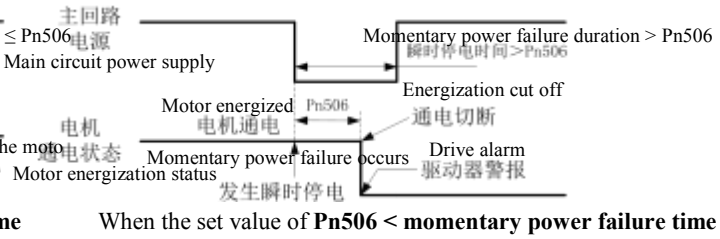


Bit1：Momentary power failure hold function

Bit1=0: Disables the momentary power failure hold function.
Bit1=1: Enables the momentary power failure hold function. This will enable the power loss detection function by default and mask the E10 alarm within the time set in Pn506.
When this function is enabled, even if the drive main circuit experiences a momentary power failure, the motor can continue to be energized (Servo ON) for the time set in Pn506.
If the momentary power failure duration is less than the set value of Pn506, the motor will continue to be energized. If it exceeds the set value, the motor will no longer be energized, and the drive will trigger alarms such as E10 or E0E.



When the set value of **Pn506 ≥ momentary power failure time**



When the set value of **Pn506 < momentary power failure time**

*Note
1: For vertical axis applications, this function is not recommended, as there is a risk of falling.
2: When enabling this function, it is recommended to also enable the torque limit function during main circuit voltage drop and set an appropriate value for Pn504.
3: The power hold time for the servo control circuit is approximately 80ms. If the control circuit power cannot be sustained during a momentary power failure, the same processing as a normal power cut-off will be executed, and the setting of Pn506 will be invalid.
Bit2: Power loss detection function (associated with bit1)
Bit2=0: Disables the power loss detection function; main circuit power loss will no longer be detected.
For vertical axis applications, be sure to enable the power loss detection function. Otherwise, the holding brake cannot be closed immediately when main circuit power loss occurs.
Bit2=1: Enables the power loss detection function.
If the momentary power failure hold function is not enabled at the same time, an E10 alarm will be triggered immediately when main circuit power loss occurs.

Bit3：Position judgment switched to encoder unit

Bit3=0: Position judgment is based on command unit.
The command unit is defined as 1 pulse input from the host controller (including multi-step positions in Pn7 group) as 1 unit.
Bit3=1: Position judgment is based on encoder unit.
The encoder unit is defined as 1 pulse feedback from the motor encoder as 1 unit.
Encoder unit = Command unit × Electronic gear ratio
Example: Factory default when using a motor equipped with a 23-bit encoder:
Since electronic gear ratio = 8388608/10000,
Encoder unit = Command unit × 8388608/10000

Bit4：Speed command reverse (speed mode)

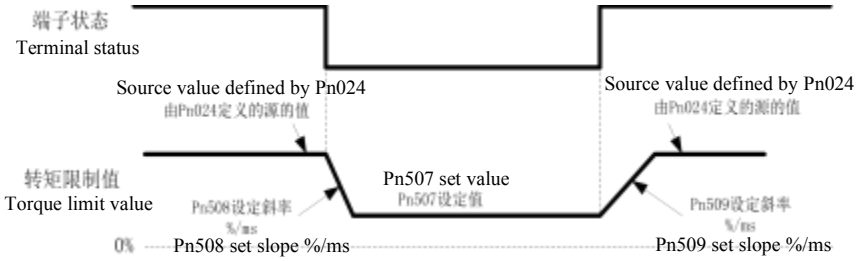
Bit4=0: Motor rotates forward with positive speed command (forward direction defined by Pn000).

Bit4=1: Motor rotates forward with negative speed command (forward direction defined by Pn000).

bit5: Set to 1 to enable the position command low-frequency interpolation function.
bit6: Set to 1 to enable the no-motor test mode.
bit7: Set to 1 to have the current loop FOC processed by ARM; set to 0 to have the current loop FOC processed by FPGA.

Pn504	Torque limit value during main circuit voltage drop				Initial value	50
	Range	1.0~100.0	**Unit**	rpm	**Effective time**	Takes effect immediately
Sets the limit value of motor output torque when the drive DC bus voltage drops below 80%.						
Pn505	Torque limit release time during main circuit voltage drop				Initial value	100
	Range	10~1000	**Unit**	ms	**Effective time**	Takes effect immediately

Starting when the main circuit voltage recovers to **90% of the rated value**, the torque limit value will be restored to the original value within this time.						
Pn506	Momentary power failure hold time				Initial value	100
	Range	10~1000	**Unit**	ms	**Effective time**	Takes effect immediately
Momentary power failure hold time Sets the time during which motor energization is maintained when a momentary power failure occurs in the main circuit power supply.						
Pn507	External torque limit				Initial value	100
	Range	0.0~350.0	**Unit**	ms	**Effective time**	Takes effect immediately
External Torque Limit Sets the external torque limit value, based on the motor rated torque. When the external digital input terminal for the internal torque limit function is active, the motor output torque limit value will smoothly transition from the setting of Pn508 to the value set in this parameter, and remain until the external digital input terminal becomes inactive. When the external digital input terminal becomes inactive, the motor output torque limit value will smoothly transition from the setting of Pn509 to the torque limit source value set in Pn024.						
Pn508	Torque Limit Switch Setting 1				Initial value	300
	Range	0.1~500.0	**Unit**	%	**Effective time**	Takes effect immediately
When the external digital input terminal configured for the internal torque limit function becomes active, the motor output torque limit value changes to the setting of Pn507 at this slope. The unit is the percentage change in torque limit value relative to the motor rated torque per millisecond.						
Pn509	Torque Limit Switch Setting 2				Initial value	300
	Range	0.1~500.0	**Unit**	%	**Effective time**	Takes effect immediately
When the external digital input terminal set for the internal torque limit function is active, the motor output torque limit value changes to the setting of Pn024 according to this slope. The unit is the percentage change of the torque limit value relative to the motor rated torque per millisecond.						
Pn510	Position Deviation Alarm Mask Selection When External Torque Limit Is Active				Initial value	0
	Range	0~1	**Unit**	—	**Effective time**	Takes effect immediately
Selects whether to suspend the excessive position deviation detection when the external digital input terminal set for the internal torque limit function is active and the motor output torque is limited to the setting of Pn025.Pn510=0: Excessive position deviation detection is still performed while the external digital input terminal is active.Pn510=1: Excessive position deviation detection is suspended while the external digital input terminal is active.						
Pn511	Alarm Mask Disable Delay After External Torque Limit Becomes Invalid				Initial value	10000



*Note

1: The external torque limit is active simultaneously in both forward and reverse directions.

2: Generally, the set value of Pn507 should be less than Pn025 and Pn026, but it can also be set larger.

	Range	1~10000	**Unit**	—	**Effective time**	Takes effect immediately

When Pn510=1, sets the delay time to resume excessive position deviation detection when the external digital input terminal for the internal torque limit function changes from active to inactive.
If Pn030 is set to a small value, and the motor is in a stalled state while the external digital input terminal is active with the drive continuously receiving position command pulses, an excessive position deviation alarm may be detected immediately when the external digital input terminal becomes inactive.Setting this parameter can provide a certain delay time to allow the motor to operate and reduce the position deviation, so as to avoid an immediate excessive position deviation alarm.

Pn512	JOG Speed				Initial value	100
	Range	1~6000	**Unit**	rpm	**Effective time**	Takes effect immediately
Pn513	JOG Acceleration/Deceleration Time				Initial value	200
	Range	1~30000	**Unit**	ms	**Effective time**	Takes effect immediately

Sets the motor rotation speed and acceleration/deceleration time during JOG operation. The acceleration/deceleration time is based on the time required for the motor to accelerate from 0 to the rated speed or vice versa. The drive can perform JOG operation via function parameter Fn001. JOG operation via function parameter Fn001 must be performed when the servo is OFF. JOG operation via external digital input terminal can be performed both when the servo is OFF and ON.
JOG command execution status:

Original State	**JOG Terminal OFF→ON and Held ON**	**JOG Terminal ON→OFF**
Motor at standstill	Runs at Pn513 to the speed set in Pn512 and continues running	Decelerates to 0 at Pn513 and returns to the original control mode
Position mode with pulse command	Clears residual pulses, starts from current speed, runs at Pn513 to the speed set in Pn512 and continues running	Resumes position mode operation from the moment the JOG command becomes invalid and starts receiving command pulses
Multi-segment position mode	Clears residual pulses, starts from current speed, runs at Pn513 to the speed set in Pn512 and continues running	Resumes multi-segment position mode and runs the remaining pulse commands of the current segment (cleared residual pulses are no longer executed)
Speed mode	Runs at Pn513 to the speed set in Pn512 and continues running	Accelerates at Pn304 or decelerates at Pn305 to the speed specified by the current speed command
Torque mode	Runs from current speed at Pn513 to the speed set in Pn512 and continues running	Resumes torque mode and runs according to the current torque command

Pn514	Offline Inertia Identification Self-learning Torque				Initial value	50
	Range	10~200	**Unit**	—	**Effective time**	Takes effect immediately

Percentage of the motor output torque relative to the motor rated torque during offline learning of the load inertia ratio.The larger the set value, the greater the possible mechanical shock, but the shorter the identification time and the number of motor rotations required. Please set an appropriate value according to the machine.

Pn515	Maximum Rotations for Offline Inertia Identification				Initial value	10
	Range	1~20	**Unit**	—	**Effective time**	Takes effect immediately

Function: Sets the maximum permissible number of rotations for offline inertia identification.
If the system inertia has not been successfully identified when the motor reaches this number of rotations, or if the motor cannot reach this number of rotations during inertia identification, an E1C alarm will occur.
*Note: If the system inertia cannot be successfully identified and the mechanical conditions allow the motor to rotate more revolutions, increase the setting value of this parameter.
*Note: If the system inertia cannot be successfully identified and the mechanical conditions do not allow the motor to rotate more revolutions, increase the setting value of Pn514.

Pn518	Drive Overload Warning Threshold				Initial value	80
	Range	20~100	**Unit**	—	**Effective time**	Takes effect immediately
Sets the warning threshold for drive overload, based on the rated output current of the drive. The drive is equipped with an overload protection function, which generates an overload curve starting from 100% of the drive rated current; in this case, the drive will directly enter an alarm state. This parameter can set the threshold for drive overload warning. Once the drive overload is detected to be greater than this set value, the drive overload warning A03 will be issued without stopping operation.						
Pn519	Motor Overload Warning Threshold				Initial value	10
	Range	20~100	**Unit**	—	**Effective time**	Takes effect immediately
Sets the warning threshold for servo motor overload, based on the rated current of the servo motor. The drive is equipped with motor overload protection, which generates an overload curve starting from 100% of the rated load of the matched servo motor; in this case, the drive will directly enter an alarm state. This parameter can set the threshold for motor overload warning. Once the motor overload is detected to be greater than this set value, the motor overload warning A03 will be issued without stopping operation.						
Pn520	Motor Stall Detection Minimum Load				Initial value	150
	Range	10.0~250.0	**Unit**	%	**Effective time**	Takes effect immediately
Sets the minimum output torque for motor stall detection.						
Pn521	Motor Stall Detection Speed				Initial value	150
	Range	0~500	**Unit**	rpm	**Effective time**	Takes effect immediately
When motor stall protection is enabled, sets the maximum motor speed for judging whether the motor is in a stall state.						
Pn522	Motor Stall Detection Time				Initial value	100
	Range	50~2000	**Unit**	ms	**Effective time**	Takes effect immediately
When motor stall protection is enabled, sets the duration for judging whether the motor is in a stall state.						
Pn523	Motor Stall Limit Torque				Initial value	100
	Range	0.0~150.0	**Unit**	%	**Effective time**	Takes effect immediately
When motor stall protection is enabled, sets the maximum motor torque in stall condition.						
Pn524	Motor Stall Limit Current				Initial value	100
	Range	0.0~150.0	**Unit**	%	**Effective time**	Takes effect immediately
When motor stall protection is enabled, sets the maximum motor current in stall condition.						

8.3.7 Communication Parameters

Pn607	EtherCAT Node Address				Initial value	0
	Range	0~65535	**Unit**	—	**Effective time**	Takes effect after power cycle
EtherCAT Slave Communication Node Address						

8.3.8 Internal Multi-Step Position Parameters

When the servo driver is in position mode (Pn000=0) and the position command source is multi-step position command (Pn321=1), this group of functions can be enabled.

There are 54 function codes from Pn700 to Pn769. Among them, the definition of multi-step positions starts from Pn706 and is divided into 16 groups, corresponding to multi-step position commands Pr1 to Pr16.Every 3 function codes set one target position, the constant running speed allowed to reach the target position, and the waiting time after positioning completion.

Pn700	Multi-step Position Command Execution Mode				Initial value	0
	Range	0~7	**Unit**	—	**Effective time**	Takes effect immediately
Pn000=0 and Pn321=1 selects internal multi-step position control. This parameter is used to select the execution mode of multi-step position control.						
Pn701	Multi-step Position Execution Step Selection				Initial value	0
	Range	0~16	**Unit**	—	**Effective time**	Takes effect immediately
When Pn700 is set to 6, this parameter is used to select the execution step.						
Pn703	Internal Position Command Acceleration Time **TPACC**				Initial value	100
	Range	1~10000	**Unit**	ms	**Effective time**	Takes effect immediately
Pn704	Internal Position Command Deceleration Time**TPDEC**				Initial value	100
	Range	1~10000	**Unit**	ms	**Effective time**	Takes effect immediately
Pn705	Internal Position Command S-Curve Smoothing Time**TPL**				Initial value	100
	Range	1~10000	**Unit**	ms	**Effective time**	Takes effect immediately
These parameters are used to set the acceleration and deceleration time of the motor in multi-step position control mode.They are invalid when using external pulse position commands. Pn703: Time to accelerate from 0 speed to motor rated speed. Pn704: Time to decelerate from motor rated speed to 0 speed. Pn705: S-curve smoothing time during acceleration and deceleration.						

The three parameters Pn706~Pn708 related to the first step Pr1 are explained in detail below.The other 15 steps are identical and will not be described again.

Pn706	Pulse Count for Multi-step Position Command Pr1				Initial value	100000
	Range	-2147483647~2147483647	**Unit**	pulse	**Effective time**	Takes effect immediately

Sets the target pulse count for the 1st step position movement.This parameter is a signed value: a positive value means the motor rotates in the forward direction specified by Pn001, and a negative value means the opposite direction.

Pn708	Travel Speed for Multi-step Position Command Pr1				Initial value	100
	Range	1~6000	**Unit**	rpm	**Effective time**	Takes effect immediately
Sets the constant speed for the 1st step position movement. *Note: If the position pulse is small, the motor may not actually reach this speed during operation.Therefore, this parameter should be understood as the **upper limit** of the motor speed during the execution of the Pr1 step.						

Pn709	Waiting time before entering Pr2 after Pr1 completion				Initial value	0
	Range	0~30000	**Unit**	ms	**Effective time**	Takes effect immediately
When cyclic operation is selected (Pn700=0, 1, 2), after the pulse count of this step is completed, the next position command will be executed after waiting for this time.This parameter is invalid when Pn700=3, 4, 5, 6.						

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