



Design and debugging manual
for AC servo driver

Applicable product

HSV-A7 Series spindle Driver

Please read this manual carefully before use

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Safety precautions

I. Personnel safety

- This product is a high-voltage and high-current product. When powered on, ensure that people are in the safe area of the moving mechanism.
- This product is a high-voltage and high-current product. Wrong operation may cause electric arc burn and electric shock.
- It is forbidden to operate the wiring and electrify according to the instructions.

II. Safety of the occasion

- This product is a high-voltage and high-current product. It is forbidden to use electricity in combustible gas and corrosive gas, otherwise it may cause fire and explosion.
- It is forbidden to use electricity at the dripping place of inflammable and explosive substances, which may cause fire and explosion.
- It is forbidden to use it under the conditions of high humidity, moisture and metal powder, which cause dangerous situations such as electric shock for oneself and others.

III. Product and equipment safety

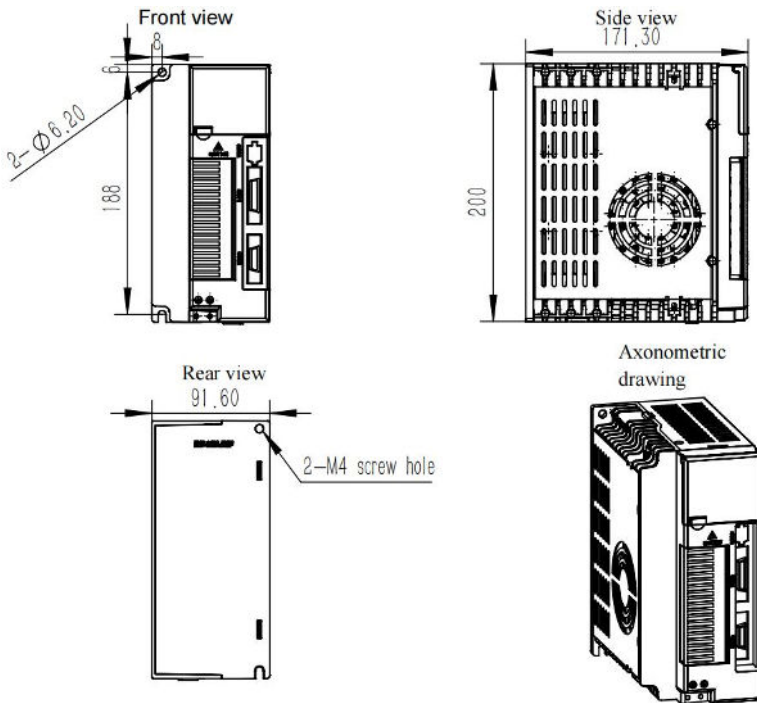
- This product is a high-voltage and high-current product. Wrong connection will cause product damage.
- PE terminal must be grounded, and ensure that the ground wire is reliably grounded.
- L series of this product is suitable for AC220V power supply; H series is suitable for AC380V power supply. Do not connect it incorrectly.
- Products U, V and W should be connected to the motor, which is output. Please do not connect the input power supply.
- Products U, V and W are three-phase outputs. Do not connect them in the wrong order. Wrong connection may cause motor runaway, equipment damage and overcurrent damage of the product.

- All terminals should be tightened. All wiring specifications should be strictly selected based on power.
- Do not distribute power or touch the terminals while the driver is powered on.
- Do not touch the terminal within 5 minutes after the power is off.
- It is prohibited to touch the motor and cables while the motor is running to prevent accidental injuries such as burns and sprains...

Chapter 1 Installation

Installation dimension of servo driver

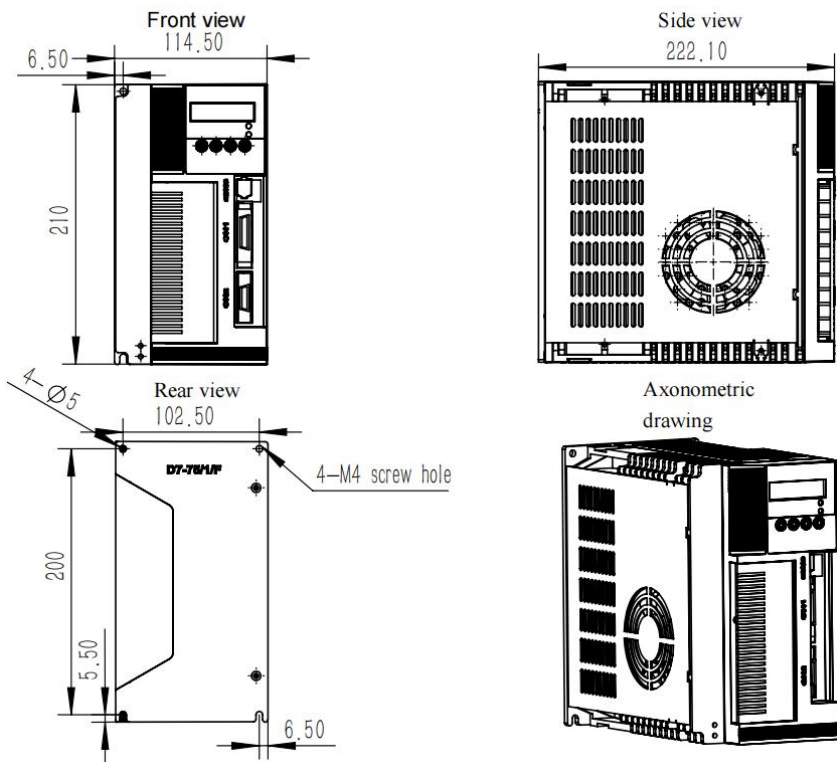
1.1.1 Installation dimension of servo driver of 3.7 KW (unit: MM)



Recommended screws: 2-M4; Recommended locking torque: 1.2 N. M.

Figure 1.1.1 3.7 KW Appearance dimension diagram

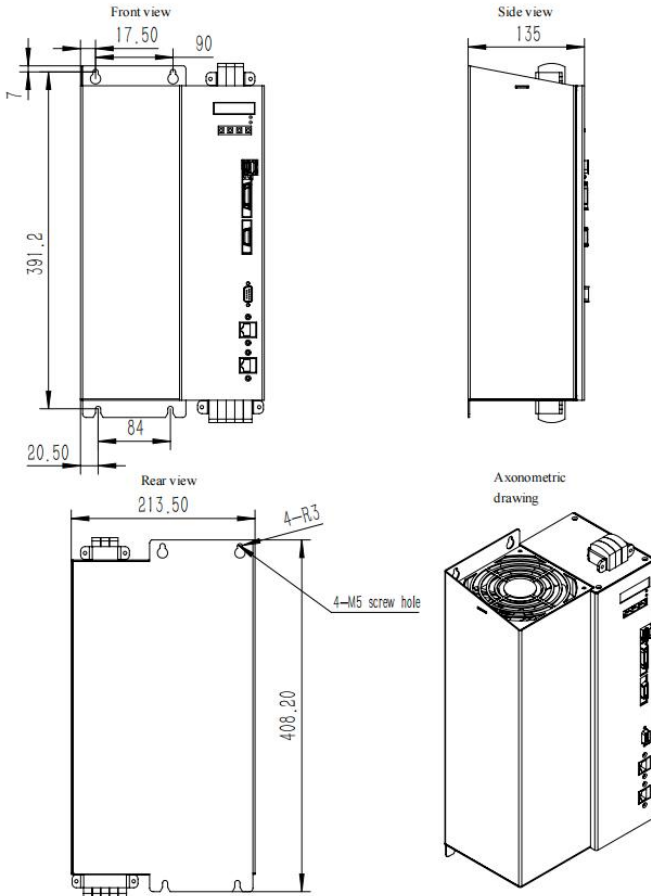
1.1.2 5.5 KW/7.5KW Servo Driver Installation Dimensions (Unit: MM)



Recommended screw: 4-M4; Recommended locking torque: 1.2 N. M.

Figure External dimension drawing of 1.1.2 5.5KW/7.5KW

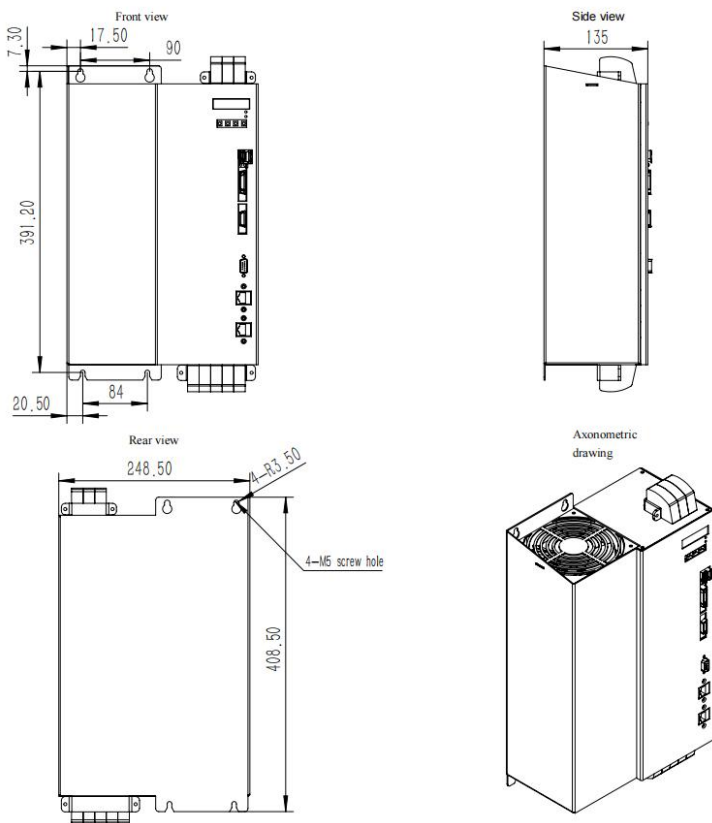
1.1.3 Installation dimension of 11KW/15 KW servo driver (unit: MM)



Recommended screw: 4-M5; Recommended locking torque: 2 N. M.

Figure 1.1.3 11KW/15KW Installation dimension drawing

1.1.4 Installation dimension of servo driver (unit: MM)



Recommended screw: 4-M5; Recommended locking torque: 2 N. M.

Figure 1.1.4 18.5KW/22KW/30KW Installation dimension drawing

1.1.5 Installation occasion

1. To ensure the normal operation of the drive, it is necessary to ensure that the ambient temperature of the drive is below 50 ° C and the relative humidity is below 90%. The long-term safe operating temperature is below 40 ° C.
2. Servo drives are prone to failure when used in harsh environments with corrosive gases, humidity, metal dust, water and processing liquids. Therefore, the working environment of the drive should be fully considered in the process of installation.
3. The vibration of equipment directly or indirectly connected to the servo driver must be guaranteed to be below 0.5G (4.9m/s²) or smaller to ensure long-term stable operation of the servo driver.
4. The servo drive may also be interfered while interfering, so it is important to pay attention to the wiring of strong and weak currents when installing the electrical cabinet or complete equipment. When external interference signals are strong, the power line and control signal of the servo drive may be severely affected, which may cause the drive to malfunction and even cause misoperation. Poor wiring and unstable operation of control devices such as the upper computer under driver interference can also occur. Pay attention to installing acoustic magnetic rings, filters, isolation transformers, etc. at the source of interference and the affected area. Special attention should be paid to the fact that the control signal line of the driver is easily disturbed, and reasonable wiring and shielding measures should be taken..

1.1.6 Installation direction and space

1. Pay attention to the installation direction (see Figure 1.3).
2. Pay attention to the installation spacing (see Figure 1.3).
3. Four M5 screws can be fixed and spring pads need to be installed.
4. The servo must be installed in a relatively enclosed space. Maintain ventilation inside the electrical cabinet and install a filter screen at the ventilation outlet to prevent dust from entering. And regularly clean to prevent blockage of airflow..

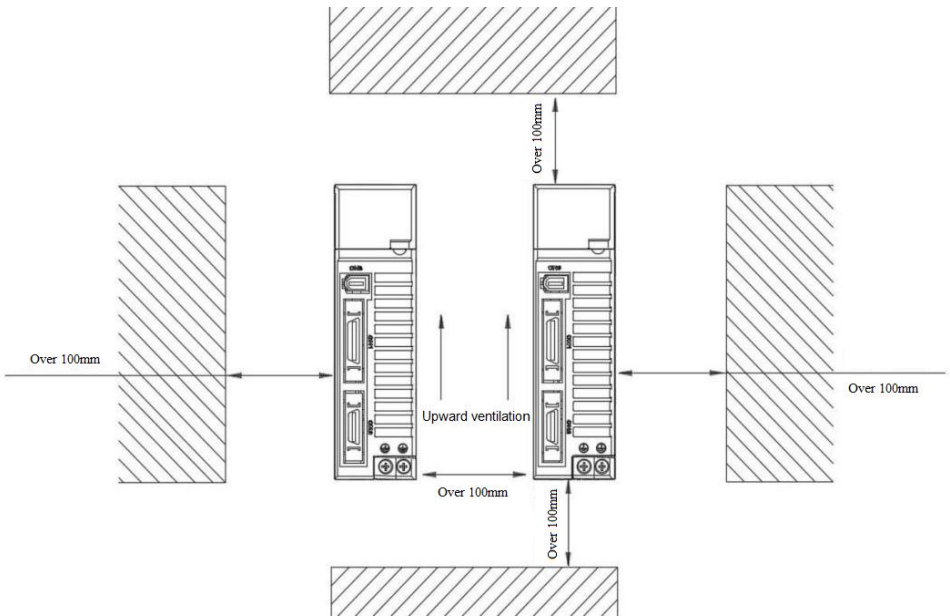


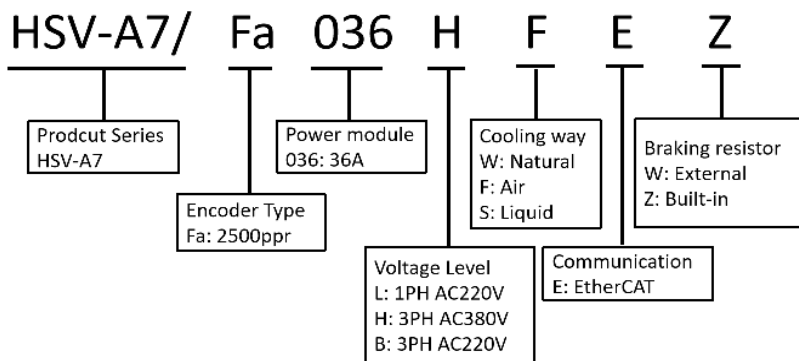
Fig. 1.3 Installation Orientation Diagram

Chapter II Function Overview

2.1 Basic functions of servo HSV-A7 series

Model		HSV-A7 Series (1.0 KW ~ 30 KW)
Control power supply and Main circuit power supply		L: single-phase or three-phase AC220V power supply; H: Three-phase 380 V power supply; Voltage fluctuation: -15 ~ + 10%, 50/60Hz;
Environment	Temperature	Operation: 0 ~ 55 ° C Storage: -40 ° C ~ 80 ° C
	Humidity	Not more than 90% (no condensation)
	Air Index	No dust (iron powder and other conductive media) in the electric cabinet
Control mode		1: Position control 2: Speed control 3: JOG operation 4: Internal speed Four speed 5: Position & speed control
External I/O		1: Enable 2: Reset 4: Pulse, CCW, CW, Disable 5: Position switching 6: Speed selection 7: Zero speed clamping 8: Extended functions such as orientation and accurate stop (option) 10: Positioning completed
Encoder feedback		10000p/R (standard), 17bit/22bit/23bit/biss/resolver (option)
Communication method		RS485/MECHATROLINK/EtherCAT/CANopen (option)
Load inertia		Less than 5 times of motor inertia
Monitoring function		Speed, current position, command pulse accumulation, position deviation, motor current, Operation status, input and output terminals, Z pulse signal, etc.
Protection function		Overvoltage, overcurrent, overspeed, overload, abnormal feedback, etc.
Alarm function		When the servo works abnormally, it will be accompanied by alarm output, LED flashing, and red light on.
Gain adjustment		Gain can be adjusted to match motor performance when the motor is running or stopping
Adapt motor		1KW~30KW

2.2 Servo selection



Chapter III Wiring

3.1 Precautions

- The servo drive is a high-voltage, high current product, and incorrect connection can cause personal injury and equipment damage..
- PE terminal must be grounded, and ensure that the ground wire is reliably grounded.
- L series of this product is suitable for AC220V power supply; H series is suitable for AC380V power supply. Please do not connect to the power supply by mistake.
- The products U, V, and W should be connected to the motor as output power. Do not connect to the input power.
- The products U, V, and W are three-phase outputs, and do not connect them in the wrong order. Incorrect connection may cause high-speed operation of the motor upon opening the switch lock, equipment damage, and overcurrent burning of this product.
- Ensure that all terminals are securely fastened and all wiring specifications are strictly selected according to power.
- Do not distribute power or touch the terminals while the drive is powered on.
- Do not touch the terminal within 5 minutes after the power is off.
- It is prohibited to touch the motor and cables while the motor is running to prevent accidental injuries such as burns and sprains.

3.2 Wiring Requirements

- It is better to use three-phase isolation transformer for power supply.
- Wire diameters of product R, S, T, and U, V, W, PE are required to be $\geq 4.0 \text{ mm}^2$.
- All power terminals are required to be cold pressed to ensure firmness and reliability.
- CN1 and CN2 are high-density signal plug cables with shielding layer.
- The wiring requirements for PE terminals should be yellow green wire and the wire diameter should be $\geq 4.0 \text{ mm}^2$.

3.3 Typical wiring

3.3.1 Pulse spindle wiring

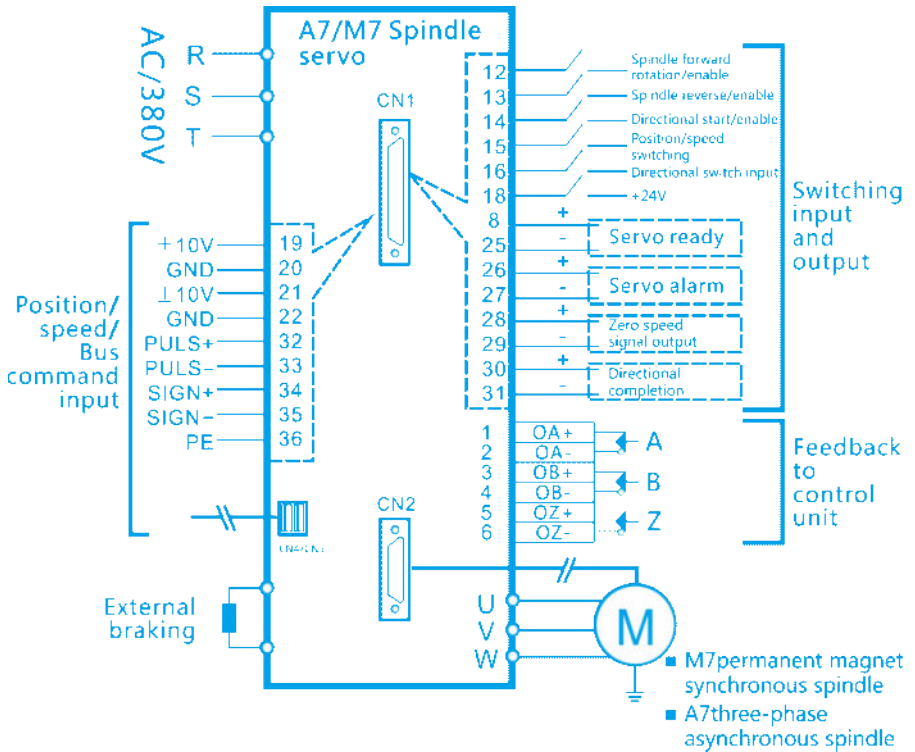


Figure 3.3 Pulse spindle wiring

Chapter IV Interface

4.1 Definitions of servo control power supply and main power terminal

Identification	Signal name	Function
R	Control circuit, main circuit power supply (connected by isolation transformer)	The L: R, S and T can be connected with any two terminals of three-phase or single-phase 220V 50HZ power supply, and the control power supply and main circuit power supply of this machine are designed as an integrated system. The H: R, S and T can be connected to a three-phase 380V 50HZ power supply, and the control power supply and main circuit power supply of this machine are designed as an integrated system. Caution: Do not connect to motors U, V, W.
S		
T		
PE	Ground wire for input power supply	Be sure to connect to the equipment casing and the ground of the workshop's main power supply.
B1/P+	External braking resistor	The small power range is usually not used, and the driver has a built-in resistor; When running at high speed with large inertia, an external braking resistor needs to be selected, and the braking resistor has a model description.
B2/PB		
u	Output to servo motor	The U, V and W on the servo terminal must correspond to those on the servo motor and cannot be misplaced. If the connection is wrong, it will lead to life accidents, equipment failure and damage to the servo system. Be careful not to connect to the power supply R, S, T.
V		
W		
PE	Output motor ground wire	Connected to servomotor housing PE.

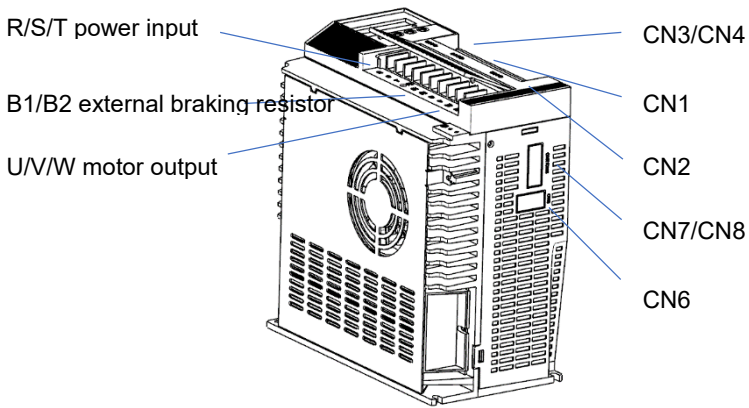


Figure 4.1 5KW ~ 7.5KW Connection Distribution Diagram

4.2 CN1 Interface: switching value/input/output

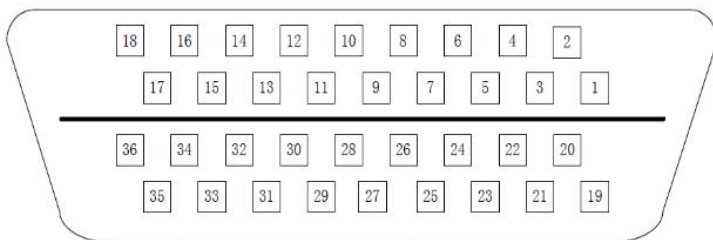


Figure 4.2 Top view of the 36 core plug solder joint of interface CN1

Type	Pin	Name	Type	Pin No.	Name
Input	12	Spindle forward/enable	Analog quantity	19	First analog +
	13	Spindle reverse/enabled		20	First analog quantity-
	14	Directional Start/Enable		21	Second Simulation +
	15	Position/speed switching		22	Second analog quantity-
	16	Directional switch input		23	Analog input ground
	18	Input COM + 24V		32	PULS+
Switch value output	8/25	Servos ready	Pulse	33	PULS-
	26/27	Servo alarm		34	SIGN+
	28/29	Zero speed signal output		35	SIGN-
	30/31	Directional completion output		36	PE
Type	Pin	Name	Type	Pin number	Name
Feedba ck signal	1	OA+	Feedba ck signal	2	OA-
	3	OB+		4	OB-
	5	OZ+		6	OZ-

4.3 CN2 Interface, encoder input signal definition

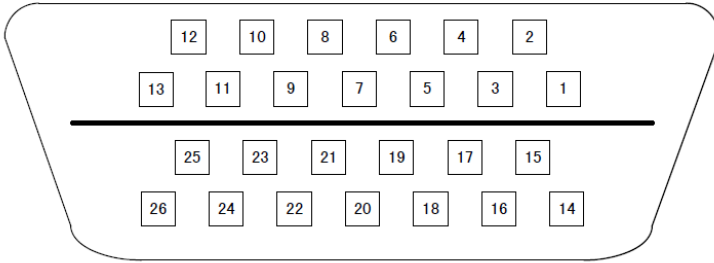


Figure 4.3 Top view of CN2 26 core plug solder joint

Type	Pin	Name	Type	Pin	Name
Optoelectronic encoder feedback input	1	A+	Rotary encoder feedback input	1	REF+
	2	A-		3	REF-
	3	B+		5	COS+
	4	B-		7	COS-
	5	Z+		9	SIN+
	6	Z-		11	SIN-
	14	5V		26	PE
	20	0V		/	/
	26	PE		/	/

4.4 Switching value input interface principle

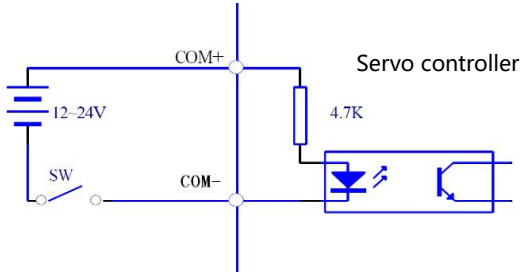


Figure 4.4 Switching value input interface

- External DC12V-24V power supply is required, with current ≥ 105 MA.
- If the positive and negative connections are reversed, the drive will be damaged and will not work properly.

4.5 Switching value output interface principle

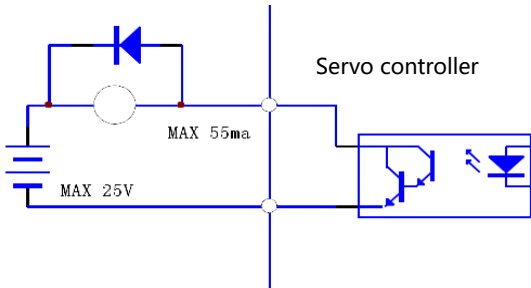


Figure Input Interface of 4.5 Switching Value

- The maximum output voltage is 25 V, and the maximum current is ≤ 55 MA.
- If the positive and negative connections are reversed, it can cause drive

damage and malfunction.

- The output load is an inductive element and requires a reverse shunt diode (the polarity must be connected correctly, otherwise the driver will be damaged, which is equivalent to a short circuit).

4.6 Pulse input interface principle

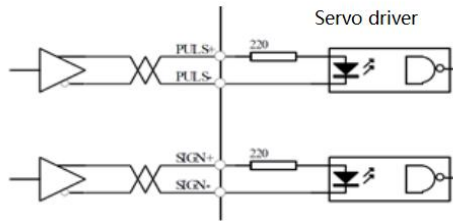


Figure 4.6-a Pulse Differential Output Mode

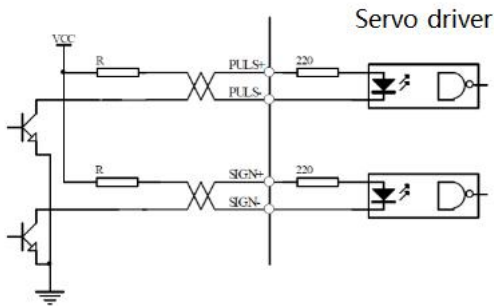


Figure 4.6-B pulse single-ended output model

- If the differential pulse output form is relatively reliable, it is recommended to use the similar RS422 line driver such as AM26LS31.
- Single-ended input mode external power supply, the operating frequency will be reduced. The following empirical data are available:

Input voltage Vcc	Series resistance R
24V	1.1K~2K
12V	500Ω ~ 820Ω
5V	80Ω ~ 120Ω

4.6 Pulse input form



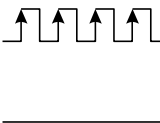

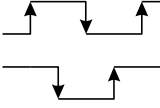
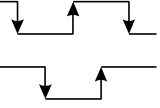
Pulse form	CCW operation	CW operation	Parameter selection
Pulse + direction			Parameter PA14 = 0
CCW pulse CW pulse			Parameter PA14 = 1
AB biphasic Quadrature pulse			Parameter PA14 = 2

Figure 4.7 Pulse form

4.7 Principle of analog input interface

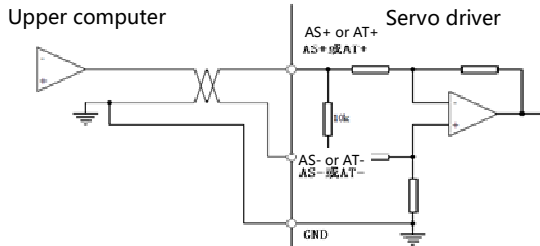


Figure 4.8-a Differential Input Interface

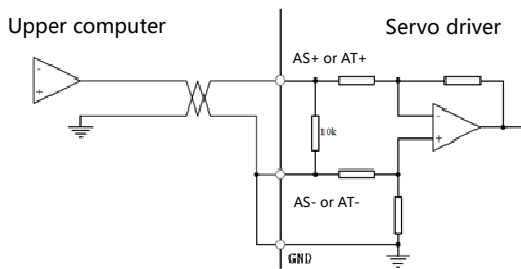


Figure 4.8-B Analog Single-Ended Input Interface

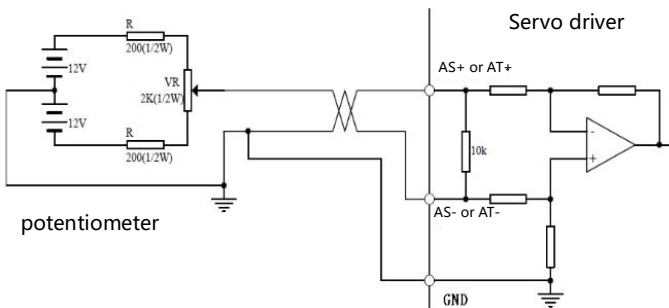


Figure 4.8-C Analog differential potentiometer input interface

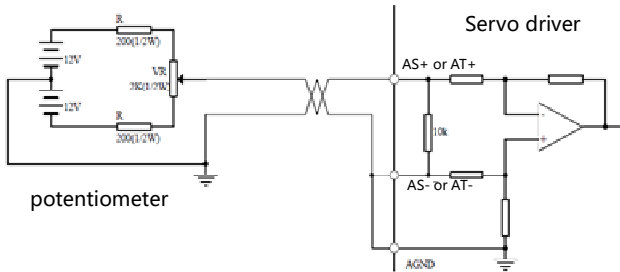


Figure 4.8-d Analog Single-Ended Potentiometer Input Interface

- The analog input voltage shall not exceed the range of $-10\text{V} \sim +10\text{V}$, otherwise the driver will be damaged.
- There is deviation in the analog quantity due to attenuation and interference in wires and interface circuits. It is recommended to be connected with shielded cable and grounded at both ends. Parameter PA49 can set the threshold voltage (unit: rev/min).
- The deviation of analog quantity exists and must be adjusted. Parameter PA45 can compensate for the deviation.

4.9 Encoder Interface Principle

4.9.1 Encoder signal output CN1 interface (driver to upper computer)

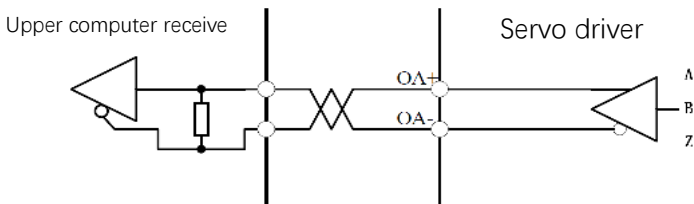


Figure 4.9.1 CN1 Encoder Output Interface

- The encoder signal is output non isolated through the differential driver AM26LS31.
- The upper computer can adopt AM26LS32 receiving or high-speed photoelectric coupling receiving.

4.9.2 encoder signal input CN2 interface (servo motor to driver)

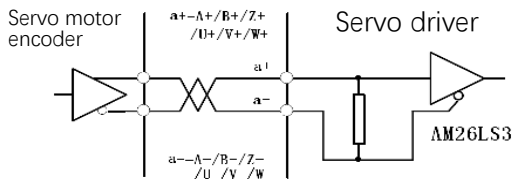


Figure 4.9.2 CN2 photoelectric encoder input interface

4.9.3 Encoder Z signal output CN1 interface (driver output to host computer for zero adjustment)

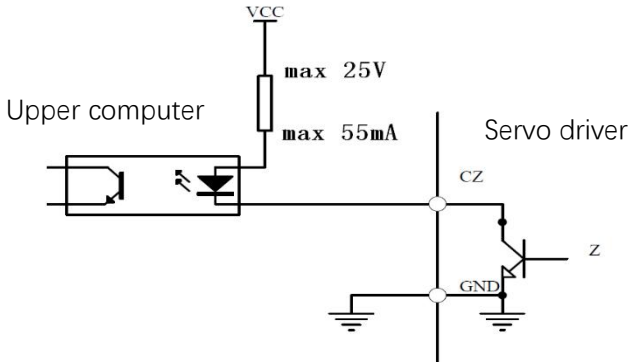


Figure 4.9.3 CN1 photoelectric encoder Z signal output interface

- This Z signal is an open collector output without isolation, and the encoder Z signal is on but not off.
- A high speed optocoupler is required to receive this signal.

Chapter 5 Display and Operation

5.1 Panel operation

The panel is composed of 6 LED digital tube displays and 4 keys " \uparrow ", " \downarrow ", " \leftarrow ", "Enter", a red light "Alm" and a green light "Run", which are used to display various states and parameters setting of the system.



Figure 5.1 operation panel

The operation is hierarchical, as follows:

The \leftarrow key represents the back, exit, and cancel of the hierarchy;

The Enter key represents hierarchy advance, enter, and confirm;

The \uparrow and \downarrow keys indicate to increase or decrease the serial number or numerical value;

Alm red indicator light is on, indicating alarm, and the digital tube has alarm display;

Run green indicator light indicates that the motor is in the enabled working state;

- When the decimal in the lower right corner of the digital tube lights up, it indicates that the current parameter value is in the modification state.
- If the Alm red light is on and the alarm number "Err--xx" flashes, in order to drive the alarm, it is necessary to cut off the power in time and find out the cause of the alarm.

5.2 Parameter structure composition

There are a total of 11 modes. Select the operation method for the first layer, Press the ← key to return to the main menu. Use the ↑ and ↓ keys to select the mode. Press the Enter key to enter the second layer of the selected mode. Press the ← key to return to the first layer.

DP--	Monitor status mode
PA--	Parameter modification mode
PE--	Spindle parameter mode
EE--	Parameter management mode
SR--	Speed trial operation Mode
JR--	JOG operating mode
AU--	Analog automatic zero adjustment
CO--	Spindle self-learning mode
OL--	Open loop operation mode
HA--	Historical alarm parameters
WA--	Main shaft orientation angle self-learning

Table 5.2 Mode Operation Diagram

5.2.1 Parameter Monitoring Mode (DP--)

DP-SPD	Motor speed	→ r 1000	-- 1000 rpm
DP-POS	5 bits lower of the current position	→ P 9999	-- 9999 pulses
DP-POS.	5 bits higher than the current position	→ P. 11	-- 110000pulses
DP-CPO	5 bits lower of position command	→ C 9999	-- 9999 pulses
DP-CPO.	5 bits upper of position command	→ C. 22	-- 220000pulses
DP-EPO	5 lower bits of position deviation	→ E 9	-- 9 pulses
DP-EPO.	5 higher bits of position deviation	→ E 0	-- 0 pulse
DP-TRQ	Motor torque (%)	→ T 60	-Motor torque 70%
DP-I	Motor current (A)	→ I 2.15	--Motor current 2.15 A
DP-LSP	Z pulse count	→ 32768	-- Number of Z pulses
DP-ABS	Single lap low 16 bit	→ 1072	-- 1072 pulses
DP-ABS.	Single lap high 16 bit	→ 13	-- 13 * 10000 pulses
DP-ABM	Multi-turn absolute position	→ 65536	-- 65536 laps
DP-CS	Speed command	→ r. 35	-- Speed command 35 rpm
DP-Ct	Torque command	→ t. 70	-- Torque command 20%
DP-APO	Rotor absolute position	→ A 2500	-- 2500 pulses
DP--IN	Input terminal status	→ Inhlhl	--Input terminal status
DP-Out	Output terminal status	→ outlhl	--Output terminal status
DP-COD	Encoder UVW input	→ cod lh	-- Encoder signal
DP-HSP	The second feedback Z pulse	→ P83820	-- Number of Z pulses
DP-SPO	The second feedback absolute position	→ P 20	-- 200000 pulses
DP-Err	Alarm mode	→ Err--	-- Err 9
DP-SLU	Axis number display	→ SLU- 1	-- Axis 1

Table 5.2.1 Watch List Chart

- The input pulse quantity is the pulse operated by the input electronic gear.
- The pulse quantity unit is the servo internal pulse unit, 10,000 pulses/revolution.
- Operation status display:
 - "No display on the digital tube" indicates that the servo strong current is not connected.
 - "Red light on" indicates that the servo is in fault state.
 - "Green light on" means that the servo strong current and enable are connected, and it is in the running state.
- The absolute position of the rotor in a circle indicates the position of the rotor relative to the stator in a circle, one circle is a cycle, the range is 0 ~ 9999, and the electronic gear ratio does not participate in the calculation.
- The HSV-A7 series covers the appearance of 8 power bands of servo drives. The signal interface definitions can be interchanged, and some power connection components or power related parameters may vary slightly.

5.3 Input terminal status display

As shown in the following figure:

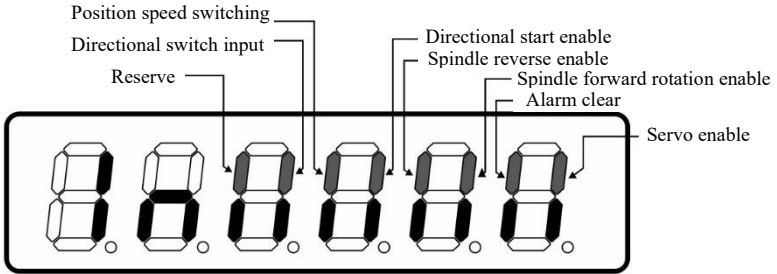


Fig. 5.3 Input Terminal Status Display

(If the stroke is **on**, the signal input is ON, and if it is off, it represents OFF.)

5.4 Output terminal status display

As shown in the following figure:

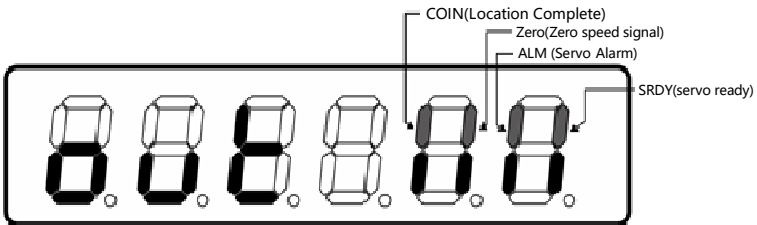


Figure 5.4 Output terminal status display

(If the stroke is **on**, the signal input is ON, and if it is off, it represents OFF.)

5.5 Encoder status display

As shown in the following figure:

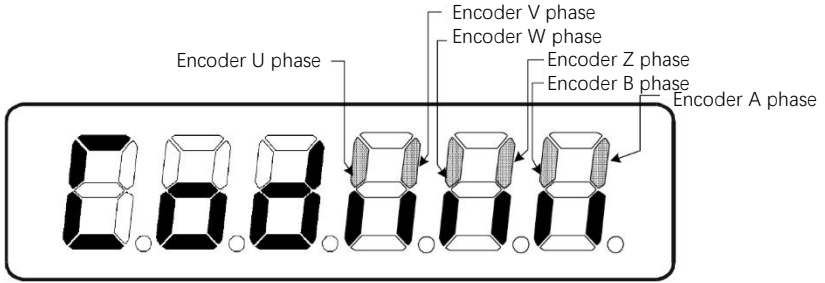


Figure 5.5 Status display of encoder feedback signal

(If the stroke is **on**, the signal input is ON, and if it is off, it represents OFF.)

5.6 Parameter modification mode (PA--)

Press the "Enter" key to enter the "PA--" parameter modification mode, press the **↑** and **↓** keys to add or subtract the parameter number, and press the "Enter" key to enter the parameter modification mode. When the parameter is modified, the decimal point at the lower right corner of the digital tube will be on. Press the "Enter" key again to confirm, and the decimal point will be off. Press the **←** key to return.

PA0	Parameter password	→ 385	User password
PA1	Motor model code	→ SP	Motor code
PA4	Control mode selection	→ 1	Speed control mode

Table 5.6.1 Modify Parameter Mode Operation

5.7 Parameter Management Mode (EE--)

Press the "Enter" key to enter the "EE--" parameter management mode, press the ↑ and ↓ keys to add or subtract the parameter items, find the menu that should be saved or restored, press the "Enter" key for more than 3 seconds, the "Finish" operation will be successful, and it will take effect after the power is off. If it fails or the password is incorrect, the "Error--" will appear.

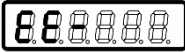


EE--SET	-- parameter saving	→ Enter – Press for more than 3 seconds
EE--RD	-- parameter read	→ Enter – Press for more than 3 seconds
EE—BA	-- Parameter backup	→ Enter – Press for more than 3 seconds
EE—RS	-- Restore backup	→ Enter – Press for more than 3 seconds
EE--DEF	-- Restore default	→ Enter – Press for more than 3 seconds

Table 5.7 Operation of parameter management mode

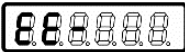


- 1、EE — SET parameter is written, and the password of parameter PA-0 is 510, which is mainly used to permanently save the parameters. When the saving is completed, it will not be affected by power failure. The modified parameters can be used after power up again.
- 2、EE-BD parameter backup is to write the parameters with good effect in the existing servo state into the EEPROM backup area, which is used together with the recovery backup.
- 3、EE — RS recovery backup is to restore the backup parameters of the backup area from the EEPROM to the parameter table.
- 4、EE — DEF4. EE - DEF restores default values. When adapting to a new

motor, it is necessary to restore the factory values, or if the parameter adjustment is chaotic, it can also be restored to the factory values before readjusting. When restoring the factory value, PA0 must be set to 385 and the motor model must be set correctly in order to restore the factory value. The restart takes effect after restoring the factory values.

Method for restoring default value settings

Step	Panel display	key	Operation
1		↑↓ ← Enter	Press the ← key twice to select the function. If the parameter number is not EE, press ↑↓.
2		↑↓ ← Enter	Press Enter and then the ↑↓ key to display "EE-DEF".
3		↑↓ ← Enter	Press and hold the Enter key for 3 seconds to display "FINISH".

Parameter saving and setting method

Step	Panel display	key	Operation
1		↑↓ ← Enter	Press the ← key twice to select the function. If the parameter number is not EE, press ↑↓.
2		↑↓ ← Enter	Press Enter and then press the ↑↓ key to display "EE-SET".
3		↑↓ ← Enter	Press and hold the Enter key for 3 seconds to display "FINISH".


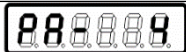


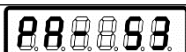


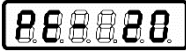
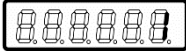


5.8 JOG inching operation mode (Jr--)

JOG inching operation mode setting method

Step	The panel shows	keystrokes	Operation
1		↑ ↓ ← Enter	Press the ← key twice to select the function. If the parameter number is not PA, press ↑ ↓.
2		↑ ↓ ← Enter	Press Enter and then press the ↑ ↓ key to display "PA-4".
3		↑ ↓ ← Enter	Press Enter to set the value "0" to "3" and press Enter to confirm.
4		↑ ↓ ← Enter	Press the ← key to select a function.
5		↑ ↓ ← Enter	Press the ↑ ↓ key to display "PA-53".
6		↑ ↓ ← Enter	Press Enter to set the value "0" to "1" and press Enter to confirm.
7		↑ ↓ ← Enter	Press the ← key twice to select the function. If the parameter number is not PE, press ↑ ↓.
8		↑ ↓ ← Enter	Press Enter and then press the ↑ ↓ key to display "PE-20".
9		↑ ↓ ← Enter	Press Enter to set the value "0" to "1" and press Enter to confirm.
10		↑ ↓ ← Enter	Press the ← key twice to select the function, then press the ↑ ↓ key to select "JR" and press Enter to confirm.
11		↑ ↓ ← Enter	Press the ↑ ↓ key to rotate the motor forward and backward.

5.9 Speed trial operation mode (Sr--)

Speed trial operation mode

Step	The panel shows	keystrokes	Operation
1		↑↓ ← Enter	Press the ← key twice to select the function. If the parameter number is not "PA", press ↑↓.
2		↑↓ ← Enter	Press Enter and then press the ↑↓ key to display "PA-4".
3		↑↓ ← Enter	Press Enter to set the value "0" to "2" and press Enter to confirm.
4		↑↓ ← Enter	Press the ← key to select a function.
5		↑↓ ← Enter	Press the ↑↓ key to display "PA-53".
6		↑↓ ← Enter	Press Enter to set the value "0" to "1" and press Enter to confirm.
7		↑↓ ← Enter	Press the ← key and then press ↑↓ to select "PE".
8		↑↓ ← Enter	Press Enter and then press the ↑↓ key to display "PE-20".
9		↑↓ ← Enter	Press Enter to set the value "0" to "1" and press Enter to confirm.
10		↑↓ ← Enter	Press the ← key twice to select the function, then press the ↑↓ key to select "Sr", and press Enter to confirm.
11		↑↓ ← Enter	Press the ↑↓ key to accelerate or decelerate the motor.

5.10 Analog automatic zero adjustment mode(AU--)

I. Speed analog zero adjustment

Press the "Enter" key to enter the "AU--spd" analog quantity zeroing mode, and then press the "Enter" key for more than 3 seconds to enter the "Start" speed analog quantity zeroing state. After that, "Finish" will be displayed and the zero drift value will be automatically saved to PA45. After that, you can also manually modify the zero drift value of PA45 and save it manually.

AU--spd	Speed analog zero setting	→ Enter – Start
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Table 5.10 Speed Analog Zero Setting Mode Operation

- Parameter PA49: Settable threshold voltage(Unit: rpm).

5.11 Spindle self-learning (CO--)

I. Spindle self-learning

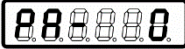
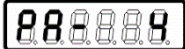

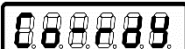
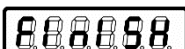
Step	The panel shows	keystrokes	Operation
1		↑ ↓ ← Enter	Press the ← key twice to select the function. If the parameter number is not
2		↑ ↓ ← Enter	Press Enter and then press the ↑ ↓ key to display "PA-4".
3		↑ ↓ ← Enter	Press the ← key to set the value "0" and the ↑ ↓ key to "8", and press the Enter
4		↑ ↓ ← Enter	Press the ↑ ↓ key to display "CO-RDY".
5		↑ ↓ ← Enter	Press and hold the Enter key for 3 seconds to display "FINISH".

Table 5.11: Spindle self-learning operation

- It is mainly used for the self-learning function of the spindle to calibrate the UVW phase sequence of the motor.

5.12 Open-loop operating mode (OL--)

I. Open-loop operation

Press the "Enter" key to enter the "OL--" open-loop operation mode, and then press the "Enter" key for more than 3 seconds.

The ring operation mode starts, the motor rotates, and "Finish" is displayed after completion.

OL--	Open loop operation	→ Enter – Finish
------	---------------------	------------------

Table 5.12 Open Loop Run Mode Operation

- It is used to preliminarily judge whether the servo motor has obvious quality problems, such as abnormal assembly of bearings and rotors.

Chapter VI Parameters

6.1 Basic parameters of PA group [PA mode]

Parameter No.	Parameter name	Unit	Parameter range	Defaults
0	Parameter password	*	0~9999	510
1	Motor model	*	*	*
2	Software version number	*	*	*
3	Initial state display	*	0~21	0
4	Control mode selection	*	0~8	1
5	Speed proportional gain	Hz	10~500	150
6	Velocity integral time constant	ms	1~5000	20
7	Torque filter	%	40~3000	100
8	Speed detection filter	%	40~3000	100
9	Position proportional gain	1/S	1~500	40
10	Position feedforward gain	%	0~100	0
11	Cut-off frequency of position feedforward filter	Hz	1~1200	300
12	Position command pulse divider	*	1~32767	1
13	Position command pulse frequency denominator	*	1~32767	1
14	Position command pulse input mode	*	0~2	2
15	Position command pulse direction reversal	*	0~1	0
16	Locate the completion range	Pulse	0~30000	20
17	Detection range of position out-of-tolerance	× 100 pulses	0~30000	400
18	Location variance error is invalid	*	0~2	0
19	Position command smoothing filter	0.1mS	0~30000	0
20	Drive inhibit input is invalid	*	0~2	1
21	JOG running speed	r/min	±3600	120
22	Internal and external speed command selection	*	0~3	3
23	Maximum speed limit	r/min	0~30000	8500
24	Internal speed 1	r/min	±30000	0

Parameter No.	Parameter name	Unit	Parameter range	Defaults
25	Internal speed 2	r/min	±30000	100
26	Internal speed 3	r/min	±30000	300
27	Internal speed 4	r/min	±30000	-100
28	Arrival speed	r/min	0~3000	5
30	User Torque Overload Alarm Value	%	50~300	200
31	User torque overload alarm detection time	ms	10~30000	0
32	Control mode switching allowed	*	0~1	1
34	Internal CCW torque limit	%	0~300	300
35	Internal CW torque limit	%	-300~0	-300
36	Command pulse signal filter coefficient	*	0~3	1
37	Command direction signal filter coefficient	*	0~3	0
40	Acceleration time constant	ms	1~10000	500
41	Deceleration time constant	ms	1~10000	500
42	Multifunctional terminal switching	Binary	0000~1111	0001
43	Analog speed command gain	(r/min)/V	10~3000	600
44	Analog Speed Command Direction Reversal	*	0~1	0
45	Analog speed instruction zero drift compensation	*	±5000	0
46	Analog speed/torque command filter	Hz	0~1000	300
49	During analog voltage threshold value speed control	r/min	0~3000	0
53	Lower 4-bit input terminal forced ON input	Binary	0000~1111	0000
54	Upper 4-bit input terminal forced ON input	Binary	0000~1111	0000
55	Inverted setting of lower 4-bit input terminal	Binary	0000~1111	0000
56	Inverted setting of input terminal of upper 4 bits	Binary	0000~1111	0000
57	Output terminal negation control word	Binary	0000~1111	0010
60	Current loop proportional gain	*	100~5000	600
61	Current loop integral time constant	*	1~1000	10
63	Zero offset value of motor encoder	Pulse	-32768~32767	160

Parameter No.	Parameter name	Unit	Parameter range	Defaults
64	Number of pole pairs of the motor	*	1~100	2
65	Number of incremental encoder lines	Pulse	0~30000	2500
66	Encoder type selection	*	0~10	5
67	Rated motor current	0.1A	0~750	100
68	Velocity proportional gain factor	*	0~2000	*
70	Driver feedback pulse output settings	Pulse	0~30000	10000
71	Feedback pulse output direction selection	*	0~1	1
72	Feedback pulse output electronic gear molecular	*	1~32767	1
73	Feedback pulse output electronic gear denominator	*	1~32767	1
75	External encoder feedback line number low order	Pulse	1~32767	2500
76	External encoder feedback line number high order	Pulse	1~32767	0
77	External Encoder Pulse Direction Reversal	*	0~1	0
80	485 communication axis address settings	*	0~5000	1
81	485 communication baud rate selection	*	0~3	2
82	485 Communication Parity Select	*	0~1	0
83	Encoder Z pulse filter coefficient	*	0~6	0
84	Filter time for DP-I display values	*	*	50
85	Allow alarm number 3	*	0~1	0
88	Save parameters during communication	*	0~1	0
95	Revolution monitoring	r/min	0~30000	*
96	Current monitoring	0.1A	0~750	*
97	Alarm code monitoring	*	1~32767	*

6.2PE Group Spindle Control Parameters [PE Mode]

Parameter No.	Parameter name	Unit	Parameter range	Defaults
20	Enable mode	*	0~1	0
21	Zero speed threshold	*	0~500	5
22	Motor phase sequence is reversed	*	0~1	0
23	Enable Delay Time	ms	0~3000	300
24	Maximum speed limit of motor	*	0~30000	6000
25	Parking mode	*	0~1	0
27	Flux current follower switch	*	0~1	1
28	Fast locked-rotor alarm detection time	ms	1~30000	500
30	Orientation Angle	*	-32767~32768	0
31	Directional speed	r/min	1~2000	100
32	Delay time of accurate stop in place	*	1~30000	500
33	Orientation reference point selection	*	0~2	0
34	Directional switch in-place mode	*	0~2	0
35	Directional velocity gain	*	10~600	150
36	Directional velocity integral time constant	*	1~500	80
37	Directional direction	*	1~2	0
38	Directional acceleration and deceleration time	ms	1~1000	100
39	Directional position gain	*	5~500	40
40	External Encoder Gear Ratio Allowed	*	0~1	0
41	Switch positioning gear denominator	*	1~30000	1
42	Switch positioning gear molecular	*	1~30000	1
45	Third speed gain	Hz	10~3000	150
46	Third velocity integral	ms	1~1000	80
48	Third Instruction Smoothing Factor	*	0~3000	0
49	Third position gain	1/S	1~500	80

50	Full closed-loop control parameter	Binary	0000~1111	0000
51	Mixed deviation detection range	%	1~200	20
52	Hybrid Deviation Detection Time	ms	0~1000	100
53	External Encoder Feedback Output Direction Reversal	*	0~1	0

6.3 Detailed Explanation of PA Group Parameters

Parameter No.	Parameter name	Detailed explanation of functions	Parameter range [Default]
0	Parameter password	a) The user password is 315. b) The model code password is 385 and is only used to modify parameter PA1. c) The motor manufacturer's password is 510, and the parameters take effect online (not recommended).	0~9999 [510]
1	Model code	a) Used to adapt to different types of servo motors, 2.21 settings according to the table, and then restore the factory value, which takes effect when the power is cut off. b) Modify this parameter. The PA0 parameter needs to be 385. c) SP is the asynchronous motor code; PM is the synchronous motor code.	*
2	Software version	a) Only the software version number is displayed, read only. b) When the version number is odd, it is full-function type; when the version number is even, it is pulse type. c) The full-function type has more analog control functions than the pulse type.	* [*]
3	Initial state display	The initial display state of the nixie tube when the driver is powered on. 0: display the motor speed; 1: Display the lower 5 digits of the current position; 2: Display the higher 5 digits of the current position; 3: Display the lower 5 bits of the position command (command pulse accumulation); 4: Display the high 5 bits of the position command (command pulse accumulation); 5: Display the lower 5 digits of position deviation; 6:5 digits higher than the display position deviation; 7: Display the motor torque; 8: Display the motor current; 9: Display Z pulse count; 10: Display control mode; 11: Display position command pulse frequency;	0~21 [0]

Parameter No.	Parameter name	Detailed explanation of functions	Parameter range [Default]
		12: Display speed command; 13: display torque command; 14: display that absolute position of the rotor in one revolution; 15: Display input terminal status; 16: Display output terminal status; 17: Display encoder input signal; 18: Display the operation status; 19: Alarm code is displayed; 20: display absolute value encoder ID; 21: Display axis address;	
4	Control mode selection	0: position control mode; 1: Speed control mode; A, the inner and outer speeds are selected by parameter PA22; B. Select the internal speed from the CN1 interface; The 12-foot and 13-foot combinations select 4 internal speeds: 12-pin OFF, 13-pin OFF: internal speed 1; speed setting PA24 Pin 12 ON, Pin 13 OFF: internal speed 2; speed setting PA25 Pin 12 OFF, Pin 13 ON: internal speed 3; speed setting PA26 Pin 12 ON, Pin 13 ON: internal speed 4; speed setting PA27 2. Control mode of test run; 3: JOG control mode; speed is set by parameter PA21. 4: Encoder check zero mode; used for synchronous motor to adjust the zero point of the coding disk. 5: Open-loop operation mode; used to detect the motor and encoder 8: Spindle self-learning mode;	0~8 [1]
5	Speed proportional gain	a) Set the proportional gain of the speed loop regulator with enhanced rigidity; b) The higher the setting, the higher the gain and the greater the stiffness. The parameter values are determined according to the specific servo drive system model and load conditions. In	50~500 [150]

Parameter No.	Parameter name	Detailed explanation of functions	Parameter range [Default]
		<p>general, the greater the load inertia, the greater the set value;</p> <p>c) Under the condition that the system does not generate oscillation, a larger value is set as far as possible;</p>	
6	Velocity integral time constant	<p>a) Tting the integral time constant of the speed loop regulator;</p> <p>b) Motor overshoot can be suppressed, the smaller the set value, the faster the integral speed, too small is easy to produce overshoot, too large makes the response slower;</p> <p>c) According to the specific drive model and load inertia setting, the larger the load inertia is, the larger the set value is;</p>	1~1000 [80]
7	Torque filter	<p>a) De-noise set torque command filter characteristic;</p> <p>b) For suppressing resonance caused by torque;</p> <p>c) The larger the value, the larger the cut-off frequency, and the smaller the vibration and noise generated by the motor. If the load inertia is very large, the set value can be increased appropriately. If the value is too large, the response will slow down and may cause oscillation.</p> <p>d) The smaller the value, the smaller the cutoff frequency and the faster the response. If a higher torque response is required, the setpoint can be reduced appropriately.</p>	20~500 [100]
8	Speed detection filter	<p>a) Denoising sets the speed detection filter characteristics.</p> <p>b) The higher the value, the higher the cutoff frequency and the lower the noise generated by the motor. If the load inertia is very large, the set value can be increased appropriately. If the value is too large, it will cause response strain, which may cause oscillation. The smaller the value, the higher the cutoff frequency and the faster the speed feedback response. If higher speed response is required, the set value can be reduced appropriately.</p>	20~500 [100]
9	Position	a) Set the proportional gain of the position	1~500

Parameter No.	Parameter name	Detailed explanation of functions	Parameter range [Default]
	proportional gain	<p>loop adjuster.</p> <p>b) The larger the setting value is, the higher the gain is, the greater the stiffness is, and the smaller the position lag is under the condition of the same frequency command pulse. But too large a value may cause oscillation or overshoot.</p> <p>c) The parameter values are determined according to the specific servo drive system model and load conditions.</p>	[80]
10	Position feedforward gain	<p>a) Sets the feedforward gain of the position loop.</p> <p>b) When it is set to 100%, it means that the position hysteresis is always 0 at any frequency of the command pulse.</p> <p>c) With the increase of the feedforward gain of the position loop, the high-speed response characteristics of the control system are improved, but the position loop of the system is unstable and easy to oscillate.</p> <p>d) The feed-forward gain of the position loop is usually zero unless a very high response is required.</p>	0~100 [0]
11	Cut-off frequency of position feedforward filter	<p>a) Set the low-pass filter cutoff frequency of the position loop feedforward.</p> <p>b) The purpose of this filter is to increase the stability of the compound position control.</p>	1~1200 [300]
12	Position command pulse divider	<p>A) If the system is programmed to run 5 mm (5000 pulses), the motor needs to rotate once: PA12/PA13 =pulse numerator/pulse denominator =actual feedback/instruction pulse e=(number of motor encoder lines (2500 lines) X frequency doubling (4))/instruction pulse number (5000)=10000/5000=2/1</p> <p>B) If the motor is directly connected to the screw, the screw pitch is 6 millimeters: PA12/PA13=10/Screw pitch (6)=5/3</p> <p>Note: CNC machine tools can be set more intuitively by referring to B. Gear ratio range: $1/100 \leq G \leq 100$</p>	1~32767 [1]
13	Position command pulse divider denominator	<p>A) If the system is programmed to run 5 mm (5000 pulses), the motor needs to rotate once: PA12/PA13 =pulse numerator/pulse denominator =actual feedback/instruction pulse e=(number of motor encoder lines (2500 lines) X frequency doubling (4))/instruction pulse number (5000)=10000/5000=2/1</p> <p>B) If the motor is directly connected to the screw, the screw pitch is 6 millimeters: PA12/PA13=10/Screw pitch (6)=5/3</p> <p>Note: CNC machine tools can be set more intuitively by referring to B. Gear ratio range: $1/100 \leq G \leq 100$</p>	1~32767 [1]

Parameter No.	Parameter name	Detailed explanation of functions	Parameter range [Default]
14	Position command pulse input mode	Four types of pulse input can be set: 0: pulse + symbol; 1: CCW pulse/CW pulse; 2: Two-phase orthogonal pulse input; See Figure 4.7 Pulse Input Form	0~2 [2]
15	Position command pulse direction	0: Default direction. 1: The direction is reversed.	0~1 [0]
16	Locate the completion range	a) During position control, when the value in the position deviation counter is less than or equal to the set value, the positioning is COIN ON, otherwise OFF. b) In other control modes, it is the speed arrival signal.	0~3000 [20]
17	Detection range of position out-of-tolerance	In the position control mode, when the count value of the position deviation counter is greater than the set value of this parameter, the servo driver will give an alarm.	0~3000 [400]
18	The position is out of tolerance Whether to detect	0: The test is valid; 1: Alarm No.4 is shielded and PA17 is invalid. 2: No.4 and No.6 alarms are shielded, and PA17 is invalid.	0~2 [0]
19	Position command smoothing filtering	This parameter can smooth and filter the command pulse and optimize the acceleration and deceleration when the upper computer has no acceleration and deceleration and does not have exponential form of acceleration and deceleration. This filtering does not lose pulses, and the execution speed may be delayed.	0~3000 [0]
20	Drive inhibit input is invalid	0: CCW and CW input are disabled. 1: CCW, CW input disable is invalid. 2: CCW and CW input are disabled, and there is no alarm prompt.	0~2 [1]
21	JOG running speed	Set the forward and reverse speed setting in JOG mode.	±3000 [120]
22	Inside and outside Speed Select	0: from internal speed; 1: From external analog quantity (-10V ~ +10V). 2: Analog quantity from outside (0 ~ + 10V;	0~3 [3]

Parameter No.	Parameter name	Detailed explanation of functions	Parameter range [Default]
		12,13 pin selects positive and negative) 3: external pulse speed.	
23	top speed stint	Setting the maximum speed limit of the servo motor is related to the servo motor. Set the maximum speed of the motor according to the model adapted to parameter PA1.	0~30000 [8500]
24	Internal speed 1	When PA4 = 1, PA22 = 0: Internal speed 1 when CNISC1 pin is OFF and SC2 pin is OFF	±30000 [0]
25	Internal speed 2 /Zeroing current	a) When PA4 = 1, PA22 = 0: When pin CNISC1 is ON and pin SC2 is OFF, it is internal speed 2; b) When PA4 = 4, set the zero current percentage of the motor;	±30000 [100]
26	Internal speed 3	When PA4 = 1, PA22 = 0: When pin CNISC1 is OFF and pin SC2 is ON, it is internal speed 3	±30000 [300]
27	Internal speed 4	When PA4 = 1, PA22 = 0: When pin CNISC1 is ON and pin SC2 is ON, it is internal speed 4	±30000 [-100]
28	Arrival speed	In non-position mode: When the motor speed is greater than the set value, COIN: ON, otherwise OFF. This parameter is only used to judge the motor speed and has no direction.	0~3000 [5]
30	User Torque Overload Alarm Value	a) Set the user's torque overload value, which is the percentage of the rated torque. The torque limit value is not divided into directions, and the forward and reverse directions are protected; b) When PA31 > 0, motor torque > PA30, duration > PA31, the driver gives an alarm, the alarm number is Err-29, and the motor stops. After the alarm, the drive must be powered back on to clear the alarm.	0~300 [200]
31	Torque overload detection time	Torque overload detection time in milliseconds; When it is 0, the user torque overload alarm function is invalid;	0~30000 [0]
32	Control mode switching allowed	Pin 11 (A-CLR) of 0: CN1 is only valid for alarm clearing. 1: When parameter PA4 = 0, pin 11 (A-CLR) of CN1 is only valid for position and speed switching. (Default location is valid)	0~1 [1]

Parameter No.	Parameter name	Detailed explanation of functions	Parameter range [Default]
		When parameter PA4 = 1, pin 11 (A-CLR) of CN1 is valid only for speed and position switching. (Default speed is valid)	
34	Internal CCW Torque limit	Sets the internal torque limit percentage value for the motor CCW direction. For example, if the setting is 2 times of the rated torque, the setting value is 200. This setting is always in effect for the limit.	0~300 [300]
35	Internal CW torque limit	Sets the motor's internal torque limit percentage value in the CW direction. For example, if the setting is 2 times of the rated torque, the setting value is -200. This setting is always in effect for the limit.	0~-300 [-300]
36	Command pulse signal filter coefficient	PA4 = 0, valid for position control The larger the setting value is, the stronger the anti-interference to the command pulse is, and the smaller the receiving pulse frequency is, and it may not be able to receive the pulse. The timing lead or lag of the pulse and direction signals can be adjusted.	0~3 [1]
37	Command direction signal filter coefficient	PA4 = 0, valid for position control The timing lead or lag of the pulse and direction signals can be adjusted.	0~3 [0]
40	Acceleration time constant	The set value indicates the acceleration time of the motor from 0 to 1000r/min. The linear acceleration and deceleration characteristic is only used for the speed control mode. If the upper computer has acceleration and deceleration characteristics, this parameter shall be set to 0.	1~30000 [500]
41	Deceleration time constant	The set value represents the deceleration time of the motor from 1000 to 0 R/min. Linear acceleration and deceleration characteristics, only for speed control mode. If the upper computer has acceleration and deceleration characteristics, this parameter shall be set to 0.	1~30000 [500]
42	Multifunctional terminal	0: No.15 alarm is in effect/1: No.15 alarm is shielded; [0001] 0: select the second return to zero/1: select the	0000~1111 [0001]

Parameter No.	Parameter name	Detailed explanation of functions	Parameter range [Default]
	switching	positioning completion; [0010] 0: maximum speed of PA50 parameter modulation in case of torque/1: maximum speed of second analog quantity modulation in case of torque; [0100]	
43	Analog quantity speed command input gain	Set the proportional relationship between the analog speed input voltage and the actual running speed of the motor. For example, the voltage of plus or minus 10 V corresponds to plus or minus 3000 revolutions, which can be set as $3000/10 = 300 \text{ R/min/V}$, i.e. 1V corresponds to 300 revolutions	10~3000 [300]
44	Analog quantity speed command direction is reversed	Reverse the polarity of the analog speed input 0: When the analog quantity speed command is positive, the speed direction is CCW; 1: When the analog quantity speed command is positive, the speed direction is CW;	0~1 [0]
45	Analog speed instruction zero drift compensation	The zero drift compensation quantity input to the analog quantity speed is the positive and negative offset. This parameter value will be automatically changed and saved when the analog quantity is automatically zeroed. See table 5.7 a	±5000 [0]
46	Analog speed command filter	Low pass filter for analog speed inputs. The larger the setting is, the faster the response speed to the speed input analog quantity is, and the larger the noise is; the smaller the setting is, the slower the response speed is, and the smaller the noise is;	0~1000 [300]
49	Analog voltage threshold value speed control	During speed control: set the threshold value of positive and negative voltage of analog quantity.	[0]
53	Lower 4-bit input terminal forced ON input	The on-off of the following functions is performed by the change of the parameter 0,1 without using the external circuit. PA53 and PA54 operate the same. SON: servo enable; [0001] A-CLR: Alarm clear; [0010]	0000~1111 [0000]

Parameter No.	Parameter name	Detailed explanation of functions	Parameter range [Default]
		Spindle forward rotation forced open; [0100] Spindle reverse forced on; [1000]	
54	Upper 4-bit input terminal forced ON input	The on-off of the following functions is performed by the change of the parameter 0,1 without using the external circuit. PA53 and PA54 operate the same. Spindle positioning forced on; [0001] Spindle speed position switching is forced on; [0010] Directional position switch is forced to open; [010 0] High and low gear selection is forced to open; [1000]	0000~1111 [0000]
55	Logic negation of lower 4-bit input terminal	The change of the parameter 0,1 is used to realize the negation of the function (namely, the input of the original external switch circuit is negated, the normally open is changed into the normally closed, and the normally closed is changed into the normally open). SON: servo enable; [0001] A-CLR: Alarm clear; [0010] Spindle forward rotation forced open; [0100] Spindle reverse forced on; [1000]	0000~1111 [0000]
56	Logic negation of upper 4-bit input terminal	The change of the parameter 0,1 is used to realize the negation of the function (namely, the input circuit of the original external switch is negated, the normally open is changed into the normally closed, and the normally closed is changed into the normally open). Spindle positioning forced on; [0001] Spindle speed position switching is forced on; [0010] Directional position switch is forced to open; [010 0] High and low gear selection is forced to open; [1000]	0000~1111 [0000]
57	Logic negation of output terminal	The change of the parameter 0,1 is used to realize the negation of the function (namely, the output circuit of the original external switch is negated, the normally open is changed into the normally closed, and the normally closed is changed into the normally open). Spindle ready; [0001] Spindle alarm; [0010] Spindle zero speed signal; [0100]	0000~1111 [0010]

Parameter No.	Parameter name	Detailed explanation of functions	Parameter range [Default]
		Spindle orientation complete; [1000]	
60	Current loop proportional gain	The driver automatically adjusts this parameter according to the motor model.	0~32767 [500]
61	Current loop integral time constant	The driver automatically adjusts this parameter according to the motor model.	0~32767 [5]
63	Encoder zero bias	When PA0 = 4, the motor encoder zeroes the offset value. (With synchronous motor)	-32767~32768 [160]
64	Number of pole pairs of the motor	The driver automatically adjusts this parameter according to the motor model.	0~100 [2]
65	Number of incremental encoder lines	Number of incremental encoder lines; bus encoder: this parameter is invalid;	0~32767 [2500]
67	Rated motor current	Rated current value of motor: Example: Motor rated current is 13 A The corresponding value of this parameter should be 130;	0~750 [100]
68	Velocity proportional gain factor	The driver automatically adjusts the parameter according to the specification of the read motor; This parameter is the coefficient of PA5 parameter; Servo motor gain = PA5 * PA68;	0~1000 [100]
70	Driver feedback pulse output	Settable feedback pulse output The number of feedback pulse output when the motor rotates one circle.	1~30000 [10000]
71	Pulse output direction selection	Feedback pulse output direction selection 0: Forward A/B feedback signal output; 1: A/B feedback signal output in reverse direction;	0~1 [1]
72	Pulsed output molecule	Effective when PA70 = 0 Feedback pulse output electronic gear molecules.	0~32767 [1]
73	Pulse output denominator	Effective when PA70 = 0 Feedback pulse output electronic gear denominator.	0~32767 [1]

Parameter No.	Parameter name	Detailed explanation of functions	Parameter range [Default]
	or		
75	External encoder feedback line number low order	Full closed-loop feedback resolution low; The combined value of PA75 and PA76 is the feedback pulse number P of the full closed loop when the motor rotates one circle; $P = PA76 * 10000 + PA75$.	0~32767 [2500]
76	External encoder feedback line number high order	Full closed-loop feedback resolution low; The combined value of PA75 and PA76 is the feedback pulse number P of the full closed loop when the motor rotates one circle; $P = PA76 * 10000 + PA75$.	0~32767 [0]
77	External encoder feedback negation	The direction of the external encoder is reversed; PA77 = 0, feedback is reversed; PA77 = 1, feedback is not reversed;	0~1 [1]
80	485 communication axis address	a) Addresses when 485 communicates with modbus RTU protocol: 1, 2, 3 b) Corresponding to the reading of absolute position when the machine tool is used: X-axis, Y-axis and Z-axis	1~32767 [1]
81	485 communication baud rate	Corresponding baud rate 0: 4800; 1: 9600; 2: 19200; 3: 38400; Data bit is 8; stop bit is 1; RTU format; maximum read length is 10;	0~3 [2]
82	485 Communication Parity Select	0: odd check; 1: even check; 2: No check	0~2 [0]
83	Filter coefficient	Encoder Z pulse filter coefficient	0~6 [0]
84	Filtering time	Filter time for DP-I display values	0~6 [50]
85	Allow alarm number 3	0: Undervoltage alarm is shielded by default; 1: Undervoltage alarm No.3 is allowed;	0~1 [0]
88	Parameters are saved	Parameter for communication: when the parameter is changed from 0 to 1, the parameter is saved once and restored to 0;	0~1 [0]

Parameter No.	Parameter name	Detailed explanation of functions	Parameter range [Default]
95	Revolution monitoring	Communication can read the motor revolution value.	0~5000
96	Current monitoring	Communication can read the motor current value	0~5000
97	Alarm code monitoring	Communication can read servo drive alarm code	0~5000

6.4 Detailed explanation of PE group parameters

Parameter No.	Parameter name	Function Explanation	Parameter range [Default]
20	Enable mode	0: pin 12/13/14 is enabled; Pin 1:10 is enabled.	0~1 [0]
21	Zero speed threshold	Output zero speed signal below this speed.	0~500 [5]
22	Motor phase sequence is reversed	The reversal of motor UVW phase sequence is related to the self-learning UVW connection sequence of the motor and cannot be directly modified.	0~1 [0]
23	Enable Delay Time	When PE20 = 0, add or subtract according to the load inertia.	0~3000 [100]
24	Maximum speed limit of motor	It is different from PA23, which only limits the instruction.	0~30000 [0]
25	Parking mode	0: Standard parking; 1: Free parking.	0~1 [0]
27	Flux current follower switch	0: Flux current follows off. 1: Flux current follows on.	0~1 [1]
28	Detection time of locked-rotor or alarm	Fast locked-rotor alarm detection time in position mode, unit: ms In the position mode, the locked rotor is detected. If the alarm time set by PE28 is exceeded, the 10 # alarm is reported.	0~20000 [500]
30	Orientation Angle	The number of pulses per revolution and the positioning angle are self-learned and automatically saved in the Ya mode.	-32768 ~32767 [0]
31	Directional speed	Directional reference speed during operation. (M2/M3 bus spindles not in effect)	1~2000 [300]
32	Quasi-stop delay time	Delay time of output signal of accurate stop in place.	1~3000 [500]
33	Directional reference selection	0: first encoder Z signal; 1: External in-position proximity switch; 2: Z signal of that second encode. (M2/M3 bus spindles not in effect)	0~2 [0]

Parameter No.	Parameter name	Function Explanation	Parameter range [Default]
34	The directional switch is in position	0: Proximity switch tripping is effective; 1: Proximity switch level is valid. 2: External encoder Z pulse. (M2/M3 bus spindles not in effect)	0~2 [0]
35	Directional velocity gain	Directional speed rigid adjustment. (M2/M3 bus spindles not in effect)	10~600 [0]
36	Directional velocity time integral coefficient	Directional speed inertia adjustment (M2/M3 bus spindle inoperative)	1~500 [80]
37	Directional direction	0: forward direction; 1: Reverse; 2: Follow the accurate stop, corresponding to the current rotation direction.	0~2 [0]
38	Directional acceleration and deceleration time	Directional acceleration and deceleration time (M2/M3 bus spindle is not effective)	1~3000 [50]
39	Directional position gain	Position following adjustment (M2/M3 bus spindle is not effective)	5~500 [40]
40	The gear ratio is allowed	External Encoder Gear Ratio Allowed	0~1 [0]
41	Switch positioning gear denominator	Denominator of mechanical transformation ratio of spindle and motor	1~32767 [1]
42	Switch positioning gear molecular	Mechanical transformation ratio numerator of spindle and motor	1~32767 [1]
45	Third speed gain	Tapping/C-axis speed gain	10~600 [150]

Parameter No.	Parameter name	Function Explanation	Parameter range [Default]
46	Third velocity integral	Tapping/C-axis speed integration times	1~500 [80]
48	Third Instruction Smoothing Factor	Tapping/C-axis command smoothing factor	0~3000 [0]
49	Third position gain	Tapping/C-axis position gain	1~500 [80]
50	Full closed-loop control parameter	PE50 = 0001, open the full closed-loop function; PE50 = 0010, shielding synchronous error alarm;	0000~1111 [0000]
51	Mixed deviation detection range	External encoder feedback lines%	1~200 [20]
52	Hybrid Deviation Detection Time	Second encoder alarm detection time	0~1000 [100]
53	External Encoder Feedback Output Direction Reversal	The direction of the external encoder is reversed; PE53 = 0, feedback is not reversed; PE53 = 1, feedback is reversed;	0~1 [0]

Chapter VII Faults and Diagnosis

7.1 Alarm list

Alarm No.	Alarm Name	Fault analysis
1	speeding	Speed of servo motor exceeds the set value
2	Main circuit overvoltage	The three-phase or two-phase power supply voltage is too high or the brake does not work.
3	Main circuit undervoltage	Three-phase or two-phase supply voltage too low
4	The position is out of tolerance	The value of the position deviation counter exceeds the set value, and the voltage is too low
5	Motor overheating	Motor temperature too high
6	Motor is blocked	The motor is stuck and the transmission is not smooth, or the load is too large.
7	Drive inhibit exception	No input for CCW, CW or parameter PA20 is not 1
8	Position deviation counter overflow	The absolute value of the position deviation counter value exceeds 230
9	Encoder malfunction	Encoder signal error
10	Fast locked-rotor alarm	Motor locked-rotor alarm in position mode
11	Faulty IPM module	Failure of IPM intelligent module
12	Overcurrent	Excessive motor current
13	Overload	Driver and motor overload (instantaneous overcurrent), transmission is not smooth
14	Brake failure	Damaged braking resistor or faulty braking circuit.
15	Encoder count error	Encoder count exception
16	Thermal overload of the motor	Electric heating value of motor exceeds the set value
17	Speed response failure	The speed error is too large for a long time
20	EEPROM error	EEPROM error, parameter save failed.
21	Orientation exception	No external stop or external encoder Z pulse

Alarm No.	Alarm Name	Fault analysis
		detected
22	D/A conversion chip error	Control board failure D/A conversion chip failure
23	Motor failure	Motor phase loss or encoder signal not detected
29	User Torque Overload Alarm	Motor load exceeds the value and duration set by the user
30	Encoder Z pulse is missing	Encoder Z pulse error
31	Encoder UVW signal disconnection	Encoder UVW signal error or mismatch with encoder
35	Excessive synchronization error of the second encoder	The synchronous error fed back by the second encoder and the motor is greater than the set value of PE51
45	MODBUS communication is abnormal	Check RS485 wiring and parameter format to eliminate interference
46	Three-phase power phase failure alarm	Input three-phase power supply is abnormal
60	IPM module over temperature	IPM temperature above PA103 setpoint
62	Alarm for long continuous braking time	Continuous braking time exceeding 750ms
78	Bus communication on and off	Wait for the communication of the upper computer; interference or poor soldering
81	Bus communication watchdog failure	Bus communication data is abnormal
82	Bus communication cycle is abnormal	Abnormal setting of communication cycle
83	Drive shaft address does not match the host computer	The axis address of the driver is inconsistent with the axis address set by the upper computer
86	Abnormal setting of drive parameter	PA4, PA59, PA53, and PA5 settings are abnormal and not factory set.
88	Not synchronized to the NC system	The drive is not synchronized to the NC system
89	Abnormal reception of transmission cycle notification frame	Abnormal reception of transmission cycle notification frame
90	Receive command	A new command is received before the current

Alarm No.	Alarm Name	Fault analysis
	exception	command is executed
91	Pulse is lost	Pulse is lost
94	Prompt for restart after successful parameter setting	The driver has been set through the controller and needs to be powered off and restarted before it can become an effective parameter.
100	System command exception	Communication error while executing CONNECT command
942	The command is not formatted correctly	The command is not formatted correctly
951	System command exception	The instruction was performed with insufficient instruction condition

7.2 Troubleshooting

Alarm No.	Alarm name	Running status	Cause	Solution
1	Speeding	At power up	Drive or motor failure	Replace the driver;
			Check the parameters	Check whether it is internally enabled;
		When enabled	Short circuit between motor UVW	Check the motor wiring;
			Encoder 0 Bit Deviation	Motor encoder zeroing;
			The servo parameters are incorrect	Recovering the servo parameters;
		During motor operation	Motor connector is shorted	Whether there is water in the motor connector;
			Command speed is too fast	Reduce the command speed;
Unstable acceleration and deceleration	Adjust the acceleration and deceleration constant;			
Excessive load	Lighten the load;			
2	Main circuit overvoltage	At power up	Supply voltage too high	Reduce the power supply voltage;
			Abnormal power waveform	Replace the power supply;
			Server failure	Replace the server;
		During operation	Circuit board failure	Replace the server;
			Faulty brake circuit	Check the braking resistance;
3	Main circuit Undervoltage	At power up	Main supply voltage too low	Change the power supply;
			Circuit board failure	Replace the server;
			Soft start circuit failure	Replace the server;
		During operation	The capacity of the transformer is insufficient	Enlarge the transformer;
			Power supply wiring is loose	Fasten the wiring terminal;
			Circuit board failure	Replace the server;
4	The position is out of tolerance	During operation	Command speed is too fast	Reduce the command speed;
			Input voltage too low	Check R/S/T power supply;
			PA17 parameter is too	The parameters are

Alarm No.	Alarm name	Running status	Cause	Solution
			small	properly increased;
			Loose or overloaded wiring	Check the fastening line;
5	Motor overheating	At power up	The servo parameters are incorrect	Adapt to the motor model;
			The sensor wiring is disconnected	Check the line and change the sensor;
		During operation	Motor power is too small	Replace the high-power motor;
			Motor interface is shorted	Do a good job of waterproof and dustproof;
			Motor damage	Replace the motor;
6	Motor is blocked	During operation	The transmission part is stuck	Disconnect the mechanical part;
			Excessive load	Lighten the load;
			Motor failure	Replace the motor;
7	Suppress exception	At power up	Check parameters and wiring	PA20, CW and CWW wiring;
8	Position deviation counter overflow	During operation	Motor is blocked	Check the load;
			The command frequency is abnormal	The speed of the upper computer is reduced;
			Wiring error	Check the line and connect the shielding layer;
9	Encoder malfunction	At power up	Encoder ABZ wiring disconnected	Incorrect connection;
			Encoder is damaged	It is fragile and needs to be replaced;
			Encoder 5V Low	Shorten the connection or change the drive;
		During operation	Poor contact of CN2 connector	Fasten the CN2 plug;
			Hidden danger of poor soldering of cables	Replace the cable;
10	Fast locked-rotor alarm	At power up	The transmission part is stuck	Disconnect the mechanical part;
			Excessive load	Lighten the load;
11	Faulty IPM module	At power up	Circuit board failure	Replace the server;
			Short circuit between motor UVW	Check the line and replace the motor;
		During operation	Motor failure	Check the line and replace the motor;

Alarm No.	Alarm name	Running status	Cause	Solution
			Poor power connection	Check the line and prevent interference;
			Short circuit between UVW	Check the line and replace the server;
			Overload	Replace the high-power drive motor;
12	Overcurrent	When energized or in operation	The motor is broken	Replace the motor;
			Short circuit between UVW	Check the line and replace the server;
			Overload	Replace the high-power drive motor;
13	Overload	At power up	The motor is damaged and flooded.	Replace the motor;
			The circuit board is broken	Replace the server;
		During operation	Excessive mechanical load	Reduce the load;
			Mechanical transmission is not smooth	Check the mechanical transmission parts;
			Short circuit between UVW	Check the cable;
			The band brake is not released.	Ensure that the power supply of the brake is stable;
14	Brake failure	At power up	Circuit board failure	Replace the servo;
		During operation	The brake resistor is damaged	Check the wiring of the braking resistor;
			Insufficient braking capacity	Extend the acceleration and deceleration time;
			Excessive mechanical inertia	Reduce mechanical inertia;
15	Encoder UVW count error	During operation	The encoder is broken	Replace the encoder;
			Encoder UVW wiring is incorrect	Check the wiring and replace it;
			Unstable encoder power supply	5V voltage is required to be stable;
			The number of encoder lines is incorrect	Adjust the number of lines corresponding to the parameters;
16	Thermal overload of the	At power up	Servo parameter error	Restore the factory value;
		During	Mechanical	Increase lubrication and

Alarm No.	Alarm name	Running status	Cause	Solution
	motor	operation	transmission is not smooth	reduce load;
			Long overload time	Load reduction, smooth start and stop;
17	Speed response failure	During operation	Too large error for a long time	Adjust parameter position feedforward;
			Start-stop time is too short	Adjust the acceleration and deceleration time;
20	ROM alarm	During operation	Parameter storage alarm	Restore the parameters and replace the servo;
21	Orientation exception	During operation	Positioning stop not detected	Check the connection of the stop block;
22	D/A chip is abnormal	At power up	Replace the control board	Restore the parameters and replace the servo;
23	Motor failure	At power up	Motor phase loss or encoder signal not detected	Check the UVW wiring or encoder wiring;
29	Insufficient torque	During operation	Large load	Replace the motor;
			Drive selection is small	Replace the driver;
30	Encoder Z pulse is missing	At power up	The Z pulse is not present	Replace the encoder;
			Cable bond error	Check the bonding wire;
			Voltage 5V unstable	Shorten the connection to reduce attenuation;
			Poor shielding and interference	The shielding layer is well grounded;
35	Excessive synchronization error of the second encoder	At power up	The synchronization error is greater than PE51	Adjust the deviation detection range of PE51;
			The encoder is broken	Replace the encoder;
			Encoder line error	Replace the correct encoder cable;
46	Three-phase electric phase loss	At power up	Input voltage too low	Check whether the power supply has phase loss;
			Technical failure	Replace the driver;
60	IPM temperature too high	At power up	IPM temperature too high	Check whether the fan is turned on;

Alarm No.	Alarm name	Running status	Cause	Solution
62	Brake failure	During operation	Continuous braking time exceeding 750MS	Reduce the resistance value of the brake resistor; The acceleration and deceleration time is increased;
78	Bus communication on and off	At power up	Wait for the communication of the upper computer	Clear the alarm after communication; Check the communication cable;
81	Bus communication watchdog failure	At power up	Bus communication data is abnormal Abnormal communication	Re-establishing communication with the controller; Check the communication cable;
82	Bus communication cycle is abnormal	At power up	Abnormal setting of communication cycle	Check whether the settings meet the requirements of the protocol;
83	Drive shaft address does not match the host computer	At power up	The axis address of the driver is inconsistent with the axis address set by the upper computer	Check the axis address setting of the upper computer and the driver and restart;
86	Abnormal setting of drive parameter	At power up	Parameter setting error	PA4, PA59, PA53 and PA55 are factory settings;
88	Not synchronized to the NC system	During operation	The drive is not synchronized to the NC system	Check the command of upper computer;
89	Abnormal reception of transmission cycle notification frame	During operation	Abnormal reception of transmission cycle notification frame	Check the command of upper computer;
90	Receive command exception	During operation	A new command is received before the current command is	Check the command of upper computer;

Alarm No.	Alarm name	Running status	Cause	Solution
			executed	
94	Restart is prompted when the parameter setting is successful	During operation	The controller sets the parameters for the drive to be effective only after power off and restart	Power off and restart;
100	System command exception	During operation	Communication error while executing CONNECT command	Check the command of upper computer;
951	System command exception	During operation	The instruction was performed with insufficient instruction condition	Check the command of upper computer;
971	System command exception	During operation	Do not execute the corresponding command at the corresponding layer	Check the command of upper computer;

- If the Alm red light is on and the alarm signal "Err - xx" in the digital tube flashes, the drive is in an alarm state and needs to be powered off in a timely manner to identify the cause of the alarm

Chapter VIII Debugging and Application

8.1 Quick debugging precautions

1. Make sure the connection is correct

- It should be ensured that the wiring of R, S, T, U, V, W must be correct, and the screws must be in a tightened state.
- L series input voltage three-phase 220 V, H series input voltage three-phase 380 V.
- Check whether the 18 pins and + 24V, 36 and 9 pins and 0V in the interface CN1 are connected correctly, and the polarity cannot be connected incorrectly.
- Check whether the + 5V in the interface CN2 is correct, and the polarity cannot be connected incorrectly.
- The motor connection cable should be checked for short circuits or grounding.
- The wiring of the same motor must correspond to the same driver.

II. Determine the power-on sequence

- Due to the integrated design of the strong current and control of the DO series servo, a power outage delay discharge design of the control and display circuits is adopted. After cutting off the power supply, the internal strong current is immediately cut off, and the display and control circuits are automatically powered off after a few seconds of delayed discharge.

For smooth use of the drive, please read the following timing diagram carefully:

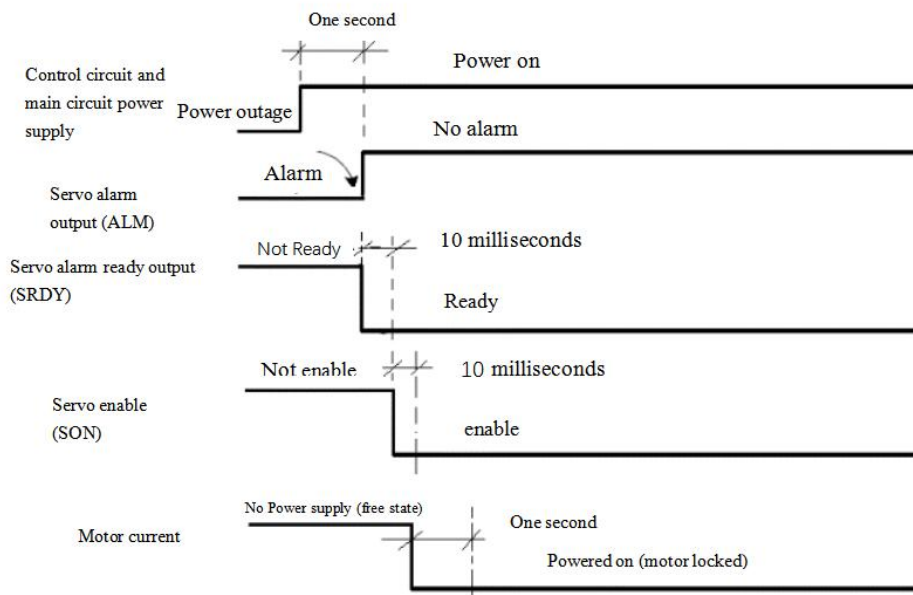
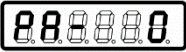

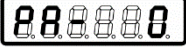
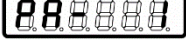
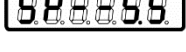




Figure 8.1 Power-on and alarm time sequence diagram

8.1 Quick parameter adjustment after power on






The debugging steps are as follows:

- 1、 Match the motor code;

Step	The panel shows	keystrokes	Operation
1		↑ ↓ ← Enter	Press the ← key twice to select the function. If the parameter number is not "PA", press ↑ ↓.
2		↑ ↓ ← Enter	Press Enter to set the value "510" to "385" and press Enter to confirm.
3		↑ ↓ ← Enter	Press the ← key to select the function to return.
4		↑ ↓ ← Enter	Press the ↑ ↓ key to display "PA-1".
5		↑ ↓ ← Enter	Press Enter and then press ↑ ↓ to select the corresponding motor power section, and press Enter to confirm.
6		↑ ↓ ← Enter	Press Enter and then the ↑ ↓ key to display "EE-DEF".
7		↑ ↓ ← Enter	Press and hold the Enter key for 3 seconds to display "FINISH".

Note: SP is the asynchronous motor code; PM is the synchronous motor code.

2、Motor phase sequence self-learning:

Step	The panel shows	keystrokes	Operation
1		↑ ↓ ← Enter	Press the ← key twice to select the function. If the parameter number is not "PA", press ↑ ↓.
2		↑ ↓ ← Enter	Press Enter and then press the ↑ ↓ key to display "PA-4".
3		↑ ↓ ← Enter	Press the ← key to set the value "0" and the ↑ ↓ key to "8", and press the Enter key to confirm.
4		↑ ↓ ← Enter	Press the ↑ ↓ key to display "CO-RDY".
5		↑ ↓ ← Enter	Press and hold the Enter key for 3 seconds to display "FINISH".

Note: A power outage restart is required.

3、Debugging completed.

Warranty Agreement

Drive warranty

- 1) Under normal use, if the drive malfunctions or is damaged, our company will be responsible for free repair within the product warranty period from the date of shipment. Otherwise, repair costs will be charged. Please strictly follow the user manual for normal use.
- 2) Warranty period: 12 months, subject to contract or agreement.。
- 3) During the warranty period, if the damage is caused by the following reasons, a certain maintenance fee will be charged according to the regulations:
 - a) Machine damage caused by errors in use and unauthorized repair and transformation;
 - b) Earthquake, lightning strike, abnormal voltage, fire, flood and other natural disasters or secondary disasters;
 - c) Hardware damage caused by artificial falling and transportation after purchase;
 - d) Machine damage caused by not following the user manual provided by our company;
 - e) Failure and damage caused by obstacles outside the machine (such as external equipment factors).
- 4) The maintenance fee shall be charged according to the latest cost of our company.
- 5) Under normal circumstances, this warranty card will not be reissued. Please ensure that you keep this card properly and present it to the maintenance personnel during warranty.
- 6) If there is any problem in the service process, please contact our company in time.
- 7) [Guangzhou Aucotech Automation Technology Ltd.](#) reserves the right of final interpretation of this Agreement.

Product warranty card

Client's name		Contact person	
Customer address		Contact number	
Alarm time			
Type of service		<input type="checkbox"/> Warranty <input type="checkbox"/> Maintenance <input type="checkbox"/> Inspection <input type="checkbox"/> Others	
Product model		Product bar code	
Service content	Symptoms	Fault analysis	Troubleshooting
Repair time		Signature of maintenance personnel	
Service evaluation	<input type="checkbox"/> Good <input type="checkbox"/> Fairly good <input type="checkbox"/> Fair <input type="checkbox"/> Poor Signature of user: MM/DD/YY		

China · [Guangzhou Auctech Automation Technology Ltd.](http://www.auctech.com.cn/)

Website: <http://www.auctech.com.cn/>

* This product and its manual are for general industrial use. Please contact the manufacturer for equipment directly related to life safety, such as medical, aviation, aerospace, nuclear energy, etc.

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*Due to the continuous updates of the company's products, any changes are subject to change without prior notice.