AC Servo System

X6 Series

User Manual

(V1.06)

Safety Information

The chapter describes important items that must be observed by users, such as confirmation, storage, carry, installation, wiring, operation, inspection, and discarding when the product arrives.

Danger

- **When the machine that installed servo drive and motor starts to operate, please make the motor in an emergency stop state at any time in advance.** Otherwise, it will result in injury of personnel and mechanical damage.
- **The front cover of drive must be closed before drive is powered on.** Otherwise, it may result in an electric shock.

  Don't touch the power terminal of drive during the CHARGE indicator is lighting and after power off or Voltage withstand test. Otherwise, the residual voltage will result in electric shock.

  Please according to the steps and instructions of user manual for trial operation. If operating in error, it will not only result in mechanical damage, but also result in personal injury accidents after the motor is installed.
- **Please never alert the drive and motor. Don't set, disassemble or repair it unless designated person**. Otherwise, it will result in injury, mechanical damage or fire risk.
- **Please install a stop device on the mechanical side to ensure safety. The brakes of servo motor are not stop devices for ensure safety.** Otherwise, it will result in injury.
- **Please be sure to connect the grounding terminals of the servo driver to the grounding electrode (the grounding resistance of the servo driver is less than 100Ω when power on).** Otherwise, it will result in electric shock or fire risk.

Storage&Carry Caution

- Please don't storage or set products in the following environment. Otherwise, it will result in fire risk, electric shock or machine damage.
  - ☐ Places in direct sunlight
  - ☐ The ambient temperature of operating places exceeds the temperature of storage and setting conditions
  - ☐ The relative humidity of operating places exceeds the humidity of storage and setting conditions
  - ☐ Places with corrosive and flammable gases
  - ☐ Places with more dust, salt and metal powder
  - ☐ Places are prone to splashing water, oil,medicines and etc.
  - ☐ The places where the vibration or shock will be transmitted to the product.
- Please don't hold the cables, motor shaft or detector when carry. Otherwise, it will result in injury or fault.

Installation Caution

- Please don't block the inhalation and exhaust ports. And don't make the foreign bodies inside into product. Otherwise, the aging of internal components will result fault or fire risk.
- Please according to the installation direction. Otherwise, it will result in fault.
- Please ensure the prescribed distance between the servo driver and the inner surface of the control cabinet and other machines when installing. Otherwise, it will result in fire risk or fault.

Wiring Caution

- Please ensure wiring correctly and reliably. Otherwise, it will result in motor out of control, personnel injury or machine fault.
- Please don't connect the commercial power supply with the U, V and W of servo motor. Otherwise, it will result in injury or fire risk.
- Please connect the power terminals firmly with the motor terminals. Otherwise, it will result in fire risk.
- **Please don't use the same sleeve for main circuit cable and input&output signal cable/encoder cable, nor tie them together. The distance between the main circuit cable and the input&output signal cable should more than 30 cm.**
- **Please use double stranded cables or multi-core double stranded shielding cables for input&output signal cables and encoder cables.**
- **The max wiring length of the cable for input and output signals is 3 m, and the max wiring length of the cable of the encoder cable is 30 m.**
- Even if the power is turned off, high voltage may remain in the servo drive. Therefore, don't touch the power terminals during the Charge Indicator is lighting. Please wire and check after ensure the Charge Instruction is off.
- Please install safety devices such as circuit breakers to prevent short circuit of external wiring. Otherwise, it will result in fire risk.
- Please take appropriate shielding measures when in the following places.
  - ☐ The place where is disturbed by static electricity and etc.
  - ☐ The place where a strong electric or magnetic field is produced.
  - ☐ The place where radiation maybe emitted.
- Please pay attention to polarity when connecting batteries. Otherwise, it will result in the damage and explosion of battery, servo drive and servo motor.

Operating Caution

☐ **In order to prevent accidents, please make test run for the servo motor (when the machine is not connected to the rotating shaft of the servo motor). After the test run is running smoothly then connect the machine.** Otherwise, it will result in injury.

- Please set the parameters in accordance with the machine beforehand when installed on the matching machine and starting to run. If starting operation without setting parameters, it will result in mechanical out of control or fault.

- **Please don't turning on/Off power frequently.** Because the capacitors in the power part of servo drive will be flowed through when the power is turning on. Therefore, if turning on/off power supply frequently, it will result in performance decline of the main circuit components in the servo drive.
- **The emergency stop function caused by forward overrun and reverse overrun is invalid when JOG runs (Fn001) and inertia detection of manual load (Fn008), please note.** Otherwise, the machine may be damaged.
- **Please install safety device to prevent the workpieces falling in the state of alarm, overrun and so on when using the servo motor on the vertical axis. In addition, please set stop by the zero position fixing when overrun.** Otherwise, the workpiece will drop in the overrun state.
- **The extreme adjustment, setting and change parameter will make servo system operation unstable, please never do this kind of operation.** Otherwise, it will result in personnel injury and machine damage.
- **Please reset the alarm after eliminating reasons and ensuring safety when alarming, then restart the operation.** Otherwise, it may result in machine damage, fire risk or personnel injury.
- **Please don't use the brake of servo motor with retaining brake for braking.** Otherwise, it may result in fault.
- **Please combine the servo motor and servo drive in accordance with the specified combination**. Otherwise, it may result in fire risk or fault.

Maintain & Inspection Caution

- **Please don't change the wiring when the power is on.** Otherwise, it will result in electric shock or injury.

- **Please copy the parameters to the new servo drive when replacing the servo drive, then restart operation.** Otherwise, it will result in machine damage.

Please maintain and inspect the drive and motor regularly for safety.

Maintenance and Inspection cautions

1) Please cut off the power supply. Please don't approach the motor and the machine driven by motor when wrong actions occur during power on.
2) Before inspection, power must be cut off, then wait for 10 minutes and ensure that the charge indicator is completely off.The internal circuit still maintains a high voltage charging state within a short period of time after the power supply is cut off.
3) If it is necessary to test the insulation resistance of the drive, all connections with the drive must be cut off. Insulation resistance test can damage the drive when the motor are connected with drive.
4) Please don't use gasoline, diluents, acid and alkaline detergents to avoid discoloration or damage of the shell.

Inspection items and period

Normal using conditions:

annual average temperature 30 C, average load rate less than 80%, daily running time less than 20 hours.

Inspection	Period	Inspection items

Daily inspection	daily	● Confirmation of environment (temperature, humidity, dust, foreign body) ● Is there any abnormal vibration and sound? ● Is the power supply voltage in the normal range? ● Is there any odor? ● Is there any fibrous adhesion in ventilator? ● Is the connection clean and tightened? ● Is there any abnormal vibration and sound?
Regular inspection	1 year	● Is the fastening part loose? ● Is there any sign of overheating? ● Is there any oil leakage on the transmission mechanism and whether it pollutes the extension part of the motor shaft extension. ● Is the terminal platform intact? ● Whether the fastening parts of the wires and actuators are loosened?

Others Caution

For detailed explanation, some illustrations in this manual remove the shell or safety protector when describing. In the actual operation, please ensure install the shell or safety protector on the original position according to the regulations, and then run according to the instructions of the user manual.

The illustrations in this manual are representative illustrations, maybe different from the products you receive.

Due to product improvement, specification change and the convenience of using this manual, we will make timely changes to this manual. After the change, the information version of this manual will be updated.

The company doesn't provide any guarantee for the quality of the products that customers have altered by themselves. We are not responsible for any damage or loss caused by the altering products.

Content

Chapter 1 Installation

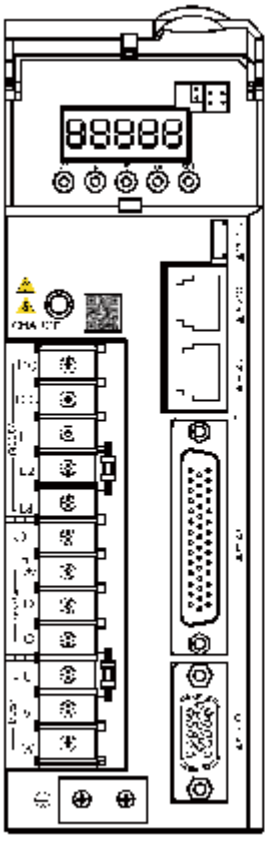
1.1 Product Inspection

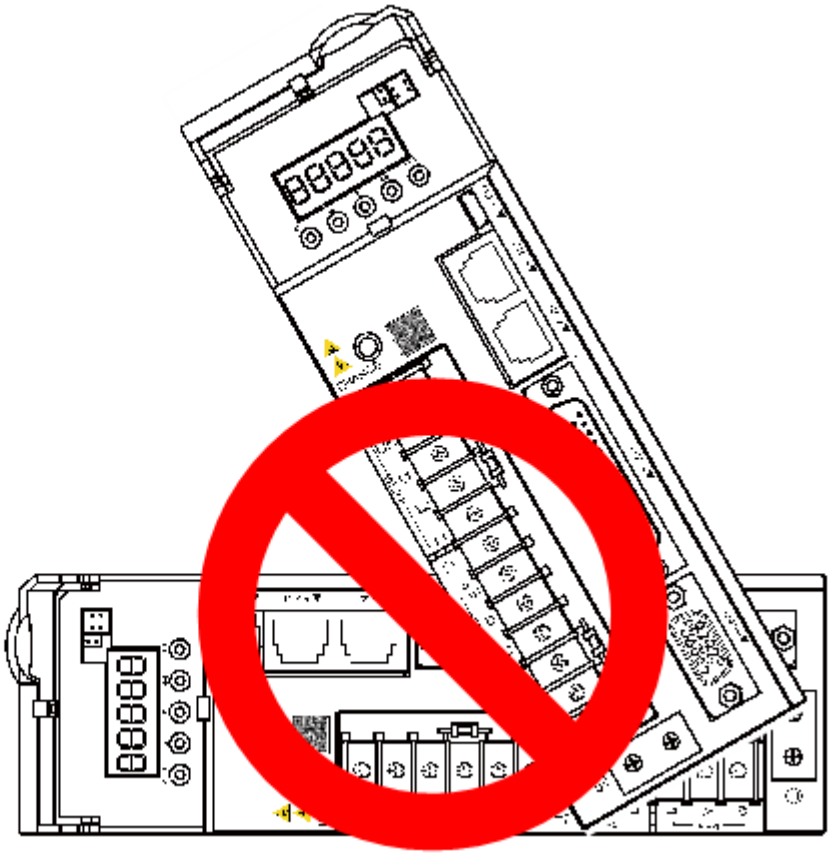
In order to prevent negligence during the purchase and delivery of the product, please check the items listed in the following form.

Items	Reference
Model	Please check the product models of the motor and drive nameplates separately. Refer to the model descriptions listed in the next chapter.
Motor shaft	Please rotate the motor shaft by hands, if it can run smoothly that the motor shaft is normal. But the motor with electromagnetic brake can't run smoothly by hands!
Appearance	Please check whether any damage on the appearance.
Screw	Please check whether the screw is loosening.

1.2 Installation

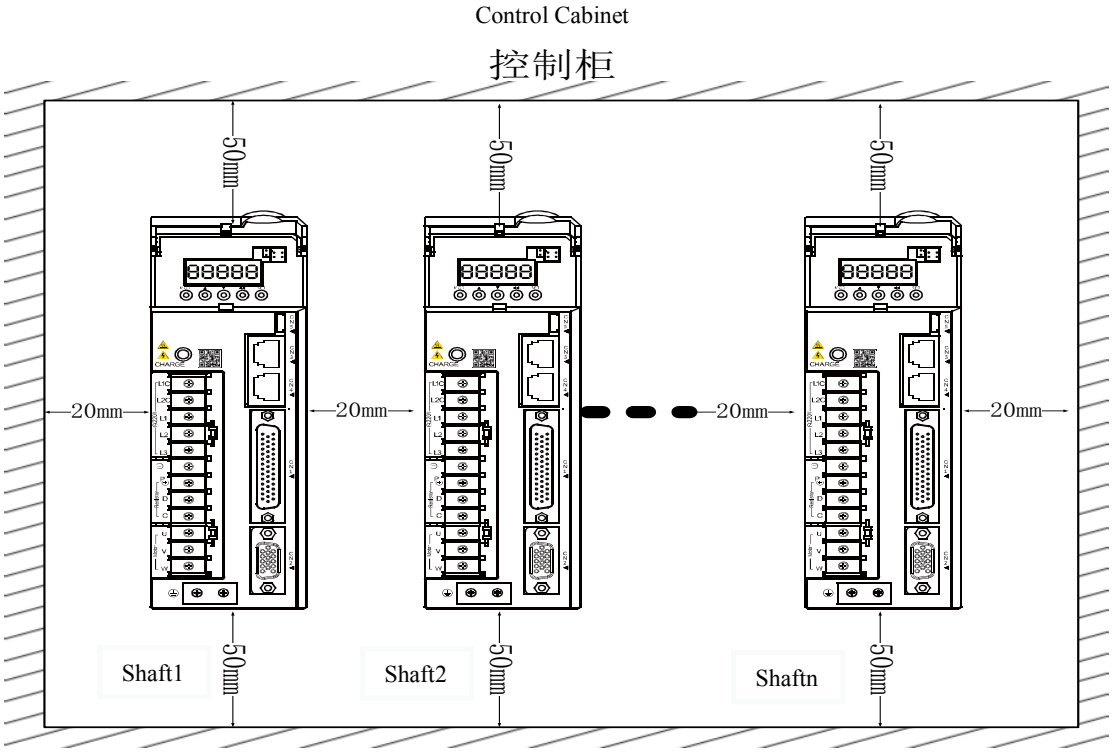
Please install as the prescribed installation direction, otherwise it will result in fault. Please keep enough space between the servo drive and contiguous items, baffles(walls) for cooling cycle effecting well. Otherwise the fault will be caused. The suction and exhaust holes can not be sealed, nor can be dumped and placed when install servo drive. Otherwise it will result in fault.





Correct Wrong

In order to make the radiator fan with lower wind resistance to exhaust heat effectively, please observe the recommended installation distance between servo drives(as the following figure).



1.3 Noise Disturbance and High Harmonic Countermeasure

There maybe switching elements noise influence during peripheral wiring and grounding of servo drive, because of the high-speed switching elements used in the main circuit of the servo drive. In order to prevent noise, the following countermeasures can be taken according to the needs.

1) Please install the EMI filter on the input side of the main circuit cable of the drive.

2) Please connect AC/DC reactor to restrain high harmonic.

3) Please make instruction input device and EMI filter near servo drive as far as possible.

4) Please keep the distance over 30cm between main circuit cable(motor main circuit cable)and input output signal cable. Don't put them into same casing or tie them together.

5) Don't use the same power supply with welding machine, EDM machine and so on. Even if the different power supply, please connect EMI filter with main circuit cable input side when high frequency generator nearby.

6) Please make proper grounding treatment.

1.4 EMI Filter

In order to ensure that EMI Filter can exert the maximum effect of restraining the interference, besides the installation and wiring of servo drive must be according to the user manual, the following points should be noticed:

Items	Advice
1	Servo drive and EMI filter must be installed on the same metal plane
2	Wiring as short as possible
3	Good grounding of metal plane
4	Good grounding of metal plane
5	The metal housing or grounding of the servo drive and EMI filter must be firmly fixed on the metal plane, and the contact area between them should be as large as possible.
6	Please use the cable of shielding copper gird for motor power cable (double shielding is preferable)
7	The shielded copper network at both ends of the motor cable must be grounded with the shortest distance and the largest contact area.

1.5 High Harmonic restraining

Please connect AC/DC reactor with servo drive to restrain high harmonic

1.6 Breakers and Fuses

If the drive is equipped with leakage circuit breaker as leakage fault protection, in order to prevent misoperation of leakage circuit breaker, please select the type with sensitivity current over 200 mA and action time over 0.1 seconds. Fuses should be fast fusing type, and select the rated current according to about 1.5 times of the drive capacity.

1.7 Selection of Regenerative Resistance

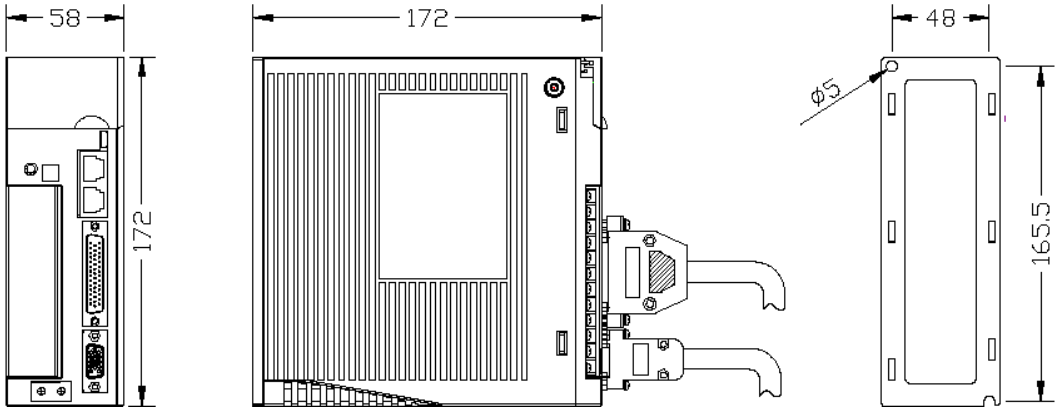
Servo drive model		Built-in brake resistance		Min allowed resistance(Ω)	The most braking energy that capacitance absorbs (J)
		Resistance(Ω)	capacity(W)		
Single phase 220V	X6□-1R620□□□	-	-	50	9
	X6□-2R820□□□	-	-	45	18
Single phase 220V	X6□-5R520□□□	50	50	40	26
3 phase 220V	X6□-7R620□□□	25	80	20	26
	X6□-01020□□□			15	47
	X6□-01520□□□				
3 phase 380V	X6□-5R440□□□	100	80	60	34
	X6□-8R440□□□	50	80	45	50
	X6□-01240□□□				50
	X6□-01840□□□	50	100	35	103

	X6□-02140□□□			25	124
	X6□-02640□□□				124

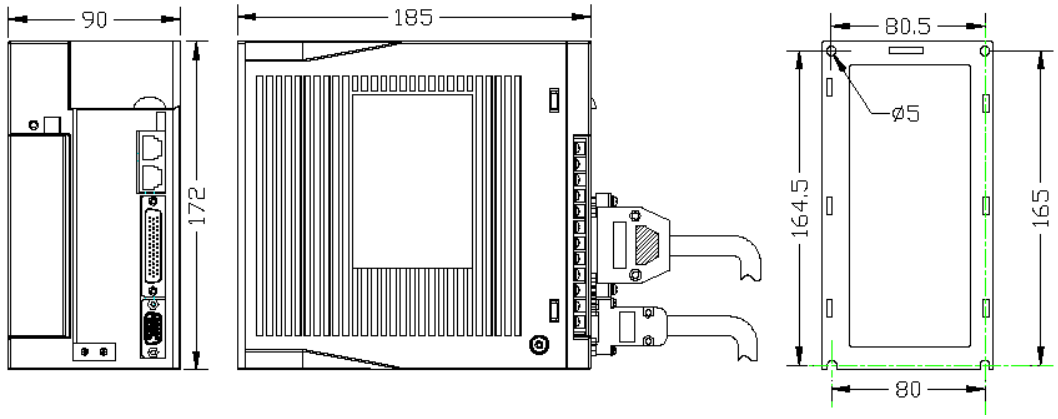
Note: S1R6 and S2R8 without built-in brake resistance, please configure the external brake resistance by users based on the needs. Please consult our company for select external brake resistance.\

1.8 Servo drive appearance and installation dimension(unit:mm）

A type：

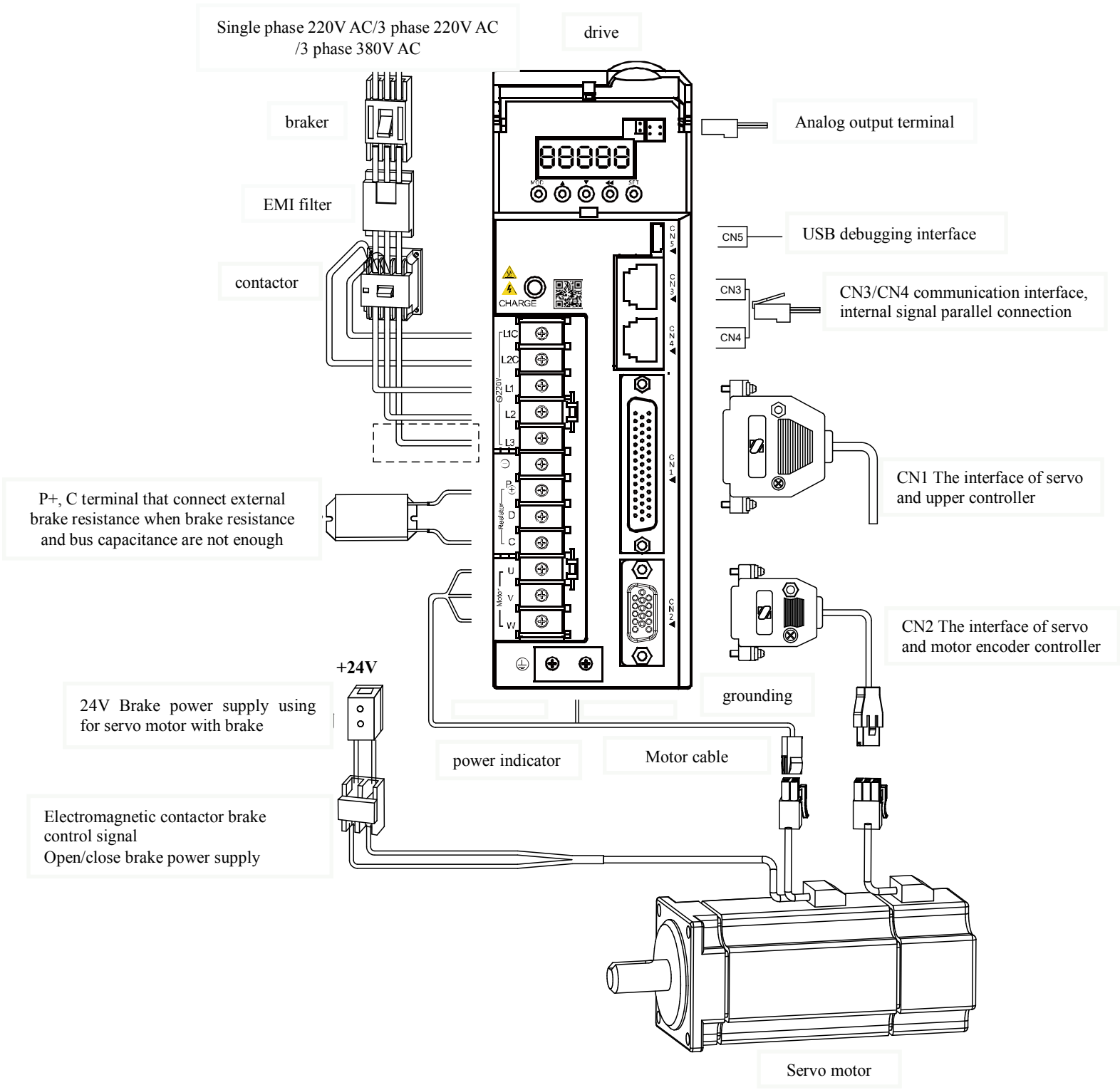


B type：

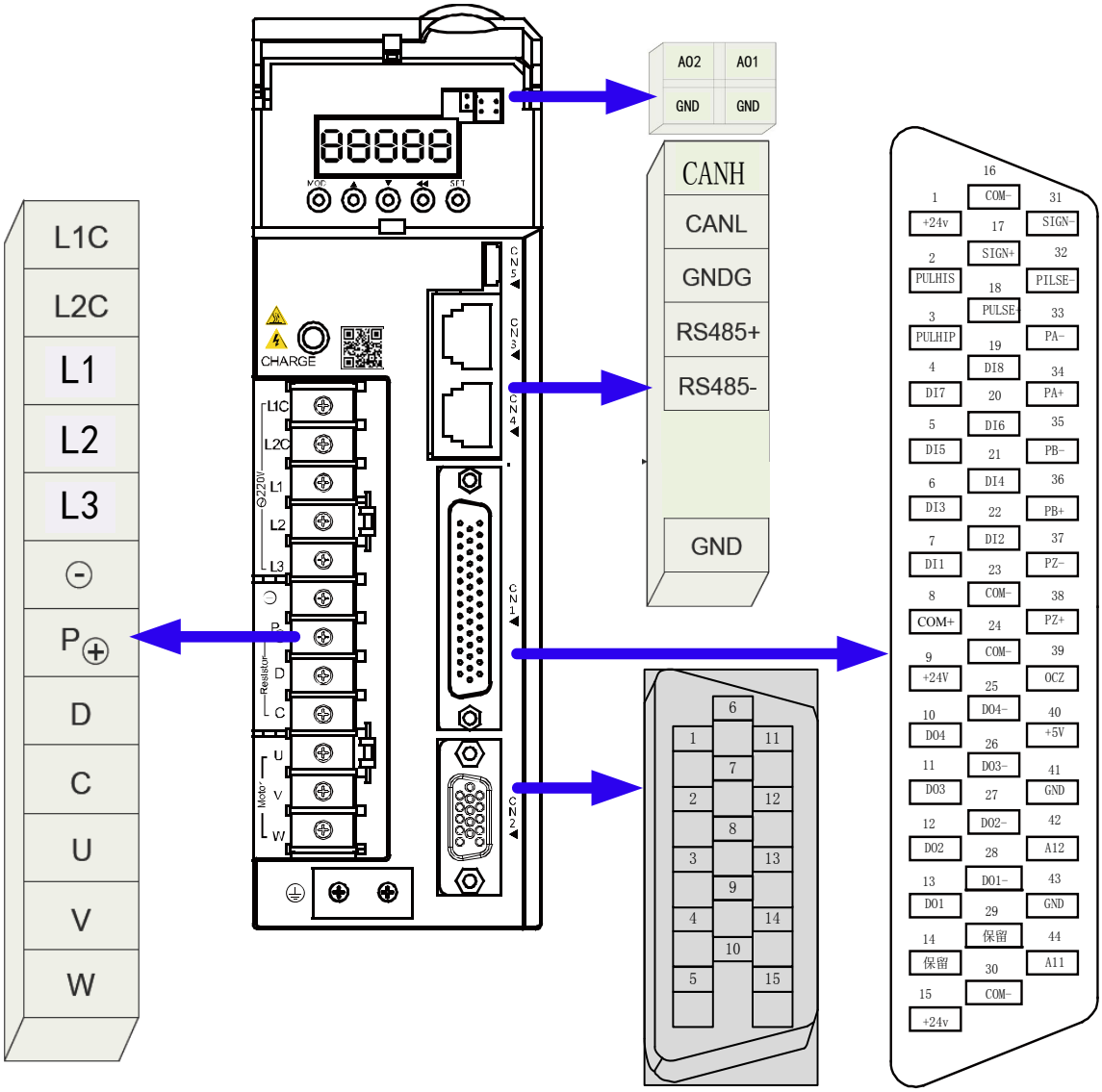


Chapter 2 System structure and Wiring

2.1 General Assembly Drawing



2.2 Pins chart



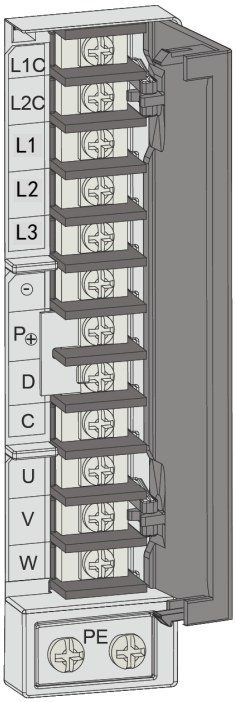
Main circuit wiring

- The wiring shall be operated by professional electrical engineers.
- Please don't turn on the power supply before wiring finished to prevent electric shock.

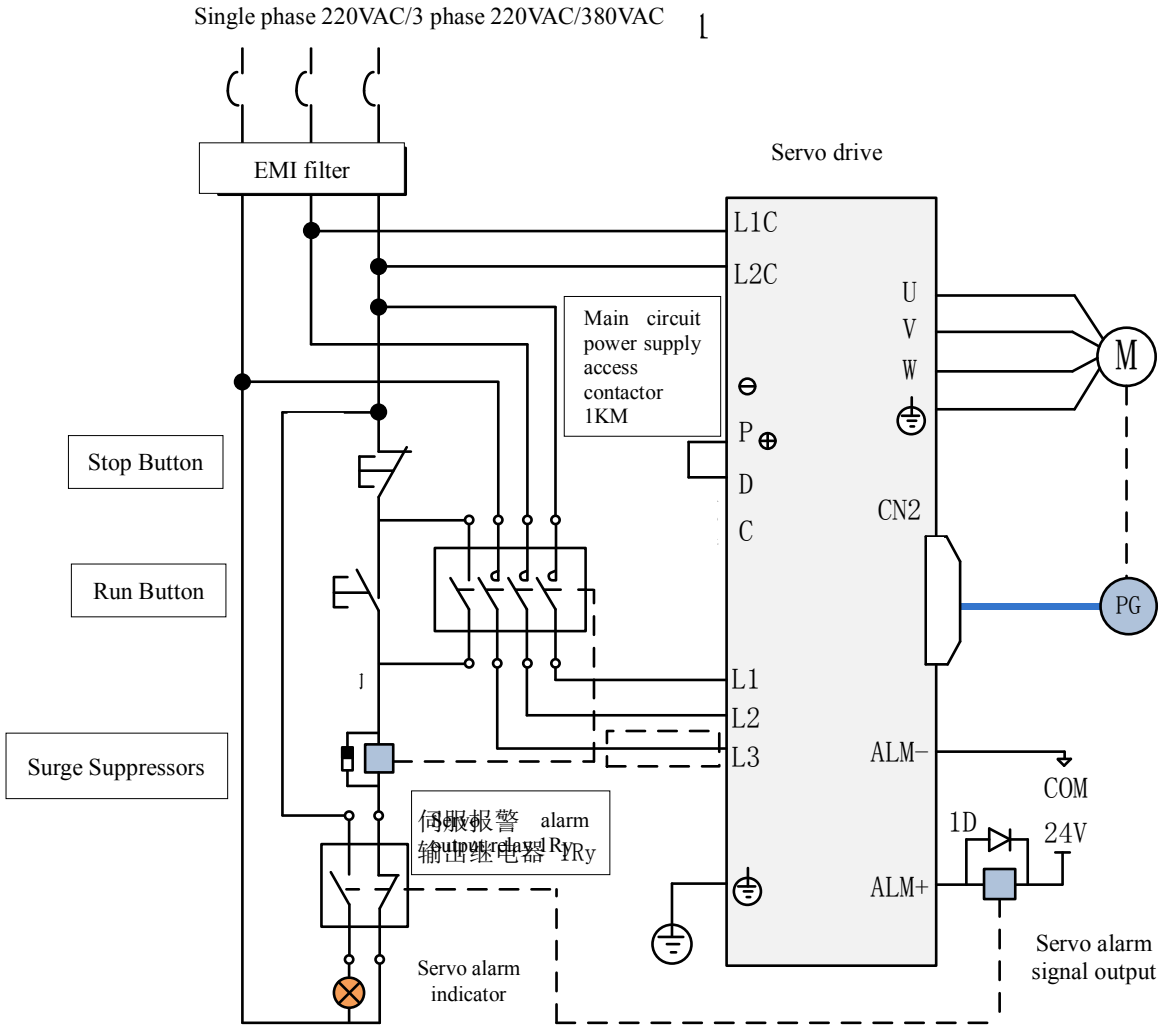
2.2.1 Main circuit wiring notes

- Check power specifications with nameplate on drive.
- Install circuit breaker or leakage circuit breaker.
- Install EMI filter.
- Install AC contactor(turn on/off main power supply of drive, should be used with surge absorber), and forbid to use AC contacotr in motor operation and stop operation strictly.
- Install reactor(reducing the high harmonic current of power supply).
- Please use crimping terminal with insulation bush for terminal wiring, and use suitable cable diameter and crimping terminal size.

2.2.2 Main circuit terminals

Terminals	Name	Signal	Description
	L1C、L2C	The input terminals of control power supply	Please select the power supply of control circuit as the rated voltage level of nameplate.
	L1、L2、L3	The input terminals of main circuit power supply	Main circuit single phase 220VAC/3 phase 220VAC/3 phase 380VAC power supply input
	P⊕、D、C	Connection terminals of external brake resistance	Short connections are connected between P⊕-D by default, please cut the short connection between P⊕-D, and connect the external brake resistance between P⊕-D.
	P⊕、Θ	Common DC Bus terminals	DC bus terminals, can be connected to common bus when multiple machines are connected in parallel.
	U、V、W	Connection terminals of servo drive	Servo motor connection terminal, connected with U,V,W of the motor.
	PE	Grounding	The two PE terminals should be connected with power supply grounding terminal and motor grounding terminal. Please ensure that the whole system is grounded

2.2.3 Main power supply wiring

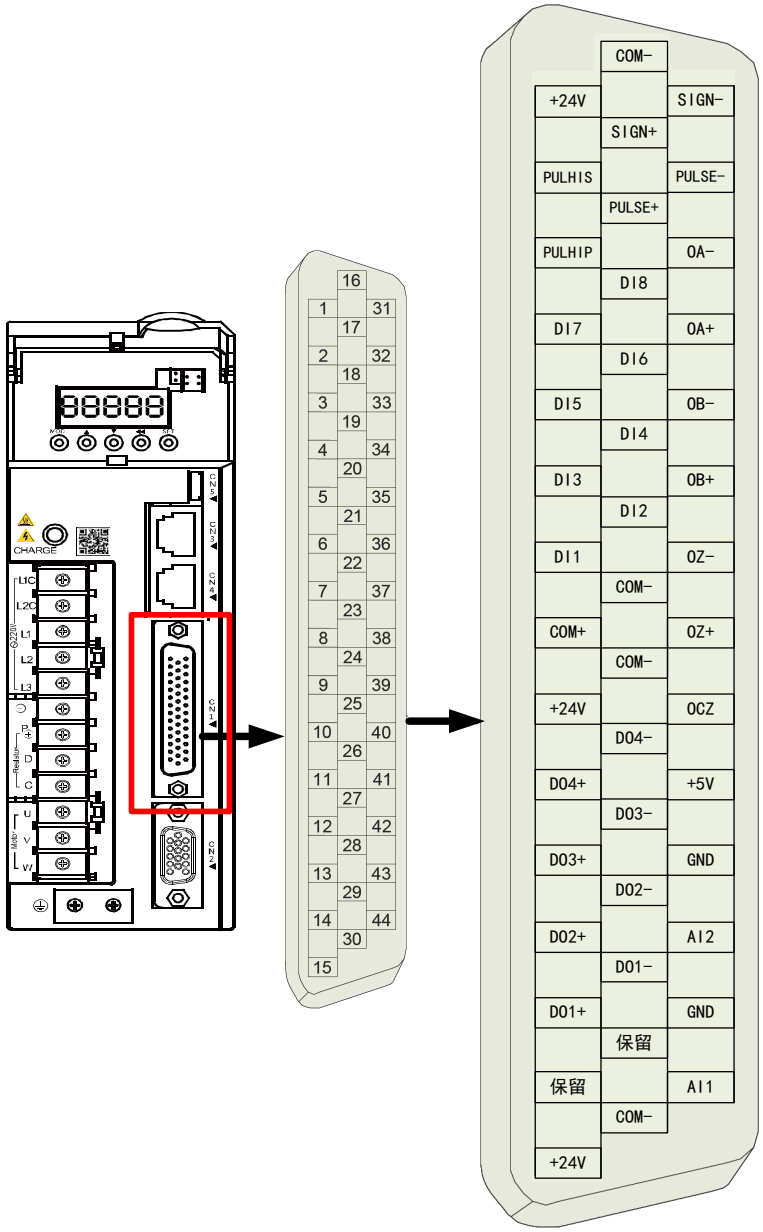


Note1:

Power supply	Drive model	Notes
Single phase 220VAC	X6□-1R620□□□	Power supply connect with terminal of L1 and L2, **L3 is invalid**
	X6□-2R820□□□	
	X6□-5R520□□□	
3 phase 220VAC	X6□-7R620□□□	
	X6□-01020□□□	
	X6□-01520□□□	
3 phase 380VAC	X6□-5R440□□□	
	X6□-8R440□□□	
	X6□-01240□□□	
	X6□-01840□□□	
	X6□-02140□□□	
	X6□-02640□□□	

2.3 Connector

2.3.1 CN1 terminals



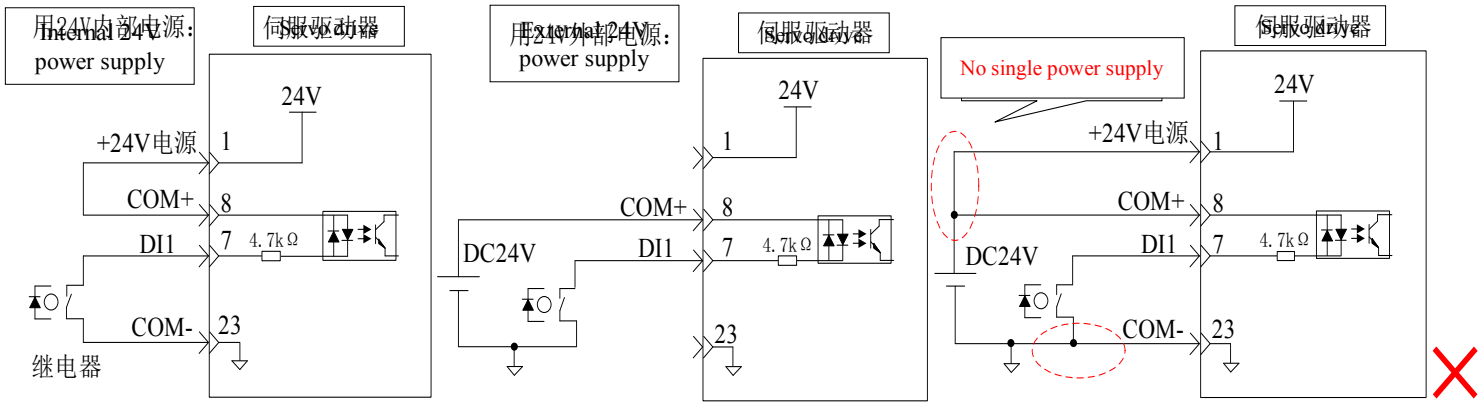
No.	Signal	Function	No.	Signal	Function	No.	Signal	Function
1	+24V	Internal 24V power supply	16	COM-	COM+(24V) Power ground	31	SIGN-	Position command sign (-)
2	PULHIS	External power supply for instruction pulse	17	SIGN+	Position Command (+)	32	PULSE-	Position command pulse(-)
3	PULHIP	External power supply for instruction pulse	18	PULSE+	Position command pulse (+)	33	OA-	Encoder A-pulse output
4	External digital input7	Digital input	19	External digital input8	Digital input	34	OA+	Encoder A pulse output
5	External digital	Digital input	20	External digital	Digital input	35	OB-	Encoder B-pulse

No.	Signal	Function	No.	Signal	Function	No.	Signal	Function
	input5			input6				output
6	External digital input3	Digital input	21	External digital input4	Digital input	36	OB+	Encoder B pulse output
7	External digital input1	Digital input	22	External digital input2	Digital input	37	OZ-	Encoder Z-pulse output
8	COM+	External 24V power supply input	23	COM-	COM+(24V) Power ground	38	OZ+	Encoder C pulse output
9	+24V	Internal 24V power supply	24	COM-	COM+(24V) Power ground	39	OCZ	Encoder Z pulse open controller output
10	External digital output 4+	Digital output	25	External digital output 4-	Digital output	40	+5V	Servo internal 5V power supply
11	External digital output 3+	Digital output	26	External digital output 3-	Digital output	41	GND	Analog input grounding
12	External digital output 2+	Digital output	27	External digital output 2-	Digital output	42	AI2	Analog input 2
13	External digital output 1+	Digital output	28	External digital output 1-	Digital output	43	GND	Analog output grounding
14	-	-	29	-	-	44	AI1	Analog input1
15	+24V	Internal 24V power supply	30	COM-	COM+(24V) Power ground			

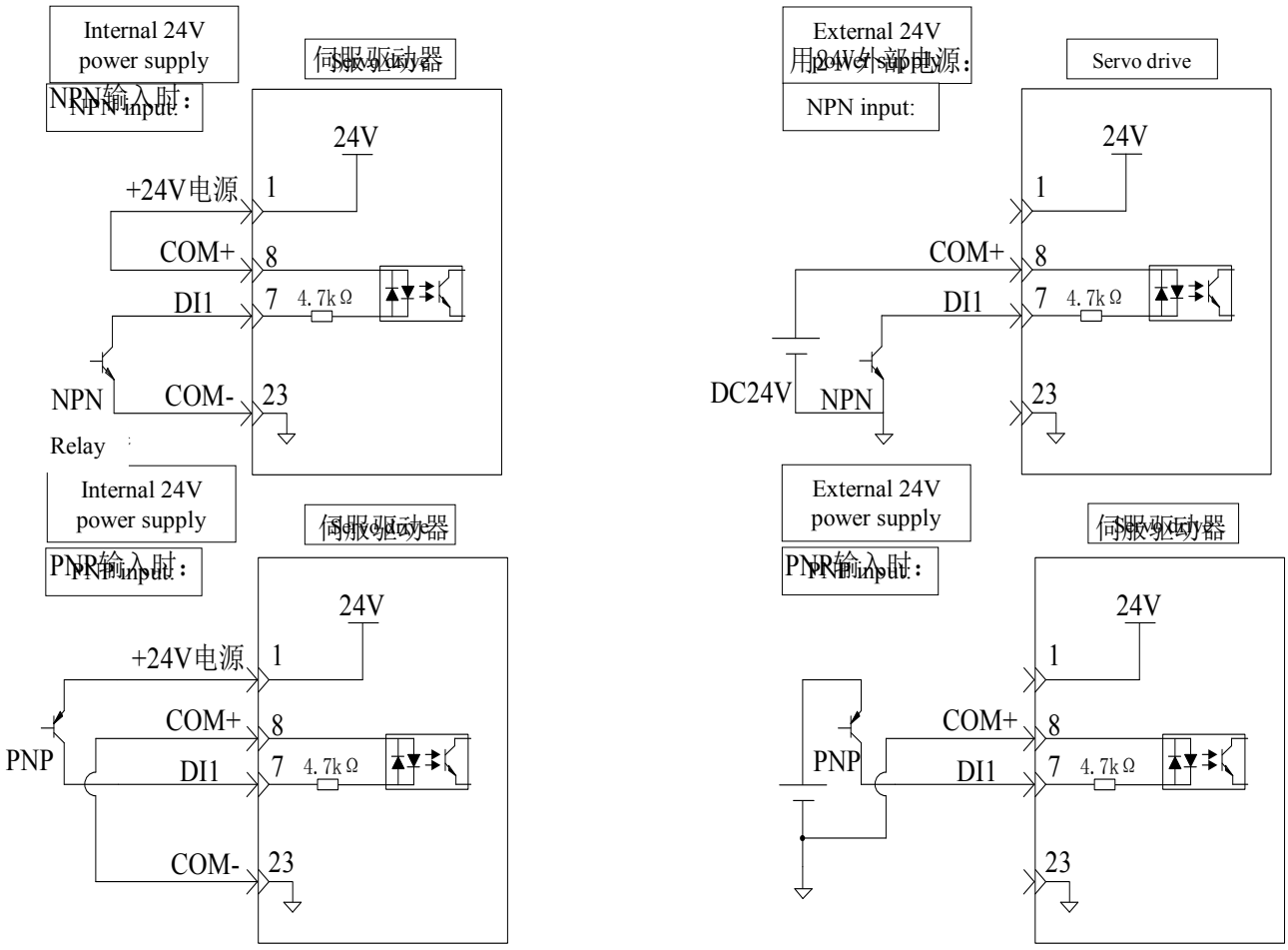
2.3.1.1Commom input terminals wiring

Taking external digital input 1 as an example, the interface circuits of external digital input 1~8 are the same.

1) When the upper device is the relay output:



2)When the upper device is the output of open controller:

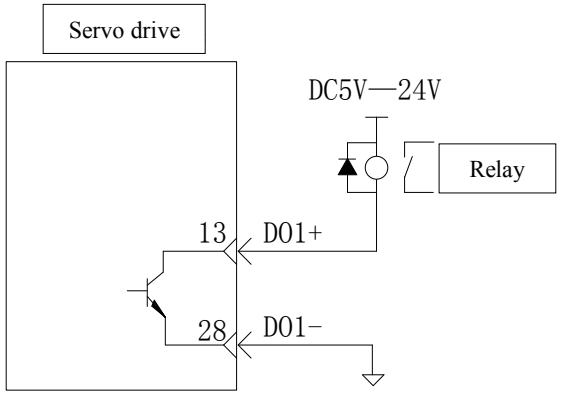


Note:■ PNP and NPN input mixing is not supported.

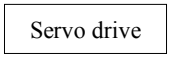
2.3.1.2 Common output terminals wiring

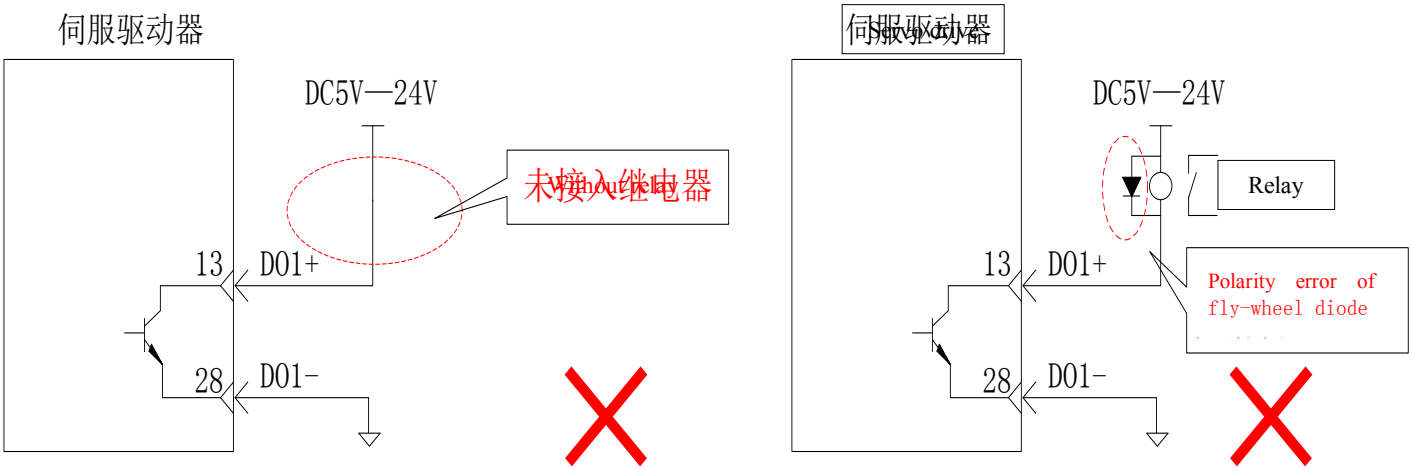
Taking external digital input 1 as an example, the interface circuits of external digital input 1~4 are the same.

1)When the upper device is the input of relay:

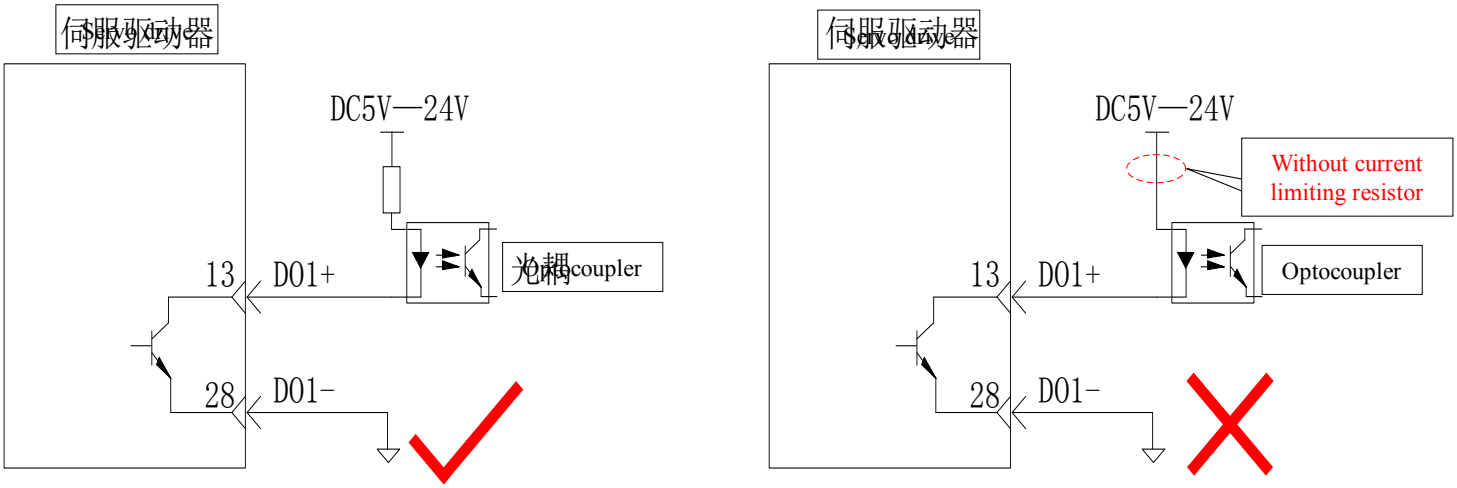


Note: Please be sure to connect with the fly-wheel diode when the upper device is relay input, otherwise it may damage the external digital output port.





2)When the upper device is the input of optocoupler input:



The allowed maximum voltage and current of servo drive internal optocoupler:

Voltage: DC30V(max)

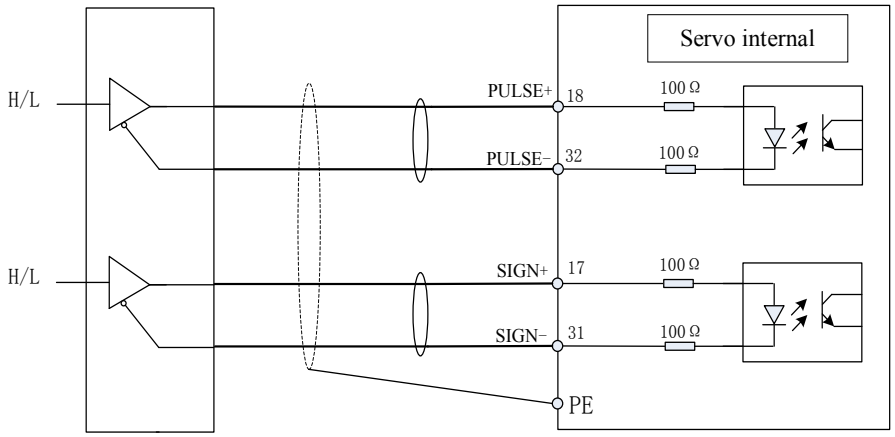
Current：DC50mA(max)

2.3.1.3 input signal(external pulse instructions)

Signal	Pin	Sign
The external power supply of instruction pulse	2	PULHIS
	3	PULHIP
Instruction sign input	17	SIGN+
	31	SIGN-
Instruction pulse input	18	PULSE+
	32	PULSE-

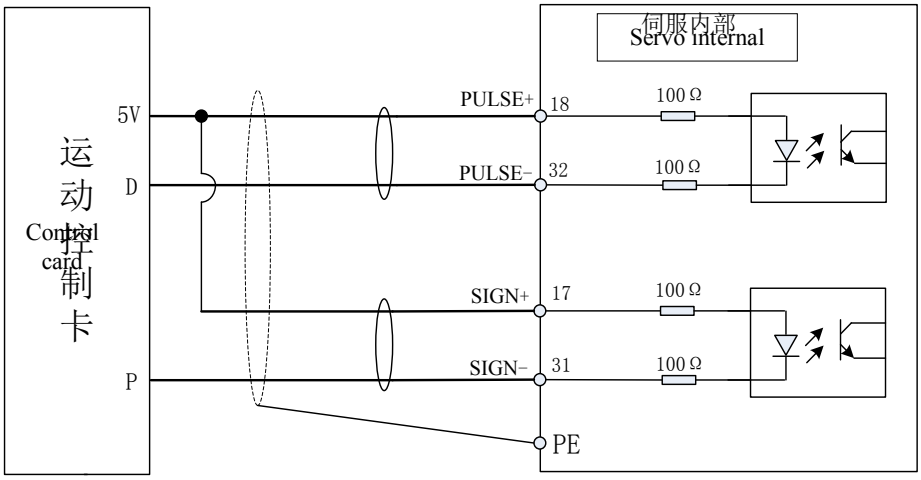
a)Differential input connection circuit

Signal transmission mode that is not easily disturbed by noise interference. This method is recommended to increase the reliability of signal transmission.

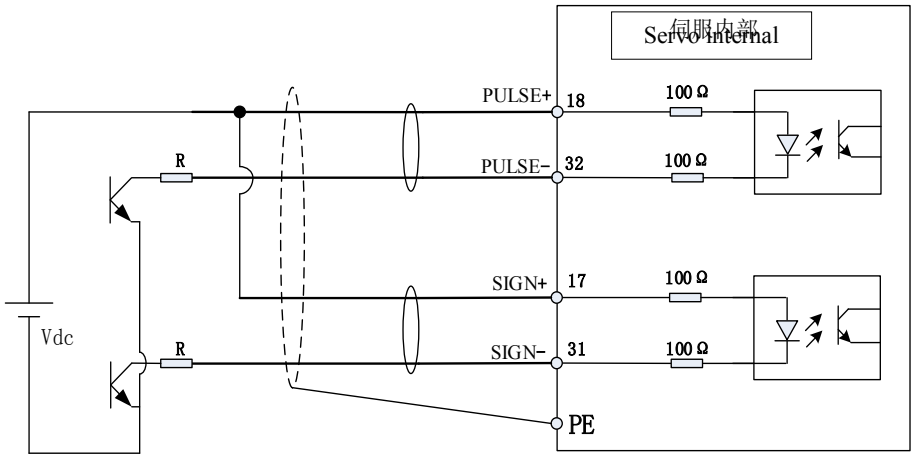


b)Connecting circuit of control card

Pulse output interface of special control card for data processing equipment can be used, such as Weihong control card.



c)Transistor open collector connection circuit(external control power supply)



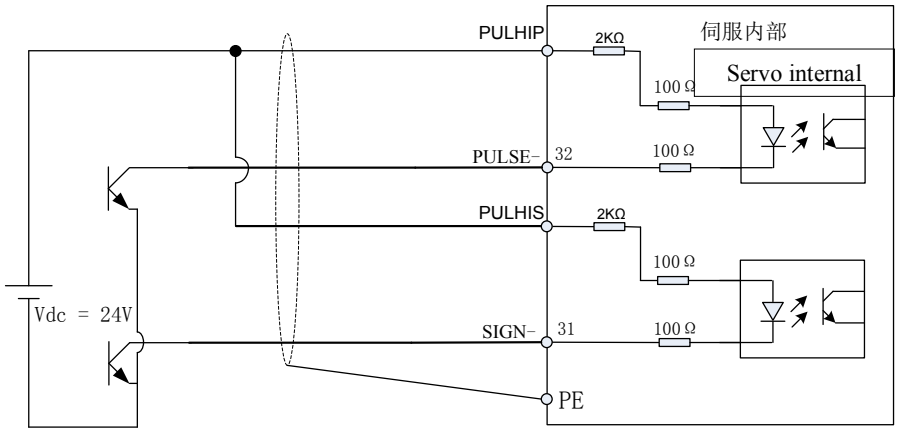
Please use current limiting resistor corresponding to Vdc value when using drive external control signal power supply Vdc, please select the current limiting resistor R as the following formula:

(Vdc-1.5)(/R+200)=10mA

R suggested value:

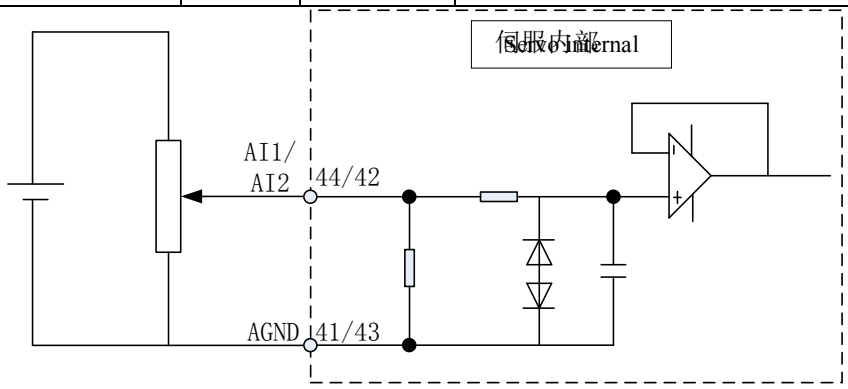
Vdc voltage	R resistance	R power
24V	2.0K	0.5W
12V	0.8K	0.5W

Transistor open collector connection circuit(using internal current limiting resistance of internal control power supply), it is recommended to use this method.



2.3.1.4 Input signal(analog) and function

Signal	Pin	Sign	Function
Analog input 1	44	AI1	External analog speed/torque/limitation
Analog input 2	42	AI2	External analog speed/torque/limitation
Analog reference ground	41、43	AGND	Analog reference ground

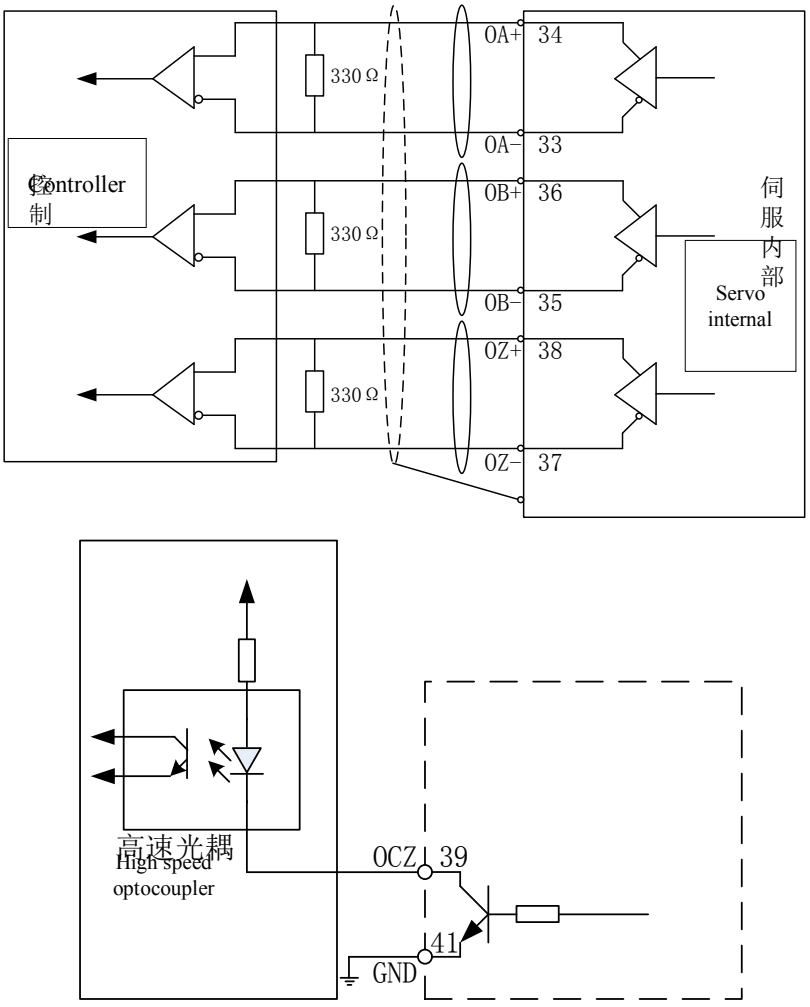


The maximum allowed input voltage of every input: ±10V

2.3.1.5 Output signal(encoder) and function

Signal	Pin	Sign	Function
Encoder A phase output	34	OA+	Encoder A、B、Z signal differential output and encoder Z signal open controller output
	33	OA-	
Encoder B phase output	36	OB+	
	35	OB-	
Encoder Z phase output	38	OZ+	

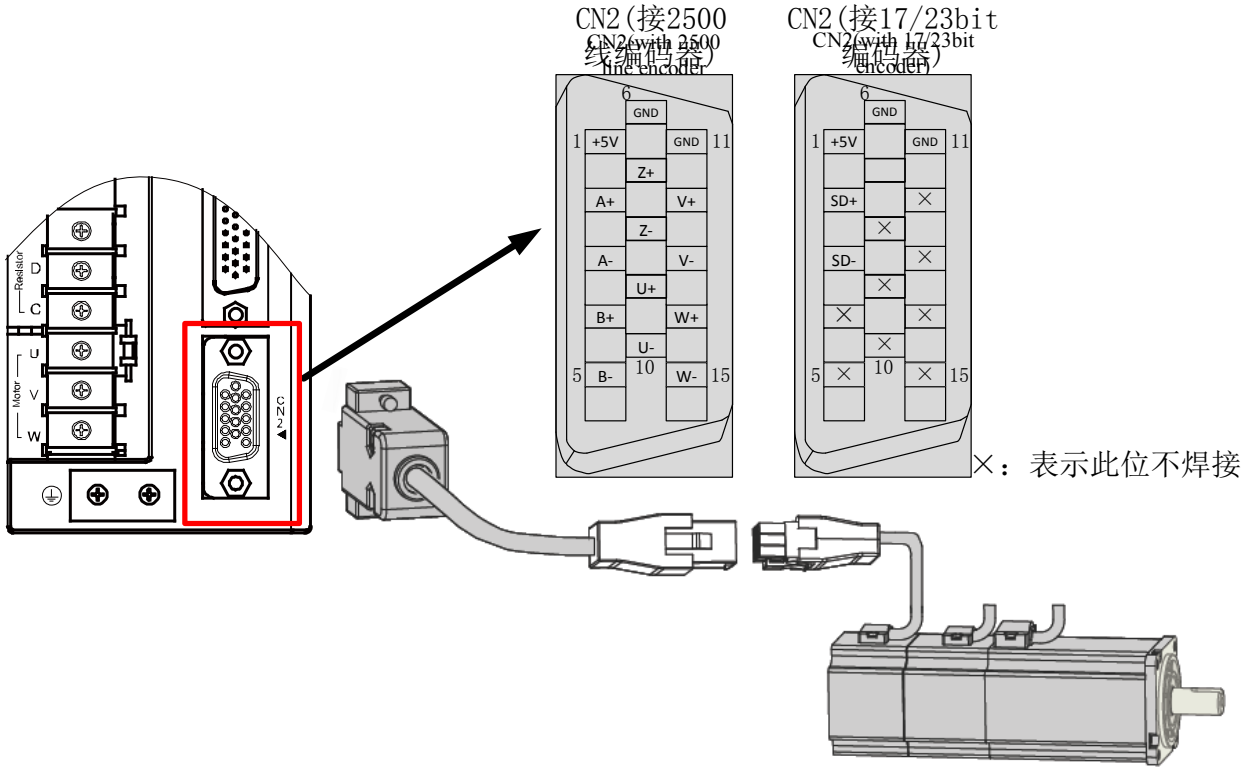
	37	OZ-+	
Encoder Z phase open controller output	39	OCZ	
Digital ground	41	GND	Digital circuit reference ground



Z-phase signal is output by open-circuit collector in the encoder signal, and non-insulated output is used.

Because the pulse width of Z signal is very narrow, please use high-speed optocoupler to receive it in the upper computer device.

2.3.2 Servo drive output and motor cables wiring



2.3.2.1 CN2 terminals definition when connect with 2500 line encoder

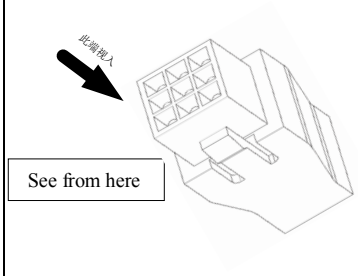
Pin	Signal	Pin	Signal	Pin	Signal
1	+5V	6	GND	11	GND
2	A+	7	Z+	12	V+
3	A-	8	Z-	13	V-
4	B+	9	U+	14	W+
5	B-	10	U-	15	W-
Metal shell	PE				

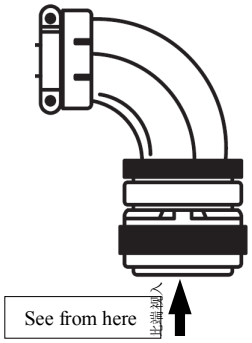
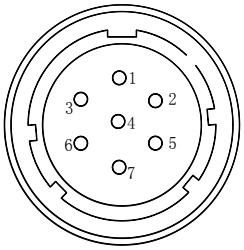
2.3.2.2 CN2 terminals definition when connect with 17 /23 bit encoder

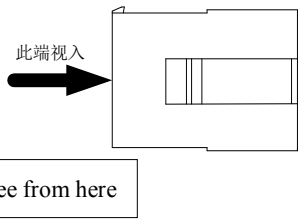
Pin	Signal	Pin	Signal	Pin	Signal
1	+5V	6	GND	11	GND
2	SD+	7	Retain	12	None
3	SD-	8	Retain	13	None
4	Retain	9	Retain	14	None
5	Retain	10	Retain	15	None
Metal shell	PE				

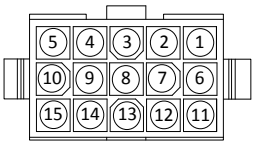
2.3.2.2 Encoder cable connect with servo motor

Encoder	Connector	Pin	Adaptable motor

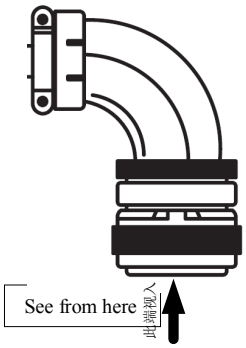
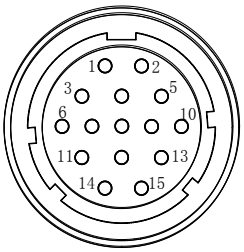
<table>
<tr><th>Encoder</th><th>Connector</th><th>Pin</th><th>Adaptable motor</th></tr>
<tr><td rowspan="2">17/23bit
Serial encoder</td><td> 
</td><td> 

<table>
<tr><th>Pin</th><th>Signal</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>40
60
80
90</td></tr>
<tr><td> 
</td><td> 

<table>
<tr><th>Pin</th><th>Signal</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>
<tr><td>2500 line
Incremental Encoder</td><td> 

</td><td> 

<table>
<tr><th>Pin</th><th>Signal</th></tr>
<tr><td>7</td><td>Z+</td></tr>
<tr><td>6</td><td>U+</td></tr>
<tr><td>10</td><td>V+</td></tr>
<tr><td>11</td><td>W+</td></tr>
<tr><td>2</td><td>+5V</td></tr>
<tr><td>5</td><td>Z-</td></tr>
<tr><td>8</td><td>U-</td></tr>
<tr><td>12</td><td>V-</td></tr>
<tr><td>15</td><td>W-</td></tr>
<tr><td>3</td><td>GND</td></tr>
<tr><td>4</td><td>B+</td></tr>
<tr><td>14</td><td>B-</td></tr>
<tr><td>9</td><td>A+</td></tr>
<tr><td>13</td><td>A-</td></tr>
<tr><td>1</td><td>PE</td></tr>
</table></td><td>40
60
80
90</td></tr>
</table>

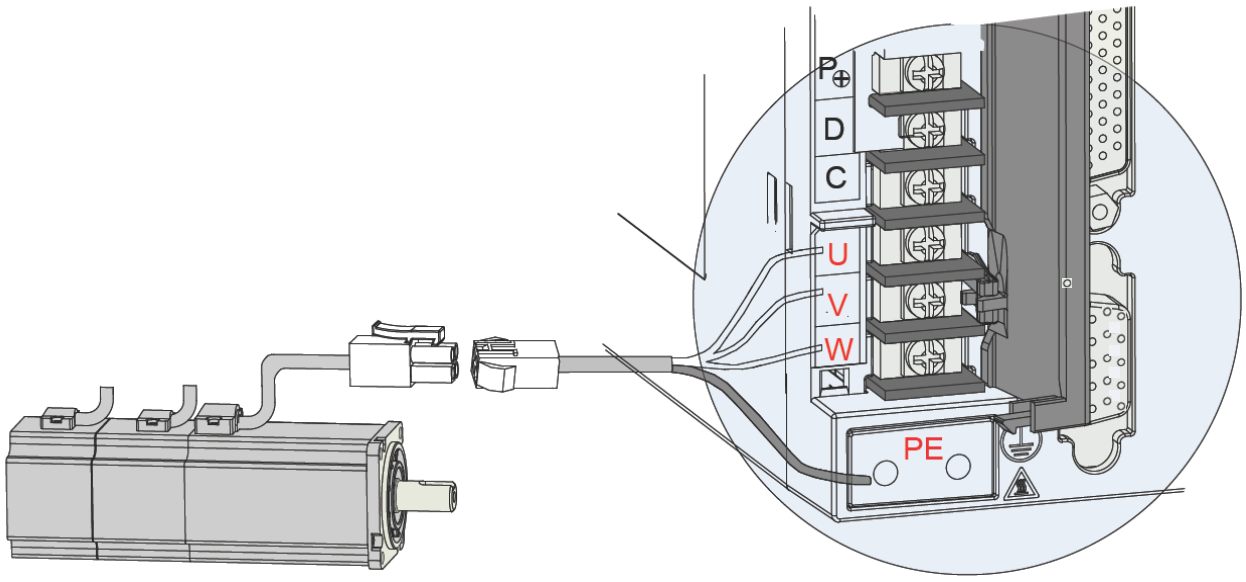
<table>
<tr><th>Encoder</th><th>Connector</th><th>Pin</th><th>Adaptable motor</th></tr>
<tr>
<td></td>
<td> 
</td>
<td> 

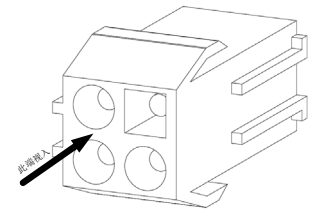
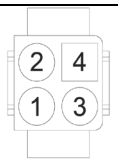
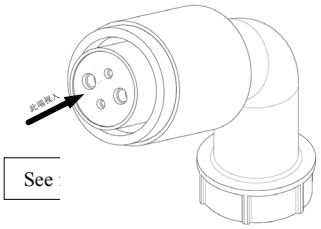
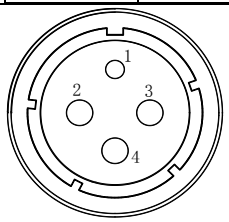
<table>
<tr><th>Pin</th><th>Signal</th></tr>
<tr><td>7</td><td>Z+</td></tr>
<tr><td>9</td><td>U+</td></tr>
<tr><td>12</td><td>V+</td></tr>
<tr><td>14</td><td>W+</td></tr>
<tr><td>1</td><td>+5V</td></tr>
<tr><td>8</td><td>Z-</td></tr>
<tr><td>10</td><td>U-</td></tr>
<tr><td>13</td><td>V-</td></tr>
<tr><td>15</td><td>W-</td></tr>
<tr><td>6,11</td><td>GND</td></tr>
<tr><td>4</td><td>B+</td></tr>
<tr><td>5</td><td>B-</td></tr>
<tr><td>2</td><td>A+</td></tr>
<tr><td>3</td><td>A-</td></tr>
<tr><td>Metal shell</td><td>PE</td></tr>
</table>
</td>
<td>110
130
180
200</td>
</tr>
</table>

Note：

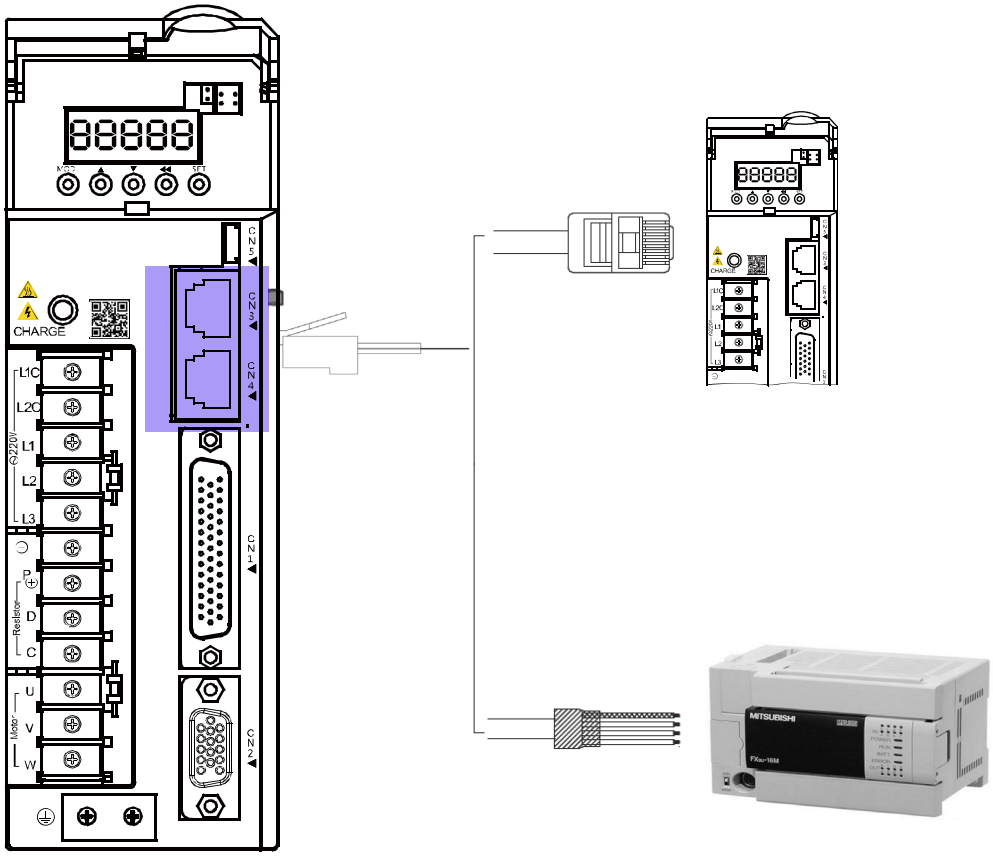
1. Shielded twisted pairs are suggested for encoder cable. The diameter of each signal cable should more than 0.2 mm2. The number of per copper wire strands should be greater than 18, and the shielded single-point grounding should be adopted.
2. It is suggested that the distance between encoder cable and motor power supply should be more than 30 cm.
3. Encoder cable length is less than 20m, if more than 20m please contact the manufacturer or agent.
4. When using 17/23 bit encoder, please use the cable with 0.2 mm2 cross-sectional area when the wire length is less than 5 meters. If it exceeds 5 meters, the cross-sectional area of the cable should be increased by 0.05 mm2 for every cable length increase of 1 meter.

2.3.3 Servo drive output and motor cable wiring

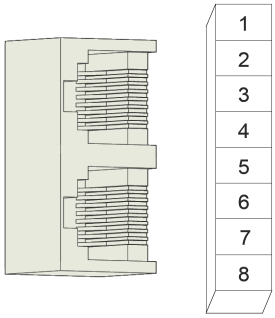


<table>
<tr><th>Connector</th><th>Pin</th><th>Adaptable motor</th></tr>
<tr>
<td> 
See from here</td>
<td> 
<table>
<tr><th>pin</th><th>signal</th></tr>
<tr><td>1</td><td>U</td></tr>
<tr><td>2</td><td>V</td></tr>
<tr><td>3</td><td>W</td></tr>
<tr><td>4</td><td>PE</td></tr>
</table></td>
<td>40
60
80
90</td>
</tr>
<tr>
<td> 
See</td>
<td> 
<table>
<tr><th>pin</th><th>signal</th></tr>
<tr><td>1</td><td>PE</td></tr>
<tr><td>2</td><td>U</td></tr>
<tr><td>3</td><td>V</td></tr>
<tr><td>4</td><td>W</td></tr>
</table></td>
<td>110
130</td>
</tr>
</table>

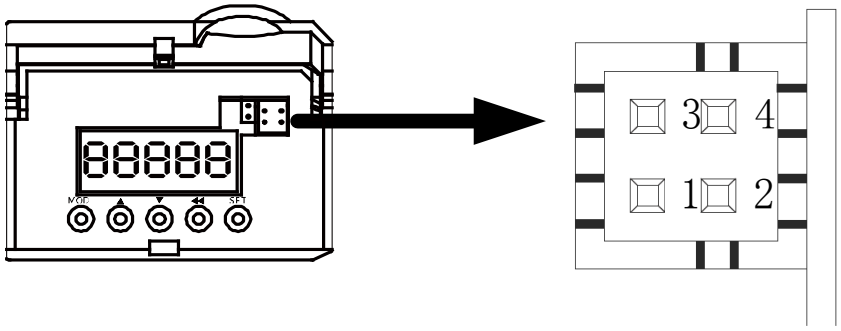
2.3.4 CN3、CN4 Communication signal terminal wiring



Communication signal connection(CN3、CN4) are two identical communication signal connectors in parallel.

Pin	No.	Definition	Function
	1	CANL	CAN communication interface
	2	CANH	
	3	GND	Reference ground
	4	RS485+	RS485communication port
	5	RS485-	
	6	Retain	
	7	Retain	
	8	GND	Reference ground
	Shell	PE	Shield

2.4 CN6 analog monitoring signal wiring

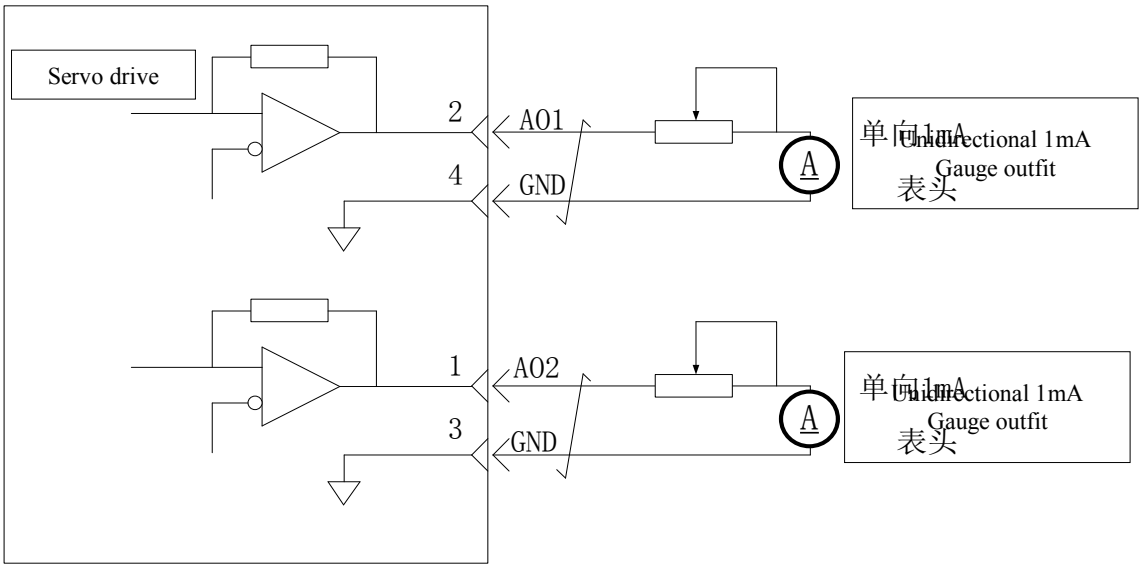


序号	1	2	3	4
Item	AO2	AO1	GND	GND

Response interface circuit:

Analog output:-10V~+10V

Maximum output:1mA



Note:The analog monitor output terminal may output about 5V voltage during the longest 50ms period after the control power supply is OFF.

Please give full consideration when using it.

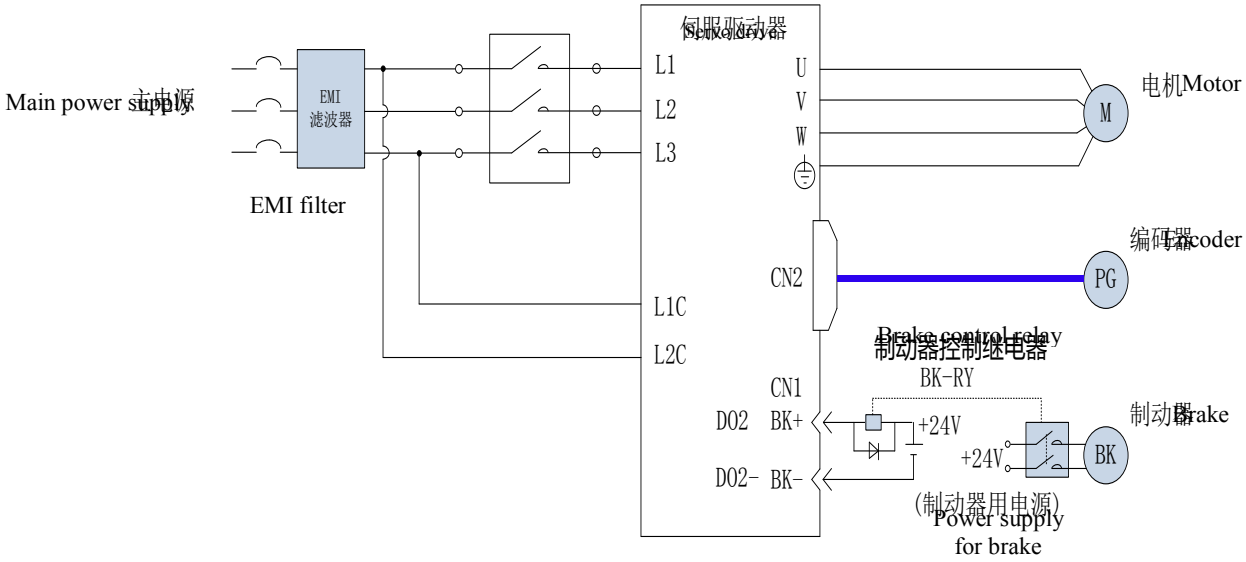
2.5 Holding brake wiring

The motor with built-in holding brake is needed in order to prevent the moving parts from moving due to gravity in the case of power failure, when the motor is used to drive the vertical shaft or similar situation.

- The built-in holding brake of the motor is only used for the purpose of maintaining the stop state, not for the purpose of stopping the operation of the motor.
- The brake coil has no polarity.
- The brake may make a clicking when the motor with built-in brake is running, the brake, but it has no effect on function.
- When the brake coil is energized (the brake is open), flux leakage may occur at the axle end and other parts. Please use magnetic sensors near motor and other instruments near the motor.

1)Holding brake wiring instance

The input signal connection of holding brake has no polarity, users should prepare 24V power supply. Brake signal/The wiring standard instance of BK and brake as the following:

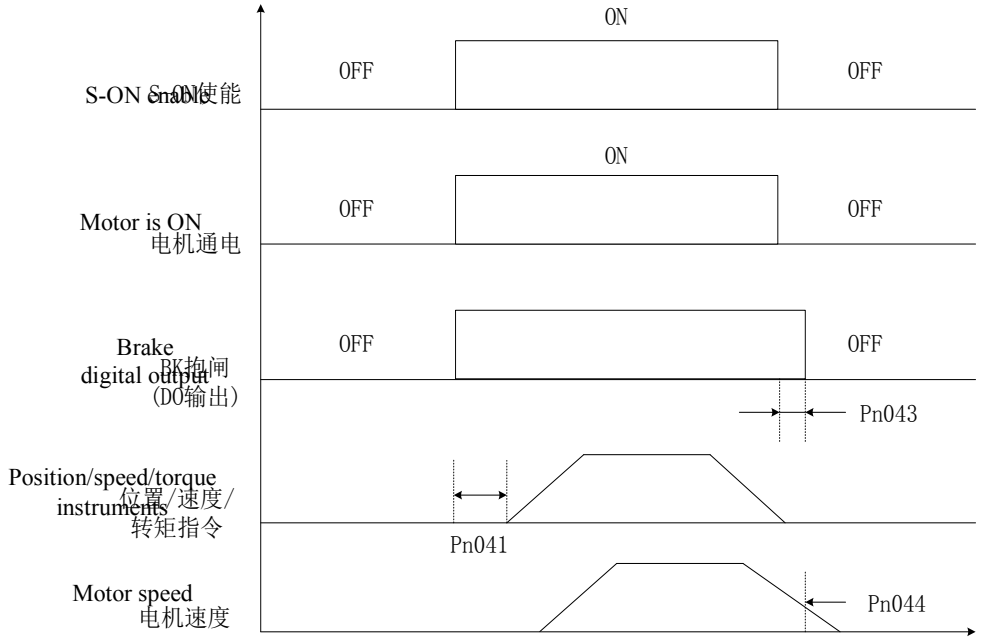


2) Holding brake wiring attentions:

(a) Please take full account of the voltage drop caused by cable resistance when select the length of side cable of motor safety brake, and the brake needs to ensure that the input voltage is 21.6V at least.

B) It is better not to share power with other electrical appliances to prevent the misoperation of brake due to the decrease of voltage or current caused by the operation of other electrical appliances.

C) Recommended cable above 0.5mm2.



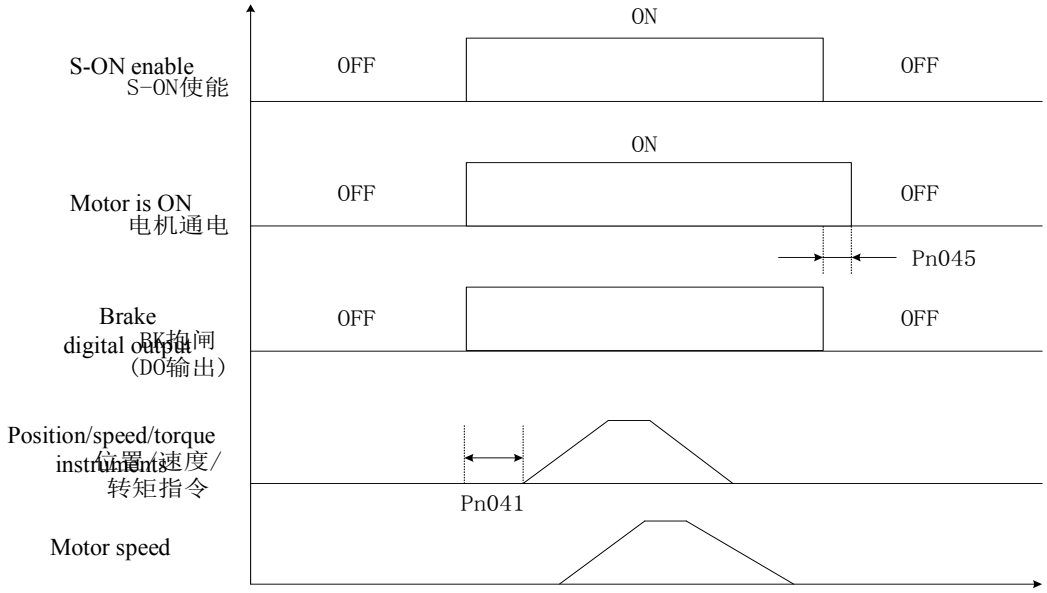
3) Motor running when Servo OFF

Output timing description of BK：

■ Servo ON, please send instructions to the servo drive after interval Pn041, otherwise the drive will not respond.

■ Servo OFF,After the time set by Pn043 or when the motor speed is lower than the speed set by Pn044, BK outputs OFF (brake off, motor stops running).

4)Servo OFF, motor static



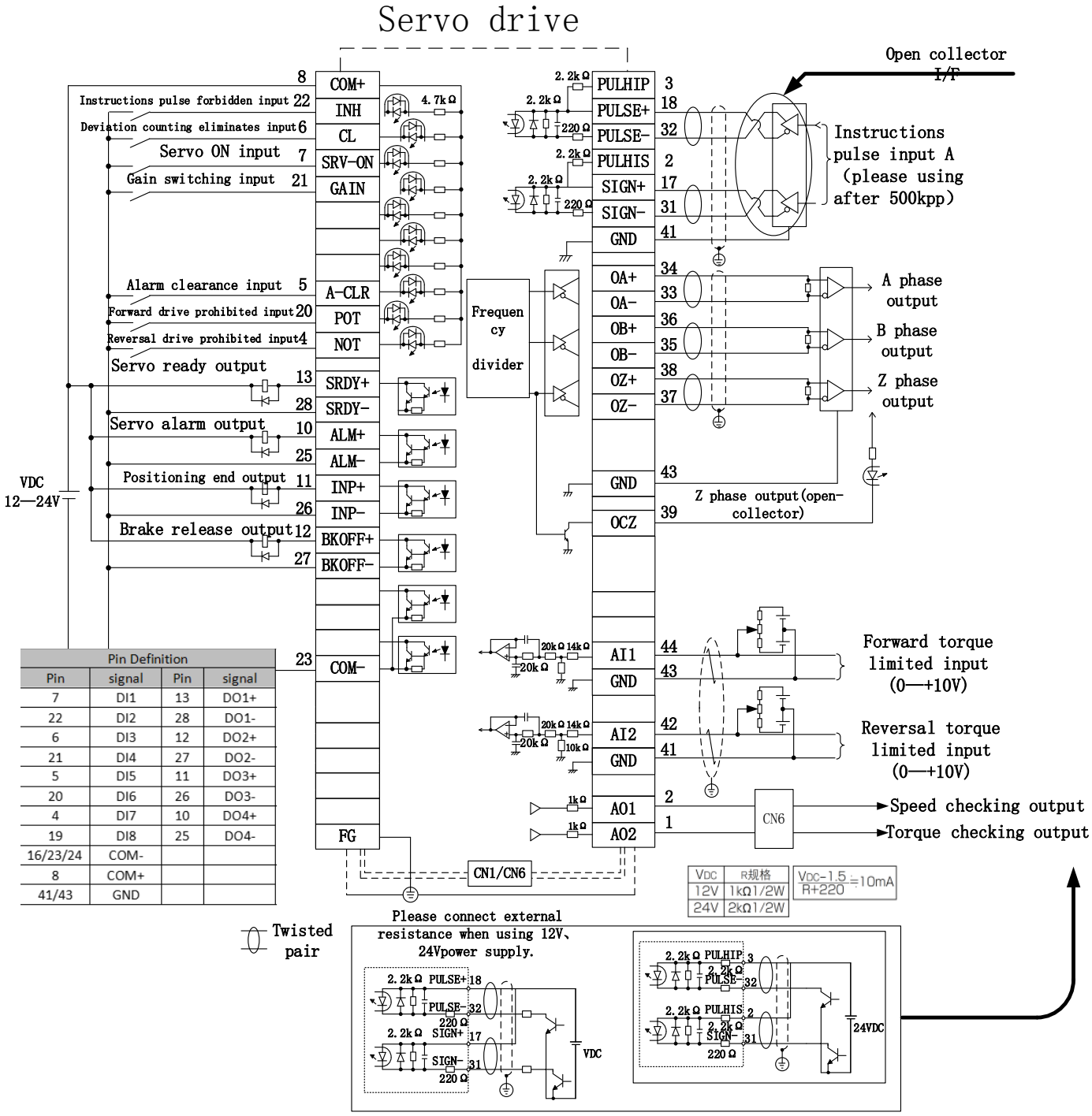
Output timing description of BK：

■ Servo ON, please send instructions to the servo drive after interval Pn041, otherwise the drive will not respond.

■ Servo OFF， send the brake signal immediately, in Pn045 time, the motor is still electrified to prevent the weight from sliding under heavy load.

2.6 Standard wiring

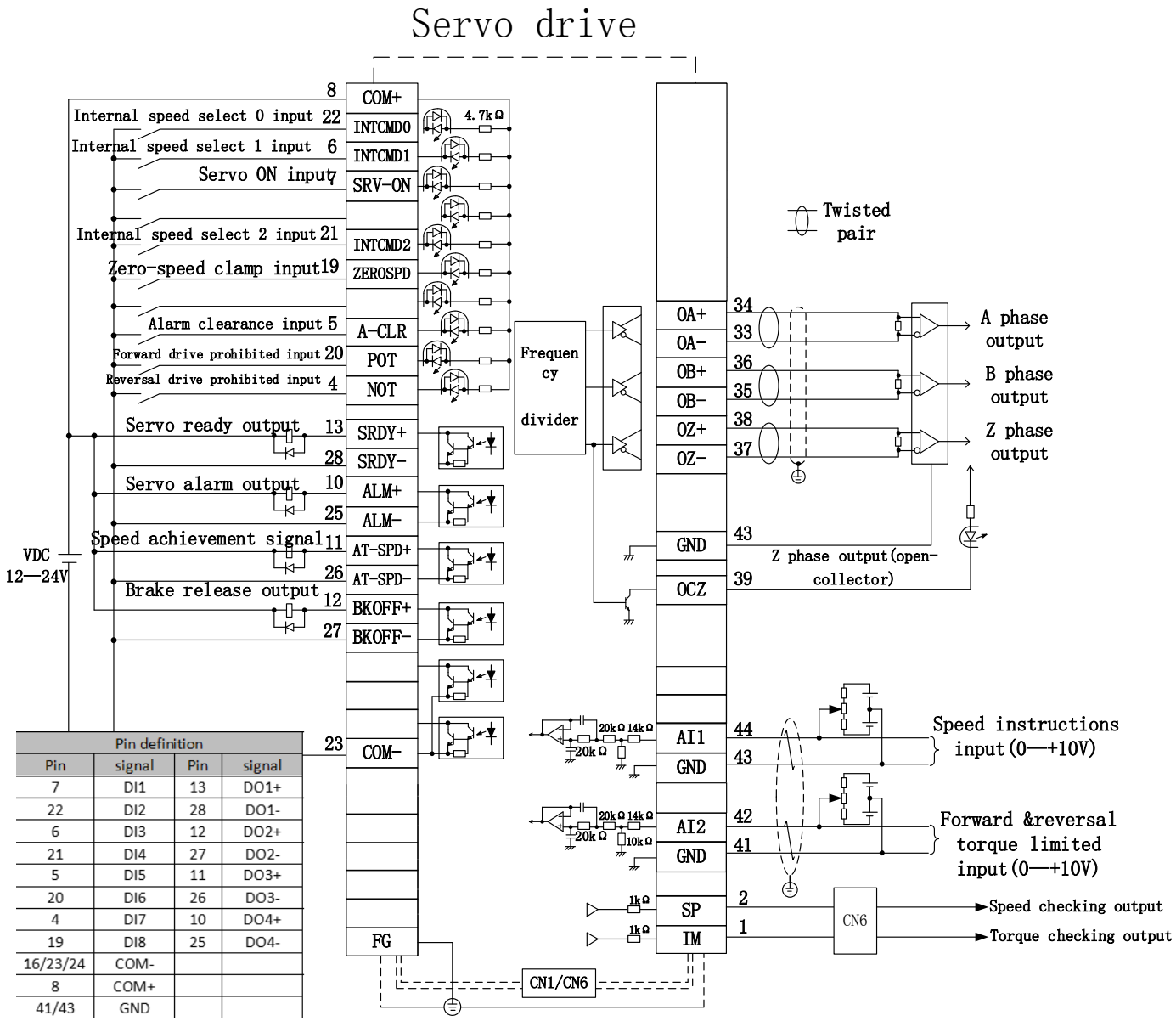
2.6.1 Position control connection



Pin Definition			
Pin	signal	Pin	signal
7	DI1	13	DO1+
22	DI2	28	DO1-
6	DI3	12	DO2+
21	DI4	27	DO2-
5	DI5	11	DO3+
20	DI6	26	DO3-
4	DI7	10	DO4+
19	DI8	25	DO4-
16/23/24	COM-		
8	COM+		
41/43	GND		

3-24 Position mode standard control circuit wiring

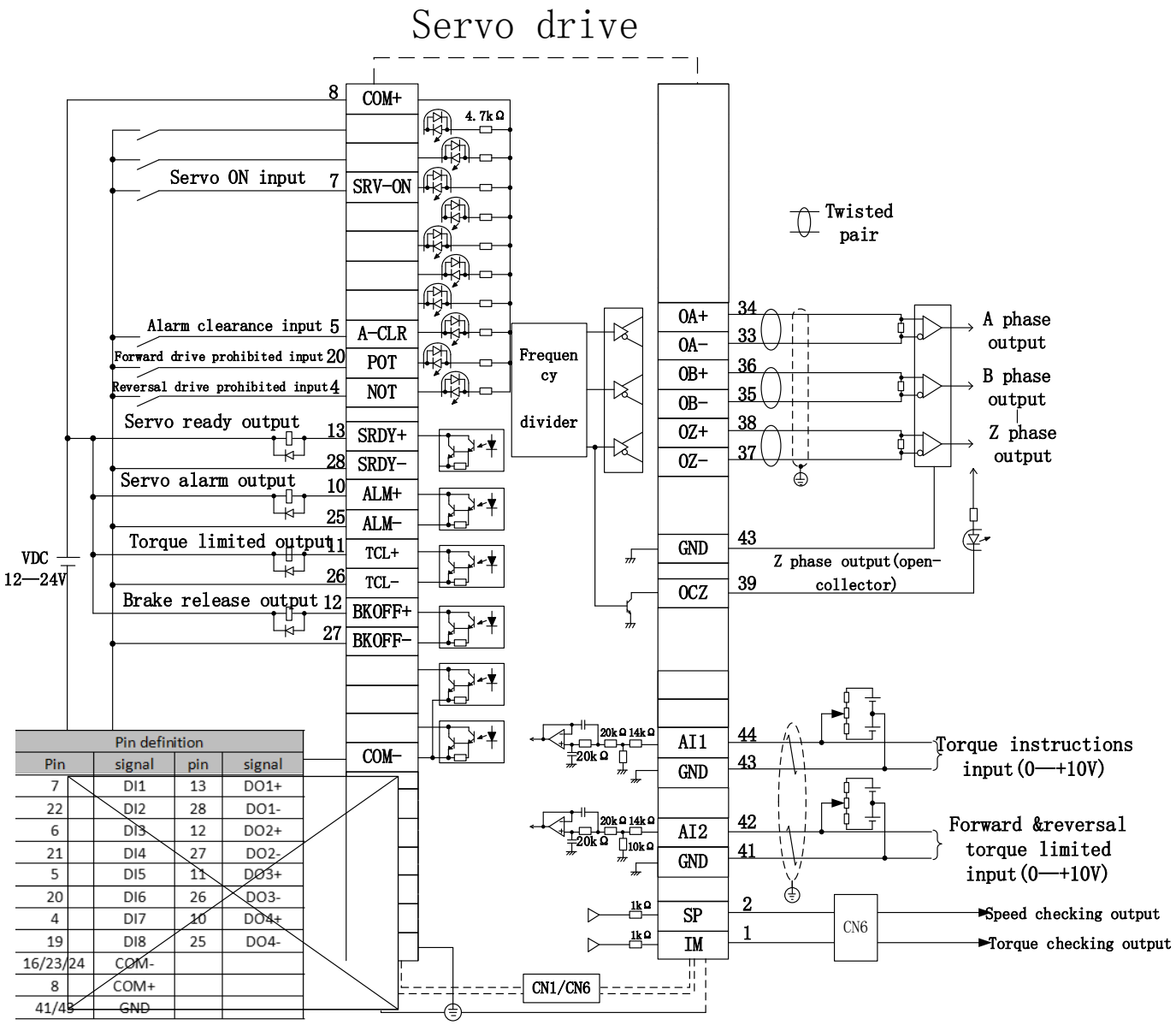
2.6.2 Speed control connection



Pin definition			
Pin	signal	Pin	signal
7	DI1	13	DO1+
22	DI2	28	DO1-
6	DI3	12	DO2+
21	DI4	27	DO2-
5	DI5	11	DO3+
20	DI6	26	DO3-
4	DI7	10	DO4+
19	DI8	25	DO4-
16/23/24	COM-		
8	COM+		
41/43	GND		

3-25 Speed mode standard control circuit wiring

2.6.3 Torque control connection

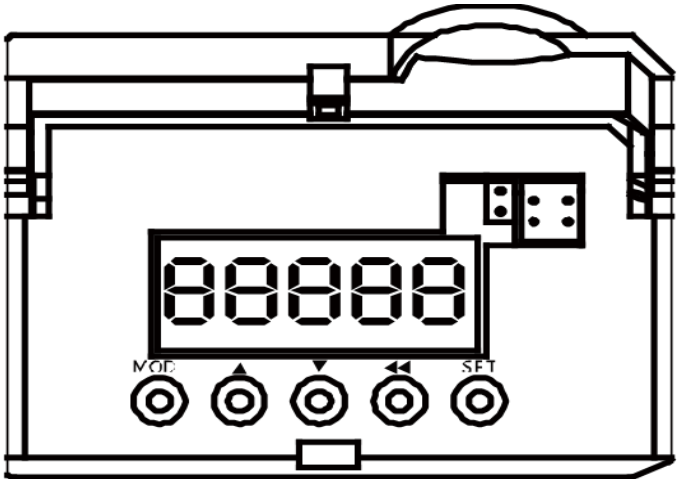


3-26 Torque mode standard control circuit wiring

Chapter 3 Panel operation

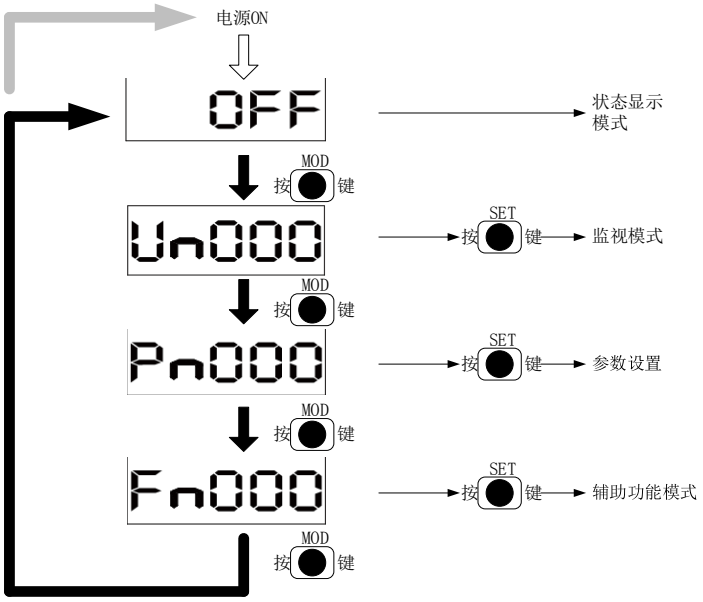
3.1 Panel operator

The panel operator is composed of the display unit and keys. The panel operator can display the status, perform auxiliary functions, set parameters and monitor the action of the servo drive. The names and functions of the panel operator keys are shown below.



Key	Function
MOD	Switch between different modes or as exit
▲	increase
▼	decrease
◂◂	Shift, cursor movement
SET	ENTER parameters, display menu

3.2 Modes switch

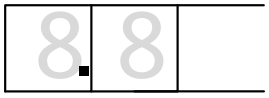
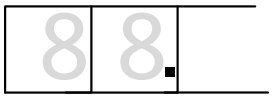
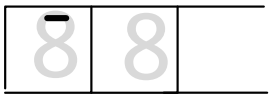
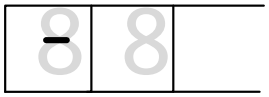
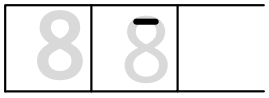
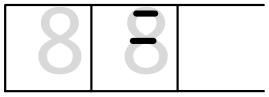


3.3 Initialization mode

It will display 88888 when power on，then will enter state monitor mode after 1s automatically.

3.4 State monitor

Abbreviation symbol	Definition
OFF	Servo is OFF state
nDc	Bus voltage of the servo is insufficient. Please check the bus circuit.
run	Servo is enable state
pot	Forward drive prohibited
not	Reverse drive prohibited

Display	Definition
	The light is ON when holding brake of motor output invalid (brake close); The light is OFF when holding brake of motor output valid (brake open).
	The light is ON when brake unit discharge; The light is OFF when brake unit does not discharge.
	The deviation between the position command and the actual position of the motor within the prescribed range, the light is ON, otherwise will be OFF in position control mode. The deviation between the speed command and the actual position of the motor within the prescribed range, the light is ON, otherwise will be OFF in speed control mode. The light is on in torque control mode.
	The light will go out when Servo is **ON**; The light be ON when servo is **OFF**.
	Servo rotation display, the light will be ON when the speed is higher than the prescribed value, the light will extinguishes when the speed is lower than the prescribed value.
	The middle and below indicator all will extinguish in position control mode; The middle indicator will be ON in torque control mode; The below indicator will be ON in speed control mode.

3.5 Parameters monitor

The setting of servo drive,output&input signal state and internal state of servo drive can be monitored(display) in the monitor mode. Display the number starting with Un on the panel operator.

3.5.1 Display content

For the display content in the monitoring mode, please refer to Chapter 8.1. The operation method of the monitoring display is described below with the motor speed (Un000).

step	Display after operating	Using key	Operate
1	Un000	MOD	Press MOD to select auxiliary functions
2	Un000	▲▼	If it does not display Un000
3	-1500	SET	Press SET to enter to monitor interface, display the speed of motor is -1500rpm.
4	Un000	MOD	Press SET or MOD, return tostep1.
5	Ending		

3.6 Parameters mode

3.6.1 Related instructions

Set the servo drive parameters, the panel operator display the number starting with Pn.

Parameter properties	Display after pressing (SET)	Effective instructions
o	-End-	Set at any time and take effect immediately
•	rEsta	After the change, it is different from the pre-change value: set at any time and power again to take effect

3.6.2 Parameters setting（Pn027）operate example

The maximum speed Pn027 is used to illustrate the operation method of modifying the parameters. Change the maximum speed from 3000 to 2000.

step	Display after operating	Using key	Operate
1	Pn000	MOD	Press MOD to select parameters setting mode

2	Pn027	▲▼◂◂	press“▲”，“▼”，“◂◂”键，display“**Pn027**”
3	3000	SET	Press “SET”，display“**3000**”
4	2000	▲▼◂◂	Using“▲”，“▼”，“◂◂” todisplay“**2000**”
5	Pn027	SET	Press “SET” return to“**Pn027**”
6	Ending		

3.7 Auxiliary functions

The number beginning with Fn is displayed on the panel operator, and the auxiliary function is used to perform the functions related to setting and adjusting the servo drive.

3.7.1 Auxiliary functions Fn000 operating example

Following is an example of servo soft reset Fn006 to illustrate the use of auxiliary functions.

Step	**Display after operating**	**Using key**	**Operate**
1	Fn000	MOD	Press MOD to select auxiliary functions
2	Fn006	▲▼◂◂	Press“▲”，“▼”，“◂◂”，display“**fn006**”
3	0	SET	Press “SET”，display“**0**”
4	rEsEt	▲	using“▲” to display“**rESEt**”
5	88888	SET	Press “SET”，system restart, return to restart interface“**88888**”
6	Ending		

Chapter 4 Test run

4.1 Checking and attentions before test run

Item	contents
Servo motor	Load
	Wring and connection
	Component loosening
	Whether the brake has been relieved beforehand? Please supply DC24V or DC90V when relieve brake
Servo drive	Wring and connection
	Power supply

4.2 JOG Running Through Panel Operator

JOG operation refers to the function of confirming the action of servo motor through speed control without connecting the upper device. Overrun prevention function is invalid during JOG operation. At the same time, the operating range of the machinery used must be considered.

4.3 Setting items before running

Please set S-ON to OFF , set speed by Pn512 before JOG running.

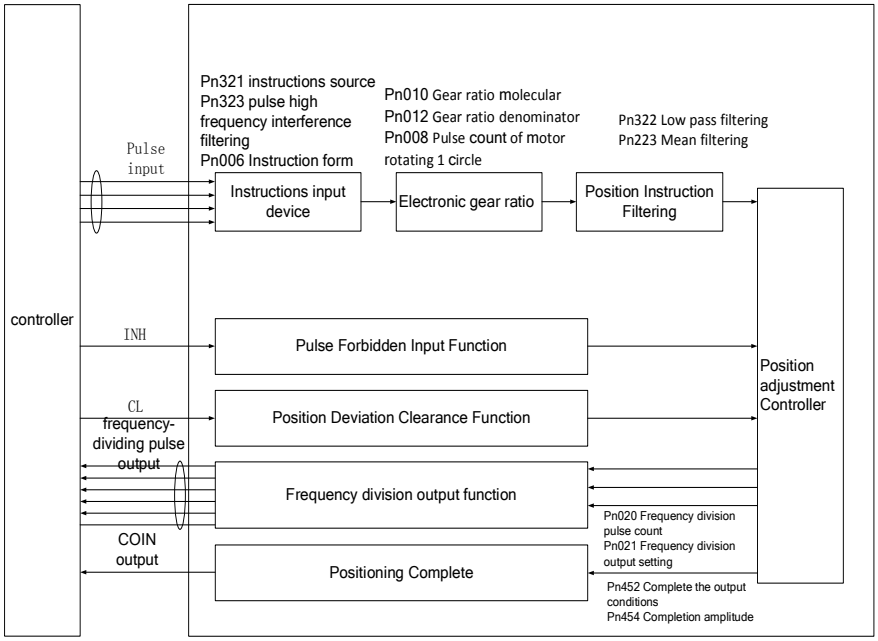
4.4 Operating steps

Step	**Display after operating**	**Using key**	**Operate**
1	Fn000	MOD	Press MOD to select auxiliary functions
2	Fn001	▲▼◂◂	Press“▲”，“▼”，“◂◂”，display“**fn001**”
3	Jog	SET	Press “SET”，display“**JoG**”，Motor excitation waiting for rotation instruction
4	Jog	▲	Using“▲”，motor forward
5	Jog	▼	Using“▼”, motor inversion
6	Ending		

Chapter 5 Operation and Debugging

According to the command mode and operation characteristics of servo drive, it can be divided into three modes: position control mode, speed control mode and torque control mod.Position control mode usually determines the moving displacement by the number of pulses, and the rotational speed is determined by the pulse frequency of external input. Because the position mode can strictly control the speed and position, it is generally used in positioning devices. Speed control mode is the most widely used servo control mode, mainly used for manipulators, chip mounters, craving and milling, CNC machine tools and so on. Speed mode controls rotational speed by giving analog input or digital input and communicating given. It should be mainly used in some constant speed conditions. For example, in the application of analog carving and milling machine, the upper computer adopts position control and the servo drive adopts speed control mode. Torque control mode changes the set torque by changing the setting of the analog given or the corresponding address value in the way of communication. It is mainly used in winding and unwinding devices which have strict requirements for material force, such as winding device or fiber-optic pulling device and some tension control occasions, the setting of torque should be changed at any time according to the change of winding radius to ensure that the material force will not change with the change of winding radius.

5.1 Position mode instructions



Position is the general mode of servo drive, the main steps as the followings:

1. Please connect the power supply of servo main circuit and control circuit correctly, motor power cable and encoder cable.and panel display base blockade "off" after power-on means that the wiring of servo power supply is correct and wiring of motor encoder is correct.

2. Servo JOG is tested by auxiliary function Fn000 to confirm whether the motor can run normally.

3. Setting the position mode. Please set the external digital input/output according to the actual situation, the function code refers to Pn4××group. In addition, the functions of origin restoration and frequency division output are set up according to the need.

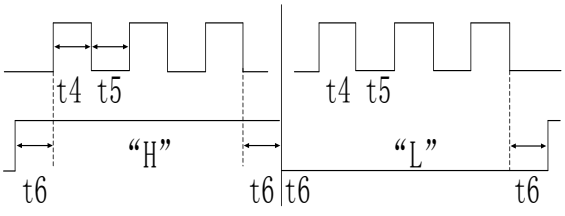
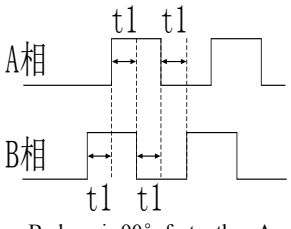
4. Servo enable, control the rotation of servo motor by position command issued by upper computer. First, make the motor rotate at low

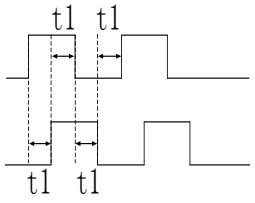
speed, and confirm whether the rotation direction and the ratio of electronic gears are normal, then adjust the gain.

5.1.1 Pulse instructions form selection

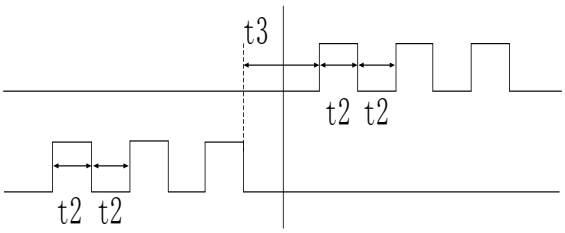
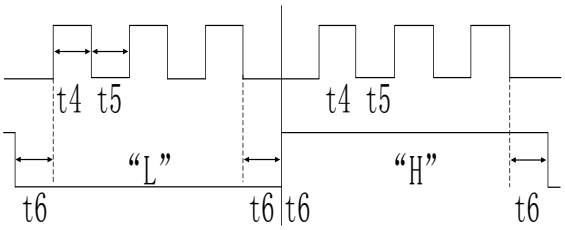
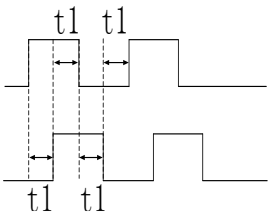
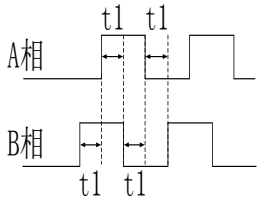
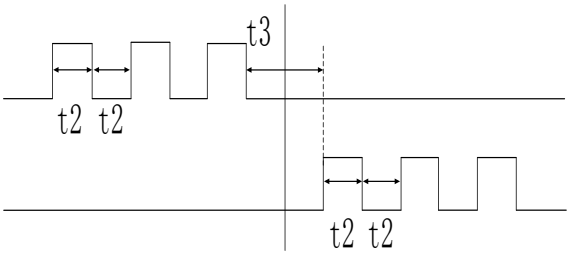
Set Pn006 and Pn007, select instructions form, including “direction+pulse”, “Orthogonal pulse”,“CW+CCW”.

<table>
<tr><th>Pn</th><th>NO</th><th>Name and function</th><th>Unit</th><th>Min</th><th>Max</th><th>Initial value</th><th>Effective time</th></tr>
<tr><td>Pn0</td><td>06</td><td>External pulse instructions input form<table><tr><td>Setting</td><td>Item</td></tr><tr><td>0</td><td>sign+ pulse</td></tr><tr><td>1</td><td>A phase+B phase
（4 frequency double）</td></tr><tr><td>2</td><td>CW+CCW</td></tr></table></td><td></td><td>0</td><td>2</td><td>0</td><td>Power again</td></tr>
<tr><td>Pn0</td><td>07</td><td>Position instructions pulse direction reversal<table><tr><td>Setting</td><td>Item</td></tr><tr><td>0</td><td>normal</td></tr><tr><td>1</td><td>Position instructions pulse direction reversal</td></tr></table></td><td></td><td>0</td><td>1</td><td>0</td><td>Power again</td></tr>
</table>

<table>
<tr><th>Instructions direction Pn007</th><th>Pulse Instruction type Pn006</th><th>Instruction pulse form</th><th>Signal</th><th>Positive direction instructions</th><th>Negative direction instruction</th></tr>
<tr><td rowspan="2">0</td><td>0</td><td>pulse sequence，+ Sign</td><td>PULSE，SIGN</td><td colspan="2"> 
</td></tr>
<tr><td>1</td><td>90°，2 phases pulse，(A phase+B phase)</td><td>PULSE，SIGN</td><td> 

B phase is 90° faster than A phase
B相比A相快90°</td><td> 

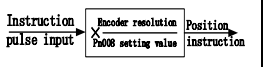
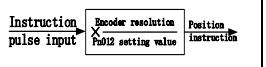
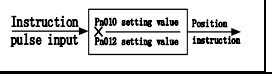
B phase is 90° slower than A phase</td></tr>
</table>

Instructions direction Pn007	Pulse Instruction type Pn006	Instruction pulse form	Signal	Positive direction instructions	Negative direction instruction
	2	Positive direction pulse sequence，+，Negative direction pulse sequence	PULSE，SIGN		
1	0	pulse sequence，+ Sign	PULSE，SIGN		
	1	90°，2 phases pulse，(A phase+B phase)	PULSE，SIGN	 B phase is 90° slower than A phase	 B phase is 90° faster than A phase B相比A相快90
	2	Positive direction pulse sequence，+，Negative direction pulse sequence	PULSE，SIGN		

PULSE/SIGN signal input I/F		Allowed input, max frequency	Min time width(μs)					
			t1	t2	t3	t4	t5	t6
Pulse sequence interface	Long-line drive interface	500kpps	2	1	1	1	1	1

5.1.2 Electronic gear ratio setting

Pn	NO	Name and function	Unit	Min	Max	Initial value	Effective time

<table>
<tr>
<td>Pn0</td>
<td>08</td>
<td>The instructions pulse count of motor rotating 1 circle
<table>
<tr><th>Pn008</th><th>Pn010</th><th>Pn012</th><th>Instruction input and motor output</th></tr>
<tr><td>1~8388608</td><td>No effect</td><td>No effect</td><td>  </td></tr>
<tr><td rowspan="2">0</td><td>0</td><td>1~1073741824</td><td>  </td></tr>
<tr><td>1~1073741824</td><td>1~1073741824</td><td>  </td></tr>
</table></td>
<td>Pulse</td>
<td>0</td>
<td>8388608</td>
<td>10000</td>
<td>immediately</td>
</tr>
</table>

5.1.3 Position instruction filtering setting

Position instruction smoothing function refers to filtering the input position instruction to make the rotation of servo motor smoother. The effect of this function is obvious in the following occasions:

☐ ■ The output pulse instruction of the upper device has not been accelerated/decelerated, and the acceleration/deceleration speed is very large;

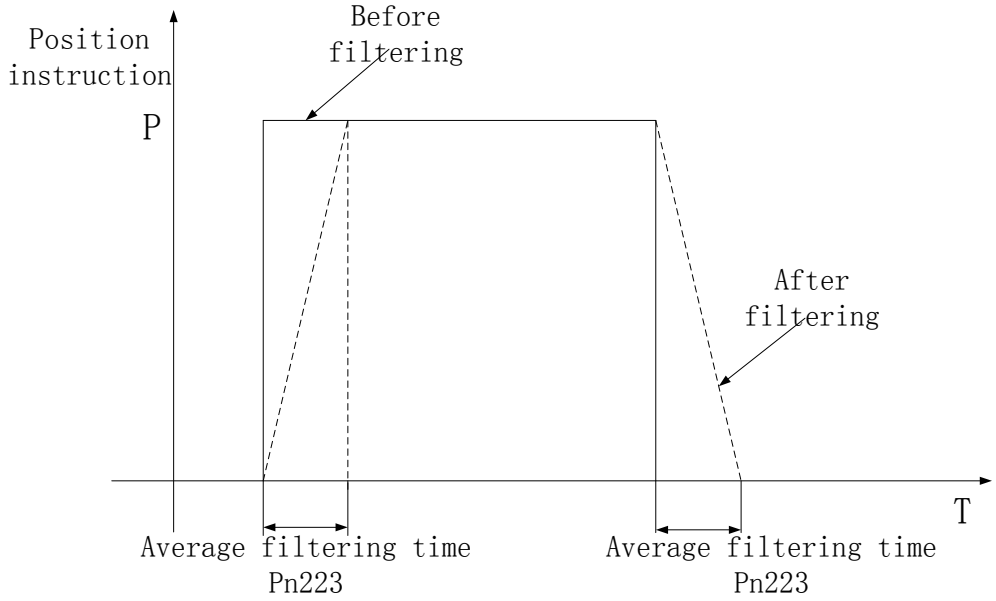
☐ ■ The frequency of instruction pulse is too low;

☐ ■ The ratio of electronic gears is more than 10 times.

Note: This function has no effect on displacement (total number of position instructions).

Position instruction smoothing function parameters setting as followings:

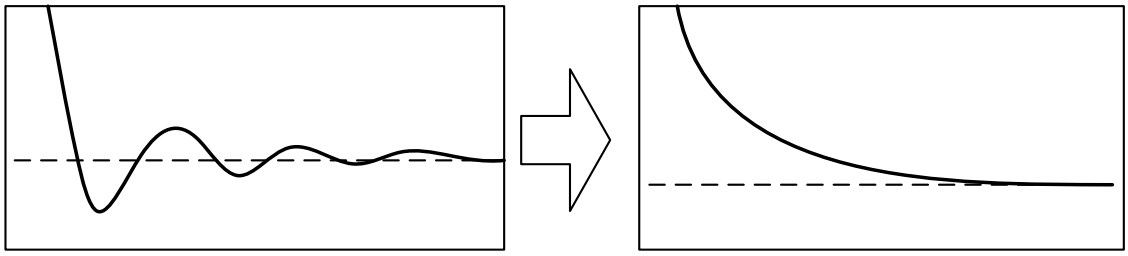
Pn	NO	Name and function	Unit	Min	Max	Initial value	Effective time
Pn2	23	Position FIR filter	ms	0	1280	0	Power again



The position FIR filter can be used to suppress the vibration of the device during the whole motion process, especially when the vibration

occurs at the moment when the deceleration stops.

The followings show the effect of using FIR filter



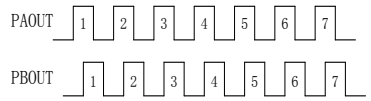
Positional deviation

Using method：

Please measure the vibration waveform, then calculate the vibration period and converted into MS unit, input to Pn223.

5.1.4 Frequency division output function

<table>
<tr><th>Pn</th><th>NO</th><th>Name and function</th><th>Unit</th><th>Min</th><th>Max</th><th>Initial value</th><th>Effective time</th></tr>
<tr><td>Pn0</td><td>20</td><td>The output pulse count of motor rotating 1 circle</td><td>Pulse</td><td>1</td><td>65535</td><td>2500</td><td>Immediately</td></tr>
<tr><td>Pn0</td><td>21</td><td>Definition of settings for frequency division output
<table><tr><th>Setting value</th><th>Item</th></tr><tr><td>0</td><td>Before 4 frequency double</td></tr><tr><td>1</td><td>After 4 frequency double（only 17bit、23bit encoder support）</td></tr></table></td><td></td><td>0</td><td>1</td><td>0</td><td>Power again</td></tr>
</table>

<table>
<tr>
<td>Pn0</td>
<td>23</td>
<td>Pulse output logical choice
<table>
<tr><td>Setting value</td><td>Item</td></tr>
<tr><td>0</td><td>A is ahead of B, When the motor is in positive rotation.</td></tr>
<tr><td>1</td><td>A is ahead of B, When the motor is in positive rotation.</td></tr>
<tr><td colspan="2"> 
</td></tr>
</table></td>
<td></td>
<td>0</td>
<td>1</td>
<td>0</td>
<td>Power again</td>
</tr>
</table>

5.1.5 Gain tuning

The gain tuning of the servo amplifier is as follows. For gain tuning, first use automatic adjustment mode 1. Please adopt the automatic adjustment mode 2 when can not meet the requirements, manual mode.

Gain tuning mode	Mode adjustment parameters Pn002 setting	Inference of load inertia ratio	Automatic setting parameters	Manual setting parameters
Manual Mode	0	Fixed Pn004 value		Pn002(gain tuning mode) Pn100(position loop ratio) Pn101(speed loop ratio) Pn102(speed loop integration time constant) Pn128(Torque given filtering time constant)
Automatic adjustment mode 1	1	Fixed Pn004 value	Pn100(position control gain) Pn101(speed control gain) Pn102(speed loop integration time constant) Pn128(Torque given filtering time constant)	Pn002(gain tuning mode) Pn003(Rigidity value) Pn004(load inertia ratio)
Automatic adjustment mode 2	2	Real-time inference	Pn100(position control gain) Pn101(speed control gain) Pn102(speed loop integration time constant)	Pn002(gain tuning mode) Pn003(Rigidity value)

Gain tuning mode	Mode adjustment parameters Pn002 setting	Inference of load inertia ratio	Automatic setting parameters	Manual setting parameters
			Pn128(Torque given filtering time constant) Pn004(load inertia ratio)	

5.1.5.1 Automatic adjustment mode:

The servo amplifier has the function of real-time automatic adjustment, which can infer the mechanical characteristics (load inertia ratio) in real time and set the optimal gain automatically according to the deduced results. With this function, the gain of servo amplifier can be easily adjusted.

Automatic adjustment mode 1:

Automatic adjustment mode 1 can not do the gain tuning normally under automatic adjustment mode 2. In this mode, the load inertia ratio can not be inferred, so please set the correct Pn004 value of the load inertia ratio.

The parameters adjusted automatically by automatic adjustment mode 2 as the followings:

Parameters	Name	Unit
Pn100	position control gain	rad/s
Pn101	speed control gain	Hz
Pn102	speed loop integration time constant	ms
Pn128	Torque given filtering time constant	ms

Automatic adjustment mode 1

Servo amplifier is set to automatic adjustment mode 2 in factory condition. In this mode, the servo amplifier infers the load inertia ratio of the machine in real time and automatically sets the optimal gain. The parameters automatically adjusted by automatic adjustment mode 2 are shown as the followings:

Parameter	Name	Umit
Pn100	position control gain	rad/s
Pn101	speed control gain	Hz
Pn102	speed loop integration time constant	ms
Pn128	Torque given filtering time constant	ms

Pn004	load inertia ratio	times

If automatic adjustment mode 2 can meet the following conditions, it can't operate normally.

■Acceleration and deceleration time constants below 5S (zero acceleration to 2000 r/min).

■The speed is over 150 r/min.

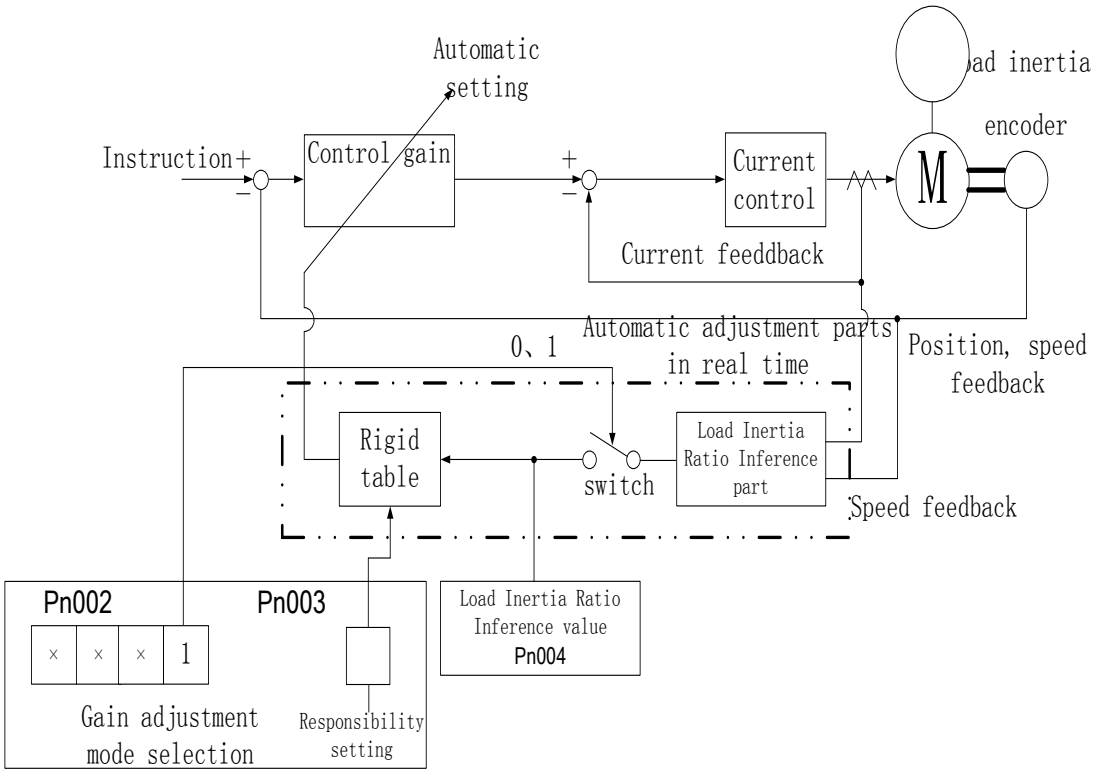
■Ratio of load and servo motor load inertia is less than 100 times.

■Acceleration and deceleration torque is more than 10% of rated torque.

If there is a sharp load change or structural loosening in the acceleration and deceleration process, the automatic adjustment may not work properly.

At this time, please use automatic mode 1 or manual mode to adjust the gain.

The block diagram of real-time automatic adjustment is shown as the following.



The load inertia ratio can be inferred by the load inertia ratio inference mechanism in real time according to the current and speed of the servo motor when the servo motor is accelerated or decelerated running. The inferred results are written into the parameter Pn004 (load inertia ratio for servo motors). This result is confirmed on the status display screen of the servo amplifier setup software.

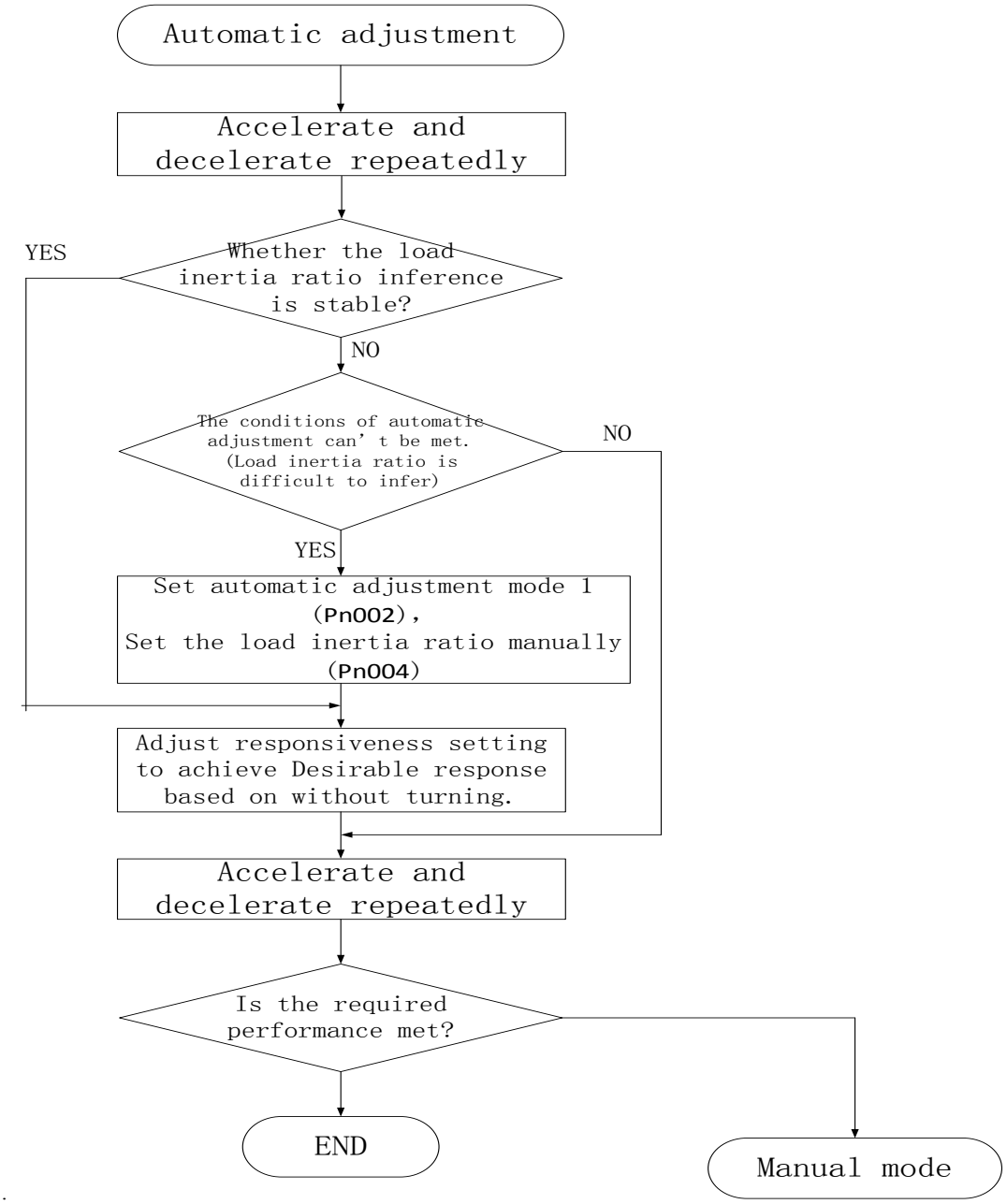
When the value of load inertia ratio is known and can't be inferred well, set the "automatic adjustment mode 1" (parameter Pn002:1) to stop the inference of load inertia ratio (make the switch OFF in the figure above),Please set load inertia ratio manually (parameter Pn004). Please set the suitable gain automatically according to the internal gain table by setting the value of the set load inertia ratio (parameter Pn004) and the responsiveness (parameter Pn003).

After the power is turned on, the result of automatic adjustment is written into EEP-ROM every 60 minutes. When the power is turned on, the gain values stored in EEP-ROM will be used as the initial value of automatic adjustment.It may be impossible to infer the inertia ratio correctly when the load changes dramatically in operation. At this point, set the automatic adjustment mode 1 (parameter Pn002:1) and set the correct load inertia ratio (parameter Pn004).

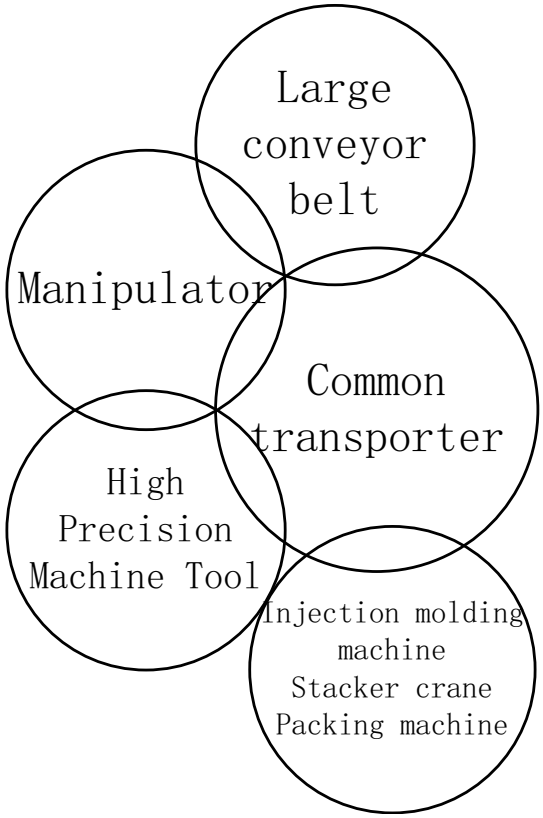
The current control gain and load inertia ratio are inferred to be stored in EEP-ROM when the change automatic adjustment mode 1 or automatic adjustment mode 2 to manual mode.

Automatic adjustment sequence

Because the automatic adjustment function is set to be effective when it leaves the factory, as long as the servo motor is running, the optimal value of gain can be set automatically according to the mechanical condition. The adjustment can be completed by changing the set value of responsiveness as needed. The adjustment steps are shown as following:



The responsiveness setting in the automatic adjustment mode sets the overall responsiveness of the servo system (Pn003). The greater the responsiveness setting, the better the tracking performance of the system and the shorter the setting time. But if the set too large, the mechanical system will vibrate. Therefore, the desired responsiveness should be set within the range of non-vibration. When the desired response can't be set because mechanical resonance over 100Hz, the adaptive filter (Pn200-Pn223) can be used to suppress the mechanical resonance. By suppressing mechanical resonance, higher responsiveness may be allowed.

Pn003 setting			
Responsiveness setting	Mechanical properties		
	Mechanical rigidity	Speed loop bandwidth[Hz]	Benchmark of corresponding machinery
0	Low	1.0	
1		2.0	
2		2.5	
3		3.0	
4		3.5	
5		4.5	
6		6.0	
7		7.5	
8		9.0	
9		11.0	
10		14.0	
11		18.0	
12		22.0	
13		27.0	
14		35.0	
15	Middle	40.0	
16		50.0	
17		60.0	
18		75.0	
19		90.0	
20		115.0	
21		140.0	
22		170.0	
23		210.0	
24		250.0	
25		280.0	
26		310.0	
27		340.0	
28		370.0	
29		400.0	
30		450.0	
31	High	500.0	

5.1.5.2 Manual mode

The all gains can be adjusted when automatic adjustment can’t meet needs.

The parameters of gain adjustment as the followings:

Parameter	Name	Unit
Pn100	Position control gain	rad/s

Parameter	Name	Unit
Pn101	speed control gain	Hz
Pn102	speed loop integration time constant	ms
Pn128	Torque given filtering time constant	ms
Pn004	Load inertia ratio	times

Adjustment sequence

sequence	operation	content
1	Roughly adjusted by automatic adjustment	
2	Change automatic mode to manual mode	
3	Set the inference value of load inertia ratio of servo motor. (There is no need to change setting when the inference value by automatic adjustment is correct.)	
4	Set the model control gain and the position control gain to be smaller. Set the speed integral compensation to be larger.	
5	The speed control gain can be increased in the range of no vibration and abnormal sound, and should be slightly reduced in the case of vibration.	Increase speed control gain
6	Velocity integral compensation can be decreased without vibration, and should be slightly increased in the case of vibration.	Decrease time constant of velocity integral compensation
7	Increase position control gain, and should be slightly reduced in the case of vibration.	Increase position control gain
8	Increase the gain of model control, and should be slightly decreased when the overshoot occurs.	Increase the gain of model control
9	If the gain can’t be increased due to the resonance of mechanical system and other reasons, that result in the desirable responsiveness can not be obtained, it can adopt filter to adjust mode and mechanical	

sequence	operation	content
	resonance suppression. After the filter suppresses the resonance, the operation of steps 3 to 5 is performed again to improve the responsiveness.	
10	Check the setting characteristics and the state of rotation, and tune the gains finely.	Micro adjustment

Adjustment content

1) speed control gain(Pn101)

This parameter determines the responsiveness of the speed loop. Increasing this value will improve the responsiveness, but if the value is too large that will easily lead to mechanical system vibration.

2)Velocity integral compensation(Pn102)

In order to eliminate the static error of the system to the instruction, the speed control loop should be set as proportional integral control. In this case, velocity integral compensation (VIC) is used to set the integral time constant. If the value is too large that can make the response worse. But if this value is set too small, the mechanical system is also prone to vibration when the load inertia is large or there are vibration factors in the mechanical system.

3)Position loop gain(Pn100)

This parameter determines the responsiveness of the position control loop to load changes. Increasing the position control gain that can decrease the load changing, but id it is too large that mechanical system is prone to vibration.

Chapter 6 Fault Warning and Treatment

6.1 Fault Warning

Code	Warning	Fault action	Eliminate
E01	Hardware (Short Circuit) Protection	Excessive motor current	No
E02	Encoder fault	Encoder disconnection	No
E03	Encoder fault	Encoder AB interfere	No
E04	Encoder fault	Encoder Z interfere	No
E05	Encoder fault	Overrange error of multi-loop data	No
E06	Encoder fault	Absolute encoder overheating	No
E07	Encoder fault	Absolute encoder battery voltage is lower than 3.1V, battery voltage is on the low side	No
E08	Encoder fault	Absolute encoder battery voltage is lower than 2.5V, Multi-loop position information has been lost	No
E09	Motor overload fault	Motor overload	Yes
E0A	Drive overload	Drive overload	Yes
E0B	Brake resistance overload fault	Insufficient brake resistance capacity	Yes
E0C	Motor overheating	Motor overheating	Yes
E0d	Drive overheating	Drive overheating	Yes
E0E	Bus fault	Bus undervoltage fault	No
E0F	Bus fault	Bus Overvoltage Fault	No
E10	Power failure of main power supply	Power failure of main power supply	No
E11	Software overcurrent fault	Excessive motor current	No
E12	Position forward limit fault	Motor travel beyond forward limit	No
E13	Position reverse limit fault	Motor travel beyond reverse limit	No
E14	Error in setting range of electronic gear ratio	Set electronic gears ratio too large or too small	Yes
E15	Input pulse frequency error	Excessive input pulse frequency	Yes
E16	Excessive position deviation fault	Excessive position deviation fault	Yes
E17	Over speed	Over speed	Yes
E18	Failure of origin regression	Failure of origin regression	Yes
E19	Input phase shortage fault	Input phase shortage fault	Yes
E1A	Motor phase sequence error	Motor phase sequence error	No
E1B	Grounding short circuit fault	Grounding short circuit fault	No
E1C	Inertia identification failure	Inertia identification failure	Yes
E1d	Encoder EEPROM failure to read and write	Encoder EEPROM failure to read and write	Yes
E1E	HOC	Hardware overcurrent	No
E1F	AD module initial correction fault	AD module initial correction fault	No
E20	Parameter storage exception	Parameter storage exception	No

Code	Warning	Fault action	Eliminate
E21	System parameter exception	System parameter exception	No
E22	Ad sampling module failure	Ad sampling module failure	No
E2A	Fan abnormality(No such failure)	Fan abnormality(No such failure)	Yes
E2B	Drive rated current input error	Drive rated current input error	Yes
E2C	Drive and motor mismatch	Drive and motor mismatch	No
E2d	Deflection angle learning failure	Deflection angle learning failure	No
E2E	Servo power off and restart	Servo power off and restart，usually used for parameter self-learning, requiring system restart to complete a large number of initialization	Yes
E2F	Zero drift correction error	Zero drift correction error	Yes

6.2 Warning

Code	Warning	Content
A01	Motor overload warning	Motor overload warning
A02	Drive overheating warning	Drive overheating warning
A03	Drive overload warning	Drive overload warning
A04	Forward overrun warning	Forward overrun warning
A05	Reverse overrun warning	Reverse overrun warning
A06	Brake overload warning	Brake overload warning
A07	Motor overheating warning	Motor overheating warning
A08	The power-on effective function code has been changed, request power up again.	The power-on effective function code has been changed, request power up again.
A09	Write EEPROM too many times in communication warning	Write EEPROM too many times in communication warning
A0A	Excessive position deviation warning	Excessive position deviation warning

6.3 Fault reason and treatment

Code	Warning	Check	Treatment
E01 E1E E11	Short circuit fault Hardware overcurrent Software overcurrent	Check whether the wiring between motor and drive is short-circuited	Eliminating short circuit and preventing metal conductor exposure
		Check the wiring sequence of the motor connected to the drive	Rewiring according to user manual
		Check whether the setting value is much larger than the factory default value	Return to the original factory default value, then amend one by one.
		Check whether the control input instructions are changing too dramatically	Modify input instruction change rate or turn on filtering function
E0E	Undervoltage fault	Check whether the main circuit input voltage wiring is normal	Reconfirmation of voltage wiring
		Measure whether the main circuit voltage is normal by voltmeter	Reconfirmation of power switch

Code	Warning	Check	Treatment
		Measure whether power supply system conforms to the specification definition by voltmeter	Use correct voltage source or connect transformer in series
E0F	Overvoltage fault	Measure whether the input voltage of the main circuit is within the rated allowable voltage by voltmeter	Use correct voltage source or connect the voltage regulator in series
		Measure whether the power supply system conforms to the specification definition by voltmeter	Use correct voltage source or connect the transformer in series
		This error still occurs when the voltmeter measures the input voltage of the main circuit within the rated allowable voltage value	Return to the manufacturer for overhaul
E1A	Phase sequence error	Check whether the motor U, V and W are misconnected	Wiring U、V、W correctly based on user manual, and grounding
E19	Input pulse shortage	Check whether L1, L2, L3 power lines are loose or single-phase input only	If it is still abnormal when the normal three-phase power supply is indeed connected, it will be sent to the distributor or the original factory for overhaul.
		Setting single-phase power supply drive to three-phases power supply	Setting parameters correctly
E22	AD sampling module fault	Initialize the parameters then power up again	Send to the distributor or the original factory for overhaul.
E09 E0A	Motor overload fault Drive overload fault	Continuous use over rated load of servo drive	Monitoring Un002 and Un027 to confirm whether the motor is in overload state
		Check whether the motor and encoder are misconnected	Reconfirmation of wiring
		Check whether the motor is blocked	Eliminate motor blockage
		overload	Please increase motor capacity or decrease load
		Please confirm the overload characteristics and operation instructions of the motor or servo drive	Change load conditions, operation conditions and motor capacity
E0C E0D	Motor overheating fault Drive overheating fault	Check whether the working environment temperature is too high	Measure the temperature and improve the working environment according to the environment temperature.
		Check installation direction of servo drive, and unreasonable connection with other devices	Check the installation of the servo drive meets the relevant requirements
E20 E21	Parameters storage exception	Check whether the upper device frequently modifies the functional parameters of the servo drive	Change the parameters write method and rewrite it

Code	Warning	Check	Treatment
		Check the parameter is saved after modification that power up again	Rewrite and check whether it is saved, if it fail to be saved when write many times, please send them back to the manufacturer for repair.
E17	Motor overspeed fault	Phase sequence error in the U、V、W wiring of servo motor	Check the wiring of motor, confirm if there is any problem with motor wiring.
		Excessive speed instruction value	Please confirm the input of the speed instruction and decrease the instruction value or gain.
		Motor speed overshoot	Please check the speed waveform of the motor to decrease the gain of the regulator.
		Whether the setting of electric angle of function zero point is correct	Please check whether these two function codes are factory value and restore them to factory value.
E02 E03 E04	Encoder disconnection Encoder ABZ interference	Please check whether the wiring of encoder U, V, W, A, B and Z is correct. Please check whether the connection joint of the encoder is reliable. Please check whether the encoder cables are welded correctly.	Reconfirm wiring and power up again. If still warning after multiple confirmations, please return to the manufacturer for overhaul.
		Please check whether the encoder wiring is reliable. Please check whether the encoder has been shielded. Please check whether the encoder and AC power line routing together.	
E06	Encoder overheating	Check whether the temperature of motor working environment is too high	Reducing environment temperature or forced air cooling of motors
E07	Low battery voltage	Measure battery voltage	Replace the battery (please replace the battery while keeping the encoder well connected to the drive terminals and make the drive power on. If the battery is replaced without power supply for the encoder, the E08 alarm will occur when the power is turned on again.)
E08	Encoder battery	Measure battery voltage	Replace the battery and manually

Code	Warning	Check	Treatment
	voltage is too low		eliminate the multi-loop fault information through Fn004 after power-on, and then power up again.
E14	Error in setting range of electronic gear ratio	Check whether the setting values of relevant parameters of electronic gear ratio are appropriate	Tuning parameter
E0B	Brake resistance overload	1: Confirm the connection status of brake resistance 2: Calculate brake resistance	1: Connect the brake resistance again 2: Use appropriate brake resistance
		Check whether IGBT used for braking is damaged	Send to distributor or factory for overhaul
		Confirmation of setting values of brake resistance (Pn034) and brake resistance capacity (Pn035)	Setting parameters correctly
E10	Power failure of main power supply	Check whether the power supply logic is correct	Adjust the power supply logic, or maintain the status when it is really necessary to cut off the main circuit power supply
E16	Excessive position deviation fault	Confirm whether the gain settings are appropriate	Adjust gain correctly
		Confirm whether the torque limit value is too low	Adjust torque limit value correctly
		Check whether the external load is too large or blocked	Decreasing external load or reassessing motor capacity

Chapter 7 Appendix

7.1 Monitoring parameters

Code	Display content	Unit
Un000	Motor speed	【rpm】
Un001	Speed instruction value	【rpm】
Un002	Torque instruction value	【%】
Un003	Incremental encoder sector number	【-】
Un004	Current electrical angle of motor	【°】
Un005	Absolute encoder rotations	【Rev】
Un006	Current circle position value of serial encoder	【Pulse】
Un008	Received external pulse frequency	【KHz】
Un010	Collected external total pulse count	【Pulse】
Un012	Total count of feedback pulses (encoder unit)	【Pulse】
Un014	Total count of feedback pulses (instruction pulse unit)	【Pulse】
Un016	Position deviation	【Pulse】
Un018	Collected external total pulse count	【Pulse】
Un020	Current position of servo motor (instruction pulse unit)	【Pulse】
Un022	Current position of servo motor (encoder unit)	【Pulse】
Un026	Corresponding Speed of Pulse Instruction	【rpm】
Un027	Motor Load Rate	【%】
Un028	Instantaneous maximum load rate of motor	【%】
Un030	Brake load rate	【%】
Un031	Output terminal state of external digital signal	【-】
Un032	Input terminal state of external digital signal	【-】
Un033	AI1 instruction voltage value (Processed by System)	【mV】
Un034	AI2 instruction voltage value (Processed by System)	【mV】
Un035	AI1 physical voltage value (Actual Value)	【mV】
Un036	AI2 physical voltage value (Actual Value)	【mV】
Un037	IGBT Module temperature	【℃】
Un040	system total running time	【Min】
Un045	Bus voltage	【V】
Un047	Effective value of motor current	【A】

7.2 Auxiliary Functions

Code	Function
Fn000	Internal S-ON instruction 0：No operation 1：Servo enable ON
Fn001	JOG function Enter this function code, drive JOG enable; Press ∧, the motor is forward running with P512, loosening and stopping; Press ∨, the motor is reversal running with P512, loosening and stopping; Press MOD to exit JOG mode
Fn002	System parameter initialization 0：No operation 65535：Initialization
Fn003	Alarm reset 0：No operation 1：Alarm reset
Fn004	Multi-loop data and fault processing of absolute encoder 0：No operation 1：Clear up fault information 2：Clear up multi-loop and fault information
Fn005	AI Channel self-adjustment 0：No operation 1：AI1 Channel self-adjustment 2：AI2 Channel self-adjustment
Fn006	Software reset 0：No operation 1：Software reset
Fn007	FFT 0：invalid 1：valid
Fn008	Off-line inertia identification switch 0：No operation 1：Identification
Fn009	Default display of power-on status 0：Power-on then display operation status XXXX：Display corresponding address parameters (communication address)

7.3 User parameters

7.3.1 Basic setting parameters

Pn000	Control mode				**Initial value**	0
	Range	0~8	**Unit**	—	**Effective time**	Effective after power up again

Select the control mode of servo system.

Pn000=0, Position control mode

Servo drive works in position control mode. It controls motor positioning by external position pulse and internal multi-segment position setting, and adjusts the speed of motor operation by pulse frequency.

Pn000=1, Speed control mode

The servo drive works in the speed control mode, and controls the speed of the motor by analog channel, parameter setting and internal multi-stage speed setting.

Pn000=2, Torque control mode

Servo drive works in the torque control mode. The output torque of motor can be controlled by analog channel and parameter setting.

Pn000=3, speed-position switching mode

The servo drive switches between the speed and position control modes by controlling the external digital input terminals when the motor is at zero speed. It works in the speed control mode when the input signal is invalid.

Pn000=5, position-torque switching mode

The servo drive switches between the torque and position control modes by controlling the external digital input terminals when the motor is at zero speed. It works in the position control mode when the input signal is invalid.

Pn000=6, speed-position switching mode

The servo drive switches between the speed and position control modes by controlling the external digital input terminals. It works in the speed control mode when the input signal is invalid.

Pn000=7, torque-speed switching mode

The servo drive switches between the speed and torque control modes by controlling the external digital input terminals. It works in the torque control mode when the input signal is invalid.

Pn000=8, position-torque switching mode

The servo drive switches between the torque and position control modes by controlling the external digital input terminals. It works in the position control mode when the input signal is invalid.

Pn002	Gain Adjustment Mode Selection				**Initial value**	1
	Range	0~2	**Unit**	—	**Effective time**	Effect immediately

Select the gain adjustment mode.

Pn002=0：Manual mode

The parameter self-adjustment is invalid, then the gain parameters are adjusted manually.

Pn002=1： Automatic adjustment mode 1

The gain parameters are automatically adjusted by a rigid meter in the parameters self-adjusting mode. This mode is suitable for the situation where the load inertia ratio is basically constant. When using this mode, users should first evaluate the inertia of the system (auxiliary function Fn008 offline inertia identification) and appropriate rigidity, fill in load inertia ratio parameter (Pn004) and rigidity parameter (Pn003) respectively. The system automatically calculates Pn100, Pn101, Pn102 and Pn128 related gain parameters, which are changed to read-only and modified by the system itself.

Pn002=2： Automatic adjustment mode 2

This is a parameter self-adjusting mode , it is suitable for the occasion where the load inertia ratio changes frequently. When using

this mode, the servo system automatically identifies the load inertia online, stores it every 30 minutes, and fills the identification results into the load inertia ratio parameter (Pn004). Users need to evaluate the appropriate rigidity and fill in the rigidity parameter (Pn003). The system automatically calculates Pn100, Pn101, Pn102 and Pn128 related gain parameters, which are changed to read-only and modified by the system itself.

Use manual mode for the following situations:

- When the automatic mode does not work well.
- Insufficient connection of mechanical parts, such as reverse gape, and especially low mechanical rigidity.
- Load inertia ratio is too large (more than 20 times), or too small (less than 3 times), and when load inertia fluctuates.
- There are continuous low-speed (less than 100 rpm) operation, and the acceleration time of not less than 100 rpm and not less than 2000 rpm/s does not last at least 50 ms.
- The acceleration and deceleration time is less than 2000 rpm/s, and the acceleration and deceleration torque is smaller than the friction torque.

Pn003	Rigidity				**Initial value**	1.0kw 以下 13； 1.5kw 及以上 11
	Range	1~31	**Unit**	—	**Effective time**	Effect immediately

Select rigidity grade. The following table shows the relationship between the rigidity settings and the gain parameters. The larger the rigidity, the faster the servo response, but the larger rigidity may make vibration.

Pn003	Pn100 Proportional gain of position regulator	Pn101 Proportional gain of speed regulator	Pn102 Integral time constant of speed regulator	Pn128 Low pass smoothing constant of torque instruction
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
Pn003	Pn100	Pn101	Pn102	Pn128
	Proportional gain of	Proportional gain of	Integral time constant of	Low pass smoothing constant of torque

	position regulator	speed regulator	speed regulator	instruction
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
30	810.0	450.0	0.20	0.05
31	900.0	500.0	0.20	0.05

Pn004	First Load Inertia Ratio				**Initial value**	2.5
	Range	1.0~120.0	**Unit**	—	**Effective time**	Effect immediately

Set the ratio of total inertia and motor rotor inertia, and the total inertia is the sum of load inertia and motor rotor inertia.

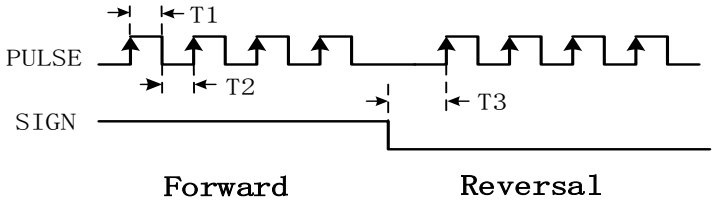
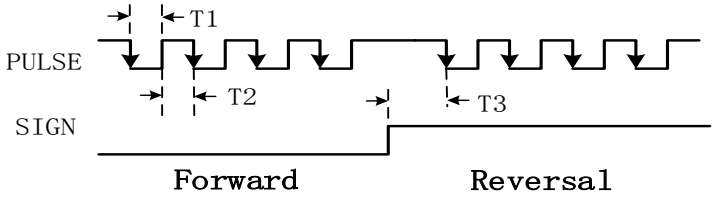
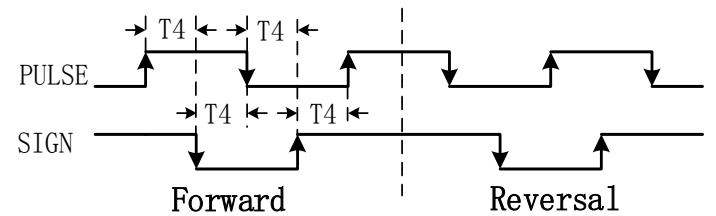
The inertia ratio of the system can be identified by off-line inertia identification (Fn008), and the user can also fill in the parameters manually

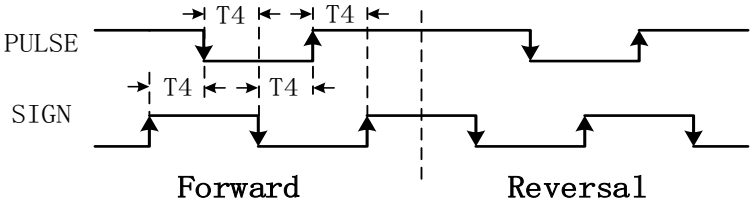
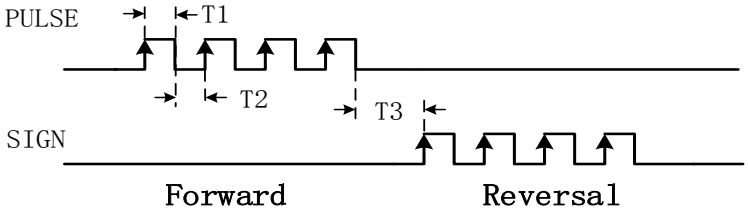
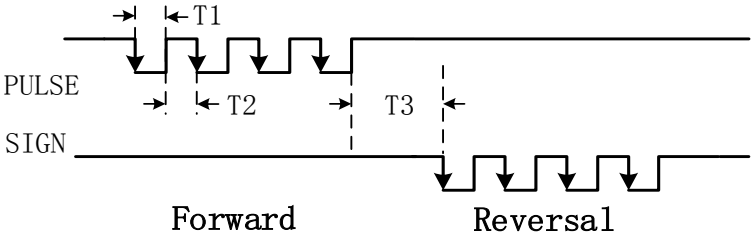
When the gain adjustment mode is set to manual mode (Pn002 = 0) and automatic mode 1 (Pn002 = 1).

the inertia ratio of the system is automatically identified online when the gain adjustment mode is set to automatic adjustment mode 2 (Pn002 = 2).

Pn006	External Pulse Instruction Input Form				**Initial value**	0
	Range	0~2	**Unit**	—	**Effective time**	Effect after power up again

Select the form of external pulse instruction,combined with the parameter Pn007, the following is expressed:

Pn006	Pn007	Instruction pulse form	Forward	Reversal
0	0	Sequence + Direction signal		
	1	Sequence + Direction signal		
1	0	Two-Phase Orthogonal Pulse（90°phase difference）		

Pn006	Pn007	Instruction pulse form	Forward	Reversal
1	0	Two-Phase Orthogonal Pulse（90°phase difference）		
2	0	Double pulse sequence （CCW）+（CW）		
	1	Double pulse sequence （CCW）+（CW）		

The allowable maximum frequency and minimum time width of the instruction pulse input signal are as follows:

Pulse form	maximum input frequency	minimum allowable width				Voltage specificationT1
		T1	T2	T3	T4	
Difference	500Kpps	1□s	1□s	2□s	0.5□s	5V
Open collector circuit	200Kpps	2.5□s	2.5□s	5□s	1.25□s	24V(MAX)

Pn007	External pulse instruction input direction				**Initial value**	0
	Range	0~1	**Unit**	—	**Effective time**	Effect after power up again

Set the input direction of the pulse instruction, refer to the Pn006 parameter specification.

Pn008	Motor instruction pulse count of every turn				**Initial value**	10000
	Range	0~8388608	**Unit**	Pulse	**Effective time**	Effect immediately

Set the needed instruction pulse count of every turn of servo motor, including external pulse instructions and multi-segment position instructions. Different ranges are set for different types of encoders.

Encoder type	Setting range
2500 line	0~10000
17bit	0~131072
23bit	0~8388608

When this parameter is set to 0, the parameters Pn010 and Pn012 are valid. Set electronic gear ratio by the relationship between the number of instruction pulses and the number of rotating cycles of the motor.

Pn010	Electronic Gear Ratio Molecule 1				**Initial value**	0
	Range	$0\sim2^{30}$	**Unit**	—	**Effective time**	Effect immediately

Set the electronic gear ratio molecule to zero, the system defaults to the encoder resolution.

Pn012	Electronic gear ratio denominator	**Initial value**	10000

	Range	1~2^{30}	Unit	—	Effective time	Effect immediately

Set electronic gear ratio denominator.

Pn008	Pn010	Pn012	Instruction Input and Motor Output
1~8388608	- No influence	- No influence	Instruction pulse input × (Encoder Resolution / Pn008 Setting value) → Position instruction
0	0	1~1073741824	Instruction pulse input × (Encoder Resolution / Pn012 Setting value) → Position instruction
	1~1073741824	1~1073741824	Instruction pulse input × (Pn010 Setting value / Pn012 Setting value) → Position instructio

Pn014	Electronic Gear Ratio Molecule 1				Initial value	0
	Range	0~2^{30}	Unit	—	Effective time	Effect immediately
Pn016	Electronic Gear Ratio Molecule 2				Initial value	0
	Range	0~2^{30}	Unit	—	Effective time	Effect immediately
Pn018	Electronic Gear Ratio Molecule 3				Initial value	0
	Range	0~2^{30}	Unit	—	Effective time	Effect immediately

In the process of servo operation, when different gear ratios need to be switched, different electronic gear ratios can be selected by configuring two external digital input terminals.

External digital input signal 1	External digital input signal 1	Effective Gear Ratio Molecule
0	0	Pn010
1	0	Pn014
0	1	Pn016
1	1	Pn018

*** Note: Electronic gear ratio is valid for both external pulse instruction and internal multi-segment position instruction. The setting range of electronic gear ratio is 0.001~64000. Excess range, drive will cause E14 failure**

Pn020	Output pulse count of every turn of motor				Initial value	2500
	Range	1~16382	Unit	—	Effective time	Effect after power up again

Set the output pulses count of per turn of the motor, and different types of encoders correspond to different output ranges.

Pn021	Frequency division output settings				Initial value	0
	Range	0~1	Unit	—	Effective time	Effect after power up again

此参数只对 17bit/23bit 编码器有效，设 0 表示 Pn020 设定的值为 4 倍频前，设 1 表示 Pn020 设定的值为 4 倍频后 This parameter is only valid for 17 bit/23 bit encoder. Set 0 means the set value of Pn020 is before 4 times frequency, and set 1 means the set value of Pn020 is after 4 times frequency.

Pn022	Z pulse output width				Initial value	0
	Range	0~3	Unit	—	Effective time	Effect after power up again

Set the output width of Z pulse. The set value can be increased and the pulse width can be broadened when the upper computer can not detect the signal.

Pn002	Output width

0	Not widening
1	0.5ms
2	1ms
3	1.5ms

Pn023	Pulse Output Logic Selection				**Initial value**	0
	Range	0~1	**Unit**	—	**Effective time**	Effect after power up again

Set the phase relationship between A phase and B phase of the output pulse. When the setting value is 0, the phase A of the output pulse is 90° ahead of B phase when the motor is in forward rotation, and the phase A of the output pulse lags 90°phase B when the motor is in reversal; when the setting value is 1, the situation is opposite.

Pn024	Selection of the First Torque Limited Source				**Initial value**	0
	Range	0~8	**Unit**	—	**Effective time**	Effect immediately

Select the source of limiting motor output torque:

Pn024=0，Pn025 limit positive torque, Pn026 limit negative torque;

Pn024=1，AI1 limit positive and negative torque;

Pn024=2，AI2 limit positive and negative torque;

Pn024=3，AI1 limit positive torque, Pn026 limit negative torque;

Pn024=4，AI2 limit positive torque，Pn027 limit negative torque；

Pn024=5，Pn025 limit positive torque，AI1 limit negative torque；

Pn024=6，Pn026 limit positive torque，AI2 limit negative torque；

Pn024=7，AI1 limit positive torque，AI2 limit negative torque；

Pn024=8，AI1 limit negative torque，AI2 限制 limit positive torque；

For example, when Pn024=1,AI1 limit positive and negative torque:

$$\text{Positive torque limiting value} = \left|\frac{AI1}{10V}\right| * Pn025$$

$$\text{Negative torque limiting value} = \left|\frac{AI1}{10V}\right| * Pn026$$

The torque limit can be switched to the torque limit 2 at any time by controlling the relevant external digital input terminals. Please refer Pn507-Pn511 for details.

Pn025	First torque limit, forward running is the largest				**Initial value**	300
	Range	0.0~350.0	**Unit**	—	**Effective time**	Effect immediately
Pn026	First torque limit, reversal running is the largest				**Initial value**	300
	Range	0.0~350.0	**Unit**	—	**Effective time**	Effect immediately

Set the maximum output of the torque in the forward and reversal direction, and the reference is the rated torque of the motor.

Pn027	Maximum Speed Setting				**Initial value**	8000
	Range	0~10000	**Unit**	rpm	**Effective time**	Effect after power up again

Set the allowed maximum speed of the servo motor, the system given can't higher than the setting value. If the speed of the motor is higher than the set value, an overspeed alarm will occur.

Pn028	Position deviation following warning value				**Initial value**	80000
	Range	0~1073741824	**Unit**	pulse	**Effective time**	Effect immediately

Set the warning threshold of position following deviation, when the position deviation reaches or exceeds the setting value, the output position following excessive deviation warning signal.						
Pn030	Position deviation following fault value				**Initial value**	100000
	Range	0~1073741824	**Unit**	pulse	**Effective time**	Effect immediately
Set the fault alarm threshold of position following deviation, when the position deviation reaches or exceeds the setting value, the output position following excessive deviation fault signal.						
Pn032	Selection of usage method of Absolute encoder				**Initial value**	0
	Range	0~1	**Unit**	pulse	**Effective time**	Effect after power up again
Select the usage method of absolute encoding, when Pn032 = 0, as an incremental encoder; when Pn032 = 1, as an absolute encoder.						
Pn033	Upper limit of rotation cycles for absolute encoder				**Initial value**	32767
	Range	1~32767	**Unit**	Rev	**Effective time**	Effect immediately
Set the upper limit of the rotation cycles for absolute encoder. If exceeds the setting value, an overrun warning will be issued.						
Pn034	Brake Resistance Setting				**Initial value**	50
	Range	20~700	**Unit**	**Ω**	**Effective time**	Effect immediately
Set the resistance value of the brake resistance. Do not modify it when using the built-in brake resistance.						
Pn035	Brake Resistance Power Setting				**Initial value**	50
	Range	20~30000	**Unit**	**W**	**Effective time**	Effect immediately
Set the power of the brake resistance. Do not modify it when using the built-in brake resistance.						
Pn036	Brake discharge duty ratio				**Initial value**	50
	Range	0~100	**Unit**	**%**	**Effective time**	Effect immediately
When braking, duty ratio of brake tube opening. When it is set to zero, the brake pipe closes completely during braking; when it is set to 100, the brake pipe opens completely during braking.						
Pn037	Percentage derate of brake resistance				**Initial value**	40
	Range	1~100	**Unit**	**%**	**Effective time**	Effect immediately
Set the derate of brake resistance. Do not modify it when using the built-in brake resistance.						
Pn041	Enable ON receiving instruction delay time				**Initial value**	200
	Range	20~motor rated speed	**Unit**	**ms**	**Effective time**	Effect immediately
Only when the effective time of ON reaches the set time of this parameter , that the position, speed and torque instructions be received.						
Pn042	Stop mode selection				**Initial value**	200
	Range	0~1311	**Unit**	**—**	**Effective time**	Effect immediately

This parameter is displayed in hexadecimal system and set stop mode.

Right 4 bits	Right 3 bits	Right 2 bits	Right 1 bits	Definition
—	—	—	0	The motor stops freely and motor is in a free state after stopping, when the servo enables OFF
—	—	—	1	Slow down and stop according to Pn047 setting time, and the motor is in free state after stopping, when the servo enables OFF.
—	—	0	—	When the second alarm occurs, the motor stops freely and motor is in a free state after stopping.
—	—	1	—	When the second alarm occurs, slow down and stop according to Pn047 setting time, the motor is in a free state after stopping.
—	0	—	—	The motor stops freely and the motor is in a free state after stopping when the overrun occurs.
—	1	—	—	Slow down and stop according to Pn048 setting time, the motor is in free state after stopping when overrun occurs.
—	2	—	—	Slow down and stop according to Pn048 setting time, the motor will be in position holding state after stopping when the overrun occurs.
0	—	—	—	Turn off dynamic braking function
1	—	—	—	Turn on dynamic braking function (valid only for type A chassis drive)

Pn043	Enable OFF-Brake instruction waiting time				**Initial value**	500
	Range	1~30000	**Unit**	**ms**	**Effective time**	Effect immediately
If the servo enables OFF or fault occurs, the brake will take effect after the waiting time when the motor rotates.						

Pn044	Speed Value of Brake Release Instruction				**Initial value**	20
	Range	1~1000	**Unit**	**rpm**	**Effective time**	Effect immediately
If the servo enabled shut down or fault occurs, the brake is released when the motor speed drops below this set value when the motor rotates.						

Pn045	Brake instruction - motor off-power delay time				**Initial value**	200
	Range	1~500	**Unit**	**ms**	**Effective time**	Effect immediately
If the servo enabled shut down, the brake will be effective immediately, and the motor will be cut off after delaying the setting time of this parameter when the motor is in a static state.						

Pn047	Zero stop deceleration time				**Initial value**	200
	Range	1~30000	**Unit**	ms	**Effective time**	Effect immediately
When the stop mode is set to zero-speed stop (Pn042 setting), this parameter specifies the deceleration time after receiving enabling shutdown instructions or secondary alarms.						

Pn048	Overrun protection deceleration time				**Initial value**	200
	Range	1~30000	**Unit**	ms	**Effective time**	Effect immediately
When an overrun warning (P-OT, N-OT) occurs, and Pn042 is set to motor decelerates and stops time when overrun zero speed stop.						

Pn049	Emergency stop deceleration time				**Initial value**	50
	Range	1~30000	**Unit**	ms	**Effective time**	Effect immediately
When the servo system suddenly stops, the motor decelerates and stops time.						

7.3.2Parameters about gain

Pn100	Position loop gain				**Initial value**	32.0
	Range	1.0~2000.0	**Unit**	rad/s	**Effective time**	Effect immediately

Setting the gain of position regulator, determines the responsiveness of position control system.

The larger the parameter setting, the higher the position response frequency, the better the follow-up of the position command, the smaller the position deviation and the shorter the positioning setting time. However, please note that excessive setting will cause vibration.

Pn101	Speed loop gain				**Initial value**	18.0
	Range	0.1~5000.0	**Unit**	Hz	**Effective time**	Effect immediately

The response of speed control loop is determined by setting the gain of speed regulator.

The larger the parameter setting, the higher the speed loop response frequency, the better the follow-up of the speed instruction. In order to improve the position loop gain to improve the response performance of the servo system, it is necessary to increase the set value of the speed loop gain. However, please note that excessive 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 it will cause vibration.

The position loop response frequency f_p = position loop gain/2π, and the speed loop response frequency = speed loop gain * load inertia ratio.

Pn102	Speed loop integral time constant				**Initial value**	31.0
	Range	0.1~5000.0	**Unit**	ms	**Effective time**	Effect immediately

Set the integral time constant of the speed loop. When the set value is 3000.0, there will be no integral effect.

The smaller the setting value is, the faster the deviation is approaching zero when stop. However, too small setting can cause vibration.

In general, the greater the inertia of load, the greater the integral time constant of speed loop should be set.

If the load inertia ratio Pn004 is set in accordance with the actual situation, the integral time constant of the speed loop $\geqq 5000/2\pi f_v$

Pn103	Gain Variation Coefficient of the Second Position Loop				**Initial value**	50
	Range	10~500	**Unit**	%	**Effective time**	Effect immediately

The fluctuation ratio of proportional gain of the target position regulator when the gain switching condition is satisfied.

Pn104	Gain Variation Coefficient of the Second Speed Loop				**Initial value**	50
	Range	10~500	**Unit**	%	**Effective time**	Effect immediately

The fluctuation ratio of proportional gain of the target speed regulator when the gain switching condition is satisfied.

Pn106	Speed Feedforward Gain				**Initial value**	30
	Range	0.0~100.0	**Unit**	%	**Effective time**	Effect immediately

Set speed feed-forward gain.

When the position control instruction changes smoothly, increasing the gain can reduce the position following deviation and improve the position following ability.

When the position control instruction changes unevenly, the machine may vibrate. Reducing this gain can reduce the vibration phenomenon.

Pn107	Speed Feedforward Smoothing Filtering Time				**Initial value**	5
	Range	0~100	**Unit**	ms	**Effective time**	Effect immediately

Set the first-order filtering time constant of feed-forward speed gain.

When the position control instruction changes smoothly, reducing this filtering time can reduce the position following deviation and improve the position following ability.

When the position control instruction changes unevenly, increasing the filtering time can reduce the vibration phenomenon of the mechanism, but the position following deviation will increase.

Pn108	Torque Feedforward Gain				**Initial value**	0
	Range	0.0~200.0	**Unit**	%	**Effective time**	Effect immediately

Set the value of torque feed-forward gain.

The acceleration (torque) can be obtained by differentiating the speed instruction, multiplying it by this parameter and adding it to the output torque instruction of the speed regulator, which can speed up the response of the motor. The reference is rated torque

Pn109	Torque feedback filtering time constant				**Initial value**	5
	Range	0.0~100.0	**Unit**	ms	**Effective time**	Effect immediately

Time constant of first order low pass filtering for torque.

The acceleration (torque) obtained by differentiating speed instruction, contains a large number of high-order harmonics. When it is superimposed on the torque instruction, it will cause high-frequency vibration of motor torque. High frequency harmonics can be eliminated and vibration can be reduced by low-pass filtering of acceleration torque and adding it to the torque instruction.

Pn110	Speed feedback filtering time constant				**Initial value**	0
	Range	0.0~20.0	**Unit**	ms	**Effective time**	Effect immediately

Set the time constant of first order filtering for speed feedback.

The rotating speed of the motor is obtained by differentiating the position of the encoder feedback. The rotating speed contains resonance and high frequency interference signals. Noise can be eliminated by this parameter, but at the same time, it will cause delay and slow loop response.

Pn112	Gain switching condition				**Initial value**	0
	Range	00~18	**Unit**	—	**Effective time**	Effect immediately

When Pn002 sets the gain adjustment mode to manual mode, this parameter is valid. This parameter is displayed in hexadecimal system.

Right 2 bits	Right 1 bits	Definition	Remark
0	0	Turn off gain switching function	Only switch position loop gain and speed loop gain
	1	External digital input signal from OFF→ON	
	2	The position deviation is lager than the setting of Pn115 (with a lag 100ppr instruction unit）；	
	3	The speed instruction corresponding to the position instruction frequency is larger than the setting value of the Pn115 (with a lag of 10 rpm)	
	4	The rotation speed of servo motor is larger than the set value of Pn115 (with a lag of 10 rpm);	
	5	External digital input signal from OFF→ON invalid；	
	6	When the position error is less than the set value of Pn115 in the position control mode (with a lag 100ppr instruction unit)；	
	7	When the position instruction frequency (revised to the corresponding speed instruction) is less than the set value of Pn115 (with a lag of 10 rpm);	
	8	When the rotation speed of servo motor is less than the set value of Pn115 (there is a lag of 10 rpm);	
1	0	Turn off integral switching function	Only switch

	1	External digital input signal from OFF→ON	speed loop integral
	2	The position deviation is lager than the setting of Pn115 (with a lag 100ppr instruction unit）；	
	3	The speed instruction corresponding to the position instruction frequency is larger than the setting value of the Pn115 (with a lag of 10 rpm)	
	4	The rotation speed of servo motor is larger than the set value of Pn115 (with a lag of 10 rpm);	
	5	External digital input signal from OFF→ON invalid；	
	6	When the position error is less than the set value of Pn115 in the position control mode (with a lag 100ppr instruction unit)；	
	7	When the position instruction frequency (revised to the corresponding speed instruction) is less than the set value of Pn115 (with a lag of 10 rpm);	
	8	When the rotation speed of servo motor is less than the set value of Pn115 (there is a lag of 10 rpm);	

Pn113	Gain switching time				**Initial value**	5
	Range	0~3000	**Unit**	ms	**Effective time**	Effect immediately
When the gain switching condition is satisfied, the gain changes linearly to the target gain value in this time (0: turn off this function).						
Pn114	Gain switching delay time				**Initial value**	5
	Range	0~3000	**Unit**	ms	**Effective time**	Effect immediately
When the gain switching condition is satisfied, it is necessary to delay the setting time of this parameter then to start the switching, so as to avoid misoperation caused by interference and other factors, which will lead to instability of the system.						
Pn115	Gain switching threshold				**Initial value**	100
	Range	0~32767	**Unit**	—	**Effective time**	Effect immediately
Set gain switching threshold						
Pn116	Control loop coefficient				**Initial value**	75
	Range	10~100	**Unit**	—	**Effective time**	Effect immediately
Effective in gain auto-tuning mode (Pn002 = 1 or 2). It is used to determine the relationship between speed bandwidth and position bandwidth. This parameter is based on the theory of automatic control, that is, the speed bandwidth should be at least four times the position bandwidth. In general, do not adjust, especially can't adjust small.						
Pn117	Low Frequency Rigidity Coefficient				**Initial value**	0.5
	Range	0.5~4.0	**Unit**	—	**Effective time**	Effect immediately

Effective in gain auto-tuning mode (Pn002 = 1 or 2). It is used to set the rigidity of the speed loop at low frequency, that is, the integral time constant of the speed loop at low frequency. It means:

$$\text{The integral time constant of the speed loop at low frequency} = \frac{Pn102}{Pn117}$$

In the automatic adjustment mode, the response of servo in low rigidity situation can be increased by increasing the setting value. However, excessive setting will cause vibration.

Pn118	PDFF Control coefficient	**Initial value**	100

	Range	0~100	**Unit**	—	**Effective time**	Effect immediately
设定为 0 时为 IP 控制器，为 100 时为 PI 控制器，1~99 时为 PDFF 控制器。Set Pn118 to zero, it's IP controller; 100, it's PI controller; 1-99 , it's PDFF controller.						
Pn119	Performance Extension 1				**Initial value**	000000
	Range	000000~111111	**Unit**	—	**Effective time**	Effect immediately

This parameter is binary display, which is used to control the switch of advanced suppression function.

Right 1/2/3/5bits	reserve
Right 4 bit	The function of speed observer is used to remove the high frequency vibration component and make the speed loop stable through estimating the change of the state of the controlled object by software when the mechanical system resonates at a frequency higher than 100Hz.
Right 6 bit	In low noise mode, the current gain is reduced appropriately after turning on, which can improve the noise.

Pn120	Torque Instruction Addition Value				**Initial value**	0
	Range	-100.0~100.0	**Unit**	%	**Effective time**	Effect immediately
When the servo system uses the vertical axis, because of the continuous load of the system gravity, this value can be converted into a given torque plus to the torque instruction. Please pay attention to the setting of the motor rotation direction. This parameter setting value is in the positive direction of the motor rotation.						
Pn121	Forward Torque Compensation				**Initial value**	0
	Range	-100.0~100.0	**Unit**	%	**Effective time**	Effect immediately
Compensation value of sliding friction in forward rotation of motor.						
Pn122	Reverse Torque Compensation				**Initial value**	0
	Range	-100.0~100.0	**Unit**	%	**Effective time**	Effect immediately
Compensation value of sliding friction in reverse rotation of motor.						
Pn123	Friction Compensation Smoothing Time Constant				**Initial value**	50
	Range	10~1000	**Unit**	ms	**Effective time**	Effect immediately
To avoid the sudden change of the compensation value leading to the vibration of the system. by first order filtering of frictional compensation value.						
Pn124	Viscous Friction Compensation Gain				**Initial value**	0
	Range	0~1000	**Unit**	0.1%/Krpm	**Effective time**	Effect immediately
Set the torque compensation of viscous friction load. The faster the speed, the bigger viscous friction. Setting Pn124 can improve response.						
Pn127	External disturbance resistance gain				**Initial value**	0
	Range	-100.0~100.0	**Unit**	%	**Effective time**	Effect immediately
External disturbance compensation after disturbance observation. It is used to reduce the speed change when load disturbance occurs.						
Pn128	Torque instruction low pass smoothing				**Initial value**	0
	Range	-100.0~100.0	**Unit**	%	**Effective time**	Effect immediately
Set the time constant of the first order low pass filter for the output torque instruction of the speed regulator.						

The output torque instruction of speed regulator may contain higher harmonic components due to the fluctuation of speed feedback and other factors, which may lead to motor vibration. Low-pass filter can eliminate high-order harmonics, but it will cause phase delay and make motor response slow.

Pn129	Cut-off Frequency Grade of Speed Observer				**Initial value**	13
	Range	0~13	**Unit**	—	**Effective time**	Effect immediately

Set the cut-off grade of the built-in speed observer.

The larger the set value, the higher the cut-off frequency of the speed observer, the wider the range of vibration suppression, but the intensity of vibration suppression will be reduced.

Pn130	Cut-off Frequency Grade of Speed Observer				**Initial value**	13
	Range	0~13	**Unit**	—	**Effective time**	Effect immediately

Set the cut-off grade of the built-in speed observer.

The larger the set value, the higher the cut-off frequency of the speed observer, the wider the range of vibration suppression, but the intensity of vibration suppression will be reduced.

Pn131	Model Tracking Control Switch 1				**Initial value**	100
	Range	0000~1211	**Unit**	—	**Effective time**	Effect immediately

The Pn131 is 16-digit display, which is used to control the switch of model tracking control function.

Right 1 bit	Model Tracking Control Selection 0: Not applicable to model tracking control 1: Applicable Model Tracking Control
Right 2 bits	Selection of Vibration Suppression 0: No vibration suppression 1: Additional vibration suppression function to specific frequency. 2: Additional vibration suppression function for two different frequencies
Right 3 bits	Selection of Adjustment for Vibration Suppression Function 0: Vibration suppression function is not automatically adjusted by auxiliary function 1: Vibration suppression function is automatically adjusted by auxiliary function.
Right 4 bits	Speed Feedforward/Torque Feedforward Selection 0: Model tracking control and speed/torque feedforward are applicable at different times 1: Model tracking control and speed/torque feedforward are applied simultaneously

Pn132	Model Tracking Control Gain				**Initial value**	50.0
	Range	1.0~2000.0	**Unit**	1/s	**Effective time**	Effect immediately
Pn133	Model Tracking Control Gain Correction				**Initial value**	100.0
	Range	50.0~200.0	**Unit**	%	**Effective time**	Effect immediately

Pn134	Model Tracking Control offset(forward direction)				**Initial value**	100.0
	Range	0.0~1000.0	**Unit**	%	**Effective time**	Effect immediately
Pn135	Model Tracking Control offset(reverse direction)				**Initial value**	100.0
	Range	0.0~1000.0	**Unit**	%	**Effective time**	Effect immediately
Pn136	Vibration Suppression 1 Frequency A				**Initial value**	50.0
	Range	1.0~250.0	**Unit**	Hz	**Effective time**	Effect immediately
Pn137	Vibration Suppression 1 Frequency B				**Initial value**	50.0
	Range	1.0~250.0	**Unit**	Hz	**Effective time**	Effect immediately
Pn138	Model Tracking Control Speed Feedback Compensation				**Initial value**	100.0
	Range	0.0~1000.0	**Unit**	%	**Effective time**	Effect immediately
Pn139	Model Tracking Control Gain				**Initial value**	50.0
	Range	1.0~2000.0	**Unit**	1/s	**Effective time**	Effect immediately
Pn140	Model Tracking Control Gain Correction				**Initial value**	100.0
	Range	50.0~200.0	**Unit**	%	**Effective time**	Effect immediately
Pn141	Vibration Suppression 2 Frequency				**Initial value**	80.0
	Range	1.0~200.0	**Unit**	Hz	**Effective time**	Effect immediately
Pn142	Vibration Suppression 2 Correction				**Initial value**	100
	Range	10~1000	**Unit**	%	**Effective time**	Effect immediately

7.3.3 Vibration Suppression Parameters

Pn200	Adaptive filter mode setting				**Initial value**	0
	Range	0~2	**Unit**	—	**Effective time**	Effect immediately
Select the mode of adaptive filter; Pn200 = 0, set 4 notch filters manually. Pn200 = 1, Notch filter 3 and notch filter 4 automatically adjust depth on line, adjust width manually. Pn200 = 2, clear Notch filter 3 and notch filter 4.						
Pn201	First notch frequency				**Initial value**	5000
	Range	50~5000	**Unit**	Hz	**Effective time**	Effect after power up again
Setting the center frequency of the first notch filter						
Pn202	First notch width				**Initial value**	2
	Range	0~20	**Unit**	—	**Effective time**	Effect after power up again
The first notch width, the larger the value, the greater the suppression near the center frequency.						
Pn203	First notch depth				**Initial value**	0
	Range	0~99	**Unit**	—	**Effective time**	Effect after power up again
The first notch depth, the larger the value, the greater the suppressed point.						
Pn204	Second notch frequency				**Initial value**	5000

	Range	50~5000	**Unit**	Hz	**Effective time**	Effect after power up again
Setting the center frequency of the second notch filter						
Pn205	Second notch width				**Initial value**	2
	Range	0~20	**Unit**	—	**Effective time**	Effect after power up again
The second notch width, the larger the value, the greater the suppression near the center frequency.						
Pn206	Second notch depth				**Initial value**	0
	Range	0~99	**Unit**	—	**Effective time**	Effect after power up again
The second notch depth, the larger the value, the greater the suppressed point						
Pn207	Third notch frequency				**Initial value**	5000
	Range	50~5000	**Unit**	Hz	**Effective time**	Effect after power up again
Setting the center frequency of the third notch filter						
Pn208	Third notch width				**Initial value**	2
	Range	0~20	**Unit**	—	**Effective time**	Effect after power up again
The third notch width, the larger the value, the greater the suppression near the center frequency.						
Pn209	Third notch depth				**Initial value**	0
	Range	0~99	**Unit**	—	**Effective time**	Effect after power up again
The third notch depth, the larger the value, the greater the suppressed point						
Pn210	Fourth notch frequency				**Initial value**	5000
	Range	50~5000	**Unit**	Hz	**Effective time**	Effect after power up again
Setting the center frequency of the fourth notch filter						
Pn211	Fourth notch width				**Initial value**	2
	Range	0~20	**Unit**	—	**Effective time**	Effect after power up again
The fourth notch width, the larger the value, the greater the suppression near the center frequency.						
Pn212	Fourth notch depth				**Initial value**	0
	Range	0~99	**Unit**	—	**Effective time**	Effect after power up again

The fourth notch depth, the larger the value, the greater the suppressed point.

Notch width setting:

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 Quasi-position Sensitivity	**Initial value**	100

	Range	10~30000	**Unit**	—	**Effective time**	Effect after power up again
Setting the amplitude of speed error, the vibration amplitude of resonance frequency is greater than this amplitude can be considered as a resonance point.						
Pn223	Position FIR Filter				**Initial value**	0
	Range	0.0~128.0	**Unit**	ms	**Effective time**	Effect after power up again
Setting the time constant of position FIR filter.						

7.3.4 Speed and Torque Position Control Parameters

Pn300	Selection of Speed Instruction Source				**Initial value**	0
	Range	0~3	**Unit**	—	**Effective time**	Effect immediately
Select speed instruction source: Pn300=0: speed instruction is given by (Pn301); Pn300=1: speed instruction is given by analog channel AI1, $\text{Speed instruction}=\frac{AI1}{10V}\times Pn301$ Pn300=2: speed instruction is given by analog channel AI2, $\text{Speed instruction}=\frac{AI2}{10V}\times Pn301$ Pn300=3: Multistage Speed Instruction（Pn800~ Pn833）						
Pn301	Digital Speed Given				**Initial value**	100
	Range	-6000~6000	**Unit**	rpm	**Effective time**	Effect immediately
Set the target speed and direction of the motor in the speed control mode. The positive value is forward direction ,.						
Pn304	Speed S-type acceleration time				**Initial value**	200
	Range	1~65535	**Unit**	ms	**Effective time**	Effect after power up again
Pn305	Speed S-type deceleration time				**Initial value**	200
	Range	1~65535	**Unit**	ms	**Effective time**	Effect after power up again
Pn306	Speed S-shaped arc time				**Initial value**	50
	Range	1~65535	**Unit**	ms	**Effective time**	Effect after power up again
When the servo drive runs in the speed mode, these three parameters are used to set the acceleration and deceleration time of the motor. Pn304: Set the time for motor speed to accelerate from 0 to the rated speed. Pn305: Set the time for motor speed to decelerate from rated speed to zero speed. Pn306: Set the smoothing time of S curve in the process of motor acceleration and deceleration. Using S curve (Pn306 is not 0), in the process of acceleration or deceleration, the drive uses three-section acceleration curve planning to smooth the motion instructions. At this time, the acceleration is continuous. So as to avoid excessive jump (differential of acceleration) caused by the sharp change of input instructions, then lead to the vibration and noise of mechanical structures. Users can use Pn304 to adjust the slope of speed change during acceleration, and use Pn305 to adjust the slope of speed change during deceleration, and use Pn306 to improve the stability of motor in start and stop.						

Pn311	Torque Instruction Source				**Initial value**	0
	Range	0~9	**Unit**	—	**Effective time**	Effect immediately

Select the source of the torque given instruction:

Pn311 = 0, the torque is given by Pn312, positive and negative symmetry;

Pn311 = 1, the torque is given by Pn312, and the reverse direction is limited by Pn315.

Pn311 = 2, the torque is given by Pn312, and the reverse direction is limited by AI1.

Pn311 = 3, the torque is given by Pn312, and the reverse direction is limited by AI2.

Pn311 = 4, the torque is given by AI1, positive and negative symmetry;

Pn311 = 5, the torque is given by AI1, and the reverse direction is limited by Pn315.

Pn311 = 6, the torque is given by AI1, and the reverse direction is limited by AI2.

Pn311 = 7, the torque is given by AI2, positive and negative symmetry;

Pn311 = 8, the torque is given by AI2, and the reverse direction is limited by Pn315.

Pn311 = 9, the torque is given by AI2, and the reverse direction is limited by AI1.

* Note that when the torque instruction is given by AI1 or AI2,

$$\text{Torque instruction}=\frac{\text{AI1 or AI2}}{10\text{V}}\times \text{Pn312}$$

When the torque limit is given by AI1 or AI2,

$$\text{Torque instruction}=\frac{\text{AI1 or AI2}}{10\text{V}}\times \text{Pn315}$$

Pn312	Digital Torque Given				**Initial value**	0
	Range	-350.0~350.0	**Unit**	%	**Effective time**	Effect immediately

Set the size and direction of the target torque of the motor in the torque control mode, and the reference is rated torque of the motor.

Pn313	Selection of Speed Limitation Instruction Source for Torque Instruction Direction				**Initial value**	0
	Range	0~2	**Unit**	—	**Effective time**	Effect immediately

Select the instruction source for limiting rotating speed of the motor in the torque control mode.

Pn313 = 0, limited by parameter Pn314;

Pn313 = 1, limited by parameter AI1;

Pn313 = 2, limited by parameter AI2;

* Note that when the speed limit instruction is given by AI1 or AI2,

$$\text{Speed limit instruction}=\frac{\text{AI1 or AI2}}{10\text{V}}\times \text{Pn314}$$

Pn314	Torque Direction Speed Limit Amplitude				**Initial value**	100
	Range	0~6000	**Unit**	rpm	**Effective time**	Effect immediately

Set the speed limit amplitude of torque instruction direction in torque control mode.

Pn315	Reverse Torque Limit Amplitude				**Initial value**	300.0
	Range	0.0~350.0	**Unit**	%	**Effective time**	Effect immediately

Set the reverse torque limit amplitude of motor in torque control mode.

Pn321	Position Instruction Source Selection				Initial value	0
	Range	0~1	Unit	—	Effective time	Effect immediately

Select the source of position instruction

Pn321 = 0, external pulse instruction, position instruction comes from the number of external input pulses, the frequency of external pulse determines the speed of motor.

Pn321 = 1, multi-segment position instructions, position instructions from parameters (Pn700 ~ Pn769).

Pn322	External Pulse Instruction Smoothing Filtering Time				Initial value	0
	Range	0~30000	Unit	ms	Effective time	Effect after power up again

Pn322 is the time constant of smoothing the external pulse instruction signal, and does not work when it is set to zero. The function of this parameter is to smooth the input pulse instructions, but there will be instruction delay.

Generally used for:

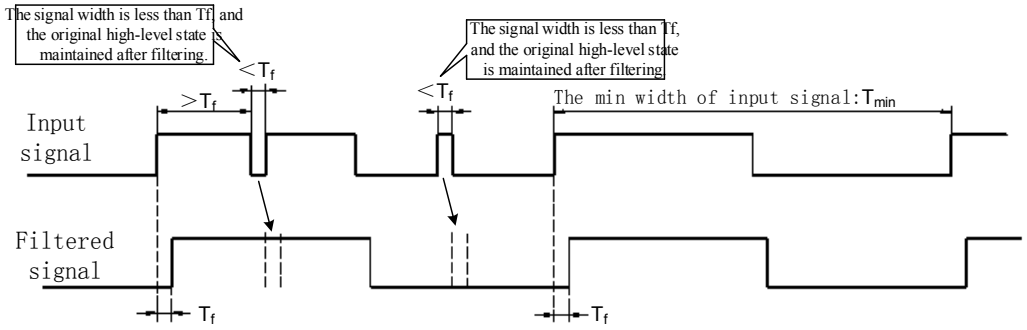
1. The upper computer has no acceleration and deceleration function.
2. The electronic gear ratio is larger.
3. Low instruction frequency;
4. Step phase and unstable phenomena occur when the motor is running.

Pn323	External Pulse Input High Frequency Filtering Time				Initial value	8
	Range	0~30000	Unit	ms	Effective time	Effect after power up again

Setting the filtering time constant for high frequency of external pulse instruction input

The high frequency interference may occur for various reasons, resulting in errors in the number of pulses received by the servo drive when using the position instruction given by the pulse. Proper setting of this parameter can avoid high frequency interference.

If the filtering time constant of the pulse input is Tf and the minimum width of the input signal is Tmin, the input signal and the filtered signal are shown in the following figure. The filtered signal will delay Tf than the input signal.



Note: Tf≤（20%~25%）Tmin

7.3.5 Input&Output parameters

Pn400	Function Selection of External Digital Input 1				Initial value	1
	Range	0~99	Unit	—	Effective time	Effect after power up again

Set the function of external digital input 1:

No.	Code	Function	Description		Trigger mode
0	DIDisable	No use			
1	SRV-ON	Servo enable	ON：Servo enable	OFF：Cancel servo enable	Level trigger

<table>
<tr><th>No.</th><th>Name</th><th>Function</th><th colspan="2">Description</th><th>Trigger mode</th></tr>
<tr><td>2</td><td>EMGS</td><td>Emergency stop</td><td>ON：Emergency stop</td><td>OFF：No use</td><td>Level trigger</td></tr>
<tr><td>3</td><td>A-CLR</td><td>Alarm and fault reset</td><td colspan="2">OFF→ON：Reset resettable Fault</td><td>Edge triggered</td></tr>
<tr><td>4</td><td>INH</td><td>Pulse prohibition</td><td>ON-Prohibit instruction pulse input</td><td>OFF：Allow pulse input</td><td>Level trigger</td></tr>
<tr><td>5</td><td>C-MODE</td><td>Control mode switching</td><td colspan="2">Please refer to Pn000 about ON/OFF</td><td>Level trigger</td></tr>
<tr><td>6</td><td>CL</td><td>Deviation Counter Clearance</td><td colspan="2">Trigger mode refer to Pn446</td><td>Edge/Level triggered</td></tr>
<tr><td>7</td><td>CMD0</td><td>Internal instruction bit0（CMD0）</td><td colspan="2" rowspan="4">In multi-segment position control mode, the signal is multi-segment position switching function.
In the multi-stage speed control mode, the signal is a multi-stage speed switching functi</td><td>Level trigger</td></tr>
<tr><td>8</td><td>CMD1</td><td>Internal instruction bit1（CMD1）</td><td>Level trigger</td></tr>
<tr><td>9</td><td>CMD2</td><td>Internal instruction bit2（CMD2）</td><td>Level trigger</td></tr>
<tr><td>10</td><td>CMD3</td><td>Internal instruction bit3（CMD3）</td><td>Level trigger</td></tr>
<tr><td>11</td><td>CTRG</td><td>Internal instruction trigger</td><td colspan="2">Inter trigger</td><td>Edge triggered</td></tr>
<tr><td>12</td><td>VC-SIGN</td><td>Speed instruction direction selection</td><td>ON：Speed instruction reverse</td><td>OFF：Setting Speed Direction</td><td>Level trigger</td></tr>
<tr><td>13</td><td>GAIN</td><td>Gain switching</td><td>ON：Use the second gain</td><td>OFF：Use the first gain</td><td>Level trigger</td></tr>
<tr><td>14</td><td>ZEROSPD</td><td>Speed Instruction Zero Fixed Enable</td><td>ON：Zero Fixed Function Enable</td><td>OFF：Invalid function</td><td>Level trigger</td></tr>
<tr><td>15</td><td>GNUM0</td><td>Molecular Selection of Electronic Gear Ratio 0(GNUM0)</td><td colspan="2" rowspan="5"><table><tr><th>GNUM1</th><th>GNUM0</th><th>Code</th></tr><tr><td>0</td><td>0</td><td>Pn010</td></tr><tr><td>0</td><td>1</td><td>Pn014</td></tr><tr><td>1</td><td>0</td><td>Pn016</td></tr><tr><td>1</td><td>1</td><td>Pn018</td></tr></table></td><td>Level trigger</td></tr>
<tr><td>16</td><td>GNUM1</td><td>Molecular Selection of Electronic Gear Ratio 1(GNUM1)</td><td>Level trigger</td></tr>
<tr><td>17</td><td>JOG_P</td><td>Forward Jog</td><td>ON：Forward Jog running</td><td>OFF：No use</td><td>Level trigger</td></tr>
<tr><td>18</td><td>JOG_N</td><td>Reverse Jog</td><td>ON：Reverse Jog running</td><td>OFF：No use</td><td>Level trigger</td></tr>
<tr><td>19</td><td>POT</td><td>Prohibit forward drive</td><td>ON-Allow forward drive</td><td>OFF-Prohibit forward drive</td><td>Level trigger</td></tr>
<tr><td>20</td><td>NOT</td><td>Prohibit reverse drive</td><td>ON-Allow reverse drive</td><td>OFF-Prohibit reverse drive</td><td>Level trigger</td></tr>
<tr><td>21</td><td colspan="5">Reserve</td></tr>
<tr><td>22</td><td>TDIR_SEL</td><td>Torque Instruction Direction Selection</td><td>ON：reverse torque instruction</td><td>OFF：Set torque direction</td><td>Level trigger</td></tr>
<tr><td>23</td><td>ORGP</td><td>External Detector Input</td><td colspan="2">Rising edge: external detector is valid
Drop Edge: external detector invalid</td><td>Edge triggered</td></tr>
</table>

	24	SHOM	Origin regression	OFF→ON：Start Origin Regression Function	Edge triggered	
	25		Internal Torque Limit 2	ON-Internal torque limit 2 Enable OFF-Internal torque Limit 2 prohibit	Level trigger	

Pn401	External Digital Input 2 Function Selection				**Initial value**	4
	Range	0~99	**Unit**		**Effective time**	0~99
Pn402	External Digital Input 3 Function Selection				**Initial value**	6
	Range	0~99	**Unit**		**Effective time**	Effect after power up again
Pn403	External Digital Input 4 Function Selection				**Initial value**	13
	Range	0~99	**Unit**		**Effective time**	Effect after power up again
Pn404	External Digital Input 5 Function Selection				**Initial value**	3
	Range	0~99	**Unit**		**Effective time**	Effect after power up again
Pn405	External Digital Input 6 Function Selection				**Initial value**	19
	Range	0~99	**Unit**		**Effective time**	Effect after power up again
Pn406	External Digital Input 7 Function Selection				**Initial value**	20
	Range	0~99	**Unit**		**Effective time**	Effect after power up again
Pn407	External Digital Input 8 Function Selection				**Initial value**	0
	Range	0~99	**Unit**		**Effective time**	Effect after power up again
Functional description of the same Pn400 parameter						
Pn408	External Digital Input Level Logic				**Initial value**	00000000
	Range	00000000~11111111	**Unit**	—	**Effective time**	Effect immediately
This parameter is displayed in binary system. Set the level logic of each external digital input terminal is. From right to left, it corresponds to the external digital input 1 to the external digital input 8. Setting 0 means that the external input is low level effective. Setting 1 means that the external input is high level effective. Each terminal can be set separately.						
Pn409	External Digital Output 1 Function Selection				**Initial value**	1
	Range	0~99	**Unit**	—	**Effective time**	Effect after power up again

Set the corresponding event of the external digital output 1. When the relevant conditions are satisfied, the terminal output is valid. The output definition is as follows:

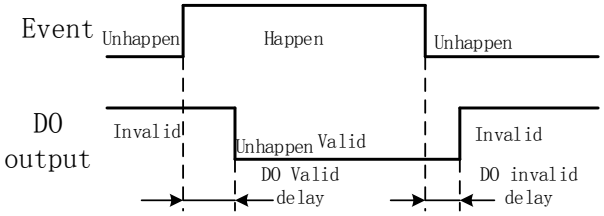
Function number	Code	Function name	Description
0	External digital output Disable	No use	
1	S-RDY	Servo Ready	Valid- Servo ready to receive S-ON instructions Invalid - Servo is not ready to receive S-ON instructions
2	ZERO	Zero speed motor	Valid - motor speed is zero Invalid - motor speed is not zero
3	INP	Location arrival	Valid:the number of position deviation pulses is less than the set value of Pn454, which satisfies the condition of Pn452 in position control mode.
4	PNEAR	Location approaching	Valid: the number of position deviation pulses is less than the setting value of Pn453 in position control mode.
5	ALM	Alarm output	Valid: alarm occurs Invalid: no alarm
6	BRK-OFF	Brake control	Valid-release holding brake (brake power on) Invalid-closed retaining brake (brake power off)
7	TGON	Motor rotation	Valid - motor is running Invalid - motor stops rotating
8	WARN	Alarm output	Valid: alarm occurs Invalid: no alarm
9	V-COIN	Speed approaching	Valid: the actual speed of the motor reaches or exceeds the set value of Pn459 in speed control,.
10	AT-SPEED	Speed consistency	Valid: the actual speed of the motor reaches or exceeds the set value of Pn460 in speed control,.
11	TCL	Torque limit	Valid-motor torque limit Invalid - motor torque unrestricted
12	V-LIMIT	Speed limit	Valid - motor speed limit Invalid - motor speed is unrestricted
13	T_CMP	Torque consistency	Valid: motor output torque reaches a given value Invalid: motor output torque does not reach the given value
14	Home	Origin regression	Valid: origin regression complete Invalid: Origin Regression not Completed
15	S_RUN	Servo enable	Valid：servo ON Invalid：servo OFF

Pn410	External Digital Output 2 Function Selection				**Initial value**	6
	Range	0~99	**Unit**	—	**Effective time**	Effect after power up again
Pn411	External Digital Output 3 Function Selection				**Initial value**	3
	Range	0~99	**Unit**	—	**Effective time**	Effect after power up again

Pn412	External Digital Output 4 Function Selection				**Initial value**	5
	Range	0~99	**Unit**	—	**Effective time**	Effect after power up again
参照 Pn409 参数功能描述 Refer to the functional of Pn409						
Pn414	External digital output terminal conduction logic				**Initial value**	1000
	Range	0000~1111	**Unit**	—	**Effective time**	Effect immediately
This parameter is displayed in binary system, set the level logic of each external digital output terminal. From right to left, the corresponding external digital input is 1 to 4. Set 0 to indicate that the event is on when it is valid, and cut off when it is invalid. Set 1 to indicate that the event is on when it is invalid, and cut off when it is valid.						
Pn415	External Digital Input Compulsory and Effective				**Initial value**	00000000
	Range	00000000~11111111	**Unit**	—	**Effective time**	Effect immediately
此参数采用二进制显示，使各个外部数字输入端子强制有效，参数从右到左依次对应外部数字输入 1-外部数字输入 8，某位设 0 表示该位输入由外部电路决定，设 1 表示强制该外部数字输入端子有效，对应功能被使能，重启后参数清零。						
Pn416	External Digital Output Forced Output				**Initial value**	0000
	Range	0000~1111	**Unit**	—	**Effective time**	Effect immediately
This parameter is displayed in binary system, which makes each external digital input terminal compulsory and effective. The parameters correspond to the external digital input 1-8 in turn from right to left. A bit set 0 means that the bit input is determined by the setup function, and a bit set 1 means that the external digital input terminal is compulsory and effective. The corresponding function is enabled, and the parameters are cleared after restart.						
Pn417	External Digital Input Filtering Time				**Initial value**	2
	Range	0~20	**Unit**	ms	**Effective time**	Effect immediately
Set the filter time of the external digital input terminal. When there is strong external interference, in order to prevent external interference, the filter time can be set for the external digital input terminal. It means that the signal of the external digital input terminal must be maintained for more than the time set by Pn417 before the drive can confirm that the state of the external digital input terminal has changed (OFF ON or ON OFF).						
Pn418	External Digital Output 1 valid Delay				**Initial value**	0
	Range	0~30000	**Unit**	ms	**Effective time**	Effect immediately
Pn419	External Digital Output 1 invalid Delay				**Initial value**	0
	Range	0~30000	**Unit**	ms	**Effective time**	Effect immediately
Pn420	External Digital Output 2 valid Delay				**Initial value**	2
	Range	0~30000	**Unit**	ms	**Effective time**	Effect immediately
Pn421	External Digital Output 2 invalid Delay				**Initial value**	0
	Range	0~30000	**Unit**	ms	**Effective time**	Effect immediately
Pn422	External Digital Output 3 valid Delay				**Initial value**	2
	Range	0~30000	**Unit**	ms	**Effective time**	Effect immediately
Pn423	External Digital Output 3 invalid Delay				**Initial value**	2
	Range	0~30000	**Unit**	ms	**Effective time**	Effect immediately

Pn424	External Digital Output 4 valid Delay				**Initial value**	2
	Range	0~30000	**Unit**	ms	**Effective time**	Effect immediately
Pn425	External Digital Output 4 invalid Delay				**Initial value**	2
	Range	0~30000	**Unit**	ms	**Effective time**	Effect immediately

Set the valid and invalid delay time for each external digital output as shown in the following figure:



Pn428	AI1Filtering time				**Initial value**	10
	Range	0~10000	**Unit**	ms	**Effective time**	Effect immediately

Set the first-order low-pass filter time constant of AI1 analog input. In order to reduce the fluctuation of analog signals caused by external electromagnetic interference and delay the vibration caused by the sudden change of analog signals, the first-order low-pass filter is applied to the analog inputs of AI1. But the system response will slow down if it is too large.

Pn429	AI1 滞环				**Initial value**	2
	Range	0~300	**Unit**	mv	**Effective time**	Effect immediately

Set the hysteresis level of AI1 analog input. When using analog to adjust speed or torque, even if the given analog value remains unchanged, the actual analog value detected by the drive may fluctuate due to electromagnetic interference and internal sampling circuit, resulting in the impossibility of obtaining a stable speed or torque given. This situation can be improved by adjusting this parameter.

Usage method:

When a constant analog signal (non-zero, recommended greater than 1V) is given by outside, the value of Un033 (AI1 channel) is monitored. If there is unacceptable fluctuation, this parameter value can be increased appropriately so that the monitored value will not fluctuate.

* Note that the larger the hysteresis loop, the greater the step of the speed or torque instruction, that is, it may not be possible to adjust the speed or torque to a specific value through the analog value.

Pn430	AI1 offset				**Initial value**	0
	Range	-3000~3000	**Unit**	mv	**Effective time**	Effect immediately

Set the offset voltage of the analog input of AI1 analog, because of circuit reasons, there may be a certain DC offset voltage given by the external analog. This can be corrected by setting this parameter.

Usage method:

Measuring the actual voltage given by AI1, then checking the value displayed by Un033 (AI1 channel), calculating the difference between them in millivolts, and filling the calculation results into this parameter can eliminate the deviation.

* Note: The offset is to translate the entire analog curve. Therefore, if there is a deviation only at 0V, the offset should not be used, but the dead zone should be used to adjust.

Pn431	AI1 Dead Zone				**Initial value**	0
	Range	-3000~3000	**Unit**	mv	**Effective time**	Effect immediately

Set the dead zone range of AI1analog.

Because of circuit and environment reasons, there will be zero drift for given analog. This parameter is used to set the loop width. When the external analog is given the actual value within this range, it will be treated as 0V.

Pn432	AI1 Zero Drift				**Initial value**	0
	Range	-2000~2000	**Unit**	mv	**Effective time**	Effect immediately
Automatic correction settings can be set through the auxiliary function Fn005.						
Pn433	AI2 Filtering time				**Initial value**	10
	Range	0~10000	**Unit**	ms	**Effective time**	Effect immediately
Set the first-order low-pass filter time constant of AI2 analog input. In order to reduce the fluctuation of analog signals caused by external electromagnetic interference and delay the vibration caused by the sudden change of analog signals, a first-order low-pass filter is applied to the analog inputs of AI2. But the system response will slow down if it is too large.						
Pn434	AI2 Hysteresis Loop				**Initial value**	2
	Range	0~300	**Unit**	mv	**Effective time**	Effect immediately
Set the hysteresis level of AI2 analog input. When using analog to adjust speed or torque, even if the given analog value remains unchanged, the actual analog value detected by the drive may fluctuate due to electromagnetic interference and internal sampling circuit, resulting in the impossibility of obtaining a stable speed or torque given. This situation can be improved by adjusting this parameter. Usage method: When a constant analog signal (non-zero, recommended greater than 1V) is given by outside, the value of Un034 (AI2 channel) is monitored. If there is unacceptable fluctuation, this parameter value can be increased appropriately so that the monitored value will not fluctuate. * Note: The larger the hysteresis loop, the greater the step of the speed or torque instruction, that is, it may not be possible to adjust the speed or torque to a specific value through the analog value.						
Pn435	AI2 offset				**Initial value**	0
	Range	-3000~3000	**Unit**	mv	**Effective time**	Effect immediately
Set the offset voltage of the analog input of AI2 analog, because of circuit reasons, there may be a certain DC offset voltage given by the external analog. This can be corrected by setting this parameter. Usage method: Measuring the actual voltage given by AI2, then checking the value displayed by Un034 (AI2 channel), calculating the difference between them in millivolts, and filling the calculation results into this parameter can eliminate the deviation. * Note: The offset is to translate the entire analog curve. Therefore, if there is a deviation only at 0V, the offset should not be used, but the dead zone should be used to adjust.						
Pn436	AI2 Dead Zone				**Initial value**	0
	Range	-3000~3000	**Unit**	mv	**Effective time**	Effect immediately
Set the dead zone range of AI2 analog. Because of circuit and environment reasons, there will be zero drift for given analog. This parameter is used to set the loop width. When the external analog is given the actual value within this range, it will be treated as 0V.						
Pn437	AI2 Zero Drift				**Initial value**	0
	Range	-2000~2000	**Unit**	mv	**Effective time**	Effect immediately
Automatic correction settings can be set through the auxiliary function Fn005.						
Pn438	AO1Function Selection				**Initial value**	0
	Range	0~20	**Unit**	—	**Effective time**	Effect immediately

Setting the output definition of AO1 terminal

Function	Definition	Function	Definition

code		code	
0	Actual speed of motor: 1V corresponds to 1000rpm	9	Write Pn445 direct output: -10000mV~10000mV
1	Speed instruction: 1V corresponds to 1000rpm	10	AI1 input：-10V~10V corresponds to -10V~10V
2	Torque instruction: 1V corresponds to 100.0% rated torque	11	AI2 input：-10V~10V corresponds to -10V~10V
3	Position deviation: 1 mV corresponds to 1 instruction unit deviation	12	Speed feed-forward value:1V corresponds to1000rpm
4	Position deviation: 1 mV corresponds to 1 encoder unit deviation	13	Torque feed-forward value: 1V corresponds to 100.0% rated torque
5	Pulse instruction corresponding speed: 1V corresponding 1000rpm	14	Effective Gain: 0V 1st Gain, 5V 2nd Gain
6	Actual Torque Output: 1V corresponds to 100.0% rated Torque	15	Position Instruction Transfer End: 5V Completed, 0V Not Completed
7	Positioning Completion: 5V Completed, 0V Not Completed	16	Bus voltage: 1V corresponds to 100V
8	Write Pn444 direct output: -10000mV~10000mV	-	Reserve

Pn439	AO1 Gain				**Initial value**	1.00
	Range	-10.00~10.00	**Unit**	—	**Effective time**	Effect immediately
Pn440	AO1 Offset				**Initial value**	0
	Range	-10000~10000	**Unit**	mv	**Effective time**	Effect immediately

Adjust the gain and offset of analog output AO1.

Analog Output Voltage = Selected Output * Analog Gain + Analog Offset

Note: These are all symbolic numbers, so consider the operation relationship.

Pn441	AO2 功能选择				**Initial value**	0
	Range	0~20	**Unit**	—	**Effective time**	Effect immediately

Setting the output definition of AO2 terminal:

Function code	Definition	Function code	Definition
0	Actual speed of motor: 1V corresponds to 1000rpm	9	Write Pn445 direct output: -10000mV~10000mV
1	Speed instruction: 1V corresponds to 1000rpm	10	AI1 input：-10V~10V corresponds to -10V~10V
2	Torque instruction: 1V corresponds to 100.0% rated torque	11	AI2 input：-10V~10V corresponds to -10V~10V
3	Position deviation: 1 mV corresponds to 1 instruction unit deviation	12	Speed feed-forward value:1V corresponds to1000rpm
4	Position deviation: 1 mV corresponds to 1 encoder unit deviation	13	Torque feed-forward value: 1V corresponds to 100.0% rated torque

	5	Pulse instruction corresponding speed: 1V corresponding 1000rpm	14	Effective Gain: 0V 1st Gain, 5V 2nd Gain	
	6	Actual Torque Output: 1V corresponds to 100.0% rated Torque	15	Position Instruction Transfer End: 5V Completed, 0V Not Completed	
	7	Positioning Completion: 5V Completed, 0V Not Completed	16	Bus voltage: 1V corresponds to 100V	
	8	Write Pn444 direct output: -10000mV~10000mV	-	Reserve	

Pn442	AO2 Gain				**Initial value**	1.00
	Range	-10.00~10.00	**Unit**	—	**Effective time**	Effect immediately
Pn443	AO2 Offset				**Initial value**	0
	Range	-10000~10000	**Unit**	mv	**Effective time**	Effect immediately
Adjust the gain and offset of analog output AO2. Analog Output Voltage = Selected Output * Analog Gain + Analog Offset Note: These are all symbolic numbers, so consider the operation relationship.						
Pn444	AO1 Direct Output				**Initial value**	0
	Range	-10000~10000	**Unit**	mv	**Effective time**	Effect immediately
Pn445	AO2Direct Output				**Initial value**	0
	Range	-10000~10000	**Unit**	mv	**Effective time**	Effect immediately
The AO terminal outputs the setting value of this parameter, which is used to test whether the drive output, the line and the upper computer sampling are intact. After the servo restart, the parameters are cleared.						
Pn446	Action Selection of Position Deviation Clearing External Digital Input Signal				**Initial value**	0
	Range	0~3	**Unit**	—	**Effective time**	Effect immediately
The external digital input terminal is set to position offset clearance, and the trigger type of terminal operation is set by this parameter. Pn446 = 0: Rising edge clearance by external digital input Pn446 = 1: Low level removal by external digital input Pn446 = 2: High level removal by external digital input Pn446 = 3: Clear the descent edge through external digital input						

Pn452	Positioning Completes Output Setting				**Initial value**	1
	Range	0~6	**Unit**	—	**Effective time**	Effect immediately

Select the valid conditions of positioning completion signal output.

Pn452 = 0: The absolute value of position deviation is less than Pn454.

Pn452 = 1: The absolute value of position deviation is less than Pn454, and the position instruction is 0.

Pn452 = 2: The absolute value of position deviation is less than Pn454, and the position instruction is 0, and the motor is at zero speed.

Pn452 = 3: The absolute value of position deviation is less than Pn454, and the position instruction is 0. The two conditions are satisfied at the same time and the duration reaches Pn455.

If one of the above three conditions is not satisfied, the output of the external digital output terminal will be invalid immediately. Revalidity

needs to be re-judged.

Pn452 = 4: The absolute value of position deviation is less than Pn454, and the position instruction is 0, and the motor is at zero speed. The three conditions are satisfied simultaneously and the duration reaches Pn455.

If one of the above four conditions is not satisfied, the output of external digital output terminal is invalid immediately. Revalidity needs to be re-judged.

Pn452 = 5: The absolute value of position deviation is less than Pn454, and the position instruction is 0.

When the condition is always satisfied, the output time of external digital output terminal which lasts Pn455 becomes invalid. When one condition is not satisfied, the output of external digital output terminal is invalid immediately.

Pn452 = 6: The absolute value of position deviation is less than Pn454, and the position instruction is 0, and the motor is at zero speed.

When the condition is always satisfied, the output time of external digital output terminal which lasts Pn455 becomes invalid. When one condition is not satisfied, the output of external digital output terminal is invalid immediately.

Pn453	Position approach width				**Initial value**	20
	Range	1~65535	**Unit**	ppr	**Effective time**	Effect immediately
Pn454	Position completion width				**Initial value**	10
	Range	1~6335	**Unit**	ppr	**Effective time**	Effect immediately

Position approach and completion of standard setting.

When the position deviation count is less than the Pn453 setting value, the relevant external digital output terminal will output effectively.

When the position deviation count is less than the set value of Pn454 and the selected condition of Pn452 is satisfied, the relevant external digital output terminal will output effectively.

Pn455	Position completion retention time				**Initial value**	0
	Range	0~3000	**Unit**	ms	**Effective time**	Effect immediately

Set the retention time for Pn452 = 3/4/5/6

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

Set the zero speed checking standard. When the absolute value of motor speed is less than the set value of this parameter, the setting external digital output terminal has output.

Pn457	Output value of rotation signal				**Initial value**	10
	Range	10~1000	**Unit**	rpm	**Effective time**	Effect immediately

Set the rotation status checking standard. When the absolute value of motor speed is more than the set value of this parameter, the setting external digital output terminal has output.

Pn458	Zero Fixed Threshold of Speed Instruction				**Initial value**	10
	Range	0~300	**Unit**	rpm	**Effective time**	Effect immediately

Analog speed instruction zero fixed value setting, that is zero clamp.

When the servo is set to speed mode and the speed instruction is given by external analog, even if the analog voltage is 0, the motor may not be stationary due to external electromagnetic interference or zero drift. If the input voltage of external analog is near 0V, the motor must be stationary, then this function can be used.

This function can satisfy the following two conditions:

1. The input analog voltage is processed by dead-time and hysteresis loop, and the absolute value of the speed instruction after filtering is less than Pn458.

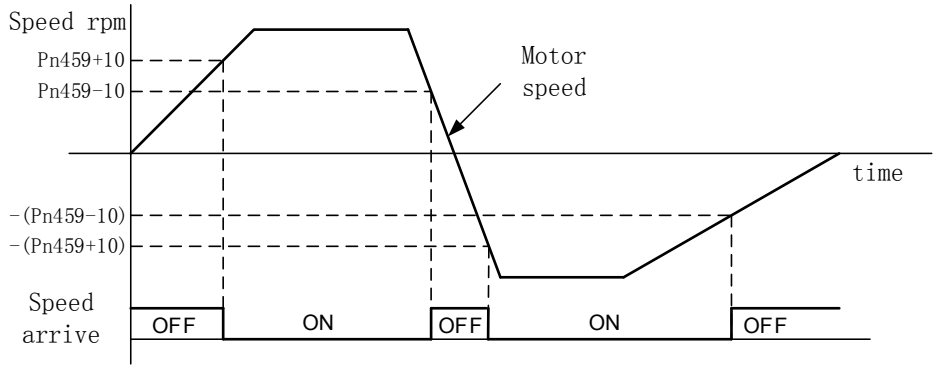
2. The drive is defined as an external digital input terminal of a zero fixed signal.

When satisfying the above conditions, the servo automatically changes from the speed mode to the position mode, so that the motor can be locked within the specified range of Pn454 in this position, even under the action of external force, it will return to the zero clamp position.

Once the speed instruction is larger than Pn458, regardless of the status of the zero fixed signal terminal, the speed mode is immediately returned to follow the instruction.

Pn459	Arrival Speed				**Initial value**	100
	Range	20~6000	**Unit**	rpm	**Effective time**	Effect immediately

设定速度到达信号输出的门限。当电机转速到达并超过此设定值后，外部数字输出端子输出有效。

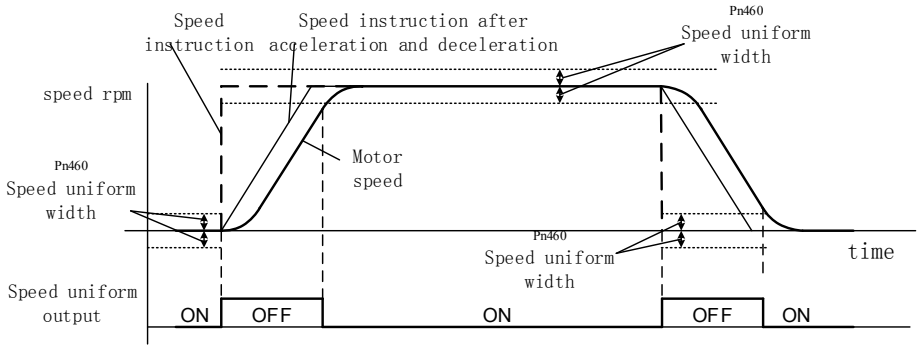


* Note: The lag of 10 rpm and the actual value of the speed arrival signal is:

OFF→ON:Pn459+10rpm ON→OFF: Pn459-10rpm

Pn460	Speed Consistency Threshold				**Initial value**	10
	Range	10~100	**Unit**	rpm	**Effective time**	Effect immediately

When the absolute value of instruction speed minus the current speed is less than or equal to Pn460, the output of external digital output terminal is valid.

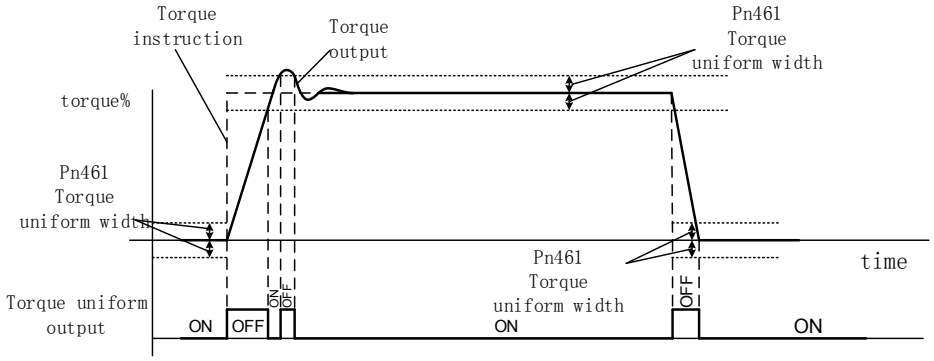


*****Note: The lag of 10 rpm and the actual value of the width is:

OFF→ON:Pn460+10rpm ON→OFF: Pn460-10rpm

Pn461	Torque Consistency Threshold				**Initial value**	5.0
	Range	3.0~100.0	**Unit**	%	**Effective time**	Effect immediately

When the absolute value of instruction torque minus the current torque is less than or equal to Pn461, the output of external digital output terminal is valid.



*Note: The 3% lag, the actual detection width of the same torque is:

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

7.3.6 Extended Functional Parameters

Pn500	Functional switch 1				Initial value	00100
	Range	00000~11111	**Unit**	—	**Effective time**	Effect immediately

This parameter is displayed in binary system. The functions are as follows:

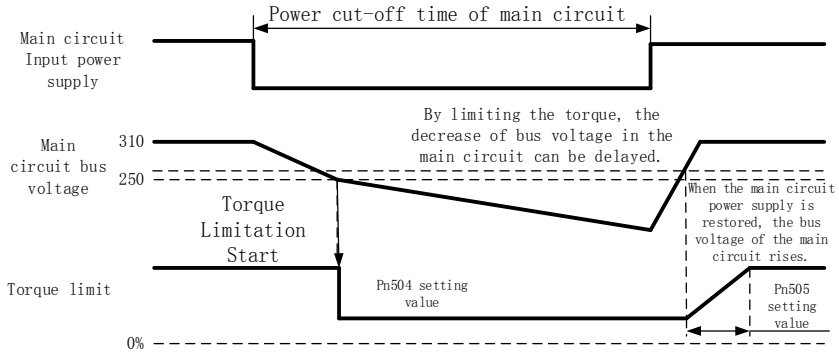
00000

bit4 bit3 bit2 bit1 bit0

Bit0:Torque limit function in main loop voltage drop

Bit0 = 0: Turn off the torque limiting function when the main circuit voltage drops. Pn504 and Pn505 are invalid.

Bit0 = 1: Turn on the torque limiting function when the bus voltage is detected to be below 80% of the rated value, the output torque of the motor will be limited to the value set by Pn504. Combining this function with the instantaneous outage maintenance function, it can also continue to operate when the power supply voltage is reduced to avoid the outage caused by alarm.



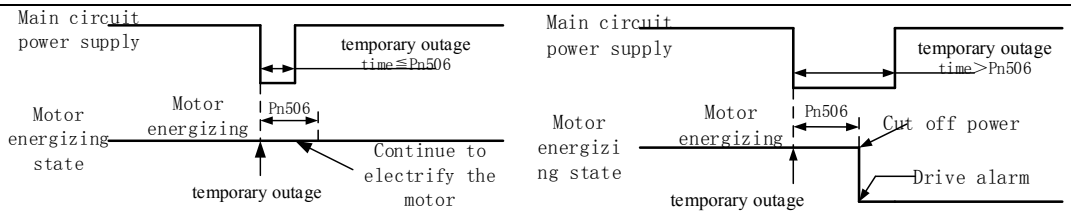
Bit1: temporary outage maintenance function

Bit 1 = 0: Turn off the temporary outage maintenance function

Bit 1 = 1: Turn on the temporary outage maintenance function, which will turn on the power-off detection function by default and shield the E10 alarm in Pn506 time.

When this function is turned on, even if the main circuit of the drive is cut off instantaneously, the motor can continue to be energized according to the time set by Pn506 (Servo ON).

When the temporary outage time is less than the Pn506 setting value, the motor will continue to be energized. If the outage time is greater than the setting value, the motor will no longer be energized, and the drive will have E10 or E0E alarms.



Pn506setting value≥temporary outage time　　Pn506 setting value＜temporary outage time

* Note 1: When the vertical axis is applied, this function is not recommended. There is possibility of falling.

2: When this function is turned on, it is suggested to turn on the torque limiting function when the main circuit voltage drops, and set the appropriate value for Pn504.

3: The power holding time of the servo control loop is about 80 ms. If the power supply in the control loop can not be continuously supplied during the instantaneous power cut-off, the same treatment as the normal power cut-off will be carried out, and the setting of Pn506 is invalid.

Bit2: Power-off detection function (associated with bit1)

Bit2 = 0: Turn off the power-off detection function, and the power-off of the main circuit is no longer detected.

When the vertical axle is used, it is necessary to turn on the power-off detection function, otherwise the brake can not be closed immediately when the main circuit power-off occurs.

Bit2 = 1: Turn on power-off detection.

If the instantaneous outage maintenance function is not turned on at the same time, the E10 alarm will occur immediately when the main circuit is powered down.

Bit3: Position Judgment Switched to Encoder Unit

Bit3 = 0: Position determination is based on instruction units.

The instruction unit is 1 pulse input from the upper device (including Pn7 multi-segment positions) as a unit of 1.

Bit3 = 1: Position determination is based on the encoder unit.

Encoder unit is 1 pulse feedback from motor encoder as 1 unit. Encoder Unit = Instruction Unit * Electronic Gear Ratio

For example, when using a motor adapted to a 23 bit encoder, the factory state is as follows:

Because the electronic gear ratio = 8388608/10000, the encoder unit = instruction unit * 8388608/10000

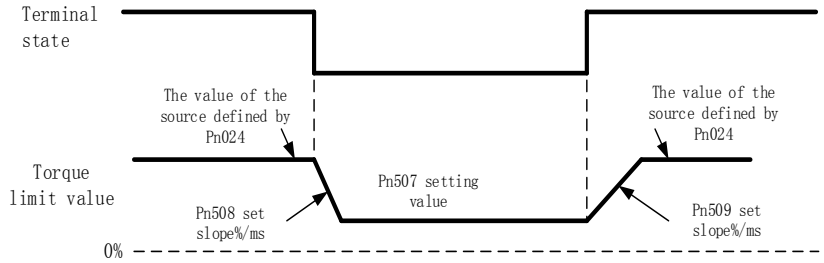
Bi4: Speed Instruction Reverse (Speed Mode)

Bi4 = 0: When the forward speed instruction, the motor rotates forward (defined by Pn001).

Bit4 = 1: When the reverse speed instruction, the motor rotates forward (defined by Pn001).

Pn504	Torque Limitation Value of Main Loop Voltage Drop				**Initial value**	50
	Range	1.0~100.0	**Unit**	rpm	**Effective time**	Effect immediately
Set the limit value of the motor output torque when the DC bus voltage of the drive is less than 80%.						
Pn505	Release Time of Torque Limit when Main Loop Voltage Drops				**Initial value**	100
	Range	10~1000	**Unit**	ms	**Effective time**	Effect immediately
The torque limit is restored to the original value in this time, when the voltage of the autonomous circuit is restored to 90% of the rated value.						
Pn506	Temporary Outage Maintenance Time				**Initial value**	100
	Range	10~1000	**Unit**	ms	**Effective time**	Effect immediately
When the power supply of the main circuit is cut off instantaneously, the time for the motor to turn on is maintained.						
Pn507	External Torque limit				**Initial value**	100
	Range	0.0~350.0	**Unit**	ms	**Effective time**	Effect immediately
Set the limit value of external torque, the reference is rated torque of motor.						

When the external digital input terminal set as the internal torque limiting function is valid, the output torque limiting value of the motor is set according to Pn508, which smoothly transits to the setting value of this parameter and lasts until the external digital input terminal is invalid. When the external digital input terminal becomes invalid, the output torque limit value of the motor is set according to Pn509. Smooth transition to the value of the torque limiting source set according to Pn024.



* Note 1: External torque limitation is effective in both forward and reverse direction.

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

Pn508	Torque Limit Switching Setting 1				**Initial value**	300
	Range	0.1~500.0	**Unit**	%	**Effective time**	Effect immediately

When the external digital input terminal set as the internal torque limiting function is valid, the output torque limiting value of the motor changes to the setting value of Pn507 according to this slope.

The unit is the percentage of the variation of the limit value of the torque per millisecond relative to the rated torque of the motor.

Pn509	Torque Limit Switching Setting 1				**Initial value**	300
	Range	0.1~500.0	**Unit**	%	**Effective time**	Effect immediately

When the external digital input terminal set as the internal torque limiting function is valid, the output torque limiting value of the motor changes to the setting value of Pn024 according to this slope.

The unit is the percentage of the variation of the limit value of the torque per millisecond relative to the rated torque of the motor.

Pn510	Shielding Selection of Position Deviation Alarm when External Torque Limitation is Effective				**Initial value**	0
	Range	0~1	**Unit**	—	**Effective time**	Effect immediately

When the external digital input terminal set as the internal torque limiting function is valid and the output torque of the motor is limited to the set value of Pn025, choose whether the suspension position deviation is too large to detect.

Pn510 = 0: Continue detecting excessive position deviation during the validity period of the external digital input terminal.

Pn510 = 1: Stop detection of excessive position deviation during the validity period of external digital input terminals.

Pn511	Invalid delay of alarm shielding after invalid external torque limit				**Initial value**	10000
	Range	1~10000	**Unit**	—	**Effective time**	Effect immediately

When Pn510 = 1, when the external digital input terminal with internal torque restriction function changes from valid to invalid, delay a certain time to recover excessive position deviation detection.

If the Pn030 setting is small, during the validity period of the external digital input terminal, if the motor is in a blocked state and the drive continuously receives the position instruction pulse, the alarm of excessive position deviation may be detected immediately when the external digital input terminal becomes invalid. Setting this parameter can delay a certain time, let the motor run to reduce the position deviation, and avoid the alarm of excessive position deviation immediately.

Pn512	JOG Speed				**Initial value**	100
	Range	1~6000	**Unit**	rpm	**Effective time**	Effect immediately

Pn513	JOG Acceleration and Deceleration Time				**Initial value**	200
	Range	1~30000	**Unit**	ms	**Effective time**	Effect immediately

Set the rotating speed and acceleration and deceleration time of the motor when JOG. The reference of the acceleration and deceleration time is the time required for the motor to accelerate from 0 to rated speed or decelerate from rated speed to 0.

The drive can be jog through the function parameter Fn001.

JOG operation through function parameter Fn001 must be performed in servo OFF and external digital input terminals in servo OFF and ON.

Activation Directive Implementation:

Original state	JOG terminal OFF→ON and continue	JOG terminal ON→OFF
Motor static	Run at the speed set by Pn513 to Pn512 and keep running	Reduce speed to 0 according to Pn513, restore original control mode
Position mode of pulse instruction	Clear the retention pulse, start with the current speed and run at the speed set by Pn513 to Pn512, and continue to run.	The position mode is restored from the time when the JOG instruction is invalid, and the instruction pulse is received
Multi-segmen position mode	Clear the retention pulse, start with the current speed and run at the speed set by Pn513 to Pn512, and continue to run.	Restore the multi-segment position mode and run the remaining pulse instructions of the current segment (the cleared residual pulse is no longer executed)
Speed mode	Run at the speed set by Pn513 to Pn512 and keep running	Accelerate by Pn304 or decelerate by Pn305 to the speed specified in the current speed instruction.
Torque mode	Run at the speed set by Pn513 to Pn512 and keep running	Restore torque mode and run according to current torque instruction

Pn514	Off-line inertia identification self-learning torque				**Initial value**	50
	Range	10~200	**Unit**	—	**Effective time**	Effect immediately

The percentage of motor output torque relative to motor rated torque when learning load inertia ratio offline.

The greater the setting value, the greater the possible mechanical impact, but the shorter the identification time and the number of rotating cycles required by the motor, please set the appropriate value according to the mechanical equipment.

Pn515	Maximum number of cycles for off-line inertia identification				**Initial value**	10
	Range	1~20	**Unit**	—	**Effective time**	Effect immediately

Parameter function: Set the maximum number of cycles allowed for off-line inertia identification

If the system inertia can not be identified successfully when the motor runs to this number of cycles, or the motor can not run to this number of cycles in the process of inertia identification, the E1C alarm will be generated.

* Note: When the inertia of the system can not be identified successfully and the mechanical condition allows the motor to rotate more cycles, please increase the setting value of this parameter.

* Note: When the inertia of the system can not be identified successfully, and the mechanical condition does not allow the motor to rotate more cycles, Please add the setting value of Pn514.

Pn518	**Drive Overload Warning Threshold**				**Initial value**	80
	Range	20~100	**Unit**	—	**Effective time**	Effect immediately

Set the warning threshold of drive overload, and the reference is the rated output current of the drive.

The drive has overload protection function and starts to generate overload curve at 100% of the rated current of the drive, but in this case, it will directly enter the alarm state. This parameter can set the warning threshold of drive overload. Once it detects that the drive

overload is greater than the set value, it will issue the drive overload warning A03, but will not stop running.

Pn519	**Motor Overload Warning Threshold**				**Initial value**	10
	Range	20~100	**Unit**	—	**Effective time**	Effect immediately

Set the warning threshold of servo motor overload, and the reference is the rated current of servo motor.

The drive has the function of motor overload protection. The overload curve is generated according to 100% of the rated load of the matched servo motor, but in this case, it will enter the alarm state directly. This parameter can set the warning threshold of motor overload. Once the motor overload is detected to be greater than the set value, the motor overload warning A03 will be issued, but the operation will not stop.

Pn520	**Motor Blocking Judging Minimum Load**				**Initial value**	150
	Range	10.0~250.0	**Unit**	%	**Effective time**	Effect immediately

Set the minimum output torque when motor blocking judgment.

Pn521	**Motor Blocking Judging Speed**				**Initial value**	150
	Range	0~500	**Unit**	rpm	**Effective time**	Effect immediately

Set the maximum speed of motor whether motor is in blocking status when the motor blocking protection is turned on.

Pn522	**Motor Blocking Judging Time**				**Initial value**	100
	Range	50~2000	**Unit**	ms	**Effective time**	Effect immediately

Set the duration of judging whether the motor is in blocking status when the motor blocking protection is turned on.

Pn523	Motor Blocking Limit Current				**Initial value**	100
	Range	0.0~150.0	**Unit**	%	**Effective time**	Effect immediately

Set the maximum current of the motor under the blocking condition when the motor blocking protection is turned on.

Pn524	Motor Blocking Limit Current				**Initial value**	100
	Range	0.0~150.0	**Unit**	%	**Effective time**	Effect immediately

Set the maximum current of the motor under the blocking condition when the motor blocking protection is turned on.

Pn530	**Zero Return Failure Alarm Time**				**Initial value**	0
	Range	0~65535	**Unit**	—	**Effective time**	Effect immediately

Starting from receiving the origin regression instruction, if the origin can not be located within the setting time of this parameter, the drive displays E18 alarm, and the ALM terminal acts.

When this parameter is set to 0, the monitoring of origin regression will be closed and the alarm will not be given even if the origin regression fails.

*** Note: It is suggested to set the appropriate time for Pn530 to avoid false alarm when the execution time is long.**

Pn531	**Origin Trigger Start Mode**				**Initial value**	0
	Range	0~2	**Unit**	—	**Effective time**	Effect immediately

Select the starting mode of origin regression function

Pn531 = 0: Turn off origin regression.

Pn531 = 1: When the servo drive is first powered on, once the servo enable(S-ON), it automatically performs origin regression.

Pn531 = 2: When the external digital input terminal enabled by origin regression is valid, the origin regression will be executed immediately. Even if the external digital input terminal is invalid when it is not completed, the execution of origin regression cannot be stopped.						
Pn532	**Origin Regression Mode**				**Initial value**	1
	Range	1~35	**Unit**	—	**Effective time**	Effect immediately
Set the short-range movement mode near the origin						
Pn533	**Low Speed Settings for the First Stage of Zero Return**				**Initial value**	500
	Range	0~6000	**Unit**	rpm	**Effective time**	Effect immediately
The motor running speed before reaching the reference point when performing origin regression function.						
Pn534	**Low Speed Settings for the Second Stage of Zero Return**				**Initial value**	500
	Range	0~6000	**Unit**	rpm	**Effective time**	Effect immediately
When performing the origin regression function, after reaching the reference point, the motor running speed is finally positioning at the origin. This speed should not be set too high, otherwise it may cause overshoot when the load inertia is large.						
Pn535	**Origin Regression Acceleration Time**				**Initial value**	100
	Range	1~30000	**Unit**	ms	**Effective time**	Effect immediately
Pn536	**Origin Regression Deceleration Time**				**Initial value**	100
	Range	1~30000	**Unit**	ms	**Effective time**	Effect immediately
Set the acceleration and deceleration time in the process of origin regression. Acceleration time refers to the time from zero speed to the rated speed of the motor. Deceleration time refers to the time from the rated speed of the motor to zero speed.						
Pn538	**Shift Pulse Number of Origin Regression**				**Initial value**	0
	Range	-2147483647~2147483647	**Unit**	pulse	**Effective time**	Effect immediately

7.3.7 Communication parameters

Pn600	**Native MODBUS Communication Station Number Setting**				**Initial value**	1
	Range	1~254	**Unit**	—	**Effective time**	Effect immediately
This machine acts as the address of the communication slave station						
Pn601	**MODBUS Communication Baud Rate**				**Initial value**	1
	Range	0~5	**Unit**	—	**Effective time**	Effect immediately
Set the communication baud rate Pn601=0：4800 bps Pn601=1：9600 bps Pn601=2：19200 bps Pn601=3：38400 bps Pn601=4：57600 bps Pn601=5：115200 bps						

Pn602	Communication Data Format				Initial value	0
	Range	0~5	Unit	—	Effective time	Effect immediately
Setting the communication data format of the computer Pn602 = 0: no check 1 + 8 + N + 1 Pn602 = 1: odd check 1 + 8 + O + 1 Pn602 = 2: parity 1 + 8 + E + 1 Pn602 = 3: No Check 1 + 8 + N + 2 Pn602 = 4: odd check 1 + 8 + O + 2 Pn602 = 5: parity 1 + 8 + E + 1						
Pn603	Communication response delay				Initial value	2
	Range	1~20	Unit	ms	Effective time	Effect immediately
Parameter function: setting communication response delay time When the computer receives the communication instructions from the upper computer, the response time is delayed.						
Pn604	Parameter Storage Selection of MODBUS Communication				Initial value	0
	Range	0~1	Unit	—	Effective time	Effect immediately
Pn604 = 0: Data sent to the drive through MODBUS communication, whether is saved according to Pn605 settings. Pn604 = 1: Data sent to the drive through MOUBUS communication will never be saved.						

7.3.8 Internal Multi-segment position parameters

If the servo drive is in position mode (Pn000 = 1) and the position instruction source is multi-segment position instruction (Pn321 = 3), this set of functions can be enabled.

Pn700-Pn769 has 54 functional codes, in which the definition of multi-segment position is divided into 16 groups from Pn706, corresponding to multi-segment position instructions Pr1 to Pr16. Each three functional codes sets a target position, the uniform speed allowed to reach the target position, and the waiting time after the location is completed.

Pn700	Multi-segment Position Instruction Execution Mode				Initial value	0
	Range	0~7	Unit	—	Effective time	Effect immediately
Pn000 = 0 and Pn321 = 1. Internal multi-segment position control is selected. This parameter is used to select the mode of multi-segment position execution.						
Pn701	Execution Segment Number Selection of Multi-segment Position				Initial value	0
	Range	0~16	Unit	—	Effective time	Effect immediately
When Pn700 is set to 6, this parameter is used to select the segment to execute.						
Pn703	Internal Position Instruction Acceleration Time T_{PACC}				Initial value	100
	Range	1~10000	Unit	ms	Effective time	Effect immediately
Pn704	Internal Position Instruction Deceleration Time T_{PDEC}				Initial value	100
	Range	1~10000	Unit	ms	Effective time	Effect immediately
Pn705	Internal Position Instruction S Curve Smoothing Time T_{PL}				Initial value	100
	Range	1~10000	Unit	ms	Effective time	Effect immediately

When using multi-segment position control mode, it is used to set the acceleration and deceleration time of the motor. These three parameters are invalid when an external pulse is used to give position instructions.

Pn703: Set the time from zero speed to motor rated speed.

Pn704: Set the time from motor rated speed to zero speed.

Pn705: Set the smoothing time of S curve during acceleration and deceleration.

Following is a detailed description of the three parameters Pn706-Pn708 involved in the first paragraph of Pr1. The other 15 paragraphs are the same and are no longer detailed.

Pn706	**Pulse Number of Multi-segment Position Instruction Pr1**				**Initial value**	100000
	Range	-2147483647~2147483647	**Unit**	pulse	**Effective time**	Effect immediately
Set the target pulse numbers of first position moving. This parameter is a signed number. Positive number means that the motor rotates in the forward direction specified in Pn001, while negative number means the opposite.						
Pn708	**Multi-segment Position Instruction Pr1 Moving Speed**				**Initial value**	100
	Range	1~6000	**Unit**	rpm	**Effective time**	Effect immediately
Set the uniform speed of the first section. *** Note: if the position pulse is less, the motor may not reach this speed in actual operation. Therefore, the meaning of the parameters should be understood as the upper limit of motor speed in the process of Pr1 position execution.**						
Pn709	**Waiting Time from Pr1 completed then enter Pr2 w**				**Initial value**	0
	Range	0~30000	**Unit**	ms	**Effective time**	Effect immediately
When the cycle running is selected (Pn700 = 0, 1, 2), the number of pulses in this section is completed, and the next position instruction is executed after waiting for this time. When Pn700 = 3, 4, 5, 6, this parameter is invalid.						

7.3.9 Internal multi-segment speed parameters

This set of functions can be enabled, when the servo drive is in speed mode (Pn000 = 0) and the speed instruction source is multi-segment speed instruction (Pn300 = 1), .

Pn800-Pn833 group has 33 function codes. Since Pn802, it has been divided into 16 groups, corresponding to multi-segment position instructions Pr1 to Pr16. Each two function codes sets a running speed and time.

Pn800	**Multi-segment Speed Instruction Execution Mode**				**Initial value**	0
	Range	0~4	**Unit**	—	**Effective time**	Effect immediately
When Pn000 = 1 and Pn300 = 3, select the mode of multi-stage speed operation.						
Pn801	**Execution Segment Number Selection of Multi-segment Speed**				**Initial value**	0
	Range	0~4	**Unit**	ms	**Effective time**	Effect immediately
When Pn800 = 4, this parameter is used to select the segment to execute.						
Pn802	**Multi-segment Speed Instruction spd1 Running Speed**				**Initial value**	100
	Range	-6000~6000	**Unit**	rpm	**Effective time**	Effect immediately
The first section speed of multi-segment.						

Pn803	Multi-segment Speed Instruction spd1 Running Time				Initial value	1.0
	Range	0~6553.5	Unit	s	Effective time	Effect immediately
The running time of the first section speed when the cycle operation (Pn800 = 0, 1, 2) . When Pn800 = 3, 4, this parameter is invalid.						

7.4 Communication protocol

7.4.1 Application

1. Applicable Series: X6 Series Servo Drive
2. Applicable network: support ModBus protocol, RTU format, with RS485 bus "single master multi-slave" communication network.

A typical RTU message frame format is as follows:

Starting bit	Device address	Function code	Data	CRC verification	Terminator
T1-T2-T3-T4	8Bit	8Bit	n*8Bit	16Bit	T1-T2-T3-T4

7.4.2 Physical interface

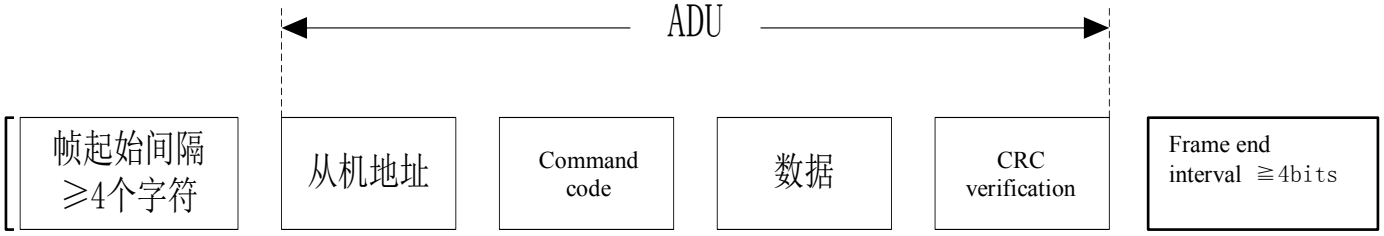
RS485 asynchronous half-duplex communication mode.

RS485 terminal default data format: 1-8-N-1, baud rate: 9600 bps.

Data formats 1-8-N-1/2, 1-8-O-1/2, 1-8-E-1/2, baud rate 4800 bps, 9600 bps, 19200 bps, 38400 bps, 57600 bps, 1152 200 BPS are optional.

Selection is set by functional code Pn601, Pn602.

7.4.3 Protocol format



The verification in ADU (Application Data Unit) is obtained by the CRC16 verification of the ADU first three parts and high-low bytes exchanging. In protocol format, low bytes of CRC verification is in the front of its high byte.

7.4.4 Command interpretation

Command 0x03：Read servo drive function code

ADU Part content	Byte	Range
The host sends the request:		
Slave address	1	0-0FEH
Command code	1	0x03
Register Start Address	2	0x0000-0x0FFFF
Number of registers	2	0x0000-0x0008
CRC verification(Low bytes precede)	2	
Slave Response:		
Slave address	1	Native address
Command code	1	0x03
Read Number of bytes	1	2*Number of registers
Register content	2*Number of registers	

CRC verification	2	

Command code 0x06: Writing single function code for servo drive

ADU Part content	Byte	Range
The host sends the request:		
Slave address	1	0-0FEH
Command code	1	0x06
Register address	2	0x0000-0x0FFFF
Register content	2	0x0000-0x0FFFF
CRC verification	2	
Slave Response:		
Slave address	1	Native address
Command code	1	0x06
Register address	2	0x0000-0x0FFFF
Register content	2	0x0000-0x0FFFF
CRC verification	2	

Command code 0x10：rewrite multiple continuous function codes of servo drive.

ADU Part content	Byte	Range
The host sends the request:		
Slave address	1	0-0FEH
Command code	1	0x10
Register Start Address	2	0x0000-0x0FFFF
Number of registers	2	0x0000-0x0008
Number of bytes of register content	1	2*Number of registers
Register content	2*Number of registers	
CRC verification	2	
Slave Response:		
Slave address	1	Native address
Command code	1	0x10
Register Start Address	2	0x0000-0x0FFFF
Number of registers	2	0x0000-0x0008
CRC verification	2	

Command code 0x08：Line diagnosis

ADU Part content	Byte	Range
The host sends the request:		
Slave address	1	0-0FEH
Command code	1	0x08
Subfunction code	2	0x0000
Data	2	0x0000-0x0FFFF
CRC verification	2	
Slave Response:		
Slave address	1	Native address

ADU Part content	Byte	Range
Command code	1	0x08
Subfunction code	2	0x0000
Data	2	0x0000-0x0FFFF
CRC verification	2	

Note: 0x08 command code is only used to check whether the line is connected.

7.4.5 Protocol Format Description

7.4.5.1 Address code

Servo drive slave address. Set range 1-247.

7.4.5.2 Function code

Function code	Function
03H	Read servo drive function code
06H	Write servo drive single function code (for 32 bit function code, do not use this operation)
10H	Writing Multiple Continuous Function Codes for Servo drives (For 32 bit function code, please use 10H operation, and one function code occupies two lengths)
08H	Line diagnosis

7.4.6 CRC C verification

First calculates the CRC value and attaches it to the sending information before sending. After receiving, the CRC value will be recalculated, and the calculated value will be compared with the received CRC value. If the two values are not equal, an error occurs during transmission.

The calculation process of CRC verification:

1) Define a CRC register and assign an initial value, FFFFFFH.
2) The first byte of the message is XOR calculated with the value of the CRC register, and the result is put into the CRC register. Starting from the address code, the start and stop bits do not participate in the calculation.
3) Extract and check LSB (the lowest bit of CRC register).
4) Each bit of the CRC register moves one bit to the right, and the highest bit is supplemented by 0.
5) If LSB is 1, the value of CRC register is XOR calculated with A001H, and the result is put into CRC register.
6) Repeat steps 3, 4 and 5 until 8 shifts are completed.
7) Repeat steps 2, 3, 4, 5, 6 to process the next byte of the transmitted information. Repeat the process until all bytes of the message are processed.
8) After calculation, the content of CRC register is the value of CRC verification.
9) Send low bytes of CRC verification value before sending high bytes.

7.4.7Detailed description of line diagnosis and settings 0x08

Subfunction code	Request data	Reply date	Subfunction definition
0000H	#data16	Same as request date	Line diagnosis

7.4.8 Abnormal response

When the host sends the wrong data or external interference that causes the servo to receive the wrong data, an abnormal response message will be sent back. Data structure of exception response:

ADU Part content	Byte	Definition
Address code	1	Slave address
Function code	1	Equal to sent functional code+0x80

Exception code	1	Refer to exception table
CRC verification（L）	2	CRC16
CRC verification（H）		CRC16

Exception code:

Data	Definition
01	CRC Check error
02	Incorrect function code
04	Incorrect length of data sent
08	Register address error
10	Register digital error
20	Register modification error
40	EEPROM busy

Note: If the function code is wrong, the exception code is 0x02.

7.4.9 Communication Address Definition

Function parameters addresses

Item	Parameters	MODBUS first address
Status display	OFF	3E00H
Monitoring mode	**Un000**	2000 H
User parameters	**Pn000**	0000 H
	Pn100	0100 H
	Pn200	0200 H
	Pn300	0300 H
	Pn400	0400 H
	Pn500	0500 H
	Pn600	0600 H
	Pn700	0700 H
	Pn800	0800 H
Auxiliary function	**Fn000**	3F00 H

Note: Functional address is offset on the basis of the corresponding first address, such as the function parameter Pn001 address is offset on the basis of Pn000, that is, 0001H.