

LZ3 series

AC Servo Drive User Manual

(V.2020 full version)



➤ Product Profile

LZ3 series digital AC servo drive is a **universal AC servo drive product** with a leading domestic level. This series of products adopts advanced full digital control and AC motor vector control theory, with excellent system performance and high reliability, and is widely used in food processing, packaging machinery, textile machinery and others Servo axis drive for related automation industrial machinery.

LZ3 series digital AC servo drives are **special servo drives for machine tools**. The control interface adopts the mainstream definition method of the machine tool industry, which can realize seamless replacement. This series of products adopts advanced full digital control and AC motor vector control theory, with excellent system performance and high reliability, and is widely applicable to various Servo axis drives for CNC lathes, milling machines, grinders, machining centers and other automated industrial machinery.

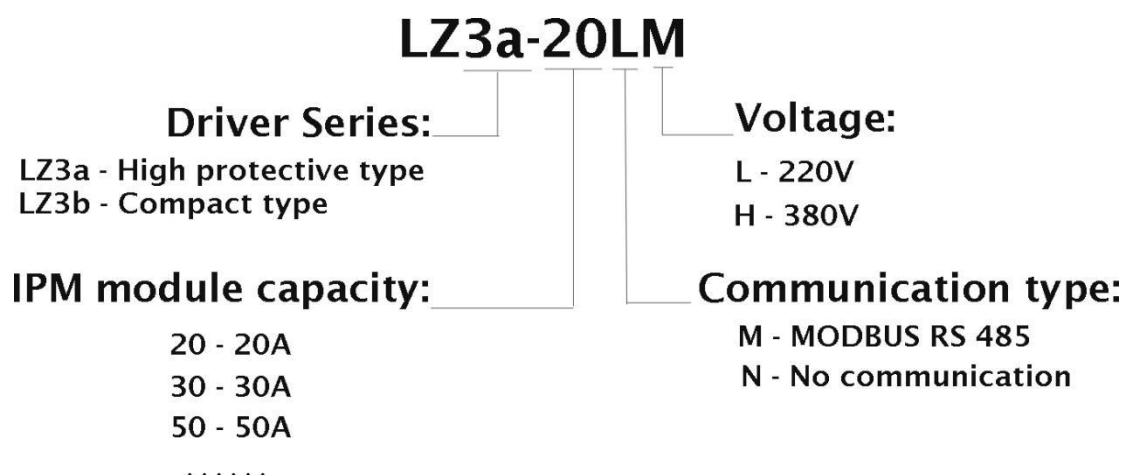
➤ Product features

- **LZ3a series fully sealed design, good protection, strong anti-interference ability**
- **LZ3b series compact design, saving installation space**

Integrate speed control, position control and torque control in one




Can drive various types of permanent magnet synchronous servo motors

Has excellent low-speed torque characteristics and industry-leading dynamic acceleration and deceleration performance.




Safety Precautions


Before product storage, installation, wiring, operation, inspection or maintenance, the user must be familiar with and observe the following important matters to ensure the safe and correct use of this product.

 Danger	Incorrect operation may cause danger and result in personal injury or death.
 Note	Incorrect operation may cause danger, cause personal injury, and may damage the equipment.
 Prohibit	Strictly prohibit behavior, otherwise it will cause damage to the equipment or unusable.

1. Use occasion

 Danger
<ul style="list-style-type: none">• It is forbidden to expose the product to moisture, corrosive gas, and flammable gas. Otherwise, it may cause electric shock or fire.• It is forbidden to use the product in places exposed to direct sunlight, dust, salt and metal powder.• It is forbidden to use the product in places where water, oil and medicine drip.

2. Wiring

 Danger
<ul style="list-style-type: none">• Please ground the ground terminal reliably. Poor grounding may cause electric shock or fire.• Do not connect the 220V driver power supply to the 380V power supply, otherwise it will cause damage to the equipment, electric shock or fire.• Do not connect the U, V, W motor output terminals to a three-phase power supply, otherwise it may cause casualties or fire.• The U, V, and W motor output terminals must be connected to the driver wiring terminals U, V, and W in a one-to-one correspondence, otherwise the motor may over-speed and cause equipment damage and personal injury.• Please fasten the power supply and motor output terminals, otherwise it may cause a fire.• For wiring, please refer to the wire material to select the wiring, otherwise it may cause a fire.

3. Operation

Note

- Before the mechanical equipment starts to run, it must be matched with appropriate parameter settings. If it is not adjusted to the proper setting value, it may cause the mechanical equipment to lose control or malfunction.
- Before starting operation, please confirm whether you can start the emergency switch to stop at any time.
- Please test whether the servo motor is operating normally under no load, and then connect the load to avoid unnecessary losses.
- Do not turn on or turn off the power frequently, otherwise it will cause overheating inside the drive.

4. Running

Don't

- When the motor is running, it is forbidden to touch any rotating parts, otherwise it will cause casualties.
- When the equipment is running, it is forbidden to touch the driver and motor, otherwise it may cause electric shock or burns.
- It is forbidden to move the connecting cable when the equipment is running, otherwise it may cause personal injury or equipment damage.

5. Maintenance and inspection

Don't

- It is forbidden to touch the inside of the drive and its motor, otherwise it may cause electric shock.
- It is forbidden to disassemble the drive panel when the power is turned on, otherwise it may cause electric shock.
- Do not touch the wiring terminals within 5 minutes after the power is turned off, otherwise the residual high voltage may cause electric shock. It is forbidden to change the wiring when the power is turned on, otherwise it may cause electric shock.
- It is forbidden to disassemble the servo motor, otherwise it may cause electric shock.

6. Scope of use



Note

The products involved in this manual are for general industrial purposes. Do not use them on devices that may directly endanger personal safety, such as nuclear energy installations, aerospace equipment, life support and maintenance equipment, and various safety equipment. If you need the above use, please contact the manufacturer's customer service.

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Chapter 1 Product Inspection and Installation

1.1 Product inspection

This product has undergone a complete functional test before leaving the factory. In order to prevent the product from being abnormal due to negligence during the delivery of the product, please check the following items in detail after unpacking:

- Check whether the servo drive and servo motor models are the same as the ordered models.
- Check the appearance of the servo driver and servo motor for damage and scratches. If damage is caused during transportation, please do not wire and send power.
- Check the servo driver and servo motor for loose parts. Whether there are loose screws, whether the screws are not tightened or fall off.
- Check whether the rotor shaft of the servo motor can rotate smoothly by hand. A motor with a brake cannot rotate directly. If any of the above items are malfunctioning or abnormal, please contact the dealer immediately

1.2 Product front panel

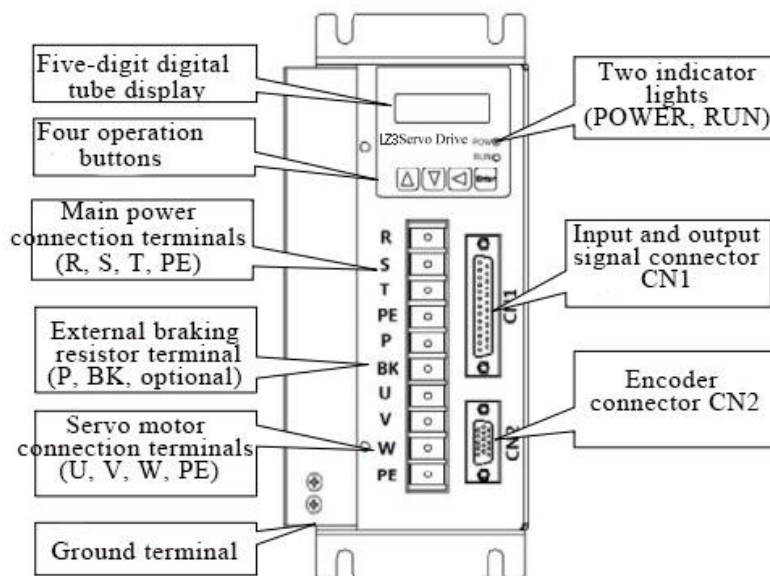


Figure 1.1 Front panel diagram

1.3 Servo drive installation

1.3.1 Installation environmental conditions

The installation environment of the servo drive has a direct impact on the normal function of the drive and its service life. Therefore, the installation environment of the drive must meet the following conditions:

- Working environment temperature: 0°C ~ 40°C; working environment humidity: below 40% ~ 80% (no condensation).
- Storage environment temperature: -40°C ~ 50°C; storage environment humidity: below 93% (no condensation).
- Vibration: below 0.5G.
- Prevent rain drops or humid environment.
- Avoid direct sunlight.
- Prevent oil mist and salt erosion.
- Prevent corrosive liquid and gas from corroding.
- Prevent the intrusion of dust, cotton wool and metal fines.
- Keep away from radioactive materials and combustible materials.
- When several drives are installed in the control cabinet, please note that enough space should be reserved for the placement position, which is conducive to air flow and heat dissipation. Please add a cooling fan to reduce the temperature around the servo drive. The long-term safe working temperature is below 40°C.
- When there is a vibration source nearby (such as a punch), if it is unavoidable, please use a vibration absorber or install an anti-vibration rubber gasket.
- When there is interference equipment nearby, it will interfere with the power line and control line of the servo drive, which may cause the drive to malfunction. Noise filters and various other anti-interference measures can be added to ensure the normal operation of the drive. But the noise filter will increase the leakage current, so it is necessary to install an isolation transformer on the power input end of the driver.

1.3.2 Installation method

- The normal installation direction of the servo drive is the vertical direction, with the top facing up to facilitate heat dissipation.
- When installing, tighten the M5 fixing screw at the rear of the servo drive.
- The installation distance between servo drives and other equipment is shown in the figure on the next page. In order to ensure the

performance and life of the drives, please leave as much installation space as possible.

- A cooling fan must be installed in the electrical control cabinet to ensure that there is vertical wind to dissipate heat to the radiator of the servo drive.
- When installing the electrical control cabinet, prevent dust or iron filings from entering the servo drive.

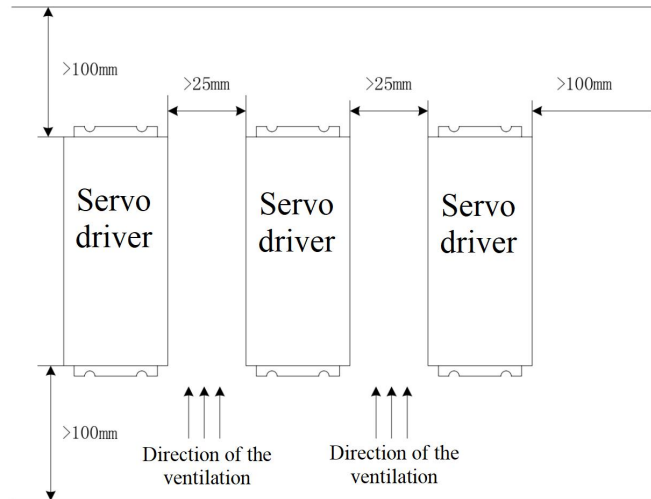


Figure 1.2 Servo drive installation diagram

1.4 Servo motor installation

1.4.1 Installation environmental conditions

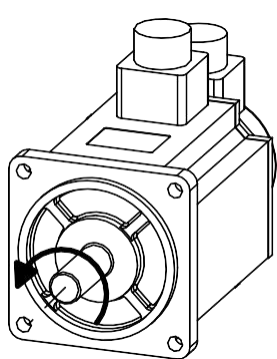
- Working environment temperature: 0~40°C; working environment humidity: below 80% (no condensation).
- Storage environment temperature: -40°C ~ 50°C; storage environment humidity: below 80% (no condensation).
- Vibration: below 0.5G.
- A place with good ventilation, low humidity and dust.
- No corrosive, flammable gas, oil and gas, cutting fluid, cutting powder, iron powder and other environments.
- Places without water vapor and direct sunlight.

1.4.2 Installation method

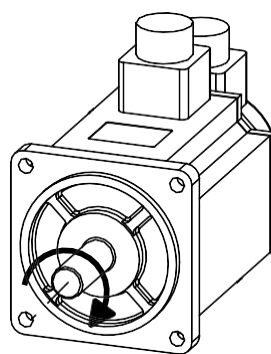
- Horizontal installation: In order to prevent liquids such as water and oil from flowing into the motor from the motor outlet end, please place the cable outlet below.
- Vertical installation: If the motor shaft is installed upwards and a reducer is attached, attention must be paid to prevent the oil in the reducer from penetrating into the motor through the motor shaft.
- The extension of the motor shaft needs to be sufficient. If the extension is insufficient, it will easily cause vibration when the motor is moving.
- When installing and disassembling the motor, do not hit the motor with a hammer, otherwise it will easily cause damage to the motor shaft and encoder.

1.5 Definition of motor rotation direction

The definition of the motor rotation direction described in this manual: facing the motor shaft extension, counterclockwise rotation (CCW) of the rotating shaft is forward rotation, and clockwise rotation (CW) of the rotation shaft is reverse rotation.



**Forward
Counterclockwise
(CCW)**



**Reverse
Clockwise (CW)**

Figure 1.3 Servo motor rotation direction definition

Chapter 2 Wiring

2.1 System composition and wiring

2.1.1 Wiring instructions

Wiring precautions:

- The wiring materials are used in accordance with the wire specifications.
- Cable length, command cable within 3m, encoder cable within 20m.
- Check whether the power supply and wiring of R, S, T are correct.
Do not connect the 220V servo to the 380V power supply.
- The phase sequence of the U, V and W terminals of the motor output must correspond to the corresponding terminals of the driver one to one. The motor may not rotate or run into a car if it is connected incorrectly. The method of changing the three-phase terminals cannot be used to make the motor reverse, which is completely different from the asynchronous motor.
- It must be grounded reliably and grounded at a single point.
- For the relay installed in the output signal, the direction of the absorbing diode must be connected correctly, otherwise it will cause a malfunction and fail to output the signal.
- In order to prevent malfunction caused by noise, please add insulation transformer and noise filter to the power supply.
- Please keep the power line (power line, motor line, etc. strong current circuit) and signal line more than 30cm away from each other for wiring. Do not place them in the same wiring duct.
- Please install a non-fuse circuit breaker to cut off the external power supply in time when the drive fails.

2.1.2 Wire specifications

Connection terminal	Symbol	Wire specifications
Main circuit power supply	R, S, T	1.5~2.5mm ²
Motor connection terminal	U, V, W	1.5~4mm ²
Ground terminal	⊕	1.5~4mm ²
Control signal terminal	CN1	≥0.14mm ² (AWG26), including shielded wire
Encoder signal terminal	CN2	≥0.14mm ² (AWG26), including shielded wire
Braking resistor terminal	P, BK	1.5~2.5mm ²

Encoder cables must use twisted pair cables. If the encoder cable is too long (>20m), the encoder power supply will be insufficient. The power supply and ground wire can be connected by multi-wire or thick wires.

2.1.3 Description of strong current terminals

Name	Terminal symbol	Detailed description
Main circuit power supply	R、S、T	Connect external AC power: Three-phase 220VAC -15%~+10% 50/60Hz
Braking resistor terminal	P、BK	When an external braking resistor is connected, it is used in parallel with the internal braking resistor Please pay attention to the selection of resistance and power to avoid burning the driver.
Motor connection terminal	U	Output to the motor U-phase power supply
	V	Output to the motor V-phase power supply
	W	Output to the motor W phase power supply
Ground terminal	PE / ⊕	Ground terminal of motor shell
	PE / ⊕	Drive ground terminal

2.2 CN1 Control signal terminal

The CN1 control signal terminal provides the signal required for connection with the upper controller. The type of the driver is different, and the socket type used is also different. Signals include:

- 6 programmable inputs, 4 programmable outputs;
- Pulse command input (position command, speed command);
- Analog quantity command input (speed command, torque command);
- Encoder signal output.

2.2.1 CN1 Terminal signal description

Special note: DI1~DI6 are programmable input ports, whose functions are configured by parameters P100~P105; DO1~DO4 are programmable output ports, whose functions are configured by parameters P108~P111; for parameter configuration, see 5.4.2 in Chapter 5 For detailed function description, please refer to chapter 5 section 5.5~5.6. The following table shows the factory default configuration.

Terminal number	Signal name	Mark	Features
	Positive power supply of input terminal	COM+	The positive pole of the power supply of the input terminal is used to drive the photoelectric coupling of the input terminal Adapter, DC12~24V, current $\geq 100\text{mA}$.
	DI1 Servo enable	SON	Servo enable input terminal. SON ON: Allow the drive to work; SON OFF: The drive enable is closed and the motor is in a free state. Note 1: Before switching from OFF to ON, the motor must be stationary. Note 2: After hitting SON ON, wait at least 50ms before inputting the command.
	DI2 Alarm clear	ARST	Alarm clear input terminal. ARST ON: clear the system alarm; ARST OFF: keep the system alarm. Note 1: Some hardware failure alarm numbers cannot be cleared by this method. Power off for maintenance, and then power on again.
	DI3 CCW drive prohibited	CCWL	CCW (counterclockwise) drive prohibition input terminal. CCWL ON: CCW drive is allowed, the motor can rotate counterclockwise; CCWL OFF: CCW drive is prohibited, and the motor is prohibited from rotating counterclockwise. Note 1: For mechanical overrun, when the switch is OFF, the torque in the CCW direction remains at 0. Note 2: This function can be shielded by setting parameter P-097, the user does not Connecting this terminal can also enable CCW drive.
	DI4 CW drive prohibited	CWL	CW (clockwise) drive prohibition input terminal. CWL ON: CW drive is allowed, and the motor can rotate clockwise; CWL OFF: CW drive is prohibited, and the motor is prohibited from rotating clockwise. Note 1: Used for mechanical overrun. When the switch is OFF, the torque in the CW direction remains at 0. Note 2: This function can be shielded by setting the parameter P-097, and the user can also enable the CW drive without connecting this terminal.
	DI5 Clear deviation counter	CLE	In position control mode (parameter P004=0), the position deviation counter clear input terminal. CLE ON: In position control, the position deviation counter is cleared.

Terminal number	Signal name	Mark	Features
	DI6 Command pulse prohibition	INH	In position control mode (parameter P004=0), the position command pulse input terminal is prohibited. INH ON: Command pulse input is prohibited; INH OFF: Command pulse input is valid.
	DO1 Servo is ready to output	SRDY+	The servo is ready for output terminals. SRDY ON: The main power supply is normal, the drive has no alarm, and the servo is ready to output ON (output is on); SRDY OFF: The main power is not turned on or the drive has an alarm, and the servo is ready to output OFF (output cut off).
		SRDY-	
	DO2 Servo alarm output	ALM+	Servo alarm output terminal. ALM ON: The servo drive has no alarm, and the servo alarm output is ON (the output is turned on); ALM OFF: The servo drive has an alarm, and the servo alarm output is OFF (output cut-off).
		ALM-	
	DO3 Positioning completed output;(Under position control mode)	COIN+	Positioning completed output terminal. COIN ON: When the position deviation counter value is within the set positioning range, the positioning completion output is ON (the output is on), otherwise the output is OFF (the output is cut off).
		COIN-	
	DO4 Mechanical brake release	BRK+	When the motor has a mechanical brake (power loss retainer), this port can be used to control the brake. BRK ON: The brake is energized, the brake is invalid, and the motor can run; BRK OFF: The brake is cut off, the brake is effective, and the motor is locked and cannot run. Note: The BRK function is controlled internally by the drive.
		BRK-	
	Command pulse PLUS input	PULS+	<ul style="list-style-type: none"> External command pulse input terminal. Note 1: The pulse input mode is set by parameter P035, P035=0, command pulse + sign mode (default state); P035=1, CCW/CW command pulse mode; P035=2, orthogonal pulse mode.
		PULS-	
	Command pulse SIGN input	SIGN+	
		SIGN-	

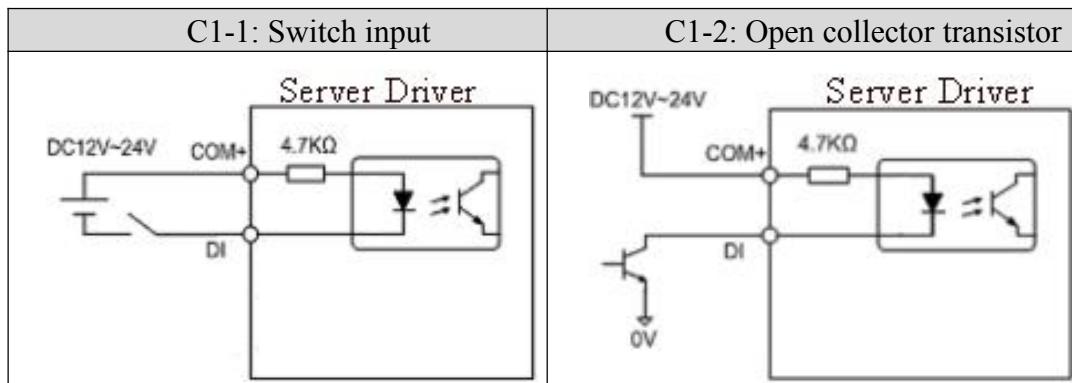
Terminal number	Signal name	mark	Function
	Analog speed command input	AS+	External analog speed command input terminal, differential mode, input impedance 10kΩ, input range -10V~+10V.
		AS-	
	Analog ground	AGND	The ground wire of the analog input.
	Analog torque command input	AT+	External analog torque command input terminal, differential mode, input impedance 10kΩ, The input range is -10V~+10V.
		AT-	
	Analog ground	AGND	The ground wire of the analog input.
	Encoder A phase signal	OA+	<ul style="list-style-type: none"> Encoder ABZ signal differential drive output (26LS31 output, equivalent to RS422); Non-isolated output (non-isolated).
		OA-	
	Encoder Phase B signal	OB+	
		OB-	
	Encoder Z phase signal	OZ+	
		OZ-	
	Encoder Z phase open collector output	CZ	<ul style="list-style-type: none"> The encoder Z phase signal is output by the open collector. When the encoder Z phase signal appears, the output is ON (the output is on), otherwise the output is OFF (the output is cut off); Non-isolated output (non-isolated); In the host computer, the Z-phase signal pulse is usually very narrow, so please use a high-speed photoelectric coupler to receive it.
	Encoder common ground	GND	Encoder common ground wire.
	Shield ground wire	FG	Shield ground terminal.

2.2.2 CN1 Terminal interface type

The following will introduce the various interface circuits of CN1 and the wiring method with the upper control device.

1. Digital input interface (C1)

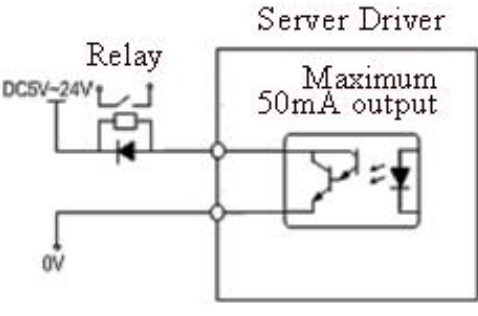
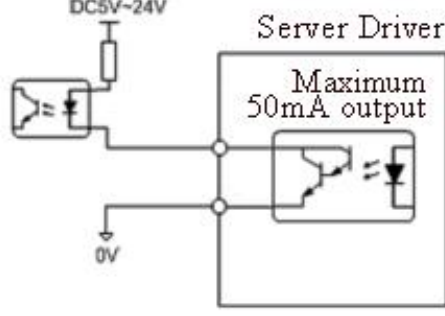
The digital input interface circuit can be controlled by switches, relays, open collector triode, photoelectric couplers, etc. The relay needs to choose a low-current relay to avoid poor contact. The external voltage range is DC12V~24V.



2. Digital output interface (C2)

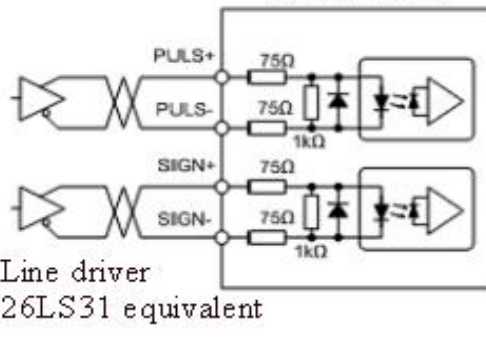
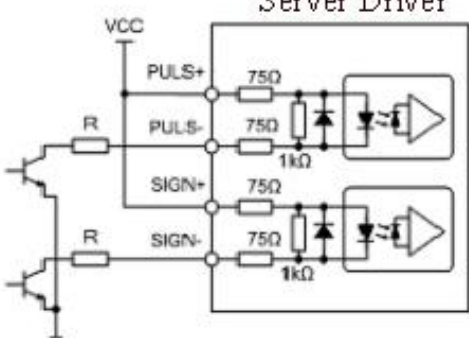
The output circuit adopts Darlington photoelectric coupler, which can be connected with relay and photoelectric coupler. Matters needing attention:

- The power supply is provided by the user. If the power supply is connected reversely, the drive will be damaged.
- The maximum external power supply is 25V, the maximum output current is 50mA, and the total current of the three channels does not exceed 100mA.
- When using an inductive load such as a relay, a diode must be added in parallel with the inductive load. If the polarity of the diode is opposite, the drive will be damaged.
- When it is turned on, there is a voltage drop of about 1V, which cannot meet the low-level requirements of TTL, so it cannot be directly connected to TTL circuits.

C2-1: Relay	C2-2: Optocoupler
	
<ul style="list-style-type: none"> • A continuation diode must be applied 	

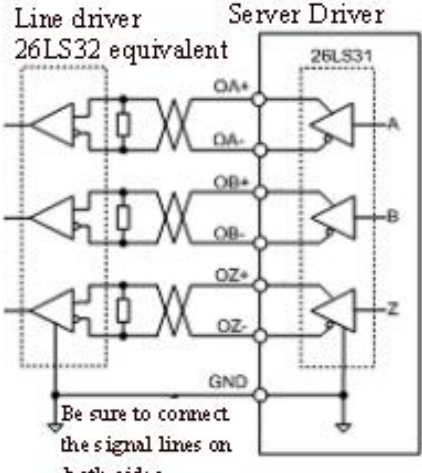
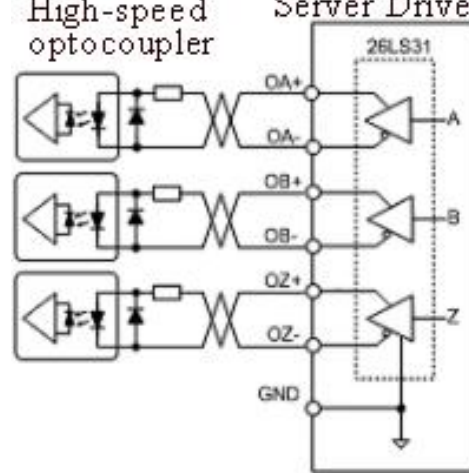
Position pulse command interface (C3)

There are two connection methods: differential drive and single-ended drive. Differential drive connection is recommended. Twisted pair wire should be used for wiring. Drive current 8~15mA, working mode set by parameter P035: pulse + sign, forward/reverse pulse, quadrature pulse.

C3-1: Differential drive	C3-2: Single-ended drive								
 <p>Line driver 26LS31 equivalent</p>									
<ul style="list-style-type: none"> • Maximum pulse frequency 500kHz (kpps); • Don't be disturbed, this connection method is recommended. 	<ul style="list-style-type: none"> • The maximum pulse frequency is 200kHz (kpps); • Recommended resistance R: <table border="1" data-bbox="901 1556 1220 1736"> <thead> <tr> <th>VCC</th> <th>R</th> </tr> </thead> <tbody> <tr> <td>5V</td> <td>82Ω~120Ω</td> </tr> <tr> <td>12V</td> <td>510Ω~820Ω</td> </tr> <tr> <td>24V</td> <td>1.5kΩ~2kΩ</td> </tr> </tbody> </table> 	VCC	R	5V	82Ω~120Ω	12V	510Ω~820Ω	24V	1.5kΩ~2kΩ
VCC	R								
5V	82Ω~120Ω								
12V	510Ω~820Ω								
24V	1.5kΩ~2kΩ								

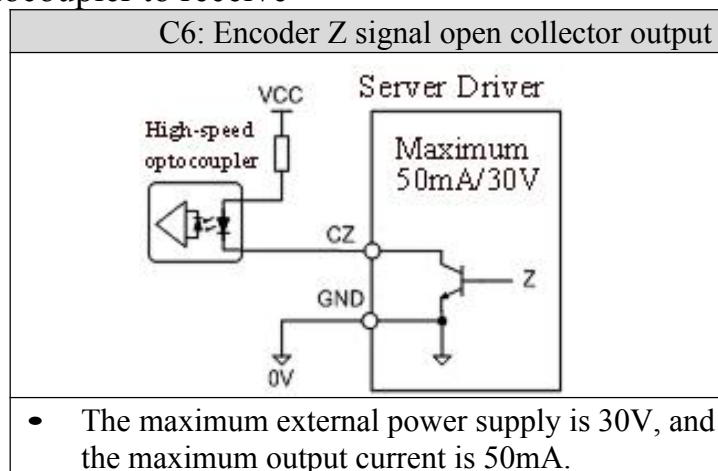
1. Encoder signal line drive output (C5)

After dividing the frequency of the encoder signal, it is output to the upper controller through the line driver.

C5-1: Long-line receiver	C5-2: Photocoupler receiver
 <p>Line driver 26LS32 equivalent</p> <p>Server Driver 26LS31</p> <p>Be sure to connect the signal lines on both sides</p>	 <p>High-speed optocoupler</p> <p>Server Driver 26LS31</p> <p>Be sure to connect the signal lines on both sides</p>
<ul style="list-style-type: none"> The upper controller uses AM26LS32 equivalent as the receiver, and it must be connected to a terminal resistor with a resistance value of $220\Omega \sim 470\Omega$; The signal ground (GND) of the drive encoder must be connected to the signal ground of the upper controller. 	<ul style="list-style-type: none"> The upper controller uses a high-speed photocoupler (for example, 6N137), and the resistance value of the current-limiting resistor is about 220Ω.

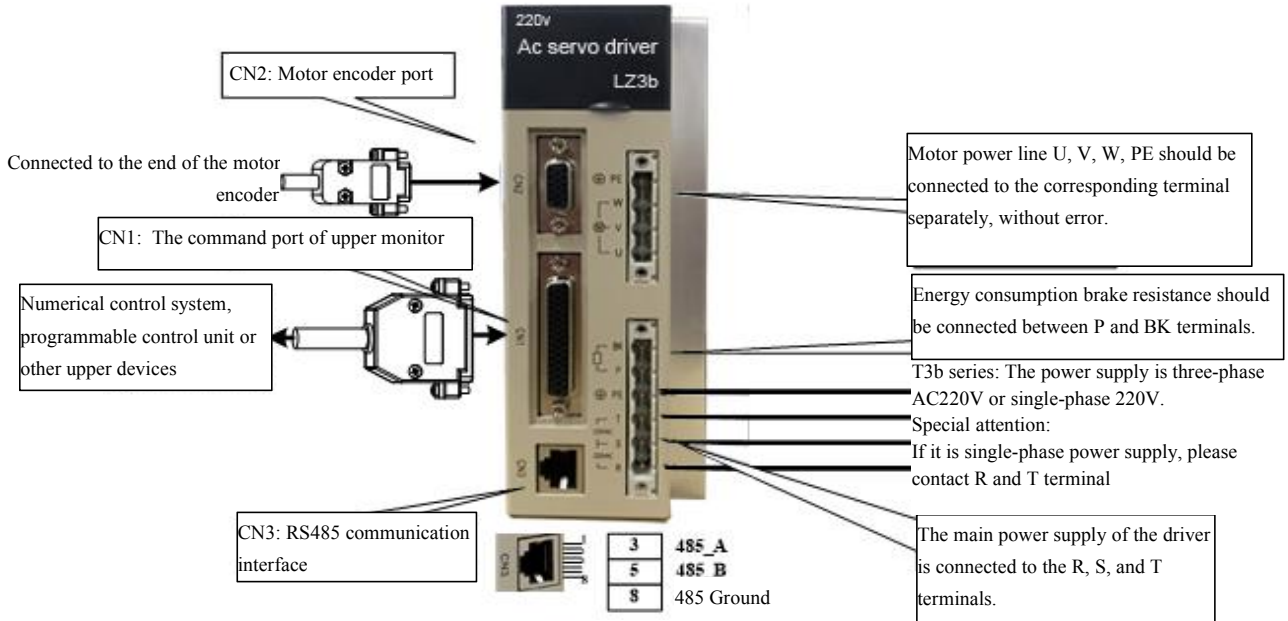
2. Encoder Z signal open collector output (C6)

The encoder Z signal is output to the host controller through the output from open collector. Due to the narrow pulse width of the Z signal, please use a high-speed photocoupler to receive

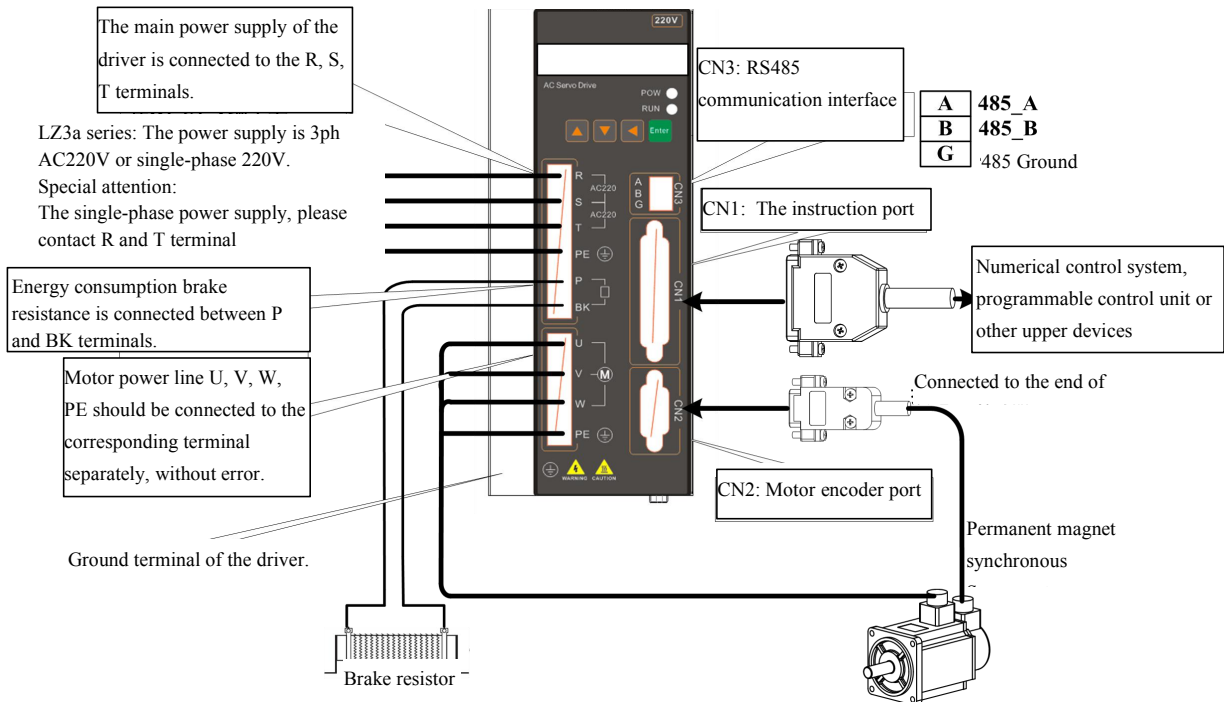


2.3 Schematic diagram of front panel terminal wiring

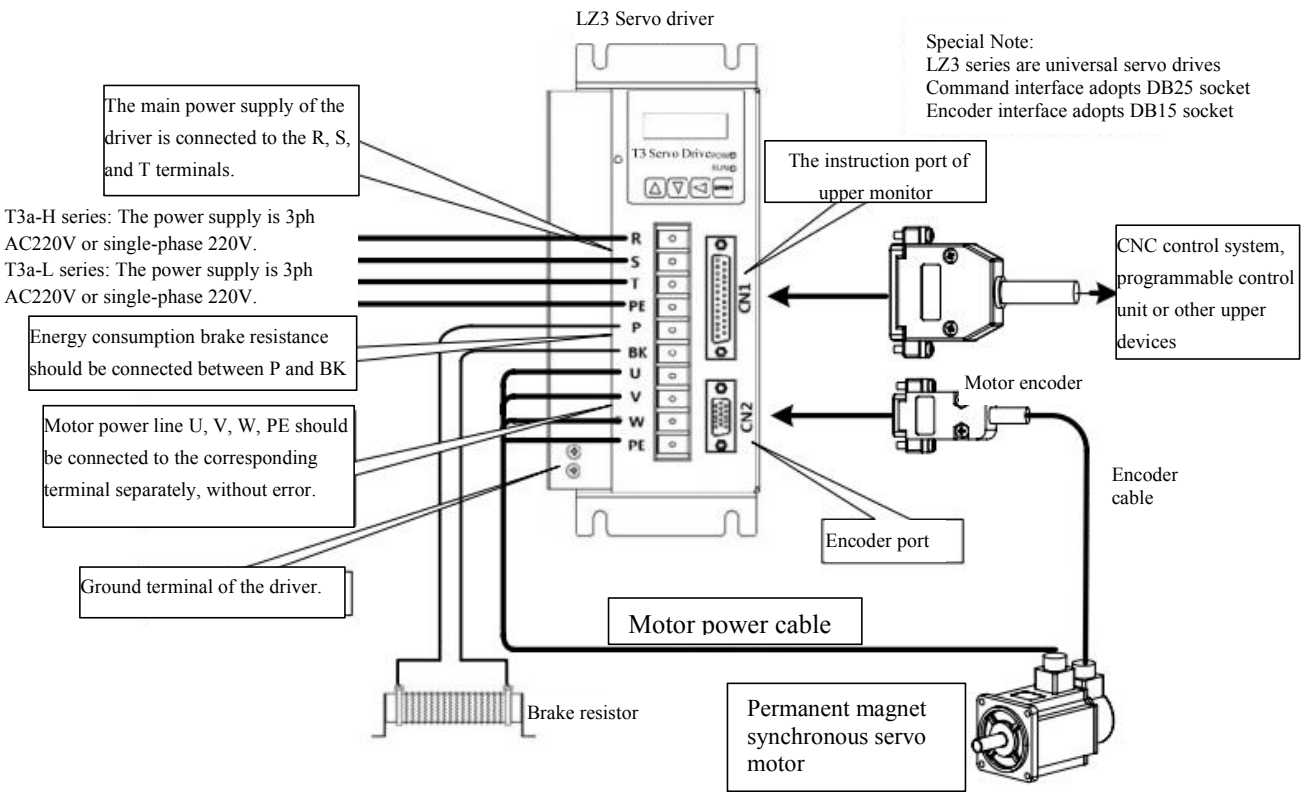
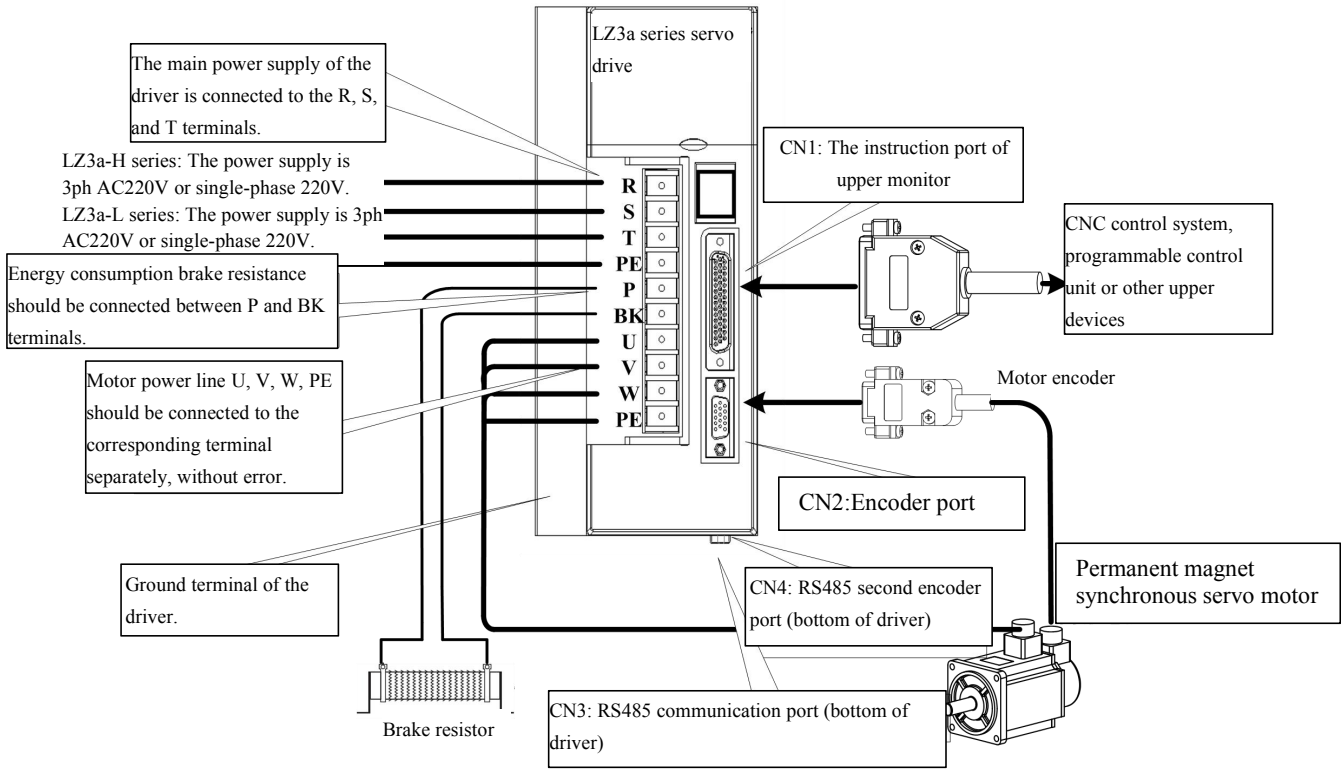
LZ3b Wiring schematic diagram
LZ3b Servo driver



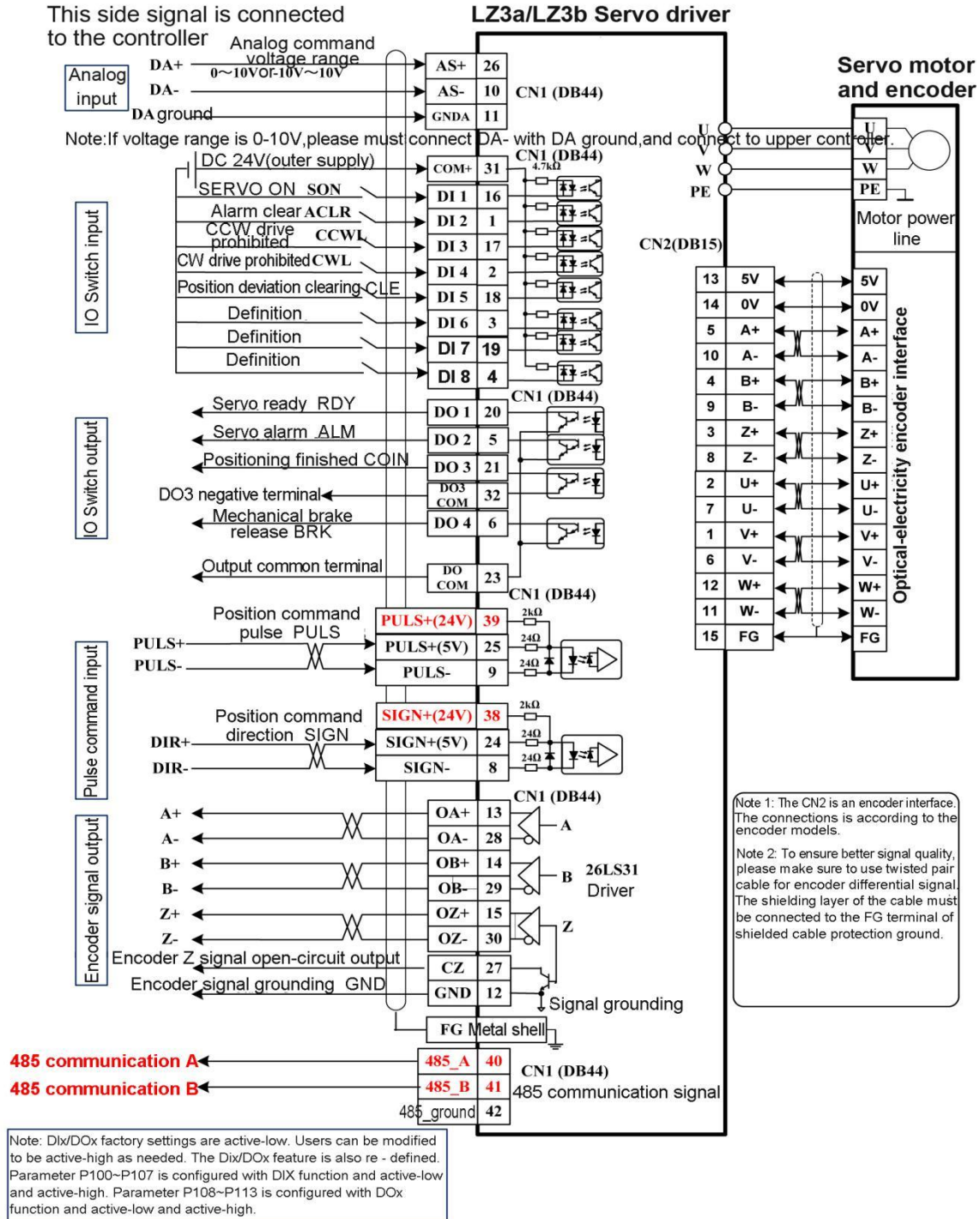
LZ3a Wiring schematic diagram
LZ3a Servo driver



LZ3a-L40/L50/L75/H25/H50/H75 Wiring schematic diagram



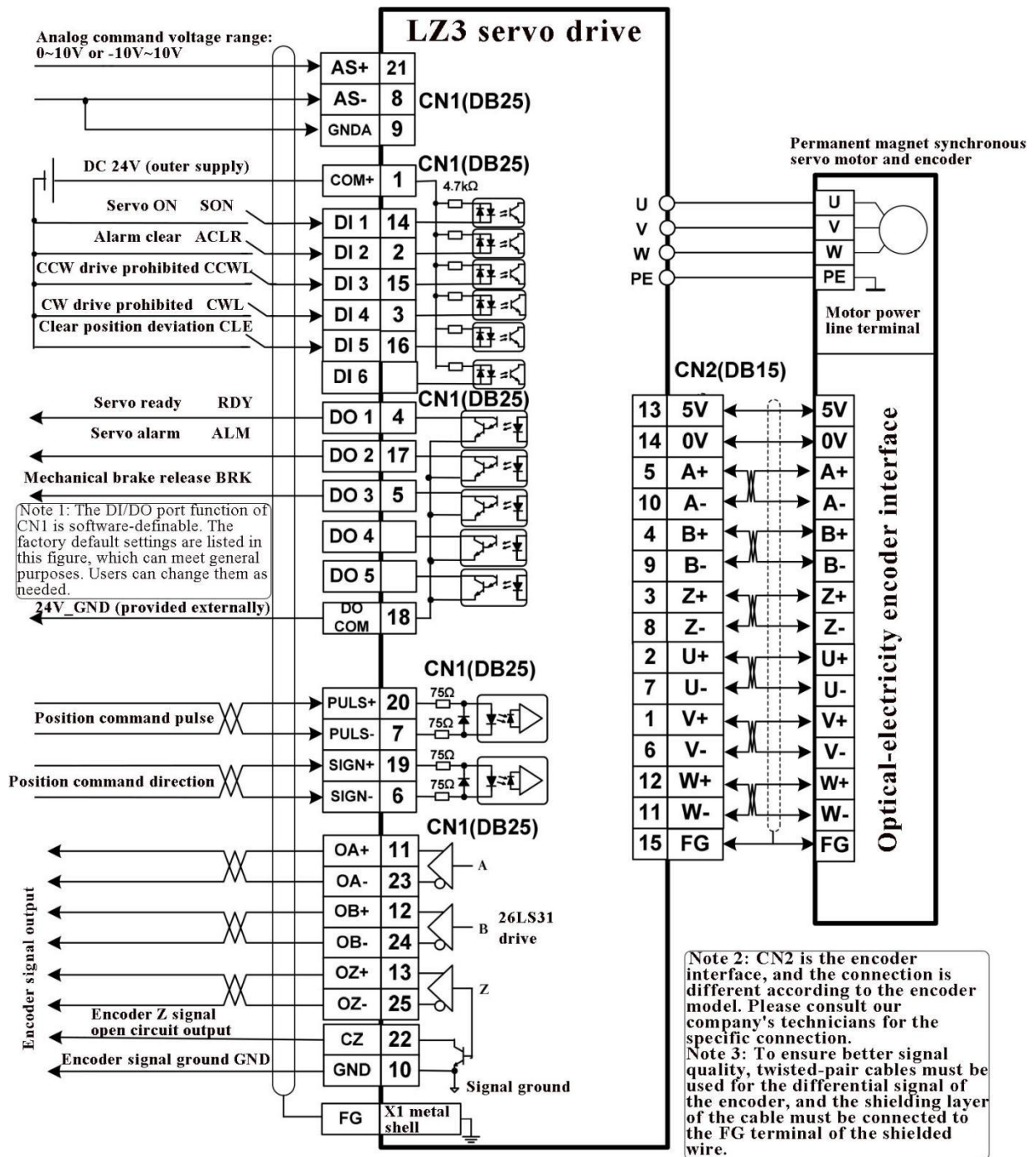
2.4 Definition diagram of control port CN1 and encoder port CN2



Special attention:

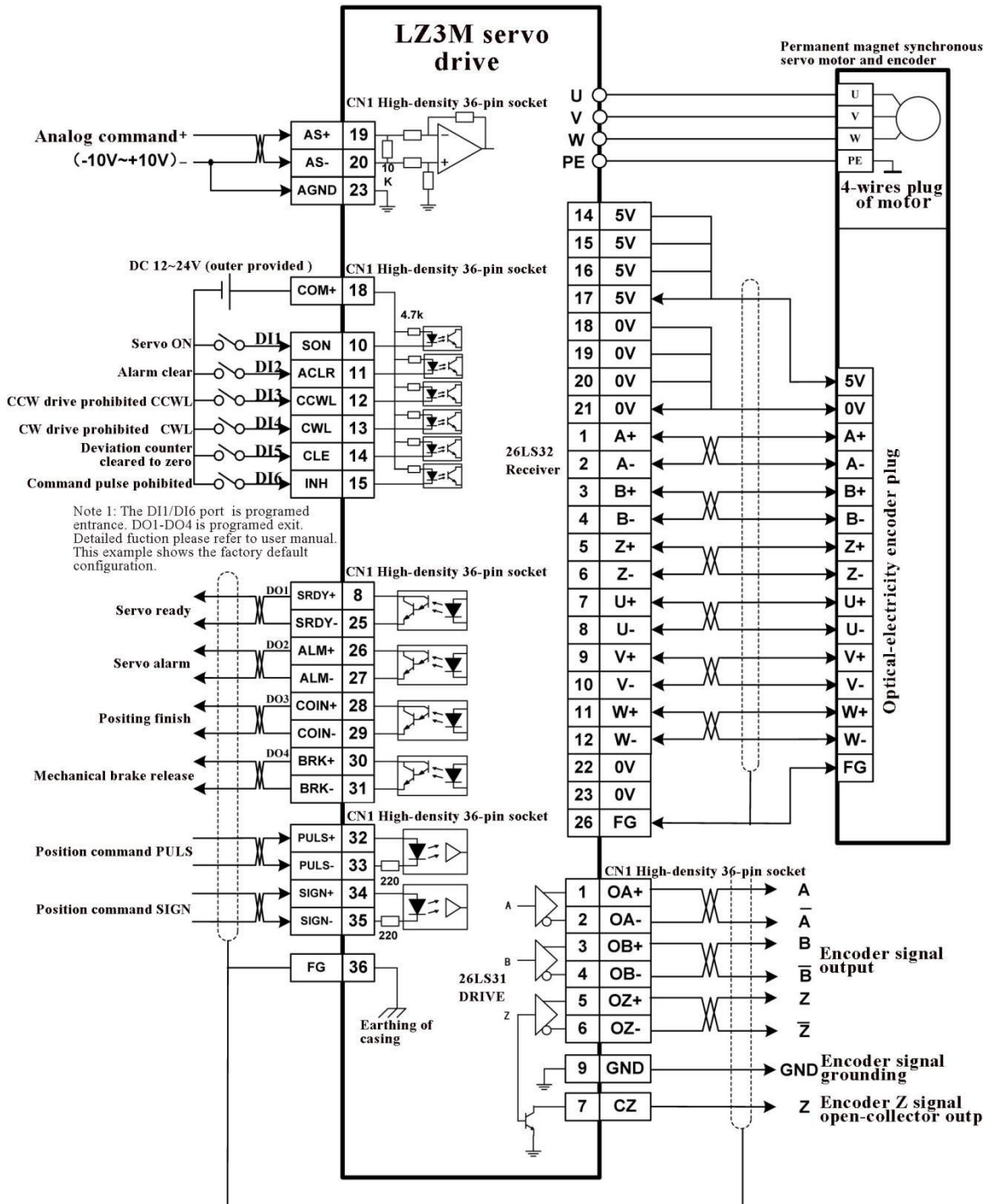
If the pulse instruction signal is a 24V power supply, the PULS + must be connected to the 39 foot of the CN1 and SIGN+ must be connected to the 38 foot of CN1, or it is possible to damage the pulse instruction port;

If the pulse instruction signal is a 5V power supply, the PULS + must be connected to the 25 foot of the CN1 and SIGN+ must be connected to the 24 foot of CN1. Otherwise, the pulse receiving may be abnormal;



Special attention:

If the pulse command signal is a 24V power supply, you must connect 2K, 5%, 0.25W resistors in series at PULS- and SIGN-, otherwise the pulse command port may be damaged.



Special attention:

If the pulse command signal is a 24V power supply, you must connect 2K, 5%, 0.25W resistors in series at PULS- and SIGN-, otherwise the pulse command port may be damaged.

2.5 Specification of braking resistor

LZ3a/LZ3b series (220V servo) braking resistor configuration table

(The standard 220V servo includes a built-in resistor, and an external braking resistor can be selected according to the load.)

Drive model	(Light load type) Recommended configuration (Use built-in resistor)	(Heavy load type) Recommended configuration (Connect external resistor in parallel)
LZ3x -L20F	47 Euro (built-in)	≥ 47 ohm, power greater than 500W
LZ3x -L30F	47 Euro (built-in)	≥ 47 ohm, power greater than 500W
LZ3x-L40F	47 Euro (built-in)	≥ 47 ohm, power greater than 500W
LZ3x-L50F	47 Euro (built-in)	≥ 47 ohm, power greater than 500W
LZ3x-L75F	47 Euro (built-in)	≥ 20 ohm, power greater than 1000W

LZ3x-H series (380V servo) braking resistor configuration table

(The standard 380V servo does not contain built-in resistors, and must be connected to an external braking resistor, except for customized models)

Drive model	(Light load type) Recommended configuration (Infrequent start and stop)	(Heavy load type) Recommended configuration (Frequent start and stop)
LZ3x-H25F	≥ 50 ohm, power greater than 1000W	≥ 50 ohm, power greater than 1500W
LZ3x-H50F	≥ 50 ohm, power greater than 1000W	≥ 50 ohm, power greater than 1500W
LZ3x-H75F	≥ 30 ohm, power greater than 1500W	≥ 30 ohm, power greater than 2000W

Chapter 3 Panel Operation

3.1 Driver panel description

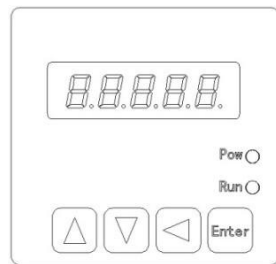
3.1.1 Panel composition

The LZ3a/LZ3 series panel consists of 5 LED digital tube displays, 4 buttons ▼, ▲, ◀, Enter and two indicator lights POW, RUN, which are used to display various state setting parameters of the system.

The LZ3b series panel consists of 5 LED digital tube displays, 5 buttons ▲, ▼, ◀, E, S, which are used to display various state setting parameters of the system.

The operations are all hierarchical operations, which are expanded layer by layer from the main menu. The operation panel is as shown in the figure below:

LZ3a/LZ3 operation panel






LZ3b operation panel



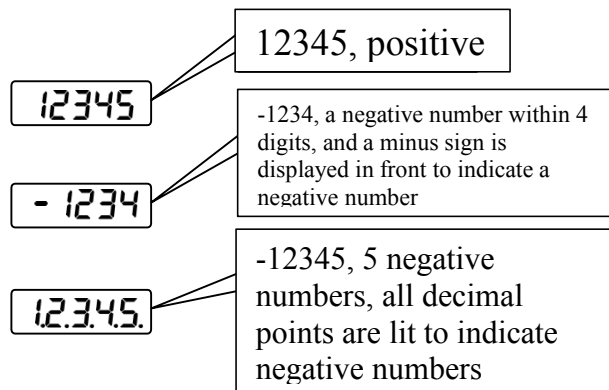
3.1.2 Panel description

Symbol	Name	Function	
POW	Power light	Lit: The main power supply is powered on; Off: The main power supply is not powered on;	T3b The second digital tube from the left is small The number lights up to indicate servo under-voltage
RUN	Running light	Lit: The motor is energized and running; Off: The motor is running without power.	T3b The first digital tube from the left The number lights up to indicate that the servo is enabled
▲	Add key	Increase the serial number or value; long press has a repeating effect.	
▼	Decrease key	Decrease the serial number or value; long press has a repeating effect.	
◀	Exit key	The menu exits; the operation is cancelled.	


 or 	Enter	Menu entry; parameter modification confirmation or operation confirmation.
	Shift key	Used for quick modification of parameter number or parameter value (only for T3b).

3.1.3 Numerical display

The value adopts 5 digital tube displays. The minus sign displayed in front of the value indicates a negative number. If it is a 5-digit negative number, all decimal points will light up to indicate a negative number. Some display items have prefix characters. If the number of digits is too long to occupy the position of the prefix characters, the prefix characters will not be displayed, only the value will be displayed. The specific display meaning is as follows:

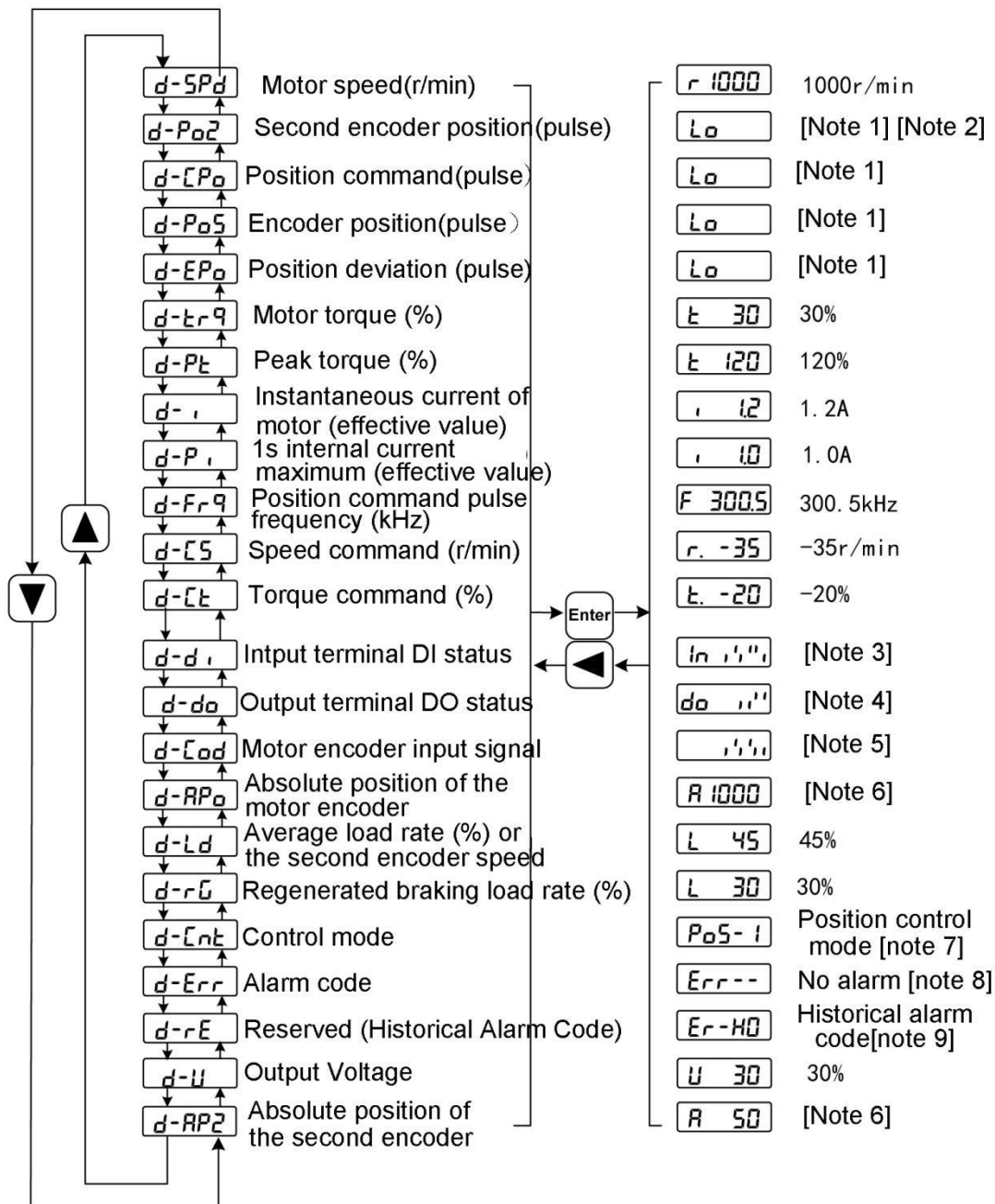


3.2 Main Menu

The first layer is the main menu. There are 4 operation modes. Use the ▲ and ▼ keys to change the mode, Press  to enter layer 2 and perform specific operations, and press the ◀ key to return to the main menu from the second layer.

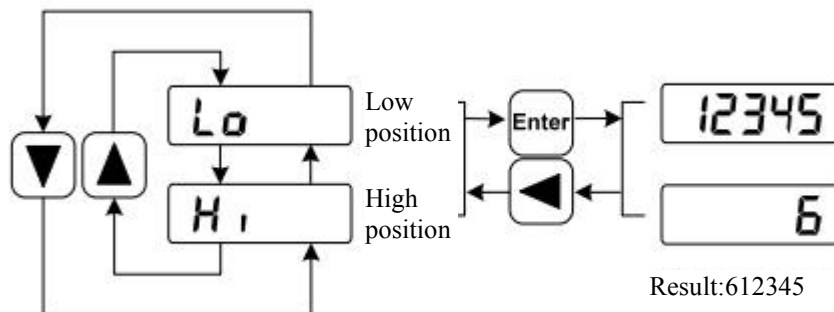
3.3 Status monitoring

Select status monitoring "d -" under the main menu and press Enter to enter the monitoring mode. There are various monitoring items. The user uses the key ▲ and ▼ to select the desired display item, press enter again, to enter the specific display status. The specific meanings of Status Monitor Display are as follows:



1. 32-bit binary value display [Note 1]

The range of 32-bit binary numbers is $-2147483648 \sim 2147483647$, which are represented by a combination of low and high bits. The low and high bits are selected through the menu, and the complete value is synthesized by the formula



$$32\text{-bit value} = \text{high value} * 100000 + \text{low value}$$

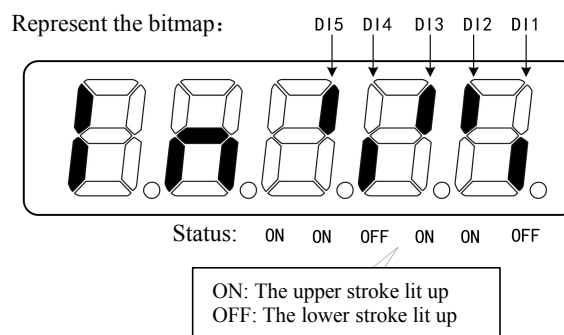
2. Pulse unit [Note 2]

The pulse of the original position instruction refers to the number of pulses input, without electronic gear transformation. The other item's impulse unit is the encoder impulse unit. Take the 2500 wire encoder as an example:

$$\begin{aligned} \text{Encoder Pulse UNIT} &= \text{Encoder resolution} \\ &= 4 \times \text{encoder lines} \\ &= 4 \times 2500 \text{ (pulse/rev)} \\ &= 10000 \text{ (pulse/rev)} \end{aligned}$$

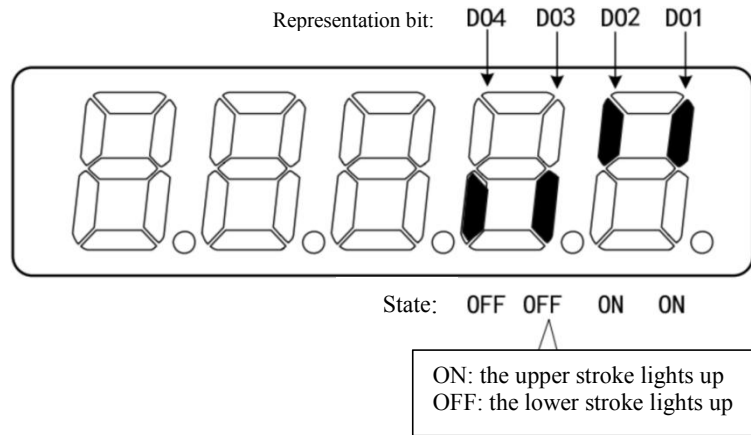
3. Input terminal DI [Note 3]

The vertical line of the digital tube indicates the state of one bit, the up stroke on the vertical line is lit to indicate ON, and the lower stroke is lit to indicate OFF.



4. Output terminal DO[Note 4]

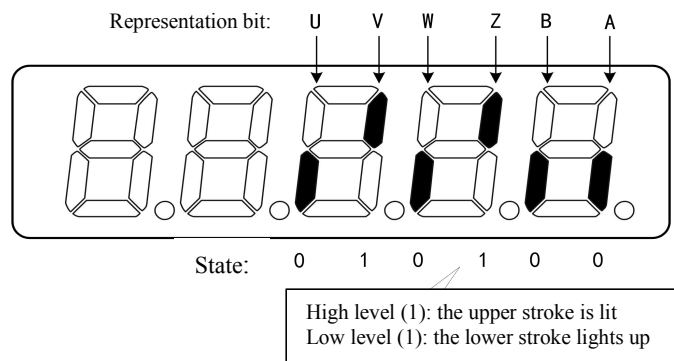
The vertical line of the digital tube indicates the state of one bit, the stroke on the vertical line is lit to indicate ON, and the lower stroke is lit to indicate OFF.



5. Encoder input signal [Note 5]

The vertical line of the digital tube indicates the state of one bit, the up stroke on the vertical line is lit to indicate high level, and the lower stroke is lit to indicate low level.

(Note: Absolute position encoder, this display is meaningless)



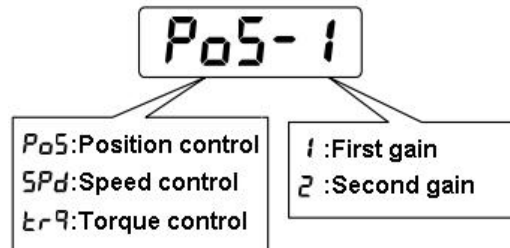
6. Rotor single-turn position [Note 6]

It indicates the position of the rotor relative to the stator in one revolution, one revolution is one cycle, the minimum resolution of the encoder is the unit, and the Z pulse of the encoder is the origin.

2500 line encoder: The range is 0~9999 (decimal), and the value is 0 when the Z pulse appears.

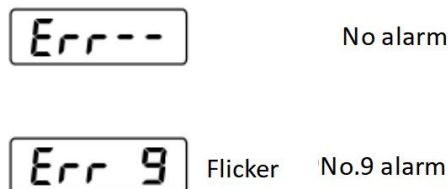
7. Control method [Note 7]

The first 3 characters indicate the control mode, and the last character indicates the gain combination.



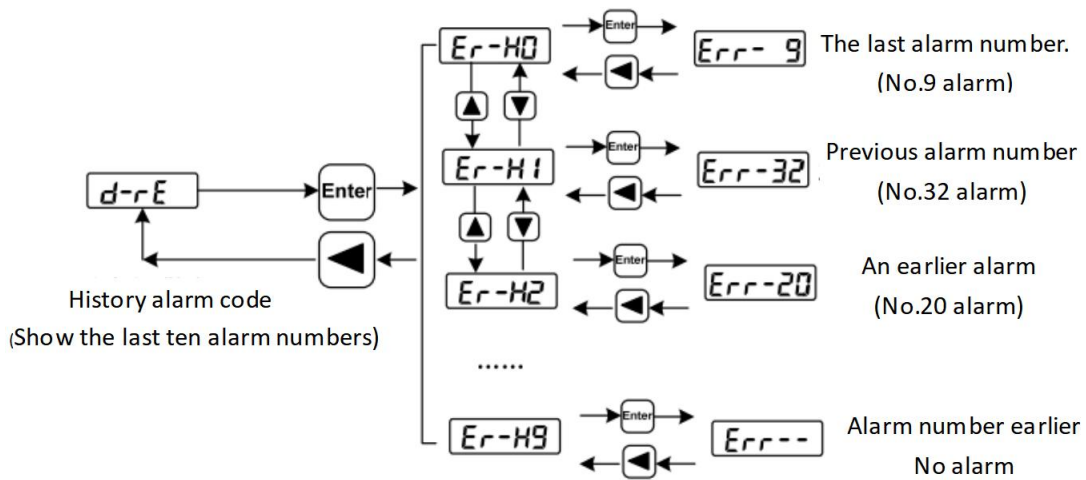
8. Alarm code [Note 8]

No alarm shows two minus signs. When there is an alarm, the alarm number is displayed and flashes. When an alarm occurs, the display will automatically enter the state monitoring and display the alarm number, but other operations can be performed through the keyboard. When it is not in the monitoring state, the decimal point of the rightmost digital tube flashes to indicate that there is an alarm. Specific examples are as follows:

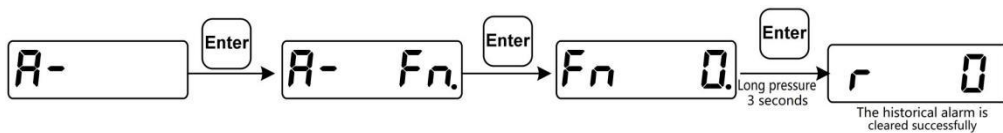


9. Historical alarm code [Note 9]

The historical alarm code displays the last 10 alarms of the drive. If there is no alarm, it will display two minus signs, and if there is an alarm, it will display the alarm number. When an alarm occurs, the drive will automatically update and store the alarm number. The operation of viewing historical alarm codes and the specific display contents are explained as follows:



The method for clearing historical alarm codes is as follows: In the case of no alarm, first set parameter P-119 to 4, and then follow the steps below to clear all historical alarm codes.



3.4 Parameter setting

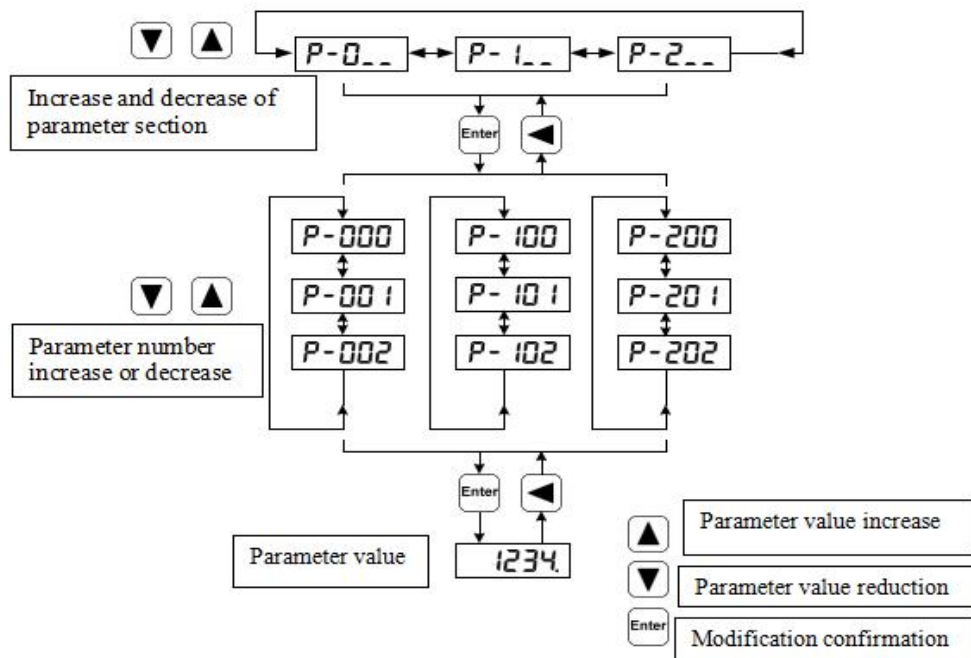
Parameters are represented by parameter segment + parameter number, the hundreds digit is the segment number, and the tens and ones digits are the parameter numbers. For example, for parameter P-102, the segment number is "1", the parameter number is "02", and the digital tube displays "P-102".

Select the parameter setting "P-" in the main menu, and press **Enter** to enter the parameter setting mode. First use the ▲, ▼ keys to select the parameter section, after selecting, press **Enter** to enter the parameter number selection of this section. Then use the ▲, ▼ keys to select the parameter number, after selecting, press **Enter** to display the parameter value.

Use the ▲, ▼ keys to modify the parameter value, press the ▲ or ▼ key once to increase or decrease the parameter by 1, press and hold the ▲ or ▼ key, the parameter can increase or decrease continuously. When the parameter value is modified, the decimal point of the rightmost LED digital tube lights up, press **Enter** to confirm that the modified value is valid, at this time the decimal point of the right LED digital tube goes out, and the modified value will be immediately reflected in the control (some parameters need to be saved and re-uploaded) Electricity can work).

After that, you can continue to modify the parameters. After the modification, press the ◀ key to return to the parameter number selection state.

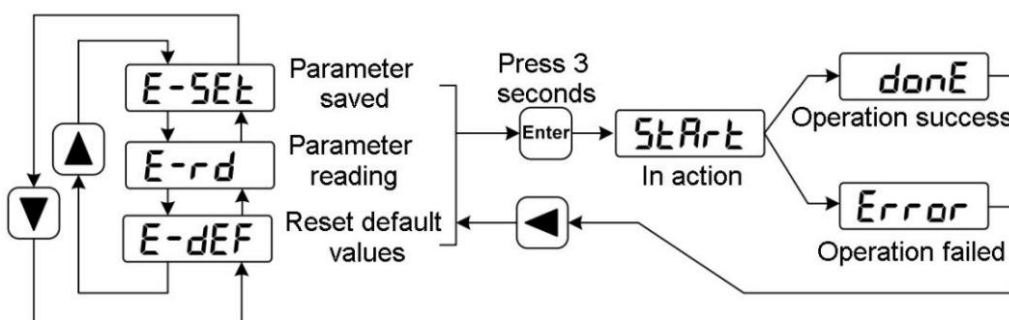
If you are not satisfied with the value being modified, do not press **Enter** to confirm, you can press the **◀** key to cancel, and the parameter restores to the original value. The modified parameters are not saved in the EEPROM. If you need to save them permanently, please use the parameter write operation in the parameter management.



3.5 parameter management

Parameter management mainly deals with the operation between parameter table and EEPROM, select parameter management "E-" in the main menu, and press **Enter** to enter parameter management mode.

Select the operation mode, there are 3 modes in total, use the **▲**, **▼** keys to select. After selecting the operation, press **Enter** and hold it for more than 3 seconds to activate the operation. After finishing, you can press the **◀** key to return to the operation mode selection state.

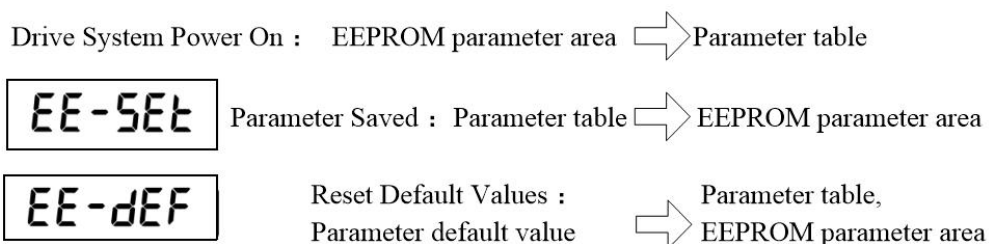


- **Parameter writing**

It means to write the parameters in the parameter table to EEPROM. The user modifies the parameter, only the parameter value in the parameter table is changed, and it will be restored to the original value when the power is turned on next time. If you want to change the parameter value permanently, you need to perform the parameter write operation, write the parameters in the parameter table into the EEPROM, and the modified parameters will be used after power-on.

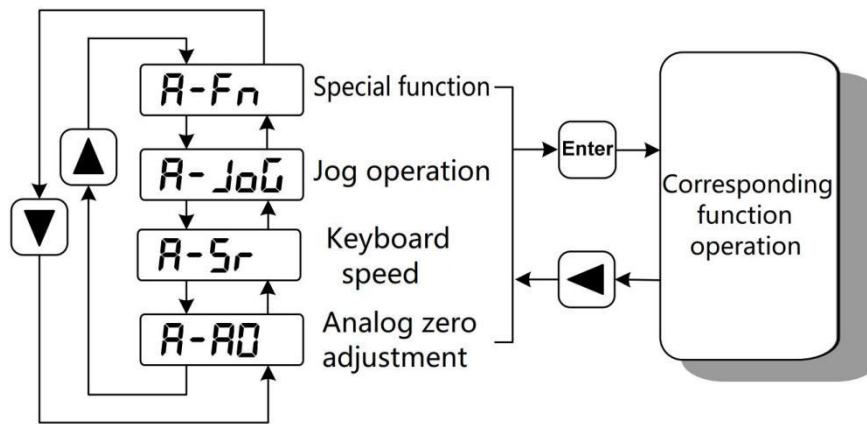
- **Restore the default value**

It means that the default values (factory values) of all parameters are read into the parameter table and written into the EEPROM. The default parameters will be used next time the power is turned on. When the user arbitrarily adjusts the parameters and fails to work normally, use this operation to restore all the parameters to the factory state. Because different drive models and motor models correspond to different parameter default values, when using the restore default parameters, you must first ensure the correctness of the motor manufacturer (parameter P-099) and motor code (parameter P-002).



3.6 Accessibility

Select the auxiliary function "A-" in the main menu, and press to enter the auxiliary function mode. Use the ▲, ▼ keys to select the operation mode. After selecting the operation, press to enter the corresponding function, and press the ◀ key to return to the operation mode selection state after completion.

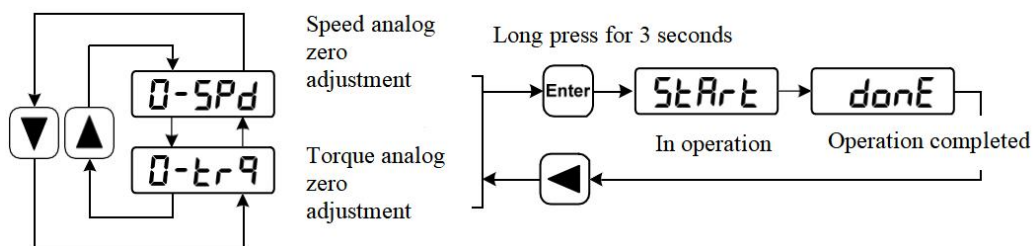


3.6.1 Brief description of functions

3.6.2 Analog zero adjustment

When using this operation, the drive automatically detects the analog zero offset and writes the zero offset value into parameter P-047 (or P-054). This operation has saved the zero offset parameters in the EEPROM, so there is no need to perform parameter write operations.

The operation method is as follows: (1) The host computer first outputs 0V analog quantity, enables the servo drive, and then selects the analog quantity Zero adjustment "A-AD" and press **Enter** to enter; (2) If the drive control mode is analog speed mode, select the speed analog zero adjustment "0-SPd" through the menu; if the drive control mode is analog torque Mode, select the torque analog zero adjustment "0-tr9" through the menu; (3) After selecting the operation, press the **Enter** key and hold it for more than 3 seconds to activate the operation. After finishing, you can press the **◀** key to return to the menu selection state, the specific display is as follows:



3.6.3 Jog (JOG) operation

Power on the drive first, confirm that there are no alarms and any abnormal conditions, the servo enable (SON) is ON and the RUN indicator light is on. At this time, the motor is energized and is in a zero-speed state.

In the auxiliary function, select Jog operation "A-JOG" and press **Enter** to enter the Jog (JOG) operation mode. The jog prompt is "J", the unit of value is r/min, and the speed command is provided by the button. Press the ▲ key and hold, the motor will run forward at JOG speed (CCW), release the button, the motor will stop and maintain zero speed; press the ▼ key and hold, the motor will run at JOG speed reverse (CW), release Press the button to stop the motor and maintain zero speed.

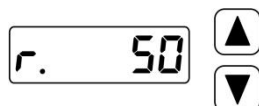
Note: The JOG speed is set by parameter P-076 (unit is r/min), and the servo enable is controlled by external switch or by parameter P-098 (Set to 1: The drive internal forced enable, set to 0: disenable) .



3.6.4 Keyboard speed control

Power on the drive first, confirm that there are no alarms and any abnormal conditions, the servo enable (SON) is ON and the RUN indicator light is on. At this time, the motor is energized and is in a zero-speed state.

In the auxiliary function, select the keyboard speed control "A-Sr", and press **Enter** to enter the keyboard speed control mode. The keyboard speed control prompt is "r.", the value unit is r/min, and the speed command is provided by the key. Use the ▲, ▼ keys to change the speed command, and the motor will run at the given speed. A positive number means forward rotation (CCW), a negative number means reverse rotation (CW), and the minimum given speed is 0.1r/min.



Note: The keyboard speed control needs to set the control mode to speed control mode, that is, set parameter P-004 to 1 (power off and restart to take effect); The servo enable is controlled by an external switch or by parameter P-098 (Set to 1: The drive internal forced enable, set to 0: disenable) .

3.7 Parameter default value restoration

In the following situations, please use the function of restoring default parameters (factory parameters):

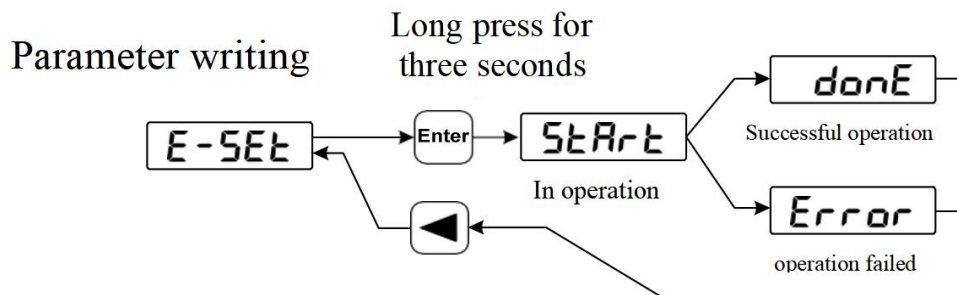
- The parameters are adjusted disorderly, and the system cannot work normally;
- Replace the motor, the new motor model is different from the original motor model;
- Other reasons cause the drive code (parameter P-001) and the motor code (parameter P-002) do not match.

The steps to restore the default parameters are as follows:

1. First make sure the servo enable (SON) is OFF, change the password (parameter P-000) to 385, and check whether the motor series (parameter P-099) and the motor code (parameter P-002) are correct. If correct, go to step 3. If wrong, go to step 2.
2. Modify the motor series (parameter P-099) and motor code (parameter P-002) to the required motor series and model. For the motor code, refer to the motor matching table in Chapter 7.2.
3. Enter parameter management and perform one of the following two operations:

(1) Restore the default values of some parameters

Only restore the default parameters related to the drive and motor, and keep other user parameters. Perform the parameter writing operation in the parameter management. This operation only has the function of restoring the default value when the password is 385 (or 316) and the motor code is modified. In other cases, only the parameter writing function is available.

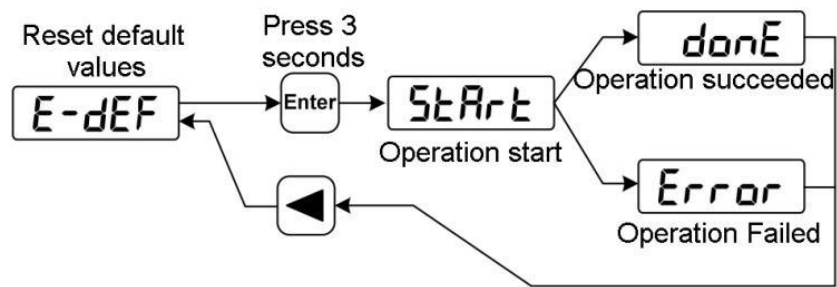


Restore only to the drive, Motor-related default values

(2) Restore the default values of all parameters

All parameters are restored to their default values, and the parameters modified by the user are also restored to factory default values. Perform the

operation of restoring default values in parameter management.



Restore the default values of all parameters

- 4 Turn off the power and power on again to work.

Chapter 4 Operation

4.1 No-load test run

The purpose of the trial operation is to confirm whether the following items are correct:

- Drive power wiring;
- Servo motor power cable wiring;
- Encoder wiring;
- The running direction and speed of the servo motor.

Pay attention: This series of servo drives adopt the integrated design of control power supply and high-power power supply. In order to use the drive successfully, please read the working sequence diagram in section 4.7 carefully. The host computer controller must strictly follow the requirements of this sequence diagram.

4.1.1 Wiring and inspection

Before powering on, confirm the followings:

- The motor is unloaded, do not load on the motor shaft, please disconnect the connector if it is already installed on the machine.
- Because of the impact of motor acceleration and deceleration, the motor must be fixed.
- Whether the wiring is correct, especially whether the driver U, V, W is in a one-to-one correspondence with the motor U, V, W wiring, the driver. Whether the wiring of R, S, T is correct.
- Whether the input voltage meets the requirements of the nameplate;
- Whether the encoder cable connection is correct.

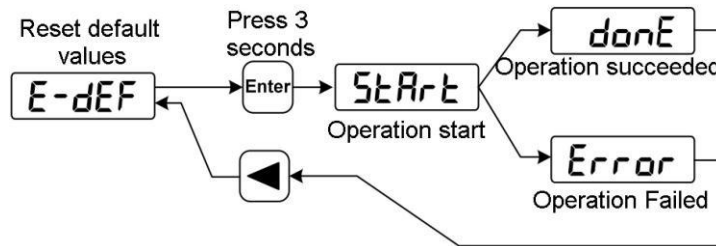
If the servo drive is a standard application, please refer to Chapter 8 for quick debugging and application.

4.1.2 Set motor code parameters

Turn on the main circuit power supply, the Pow indicator of the driver will light up, and the display panel will light up. If an alarm occurs, please check the connection. Set the motor code parameters according to the following steps:

- 1 Modify the operation password (parameter P-000) to 385;
- 2 Modify the motor series (parameter P-099) and motor code

- (parameter P-002) to the required motor model. For the motor model code, refer to the motor matching table in Chapter 7.2;
- 3 Enter the parameter management and perform the operation of restoring the default values as shown in the figure below:



Rest default values for all parameters

- 4 Turn off the power and turn on the power again to start a trial run operation. Three trial run methods are provided as follows:
 - a. **Keyboard speed control trial run (Fn -20);**
 - b. **JOG trail run**

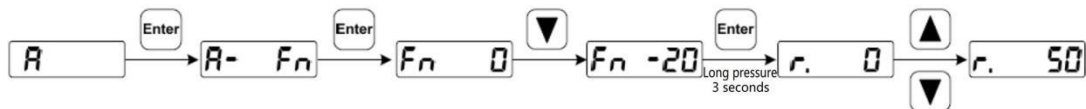
4.1.3 Trial run of keyboard speed regulation (Fn -20)

1. Power on

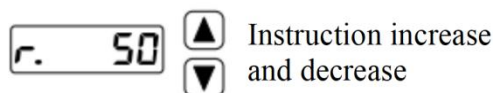
Turn on the main circuit power supply, the **Pow** indicator of the driver will light up, and the display panel will light up. If an alarm occurs, please check the connection.

2. Operation

After confirming that there are no alarms and any abnormal conditions, perform the following operations as shown in the figure below:



The keyboard speed control prompt is "r.", the value unit is r/min, and the speed command is provided by the key. Use the ▲, ▼ keys to change the speed command, and the motor will run at the given speed. A positive number means forward rotation (CCW), a negative number means reverse rotation (CW), and the minimum given speed is 0.1r/min.



After the keyboard speed regulation test runs without any abnormality, the mechanical load can be connected, and the next step of debugging can be carried out under the control instructions of the upper computer controller.

4.1.4 JOG trail run

1. Power on

Turn on the main circuit power supply, the **Pow** indicator of the driver will light up, and the display panel will light up. If an alarm occurs, please check the connection.

2. Operation

After confirming that there are no alarms and any abnormal conditions, set P098 to 1, then the servo enable (SON) is ON and the RUN indicator light is on. At this time, the motor is energized and is in the zero-speed state.

In the auxiliary function, select the JOG operation "**⏏- JOG**", and press **Enter** key to enter the JOG operation mode. The jog prompt is "**J**", the unit of value is r/min, and the speed command is provided by the button:

Press the **▲** key and hold, the motor will run forward (CCW) at JOG speed, release the button, the motor will stop and maintain zero speed; press **▼** key and hold, the motor will run at JOG speed reverse (CW), release Press the button to stop the motor and maintain zero speed.

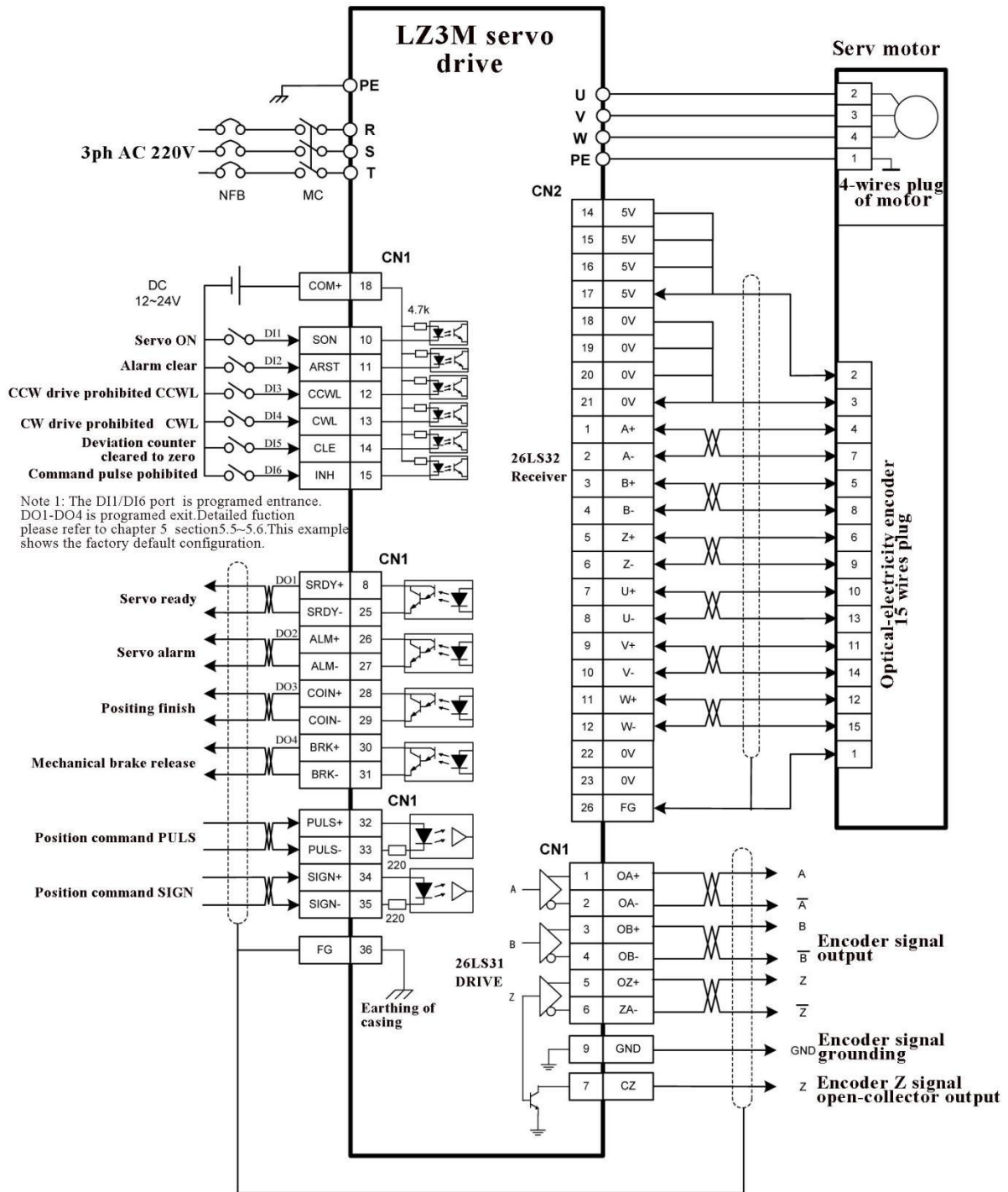


The JOG speed is set by parameter P076, and the default speed is 100r/min. **If the motor is running normally, you can enter the next operation (position control mode or other working modes).**

4.2 Position control

Position control is used in systems which require precise positioning, such as **CNC machine tools and textile machinery**. The source of position command is pulse command, and pulses are input from PULS+, PULS-, SIGN+ and SIGN- of the input terminals. The user needs to wire correctly according to the description of the position control wiring diagram, combined with the actual use requirements, and then set the position control related parameters. A simple example of position control in this manual is as follows:

4.2.1 Position control wiring diagram (take LZ3M as an example)



The parameter settings of this example are as follows:(Other parameters use factory default values)

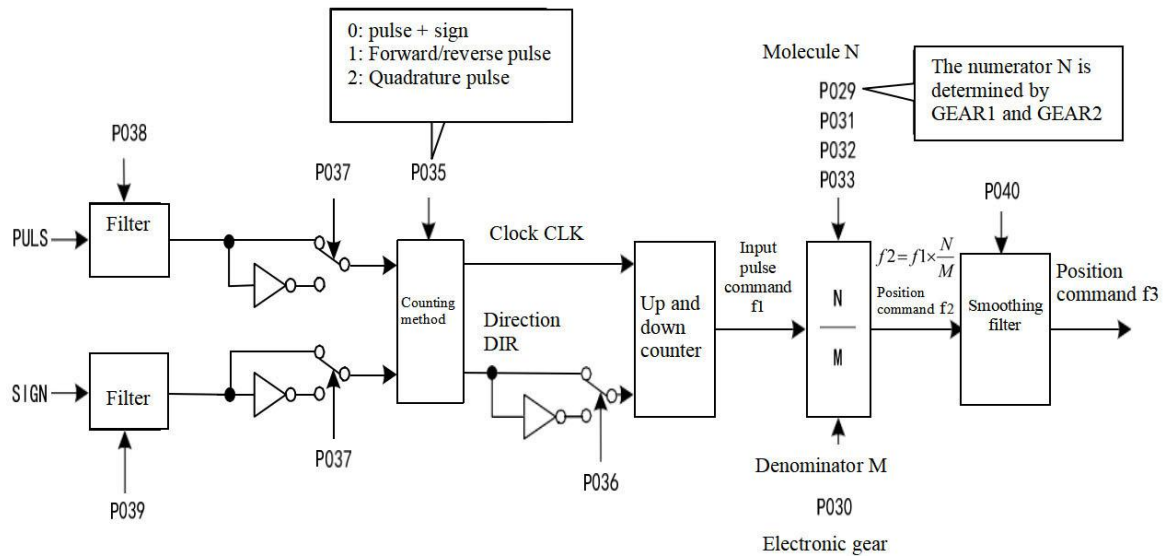
Parameter	Name	Settings	Default value	Parameter Description
P-004	Control method	0	0	Set to position control mode
P-097	Ignore drive prohibition	0 (Prohibited to use the driver)	3 (Ignore drive prohibition)	Set to 0, use forward drive prohibition (CCWL) and reverse drive prohibition (CWL). If it is set to 3 to ignore the positive and negative limits, it is not necessary to connect CCWL and CWL. The user needs to set this parameter correctly according to the actual usage, see section 4.6 for details.

4.2.2 Position command

1. Parameters related to the position command

Parameter	Name	Parameter range	Default value	Unit	Suitable
P-029	Position command pulse electronic gear 1st numerator	1~32767	1		P
P-030	Position command pulse electronic gear denominator	1~32767	1		P
P-035	Position command pulse input method	0~2	0		P
P-036	Position command pulse input direction	0~1	0		P
P-037	Position command pulse input signal logic	0~3	0		P
P-038	Position command pulse signal filter coefficient	0~3	0		P
P-039	Position command direction signal filter coefficient	0~3	0		P
P-040	Position command exponential smoothing filter time	0~10000	0	0.1ms	P

2. Command pulse transmission path



3. Command pulse input mode

The input mode is determined by parameter P035; the phase of the input signal PULS and SIGN can be set by parameter P037 to adjust the counting edge; parameter P036 is used to change the counting direction, set to 1 to reverse the count value.

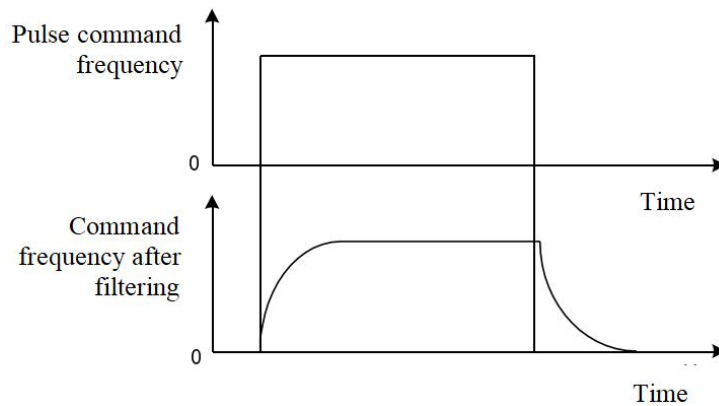
Pulse command form	Forward rotation (CCW)	Reverse (CW)	Parameter P035
Pulse + direction	PULS SIGN	PULS SIGN	0
Forward/reverse pulse	PULS SIGN	PULS SIGN	1
Quadrature pulse	PULS SIGN	PULS SIGN	2

Note: The arrow indicates the counting edge, and when P036=0, P037=0

4. Smooth filtering

As shown in the figure below, parameter P040 is to smoothly filter the command pulse, with exponential acceleration and deceleration. The filter will not lose input pulses, but there will be command delays. When set to 0, the filter has no effect. The parameter value represents the time for the frequency of 0 to

rise to 63.2% of the position command frequency.



The filter smooths the input pulse frequency. This filter is used in situations where the host controller has no acceleration/deceleration function, the electronic gear is relatively large, and the command frequency is low.

4.2.3 Input electronic gear

(1) Basic description of electronic gear ratio

The electronic gear can define the unit pulse command input to the device to make the transmission device move any distance. The pulse command generated by the upper controller does not need to consider the gear ratio, reduction ratio or motor encoder line number of the transmission system. The following table is the description of electronic gear variables:

Variable	Variable description	Value of this device
C	Encoder line/digit	2500 lines
P_t	By default (electronic gear ratio is 1:1) the number of pulses required for one revolution of the encoder (pulse/rev)	$=4 \times C$ $=4 \times 2500$ $=10000(\text{pulse/rev})$
R	Reduction ratio	$R=B/A$, where A: the number of rotations of the motor; B: Number of rotations of the load shaft
ΔP	A command pulse movement	
P_c	Number of command pulses per revolution of load shaft	
$Pitch$	Ball screw pitch (mm)	
D	Roller diameter (mm)	

Calculation Formula:

$$\text{Electronic gear } \left(\frac{N}{M}\right) = \frac{\text{Encoder one revolution resolution } (P_t)}{\text{The number of command pulses per revolution of the load shaft } (P_c) \times \text{Reduction ratio } (R)}$$

Among,

$$\text{Number of command pulses per revolution of load shaft } (P_c) = \frac{\text{The amount of movement of the load shaft in one revolution}}{\text{A command pulse movement } (\Delta P)}$$

Reduce the above calculation results, and make the numerator and denominator less than or equal to the integer value of 32767, and write them into the parameters.

(2) Electronic gear ratio dynamic switching function

The drive provides 4 groups of electronic gear numerator N, which can be changed online, which is determined by GEAR1 and GEAR2 input by DI. The denominator M (parameter P-030) is the same.

Parameter P-034 can be set the dynamic electronic gear application mode, the specific instructions are as follows:

P-034 is set to 0: It is forbidden to use dynamic electronic gear ratio switching, the command pulse electronic gear numerator is set by P029;

P-034 is set to 1: It is allowed to use dynamic electronic gear ratio switching, and the command pulse electronic gear numerator is determined by GEAR1 which input by DI;

DI signal [Note]GEAR1	Command pulse electronic gear molecule N
0	The first numerator (parameter P-029)
1	The second numerator (parameter P-031)

Note: 0 means OFF, 1 means ON.

Set P-034 to 2: Allow dynamic electronic gear ratio switching, and the command pulse electronic gear numerator is determined by GEAR1 and GEAR2 which input by DI.

DI signal [Note]		Command pulse electronic gear molecule N
GEAR2	GEAR1	
0	0	1st numerator (parameter P-029)
0	1	2nd numerator (parameter P-031)
1	0	3rd numerator (parameter P-032)
1	1	4th numerator (parameter P-033)

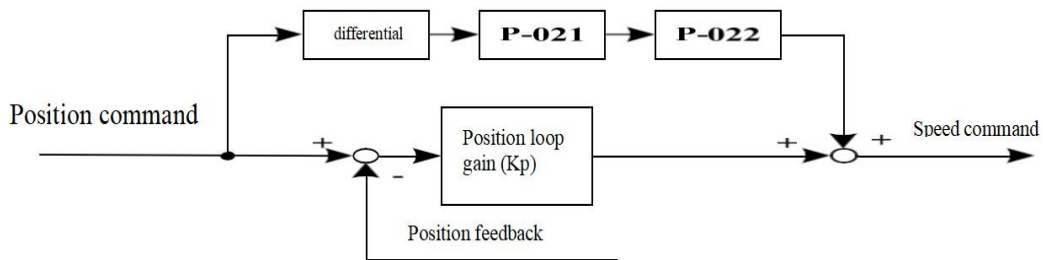
Note: 0 means OFF, 1 means ON.

4.2.4 Position control related gain

Parameter	Name	Parameter range	Default value	Unit	Suitable
P-009	Position loop gain	1~1000	40	1/s	P
P-021	Position loop feed-forward gain	0~100	0	%	P
P-022	Position loop feed-forward filter time constant	0.20~50.00	1.00	ms	P

Because the position loop includes the speed loop, according to the order of the inner loop first, then the outer loop, first set the load moment of inertia ratio, then adjust the speed loop gain, speed loop integral time constant, and finally adjust the position loop gain.

The following is the position controller of the system. Increasing the position loop gain K_p can increase the position loop bandwidth, but it is limited by the speed loop bandwidth. To increase the gain of the position loop, the bandwidth of the speed loop must be increased first.



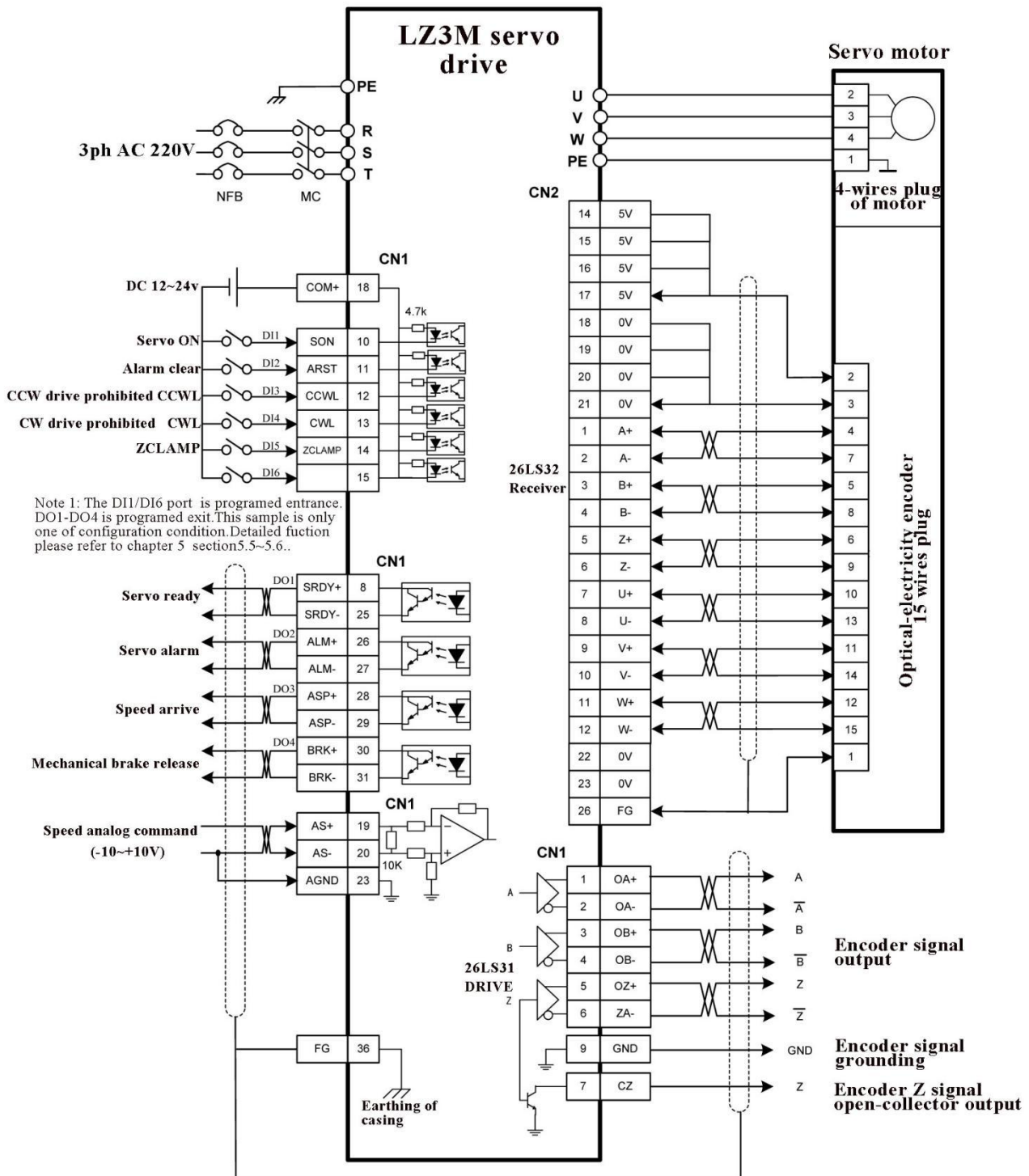
Feed-forward can reduce the phase lag of the position loop control, and can reduce the position tracking error during position control and shorter positioning time. The feed-forward amount increases, and the position control tracking error decreases, but if it is too large, the system becomes unstable and overshoots. If the electronic gear ratio is greater than 10, it is easy to produce noise. For general applications, P-021 can be set to 0%. When high response and low tracking error are required, it can be increased appropriately. It should not exceed 80%. At the same time, it may be necessary to adjust the position loop feed-forward filter time constant (parameter P-022).

4.3 Speed control

Speed control is used in occasions that require precise speed control, such as **knitting machines, drilling machines, and CNC processing machines**. It can also work with the upper device to form a closed-loop position control.

4.3.1 Simple example of speed control (take LZ3M as an example)

This manual gives a simple example of speed control (analog speed command input), the following figure is the wiring diagram:



The parameter settings of this example are as follows:(Other parameters use factory default values)

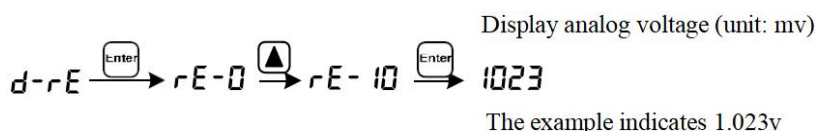
Parameter	Name	Settings	Default value	Parameter Description
P-004	Control method	1	0	Set to speed control mode
P-025	Speed command source	0	0	Set as analog input
P-060	Speed command acceleration time	Set as needed	100	Acceleration time from zero speed to 1000r/min(ms)
P-061	Speed command deceleration time	Set as needed	100	Deceleration time from 1000r/min to zero speed(ms)
P-097	Ignore drive prohibition	0 (Prohibited to use the driver)	3 (Ignore drive prohibition)	Use forward drive prohibition (CCWL) and reverse drive prohibition (CWL). If it is set to ignore, CCWL and CWL can not be connected, see section 4.6 for details.
P-104	Digital input DI5 function	7	20	DI5 is set to zero-speed clamp ZCLAMP
P-110	Digital output DO3 function	6	5	DO3 is set to speed to reach ASP

4.3.2 Parameters related to speed command

The parameters related to the speed command are as follows:

Parameter	Name	Parameter range	Default value	Unit	Suitable
P-025	Speed command source	0~3	0		S
P-046	Analog speed command gain	10~3000	300	r/min/V	S
P-047	Analog speed command zero offset compensation	-15000~15000	0	0.1mv	S
P-048	Analog speed command direction	0~1	0		S
P-049	Analog speed command filter time constant	2~500	20	0.1ms	S
P-050	Analog speed command polarity	0~2	0		S
P-051	Analog speed command dead zone 1	0~13000	0	mv	S
P-052	Analog speed command dead zone 2	-13000~0	0	mv	S

Refer to the description in section 3.6.2 for details of the **analog zero adjustment operation method**. You can also manually set the parameter P-047 to adjust the zero offset value according to the input analog value. The analog voltage value received by the driver can be viewed through the following menu items:



4.3.3 Speed command source

There are several different sources of speed command, which are set by parameter P-025, which are explained as follows:

P-025	Instruction	Explain
0	Analog speed command	Port AS+ and AS- input analog voltage
1	Internal multi-stage speed command <8 optional P-137~P-144>	It is determined by DI input SP1, SP2, SP3 [Note 1].
2	Analog speed command + internal multi-stage speed command	When SP1, SP2, and SP3 are all OFF, it is an analog command, and the rest are determined by SP1, SP2, and SP3 [Note 2].

Note 1: Internal speed command:

DI signal			Speed command
SP3	SP2	SP1	
0	0	0	Internal speed 1 (parameter P-137)
0	0	1	Internal speed 2 (parameter P-138)
0	1	0	Internal speed 3 (parameter P-139)
0	1	1	Internal speed 4 (parameter P-140)
1	0	0	Internal speed 5 (parameter P-141)
1	0	1	Internal speed 6 (parameter P-142)
1	1	0	Internal speed 7 (parameter P-143)
1	1	1	Internal speed 8 (parameter P-144)

Note 2: Analog speed command + internal speed command:

DI signal			Speed command
SP3	SP2	SP1	
0	0	0	Analog speed command
0	0	1	Internal speed 2 (parameter P-138)

0	1	0	Internal speed 3 (parameter P-139)
0	1	1	Internal speed 4 (parameter P-140)
1	0	0	Internal speed 5 (parameter P-141)
1	0	1	Internal speed 6 (parameter P-142)
1	1	0	Internal speed 7 (parameter P-143)
1	1	1	Internal speed 8 (parameter P-144)

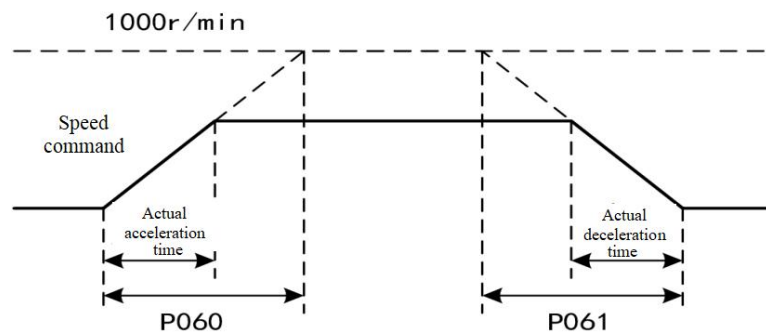
Above 0 means OFF, 1 means ON. There are two DI inputs that provide special functions: CZERO (zero command) and CINV (command inversion). When CZERO is ON, the speed command is forced to zero; when CINV is ON, the speed command is inverted.

4.3.4 Acceleration and deceleration control

The acceleration and deceleration control is related to the following parameters:

Parameter	Name	Parameter range	Default value	Unit	Suitable
P-060	Speed command acceleration time	0~30000	100	ms	S
P-061	Speed command deceleration time	0~30000	100	ms	S

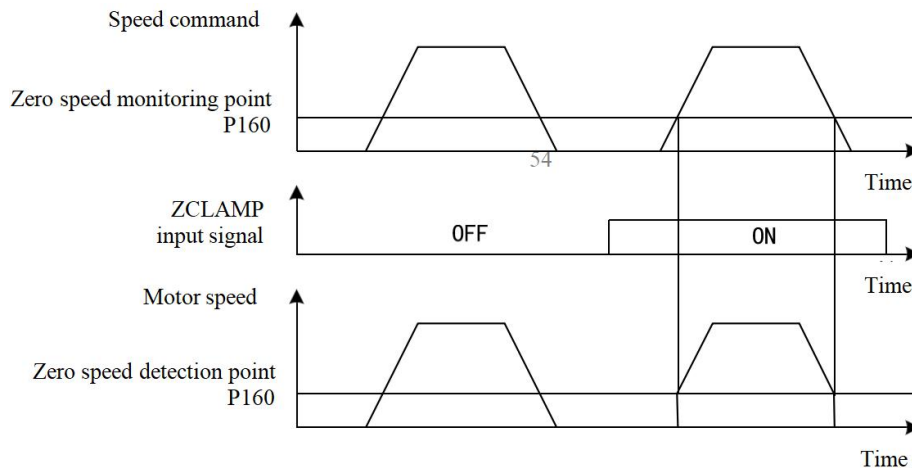
Acceleration and deceleration control can slow down sudden changes in speed and make the motor run smoothly. As shown in the figure below, parameter P-060 sets the motor's acceleration time from zero speed to 1000r/min, and P-061 sets the motor's deceleration time from 1000r/min to zero speed. If the driver and the upper device constitute position control, this parameter should be set to 0.



4.3.5 Zero-speed clamp

The parameters related to zero-speed clamping are as follows:

Parameter	Name	Parameter range	Default value	Unit	Suitable
P-160	Zero speed detection point	0~1000	10	r/min	ALL
P-161	Zero speed detection hysteresis	0~1000	5	r/min	ALL
P-162	Zero-speed clamp mode	0~1	0		S



During speed control, even if the motor is at zero speed, the external force may rotate and cause the position to change. If it is an analog speed command input, the absolute zero speed command is not easy to implement. In order to solve these two problems, you can consider using the zero speed clamp function. When the following conditions are met, the zero-speed clamp function is turned on:

- Condition 1: Speed control mode;
- Condition 2: ZCLAMP (zero-speed clamp) in DI is ON;
- Condition 3: Speed command is lower than parameter P-160.

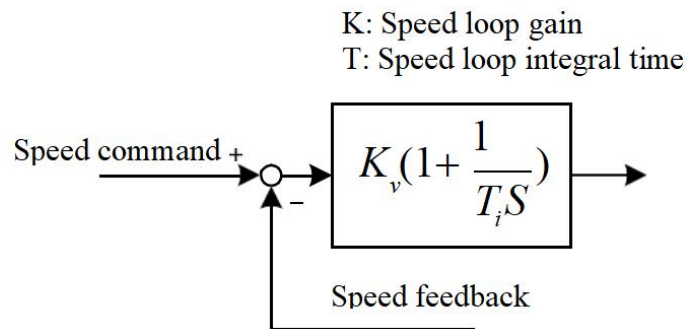
When any of the above conditions are not met, normal speed control is executed. The zero-speed clamp has the following two modes:

P-162	Instruction
0	The motor position is fixed at the moment the function is turned on. At this time, the internal position control is connected, even if it rotates due to external force, it will return to the zero fixed point.
1	When the function is turned on, the speed command is forced to zero speed. The interior is still speed controlled and may rotate due to external forces.

4.3.6 Speed control related gain

Parameter	Name	Parameter range	Default value	Unit	Suitable
P-005	1st speed loop gain	1~3000	40	Hz	P,S
P-006	1st speed loop integral time constant	1.0~1000.0	20.0	ms	P,S
P-017	Load moment of inertia ratio	0.0~200.0	1.0	Times	P,S
P-018	Speed loop PDFF control coefficient	0~100	100	%	P,S

First set the load moment of inertia ratio, and then adjust the speed loop gain and speed loop integral time constant. The following is the speed controller of the system. Increasing the speed loop gain K_v can increase the speed response bandwidth, and reduce the speed loop integral time constant T_i , which can increase the system rigidity and reduce the steady-state error.



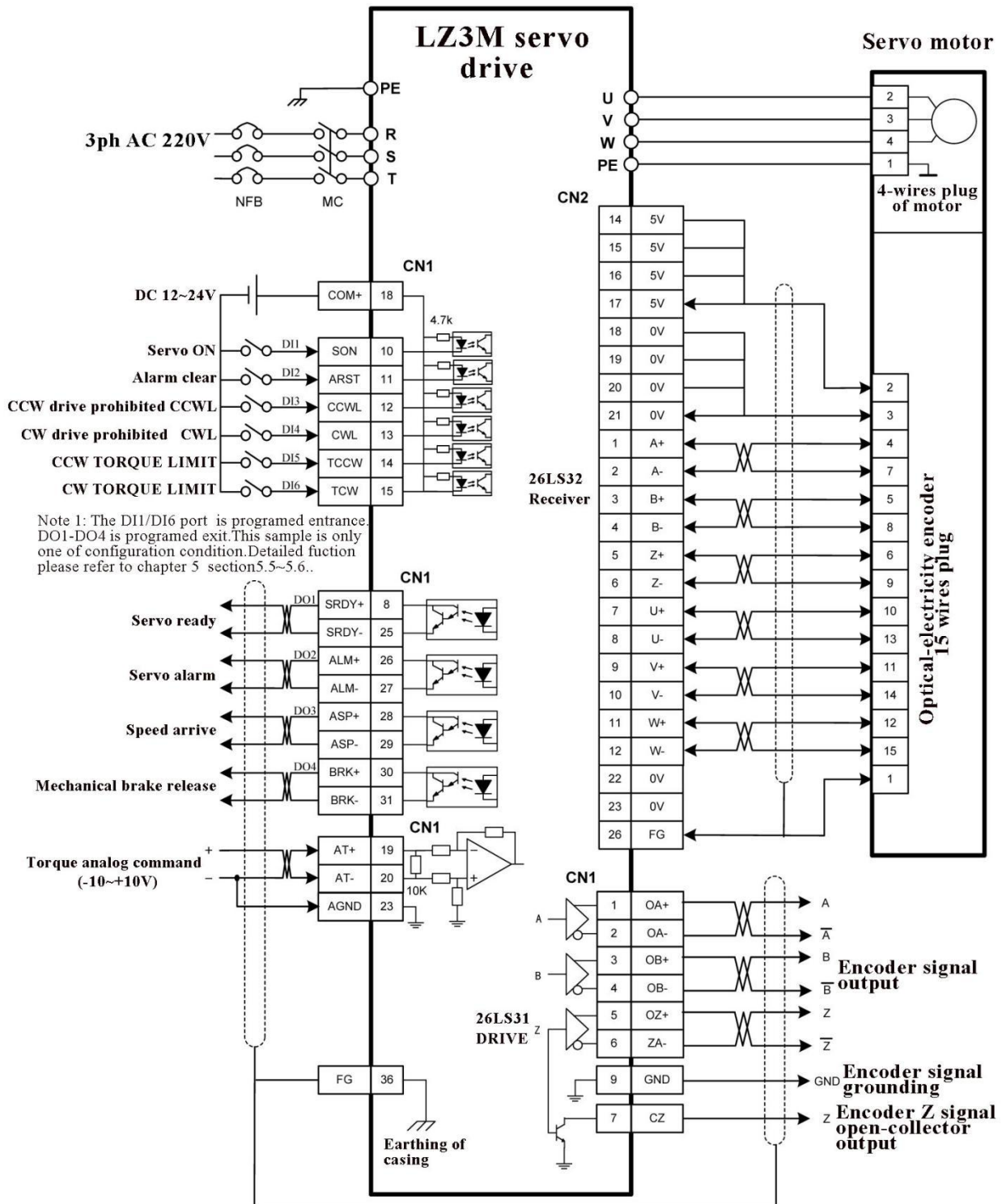
P-018 can select speed controller structure, 0 is IP regulator, 100 is PI regulator, and 1~99 are PDFF regulator. If the parameter value of P-018 is too large, the system will have high frequency response. If the parameter value is too small, the system will have high rigidity (ability to resist deviation). The medium value takes into account both frequency response and rigidity.

4.4 Torque control

Torque control is used in **printing presses, winding machines, injection molding machines**, etc. The output torque of the motor is proportional to the input command.

4.4.1 Simple example of torque control (take LZ3M as an example)

This manual gives a simple example of torque control (analog torque command input), the following figure is the wiring diagram:



The parameter settings of this example are as follows: (Other parameters use factory default values)

Parameter	Name	Settings	Default value	Parameter Description
P-004	control method	2	0	Set to torque control
P-026	Torque command source	0	0	Set as analog input
P-097	Ignore drive prohibition	0	3	Use forward drive prohibition (CCWL) and reverse drive prohibition (CWL). If it is set to ignore, CCWL and CWL may not be connected. For details, see section 4.6.
P-104	Digital input DI5 function	5	20	DI5 is set to forward torque limit TCCW
P-105	Digital input DI6 function	6	21	DI6 is set to reverse torque limit TCW
P-110	Digital output DO3 function	6	5	DO3 is set to speed to reach ASP

4.4.2 Parameters related to torque command

The parameters related to the torque command are shown in the following table:

Parameter	Name	Parameter range	Default value	Unit	Suitable
P-026	Torque command source	0~2	0		T
P-053	Analog torque command gain	1~300	30	%/V	T
P-054	Analog torque command zero offset compensation	-1500.0~1500.0	0.0	mv	T
P-055	Analog torque command direction	0~1	0		T
P-056	Analog torque command filter time constant	20~500	20	0.1ms	T
P-057	Analog torque command polarity	0~2	0		T
P-075	Maximum speed limit	0~6000	3500	r/min	ALL

Refer to the description in section 3.6.2 for details of the **analog zero adjustment operation method**. You can also manually set the parameter P-054 to adjust the zero offset value according to the input analog value. The analog voltage value received by the driver can be viewed through the following menu items:



The example indicates 1.023v

4.4.3 Torque command source

There are several different sources of torque command, which are set by parameter P-026 as follows:

P-026	Instruction	Explain
0	Analog torque command	Port AS+ and AS- input analog voltage
1	Internal torque command	It is determined by DI input TRQ1 and TRQ2 [Note 1].
2	Analog torque command + internal torque command	When TRQ1 and TRQ2 are all OFF, it is an analog command, and the rest are determined by TRQ1 and TRQ2 [Note 2].

Note 1: Internal torque command:

DI signal		Torque command
TRQ2	TRQ1	
0	0	Internal torque 1 (parameter P-145)
0	1	Internal torque 2 (parameter P-146)
1	0	Internal torque 3 (parameter P-147)
1	1	Internal torque 4 (parameter P-148)

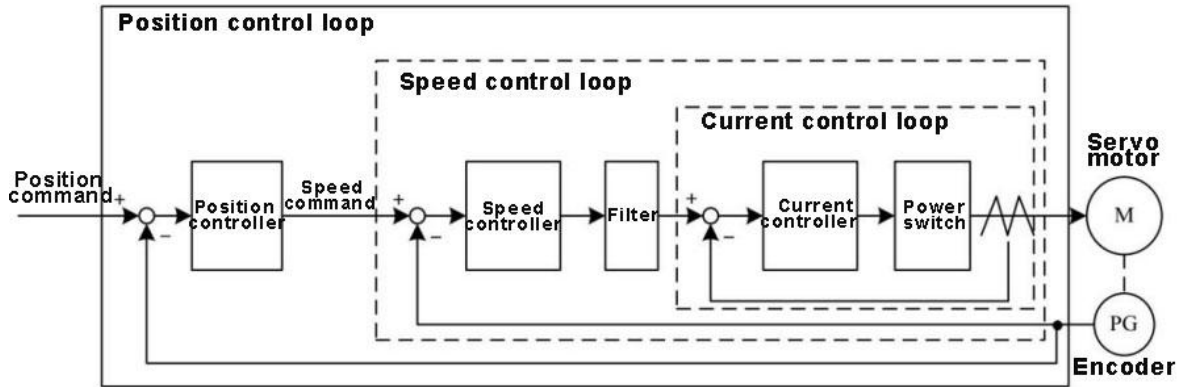
Note 2: Analog torque command + internal torque command:

DI signal		Torque command
TRQ2	TRQ1	
0	0	Analog torque command
0	1	Internal torque 2 (parameter P-146)
1	0	Internal torque 3 (parameter P-147)
1	1	Internal torque 4 (parameter P-148)

Above 0 means OFF, 1 means ON. There are two DI inputs CZERO (zero command) and CINV (command inversion) to provide special functions. When CZERO is ON, the torque is forced to zero; when CINV is ON, the torque command is inverted.

4.5 Gain adjustment

The driver includes three control loops: current control loop, speed control loop and position control loop. The control block diagram is as follows:



In theory, the control loop bandwidth of the inner layer must be higher than that of the outer layer, otherwise the entire control system will be unstable and cause vibration or poor response. Therefore, the relationship between the bandwidth of the three control loops is as follows:

Current loop bandwidth > Speed loop bandwidth > Position loop bandwidth

Since the drive has adjusted the current control loop to the best state, the user only needs to adjust the speed control loop and position control loop parameters.

4.5.1 Gain parameters

The parameters related to the control gain are as follows:

Parameter	Name	Parameter range	Default value	Unit	Suitable
P-005	Speed loop gain	1~3000	50	Hz	P,S
P-006	Speed loop integral time constant	1~1000	20	ms	P,S
P-009	Position loop gain	1~1000	40	1/s	P
P-017	Load moment of inertia ratio	1~2000	10	0.1 time	P,S
P-007	Torque filter time constant	1~500	25	0.1ms	ALL
P-019	Speed detection filter time constant	5~500	25	0.1ms	P,S

The symbols are defined as follows:

K_v : speed loop gain;

T_i : Speed loop integral time constant;

K_p : position loop gain;

G : Load moment of inertia ratio (P-017);

J_L : The load moment of inertia converted to the motor shaft;

J_M : Moment of inertia of the motor rotor.

1. Speed loop gain K_v

The speed loop gain K_v directly determines the response bandwidth of the speed loop. On the premise that the mechanical system does not produce vibration or noise, increasing the speed loop gain will speed up the speed response and follow the speed command better. However, a setting that is too large is likely to cause mechanical resonance. The speed loop bandwidth is expressed as:

$$\text{Speed loop bandwidth (Hz)} = \frac{1+G}{1+J_L/J_M} \times K_v \text{ (Hz)}$$

If the load moment of inertia ratio G is set correctly ($G=J_L/J_M$), the speed loop bandwidth is equal to the speed loop gain K_v .

2. Speed loop integral time constant T_i

The speed loop integral can effectively eliminate the steady-state error of the speed, and quickly react to the subtle speed changes. On the premise that the mechanical system does not produce vibration or noise, reduce the speed loop integral time constant T_i to increase the rigidity of the system and reduce the steady-state error. If the load inertia ratio is large or there are resonance factors in the mechanical system, it must be confirmed that the speed loop integral time constant is large enough, otherwise the mechanical system is prone to resonance. If the load moment of inertia ratio G is set correctly ($G=J_L/J_M$), use the following formula to obtain the speed loop integral time constant T_i :

$$T_i \text{ (ms)} \geq \frac{4000}{2\pi \times K_v \text{ (Hz)}}$$

3. Position loop gain K_p

$$\text{Position loop bandwidth (Hz)} \leq \frac{\text{Speed loop bandwidth (Hz)}}{4}$$

The gain of the position loop directly determines the response speed of the position loop. On the premise that the mechanical system does not produce vibration or noise, increase the position loop gain value to speed up the response speed, reduce the position tracking error, and shorten the positioning time. But too large setting will cause mechanical system vibrate or positioning overshoot. The bandwidth of the position loop cannot be higher than the bandwidth of the speed loop, generally

If the load moment of inertia ratio G is set correctly ($G=J_L/J_M$), the position loop gain K_p is calculated as follows:

$$K_p (1/s) \leq 2\pi \times \frac{K_v (Hz)}{4}$$

4.5.2 Gain adjustment steps

The choice of position and speed bandwidth must be determined by the rigidity and application of the machine. The conveying machinery connected by the belt has low rigidity and can be set to a lower bandwidth; the ball screw driven by the reducer has medium mechanical rigidity and can be set to Medium bandwidth; Direct drive ball screw or linear motor has high rigidity and can be set to high bandwidth. If the mechanical characteristics are unknown, you can gradually increase the gain to increase the bandwidth until resonance, and then lower the gain.

In the servo gain, if one parameter is changed, the other parameters also need to be re-adjusted. Please do not make major changes to only one parameter. Regarding the steps of changing servo parameters, generally please follow the following principles:

Improve response	Reduce response, suppress vibration and overshoot
1. Increase the speed loop gain K_v (P-005) 2. Reduce the speed loop integral time constant T_i (P-006) 3. Increase the position loop gain K_p (P-009)	1. Reduce the position loop gain K_p (P-009) 2. Increase the speed loop integral time constant T_i (P-006) 3. Reduce the speed loop gain K_v (P-005)

Gain adjustment steps for speed control

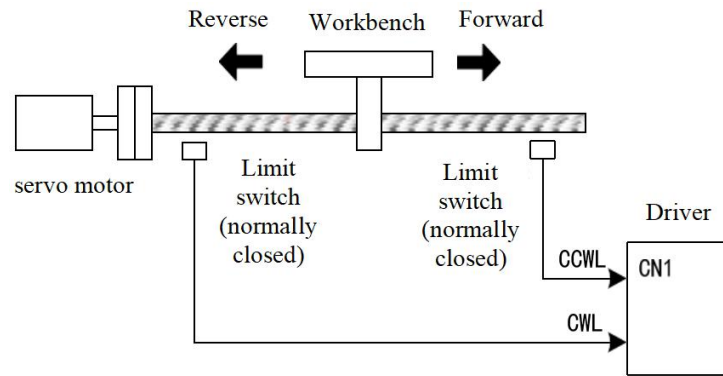
1. Set the load inertia ratio (P-017).
2. Set the speed loop integral time constant (P-006) to a larger value.
3. The speed loop gain (P-005) should be increased within the range of no vibration and abnormal sound, and slightly decreased if vibration occurs.
4. The integral time constant of the speed loop should be reduced within the range where no vibration occurs. If vibration occurs, adjust it slightly.
5. If the gain cannot be increased due to resonance of the mechanical system and other reasons, and the desired responsiveness cannot be obtained, adjust the torque low-pass filter (P-007) or the speed detection filter (P-019) to suppress resonance. , And then repeat the above steps to improve responsiveness.

Gain adjustment steps for position control

1. Set the load moment of inertia ratio (P-017).
2. Set the speed loop integral time constant (P-006) to a larger value.
3. The speed loop gain (P-005) should be increased within the range of no vibration and abnormal sound, and slightly decreased if vibration occurs.
4. The integral time constant of the speed loop should be reduced within the range where no vibration occurs. If vibration occurs, adjust it slightly.
5. Increase the position loop gain (P-009), if vibration occurs, adjust it slightly.
6. If the gain cannot be increased due to resonance in the mechanical system, and the desired responsiveness cannot be obtained, adjust the torque low-pass filter (P-007) or the speed detection filter (P-019) to suppress resonance. , And then repeat the above steps to improve responsiveness.
7. If you need shorter positioning time and smaller position tracking error, you can appropriately adjust the position feed-forward (P-021, P-022).

4.6 Over-travel protection

The over-travel protection function refers to the safety function that the limit switch acts to force the motor to stop when the moving part of the machine exceeds the designed safe moving range. The schematic diagram of over-travel protection is as follows:



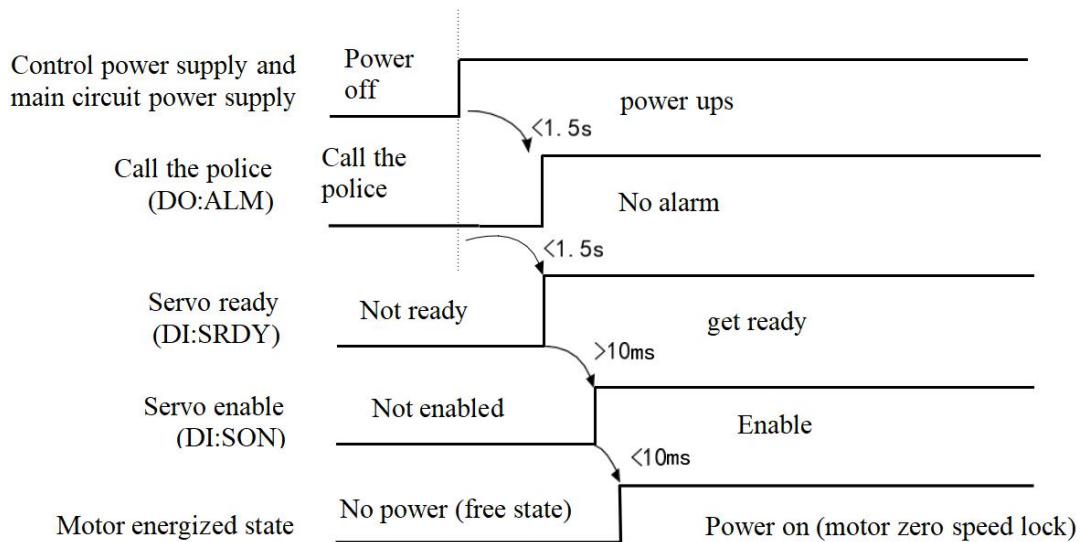
It is recommended to use normally closed contacts for limit switches, which are closed within a safe range, and open for over-travel. Connected to forward drive prohibition (CCWL) and reverse drive prohibition (CWL), can also be set to use or ignore through parameter P-097. If it is set to use, the limit signal must be connected; if it is set to ignore, the signal is not required. The default value of the parameter is that both CCWL and CWL are ignored. If you need to use it, you must modify the parameter P-097. Even in the over-travel state, it is still allowed to exit the over-travel state by inputting a reverse command.

P-097	Reverse drive prohibited (CWL)	Forward rotation prohibited (CCWL)
0	use	use
1	use	neglect
2	neglect	use
3(default)	neglect	neglect

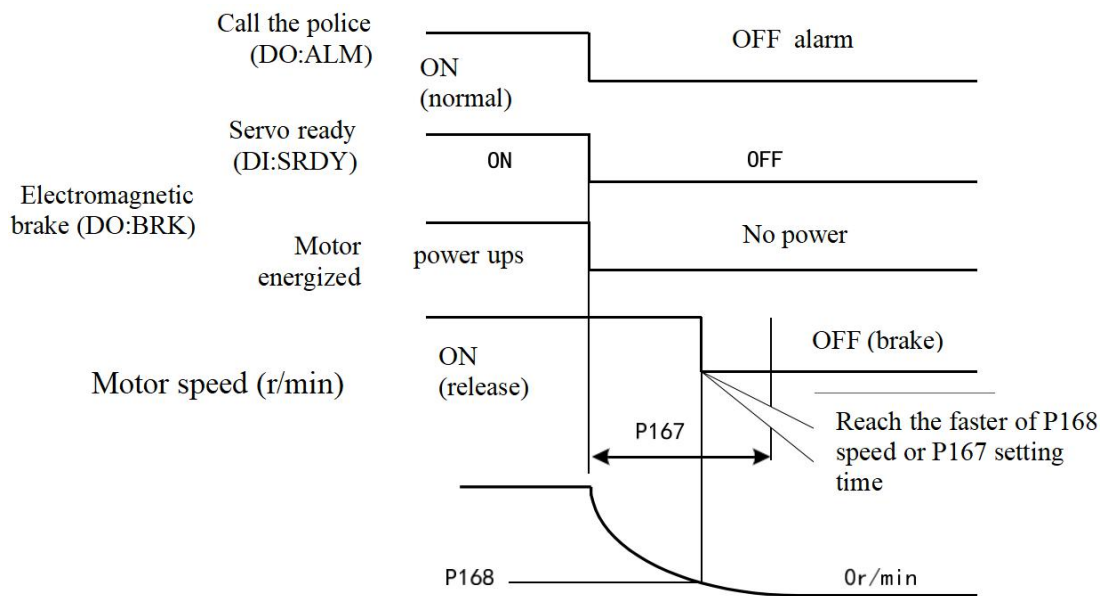
4.7 Working sequence

4.7.1 Power on sequence

- After the main power is turned on, there is a delay of about 1.5 seconds, and the servo ready signal (SRDY) is ON. At this time, the servo enable (SON) signal can be received, and the servo enable is detected to be valid, the power circuit is turned on, the motor is excited, and it is running state. It is detected that the servo enable is invalid or there is an alarm, the power circuit is closed, and the motor is in a free state.

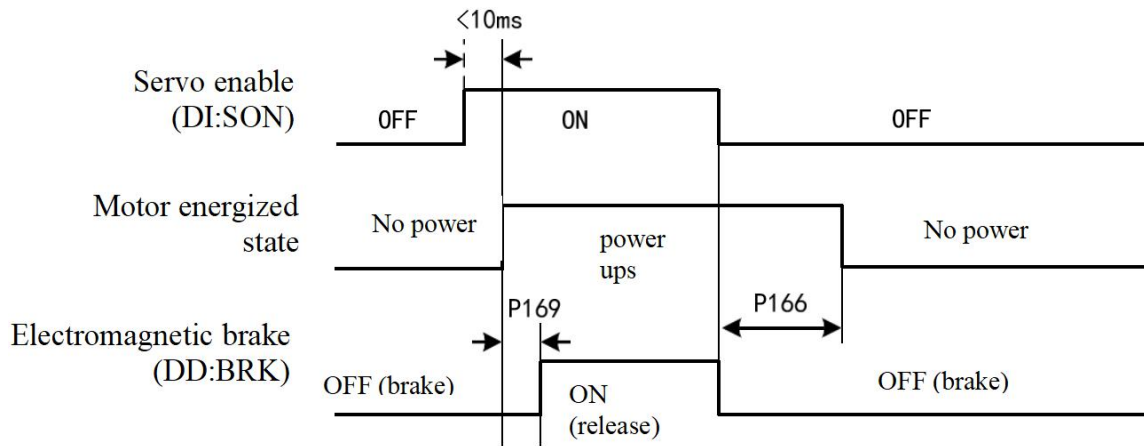


4.7.2 Alarm sequence when the servo is ON



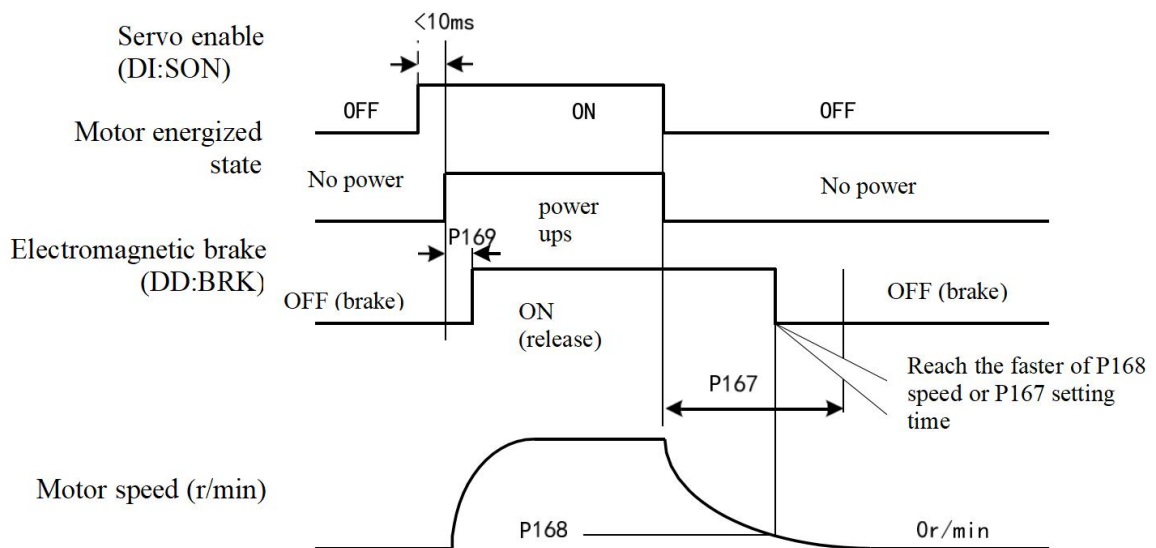
4.7.3 Action sequence of electromagnetic brake when the motor is stationary

When the motor speed is lower than the parameter P165, the electromagnetic brake action sequence:



4.7.4 The electromagnetic brake action sequence when the motor is running

When the motor speed is higher than the parameter P165, the electromagnetic brake action sequence:



4.8 Electromagnetic brake

The electromagnetic brake (holding brake, power failure brake) is used to lock the vertical or inclined workbench connected to the motor to prevent the workbench from falling when the servo power is lost. To achieve this function, a motor with a brake is required. The brake can only be used to maintain the workbench, and must not be used to decelerate and stop the movement of the

machine.

4.8.1 Electromagnetic brake parameters

Parameters of electromagnetic brake:

Parameter	Name	Parameter range	Default value	Unit	Suitable
P-165	Motor static speed detection point	0~1000	5	r/min	ALL
P-166	Electromagnetic brake delay time when the motor is stationary	0~2000	500	ms	ALL
P-167	Electromagnetic brake waiting time when the motor is running	0~2000	500	ms	ALL
P-168	Action speed of electromagnetic brake when motor is running	0~3000	100	r/min	ALL
P-169	Delay time of electromagnetic brake release	0~3000	500	ms	ALL

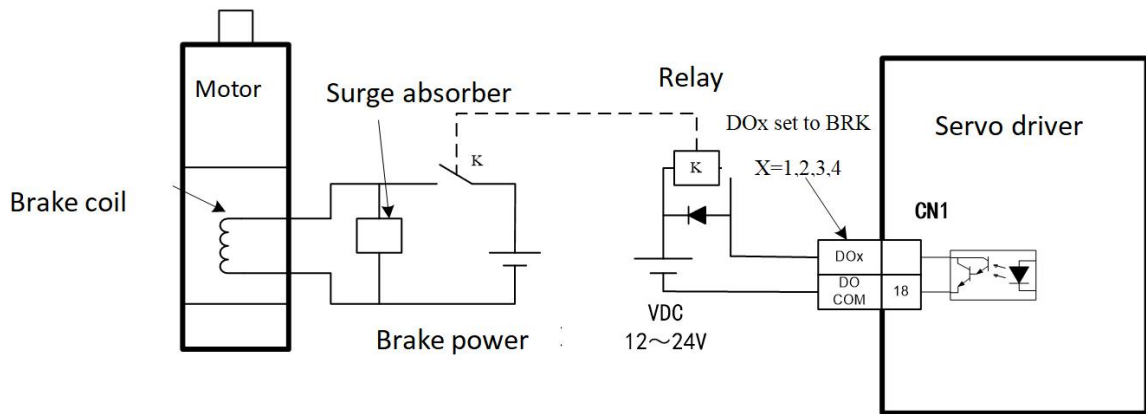
4.8.2 Use of electromagnetic brake

The figure below is the brake wiring diagram. The brake release signal BRK of the driver is connected to the relay coil, and the relay contact is connected to the brake power supply. The brake power supply is provided by the user and has sufficient capacity. It is recommended to install a surge absorber to suppress the surge voltage caused by the on/off action of the relay. A diode can also be used as a surge absorber, but it will cause a little brake delay. After the motor stops steadily (the speed is less than P-165), the servo is OFF. At this time, the motor continues to be energized to maintain the position, and the brake.

From release to braking, after a period of stabilization (the time is determined by parameter P-166), the motor power supply is removed.

When the motor is running (speed greater than P-165), the servo is OFF. At this time, the motor current is cut off and the brake continues to be released. After a period of delay, the brake brakes. This is to make the motor decelerate from high-speed rotation to low-speed, and then make the mechanical brake act, to avoid damage to the brake. The delay time is the time required for parameter P-167 or the motor speed to decelerate to the speed of parameter P-168, whichever is the minimum.

P-169: When the system changes from the disabled state to the enabled state, define the delay time from when the motor current is turned on to when the electromagnetic brake is released (DO output terminal BRK ON).



Chapter 5 Parameters

5.1 List of parameters

The applicable column indicates the applicable control mode, P is the position control, S is the speed control, T is the torque control, and All is the position, speed, and torque control. The parameter value "*" means that the factory default value may be different.

5.1.1 0 segment parameters

Parameter	Name	Parameter range	Default value	Unit	Suitable
P000	Operation password	0~9999	315		ALL
P001	Drive model code	*	*		ALL
P002	Motor code	*	*		ALL
P003	Software version	*	*		ALL
P004	control method	0~8	0		ALL
P005	1st speed loop gain	1~3000	50	Hz	P,S
P006	1st speed loop integral time constant	1~1000	20	ms	P,S
P007	1st torque filter time constant	1~500	25	0.1ms	ALL
P009	1st position loop gain	1~1000	40	1/s	P
P019	Speed detection filter time constant	5~500	35	0.1ms	P,S
P021	Position loop feed-forward gain	0~100	0	%	P
P022	Position loop feed-forward filter time constant	2~500	10	0.1ms	P
P025	Speed command source	0~3	0		S
P026	Torque command source	0~2	0		T
P029	Position command pulse electronic gear 1st numerator	1~32767	1		P
P030	Position command pulse electronic gear denominator	1~32767	1		P
P031	Command pulse electronic gear 2nd numerator	1~32767	1		P
P032	Command pulse electronic gear 3rd numerator	1~32767	1		P
P033	Command pulse electronic gear 4th numerator	1~32767	1		P

Parameter	Name	Parameter range	Default value	Unit	Suitable
P035	Position command pulse input method	0~2	0		P
P036	Position command pulse input direction	0~1	0		P
P037	Position command pulse input signal logic	0~3	0		P
P038	Position command pulse signal filter coefficient	0~3	0		P
P039	Position command direction signal filter coefficient	0~3	0		P
P040	Position command exponential smoothing filter time	0~10000	0	0.1ms	P
P046	Analog speed command gain	10~3000	300	r/min/ V	S
P047	Analog speed command zero offset compensation	15000~ 15000	0	0.1mv	S
P048	Analog speed command direction	0~1	0		S
P049	Analog speed command filter time constant	2~500	20	0.1ms	S
P050	Analog speed command polarity	0~2	0		S
P051	Analog speed command dead zone 1	0~ 13000	0	mv	S
P052	Analog speed command dead zone 2	-13000~ 0	0	mv	S
P053	Analog torque command gain	1~300	30	%/V	T
P054	Analog torque command zero offset compensation	1500~ 1500	0	mv	T
P055	Analog torque command direction	0~1	0		T
P056	Analog torque command filter time constant	2~500	20	0.1ms	T
P057	Analog torque command polarity	0~2	0		T
P060	Speed command acceleration time	0~10000	100	ms	S
P061	Speed command deceleration time	0~10000	100	ms	S
P063	EMG (emergency stop)/ALM deceleration time	0~10000	1000	ms	ALL
P064	Torque limit selection	0~2	0		ALL

Parameter	Name	Parameter range	Default value	Unit	Suitable
P065	Internal forward rotation (CCW) torque limit	0~300	300	%	ALL
P066	Internal reverse (CW) torque limit	-300~0	-300	%	ALL
P067	External forward rotation (CCW) torque limit	0~300	100	%	ALL
P068	External reverse (CW) torque limit	-300~0	-100	%	ALL
P069	Trial run torque limit	0~300	100	%	ALL
P070	Forward rotation (CCW) torque overload alarm level	1~300	140	%	ALL
P071	Reverse (CW) torque overload alarm level	-300~-1	-140	%	ALL
P072	Torque overload alarm detection time	1~30000	5000	ms	ALL
P075	Maximum speed limit	0~6000	3500	r/min	ALL
P076	JOG running speed	0~5000	100	r/min	S
P077	Speed limit selection	0~2	0		T
P078	Speed limit during torque control	0~5000	1000	r/min	T
P079	Speed limit error during torque control	1~5000	100	r/min	T
P080	Position tolerance detection	0~32767	400	0.01 circle	P
P081	First encoder type selection	0~1	0		ALL
P082	Number of first encoder lines	1~32767	2500	pulse	ALL
P083	Zero offset angle of the first encoder	-3600~3600	-216	0.1 degree	ALL
P084	The first encoder control parameter	0~11111	0		ALL
P097	Positive and negative limit use mode / positive and negative control	0~33	33		ALL
P098	Forced enable	0~1	0		ALL
P099	Motor series code	0~15	0		ALL

5.1.2 1 Segment parameters

Parameter	Name	Parameter range	Default value	Unit	Suitable
P100	Digital input DI1 function	-21~21	1		ALL
P101	Digital input DI2 function	-21~21	2		ALL
P102	Digital input DI3 function	-21~21	3		ALL
P103	Digital input DI4 function	-21~21	4		ALL
P104	Digital input DI5 function	-21~21	20		ALL
P105	Digital input DI6 function	-21~21	21		ALL
P108	Digital output DO1 function	-12~12	2		ALL
P109	Digital output DO2 function	-12~12	3		ALL
P110	Digital output DO3 function	-12~12	5		ALL
P111	Digital output DO4 function	-12~12	8		ALL
P120	Digital input DI is forced to be valid 1	00000~11111	00000		ALL
P121	Digital input DI is forced to be valid 2	00000~11111	00000		ALL
P122	Digital input DI is forced to be valid 3	00000~11111	00000		ALL
P123	Digital input DI is forced to be valid 4	00000~11111	00000		ALL
P124	Digital input DI is forced to be valid 5	00000~11111	00000		ALL
P125	Digital input DIx filter	1~1000	5	ms	ALL
P136	Enable off or stop mode when alarm occurs	0~1	0		ALL
P137	Internal speed 1	-5000~5000	0	r/min	S
P138	Internal speed 2	-5000~5000	0	r/min	S
P139	Internal speed 3	-5000~5000	0	r/min	S
P140	Internal speed 4	-5000~5000	0	r/min	S
P141	Internal speed 5	-5000~5000	0	r/min	S
P142	Internal speed 6	-5000~5000	0	r/min	S
P143	Internal speed 7	-5000~5000	0	r/min	S
P144	Internal speed 8	-5000~5000	0	r/min	S
P145	Internal torque 1	-300~300	0	%	T
P146	Internal torque 2	-300~300	0	%	T
P147	Internal torque 3	-300~300	0	%	T
P148	Internal torque 4	-300~300	0	%	T
P150	Positioning completion range	0~32767	10	pulse	P
P151	Positioning complete return difference	0~32767	5	pulse	P
P152	Positioning proximity	0~32767	500	pulse	P

Parameter	Name	Parameter range	Default value	Unit	Suitable
P153	Positioning approach difference	0~32767	50	pulse	P
P154	Arrival speed	-5000~5000	500	r/min	ALL
P155	Arrival speed difference	0~5000	30	r/min	ALL
P156	Polarity of arrival speed	0~1	0		ALL
P157	Reach torque	-300~300	100	%	ALL
P158	Reached torque difference	0~300	5	%	ALL
P159	Reached torque polarity	0~1	0		ALL
P160	Zero speed detection point	0~1000	10	r/min	ALL
P161	Zero speed detection hysteresis	0~1000	5	r/min	ALL
P162	Zero-speed clamp mode	0~1	0		S
P164	Emergency stop method	0~1	0		P
P165	Motor static speed detection point	0~1000	5	r/min	ALL
P166	Electromagnetic brake delay time when the motor is stationary	0~5000	500	ms	ALL
P167	Electromagnetic brake waiting time when the motor is running	0~5000	500	ms	ALL
P168	Action speed of electromagnetic brake when motor is running	0~3000	100	r/min	ALL
P169	Delay time of electromagnetic brake opening	0~5000	500	ms	ALL

5.1.3 2 Segment parameters (partial)

Parameter	Name	Parameter range	Default value	Unit	Suitable
P201	Number of motor pole pairs	1~50	4		ALL
P204	Motor rated current	1~4000	60	0.1A	ALL
P207	Motor rated speed	1~30000	2500	r/min	ALL

5.2 DI function list

No.	Symbol	DI function	No.	Symbol	DI function
0	NULL	No function	14	TRQ2	Internal torque selection 2
1	SON	Servo enable	15	EMG	Emergency shutdown
2	ARST	Alarm clear	16	CMODE	Control mode switching
3	CCWL	Forward drive prohibited	17	GAIN	Gain switching

No.	Symbol	DI function	No.	Symbol	DI function
4	CWL	Reverse drive prohibited	18	GEAR1	Electronic gear selection 1
5	TCCW	Forward torque limit	19	GEAR2	Electronic gear selection 2
6	TCW	Reverse torque limit	20	CLE	Position deviation clear
7	ZCLAMP	Zero speed clamp	21	INH	Pulse input prohibited
8	CZERO	Zero instruction			
9	CINV	Inverted instruction	23	CCW	Forward running (start)
10	SP1	Internal speed selection 1	24	CW	Reverse operation
11	SP2	Internal speed selection 2			
12	SP3	Internal speed selection 3			
13	TRQ1	Internal torque selection 1			

5.3 List of DO functions

No.	Symbol	DO function	No.	Symbol	DO function
0	OFF	Has been invalid	8	BRK	Electromagnetic brake
1	ON	Always effective	9	RUN	Servo running
2	SRDY	Servo ready	10	NEAR	Positioning close
3	ALM	Call the police	11	TRQL	Torque limit
4	ZSP	Zero speed	12	SPL	Speed limit
5	COIN	Positioning completed	14	PtoS	Position/speed mode switching completed
6	ASP	Speed reached	15	PtoT	Position/torque mode switching completed
7	ATRQ	Torque reached	16	StoT	Speed/torque mode switching completed
			20	DO3_ZOUT	Zero return Z signal output (only DO3 supports this function)

5.4 Detailed explanation of parameters

5.4.1 0 Segment parameters

P000	Operation password	Scope	Default value	Unit	Suitable
		0~9999	315		ALL

- Hierarchical management of parameters can ensure that the parameters will not be modified by mistake.
- Some special operations need to set a proper password.
- P-001 drive code, P-002 motor code, P-099 motor series code, P-000 must be set to 385 (or 316) when modifying, otherwise the modification will be invalid

P001	Drive code	Scope	Default value	Unit	Suitable
		*	*		ALL

- The drive model currently in use. The factory has been set up and cannot be modified by the user.
- 1: L20(220V, 0.75kW) 2: L30(220V, 1.5kW)、3: L40 (220V, 2.5kW)

P002	Motor code	Scope	Default value	Unit	Suitable
		*	*		ALL

- The currently used motor model, please set according to the actual motor model used.
- Refer to the motor adaptation table in Chapter 7.2 for the meaning of the parameters.
- When changing different types of motors, this parameter needs to be modified. For specific operations, please refer to chapter 3.7.

P003	Software version	Scope	Default value	Unit	Suitable
		*	*		ALL

- The software version number cannot be modified.

P004	Control method	Scope	Default value	Unit	Suitable
		0~8	0		ALL

- Parameter meaning:
0: Position control mode; 1: Speed control mode; 2: Torque control mode
3: Position/speed mode; 4: Position/torque mode; 5: Speed/torque mode;
- When set to 3, 4, 5, the specific control mode is determined by the CMODE input by DI:

P004	CMODE[Note]	Control method
3	0	Position control
	1	speed control
4	0	Position control
	1	Torque control
5	0	speed control
	1	Torque control

Note: 0 means OFF, 1 means ON.

P005	1st speed loop gain	Scope	Default value	Unit	Suitable
		1~3000	50	Hz	P,S

- The proportional gain of the speed regulator, increasing the parameter value, can speed up the speed response, and if it is too large, it is easy to cause vibration and noise.
- If P017 (inertia ratio) is set correctly, the parameter value is equal to the speed response bandwidth.

P006	1st speed loop integral time constant	Scope	Default value	Unit	Suitable
		1~1000	20	ms	P,S

- The integral time constant of the speed regulator, reducing the parameter value can reduce the speed control error and increase the rigidity. If it is too small, it is easy to cause vibration and noise.
- Set to the maximum value (1000) to cancel the integration, and the speed regulator is the P controller.

P007	1st torque filter time constant	Scope	Default value	Unit	Suitable
		1~500	35	0.1ms	ALL

- Torque low-pass filter can suppress mechanical vibration.
- The larger the value, the better the vibration suppression effect. If it is too large, the response will become slower and may cause oscillation; the smaller the value, the faster the response will be, but it is limited by mechanical conditions.
- When the load inertia is small, a smaller value can be set, and when the load inertia is large, a larger value can be set.

P009	1st position loop gain	Scope	Default value	Unit	Suitable
		1~1000	40	1/s	P

- Proportional gain of the position regulator; increasing the parameter value can reduce the position tracking error and improve the response. If it is too large, it may cause overshoot or oscillation.

P019	Speed detection filter time constant	Scope	Default value	Unit	Suitable
		5~500	35	0.1ms	P,S

- The larger the parameter value, the smoother the detection, the smaller the parameter value, the faster the detection response, too small may cause noise; too large may cause oscillation.

P021	Position loop feed-forward gain	Scope	Default value	Unit	Suitable
		0~100	0	%	P

- Feed forward can reduce the position tracking error in position control. When it is set to 100, the position tracking error is always 0 under the command pulse of any frequency.

- Increasing the parameter value improves the response of the position control. If the parameter value is too large, the system becomes unstable and easy to produce oscillation.

P022	Position loop feed-forward filter time constant	Scope	Default value	Unit	Suitable
		2~500	10	0.1ms	P

- Filtering the feed-forward quantity of the position loop is used to increase the stability of the feed-forward control.

P025	Speed command source	Scope	Default value	Unit	Suitable
		0~5	0		S

- During speed control, set the source of speed command.
- Parameter meaning:
 0: Analog quantity speed 1: Internal multi-stage speed <8 optional P137~P144>
 2: Analog quantity + internal multi-stage speed
 3: Pulse speed/internal test speed <P-020>

The specific meaning is as follows:

- 0: Analog speed command, input by analog ports AS+ and AS-.
- 1: Internal speed command, determined by SP1, SP2, and SP3 input by DI:

DI signal [Note]			Speed command
SP3	SP2	SP1	
0	0	0	Internal speed 1 (parameter P138)
0	0	1	Internal speed 2 (parameter P139)
0	1	0	Internal speed 3 (parameter P140)
0	1	1	Internal speed 4 (parameter P141)
1	0	0	Internal speed 5 (parameter P142)
1	0	1	Internal speed 6 (parameter P143)
1	1	0	Internal speed 7 (parameter P144)
1	1	1	Internal speed 8 (parameter P145)

Note: 0 means OFF, 1 means ON.

- 2: Analog speed command + internal speed command:

DI signal [Note]			Speed command
SP3	SP2	SP1	
0	0	0	Analog speed command
0	0	1	Internal speed 2 (parameter P138)
0	1	0	Internal speed 3 (parameter P139)
0	1	1	Internal speed 4 (parameter P140)
1	0	0	Internal speed 5 (parameter P141)
1	0	1	Internal speed 6 (parameter P142)
1	1	0	Internal speed 7 (parameter P143)

1	1	1	Internal speed 8 (parameter P144)
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Note: 0 means OFF, 1 means ON.

P026	Torque command source	Scope	Default value	Unit	Suitable
		0~2	0		T

- During torque control, set the source of torque command.
- Parameter meaning:
 - 0: Analog torque command, input by analog ports AS+ and AS-.
 - 1: Internal torque command, determined by TRQ1 and TRQ2 input by DI:

DI signal [Note]		Torque command
TRQ2	TRQ1	
0	0	Internal torque 1 (parameter P145)
0	1	Internal torque 2 (parameter P146)
1	0	Internal torque 3 (parameter P147)
1	1	Internal torque 4 (parameter P148)

Note: 0 means OFF, 1 means ON.

2: Analog torque command + internal torque command;

DI signal [Note]		Torque command
TRQ2	TRQ1	
0	0	Analog torque command
0	1	Internal torque 2 (parameter P146)
1	0	Internal torque 3 (parameter P147)
1	1	Internal torque 4 (parameter P148)

Note: 0 means OFF, 1 means ON.

P029	Position command pulse electronic gear 1st numerator	Scope	Default value	Unit	Suitable
		1~32767	1		P

P030	Position command pulse electronic gear denominator	Scope	Default value	Unit	Suitable
		1~32767	1		P

- It is used to divide or multiply the frequency of the input pulse, which can be easily matched with various pulse sources to achieve the pulse resolution required by the user.
- The numerator N of the command pulse electronic gear is set by parameter P029, and the denominator M is set by parameter P030.
- The input pulse command is changed by N/M to obtain the position command.

P031	Position command pulse electronic gear 2nd numerator	Scope	Default value	Unit	Suitable
		1~32767	1		P

- Refer to the description of parameters P029 and P030.

P032	Position command pulse electronic gear 3rd numerator	Scope	Default value	Unit	Suitable
		1~32767	1		P

- Refer to the description of parameters P029 and P030.

P033	Position command pulse electronic gear 4th numerator	scope	Default value	Unit	Suitable
		1~32767	1		P

- Refer to the description of parameters P029 and P030.

P034	Position command control word	Scope	Default value	Unit	Suitable
		0~11111	0		S

- Set the source of position instruction and dynamic electronic gear application mode when set position control.

- Parameter meaning:

Ten digits: set position command

0: External pulse 1: Internal digital quantity

One digit: Set the dynamic electronic gear application mode (see the description in chapter 4.2.3 for details)

0: Prohibit the use of dynamic electronic gear ratio switching, the command pulse electronic gear numerator is set by P029

1: Allow the use of dynamic electronic gear ratio switching, and the command pulse electronic gear numerator is determined by GEAR1 which input by DI.

2: Dynamic electronic gear ratio switching is allowed, and the command pulse electronic gear numerator is determined by GEAR1 and GEAR2 which input by DI.

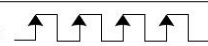

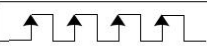
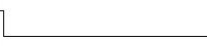
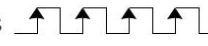

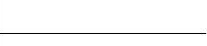

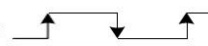
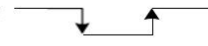


P035	Position command pulse input method	Scope	Default value	Unit	Suitable
		0~2	0		P

- Set the command pulse input mode, parameter meaning:

0: pulse + direction

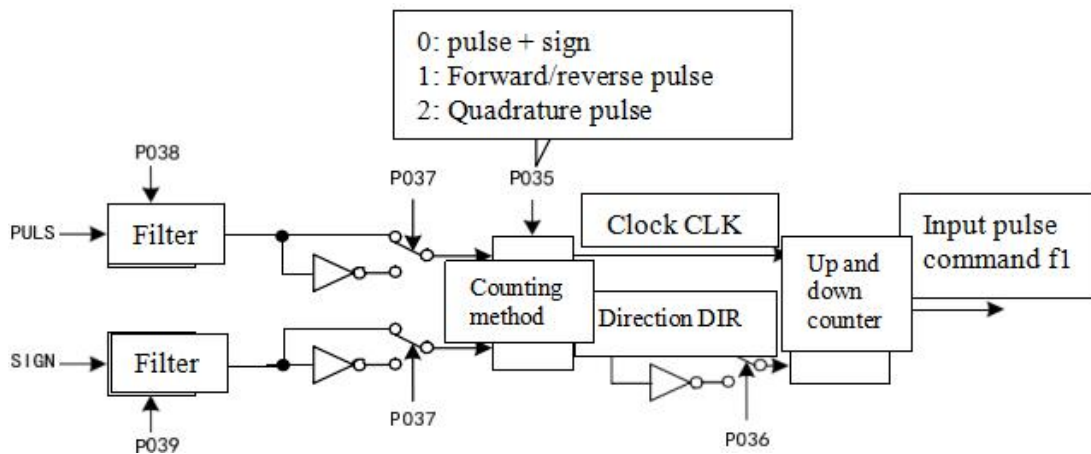
1: Forward/reverse pulse

2: Quadrature pulse

Pulse command form	Forward rotation (CCW)	Reverse (CW)	Parameter PO35
Pulse + direction	PULS  SIGN 	PULS  SIGN 	0
Forward/reverse pulse	PULS  SIGN 	PULS  SIGN 	1
Quadrature pulse	PULS  SIGN 	PULS  SIGN 	2

Note: The arrow indicates the counting edge, and the parameter is set to P036=0,P037=0.

● Block diagram of command pulse input



- After the parameter is modified, it must be saved and it will be effective after power-on again.

P036	Position command pulse input direction	Scope	Default value	Unit	Suitable
		0~1	0		P

- Parameter meaning:
0: Normal direction 1: Reverse direction

P037	Position command pulse input signal logic	scope	Default value	Unit	Suitable
		0~3	0		P

- Set the pulse input signal PULS and SIGN signal phase to adjust the counting edge and counting direction.

P037	PULS signal phase	SIGN signal phase
0	In phase	In phase
1	Inverted	In phase
2	In phase	Inverted
3	Inverted	Inverted

- After the parameter is modified, it must be saved and it will be effective after power-on again.

P038	Position command pulse signal filter coefficient	Scope	Default value	Unit	Suitable
		0~3	0		P

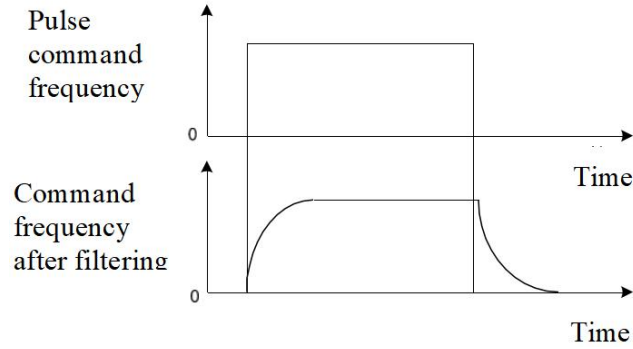
- Perform digital filtering on the pulse input signal PULS. The greater the value, the greater the filtering time constant.
- The maximum pulse input frequency is 500kHz (kpps) at the default value. The larger the value, the maximum pulse input frequency will decrease accordingly.
- It is used to filter the noise on the signal line to avoid counting errors. If there is a phenomenon of inaccuracy caused by inaccurate counting, the parameter value can be increased appropriately.
- The timing of pulse and direction signal can be adjusted ahead or lagging behind.
- After the parameter is modified, it must be saved and it will be valid after power-on again.

P039	Position command direction signal filter coefficient	Scope	Default value	Unit	Suitable
		0~3	0		P

- Perform digital filtering on the pulse direction signal SIGN. The larger the value, the larger the filtering time constant.
- After the parameter is modified, it must be saved and it will be valid after power-on again.
- The timing of pulse and direction signal can be adjusted ahead or lagging behind.
- After the parameter is modified, it must be saved and it will be valid after power-on again.

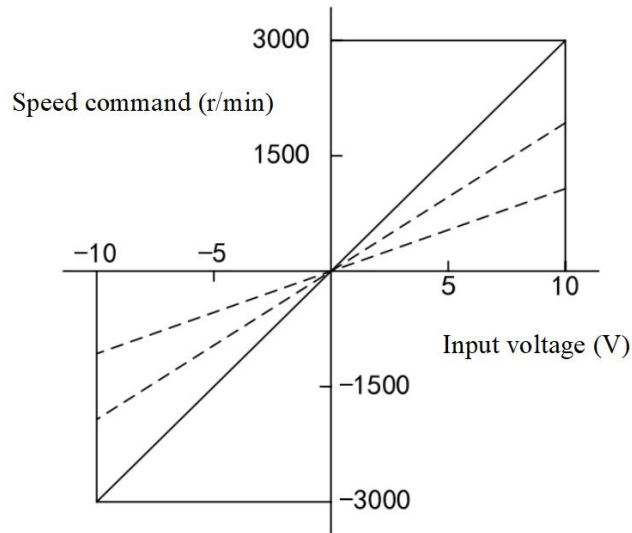
P040	Position command exponential smoothing filter time	Scope	Default value	Unit	Suitable
		0~10000	0	0.1ms	P

- Smooth filtering of command pulses, with exponential acceleration and deceleration. The filter will not lose input pulses, but there will be command delays. When set to 0, the filter will not work.
- This filter is used for:
 1. The upper controller has no acceleration/deceleration function.
 2. The electronic gear is relatively large ($N/M > 10$).
 3. The command frequency is low.
 4. When the motor is running, step jumps and unevenness occur.



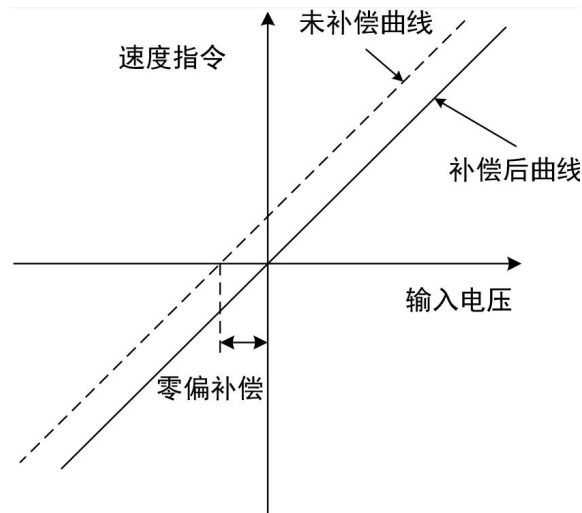
P046	Analog speed command gain	Scope	Default value	Unit	Suitable
		10~3000	300	r/min/V	S

- Set the proportional relationship between the analog speed input voltage and the actual running speed of the motor.
- The analog input range is -10V~10V.



P047	Analog speed command zero offset compensation	Scope	Default value	Unit	Suitable
		-15000~15000	0	0.1mv	S

- The zero offset compensation value of analog speed input, the actual speed command is the input analog value minus this parameter value.
- The analog automatic zero adjustment function can be used. This parameter is automatically set. Refer to Chapter 3.6.2.



P048	Analog speed command direction	Scope	Default value	Unit	Suitable
		0~1	0		S

● Parameter meaning:

P048	Positive polarity (positive voltage) analog input	Negative polarity (negative voltage) analog input
0	Forward rotation (CCW) speed command	Reverse (CW) speed command
1	Reverse (CW) speed command	Forward rotation (CCW) speed command

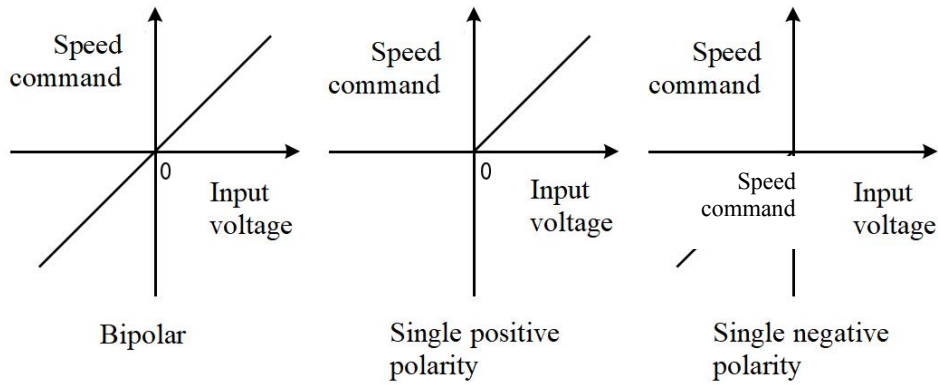
P049	Analog speed command filter time constant	Scope	Default value	Unit	Suitable
		2~500	20	0.1ms	S

- Low-pass filter for analog speed input.
- The larger the setting, the slower the response speed of the input analog quantity, which is beneficial to reduce the interference of high-frequency noise; the smaller the setting, the faster the response speed, but the high-frequency noise interference is greater.

P050	Analog speed command polarity	Scope	Default value	Unit	Suitable
		0~2	0		S

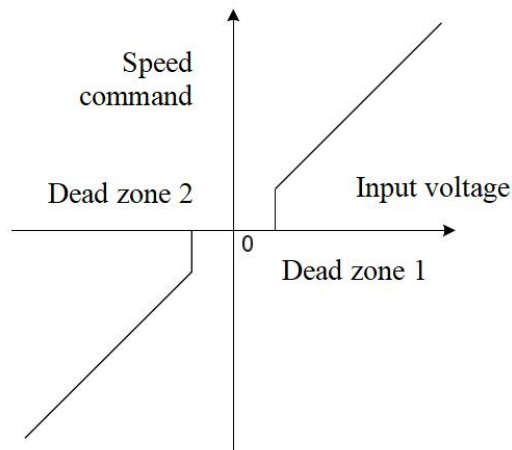
● Parameter meaning:

- 0: Bipolar.
- 1: Single positive polarity. The input positive polarity is valid, and the negative polarity is forced to 0.
- 2: Single negative polarity. Input negative polarity is valid, when positive polarity is forced to 0.



P051	Analog speed command dead zone 1	Scope	Default value	Unit	Suitable
		0~13000	0	mv	S

- The command is forced to 0 when the input voltage is between dead zone 2 (parameter P052) and dead zone 1 (parameter P051).

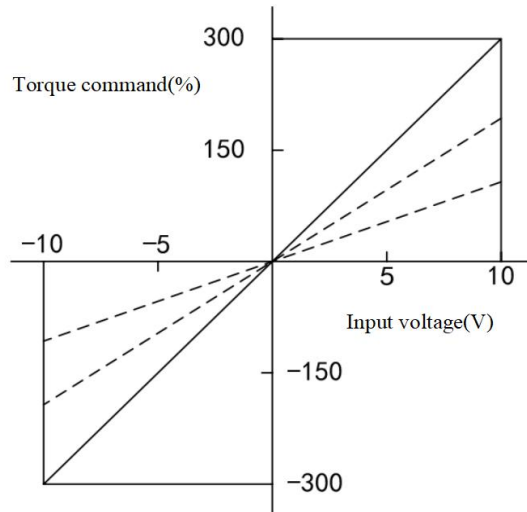


P052	Analog speed command dead zone 2	Scope	Default value	Unit	Suitable
		-13000~0	0	mv	S

- Refer to the description of parameter P051.

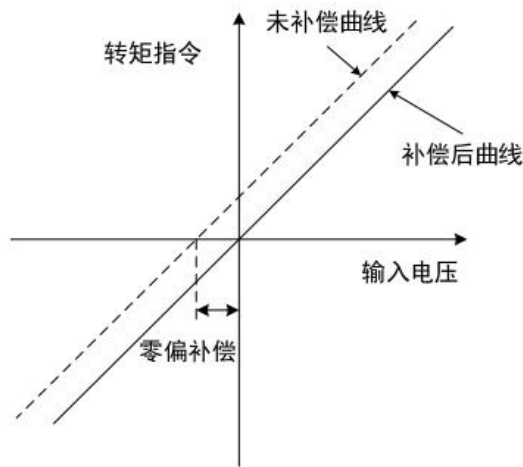
P053	Analog torque command gain	Scope	Default value	Unit	Suitable
		1~300	30	%/V	T

- Set the proportional relationship between the analog torque input voltage and the actual running torque of the motor. The unit of the set value is the rated torque 1%/V;
- The analog input range is -10V~10V.



P054	Analog torque command zero offset compensation	Scope	Default value	Unit	Suitable
		-1500~1500	0	mv	T

- The zero offset compensation value of analog torque input. The actual torque command is the input analog value minus the value of this parameter.
- The analog automatic zero adjustment function can be used. This parameter is automatically set. Refer to Chapter 3.6.2.



P055	Analog torque command direction	Scope	Default value	Unit	Suitable
		0~1	0		T

- Parameter meaning:

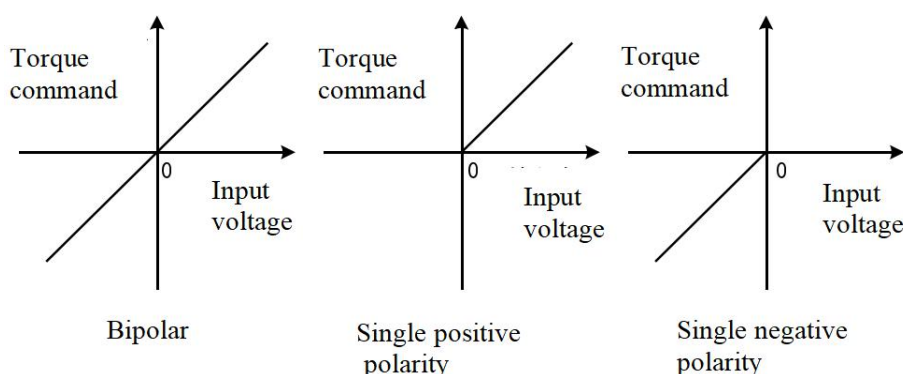
P055	Positive polarity (positive voltage) analog input	Negative polarity (negative voltage) analog input
0	Forward rotation (CCW) torque command	Reverse (CW) torque command
1	Reverse (CW) torque command	Forward rotation (CCW) torque command

P056	Analog torque command filter time constant	Scope	Default value	Unit	Suitable
		2~500	20	0.1ms	T

- Low-pass filter coefficient of analog torque input.
- The larger the setting, the slower the response speed of the input analog quantity, which is beneficial to reduce the interference of high-frequency noise; the smaller the setting, the faster the response speed, but the high-frequency noise interference is greater.

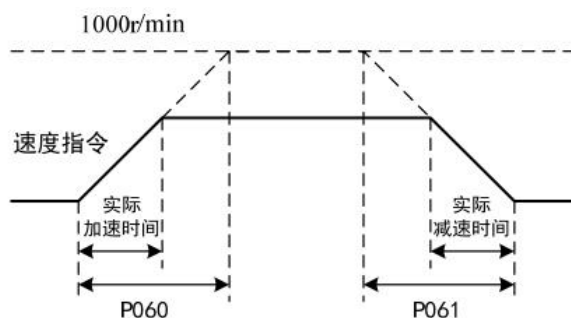
P057	Analog torque command polarity	Scope	Default value	Unit	Suitable
		0~2	0		T

- Parameter meaning:
 - 0: Bipolar.
 - 1: Single positive polarity. The input positive polarity is valid, and the negative polarity is forced to 0.
 - 2: Single negative polarity. Input negative polarity is valid, when positive polarity is forced to 0.



P060	Speed command acceleration time	Scope	Default value	Unit	Suitable
		0~10000	100	ms	S

- Set the acceleration time of the motor from zero speed to 1000r/min.
- Only used for speed control mode, position control mode is invalid.
- If it is used in speed control mode and forms a position control closed loop with the host computer, this parameter should be set to 0.



P061	Speed command deceleration time	Scope	Default value	Unit	Suitable
		0~10000	100	ms	S

- Set the deceleration time of the motor from 1000r/min to zero speed.
- Only used for speed control mode, position control mode is invalid.
- If it is used in speed control mode and forms a position control closed loop with the host computer, this parameter should be set to 0.

P063	EMG (emergency stop)/ALM deceleration time	Scope	Default value	Unit	Suitable
		0~10000	1000	ms	ALL

- It works when the EMG (emergency stop) mode is deceleration to stop (P-164 is set to 1).
- It will work when the stop mode is deceleration stop (P-136 is set to 1) when the alarm occurs.
- Set the deceleration time of the motor from 1000r/min to zero speed when EMG (emergency stop) or alarm occurs, and the deceleration curve is linear.

P064	Torque limit selection	Scope	Default value	Unit	Suitable
		0~2	0		ALL

- Set the torque limit mode:

P064	Instruction	Forward rotation (CCW)	Reverse (CW)
0	Basic restrictions	Determined by DI input TCCW: TCCW=OFF: parameter P065 TCCW=ON: parameter P067	Determined by DI input TCW: TCW=OFF: parameter P066 TCW=ON: parameter P068
1	Basic limit + analog limit	In addition to the basic limit, it is also limited by the analog torque command (this limit is not Sub-direction).	
2	Basic limit + internal torque limit	In addition to the basic limit, it is also limited by the internal torque command (this limit does not distinguish the direction). The internal torque command is input by DI input TRQ1, TRQ2 Decide.	

- Note: 1. If multiple restrictions occur, the final limit value is the smaller absolute value.
2. The restrictions of P065 and P066 are valid at all times.
3. Even if the set value exceeds the maximum torque allowed by the system, the actual torque will be limited within the maximum torque.

P065	Internal forward rotation (CCW) torque limit	Scope	Default value	Unit	Suitable
		0~300	300	%	ALL

- Set the internal torque limit value in the CCW direction of the motor.
- This restriction is effective at any time.

- If the set value exceeds the maximum overload capacity allowed by the system, the actual limit is the maximum overload capacity allowed by the system.

P066	Internal reverse (CW) torque limit	Scope	Default value	Unit	Suitable
		-300~0	-300	%	ALL

- Set the internal torque limit value in the CW direction of the motor.
- This restriction is effective at any time.
- If the set value exceeds the maximum overload capacity allowed by the system, the actual limit is the maximum overload capacity allowed by the system.

P067	External forward rotation (CCW) torque limit	Scope	Default value	Unit	Suitable
		0~300	100	%	ALL

- Set the external torque limit value in the CCW direction of the servo motor.
- This limit is valid only when TCCW (forward torque limit) of DI input is ON.
- When the limit is valid, the actual torque limit is the minimum of the maximum overload capacity allowed by the system, the internal forward torque limit, and the external forward torque limit.

P068	External reverse (CW) torque limit	Scope	Default value	Unit	Suitable
		-300~0	-100	%	ALL

- Set the external torque limit value in the CW direction of the servo motor.
- This limit is valid only when TCW (reverse torque limit) of DI input is ON.
- When the limit is valid, the actual torque limit is the smallest absolute value among the maximum overload capacity allowed by the system, the internal reverse torque limit, and the external reverse torque limit.

P069	Trial run torque limit	Scope	Default value	Unit	Suitable
		0~300	100	%	ALL

- Set the torque limit value in trial operation mode (speed JOG operation, keyboard speed regulation, demonstration mode).
- Regardless of the direction of rotation, both forward and reverse rotation are restricted.
- The internal and external torque limits are still valid.

P070	Forward rotation (CCW) torque overload alarm level	Scope	Default value	Unit	Suitable
		0~300	140	%	ALL

- Set the torque overload value of the forward rotation (CCW), which is a percentage of the rated torque.
- When the forward torque of the motor exceeds P070 and the duration is longer than P072, the drive alarms, the alarm number is Err-29, and the

motor stops.

P071	Reverse (CW) torque overload alarm level	Scope	Default value	Unit	Suitable
		-300~0	-140	%	ALL

- Set the reverse torque (CW) torque overload value, which is a percentage of the rated torque.
- When the motor reverse torque exceeds P071 and the duration is longer than P072, the drive alarms, the alarm number is Err-29 and the motor stops.

P072	Torque overload alarm detection time	Scope	Default value	Unit	Suitable
		1~30000	1000	ms	ALL

- Refer to the description of parameters P070 and P071.

P075	Maximum speed limit	Scope	Default value	Unit	Suitable
		0~6000	3500	r/min	ALL

- Set the allowable maximum speed limit of the servo motor.
- It has nothing to do with the direction of rotation.
- If the set value exceeds the maximum speed allowed by the system, the actual speed will also be limited within the maximum speed.

P076	JOG running speed	Scope	Default value	Unit	Suitable
		0~5000	100	r/min	S

- Set the running speed of JOG operation.

P077	Speed limit selection	scope	Default value	Unit	Suitable
		0~2	0		T

- Set the speed limit mode during torque control, the speed limit does not distinguish the direction.

P077	Instruction	Explain
0	Basic restrictions	Limited by parameter P078.
1	Basic limit + analog limit	In addition to the basic restrictions, it is also restricted by the analog speed command.
2	Basic limit + internal speed limit	In addition to the basic limitation, it is also limited by the internal speed command. The internal speed command is determined by the DI input SP1, SP2, SP3, refer to the DI description.

Note: 1. If multiple restrictions occur, the final limit value is the smaller absolute value. Even if the set value exceeds the maximum speed allowed by the system, the actual speed will be limited within the maximum speed.

P078	Speed limit during torque control	Scope	Default value	Unit	Suitable
		0~5000	1000	r/min	T

- In torque control, the motor running speed is limited within this parameter.
- It can prevent over-speeding at light load.
- When over-speed occurs, the speed negative feedback is connected to reduce the actual torque, but the actual speed will be slightly higher than the speed limit value.

P079	Speed limit error during torque control	Scope	Default value	Unit	Suitable
		1~5000	100	r/min	T

- When over-speed occurs, this parameter can adjust the negative feedback of speed.
- The smaller the parameter value, the larger the negative feedback amount, the steeper the speed limit curve, and the smaller the over-speed amount, but too small a value may cause vibrate.

P080	Position tolerance detection	Scope	Default value	Unit	Suitable
		0~32767	400	0.01 circle	P

- Set the detection range of position out-of-tolerance alarm.
- In the position control mode, when the count value of the position deviation counter exceeds the pulse corresponding to this parameter value, the servo drive will give a position out of tolerance alarm (Err 4).
- The unit is circle, multiply by the encoder's resolution per circle to get the number of pulses. If a 2500 line encoder is used, the resolution per revolution of the encoder is 10000. When the parameter value is 400, it corresponds to 40,000 encoder pulses.

P081	First encoder type selection	Scope	Default value	Unit	Suitable
		0~1	0		ALL

- Set the type of motor encoder;
- Parameter meaning: 0: Non-saving-line photoelectric encoder; 1: Saving-line photoelectric encoder.

P082	Number of first encoder lines	Scope	Default value	Unit	Suitable
		1~32767	2500	pulse	ALL

- Set the line number of the motor encoder, the default setting is 2500 line photoelectric encoder;
- If it is an incremental encoder, the number of pulses per revolution ppr = the number of lines of the motor encoder * 4.

P084	The first encoder control parameter	Scope	Default value	Unit	Suitable
		0~11111	0		ALL

- Set the polarity of the motor encoder A/B signal:
0: A/B is not inverted 1: A/B is inverted

P097	Positive and negative limit use mode / positive and negative control	Scope	Default value	Unit	Suitable
		0~33	33		ALL

- Forward rotation drive prohibition (CCWL) and reverse rotation drive prohibition (CWL) in **DI** input are used for limit travel protection. Normally closed switch is used. When the input is ON, the motor can run in this direction, and when it is OFF, it cannot run in this direction. . If the limit travel protection is not used, it can be ignored by this parameter, so that it can run without connecting the drive prohibition signal.
- The default value is to ignore the drive prohibition. If you need to use the drive prohibition function, please modify this value first.
- **The meaning of the one-digit parameter:**

P097 One digit	Reverse drive prohibited (CWL)	Forward rotation prohibited (CCWL)
0	use	use
1	use	neglect
2	neglect	use
3	neglect	neglect

Use: When the input signal is ON, the motor can run in this direction; when the input signal is OFF, the motor cannot run in this direction.

Neglect: The motor can run in this direction, and the drive prohibition signal has no effect, so this signal may not be connected.

- **The ten-digit digital parameter meaning: in speed control mode, it can be used with analog speed command**

P097 Ten digits	Forward signal usage mode (Analog speed command)	Inverted signal usage mode (Analog speed command)
0	Use	Use
1	Use	Not use
2	Not use	Use
3	Not use	Not use

Use: The value of the speed command is given by the 0~10V analog , and the direction is determined by the forward and reverse input points.

Not use: The value and direction of the speed command are given by the -10V~10V analog , and the forward and reverse input points have no effect.

P098	Forced enable	Scope	Default value	Unit	Suitable
		0~1	0		ALL

- Parameter meaning
 - 0: Enable is controlled by SON which input by DI;
 - 1: Software is forcibly enabled.

P099	Motor series code	Scope	Default value	Unit	Suitable
		0~15	0		ALL

- Set the motor series, different series of motor power line UVW phase sequence may be different, encoder AB signal polarity, encoder installation offset angle may also be different;
- Wrong setting may cause the motor to stall or runaway! Therefore, the user must ensure the correctness of this parameter before using the driver!
- Parameter meaning
 - For specific setting instructions, see Chapter 7 Motor Matching Table.

5.4.2 1 Segment parameters

P100	Digital input DI1 function	Scope	Default value	Unit	Suitable
		-21~21	1		ALL

- Digital input DI1 function planning, the absolute value of the parameter indicates the function, and the symbol indicates the logic. For the function, please refer to chapter 5.5.
- Symbols indicate input logic, positive numbers indicate positive logic, negative numbers indicate negative logic, ON is valid, OFF is invalid:

Parameter value	DI input signal	DI result
positive number	open circuit	OFF
	Conduction	ON
negative number	open circuit	ON
	Conduction	OFF

- When multiple input channels have the same function selection, the function result is a logical OR relationship. For example, if both P100 and P101 are set to 1 (SON function), when either DI1 or DI2 is ON, SON is valid.

- The input function that is not selected by the parameters P100~P104, that is, the unplanned function, will result in OFF (invalid). But there are exceptions. Setting parameters P120~P124 can force the input function to ON (valid), regardless of whether the function is planned or not.

P101	Digital input DI2 function	Scope	Default value	Unit	Suitable
		-21~21	2		ALL

- Digital input DI2 function planning, refer to the description of parameter P100.

P102	Digital input DI3 function	Scope	Default value	Unit	Suitable
		-21~21	3		ALL

- Digital input DI3 function planning, refer to the description of parameter P100.

P103	Digital input DI4 function	Scope	Default value	Unit	Suitable
		-21~21	4		ALL

- Function planning of digital input DI4, refer to the description of parameter P100.

P104	Digital input DI5 function	Scope	Default value	Unit	Suitable
		-21~21	20		ALL

- Digital input DI5 function planning, refer to the description of parameter P100.

P105	Digital input DI6 function	Scope	Default value	Unit	Suitable
		-21~21	21		ALL

- Function planning of digital input DI6, refer to the description of parameter P100.

P108	Digital output DO1 function	Scope	Default value	Unit	Suitable
		-12~12	2		ALL

- Digital output DO1 function planning, the absolute value of the parameter indicates the function, and the symbol indicates the logic. For the function, please refer to Chapter 5.6.
- 0 means forced OFF, 1 means forced ON.
- The symbol represents output logic, a positive number represents positive logic, and a negative number represents negative logic:

Parameter value	Corresponding function	DO output signal
Positive number	ON	Conduction
	OFF	end
negative number	ON	end
	OFF	Conduction

P109	Digital output DO2 function	Scope	Default value	Unit	Suitable
		-12~12	3		ALL

- Digital output DO2 function plan, refer to the description of parameter P108.

P110	Digital output DO3 function	Scope	Default value	Unit	Suitable
		-12~12	5		ALL

- Digital output DO3 function plan, refer to the description of parameter P108.

P111	Digital output DO4 function	Scope	Default value	Unit	Suitable
		-12~12	8		ALL

- Digital output DO4 function plan, refer to the description of parameter P108.

P120	Digital input DI is forced to be valid 1	Scope	Default value	Unit	Suitable
		00000~11111	00000		ALL

- The corresponding function is represented by 5-digit decimal:

Digit	Dec5	Dec4	Dec3	Dec2	Dec1
Corresponding function	CWL	CCWL	ACLR	SON	NULL

- The function used to force the DI input is valid. If the corresponding function bit is set to 1, the function is forced ON (valid).
- Refer to section 5.5 for the meaning of **DI** symbols.
- Parameter meaning:

A bit in this parameter	Corresponding function [Note]	Functional result
0	Unplanned	OFF
	Planned	Determined by input signal
1	Not planned or planned	ON

Note: Planned refers to the function selected by parameters P100~P105.

Unplanned refers to the function not selected by parameters P100~P105.

P121	Digital input DI is forced to be valid 2	Scope	Default value	Unit	Suitable
		00000~11111	00000		ALL

- The corresponding function is represented by 5-digit decimal:

Digit	Dec5	Dec4	Dec3	Dec2	Dec1
Corresponding function	CINV	CZERO	ZCLAMP	TCW	TCCW

- Others reference to the description of parameter P120.

P122	Digital input DI is forcibly valid 3	Scope	Default value	Unit	Suitable
		00000~11111	00000		ALL

- Corresponding functions are represented by 5-digit decimal

Digit	Dec5	Dec4	Dec3	Dec2	Dec1
Corresponding function	TRQ2	TRQ1	SP3	SP2	SP1

- Others reference to the description of parameter P120.

P123	Digital input DI is forced to be valid 4	Scope	Default value	Unit	Suitable
		00000~11111	00000		ALL

- The corresponding function is represented by 5-digit decimal:

Digit	Dec5	Dec4	Dec3	Dec2	Dec1
Corresponding function	GEAR2	GEAR1	GAIN	CMODE	EMG

- Others reference to the description of parameter P120.

P124	Digital input DI is forcibly valid 5	Scope	Default value	Unit	Suitable
		00000~11111	00000		ALL

- The corresponding function is represented by 5-digit decimal:

Digit	Dec5	Dec4	Dec3	Dec2	Dec1
Corresponding function			PC	INH	CLR

- Others reference to the description of parameter P120.

P125	Digital input DIx filter (DI1~DI6 share this filter parameter)	Scope	Default value	Unit	Suitable
		1~1000	5	ms	ALL

- **DI** input digital filter time constant.
- The smaller the parameter value, the faster the signal response speed; the larger the parameter value, the slower the signal response speed, but the stronger the ability to filter out noise.

P136	Enable off or stop mode when alarm occurs	Scope	Default value	Unit	Suitable
		0~1	0		P

- When the drive is enabled off or an alarm occurs, this parameter is used to set the stop mode.
- The meaning of the parameter is:
 - 0: The drive directly cuts off the motor current and the motor stops freely.
 - 1: The drive keeps the first enable state, controls the motor to decelerate to stop with the deceleration time defined by P063, and then closes the enable to cut off the motor current.

P137	Internal speed 1	Scope	Default value	Unit	Suitable
		-5000~5000	0	r/min	S

- Internal speed 1, refer to the description of parameter P025.

P138	Internal speed 2	Scope	Default value	Unit	Suitable
		-5000~5000	0	r/min	S

- Internal speed 2, refer to the description of parameter P025.

P139	Internal speed 3	Scope	Default value	Unit	Suitable
		-5000~5000	0	r/min	S

- Internal speed 3, refer to the description of parameter P025.

P140	Internal speed 4	Scope	Default value	Unit	Suitable
		-5000~5000	0	r/min	S

- Internal speed 4, refer to the description of parameter P025.

P141	Internal speed 5	Scope	Default value	Unit	Suitable
		-5000~5000	0	r/min	S

- Internal speed 5, refer to the description of parameter P025.

P142	Internal speed 6	Scope	Default value	Unit	Suitable
		-5000~5000	0	r/min	S

- Internal speed 6, refer to the description of parameter P025.

P143	Internal speed 7	Scope	Default value	Unit	Suitable
		-5000~5000	0	r/min	S

- Internal speed 7, refer to the description of parameter P025.

P144	Internal speed 8	Scope	Default value	Unit	Suitable
		-5000~5000	0	r/min	S

- Internal speed 8, refer to the description of parameter P025.

P145	Internal torque 1	Scope	Default value	Unit	Suitable
		-300~300	0	%	T

- Internal torque 1, refer to the description of parameter P026.

P146	Internal torque 2	Scope	Default value	Unit	Suitable
		-300~300	0	%	T

- Internal torque 2, refer to the description of parameter P026.

P147	Internal torque 3	Scope	Default value	Unit	Suitable
		-300~300	0	%	T

- Internal torque 3, refer to the description of parameter P026.

P148	Internal torque 4	Scope	Default value	Unit	Suitable
		-300~300	0	%	T

- Internal torque 4, refer to the description of parameter P026.

P150	Positioning completion range	Scope	Default value	Unit	Suitable
		0~32767	10	pulse	P

- Set the pulse range of positioning completion under position control. When the number of remaining pulses in the position deviation counter is less than or equal to the setting value of this parameter, the COIN of the digital output DO(Positioning completed) ON, otherwise OFF.
- The comparator has a hysteresis function, which is set by parameter P151.

P151	Positioning complete return difference	Scope	Default value	Unit	Suitable
		0~32767	5	pulse	P

- Refer to the description of parameter P150.

P152	Positioning proximity	Scope	Default value	Unit	Suitable
		0~32767	500	pulse	P

- Set the positioning approach pulse range under position control. When the number of remaining pulses in the position deviation counter is less than or equal to the setting value of this parameter, the NEAR of the digital output DO(Near positioning) ON, otherwise OFF.
- The comparator has the function of hysteresis, which is set by parameter P153.
- It is used to prepare for the next step when the host computer accepts the NEAR signal when the positioning is about to be completed. Generally, the parameter value is greater than P150.

P153	Positioning approach difference	Scope	Default value	Unit	Suitable
		0~32767	50	pulse	P

- Refer to the description of parameter P152.

P154	Arrival speed	Scope	Default value	Unit	Suitable
		-5000~5000	500	r/min	ALL

- When the motor speed exceeds this parameter, the ASP (speed reached) of the digital output DO is ON, otherwise it is OFF.
- The comparator has the function of hysteresis, which is set by parameter P155.
- Position setting function, controlled by parameter P156:

P156	P154	Comparators
0	>0	Speed regardless of direction
1	>0	Only detect forward speed
	<0	Only detect reverse speed

P155	Arrival speed difference	Scope	Default value	Unit	Suitable
		0~5000	30	r/min	ALL

- Refer to the description of parameter P154.

P156	Polarity of arrival speed	Scope	Default value	Unit	Suitable
		0~1	0		ALL

- Refer to the description of parameter P154.

P157	Reach torque	Scope	Default value	Unit	Suitable
		-300~300	100	%	ALL

- When the motor torque exceeds this parameter, the ATRQ (torque arrival) of the digital output DO is ON, otherwise it is OFF.
- The comparator has the function of hysteresis, which is set by parameter P158.
- Position setting function, controlled by parameter P159:

P159	P157	Comparators
0	>0	Torque regardless of direction
1	>0	Only detect forward torque
	<0	Only detect reverse torque

P158	Reached torque difference	Scope	Default value	Unit	Suitable
		0~300	5	%	ALL

- Refer to the description of parameter P157.

P159	Reached torque polarity	Scope	Default value	Unit	Suitable
		0~1	0		ALL

- Refer to the description of parameter P157.

P160	Zero speed detection point	Scope	Default value	Unit	Suitable
		0~1000	10	r/min	ALL

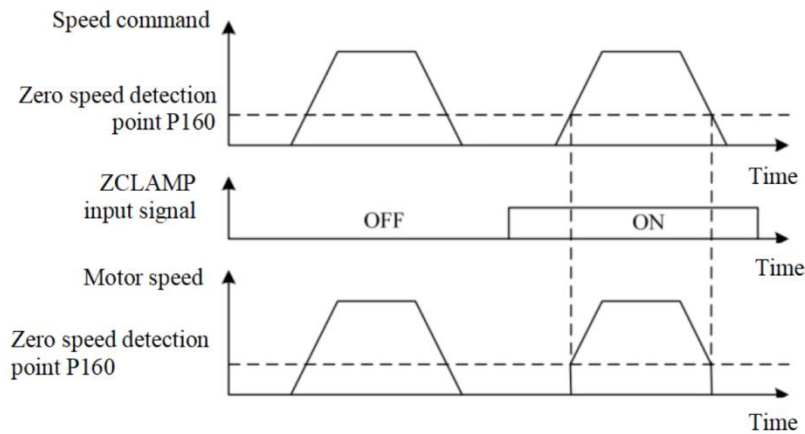
- When the motor speed is lower than this parameter, the ZSP (zero speed) of the digital output DO is ON, otherwise it is OFF.
- The comparator has the function of hysteresis, which is set by parameter P161.

P161	Zero speed detection hysteresis	Scope	Default value	Unit	Suitable
		0~1000	5	r/min	ALL

Refer to the description of parameter P160.

P162	Zero-speed clamp mode	Scope	Default value	Unit	Suitable
		0~1	0		S

- When the following conditions are met, the zero-speed clamp function is turned on:
 - Condition 1: Speed control mode
 - Condition 2: ZCLAMP (zero speed clamp) in DI is ON
 - Condition 3: Speed command is lower than parameter P160
- When any of the above conditions are not met, normal speed control is executed.
- When the zero-speed clamp function is turned on, the meaning of this parameter:
 - 0: The motor position is fixed at the moment when the function is turned on. At this time, the internal position control is connected, even if it rotates due to external force, it will return to the zero fixed point.
 - 1: The speed command is forced to zero speed when the function is turned on. The interior is still speed controlled and may rotate due to external forces.



P164	Emergency stop method	Scope	Default value	Unit	Suitable
		0~1	0		P

- When EMG (emergency stop) in the drive DI is ON, this parameter is used to set the stop mode.
- The meaning of the parameter is:
 - 0: The drive directly cuts off the motor current and the motor stops freely;
 - 1: The drive keeps the enabled state and controls the motor to decelerate to stop with the acceleration/deceleration time defined by P063.

P165	Motor static speed detection point	Scope	Default value	Unit	Suitable
		0~1000	5	r/min	ALL

- The motor is at a standstill detection, if the motor speed is lower than the parameter value, the motor is regarded as a standstill.
- Only used for timing judgment of electromagnetic brake.

P166	Electromagnetic brake delay time when the motor is stationary	Scope	Default value	Unit	Suitable
		0~5000	500	ms	ALL

- When the system changes from the enabled state to the disabled state or an alarm occurs, define the braking from the electromagnetic brake when the motor is stationary (DO output terminal BRK OFF) The delay time from when the motor current is cut off.
- This parameter is to make the brake reliably brake and then cut off the current to avoid the slight displacement of the motor or the drop of the workpiece. The parameter should not be less than the delay time of mechanical braking.
- Refer to section 4.7 for corresponding timing.

P167	Electromagnetic brake waiting time when the motor is running	Scope	Default value	Unit	Suitable
		0~5000	500	ms	ALL

- When the system changes from the enabled state to the disabled state or an alarm occurs, define the delay time from the motor current cut-off to the electromagnetic brake braking (DO output terminal BRK OFF) during the motor operation.
- This parameter is to make the motor decelerate from high-speed rotation to low-speed, and then let the brake brake to avoid damage to the brake;
- The actual action time is P167 or the time which the motor required to decelerate to the value of P168, taking the minimum of the two.
- Refer to section 4.7 for corresponding timing.

P168	Action speed of electromagnetic brake when motor is running	Scope	Default value	Unit	Suitable
		0~3000	100	r/min	ALL

- Refer to the description of parameter P167.

P169	Delay time of electromagnetic brake opening	scope	Default value	Unit	Suitable
		0~5000	500	r/min	ALL

- When the system changes from the disabled state to the enabled state, define the delay time from when the motor current is turned on to when the electromagnetic brake is released (DO output terminal BRK ON).
- Refer to section 4.7 for corresponding timing.

5.5 DI function detailed explanation

Special note: DI1~DI6 are programmable input ports, whose functions are configured by parameters P100~P105; DO1~DO4 are programmable output ports, whose functions are configured by parameters P108~P111; for parameter configuration, see 5.4.2 in Chapter 5 Section, the specific function description is as follows:

No.	Symbol	Function	Function explanation								
0	NULL	No function	The input status has no effect on the system.								
1	SON	Servo enable	OFF: The servo drive is not enabled, and the motor does not pass current; ON: The servo drive is enabled and the motor is current.								
2	ARST	Alarm clear	When there is an alarm, if the alarm is allowed to be cleared, the rising edge of the input (the moment from OFF to ON) is cleared. In addition to the alarm. Note that only some alarms can be cleared.								
3	CCWL	CCW drive prohibited	<p>OFF: prohibit forward (CCW) rotation; ON: allow forward (CCW) rotation.</p> <p>Used for mechanical limit travel protection, the function is controlled by parameter P097. Note that the default value of P097 is to ignore this function. If you need to use this function, you need to modify P097.</p> <table border="1"> <thead> <tr> <th>P097</th> <th>Instruction</th> </tr> </thead> <tbody> <tr> <td>0</td> <td rowspan="2">To use the CCW drive prohibition function, the normally closed contact of the travel switch must be connected.</td> </tr> <tr> <td>2</td> </tr> <tr> <td>1</td> <td rowspan="2">Ignore the CCW drive prohibition function, the motor can run in the CCW direction, this signal has no effect, and no need to connect.</td> </tr> <tr> <td>3 (default)</td> </tr> </tbody> </table>	P097	Instruction	0	To use the CCW drive prohibition function, the normally closed contact of the travel switch must be connected.	2	1	Ignore the CCW drive prohibition function, the motor can run in the CCW direction, this signal has no effect, and no need to connect.	3 (default)
P097	Instruction										
0	To use the CCW drive prohibition function, the normally closed contact of the travel switch must be connected.										
2											
1	Ignore the CCW drive prohibition function, the motor can run in the CCW direction, this signal has no effect, and no need to connect.										
3 (default)											
4	CWL	CW drive prohibited	<p>OFF: CW rotation is prohibited; ON: Allow CW rotation.</p> <p>Used for mechanical limit travel protection, the function is controlled by parameter P097. Note P097 default value is to ignore this function. If you need to use this function, you need to modify P097.</p> <table border="1"> <thead> <tr> <th>P097</th> <th>Instruction</th> </tr> </thead> <tbody> <tr> <td>0</td> <td rowspan="2">To use the CW drive prohibition function, the normally closed contact of the travel switch must be connected.</td> </tr> <tr> <td>1</td> </tr> <tr> <td>2</td> <td rowspan="2">Ignore the CW drive prohibition function, the motor can run in the CW direction, this signal has no effect, and no need to connect.</td> </tr> <tr> <td>3 (default)</td> </tr> </tbody> </table>	P097	Instruction	0	To use the CW drive prohibition function, the normally closed contact of the travel switch must be connected.	1	2	Ignore the CW drive prohibition function, the motor can run in the CW direction, this signal has no effect, and no need to connect.	3 (default)
P097	Instruction										
0	To use the CW drive prohibition function, the normally closed contact of the travel switch must be connected.										
1											
2	Ignore the CW drive prohibition function, the motor can run in the CW direction, this signal has no effect, and no need to connect.										
3 (default)											
5	TCCW	CCW torque limit	<p>OFF: CCW direction torque is not limited by P067 parameter; ON: CCW direction torque is limited by P067 parameter.</p> <p>Note that regardless of whether TCCW is valid or invalid, the CCW direction torque is also limited by parameter P065.</p>								

No.	Symbol	Function	Function explanation																																							
6	TCW	CW torque limit	OFF: CW direction torque is not limited by P068 parameter; ON: CW direction torque is limited by P068 parameter. Note that regardless of whether TCW is valid or invalid, the torque in the CW direction is still limited by parameter P066.																																							
7	ZCLAMP	Zero speed clamp	When the following conditions are met, the zero-speed clamp function is turned on: Condition 1: Speed control mode; Condition 2: ZCLAMP ON; Condition 3: The speed command is lower than the parameter P160. When any of the above conditions are not met, normal speed control is executed. Refer to the description of parameter P162 for specific application.																																							
8	CZERO	Zero instruction	Under speed or torque control, the speed or torque commands are respectively: OFF: normal command; ON: Zero command.																																							
9	CINV	Inverted instruction	Under speed or torque control, the speed or torque commands are respectively: OFF: normal command; ON: The instruction is reversed.																																							
10	SP1	Internal speed selection 1	For speed control and speed limit, the combination of SP1, SP2 and SP3 selects internal speed 1~8: <table border="1" style="margin-left: 20px;"> <thead> <tr> <th colspan="3">DI signal [Note]</th> <th rowspan="2">Speed command</th> </tr> <tr> <th>SP3</th> <th>SP2</th> <th>SP1</th> </tr> </thead> <tbody> <tr> <td>0</td> <td>0</td> <td>0</td> <td>Internal speed 1 (parameter P137)</td> </tr> <tr> <td>0</td> <td>0</td> <td>1</td> <td>Internal speed 2 (parameter P138)</td> </tr> <tr> <td>0</td> <td>1</td> <td>0</td> <td>Internal speed 3 (parameter P139)</td> </tr> <tr> <td>0</td> <td>1</td> <td>1</td> <td>Internal speed 4 (parameter P140)</td> </tr> <tr> <td>1</td> <td>0</td> <td>0</td> <td>Internal speed 5 (parameter P141)</td> </tr> <tr> <td>1</td> <td>0</td> <td>1</td> <td>Internal speed 6 (parameter P142)</td> </tr> <tr> <td>1</td> <td>1</td> <td>0</td> <td>Internal speed 7 (parameter P143)</td> </tr> <tr> <td>1</td> <td>1</td> <td>1</td> <td>Internal speed 8 (parameter P144)</td> </tr> </tbody> </table> Note: 0 means OFF, 1 means ON.	DI signal [Note]			Speed command	SP3	SP2	SP1	0	0	0	Internal speed 1 (parameter P137)	0	0	1	Internal speed 2 (parameter P138)	0	1	0	Internal speed 3 (parameter P139)	0	1	1	Internal speed 4 (parameter P140)	1	0	0	Internal speed 5 (parameter P141)	1	0	1	Internal speed 6 (parameter P142)	1	1	0	Internal speed 7 (parameter P143)	1	1	1	Internal speed 8 (parameter P144)
DI signal [Note]				Speed command																																						
SP3	SP2	SP1																																								
0	0	0		Internal speed 1 (parameter P137)																																						
0	0	1		Internal speed 2 (parameter P138)																																						
0	1	0		Internal speed 3 (parameter P139)																																						
0	1	1		Internal speed 4 (parameter P140)																																						
1	0	0		Internal speed 5 (parameter P141)																																						
1	0	1	Internal speed 6 (parameter P142)																																							
1	1	0	Internal speed 7 (parameter P143)																																							
1	1	1	Internal speed 8 (parameter P144)																																							
11	SP2	Internal speed selection 2																																								
12	SP3	Internal speed selection 3																																								

No.	Symbol	Function	Function explanation																		
13	TRQ1	Internal torque selection 1	For torque control and torque limit, the combination of TRQ1 and TRQ2 selects internal torque 1~4: <table border="1" style="margin: 10px auto;"> <thead> <tr> <th colspan="2">DI signal [Note]</th> <th rowspan="2">Torque command</th> </tr> <tr> <th>TRQ2</th> <th>TRQ1</th> </tr> </thead> <tbody> <tr> <td>0</td> <td>0</td> <td>Internal torque 1 (parameter P145)</td> </tr> <tr> <td>0</td> <td>1</td> <td>Internal torque 2 (parameter P146)</td> </tr> <tr> <td>1</td> <td>0</td> <td>Internal torque 3 (parameter P147)</td> </tr> <tr> <td>1</td> <td>1</td> <td>Internal torque 4 (parameter P148)</td> </tr> </tbody> </table> <p>Note: 0 means OFF, 1 means ON.</p>	DI signal [Note]		Torque command	TRQ2	TRQ1	0	0	Internal torque 1 (parameter P145)	0	1	Internal torque 2 (parameter P146)	1	0	Internal torque 3 (parameter P147)	1	1	Internal torque 4 (parameter P148)	
DI signal [Note]		Torque command																			
TRQ2	TRQ1																				
0	0	Internal torque 1 (parameter P145)																			
0	1	Internal torque 2 (parameter P146)																			
1	0	Internal torque 3 (parameter P147)																			
1	1	Internal torque 4 (parameter P148)																			
14	TRQ2	Internal torque selection 2																			
15	EMG	Emergency shutdown	OFF: Allow the servo drive to work; ON: Stop the motor according to the mode set by parameter P164.																		
16	CMODE	Control mode switching	When parameter P004 is set to 3, 4, 5, the control mode can be switched: <table border="1" style="margin: 10px auto;"> <thead> <tr> <th>P004</th> <th>CMODE</th> <th>control method</th> </tr> </thead> <tbody> <tr> <td rowspan="2">3</td> <td>0</td> <td>Location</td> </tr> <tr> <td>1</td> <td>speed</td> </tr> <tr> <td rowspan="2">4</td> <td>0</td> <td>Location</td> </tr> <tr> <td>1</td> <td>Torque</td> </tr> <tr> <td rowspan="2">5</td> <td>0</td> <td>speed</td> </tr> <tr> <td>1</td> <td>Torque</td> </tr> </tbody> </table> <p>Note: 0 means OFF, 1 means ON.</p>	P004	CMODE	control method	3	0	Location	1	speed	4	0	Location	1	Torque	5	0	speed	1	Torque
P004	CMODE	control method																			
3	0	Location																			
	1	speed																			
4	0	Location																			
	1	Torque																			
5	0	speed																			
	1	Torque																			
17	GAIN	Gain switching	When parameter P176=2, switch the gain combination through GAIN: OFF: The first gain; ON: The second gain.																		
18	GEAR1	Electronic gear selection 1	Parameter P034 is used to configure the dynamic electronic gear application mode. Please refer to the specific instructions in chapter 4.2.3 for details.																		
19	GEAR2	Electronic gear selection 2																			
20	CLE	Position deviation clear	Clear the position deviation counter, the clear mode is selected by parameter P163, the position deviation clear occurs in: P163=0: CLE ON level; P163=1: CLE rising edge (moment of turning OFF to ON).																		
21	INH	Pulse input prohibited	OFF: The position command pulse is allowed to pass; ON: Position command pulse is prohibited.																		

5.6 Detailed explanation of DO function

No.	Symbol	Function	Function explanation
0	OFF	invalid	Force output OFF.
1	ON	efficient	The forced output is ON.
2	SRDY	Servo ready	OFF: The main power of the servo is not turned on or there is an alarm; ON: The main power supply of the servo is normal and there is no alarm.
3	ALM	Call the police	OFF: there is an alarm; ON: No alarm.
4	ZSP	Zero speed	OFF: The motor speed is higher than parameter P160 (regardless of direction); ON: Motor speed is lower than parameter P160 (regardless of direction).
5	COIN	Positioning completed	Position control OFF: position deviation is greater than parameter P150; ON: The position deviation is less than parameter P150.
6	ASP	Speed reached	OFF: Motor speed is lower than parameter P154; ON: The motor speed is higher than parameter P154. With polarity setting function, please refer to the description of parameter P154.
7	ATRQ	Torque reached	OFF: Motor torque is lower than parameter P157; ON: The motor torque is higher than parameter P157. With polarity setting function, please refer to the description of parameter P157.
8	BRK	Electromagnetic brake	OFF: electromagnetic brake braking; ON: The electromagnetic brake is released.
9	RUN	Servo running	OFF: The servo motor is not powered on; ON: The servo motor is running while energized.
10	NEAR	Positioning close	Position control OFF: position deviation is greater than parameter P152; ON: The position deviation is less than parameter P152.
11	TRQL	Torque limiting	OFF: The motor torque has not reached the limit value; ON: The motor torque reaches the limit value. The torque limit method is set by parameter P064.
12	SPL	Speed limiting	For torque control OFF: The motor speed has not reached the limit value; ON: The motor speed reaches the limit value. The speed limit method is set by parameter P077.

Chapter 6 Faults and Diagnosis

6.1 Alarm list

Alarm code	Alarm name	Alarm content	Alarm clear
Err--	No alarm	Working fine	
Err 1	Speeding	Motor speed exceeds the maximum limit value	Yes
Err 2	Power main circuit over-voltage	The main circuit power supply voltage exceeds the specified value, check the brake power	No
Err 3	Power main circuit under-voltage	Whether the resistance is damaged or whether the resistance value is appropriate	No
Err 4	Location is out of tolerance	The main circuit power supply voltage is lower than the specified value	Yes
Err 5	Position command overlocking	Position tracking deviation exceeds the set value	Yes
Err 6	Motor stalled	The position command frequency exceeds the maximum allowable frequency	Yes
Err 7	Drive prohibition abnormal	Wrong connection of motor power line, wrong number of pole pairs P-201	Yes
Err 9	Incremental encoder ABZ signal failure	CCWL, CWL drive stroke limit switch signal is different	Yes
Err10	Incremental encoder UVW signal failure	often	Yes
Err11	IPM module failure	Encoder ABZ signal has interference or disconnection	No
Err12	Over-current	Encoder UVW signal has interference or disconnection	Yes
Err13	Overload	Power main circuit IPM inverter module fails	Yes
Err14	Braking peak power overload	Servo drive instantaneous current is too large	Yes
Err20	EEPROM error	The average load current of the motor is too large	No
Err21	Logic circuit error	If the load is too large for a short time during braking, check the braking resistance	No
Err23	AD conversion reference voltage error	Whether it is damaged or whether the resistance value is appropriate	No
Err24	The AD conversion channel is asymmetrical or has a large zero drift	EEPROM read/write error or unexpected power failure when saving parameters	No
Err29	User torque overload alarm	Processor peripheral logic circuit failure	Yes
Err30	Encoder Z signal loss	AD sampling circuit voltage reference is not a standard value	No

Err31	Encoder Z signal detection abnormal	AD sampling amplification and conditioning circuit is abnormal	No
Err32	Encoder UVW signal illegal encoding	The motor load exceeds the value and duration set by the user	No
Err33	Wire-saving encoder signal error	Encoder Z signal does not appear	No
Err36	The second encoder is disconnected	Encoder Z signal has interference or signal is unstable	No

6.2 Alarm reason and treatment

Err 1(Over-speeding)

Reason	Inspection	Solution
Motor wiring U, V, W phase sequence error	Check U, V, W wiring	Correctly connect the U, V, W wiring, and correspond to the U, V, W labels of the driver plug one by one
Motor speed overshoot	Check the running status, view the parameters	Adjust the servo gain to reduce the overshoot; in speed control, increase the acceleration and deceleration time
Encoder wiring error	Check the encoder wiring	Correct wiring

Err 2(Main circuit over-voltage)

Reason	Inspection	Solution
Input AC power is too high	Check the power supply voltage	Make the voltage meet product specifications
Regenerative braking failure	Whether the regenerative braking resistor and brake tube are invalid or the wiring is disconnected	Maintain
Regenerative braking energy is too large	Check the brake load rate	Reduce start and stop frequency Increase acceleration and deceleration time Decrease torque limit value Reduce load inertia Replace with larger power drive and motor Replace with larger braking resistor

Err 3(Main circuit under-voltage)

Reason	Inspection	Solution
Input AC power is too low	Check the power supply voltage	Make the voltage meet product specifications

Err 4(Location is out of tolerance)

Reason	Inspection	Solution
Motor wiring U, V, W phase sequence error	Check U, V, W wiring	Correctly connect the U, V, W wiring of the motor, corresponding to the U, V, W labels of the driver plug one by one
Encoder zero point change	Check encoder zero	Reinstall the encoder and adjust zero
Encoder wiring error	Check the encoder wiring	Correct wiring
Motor stuck	Check the motor and mechanical connections	Maintain
Command pulse frequency is too high	Check the input frequency and pulse division/multiplication parameters	Reduce input frequency Adjust pulse frequency division/multiplication parameters
Position loop gain is too small	Check parameters P009, P013	Increase position loop gain
Out-of-tolerance detection range is too small	Check parameter P080	Increase the value of parameter P080
Insufficient torque	View torque	Increase torque limit value Increase position command smoothing filter time Reduce load Replace with larger power drive and motor

Err 5(Position command overclocking)

Reason	Inspection	Solution
Command pulse frequency is too high	Check whether the input frequency and electronic gear ratio are set correctly	Reduce input frequency Set P029, P030 correctly
The interval between motor enable and	The upper computer gives a delay to at least 500ms between when the enable is	Modify the upper computer timing

command pulse is too short	given and the pulse is sent (waiting for the motor to be fully energized)	
The host computer command is not processed for acceleration and deceleration or the acceleration and deceleration time is too short	Is the acceleration and deceleration time setting of the position command sent by the host computer reasonable?	Increase the acceleration and deceleration time of the command sent by the host computer. Properly increase the position command smoothing filter coefficient P040.

Err 6(Motor stalled)

Reason	Inspection	Solution
Motor stuck	Check the motor and mechanical connections	Overhaul
Motor wiring U, V, W phase sequence error	Check U, V, W wiring	Correctly connect the U, V, W wiring of the motor, corresponding to the U, V, W labels of the driver plug one by one
Encoder wiring error	Check the encoder wiring	Correct wiring
Motor load is too heavy	Check whether the load current i_a is too large	Reduce load Increase torque limit P065 Replace with a more powerful drive

Err 7(Drive prohibition abnormal)

Reason	Inspection	Solution
When the servo is enabled, the CCWL and CWL drive prohibition inputs are invalid	Check CCWL, CWL wiring	Input CCWL and CWL signals correctly. If CCWL and CWL signals are not used, parameter P097 Shield can be set

Err 9(Encoder AB signal failure)

Reason	Inspection	Solution
Encoder wiring error	Check the encoder wiring	Correct wiring
Encoder cable and connector are bad	Check cables and connectors	Replace cables and connectors
The motor model is not set correctly	Check motor model	Reset the motor model
Encoder is damaged	Check the encoder	Replace the encoder

Err11(Power module failure)

Reason	Inspection	Solution
Short circuit between motor wiring U, V, W	Check U, V, W wiring	Correctly connect U, V, W wiring
Damaged motor winding insulation	Check the motor	Replace the motor
Drive is damaged	Check the drive	There is no problem with the motor. It still alarms when the power is turned on again. It may be that the drive is damaged. Replace the drive.
Poor grounding	Check the ground wire	Properly grounded
Be disturbed	Check the source of interference	Increase the line filter, keep away from the interference source

Err12(Over-current)

Reason	Inspection	Solution
Short circuit between motor wiring U, V, W	Check U, V, W wiring	Correctly connect U, V, W wiring
Damaged motor winding insulation	Check the motor	Replace the motor
Drive is damaged	Check the drive	There is no problem with the motor. It still alarms when the power is turned on again. It may be that the drive is damaged. Replace the drive.

Err13(Overload)

Reason	Inspection	Solution
Continuous operation beyond rated load	View load rate	Reduce the load or change to a larger power drive
System is unstable	Check whether the motor oscillates	Reduce system gain
Acceleration and deceleration too fast	Check whether the motor runs smoothly	Increase acceleration and deceleration time
Encoder zero point change	Check encoder zero	Reinstall the encoder and adjust zero

Err14(Braking peak power overload)

Reason	Inspection	Solution
Input AC power is too high	Check the power supply voltage	Make the voltage meet product specifications
Regenerative braking failure	Whether the regenerative braking resistor and brake tube are invalid or the wiring is disconnected	Maintain
Regenerative braking energy is too large	Check the brake load rate	Decrease start and stop frequency, increase acceleration and deceleration time Replace with larger power drive and motor Replace with larger braking resistor
Encoder problem	The number of lines and the number of poles are incorrect Encoder Z signal error Encoder is damaged	Replace the encoder

Err20(EEPROM error)

Reason	Inspection	Solution
EEPROM chip is damaged	Power on again and check	The fault does not disappear, please replace the drive

Err21(Logic circuit error)

Reason	Inspection	Solution
Control circuit failure	Power on again and check	The fault does not disappear, please replace the drive

Err23(AD conversion reference voltage error)

Reason	Inspection	Solution
Current sensor and connector problem	Check the main circuit, whether the flexible cable is loose	Replace the drive
AD converter and analog amplifier circuit problem	Check the control circuit	Replace the drive

Err24(The AD conversion channel is asymmetric or the zero drift value is too large)

Reason	Inspection	Solution
AD converter and analog amplifier circuit problem	Check the control circuit	Replace the drive

Err29(User torque overload alarm)

Reason	Inspection	Solution
Unexpectedly large load occurs	Check the load	Adjust load
Unreasonable setting of parameters P070, P071, P072	Check the parameters	Adjustment parameters

Err30(Encoder Z signal loss)

Reason	Inspection	Solution
Encoder problem	View encoder Z signal	Replace the encoder
Encoder cable and connector problem	Check cables and connectors	Replace cables and connectors
Drive interface circuit failure	Check the control circuit	Replace the drive

Err31(Encoder Z signal detection abnormal)

Reason	Inspection	Solution
Encoder problem	View encoder Z signal	Replace the encoder
There is interference in the encoder cable	Check cables and connectors	Replace cables and connectors
Drive interface circuit failure	Check the control circuit	Replace the drive

Err32(Encoder UVW signal illegal encoding)

Reason	Inspection	Solution
Encoder problem	Check the encoder UVW signal	Replace the encoder
Encoder wiring error, disconnection	Check the encoder wiring	Correct wiring, including shielded wires

Err33(Saving-line encoder signal error)

Reason	Inspection	Solution
Encoder problem	Check the encoder signal	Replace the encoder
The motor model is not set correctly	Check the motor model and confirm whether the motor is equipped with a wire-saving encoder	Reset the motor model

Chapter 7 Specifications and Adapted Motors

7.1 Drive specifications

Model naming rules

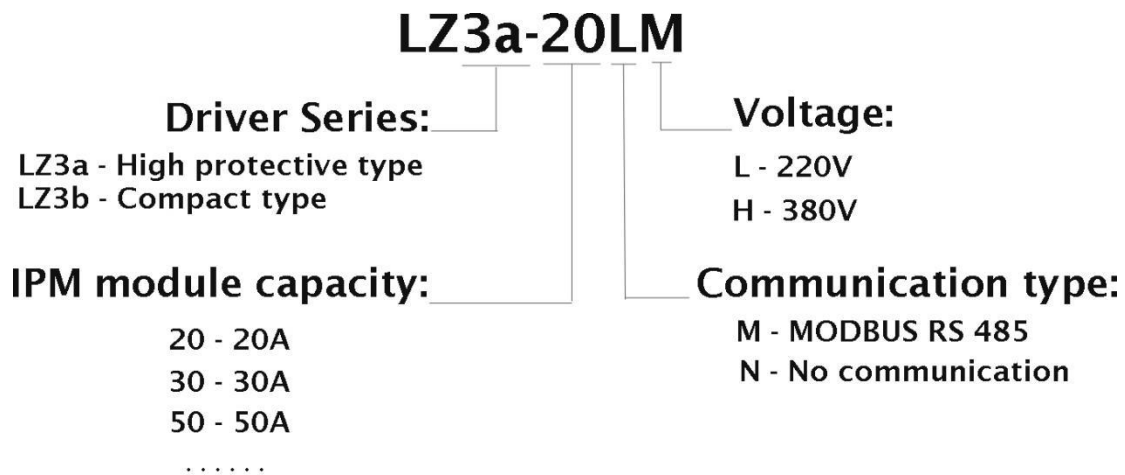
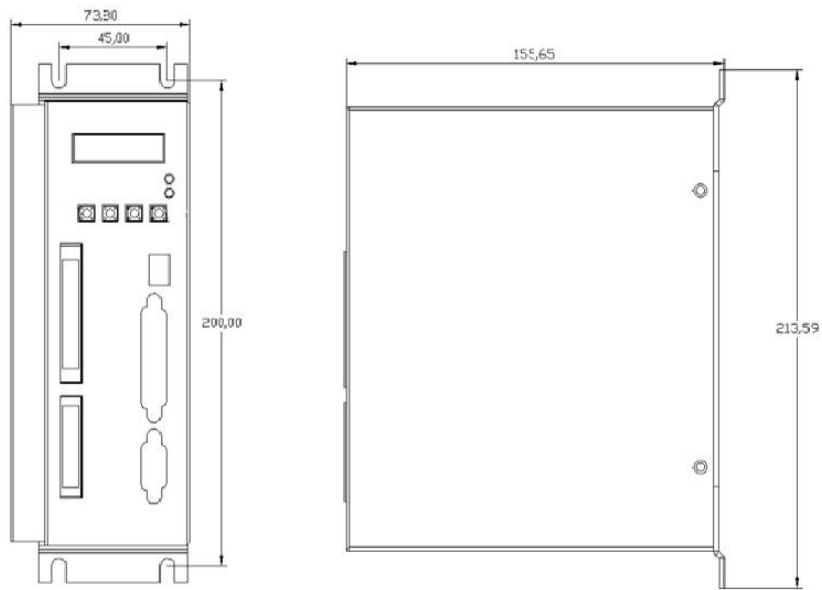


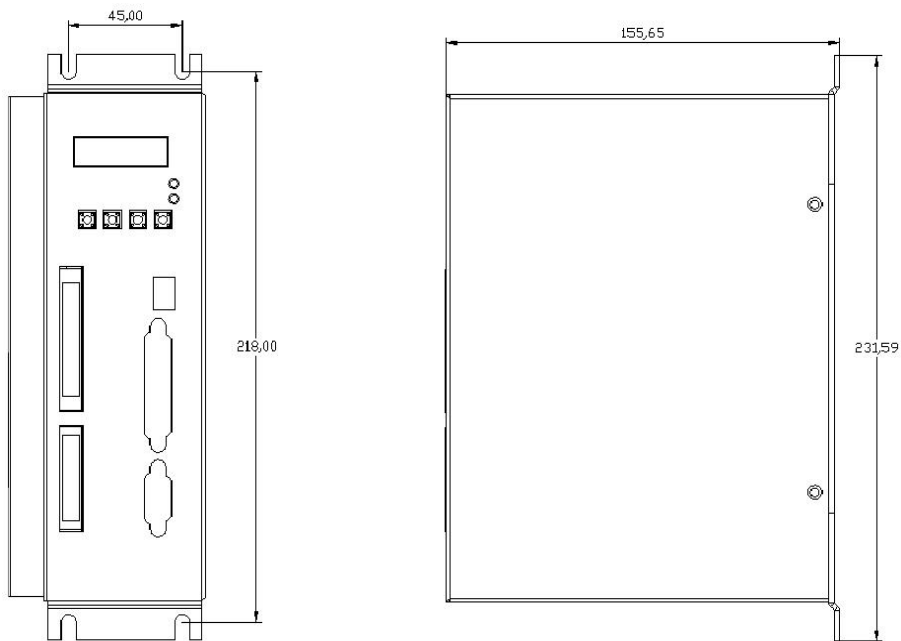
Figure 7.1 Drive model naming rules

Drive installation dimension drawing

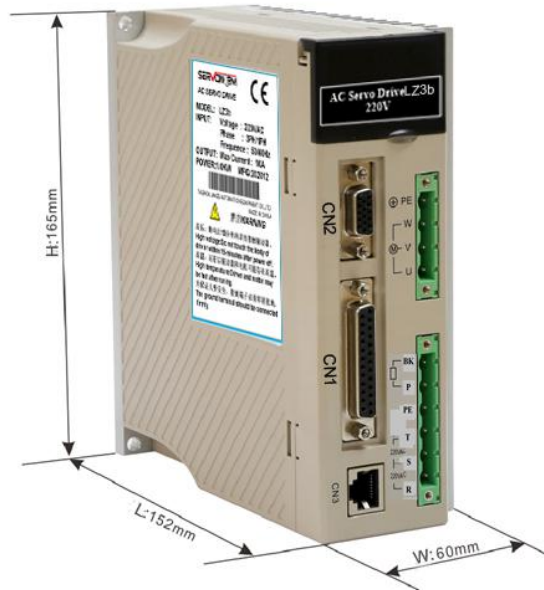
LZ3a-L20 installation dimension drawing (unit: mm)



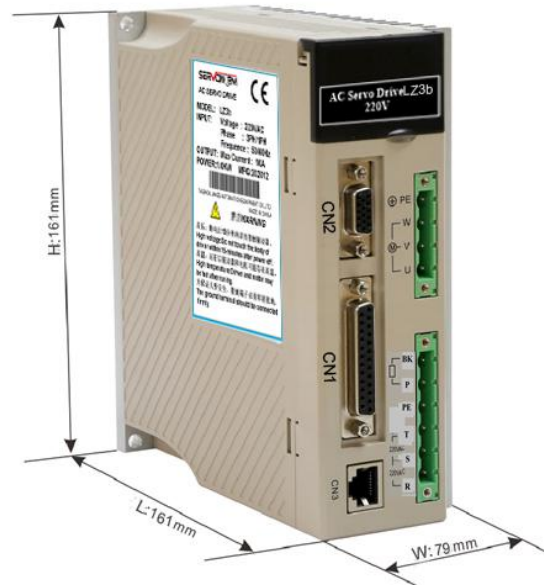
LZ3a-L30 installation dimension drawing (unit: mm)



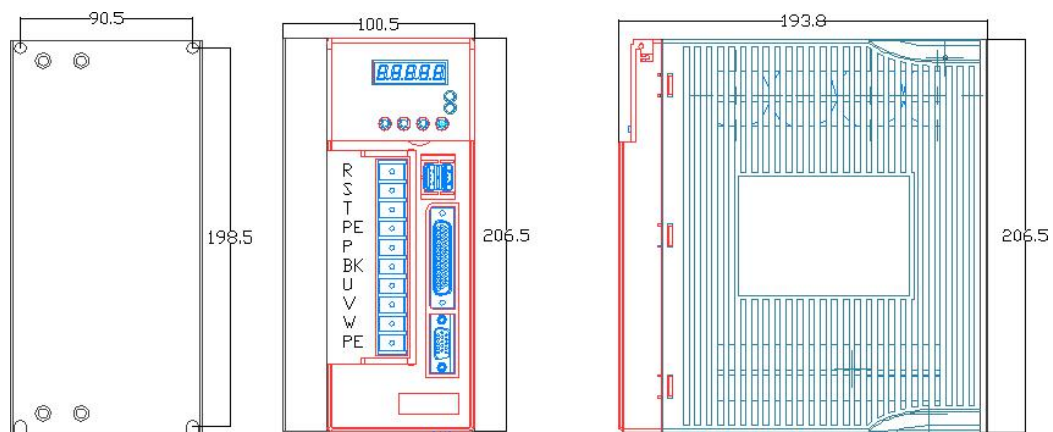
LZ3b-15L/20L Installation dimension diagram



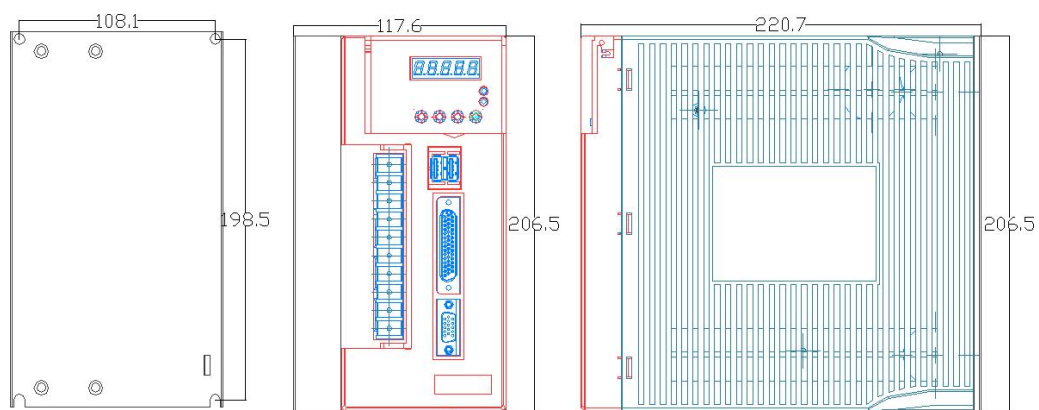
LZ3b-30L Installation dimension diagram



LZ3a-L40/LZ3a-H25 installation dimension drawing (unit: mm)

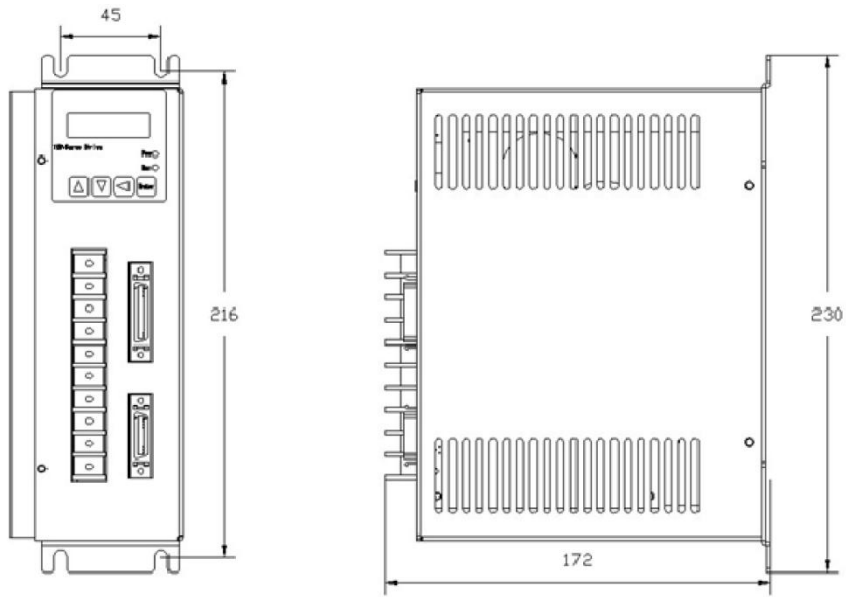


LZ3a-L50/L75, LZ3a-H50/H75 installation dimension drawing (unit: mm)

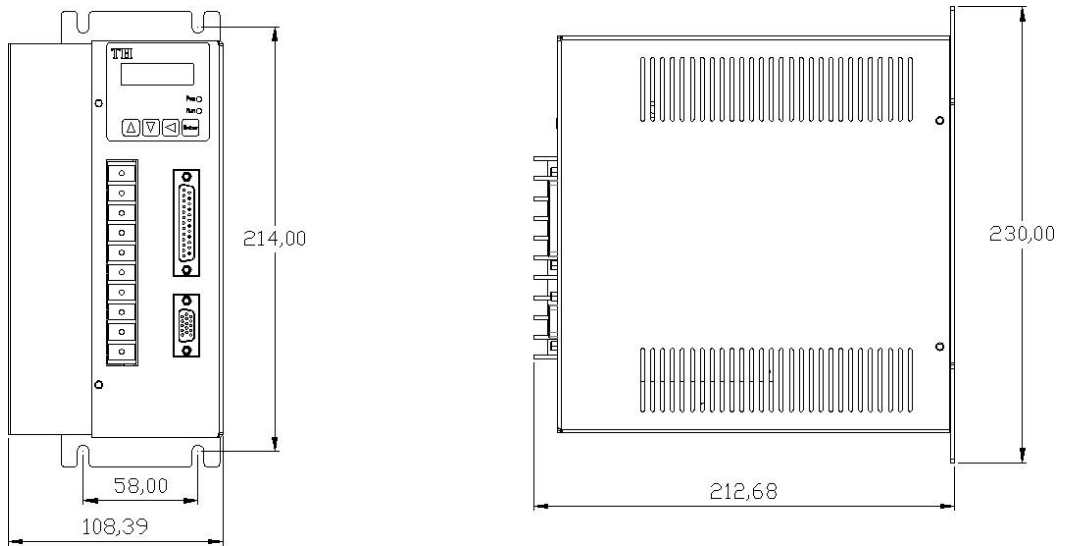


Note: LZ3x stands for LZ3/LZ3M/LZ3G

LZ3x-L20/L30 installation dimension drawing (unit: mm)



LZ3x-L50/L75 installation dimension drawing (unit: mm)



- **Introduction to model specifications and functions**

Table 7.1 Drive model specifications and functions

Model		LZ3x-L20	LZ3x-L30	LZ3x-L40	LZ3x-L50	LZ3x-L75	LZ3x-H25	LZ3x-H50	LZ3x-H75	
Input power	main power	Single-phase/three-phase 220VAC -15%+10% 50/60Hz					Three-phase 380VAC -15%+10% 50/60Hz			
Environment	Temperature	Work: 0°C ~ 40°C					Storage: -40°C ~ 50°C			
	Humidity	Work: 40% ~ 80% (no condensation) Storage: 93% or less (no condensation)								
	Atmospheric pressure	86kPa ~ 106 kPa								
Protection level		IP20								
Control mode		Position, speed, torque, position/speed, speed/torque, position/torque								
Digital input		8 programmable input terminals (photoelectric isolation)								
Digital output		6 programmable output terminals (photoelectric isolation)								
Encoder signal output	signal type	A, B, Z differential output, Z signal open collector output								
Location	Input frequency	Differential input: ≤500kHz (kpps); Single-ended input: ≤200kHz (kpps)								
	Command mode	Pulse + direction; forward/reverse pulse; quadrature pulse								
	Electronic gear ratio	1 ~ 32767/1 ~ 32767								
speed	Analog command input	±10VDC, input impedance 10kΩ								
	Command acceleration and deceleration	Parameter setting P-060/P-061								
	Instruction source	Analog quantity, internal speed command								
Torque	Analog command input	-10V ~ +10V, input impedance 10kΩ								
	Torque limit	Parameter setting P-065/P-066								
	Instruction source	Analog quantity, internal torque command								
Monitoring function		Speed, current position, position deviation, motor torque, motor current, command pulse frequency, etc.								
Protective function		Over-speed, over-voltage, over-current, overload, brake								

		abnormality, encoder abnormality, position out of tolerance, command overclocking, etc.
Characteristic	Speed frequency response	$\geq 800\text{Hz}$
	Speed fluctuation rate	$< \pm 0.03\%$ (load 0~100%); $< \pm 0.02\%$ (power -15% ~ +10%)

Note: LZ3x stands for LZ3a/LZ3b/LZ3/LZ3M/LZ3G

7.2 Standard 4-pair motor matching table (photoelectric encoder)

Table 7.2 T3a-H25/H50/H75 drive matching motor model
(Motor series code P-099: F1-MG)

Motor model code (P-002)	Matching driver (AC 380V)	Servo motor model (380V)	Rated power (kW)	Rated current (A)	Rated torque (Nm)	Overload multiple
0	LZ3a-H25	110LZ-M02030	0.6	2.0	2	3
1		110LZ-M04020	0.8	2.0	4	3
2		110LZ-M04030	1.2	3.0	4	3
3		110LZ-M05030	1.5	4.5	5	3
4		110LZ-M06020	1.2	3.0	6	3
5		110LZ-M06030	1.8	4.5	6	3
6		130LZ-M04025	1.0	2.6	4	3
7		130LZ-M05025	1.3	3.0	5	3
8		130LZ-M06025	1.5	3.7	6	3
9		130LZ-M07725	2.0	4.7	7.7	3
10		130LZ-M10010	1.0	2.5	10	3
11		130LZ-M10015	1.5	3.5	10	3
12		130LZ-M10020	2.0	5.1	10	3
13		130LZ-M10025	2.6	5.9	10	3
14		130LZ-M15015	2.3	5.0	15	3
15		130LZ-M15025	3.8	7.4	15	2.8
16		130LZ-M17020	3.5	7.4	17	2.8
17	150LZ-M15020	3.0	6.8	15	3	
18	LZ3a-H25/H50	150LZ-M15025	3.8	9.5	15	2.2/2.9
19	LZ3a-H25/H50	150LZ-M18020	3.6	8.5	18	2.5/3
20	LZ3a-H25/H50	150LZ-M23020	4.7	12	23	1.8/2.3
21	LZ3a-H25/H50	150LZ-M27015	4.2	11	27	1.9/2.5
22	LZ3a-H50/H75	150LZ-M27020	5.5	14.5	27	2/2.7
23	LZ3a-H75	150LZ-M27025	6.8	17	27	2.3

24	LZ3a-H25	180LZ-M17215	2.7	6.5	17.2	3
25	LZ3a-H25	180LZ-M19015	3.0	7.5	19	2.8
26	LZ3a-H25/H50	180LZ-M21520	4.5	9.5	21.5	2.2/2.9
27	LZ3a-H25	180LZ-M27010	2.9	7.5	27	2.8
28	LZ3a-H25/H50	180LZ-M27015	4.3	10	27	2.1/2.8
29	LZ3a-H25/H50	180LZ-M35010	3.7	10	35	2.1/2.8
30	LZ3a-H25/H50	180LZ-M35015	5.5	12	35	1.8/2.3
31	LZ3a-H75	180LZ-M48015	7.5	20	48	1.95

Table 7.3 LZ3x-L20/L30 drive matching motor model

(Motor series code P-099: F1-MG)

Motor model code (P-002)	Adapter driver (AC 220V)	Servo motor model (220V)	Rated power (kW)	Rated current (A)	Rated torque (Nm)	Overload multiple
20	LZ3x-L20	40LZ-M00130	0.05	0.61	0.16	3
20		40LZ-M00330	0.1	0.9	0.32	3
21		60LZ-M00630	0.2	1.2	0.6	3
22		60LZ-M01330	0.4	2.8	1.3	3
23		60LZ-M01930	0.6	3.5	1.9	3
27		80LZ-M01330	0.4	2.0	1.3	3
28		80LZ-M02430	0.75	3.0	2.4	2.5
29		80LZ-M03520	0.73	3.0	3.5	2.5
30		80LZ-M04025	1.0	4.4	4	2.5
31		90LZ-M02430	0.75	3	2.4	3
32		90LZ-M03520	0.73	3	3.5	3
33		90LZ-M04025	1.0	4	4	2.5
34		LZ3x-L20/L30	110LZ-M02030	0.6	2.5	2
35	LZ3x-L20/L30	110LZ-M04030	1.2	5	4	2/3
39	LZ3x-L20/L30	110LZ-M04020	0.8	3.5	4	3/3
36	LZ3x-L30	110LZ-M05030	1.5	6	5	2.5
37	LZ3x-L30	110LZ-M06020	1.2	4.5	6	3
38	LZ3x-L30	110LZ-M06030	1.8	6	6	2.5
44	LZ3x-L20/L30	130LZ-M04025	1	4	4	2.5/3
45	LZ3x-L20/L30	130LZ-M05025	1.3	5	5	2/3
46	LZ3x-L30	130LZ-M06025	1.5	6	6	2.5
41	LZ3x-L30	130LZ-M06030	1.8	7	6	2.2
47	LZ3x-L30	130LZ-M07720	1.6	6	7.7	2.5
47	LZ3x-L30	130LZ-M07725	2.0	7.5	7.7	2
48	LZ3x-L30	130LZ-M07730	2.4	9	7.7	1.6/2
40	LZ3x-L20/L30	130LZ-M10010	1.0	4.5	10	2.2/3
49	LZ3x-L30	130LZ-M10015	1.5	6	10	2.5

43	LZ3x-L30	130LZ-M10020	2	8.5	10	1.7
50	LZ3x-L30	130LZ-M10025	2.6	10	10	1.5
51	LZ3x-L30	130LZ-M15025	3.8	13.5	15	1.3
52	LZ3x-L30	130LZ-M15015	2.3	9.5	15	1.6

Note: LZ3x represents multiple series of LZ3a/LZ3b/LZ3M/LZ3

Table 7.4 LZ3a-L40/L50/L75 drive matching motor model
(Motor series code P-099: F1-MG)

Motor model code (P-002)	Adapter driver (AC 220V)	Servo motor model (220V)	Rated power (kW)	Rated current (A)	Rated torque (Nm)	Overload multiple
0	LZ3a-L40	130LZ-M07720	1.6	6	7.7	3
0	LZ3a-L40	130LZ-M07725	2.0	7.5	7.7	3
1	LZ3a-L40/L50	130LZ-M07730	2.4	9	7.7	2.3/3
2	LZ3a-L40	130LZ-M10015	1.5	6	10	3
3	LZ3a-L40/L50	130LZ-M10025	2.6	10	10	2.1/2.8
4	LZ3a-L40/L50	130LZ-M12020	2.4	10	12	2.1/2.8
5	LZ3a-L40/L50	130LZ-M15015	2.3	9.5	15	2.2/3
6	LZ3a-L50/L75	130LZ-M15025	3.9	13.5	15	1.6/2.3
7	LZ3a-L50/L75	150LZ-M15020	3.0	14	15	2.0/2.8
8	LZ3a-L50/L75	150LZ-M15025	3.8	17	15	1.7/2.4
9	LZ3a-L50/L75	150LZ-M18020	3.6	17	18	1.7/2.4
10	LZ3a-L50/L75	150LZ-M23020	4.7	21	23	1.4/1.9
11	LZ3a-L50/L75	150LZ-M27020	5.4	24	27	1.4/1.9
12	LZ3a-L40/L50	180LZ-M17215	2.7	10.5	17.2	2/2.7
13	LZ3a-L50/L75	180LZ-M19015	3	12	19	2.3/3
14	LZ3a-L50/L75	180LZ-M21520	4.5	16	21.5	1.8/2.5
15	LZ3a-L50/L75	180LZ-M27010	2.9	12	27	2.3/3
16	LZ3a-L50/L75	180LZ-M27015	4.3	16	27	1.8/2.4
17	LZ3a-L50/L75	180LZ-M35010	3.7	16	35	1.8/2.4
18	LZ3a-L75	180LZ-M35015	5.5	24	35	1.6
19	LZ3a-L75	180LZ-M48015	7.5	32	48	1.2

7.3 Standard 4-pair motor matching table (magnetic encoder)

Table 7.5 LZ3x-L20/LZ3x-L30 drive matching motor model
(Motor series code P-099: F4-WG)

Motor model code (P-002)	Adapter driver (AC 220V)	Servo motor model (220V)	Rated power (kW)	Rated current (A)	Rated torque (Nm)	Overload multiple	
20	LZ3x-L20	40LZ-C00130	0.05	0.4	0.16	3	
20		40LZ-C00330	0.1	0.6	0.32	3	
21		60LZ-C00630	0.2	1.2	0.6	3	
22		60LZ-C01350	0.4	3.6	1.3	3	
23		60LZ-C01930	0.6	3.5	1.9	3	
27		80LZ-C01330	0.4	2.6	1.3	3	
28		80LZ-C02430	0.75	3.0	2.4	3	
29		80LZ-C03230	1.0	5.0	3.2	2.5	
30		80LZ-C04025	1.0	4.4	4	2.5	
31		90LZ-C02430	0.75	3	2.4	3	
32		90LZ-C03520	0.73	3	3.5	3	
33		90LZ-C04025	1.0	4	4	2.5	
34		LZ3x-L20/L30	110LZ-C02030	0.6	2.5	2	2.5/3
35		LZ3x-L20/L30	110LZ-C04030	1.2	5	4	2/3
39	LZ3x-L20/L30	110LZ-C04020	0.8	3.5	4	3/3	
36	LZ3x-L30	110LZ-C05030	1.5	6	5	2.5	
37	LZ3x-L30	110LZ-C06020	1.2	4.5	6	2.5	
38	LZ3x-L30	110LZ-C06030	1.8	6	6	1.8	
44	LZ3x-L20/L30	130LZ-C04025	1	4	4	2.5/3	
45	LZ3x-L20/L30	130LZ-C05025	1.3	5	5	2/3	
46	LZ3x-L30	130LZ-C06025	1.5	6	6	2.5	
47	LZ3x-L30	130LZ-C07725	2.0	7.5	7.7	2	
48	LZ3x-L30	130LZ-C07730	2.4	9	7.7	1.6	
40	LZ3x-L20/L30	130LZ-C10010	1.0	4.5	10	2.2/3	
49	LZ3x-L30	130LZ-C10015	1.5	6	10	2.5	
50	LZ3x-L30	130LZ-C10025	2.6	10	10	1.5	
51	LZ3x-L30	130LZ-C15025	3.8	13.5	15	1.2	
52	LZ3x-L30	130LZ-C15015	2.3	9.5	15	1.6	

Remark 1: The above motors are all equipped with 2500-line magnetic encoder. You must first set P-000 to 385, **then select the motor series**

parameter P-099 to F4-WG, and then set the motor code parameter P-002 according to the motor model, and execute the restoration of the motor. Operating E-DEF with default parameters can ensure better control performance. Please be sure to follow the above steps to correctly set the motor series parameters and model code parameters!

Remark 2: LZ3x represents two series, T3a and T3b.

7.4 Customized 5-pair-pole A series motor matching table (5-pair-pole motor + photoelectric encoder)

Table 7.6 T3x-L15~L75 driver adapts 5 pairs of pole motor models

(Motor series code P-099: F5-nA)

Motor model code (P-002)	Adapter drive model specifications (AC 220V)	Servo motor model (220V)	Rated power (kW)	Rated current (A)	Rated torque (Nm)	Overload multiple
1	LZ15	60ALZ-M00630LB	0.2	1.1	0.64	3
2	LZ15	60ALZ-M01330LB	0.4	2.1	1.27	3
3	LZ15	80ALZ-M01330LB	0.4	2.3	1.27	3
4	LZ20	80ALZ-M02430LB	0.75	4	2.39	2.5
5	LZ20//LZ30	80ALZ-M03220LB	0.67	5.6	3.2	2/3
6	LZ20/LZ30	110ALZ-M04220LB	0.88	4.5	4.2	2.2/3
7	LZ20/LZ30	110ALZ-M05420LB	1.1	5.5	5.4	2/2.7
8	LZ30	110ALZ-M06420LB	1.3	6.5	6.4	2.5
9	LZ30/LZ40	110ALZ-M07520LB	1.6	8.0	7.5	2/2.5
10	LZ30	110ALZ-M04230LB	1.3	6.5	4.2	2.5
11	LZ30/LZ40	110ALZ-M05430LB	1.7	8.2	5.4	2/2.5
12	LZ30/LZ40	110ALZ-M06425LB	1.7	9.5	6.4	1.7/2
13	LZ30	130ALZ-M05415LB	0.85	6.5	5.4	2.5
14	LZ30/LZ40	130ALZ-M06415LB	1.0	8.0	6.4	2/2.5
15	LZ30/LZ40	130ALZ-M07515LB	1.2	9.0	7.5	1.7/2
16	LZ30/LZ40	130ALZ-M08415LB	1.3	9.5	8.4	1.7/2
17	LZ30/LZ40	130ALZ-M09615LB	1.5	10.0	9.6	1.5/2
18	LZ50	130ALZ-M11515LB	1.8	14.0	11.5	2
19	LZ50	130ALZ-M14615LB	2.3	16.0	14.6	2
20	LZ30/LZ40	130ALZ-M05430LB	1.7	9.5	5.4	1.7/2
21	LZ40/LZ50	130ALZ-M06430LB	2.0	11.5	6.4	1.7/2.5
22	LZ40/LZ50	130ALZ-M07530LB	2.4	12.0	7.5	1.5/2.5
23	LZ50	130ALZ-M08430LB	2.6	13.5	8.4	2.2
24	LZ50	130ALZ-M09625LB	2.5	16	9.6	1.9
25	LZ50/LZ75	130ALZ-M11520LB	2.4	17.8	11.5	1.7/2.2
26	LZ75	130ALZ-M14620LB	3.1	23.0	14.6	1.8

27	LZ30/LZ40	180ALZ-M17215LB	2.7	10.8	17.2	1.5/2
28		180ALZ-M21520LB				
29	LZ50/LZ75	180ALZ-M27015LB	4.3	17.5	27	1.7/2.2
30	LZ75	180ALZ-M48015LB	7.5	30	48	1.4
31		180ALZ-M35015LB				
32	LZ20/LZ30	130ALZ-M04820LB				

Remarks: The above motors are all 5-pole motors, standard 2500-line photoelectric encoder, you must first set P-000 to 385 or 316, then select the motor series parameter P-099 to **F5-nA**, and then set the motor code according to the motor model Parameter P-002, execute E-DEF to restore the motor default parameters to ensure better control performance. Please follow the above steps to correctly set the motor series parameter P-099 and model code parameter P-002!

Chapter 8 Quick Commissioning Guide

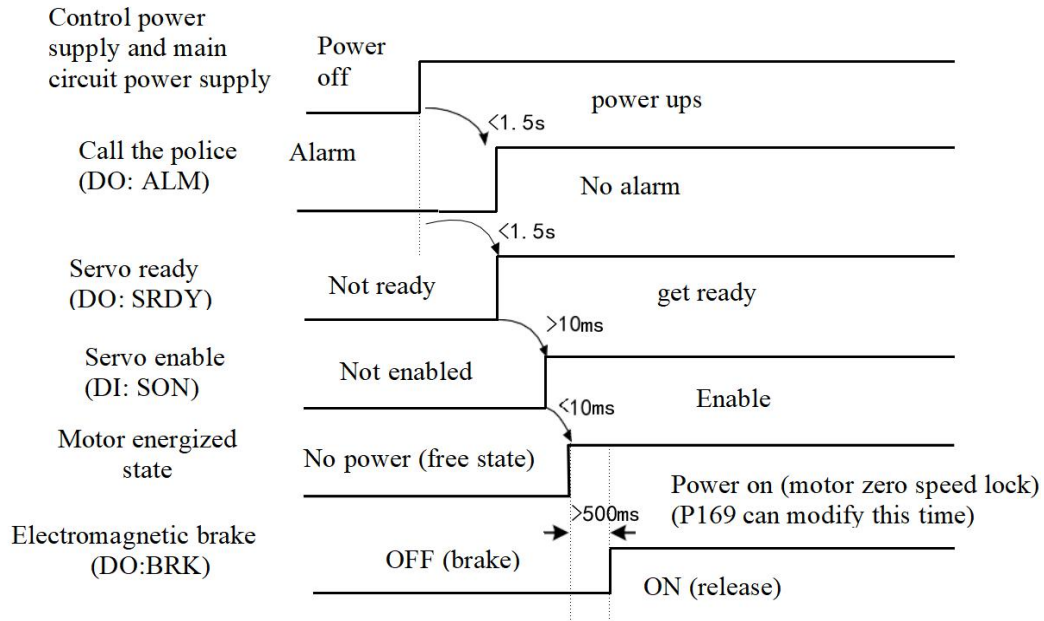
8.1 Precautions for quick commissioning

1. Make sure the wiring is correct

- The power terminal R/S/T and the motor power terminal U/V/W should not be reversed or loosened;
- L series input voltage must be three-phase or single-phase 220V, H series input voltage must be three-phase 380V;
- Check whether the +5V power supply in the CN2 terminal is correct, and the polarity cannot be reversed;
- Whether the motor connecting cable is short-circuited, it must be grounded reliably;
- Check the command cable and motor encoder cable, they must be connected reliably;
- The wiring of the same motor must correspond to the same drive.

2. Determine the power-on sequence

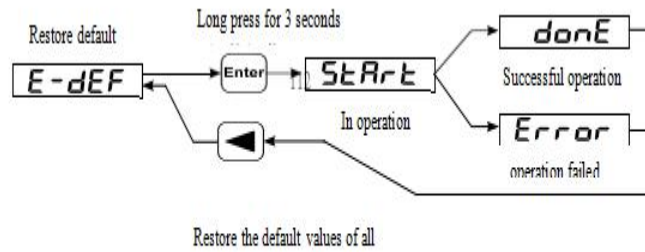
- The power and control power of LZ3x series servo drives adopt an integrated design. When the power is turned on, the power and control power are turned on at the same time. When the power is turned off, the internal power is cut off first, and the display and control circuit are automatically turned off after a few seconds of delayed discharge. Please wait;
- If equipped with a servo motor with electromagnetic brake (brake), the brake is not controlled by the servo driver. Please ensure that the brake is energized (brake release) more than 0.5 seconds after the servo is enabled to ensure the safety and position of the equipment Accuracy
- In order to use the servo drive smoothly, please read the following timing diagram carefully (for more detailed timing diagrams, please refer to section 4.7 of this manual):



8.2 Position control mode (quick debugging)

Example: LZ3x-L40F servo drive, adapted to 130LZ-M15015 servo motor (position control)

- 1: After power-on (**Pow**) the green indicator light is on, measure the three-phase 220V voltage between the power terminals R, S, and T to ensure that the power supply is normal;
- 2: Do not turn on the servo enable signal temporarily, check whether there is an alarm, if there is no alarm, it works normally, and you can proceed to the next step;
- 3: Start to adapt the motor control parameters:
 - a). Enter the parameter modification mode "**P**-", modify the operation password (parameter P-000) to 385, and then modify the motor series (parameter P-099) and the motor code (parameter P-002) to the required motor model. For the model code, please refer to the motor adaptation table in Chapter 7.2., In this example, P-002 is set to 5;
 - b). Enter the parameter management mode "**E**-", perform the operation of restoring the default values as shown in the figure below (must be powered off to take effect), and turn off the power after the operation is successful;



c). After re-powering on, check several key parameters of position control (as shown in the following table 8.1). After confirming that they are correct, the upper computer can give an external enable signal SON (or internal enable: P-098 is set to 1), (Run) After the green light is on, a pulse signal is given to observe the motor running effect, and the gain adjustment running characteristics can be modified appropriately.

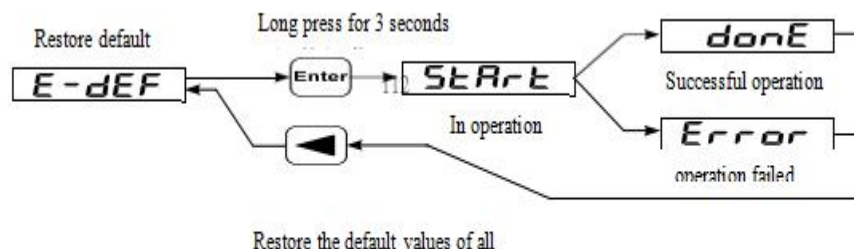
Table 8.1 Key parameter settings of position control mode

Parameter	Name	Settings	Parameter Description
P-004	control method	0 (default value)	Set to position control mode
P-029	Electronic gear molecule	1 (default value)	Electronic gear molecule
P-030	Electronic gear denominator	1 (default value)	Electronic gear denominator
P-035	Pulse input method	0 (default value)	0: pulse + direction 1: Forward/reverse pulse 2: Quadrature pulse
P-036	Pulse input direction	0 (default value)	0: normal direction 1: Inverted direction
P-005	Speed loop proportional gain	50 (default value)	To increase rigidity or reduce tracking error, P-005/P-009 can be increased appropriately, and the adjustment amount is 5 each time.
P-006	Speed loop integral time constant	20 (default value)	
P-009	Position loop proportional gain	40 (default value)	
P-007	Torque filter time constant	25 (default value)	When the motor generates vibration or noise, it can be adjusted appropriately, and the adjustment amount is 5 each time.
P-019	Speed detection filter time constant	35 (default value)	

8.3 Speed control mode (quick debugging)

Example: T3x-L30F servo drive, adapted to 130ST-M10015 servo motor (speed control)

- 1: After power-on (**Pow**) the green indicator light is on, measure the three-phase 220V voltage between the power terminals R, S, and T to ensure that the power supply is normal;
- 2: Make sure that the speed analog differential input or single-ended input wiring is correct;
- 3: Do not turn on the servo enable signal temporarily, check whether there is an alarm, if there is no alarm, it works normally, and you can proceed to the next step;
- 4: Start to adapt the motor control parameters:
 - a). Enter the parameter modification mode "**P-**", modify the operation password (parameter P-000) to 385, and then modify the motor series (parameter P-099) and the motor code (parameter P-002) to the required motor model. For the model code, please refer to the motor adaptation table in Chapter 7.2. In this example, P-002 is set to 49;
 - b). Enter the parameter management mode "**E-**", perform the operation of restoring the default values as shown in the figure below (must be powered off to take effect), and turn off the power after the operation is successful;



- c). After powering on again, set several key parameters of speed control (as shown in Table 8.2), and then switch the menu to "**E-5Et**" and press the **Enter** key for 3 seconds to execute the parameter save operation. After the save is successful, power off and restart. After confirming that it is correct, the host computer can give the external enable signal SON (or internal enable: P-098 is set to 1), after the (Run) green light is on, the analog automatic zero adjustment operation can be performed (see section 3.6.2 for details), give an analog command, observe the motor running effect, and modify the gain adjustment running characteristics appropriately.

Fig8.2 Speed control mode key parameter setting

Parameter	Name	Settings	Parameter Description
P-004	control method	1	Set to speed control mode
P-025	Speed command source	0 (default value)	0: Analog speed 1: Internal multi-step speed <8 optional P137~P144 settings>
P-046	Analog speed command gain	300 (default value) set as required	Rotation speed corresponding to 1V analog voltage (unit: r/min/V)
P-047	Analog speed command zero offset compensation	0 (default value) set as required	Unit: 0.1mv
P-048	Analog speed command direction	0 (default value) set as required	0: normal direction 1: Inverted direction
P-060	Speed command acceleration time	100 (default value) set as required	0~1000r/min acceleration time (Unit: ms)
P-061	Speed command deceleration time	100 (default value) set as required	1000~0r/min deceleration time (Unit: ms)
P-005	Speed loop proportional gain	50 (default value)	To increase the rigidity, P-005 can be increased appropriately, and the adjustment amount is 5 each time
P-006	Speed loop integral time constant	20 (default value)	If the load inertia is large, you can increase P-006 appropriately, and the amount of adjustment is 10 each time
P-007	Torque filter time constant	25 (default value)	When the motor generates vibration or noise, it can be adjusted appropriately, and the adjustment amount is 5 each time.
P-019	Speed detection filter time constant	35 (default value)	

8.4 Torque control mode (quick debugging)

Example: LZ3x-L20F servo drive, adapted to 110LZ-M06020 servo motor (torque control)

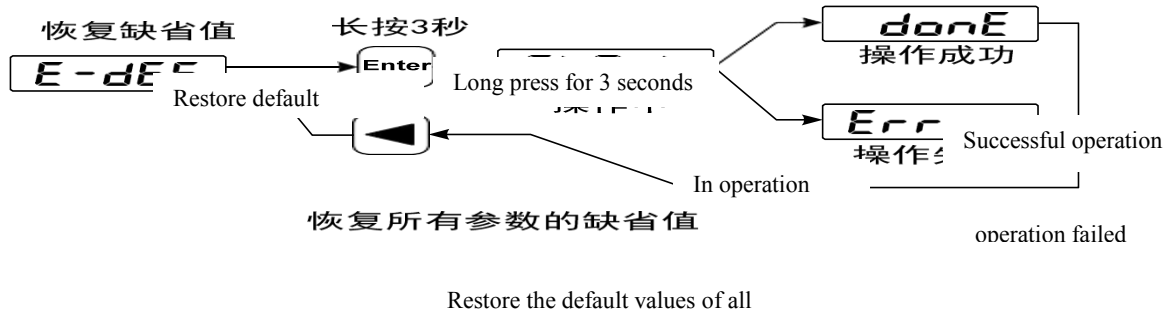
- 1:** After power-on (Pow) the green indicator light is on, measure the three-phase 220V voltage between the power terminals R, S, and T to ensure that the power supply is normal.
- 2:** Make sure that the differential input or single-ended input wiring of the torque analog quantity is correct.

3: Do not turn on the servo enable signal temporarily, check whether there is an alarm, if there is no alarm, it works normally, and you can proceed to the next step.

4: Start to adapt the motor control parameters:

a). Enter the parameter modification mode "**P-**", modify the operation password (parameter P-000) to 385, and then modify the motor series (parameter P-099) and the motor code (parameter P-002) to the required motor model. For the model code, please refer to the motor adaptation table in Chapter 7.2. In this example, P-002 is set to 37.

b). Enter the parameter management mode "**E-**", perform the operation of restoring the default values as shown in the figure below (must be powered off to take effect), and turn off the power after the operation is successful.



c). After power-on again, set several key parameters of speed control (as shown in Table 8.3), and then switch the menu to "**E-5E**" and press the **Enter** key for 3 seconds to execute the parameter save operation. After the save is successful, power off and restart. After confirming that it is correct, the host computer can give the external enable signal SON (or internal enable: P-098 is set to 1), after the (Run) green light is on, the analog automatic zero adjustment operation can be carried out (see 3.6.2 for details) Chapter), give analog commands, observe the motor running effect, and modify the gain adjustment running characteristics appropriately.

Table 8.3 Key parameter settings of torque control mode

Parameter	Name	Settings	Parameter Description
P-004	control method	2	Set to torque control mode
P-026	Torque command source	0 (default value)	0: analog torque 1: Internal multi-step torque <4 optional P145~P148 settings>
P-053	Analog torque command gain	30 (default value) Set as required	The percentage of the rated torque of the motor corresponding to the 1V analog voltage (unit: 1%/V)

P-054	Analog torque command zero offset compensation	0 (default value) set as required	Unit: 0.1mv
P-055	Analog torque command direction	0 (default value) set as required	0: normal direction 1: Inverted direction
P-078	Speed limit during torque control	1000 (default value) set as required	(Unit: r/min)

8.5 Typical debugging problems and countermeasures

①、The error is reported when restoring the default parameters

- a、Confirm whether the operation password (P-000) is set correctly;
- b、The restore default operation must be performed when the drive is not enabled;

②、The upper computer is enabled, the driver (Run) is enabled and the green light is off

- a、Check whether the R/S/T voltage of the power supply is low and whether the wiring is correct;
- b、Check whether the CN1 interface and +24V input are correct;
- c、Check whether the SON signal of the CN1 interface is connected to 0V;
- d、Through the above measures, if the (Run) enable green light does not light up, you can use the internal enable (P098 is set to 1) and try again.

③、"Err-9/Err-10/Err-30/Err-31/Err-32/Err-33" fault alarm appears

Note:The photoelectric encoder at the end of the servo motor is a typical fragile and vulnerable component. Special attention should be paid to the protection! a. The above alarm indicates that there is a problem with the encoder or the encoder connection cable;

- a、The above alarm indicates that there is a problem with the encoder or the encoder connection cable;
- b、Check whether the shielding layer is well grounded at both ends, and whether the plug has water or impurities;

-
- c、 Whether the connection line is too long will attenuate the encoder power supply 5V;
 - d、 Confirm whether it is an interference problem, whether there is a strong magnetic and strong electric line nearby, and if there is, isolate it as much as possible.

④、 Noise or vibration (high frequency) occurs during the operation of the servo motor

- a、 Properly increase the filter coefficients P-007 and P-019, and adjust the value to 5 each time;
- b、 If the effect of increasing the filter coefficient is not obvious, it is necessary to reduce the proportional gain of the speed loop and the proportional gain of the position loop, that is, reduce P-005 and P-009, and the adjustment amount is 5 each time;
- c、 If none of the above measures improves significantly, please check whether there is interference in the encoder connection line, and check whether the shielding layer is well grounded at both ends.

⑤、 Vibration (low frequency) occurs during the operation of the servo motor

- a、 Determine whether the load and inertia of the servo motor are within the allowable range of the motor. If the load and inertia exceed the rated multiple of the motor too much (load torque is greater than 3 times, inertia is greater than 5 times), please re-select a larger motor ;
- b、 Properly increase the speed loop proportional gain P-005, the adjustment amount is 5 each time;
- c、 If the effect of increasing P-005 is not obvious, you can appropriately decrease the filter coefficient P-007/P-019, and the amount of adjustment is 5 each time;
- d、 If the effect of reducing the filter coefficient is not obvious, you can appropriately reduce the position loop gain P-009, and the amount of adjustment is 5 each time;
- e、 If none of the above measures can significantly improve, please check whether there is interference between the encoder connection line and the command connection line, and check whether the shielding layer is well grounded at both ends.

⑥、Err-2 or Err-11 alarm occurs on the drive

- a、 Judge whether the drive will give an alarm when it is powered on or when a large inertia frequently accelerates and decelerates:
- b、 If it is powered on, it will alarm to confirm that the hardware circuit of the drive is faulty;
- c、 If the alarm occurs during frequent acceleration and deceleration with large inertia, first check the monitoring menus $d-I$ and $d-P$ to observe whether the instantaneous value and maximum value of the current exceed the allowable range of the drive and motor. If it exceeds the range, reduce the inertia acceleration accordingly (speed mode: adjust Maximum acceleration time P-060 and deceleration time P-061; position mode: increase the acceleration and deceleration time of the host computer controller), make the current control within the allowable range of the drive and the motor, and check whether the fault disappears.

⑦、 "Err-5/Err-12" appears on the drive when the servo motor starts

- a、 If "Err-5" appears, it means that the pulse command frequency of the host computer is too fast, which exceeds the response capacity of the servo motor. It is recommended to increase the acceleration and deceleration time of the host computer, or increase the position command smoothing time P-040 appropriately, and the amount of adjustment is 10 each time.
- b、 The above measures are invalid or the host computer cannot be modified, please set P-116 to 32 to shield the "Err-5" alarm (need to power off and restart to take effect);
- c、 If the driver displays "Err-12" over-current alarm when starting, it means that the load is too large when the motor starts. Please check whether the driver selection is too small or whether the driver is damaged.

⑧、 "Err-4" appears in the drive when the servo motor is running

- a、 If the low-speed operation is normal and the high-speed operation appears "Err-4", please first check whether the P-075 maximum speed limit is too low, and then appropriately increase the position loop gain P-009 (each adjustment is 5), or increase it appropriately Position tolerance detection range P-080.
- b、 If you only need to give the position command, no matter what the speed, the motor will appear "Err-4" as soon as it runs. Please

make sure whether the motor is blocked or damaged, and whether the driver's strong current circuit is damaged;

- c、 If "Err-4" appears when the acceleration is fast during operation, please confirm whether the driver and motor are selected too small;
- d、 If "Err-4" occasionally appears during operation, please check whether there is interference between the encoder connection line and the command connection line, and check whether the shielding layer is well grounded at both ends.

⑨、 **The drive is running normally, the host computer appears "position tracking error is too large"**

- a、 Determine the detection threshold for the position tracking error of the host computer to exceed the limit, set the driver position out-of-tolerance detection range P-080 to a value smaller than the threshold, and observe whether the driver appears "Err-4" during operation;
- b、 If the driver does not show "Err-4", it means that there is interference in the encoder signal sent back to the upper computer on the command connection line. Please check whether the connection line is welded reliably and the shielding layer is well grounded at both ends;
- c、 If the driver shows "Err-4", it means the response of the driver and the motor. Please confirm the integrity of the driver and the motor first, and then increase the position loop and speed loop gain P-009/P-005;
- d、 If the above measures have no obvious effect, consider selecting larger drives and motors.

Chapter 9 Communication Function Description

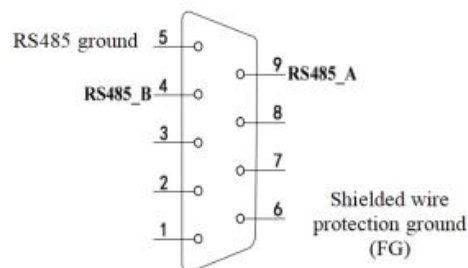
9.1 Function overview and wiring diagram

LZ3a/LZ3b servo drive has an RS-485 serial communication interface. This interface can be used to control the servo system, change the parameters, and monitor the status of the servo system through the MODBUS protocol. The wiring instructions of the communication port CN3 are as follows:

The communication port of the L20/L30 driver uses a three-position terminal, and the appearance and pin distribution are:

A	1	485_A
B	2	485_B
G	3	485 ground

The communication ports of drives of other specifications use double-row DB9 sockets, and the appearance and pin distribution are as follows:



Special note: RS485 communication port can also be connected through 40/41/42 of CN1. For details, please refer to the illustration in section 2.4.

9.2 Communication parameters

P-181	Drive communication ID number	scope	Default value	unit
		-1~32	-1	

When using RS-485 communication, the upper controller is the master and the servo driver is the slave. The communication address of the servo drive needs to be set by this parameter to a different communication station number.

The setting range of the station number address is -1~32. **The default value is -1 which means the communication function is closed, and the setting value greater than 0 means the communication function is open.** Before using the communication function, this parameter must be set to the required station number. This station number represents the absolute address of the drive in the communication network. A group of servo drives can only set one station number. If the station number is set repeatedly, Resulting in normal communication.

P-182	MODBUS communication baud rate	scope	Default value	unit
		0~3	2	

Use this parameter to select the baud rate of RS-485 communication. Different values correspond to different baud rates. The selected communication baud rate must be consistent with the communication baud rate of the host controller. The specific settings are as follows:

Parameter meaning:

- 0: The baud rate is 4800bps 1: The baud rate is 9600bps
- 2: The baud rate is 19200bps 3: The baud rate is 384bps

P-183	MODBUS communication data mode selection (For the time being, only RTU data format is supported)	scope	Default value	unit
		0~5	1	

Use this parameter to select the data mode of RS-485 communication. The selected data mode must be consistent with the communication protocol of the upper controller. The specific parameter values have the following meanings:

- 0: Data bit-8 bits Check bit-None Stop bit-1 bit
- 1: Data bit-8 bits Parity bit-Even parity (Even) Stop bit-1 bit
- 2: Data bit-8 bits Check bit-Odd check (Odd) Stop bit-1 bit
- 3: Data bit-8 bits Check bit-none Stop bits-2 bits
- (PC debugging communication mode: 13)**
- 4: Data bit-8 bits Parity bit-Even parity (Even) Stop bits-2 bits
- 5: Data bit-8 bits Check bit-Odd check (Odd) Stop bit-2 bits

9.3 MODBUS communication protocol

When using RS-485 serial communication, each servo drive must set its communication station number in the parameter P-181 in advance, and the computer or upper controller will control the corresponding servo drive according to the station number; the baud rate needs to refer to the upper position. The communication method of the controller is used to set the parameter P-182; the MODBUS communication protocol only supports RTU (Remote Terminal Unit) mode temporarily, and the user can set the required communication data mode on the parameter P-183 according to the requirements of the upper controller. After the above parameter setting is completed, you need to perform the parameter saving operation and restart the drive after power off to take effect. The following describes the specific content of MODBUS communication.

Communication data structure:

- RTU mode:

The MODBUS application layer protocol defines a simple protocol data unit (PDU), as shown in the figure below, the protocol data unit does not depend on the underlying communication layer.

Address field	function code	Data field	Check code
---------------	---------------	------------	------------

MODBUS takes the address field as the start of the frame, and the content of the address field is the effective address value (0~247). The host places the slave address value in the address field of the request information to determine the recipient of the request information, and the qualified slave. After receiving the information and completing the corresponding processing, place its own address value in the address field of the response message, so that the host knows which slave sent the response.

After the address field is the function code, which indicates what kind of operation the slave will complete. After the function code is the data field, the data field contains the request and response parameters. The format, length, and meaning of the data field are also different depending on the function code.

The check code is used to verify the validity of information and ensure the reliability of information transmission. 16 bits CRC (Cyclical Redundancy Check) check is used to check in RTU mode.

In RTU mode, each 8-bit data in the message frame is sent in two 4-bit hexadecimal codes, for example: 1 byte data 64H.

RTU mode is a bit-oriented transmission mode. The frame starts with an idle time of no less than 3.5 characters, and then the address field is sent. The network device monitors the communication bus, and it can receive after the

idle time of 3.5 characters is continuously monitored. When it is judged that the received address field information is valid, continue to receive the subsequent information, and then perform corresponding operations according to the function code and additional information. If response information is required, the response information is encapsulated and sent to the host. The last byte sent after about 3.5 characters of idle time indicates the end of the information frame, and a new information frame can be sent. The RTU mode relies on simulated synchronization information to maintain frame synchronization, and the entire information frame must be transmitted as a continuous data stream at one time. If a continuous data stream is in the transmission process, the receiving device detects that there is more than 1.5 character interval time, it will consider that a frame of data has been received, and the next received character will be the beginning of the next frame. Under normal circumstances, the interval time between information frames is at least 3.5 characters, that is, after one frame of data is sent, at least 3.5 characters of idle time can be passed before the next frame of data can be sent.

The format of the information frame in RTU mode is:

START	Address field (ADR)	Function code (CMD)	Data field (DATA)	Check code (CRC)	END
T1-T2-T3-T4	8 bits	8 bits	n*8 bits	16 bits	T1-T2-T3-T4

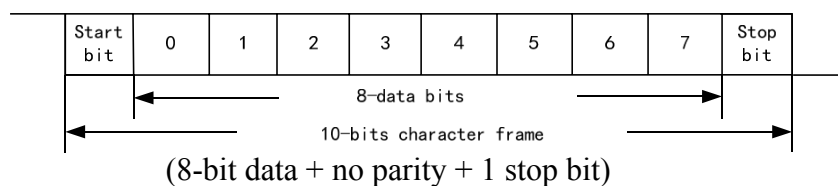
Note:T1-T2-T3-T4 means that the minimum time interval from the previous frame is 3.5 characters.

In RTU mode, the format of sending each byte is:

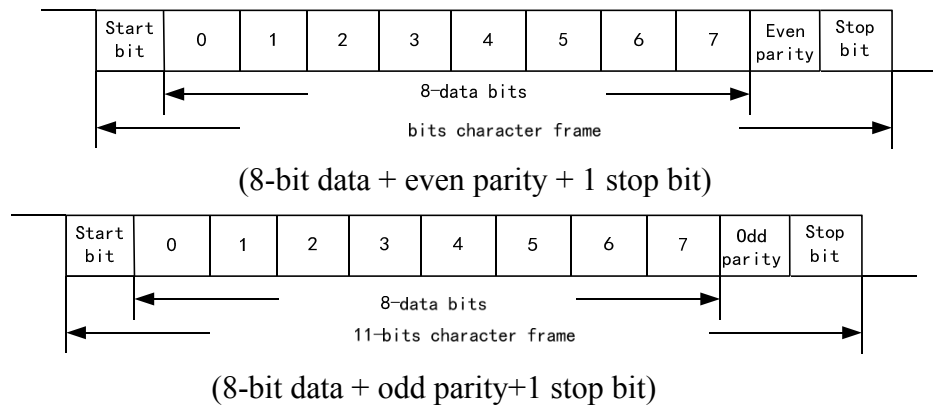
Start bit	Data bit (low bit first)	Parity bit	Stop bit
1 bit	8 bits	1 bit or no bit	1 bit or 2 bits

Character structure:

10bits character box (for 8bits character without check)



11 bits character box (for 8bit characters plus checksum)



Communication information frame format:

The items in the **communication information frame** format box are explained as follows:

- **START(communication start)**
RTU mode: The minimum time interval from the previous frame is 3.5 character time.
- **ADR(communication address)**
The legal communication address range is between 1 and 32, as shown below: To communicate with the servo drive with station number 16 (hexadecimal 10H):
RTU mode: ADR = 10H
- **CMD (function code) and DATA (data field)**
The format of data characters depends on the function code. The commonly used function codes are described as follows:
 - Command code 03H:** Read the parameter value of the drive
 - Command code 04H:** Read the operating status of the drive (such as motor speed, position, current, torque and other variable values)
 - Command code 06H:** Write the parameters of the drive (single write)
 - Command code 41H:** Write drive parameters into EEPROM (parameter save)
- **CRC (RTU mode) frame check calculation:**
RTU mode:
RTU mode uses CRC (Cyclical Redundancy Check) frame check, and the calculation of CRC frame check is explained in the following

Steps:

- Step 1: Initialize a 16bits register whose content is FFFFH, which is called CRC register.
- Step 2: Perform an exclusive OR operation between the first byte of the command message and the low byte of the 16-bitsCRC register, and store the result back to the CRC register.
- Step 3: Check the least significant bit (LSB) of the CRC register. If this bit is 0, shift one bit to the right; if this bit is 1, shift the value of the CRC register one bit to the right, and then perform XOR operation with A001H.
- Step 4: Go back to step 3 until step 3 has been executed 8 times, and then go to step
- Step 5: Repeat steps 2 to 4 for the next byte of the command information, until all bytes have completed the above processing, at this time the content of the CRC register is the CRC frame check.

Note: After calculating the CRC frame check, in the command information, the low bit of CRC must be filled in first, and then the high bit of CRC must be filled in, please refer to the following example.

For example: read the 0 segment 05 parameter of the servo drive with the station number 01H. The final content of the CRC register calculated from the ADR to the last byte of the data is 3794H, and the command information is as follows. It should be noted that the byte 94H should be transmitted before the byte 37H.

ADR	01H
CMD	03H
Starting data position	00H (high byte)
	05H (low byte)
Number of data	00H (high byte)
	02H (low byte)
CRC Low	94H (high byte)
CRC High	37H (low byte)

➤ **END (end of communication):**

RTU mode: The minimum time interval with the next frame is 3.5 character time.

Function code (CMD):

The function code is 1 byte (8bits), and its range is 1~255.

Function code (HEX)	Specific meaning	Meaning in Modbus protocol specification
03H	Read the parameter value of the drive (multiple parameters can be read at the same time)	Read Holding Register
04H	Read the operating state of the drive (such as motor speed, position, current, torque and other variable values, multiple states can be read at the same time)	Read Input Register
06H	Write the parameters of the drive (single write)	Write Single Register
08h	Diagnosis function	Diagnostic
41H	Write the driver's parameters into EEPROM (parameter save)	

Various abnormalities and errors may occur during communication. In order to enable these abnormalities and errors to be recognized by the host, corresponding abnormal codes are defined, as shown in the following table. When the slave receives the host's information and finds an error or fails to complete the normal response, the slave will send an error response frame to the master, that is, the highest position of the function code byte is 1, and the corresponding exception code is placed in the data field (Exception Code).

Exception Code (HEX)	Mean
01h	ILLEGAL FUNCTION
02h	ILLEGAL DATA ADDRESS
03h	ILLEGAL DATA VALUE
04h	SLAVE DEVICE FAILURE
05h	ACKNOWLEDGE
06h	SLAVE DEVICE BUSY

9.4 Write and read parameters

For details of all the parameters of the servo drive, please refer to the parameter chapter of the commissioning manual. The parameters are divided by parameter section. Each parameter is represented by 16 bits of data, and the communication address of each parameter is determined by the parameter

number (range 0~249). For example, the communication address of parameter P-005 is 005 (decimal), and the communication address of parameter P-108 is 108 (decimal system), the communication address of parameter P-204 is 204 (decimal system), and other parameters can be deduced by analogy.

All parameters described in the parameter section can be read through communication, but only some parameters are open to allow users to modify and write. The parameters listed in the commissioning manual are allowed to modify and write, and other unspecified parameters are reserved by the servo drive. Parameters (the user cannot write the reserved parameters, otherwise it may cause the servo drive to run abnormally). If the user needs to modify other parameters, please contact the technical staff of our company.

9.5 Description of Monitoring Status Quantities Address

The internal status of the servo drive can be read through the RS-485 communication port, and the write operation is invalid. The state quantity is stored in 16bit data, providing a total of 40 state variables from 0 to 39. The read address (hexadecimal) of the related state quantity is as follows:

- 0x0000: motor speed, unit "r/min";
- 0x0001: Original position command (input pulse) low 16bit;
- 0x0002: Original position command (input pulse) high 16bit;
- 0x0003: Position command (pulse) low 16bit;
- 0x0004: position command (pulse) high 16bit;
- 0x0005: The current motor position (pulse) is 16 bits lower;
- 0x0006: The current motor position (pulse) is 16bit high;
- 0x0007: Position deviation (pulse) low 16bit;
- 0x0008: position deviation (pulse) high 16bit;
- 0x0009: Motor torque, unit "%" (percentage of rated torque);
- 0x000A: Peak torque, unit "%" (peak torque within 1s); <10>
- 0x000B: the instantaneous current of the motor, the unit is "0.1A" (12: represents the real-time current of the motor 1.2A);
- 0x000C: motor peak current, the unit is "0.1A" (152: the maximum current within 1s is 15.2A);
- 0x000D: Position command pulse frequency, the unit is "0.1kHz" (3000: means 300kHz);
- 0x000E: Speed command, unit "r/min";
- 0x000F: Torque command, unit "%"; <15>
- 0x0010: Speed analog command voltage, the unit is "mV";
- 0x0011: Torque analog command voltage, unit "mV";
- 0x0012: Input terminal DI state, [Note 1];

0x0013: Output terminal DO status, [Note 2];
0x0014: The single-turn absolute position (pulse) of the motor encoder is 16 bits lower; <20>
0x0015: Motor encoder single-turn absolute position (pulse) high 16bit;
0x0015: The single-turn absolute position (pulse) of the motor encoder is 16 bits high;
0x0016: Multi-turn position of the motor encoder (when there is no multi-turn information, read the value of 0);
0x0017: Regenerative braking load rate, the unit is "%";
0x0018: Average load rate, unit "%";
0x0019: Output voltage, unit "%"; <25>
0x001A: Alarm code;
0x001B: motor speed, unit "0.1r/min";
0x001C: The second encoder position (pulse) is 16 bits lower;
0x001D: The position (pulse) of the second encoder is 16 bits high;
0x001E: reserved <30> DC bus voltage
0x001F: reserved
0x0020: reserved
0x0021: reserved
0x0022: reserved
0x0023: reserved <35>
0x0024: reserved
0x0025: reserved
0x0026: reserved
0x0027: reserved <39>

[Note 1]: The data read from this address is 16 bits, bit5~bit0 correspond to the input state of DI6~DI1 respectively, "1" means input high level, "0" means input low level; bit15~bit6 are reserved Bit.

[Note 2]: The data read from this address is 16 bits, bit5~bit0 means the input state of DO6~DO1, "1" means input high level, "0" means input low level; bit15~bit6 are reserved Bit.

9.6 Communication example

9.6.1 Reading state quantity (CMD=04H)

Use the read status function code (04H) to read all monitoring status variables in the servo drive. The communication frame format is described as follows:

Note: The maximum number of states read each time is 8.

The request frame format is as follows:

Address field 1 byte	Function code 1 byte	Starting address value 2 bytes, high byte first	Number of read states 2 bytes, high byte first	CRC check code 2 bytes, low byte first
0x01	0x04	0x00, 0x00	0x00, 0x01 (N)	CRC_Lo, CRC_Hi

Normal response:

Address field 1 byte	Function code 1 byte	Number of bytes occupied by status 1 byte	Status value, 2N bytes, High byte first	CRC check code 2 bytes, low byte first
0x01	0x04	0x02 (2N)	0xXX,0xXX,	CRC_Lo, CRC_Hi

Abnormal response:

Address field 1 byte	Function code 1 byte	Exception code 1 byte	CRC check code 2 bytes, low byte first
0x01	0x84	0x01 or 02 or 03 or 04	CRC_Lo, CRC_Hi

Examples are as follows:

The host sends a frame:

ADDR	CODE	STADDR_H	STADDR_L	RNUM_H	RNUM_L	CRC_L	CRC_H
0x01	0x04	0x00	0x01	0x00	0x02	0xXX	0xXX

Slave machine response frame:

ADDR	CODE	BYTE_NUM	DATA1_H	DATA1_L	DATA2_H	DATA2_L	CRC_L	CRC_H
0x01	0x04	0x04	0xXX	0xXX	0xXX	0xXX	0xXX	0xXX

STADDR: start address of read status

RNUM: number of read status

BYTE_NUM: The number of bytes occupied by the read status (for example, if RNUM is 2, that is, 2 pieces of 16-bit data, BYTE_NUM is $2*2 = 4$ bytes)

DATA: The status value read back, X represents the serial number, DATA1 is the first data, DATA2 is the second data

In the sending frame of this example, STADDR = 0x0001, RNUM = 0x02, which means to read 2 status data starting from the starting address 0x0001 (that is, read the two status values at addresses 0x0001 and 0x0002, the specific meaning is described in the previous section). BYTE_NUM = 0x04 in the response frame, indicating that the two status values read occupy 4 bytes, followed by DATA1, DATA2

That is, the status values at addresses 0x0001 and 0x0002.

9.6.2 Read parameters (CMD=03H)

The parameter reading function code (03H) can be used to read all the parameters in the drive. The description of the communication frame format is as follows:

Note: The maximum number of parameters read each time is 8.

The request frame format is as follows:

Address field 1 byte	Function code 1 byte	Starting address value 2 bytes, high byte first	Number of read states 2 bytes, high byte first	CRC check code 2 bytes, low byte first
0x01	0x03	0x00, 0x00	0x00, 0x01 (N)	CRC_Lo, CRC_Hi

Normal response:

Address field 1 byte	Function code 1 byte	Number of bytes occupied by status 1 byte	Status value, 2N bytes, High byte first	CRC check code 2 bytes, low byte first
0x01	0x03	0x02 (2N)	0xXX,0xXX,	CRC_Lo, CRC_Hi

Abnormal response:

Address field 1 byte	Function code 1 byte	Exception code 1byte	CRC check code 2 bytes, low byte first
0x01	0x83	0x01 or 02 or 03 or 04	CRC_Lo, CRC_Hi

Examples are as follows:

The host sends a frame:

ADDR	CODE	STADDR_H	STADDR_L	RNUM_H	RNUM_L	CRC_L	CRC_H
0x01	0x03	0x00	0x01	0x00	0x02	0xXX	0xXX

Slave machine response frame:

ADDR	CODE	BYTE_NUM	DATA1_H	DATA1_L	DATA2_H	DATA2_L	CRC_L	CRC_H
0x01	0x03	0x04	0xXX	0xXX	0xXX	0xXX	0xXX	0xXX

STADDR: Read the starting address of the parameter

RNUM: the number of parameters read

BYTE_NUM: The number of bytes occupied by the read parameter (for example, if RNUM is 2, that is, 2 pieces of 16-bit data, BYTE_NUM is $2*2 = 4$)

DATA_X: the parameter value read back, X represents the serial number, DATA1 is the first parameter, DATA2 is the second parameter

In the sending frame of this example, STADDR = 0x01, RNUM = 0x02, which means to read 2 parameters starting from the starting address 1. (That is, read the two parameters P-001 and P-002 with addresses 0x01 and 0x02).

BYTE_NUM = 0x04 in the response frame, indicating that the two parameter values read occupy 4 bytes, followed by DATA1, DATA2

That is, the parameter values with addresses 0x01 and 0x02.

9.6.3 Write a single parameter (CMD=06H)

Use the parameter writing function code (06H) to write the parameters listed in the commissioning manual. The communication frame format is described as follows:

Note: Function code 06H can only write one parameter at a time. Before writing the parameter, please refer to the parameter manual to confirm the specific meaning of the parameter. Writing the parameter value incorrectly may cause the servo drive to operate abnormally!

The request frame format is as follows:

Address field 1 byte	Function code 1 byte	Parameter number 2 bytes, high byte first	Parameter value written 2 bytes, high byte first	CRC check code 2 bytes, low byte first
0x01	0x06	0x00, 0x00	0x00, 0x64	CRC_Lo, CRC_Hi

Normal response:

Address field 1 byte	Function code 1 byte	Parameter number 2 bytes, high byte first	Parameter value written 2 bytes, high byte first	CRC check code 2 bytes, low byte first
0x01	0x06	0x00, 0x00	0x00, 0x64	CRC_Lo, CRC_Hi

Abnormal response:

Address field 1 byte	Function code 1 byte	Exception code 1 byte	CRC check code 2 bytes, low byte first
0x01	0x86	0x01 or 02 or 03 or 04	CRC_Lo, CRC_Hi

Examples are as follows:

The host sends a frame:

ADDR	CODE	WADDR_H	WADDR_L	VALUE_H	VALUE_L	CRC_L	CRC_H
0x01	0x06	0x00	0x01	0x01	0x02	0xXX	0xXX

Slave machine response frame:

ADDR	CODE	WADDR_H	WADDR_L	VALUE_H	VALUE_L	CRC_L	CRC_H
0x01	0x06	0x00	0x01	0x01	0x02	0xXX	0xXX

WADDR: write parameter address

VALUE: the value to be written

In the sending frame of this example, ADDR = 0x01, VALUE = 0x0102, which means that the value 0x0102 is written into the parameter whose address is 0x01.

The response frame is the same as the transmission frame.



9.6.4 Write multiple parameters (CMD=10H)

The parameters listed in the commissioning manual can be written using the parameter writing function code (10H). The description of the communication frame format is as follows:

Note: Function code 10H can write multiple parameters at a time (the maximum number of parameters written in a single time is 10). Before writing the parameter, please refer to the parameter manual to confirm the specific meaning of the parameter. Writing the parameter value incorrectly may cause the servo drive to operate abnormally!

The request frame format is as follows:

Address field 1 byte	Function code 1 byte	Starting address value, 2 bytes, high byte first	The number of written parameters, 2 bytes, high byte first (1~122)	The number of bytes occupied by the parameter, 1 byte (0~255)	Parameter value, 2N bytes, high byte first	CRC check code 2 bytes, low byte first
0x01	0x10	0x00, 0x00	0x00, 0x02 (N)	0x04 (2N)	0xXX, 0xXX,	CRC_Lo, CRC_Hi

Normal response:

Address field 1 byte	Function code 1 byte	Starting address value, 2 bytes, high byte first	The number of written parameters, 2 bytes, High byte first	CRC check code 2 bytes, low byte first

0x01	0x10	0x00, 0x00	0x00, 0x02 (N)	CRC_Lo, CRC_Hi
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Abnormal response:

Address field 1 byte	Function code 1 byte	Exception code 1 byte	CRC check code 2 bytes, low byte first
0x01	0x90	0x01 or 02 or 03 or 04	CRC_Lo, CRC_Hi

Examples are as follows:

The host sends a frame:

ADR	CODE	SADRH	SADRL	WNUMH	WNUML	WNUMB	D1_H	D1_L	D2_H	D2_L	CRCL	CRCH
0x01	0x10	0x00	0x01	0x00	0x02	0x04	0xXX	0xXX	0xXX	0xXX	0xXX	0xXX

Slave machine response frame:

ADR	CODE	SADRH	SADRL	WNUMH	WNUML	CRCL	CRCH
0x01	0x10	0x00	0x01	0x00	0x02	0xXX	0xXX

SADR: write parameter start address SADRH (high byte) SADRL (low byte)

WNUM: the number of written parameters WNUMH (high byte)

WNUML (low byte) WNUMB: the number of bytes written by the

parameter (for example, WNUM is 2, that is, two 16-bit data, then

WNUMB is $2 * 2 = 4$)

D1_H: The high byte value of the first parameter written

D1_L: The low byte value of the first parameter written

D2_H: the high byte value of the second parameter written

D2_L: The low byte value of the second parameter written

In this example, SADR = 0x01 and WNUM = 0x02 in the sending frame, which means that starting from the starting address 1, write 2 parameters (that is, the two parameters P-001 and P-002 with addresses 0x01 and 0x02).

9.6.5 Diagnosis function (CMD=08H)

After the master sends the diagnostic frame, the slave (servo drive) will respond with the same data.

Tip: The diagnosis function can be used to determine whether the MODBUS communication is normal.

The host sends a frame:

ADDR	CODE	DATA_H	DATA_L	CRC_L	CRC_H
0x01	0x08	0x12	0x34	0xXX	0xXX

Slave machine response frame:

ADDR	CODE	DATA_H	DATA_L	CRC_L	CRC_H
0x01	0x08	0x12	0x34	0xXX	0xXX

The response frame data from the slave of the diagnostic command should be exactly the same as the frame data sent by the master, so the diagnostic command can be used to check whether the communication is normal. DATA can be any custom data. For example, if the master sends 0xABCD, the slave responds with 0xABCD.

9.6.6 Save parameters (CMD=41H)

The parameter saving function code (41H) can be used to store the parameters of the drive in EEPROM. The communication frame format is explained as follows:

Note: After sending this command, the servo drive needs some time to save the parameters to EEPROM

It is recommended that after sending this command, wait for more than 5S before performing other operations.

The request frame format is as follows:

Address field 1 byte	Function code 1 byte	CRC check code 2 bytes, low byte first
0x01	0x41	CRC_Lo, CRC_Hi

Normal response:

Address field 1 byte	Function code 1 byte	CRC check code 2 bytes, low byte first
0x01	0x41	CRC_Lo, CRC_Hi

Abnormal response:

Address field 1 byte	Function code 1 byte	Exception code 1byte	CRC check code 2 bytes, low byte first
0x01	0xC1	0x01 or 02 or 03 or 04	CRC_Lo, CRC_Hi

9.6.7 Servo enable/disable (CMD=42H)

Request/normal response:

Address field 1 byte	Function code 1 byte	Enable shutdown flag 1byte	CRC check code 2 bytes, low byte first
0x01	0x42	0x55 (enable) or 0xAA (off)	CRC_Lo, CRC_Hi

Abnormal response:

Address field 1 byte	Function code 1 byte	Exception code 1byte	CRC check code 2 bytes, low byte first
0x01	0xC2	0x01 or 02 or 03 or 04	CRC_Lo, CRC_Hi

9.6.8 Alarm clear (CMD=43H)

Request/normal response:

Address field 1 byte	Function code 1 byte	CRC check code 2 bytes, low byte first
0x01	0x43	CRC_Lo, CRC_Hi

Abnormal response:

Address field 1 byte	Function code 1 byte	Exception code 1byte	CRC check code 2 bytes, low byte first
0x01	0xC3	0x01 or 02 or 03 or 04	CRC_Lo, CRC_Hi

9.6.9 JOG Jog operation (CMD=44H)

Request/normal response:

Address field 1 byte	Function code 1 byte	Operation mode 1byte	CRC check code 2 bytes, low byte first
0x01	0x44	0x03 (enable, JOG zero-speed hold), 0x01 (JOG forward rotation), 0x02 (JOG reverse), 0x00 (Exit JOG, disable enable) Note: JOG speed is controlled by P-076 (r/min)	CRC_Lo, CRC_Hi

Abnormal response:

Address field 1 byte	Function code 1 byte	Exception code 1byte	CRC check code 2 bytes, low byte first
0x01	0xC4	0x01 or 02 or 03 or 04	CRC_Lo, CRC_Hi