DC Servo Drive NSP-SERVO-DC-20
Operation Manual

Email:zgc@cz-zgc.com www.zgcmotors.com

Contents

Foreword

Thank you for choosing NSP-SERVO-DC-20 Low-voltage DC servo drive.

This manual describes the installation, commissioning, maintenance and operation of NSP-SERVO-DC-20 Low-voltage DC servo drive (100W-2000W range). Before use, please read this manual carefully and be familiar with the safety precautions of this product.

Due to product improvement, specification, version change and other reasons, this manual will be changed in due course, and the company will not notify you in advance.

If you have any questions when using the products of our company, please refer to the relevant instructions or call the technical service department of our company, and we will meet your requirements in the shortest possible time.

Safety Precautions

Before product storage, installation, wiring, operation, inspection, or maintenance, the user must familiarize themselves with and adhere to the following important matters to ensure safe use of this product.

⚠ **Danger**	Incorrect operation may cause danger resulting in severe injury or death.
⚠ **Warning**	Incorrect operation may cause danger, resulting in personal injury and potential equipment damage.
⊘ **Prohibition**	Strictly prohibited actions; otherwise, it may lead to equipment damage or failure.

1. Usage Environment

⚠ Danger
• Never operate the product in environments where it is exposed to moisture, corrosive gases, or flammable gases. Failure to do so could result in electric shock or fire. • Never install the product in locations subject to direct sunlight, or excessive dust, salt, or metal powder. • Never use the product in areas where water, oil, or chemicals may drip or spill.

2. Wiring

⚠ Danger
• Please make sure the grounding terminal is reliably grounded, poor grounding may cause electric shock or fire. • Please do not connect the drive DC power supply to an AC power source, as it may cause equipment damage, electric shock, or fire. • Please do not connect the U, V, W motor output terminals to a three-phase power supply, as it may cause personal injury or fire. • The U, V, W motor output terminals must be connected one-to-one with the motor terminals U, V, W. Incorrect connection may cause the motor to overspeed, leading to equipment damage and personal injury. • Please tighten the power and motor output terminals securely; loose connections may

cause fire.
• Please select the wire according to material requirements, otherwise may result in fire.

3. Personnel Operation

⚠ Warning
• Before starting the machinery, appropriate parameter settings must be configured. Incorrect settings may cause the machinery to lose control or malfunction. • Before starting operation, confirm that the emergency stop switch can be activated at any time. • First, please test whether the servo motor could running normally under no-load condition, then connect the load, to avoid unnecessary loss. • Do not frequently turn the power ON and OFF, as it may cause internal overheating of the drive.

4. Equipment in Operation

⊘ Prohibition
• When the motor is running, do not touch any rotating parts, as it may cause personal injury. • When the equipment is operating, do not touch the drive and motor, as it may cause electric shock or burns. • When the equipment is operating, do not move the connecting cable, as it may cause personal injury or equipment damage.

5. Maintenance and Inspection

⃠ Prohibition
• Do not touch the interior of the drive or motor, as it may cause electric shock. • Do not remove the drive cover while power is ON, as it may cause electric shock. • Do not touch the terminals within 2 minutes after power OFF, as residual high voltage may cause electric shock. • Do not change wiring with power ON, as it may cause electric shock. • Do not disassemble the servo motor, as it may cause electric shock.

6. Scope of Use

⚠ Warning
This user manual applies to products for general industrial equipment. Please do not use them in applications that directly impact personal safety, such as nuclear energy equipment, aerospace devices, life-support systems, or other critical safety equipment. For use in the above applications, please contact our company.

Chapter 1 Product Inspection and Installation

1.1 Product Inspection

This product has undergone complete functional testing before shipment. To prevent issues caused by mishandling during transportation, please carefully inspect the following items after unpacking:

• Check if the models of the servo drive and servo motor match your order.

• Check the servo drive and servo motor for any external damage or scratches. Do not wire or power on if damage from shipping is found.

• Check the servo drive and servo motor for any loose components, such as screws that are not tightened or have fallen out.

• Check if the motor rotor shaft can be rotated smoothly by hand. Motors with brakes cannot be rotated directly.

If any of the above issues are found, please contact your dealer immediately.

1.2 Installation and Wiring

• Installation inside Electrical Control Cabinet

The heat generated by electrical equipment inside the control cabinet and the heat dissipation conditions will cause the temperature around the servo drive to rise. Considering drive cooling and the layout within the cabinet, the long-term safe operating temperature should be below 40° C.

• Presence of Heat-Generating Equipment near Servo Drive.

Operating the servo drive under high temperatures will significantly shorten its lifespan and may cause failures. Ensure the ambient temperature around the servo drive remains below 40° C under conditions of heat convection and radiation.

• Presence of Vibrating Equipment near Servo Drive.

Implement appropriate anti-vibration measures to ensure the servo drive is unaffected by vibration. Vibration should be kept below 0.5G (4.9 m/s^2).

• Use in Harsh Environments.

Using the servo drive in harsh environments with corrosive gases, moisture, metal dust, water, or processing fluids may cause drive failure. Ensure the drive's operating environment is suitable during installation.

• Presence of Interfering Equipment near Servo Drive.

The presence of interfering equipment near the servo drive can cause significant interference to the drive's power and control lines, leading to malfunctions. Noise filters and other anti-interference measures can be employed to ensure normal drive operation. Note that adding noise filters may increase leakage current; an isolation transformer can be used to avoid this issue. Pay special attention to control signal lines, which are susceptible to interference; implement proper routing and shielding measures.

1.3 Installation Method

• Installation Direction

Normal installation direction for the servo drive is vertical upright.

• Installation fixed

When mounting, tighten the 2 M4 fixing screws on the rear of the servo drive.

• Installation interval

Please refer to figure 2.1 for installation intervals between servo drive and other equipment. Note that the figure indicates the minimum size. To ensure drive performance and lifespan, allow as much space as possible.

• Heat Dissipation

The servo drive uses a fan cooling method. A cooling fan must also be installed inside the electrical control cabinet to ensure vertical airflow cools the drive's heat sink.

• Installation Notes

When installing the electrical control cabinet, prevent dust or metal chips from entering the servo drive.

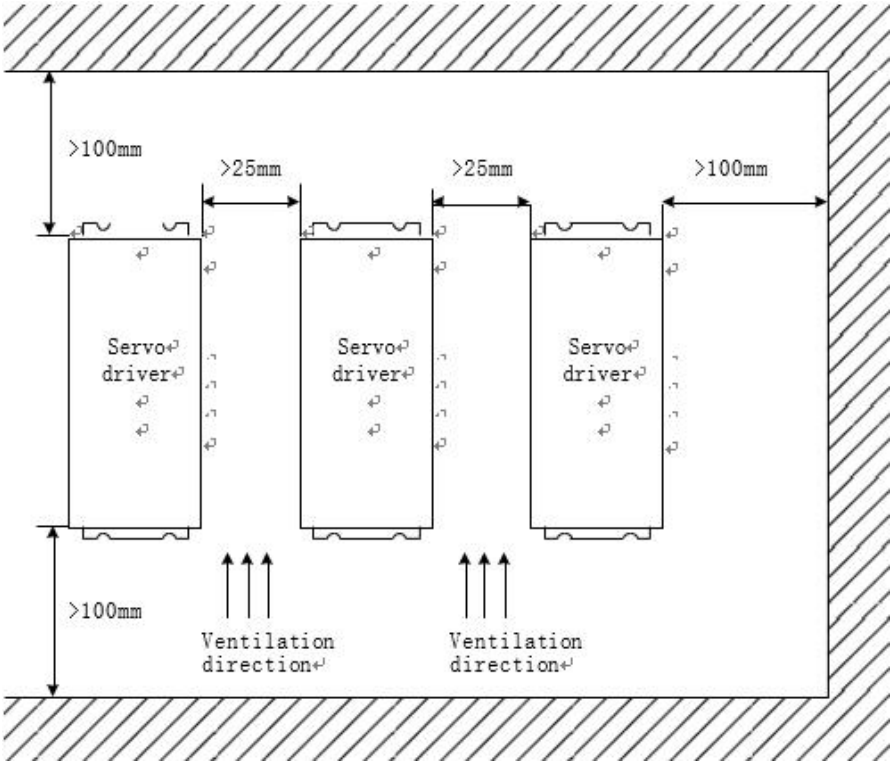


Figure 1.1 servo drive installation diagram

1.4 Servo Motor Installation

1.4.1 Installation Environmental Conditions

• Working environment temperature: 0~40℃; Working environment humidity: Below 80% (non-condensing).

• Storage environment temperature: -40 ~ 50℃; Storage environment humidity: Below 80% (non-condensing).

• Vibration: Below 0.5G.

• A place with well-ventilated, lower humidity, less dust.

• Environment free from corrosive, flammable gases, oil mist, cutting fluid, chips, iron powder, etc.

• Location without moisture and direct sunlight.

1.4.2 Installation Method

• Horizontal Mounting: To prevent liquids like water or oil from entering the motor through the cable outlet, position the cable outlet downward.

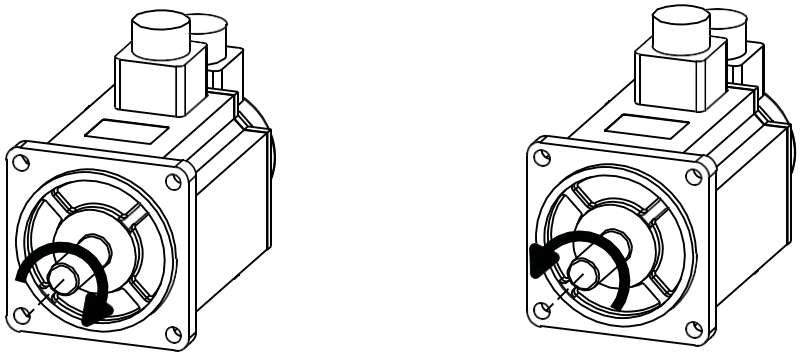
• Vertical Mounting: If the motor shaft is mounted facing upward and is equipped with a gearbox, take care to prevent oil from the gearbox from seeping into the motor interior along the motor shaft.

• Motor Shaft Extension: The motor shaft must have sufficient extension. Insufficient extension may cause vibration during motor operation.

• Installation and Dismantling: Do not strike the motor with a hammer during installation or dismantling, as this can easily damage the motor shaft and encoder.

1.5 Motor Rotation Direction Definition

Definition of motor rotation direction described in this manual: When facing the motor shaft, clockwise (CW) rotation of the rotating shaft is defined as forward rotation, and counterclockwise (CCW) rotation of the rotating shaft is defined as reverse rotation.



positive rotation(CW) reverse rotation(CCW)

Figure 1.2 Motor rotation direction definition

Chapter 2 Wiring

2.1 Wiring Specifications

• Wire Gauge: VCC, GND, U, V, W, PE terminal wire gauge ≥1.0mm² (AWG14-16); VCC, RB terminal wire gauge ≥0.75mm² (AWG18).

• Terminals: Use pre-insulated cold-pressed terminals and ensure connections are secure.

2.2 Wiring Method

• Please use the recommended cable or similar shielded cable for input/output and encoder signal cables. Cable length: I/O signal lines ≤ 3m, encoder signal lines ≤ 3m. Connect using the shortest possible distance. Separate main circuit wiring from signal lines.

• The grounding wire shall be thick and robust, and a single-point grounding configuration shall be adopted. The servo motor's grounding terminal must be connected to the servo drive's grounding terminal PE.

• To prevent malfunctions caused by interference, it is recommended to install a noise filter and note the following:

1) Install the noise filter, servo drive, and host controller as close together as possible.

2) Install surge suppressors on coils of relays, electromagnetic contactors, brakes, etc.

3) do not pass the main cable and signal cable in the same pipeline or tie them together.

• When a strong interference source is used nearby (such as welding machines, EDM machines, etc.), using an transformer on the input power supply could prevent the malfunction caused by interference.

• Please install a Non-Fuse Breaker (NFB) to promptly cut off external power in case of drive failure.

• Properly connect the cable shield.

2.3 Precautions

• The terminals U, V, W of the drive must be connected by one-to-one with the terminals U, V, W of the servo motor. Noted that the motor cannot be reversed by exchanging the three-phase terminals, which is completely different from induction motors and standard brushless motors.

• Because the servo motor needs to carry high-frequency switching current, the leakage current is relatively high. So the motor's grounding terminal must be connected to the servo drive's PE terminal and ensure it is well-grounded.

• Because the servo drive contains large-capacity electrolytic capacitors, high voltage remains in the internal circuit even after power is cut off. Wait at least 5 minutes after disconnecting power before touching the drive and motor.

• The operator should keep a certain distance from the drive and motor after turning on the power.

• Keep a safe distance from the drive and motor when power is ON.

• Disconnect the power if not used for an extended period.

2.4 Overview

The NSP-SERVO-DC-05 series low-voltage servo drive utilizes a high-performance processor to provide users with a cost-effective servo control solution. While ensuring stability and reliability, it pursues functions and performance closely tailored to applications. Compared to stepper products, it offers lower noise, less heat, higher speed, constant torque output, and no lost steps. Compared to stepper-servo hybrid products, it completely abandons the inherent disadvantages of stepper motors, offering superior functionality, performance, and reliability. Compared to well-known high-voltage servos, it offers comparable performance, lower cost, and ease of use.

2.5 Basic Features

- Operating Voltage: 24V-60V DC
- Output Current: Peak 1A-45A
- Rated Speed: 3000 RPM, supports up to 5000 RPM

- Compatible Motors: 100W-2000W Low Voltage DC Servo Motors.

- Control Modes: External Pulse, Analog Input, CAN bus, RS485 bus, RS232, Type-C communication control, etc. Supports Position Mode, Speed Mode, Torque Mode.

- Parameter Debugging: Uses RS232 communication, Type-C communication, PC configuration software, supports parameter backup, import, and export.

- Fault Protection: Includes undervoltage, overvoltage, overload, overcurrent, alarm output, excessive position error, encoder error, etc.

2.6 Applications

Various electronic processing equipment, assembly line material transfer devices, medical equipment, instrumentation, precision testing equipment, channel gate control, Cartesian coordinate robots, servo fixed-length positioning, garage blocking control, equipment loading and unloading devices, equipment auxiliary motion devices, grasping picking and handling machinery, inkjet printers, photo machines, home and office automation equipment, etc.

2.7 Technical Indicators

Utilizes FOC (Field Oriented Control) technology and SVPWM (Space Vector Pulse Width Modulation) algorithm. Easily modify motor parameters to adapt to various motor specifications. Built-in electronic gears and graphical debugging software. Custom control functions available upon user request.

Repeat Tracking Error: 1 pulse

Speed Control Accuracy: 1RPM

Input Frequency Range: 500KHZ

Maximum Speed: 5000RPM.(depends on motor)

Minimum Speed: 1RPM

Positioning Accuracy: 1/10000 (incremental); 1/131072 (absolute)

Maximum No-load Acceleration: 200RPM/ms

Compatible Motors: Adapts to 24-60V low-voltage DC servo motors, DC brushless motors with encoders, or coreless motors.

2.8 Standard Connection

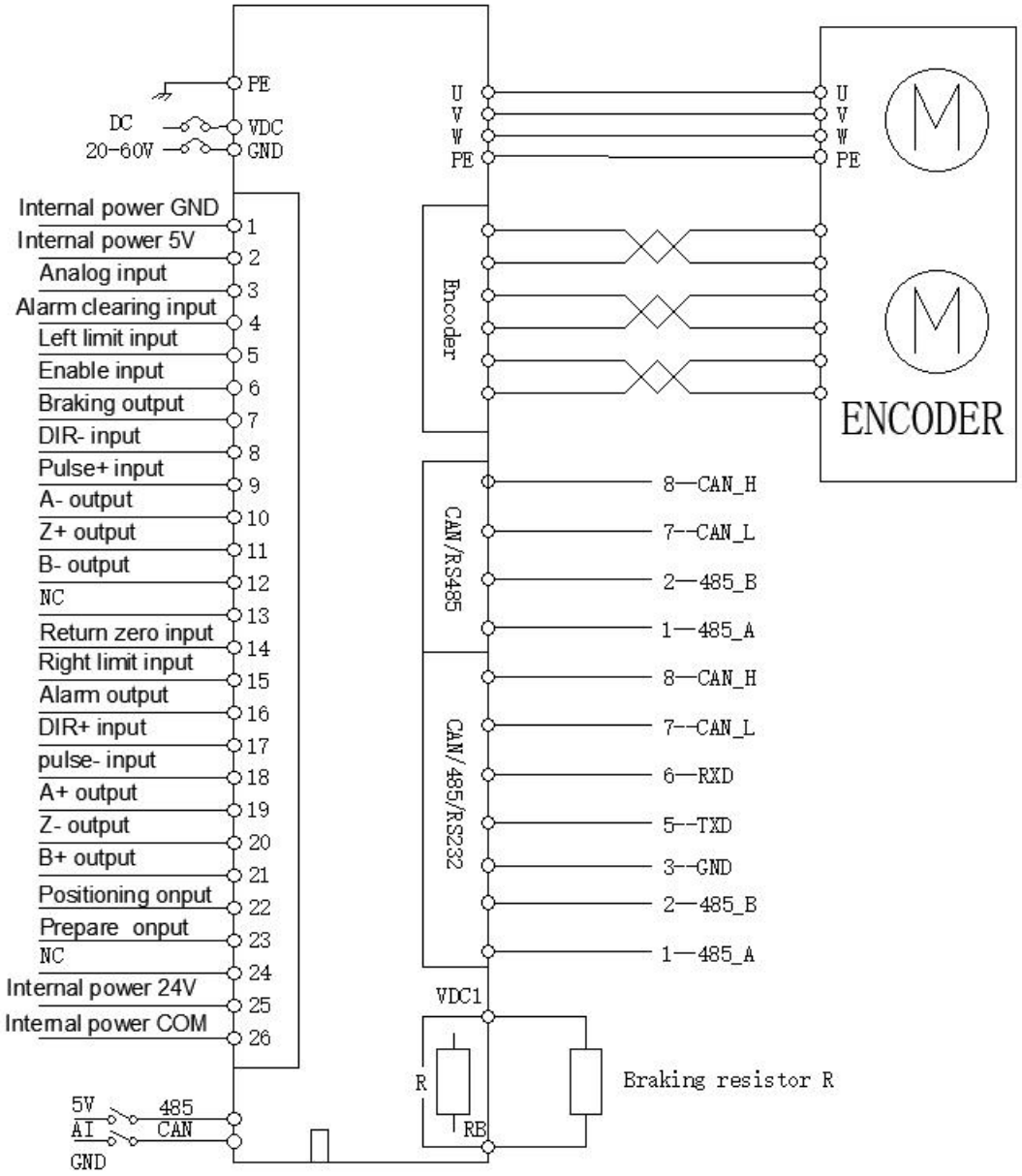


Figure 2.1 Standard wiring for drive control

Chapter 3 Connector

3.1 Drive Power Terminal TB

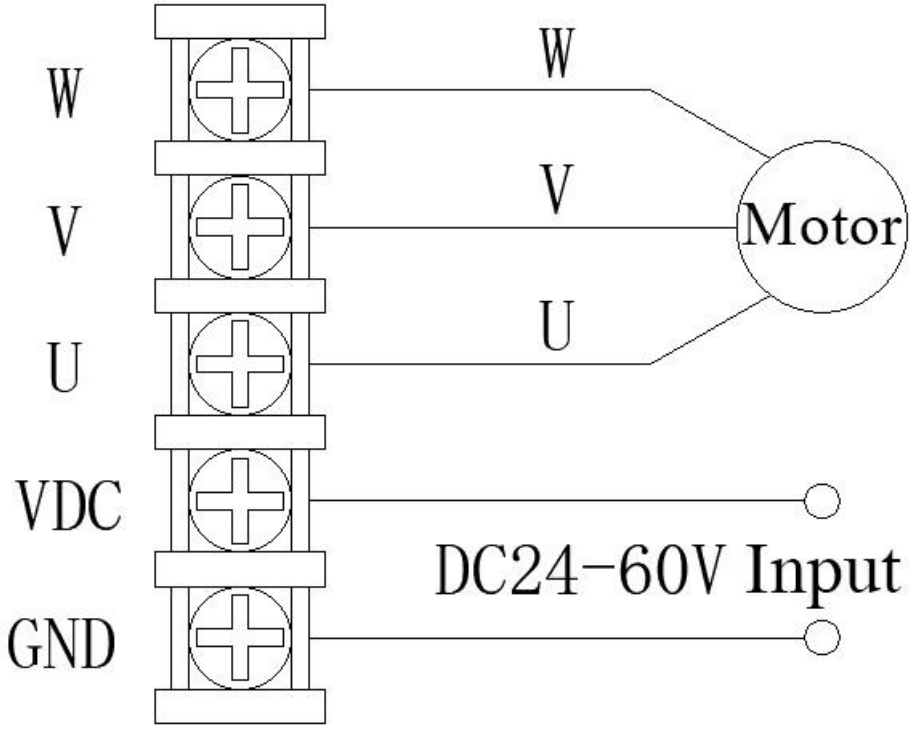


Figure 3.1 drive power terminal

3.2 Control Signal Input/Output Terminal CN1

Control mode abbreviation: P for position control mode, S for speed control mode, T for torque control mode.

Table 3.2 Control signal input/output terminal CN1

Terminal No.	Signal Name	Mark	I/O	Mode	Function
2	Internal power supply 5V	DC5V		S	Analog input power supply
3	Analog speed input	AS			External analog speed signal input terminal
22	Positioning complete output (under position control mode); Speed reached output (under speed control mode)	COIN	Type	P	Position complete output terminal COIN ON: when the position deviation counter value in the set positioning range, the output is ON (output conduction), otherwise the output is OFF (output cutoff).
23	Servo ready output	SRDY			Servo ready output terminal SRDY ON: Output is ON when control power and main power are normal, and the drive has no alarm. SRDY OFF: Output is OFF when main power is off or drive has an alarm.
26	External power negative	COM-			The negative pole of power supply for input terminal.

5	CCW drive disabled	RSTP	Type	P	CCW (counterclockwise) drive disabled input terminal RSTP ON: CCW drive enabled, the motor can rotate counterclockwise. RSTP OFF: CCW drove disabled, the motor disabled rotate counterclockwise. Note: for mechanical overrun, when the switch is OFF, the CCW direction torque keep at 0.
4	Alarm reset	ALRS	Type		Alarm reset input terminal ALRS ON: clear system alarm. ALRS OFF: Maintains system alarm. Note 1: Alarms with fault codes >10 cannot be cleared this way; It need to be powered off for inspection, and powered on again.
25	Positive pole of external power supply	COM+	Type		The positive pole of power supply for input terminal, used to drive the photocoupler of the input terminal, DC12~24V, current≥100mA.
1	Analog ground wire	GND			Analog input ground wire.
9	Command pulse PLUS input	PULS+	Type	P	External command pulse input terminals. Note 1: Pulse input mode is set by parameter
18		PULS-			

17	Command pulse SIGN input	SIGN+			PA52. PA52=0: Pulse + Sign (default); PA52=1: Dual Pulse (CW/CCW); PA52=2: Quadrature Pulse (A/B phase).
8		SIGN-			
19	Encoder A-phase signal	OA+	Type		Encoder ABZ signals differential drive output (26LS31 output, equivalent to RS422). Non-isolated output (non-isolated).
10		OA-			
21	Encoder B-phase signal	OB+			
12		OB-			
11	Encoder Z- phase signal	OZ+			
20		OZ-			
16	Servo alarm output	ALM			ALM OFF: Servo drive no alarm, output is OFF (output cut-off). ALM ON: Servo drive has an alarm, output is ON (output conduction).
7	Mechanical brake release	BRK	Type		When the motor has a mechanical brake (loss power holder), this port can be used to control the brake. BRK ON: brake energized, brake invalid, motor can run. BRK OFF: brake cut off, brake valid, motor locked cannot run. Note: BRK function is controlled internally by the drive.

15	CW drive disable	FSTP	Type	P	CW (clockwise) drive disable input terminal FSTP ON: CW drive allow, motor can rotate clockwise FSTP OFF: CW drive disable, motor cannot rotate clockwise. Note: used for mechanical overrun, when the switch is OFF, the torque in the CW direction keep at 0.
6	Servo Enable (Servo ON)	SON	Type		Servo ON input terminal ON: allow drive operation, motor in a locked state. OFF: drive stop working, motor in a free state. Note 1: when turning from SON OFF to SON ON, the motor must be at rest. Note 2: after turning SON ON, wait at least 50ms before entering the command.
27/28	Shielded ground wire	FG			Shielded ground wire terminal.

3.3 Incremental Encoder Signal & Absolute Encoder Input Terminal CN2

Table 3.3 Encoder Signal Input Terminal CN2

Terminal No.	Signal name	Function		
		Mark	I/O	Description
2	5V supply power	+5V		Servo motor encoder with+5V power supply and common ground; When the cable length is long, multiple core wires should be connected in parallel to reduce the voltage drop of the line.
1	Power common grounding cable	0V		
8	Encoder A+ input	A+	Type7	Connect to encoder A+
15	Encoder A- input	A-		Connect to encoder A-
7	Encoder B+ input	B+	Type7	Connect to encoder B+
14	Encoder B- input	B-		Connect to encoder B-
6	Encoder Z+ input	Z+	Type7	Connect to encoder Z+
13	Encoder Z- input	Z-		Connect to encoder Z-
5	Encoder U+ input	U+	Type7	Connect to encoder U+
12	Encoder U- input	U-		Connect to encoder U-
4	Encoder V+ input	V+	Type7	Connect to encoder V+
11	Encoder V- input	V-		Connect to encoder V-
3	Encoder W+ input	W+	Type7	Connect to encoder W+
10	Encoder W- input	W-		Connect to encoder W- (Shared pin)
9	Absolute Diff Signal+	RS485A	Type7	Connect to absolute encoder +
10	Absolute Diff Signal-	RS485B	Type7	Connect to absolute encoder - (Shared pin)
16/17	Shielded grounding cable	FG		Shielded grounding cable terminal

3.3.1 Switching Input Interface

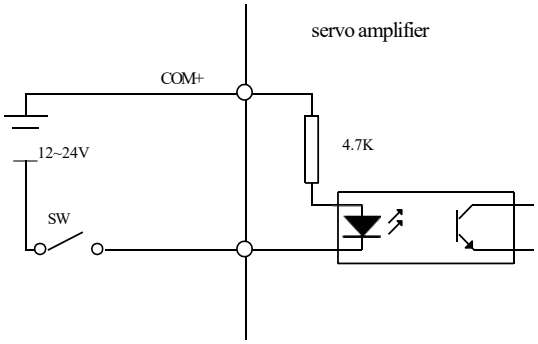
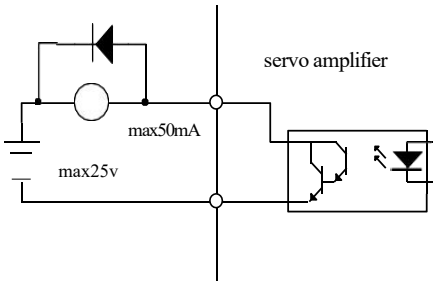


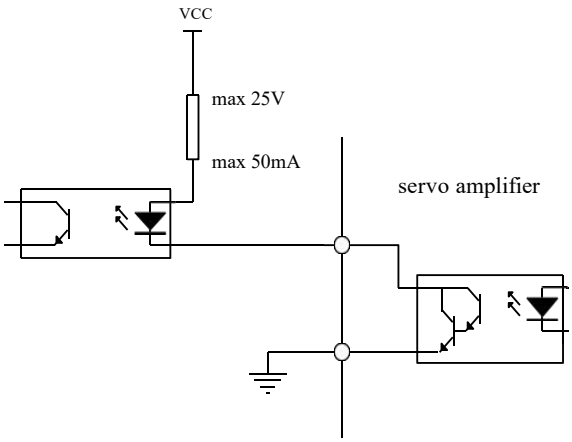
Figure 3.3.1 type1 switching input interface

- Power supplied by the user, DC12~24V, current≥100mA
- Note: If the power polarity is reversed, the servo drive will not work.

3.3.2 Switching Output Interface



a. relay connection



b. optocoupler connection

Figure3.3.2 Type2 switching output interface

• Output Stage: Darlington Transistor, which connects to relays or photocouplers;

• The external power supply is provided by the user. Note: Reversed power polarity will damage the servo drive.

• Output is open-collector, max current 50mA, max external supply voltage 25V. The load must meet these limits. Exceeding limits or connecting output directly to power supply will damage the drive.

• If the load is inductive (e.g., relay), a freewheeling diode must be connected in reverse parallel across the load. Incorrect diode polarity will damage the drive.

• The output transistor is Darlington transistor, when it turn on, the voltage drop V_{ce} between the collector and the transmitting set is about 1V, which cannot meet the TTL low level requirements, so it cannot be directly connected with the TTL integrated circuit.

3.3.3 Pulse Input Interface

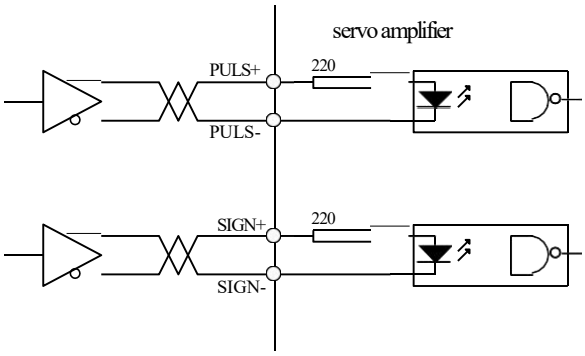


Figure 3.3.3 Type3 Pulse input interface - differential drive mode

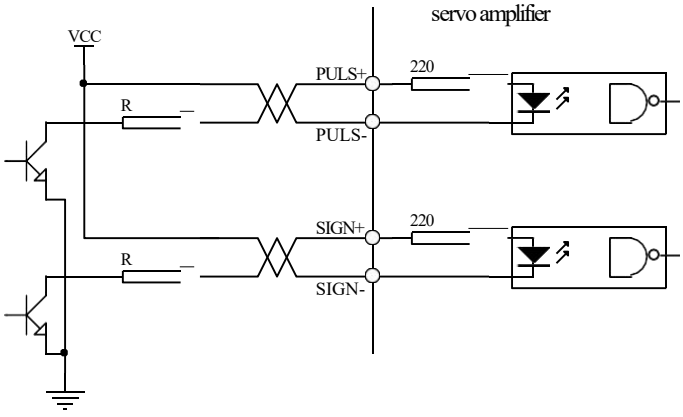


Figure 3.3.4 Type4 Pulse input interface - single-ended drive mode

• For reliable pulse data transmission, differential drive mode is recommended.

• In differential drive mode, use a line drive like AM26LS31 or equivalent.

•Using the single-ended drive mode will reduce the operating frequency. Determine the value of resistor R based on the conditions of the pulse input circuit: the drive current is 10～15mA,

and the maximum voltage of the external power supply is limited to 25V. Empirical values: VCC=24V, R=1.3~2kΩ; VCC=12V, R=510~820Ω; VCC=5V, R=82~120Ω.

• In single-ended drive mode, external power is provided by user. Note: Reversed power polarity will damage the servo drive.

•Pulse input forms are detailed in Table 3.4. Arrows indicate counting edges. Table 3.5 shows pulse input timing parameters. When using 2-phase input form, the 4x frequency pulse frequency should be ≤500kHz.

Table 3.4 Pulse input form

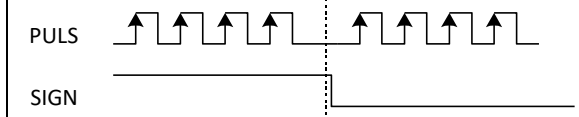
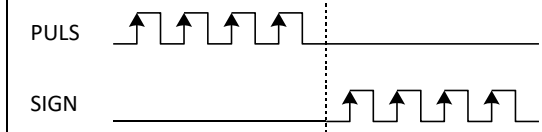
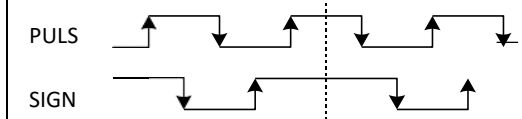
Pulse Command Form	CCW	CW	Parameter Setting Value
Pulse train symbol			0 Command pulse + Symbol
CCW pulse train CW pulse train			1 CCW pulse/CW pulse
A-phase pulse train B-phase pulse train			2 2-phase command pulse

Table 3.5 Pulse input timing parameters

Parameter	Differentially-driven input	Single-ended driven input
t_{ck}	>2μS	>5μS
t_h	>1μS	>2.5μS
t_l	>1μS	>2.5μS
t_{rh}	<0.2μS	<0.3μS
t_{rl}	<0.2μS	<0.3μS
t_s	>1μS	>2.5μS
t_{qck}	>8μS	>10μS
t_{qh}	>4μS	>5μS
t_{ql}	>4μS	>5μS
t_{qrh}	<0.2μS	<0.3μS
t_{qrl}	<0.2μS	<0.3μS
t_{qs}	>1μS	>2.5μS

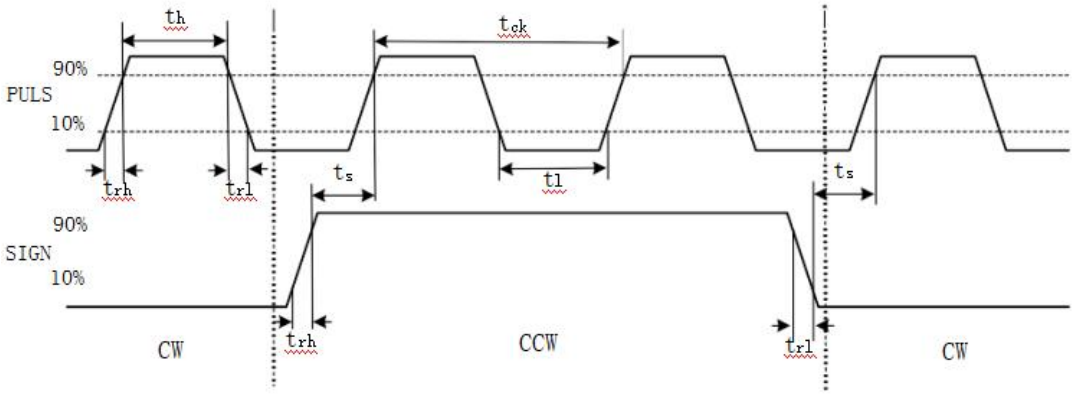


Figure 3.6 Pulse + symbol input interface timing diagram (max pulse frequency 500kHz)

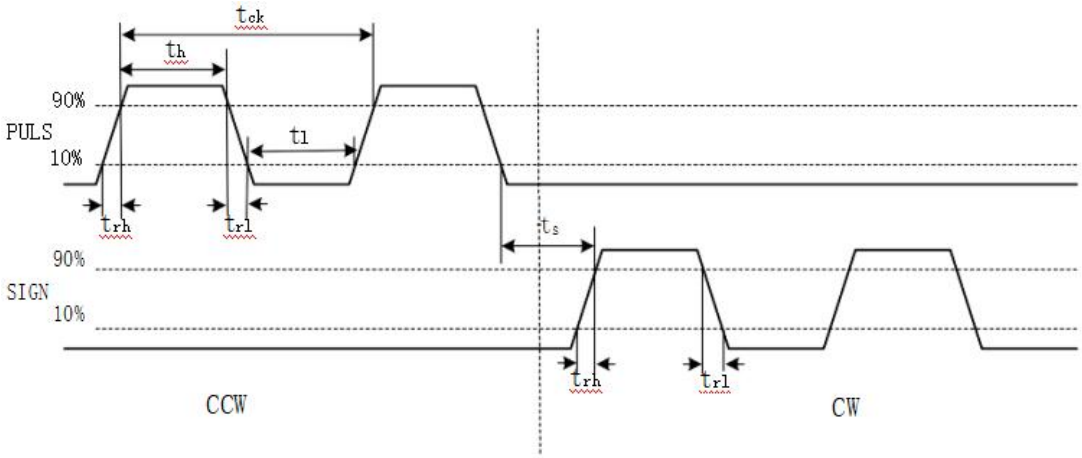


Figure 3.7 CCW pulse /CW pulse input interface timing diagram

(max pulse frequency 500kHz)

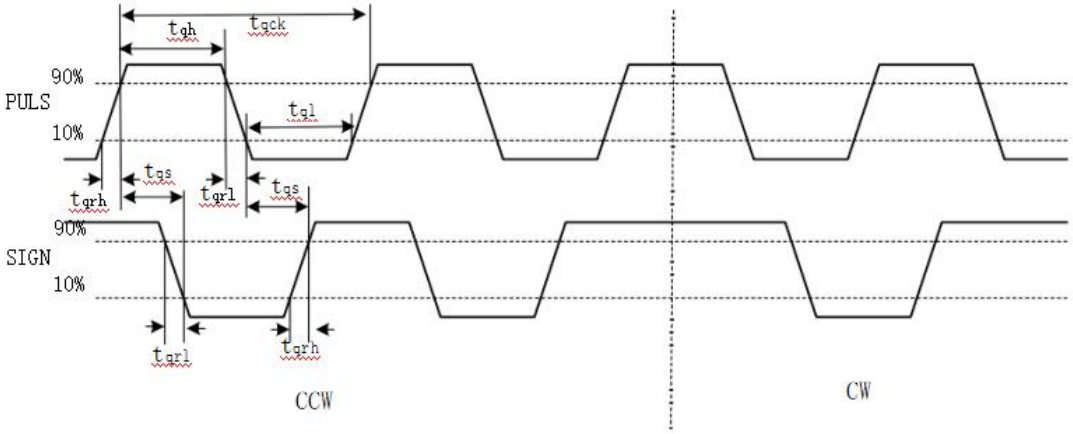


Figure 3.8 2-Phase command pulse input interface timing diagram(max pulse frequency 125kHz)

3.3.4 Analog Input Interface

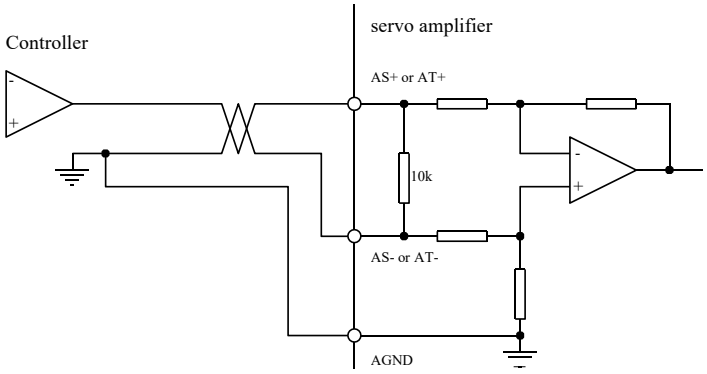


Figure 3.9 a Analog differential input interface

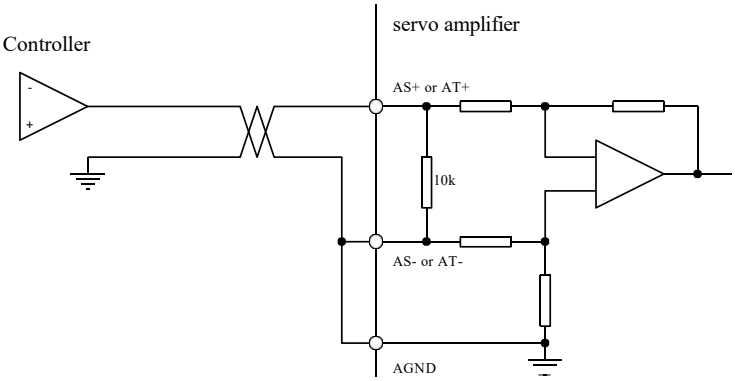


Figure 3.10 b Analog single-ended input interface

• Recommended to use shielded cable to reduce noise interference.

• It is normal for the analog input interface to have a zero offset, which can be compensated by adjusting the parameter PA46.

• Analog interface is non-insulated.

3.3.5 Encoder Signal Output Interface

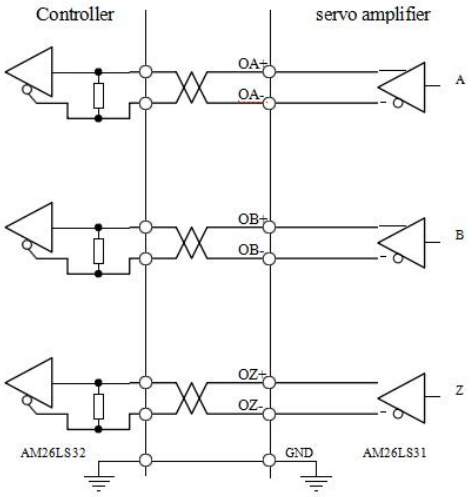


Figure 3.11a Photoelectric encoder output interface

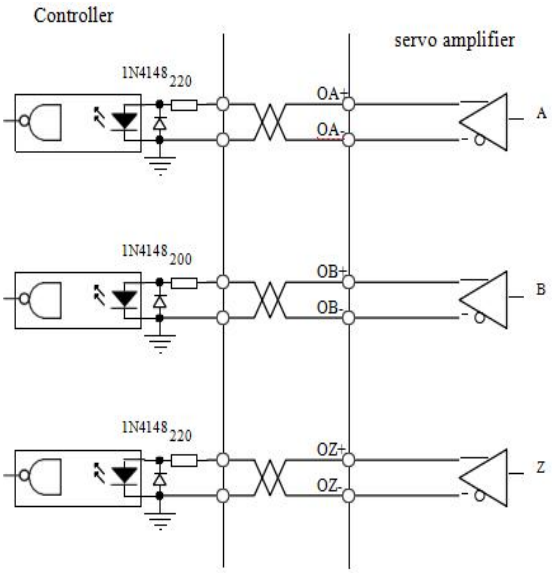
• The encoder signal is output through a differential drive (AM26LS31).

• The controller input interface can use AM26LS32 receiver and must be connected to a terminal resistor of ~1kΩ.

• The controller grounding cable and drive grounding cable must be reliably connected.

• Non-isolated output.

• The controller input can also be accepted by an optocoupler, but high-speed optocouplers (e.g., 6N137) must be used.



3.3.6 Servo Motor Communication Network Port Input Interface

(1) Network Port Front View:

(2) RS232 interface

Network interface No.	DB9 No.	Remark
6-RXD	2	External computer COM TXD
5-TXD	3	External computer COM RXD
3-GND	5	Signal grounding cable

(3) Bus interface (pin numbers in the direction of the film text 1-8)

No.	Name	Remark
8	CAN_H	CAN Bus H
7	CAN_L	CAN Bus L
2	RS485B	485 Bus B
1	RS485A	485 Bus A

Chapter 4 Parameters

4.1 Parameter List

Factory values in the table below use NSP-SEVIO-DC-20 (with a 45A drive) as an example.

Table 4.1 User Parameter List

No.	Description	Applicable method	Parameter range	Factory default	Unit
0	Password	P, S, T	0~9999	880	
1	Localhost	P, S, T	0~255	1	
2	Display mode	P, S, T	1~6	1	
3	Control mode	P, S, T	0~8	4	
4	Communication mode	P, S, T	0~1	1	
5	Software enable	P, S, T	0~1	0	
6	JOG operating speed	S,	1~1000	100	r/min
7	Mechanical brake action setting when the motor is running	P, S, T	1~5000	50	
8	Mechanical brake action speed when the motor is running	P, S, T	0~1	100	
9	Position deviation time	P, S, T	0~30000	3000	ms
10	Torque mode current	T,	-30000~30000	20000	r/min
11	Position mode speed	P	-3000~3000	3000	r/min
12	Velocity mode speed	S	-3500~3500	3500	r/min
13	Maximum speed limit	P, S, T	0~4500	5000	r/min
14	Electronic gear ratio numerator	P	1~32767	100	
15	Electronic gear ratio denominator	P	1~32767	100	
16	Position proportional gain	P	100~10000	1000	
17	Position feedforward gain	P	100~10000	0	
18	Speed proportional gain	S	100~10000	1600	
19	Speed integral	S	100~10000	500	
20	Current proportional gain	P, S, T	1000~3000	2000	
21	Current integral	P, S, T	100~1000	300	
22	Speed acceleration time constant	S	1~30	10	

No.	Description	Applicable method	Parameter range	Factory default	Unit
23	Speed deceleration time constant	S	1~30	10	
24	Position acceleration time constant	P	1~10	6	
25	Position deceleration time constant	P	1~10	6	
26	Rotation direction CW/CCW	P,S,T	0~1	0	
27	Pulse direction CCW/CW	P	0~1	0	
28	Overvoltage alarm	P，S，T	100~1000	55	V
29	Overvoltage alarm time	P，S，T	100~5000	1000	ms
30	Torque overload alarm	P，S，T	100~1000	200	ms
31	Torque overload alarm detection time	P，S，T	100~1000	100	ms
32	Absolute zero offset	P	1000~10000	578100	
33	Rated current	P，S，T	1~50	45	A
34	Overcurrent alarm time	P，S，T	10~10000	3000	ms
35	Overload factor	P，S，T	10~1000	100	%
36	Encoder lines	P，S，T	1000~30000	2500	
37	Number of motor pole pairs	P，S，T	1~16	5	
38	Encoder type	P，S，T	0~1	0	
39	Encoder zero offset	P，S，T	1~32767	1833	
40	Position Mode Type (Relative/Absolute)	P	0~1	0	
41	System baud rate	P，S，T	0~4	1	
42	Torque command filter	P，S，T	10~200	20	%
43	Speed detection filter	P，S，T	10~200	100	%
44	Position out-of-tolerance detection range	P	1000~60000	50000	
45	Analog speed command input gain	S	1~1000	400	
46	Analog rotation speed command zero offset compensation	S	1~1000	100	
47	Analog speed dead band	S	0~3000	1000	
48	Analog speed command filter	S	0~1000	100	
49	CAN communication group number	P，S，T	0~255	0	
50	CAN auto-report content	P，S，T	0~2	0	
51	CAN auto-report time	P，S，T	0~2000	0	
52	External pulse control mode	P	0~2	0	
53	Position complete range	P	0-100	20	

4.2 Parameter Details

Table 4.2 Detailed explanation of user parameters

No.	Description	Function	Parameter range
0	Password	• Used to prevent accidental modification of parameters. Under normal circumstances, when parameters need to be set, first set this parameter to the required password, then set the parameters. After debugging, finally set this parameter to 880 to ensure that parameters will not be accidentally modified in the future. • Passwords are classified into levels, corresponding to user parameters, system parameters, and all parameters. • To modify the model code parameter (PA00), the model code password must be used; other passwords cannot modify this parameter. • User Password: 888. • Zero Offset Adjustment Password: 889.	0~9999
1	Localhost	• Network address in local communication mode.	0~255
2	Initial display status	• Selects the display state after power-on. 1. Display motor speed 2. Display the current voltage 3. Display motor current 4. Display motor torque 5. Display position pulse frequency 6. Display alarm code	1-6
3	Control mode selection	• This parameter can be used to set the drive control mode. 0. Position pulse mode 1. Position Communication Mode 2. Position Analog Mode 3. Speed Communication Mode 4. Speed Analog Mode 5. Torque Analog Mode 6. Torque Communication Mode 7. JOG Debug Mode 8. Keypad Speed Mode. • Position Pulse Mode: Position command input from the pulse input interface. • Position Communication Mode: Position command sent from the network uplink. • Speed Communication Mode: Speed command sent from the	0-8

		network uplink. • Torque Communication Mode: Torque command send from the network uplink. • Speed Analog Mode: Analog speed command input from the input interface. • Keypad Speed Mode: Speed command send from keyboard, for testing the speed of motor and drive. • JOG Control Mode: Enter JOG operation, press and hold the ↑ key to run the motor at JOG speed; release to stop and maintain zero speed. Press and hold the ↓ key for reverse operation at JOG speed; release to stop and maintain zero speed.	
4	Communication mode	• 0: PLC mode • 1: Command from network	0-1
5	Software enable	• 0: stop to lock the motor shaft • 1: lock the motor shaft	0-1
6	JOG operation speed	Sets the operating speed for JOG operation.	-1000~1000 r/min
7	Mechanical brake action setting during motor operation	• Defines the delay time from motor current cutoff to mechanical brake activation (BRK output changes from ON to OFF) during motor operation. • This parameter is designed to activate the mechanical brake only after the motor decelerates from high-speed to low-speed rotation, preventing brake damage. • The actual activation time is the smaller value between PA7 and the time required for the motor to decelerate to the value set in PA8. • Refer to Figure 7.6 for the corresponding timing sequence.	0~200x10ms
8	Mechanical brake action speed when the motor is running	• Define the speed value from motor current cutoff to mechanical brake action (BRK output changes from ON to OFF) during motor operation. • The actual activation time is the smaller of PA7 and the time required for the motor to decelerate to the value set in PA8. • Refer to Figure 7.5 for the corresponding timing sequence.	0~3000 r/min
9	Position error time	• Defines the maximum position error range.	1000-3000
10	Torque mode current	• Maximum current value in torque mode.	1-20000
11	Position mode speed	• Set the maximum speed limit of the servo motor.	0-3000
12	Velocity mode speed	• Set the maximum speed limit of the servo motor.	0-3500
13	Maximum speed limit	• Set the maximum speed limit of the servo motor. • Independent of rotation direction.	3500-5000

		• If the set value exceeds the rated speed, the actual maximum speed limit is the rated speed.	
14	Electronic gear ratio numerator	• Sets the frequency division (electronic gear) of the position command pulse. • In position control mode, by setting parameters PA14 and PA15, it can be easily matched with various pulse sources to achieve the user's desired control resolution (i.e., angle/pulse). · P×G=N×C×4 · P: Number of input command pulses; · G: Electronic gear ratio; · **G=Frequency Division Numerator/Frequency Division Denominator** · N: Number of motor rotations; · C: Lines per revolution of the photoelectric encoder; **C=2500** for this system. •【Example】When the input command pulse is 6000 and the servo motor rotates 1 revolution: · **G=(N×C×4)/P=(1×2500×4)/6000=5/3** · Set parameter PA14 to 5 and PA15 to 3. • The recommended range of the electronic gear ratio is: 1/50 ≤ G ≤ 50	1~1000
15	Electronic gear ratio denominator	• See parameter PA14	1~1000
16	Position proportional gain	• Sets the proportional gain of the position loop regulator. • The larger the setting value, the higher the gain and the greater the stiffness; under the same command pulse frequency, the smaller the position lag. However, an excessively large value may cause oscillation or overshoot. • The parameter value shall be determined based on the specific servo drive system model and load conditions.	1~2000/s
17	Position feedforward gain	• Sets the feedforward gain of the position loop. • When set to 100%, it means that the position lag is always zero under command pulses of any frequency. •Increasing the feedforward gain of the position loop improves the high-speed response characteristics of the control system, but it will make the position loop of the system unstable and prone to oscillation. • Unless high response characteristics are required, the feedforward gain of the position loop is usually set to 0.	0~2000%
18	Speed proportional gain	• Sets the proportional gain of the speed loop regulator. • The higher the setting value, the higher the gain and the greater the stiffness. The parameter value shall be determined based on the	1000-5000

		specific servo drive system model and load conditions. Generally, the larger the load inertia, the larger the setting value. • Set it as large as possible on the premise that the system does not oscillate.	
19	Speed integral time constant	• Sets the integral time constant of the speed loop regulator. • Smaller values increase integral speed, stiffness, and the system's ability to resist deviations, but may cause overshoot.	100-2000
20	Current gain	• Sets the proportional gain of the current loop regulator.	100-3000
21	Current integral time constant	• Sets the integral time constant of the current loop regulator.	100-3000
22	Speed acceleration time constant	• Sets the motor's acceleration time from 0-1000 r/min. • The acceleration/deceleration characteristics are linear. • Applicable only to speed control mode; invalid in position control mode. • If the drive is used in combination with an external position loop, this parameter should be set to 0.	1-10000ms
23	Speed deceleration time constant	• Sets the motor's deceleration time from 1000-0 r/min. • The acceleration/deceleration characteristics are linear. • Applicable only to speed control mode; invalid in position control mode. • If the drive is used in combination with an external position loop, this parameter should be set to 0.	1-10000ms
24	Position acceleration time constant	• Sets the motor's acceleration time from 0-1000 r/min. • The acceleration/deceleration characteristics are linear. • Applicable only to position control mode; invalid in speed control mode. • If the drive is used in combination with an external position loop, this parameter should be set to 0.	1-10000ms
25	Position deceleration time constant	• Sets the motor's deceleration time from 1000-0 r/min. • The acceleration/deceleration characteristics are linear. • Applicable only to position control mode; invalid in speed control mode. • If the drive is used in combination with an external position loop, this parameter should be set to 0.	1-10000ms
26	Rotation direction CW/CCW	• 0: Defines CW rotation as clockwise. • 1: Defines CCW rotation as counterclockwise.	0-1
27	Pulse direction CCW/CW	• 0: Defines PLC pulse CW as clockwise. • 1: Defines PLC pulse CCW as counterclockwise.	0-1
28	Overvoltage alarm	• Sets the maximum overvoltage point of the DC bus voltage.	32-60V

29	Overvoltage alarm time	• Sets the overvoltage detection time.	0-3000ms
30	Torque overload alarm	• Set the maximum torque of system alarm.	250-500
31	Torque overload alarm detection time	• Set the maximum torque alarm time of the system.	0-3000ms
32	Absolute zero offset	• Set the zero position deviation value of the motor.	1000-10000
33	Rated current	• Set the maximum current of the system.	1-10A
34	Overcurrent alarm time	• Sets the maximum system overcurrent duration.	0-3000
35	Overload factor	• Sets the maximum overload factor.	0%~200%
36	Encoder lines	• Sets the encoder pulses per revolution.	1000-5000
37	Number of motor pole pairs	• Sets the motor's maximum pole pairs.	2-10
38	Encoder type	• 0: incremental encoder. • 1: absolute encoder.	0-1
39	Encoder zero offset	• Set the zero offset value of motor.	1000-3600
40	Position mode type	• 0: Defines as Absolute Position. • 1: Defines as Relative Position.	0-1
41	System baud rate	• Sets the baud rate for system communication. • 0: Baud rate = 57600 • 1: Baud rate = 38400 • 2: Baud rate = 19200 • 3: Baud rate = 9600	0-3
42	Torque command filter	• Sets the torque command filter characteristics. • Used to suppress resonance caused by torque. • A smaller value results in a lower cutoff frequency, reducing motor vibration and noise. If the load inertia is large, the setting value can be appropriately decreased. An excessively small value will cause slower response and may lead to oscillation. • A larger value results in a higher cutoff frequency and faster response. If higher torque response is required, the setting value can be appropriately increased.	20~500%
43	Speed detection filter	• Sets the speed detection filter characteristics • A smaller value results in a lower cutoff frequency, reducing motor noise. If the load inertia is large, the setting value can be appropriately decreased. An excessively small value will cause slower response and may lead to oscillation. • A larger value results in a higher cutoff frequency and faster	20~500%

		speed feedback response. If higher speed response is required, the setting value can be appropriately increased.	
44	Position deviation window	• Sets the position deviation alarm window • In position control mode, the servo drive outputs a position deviation alarm when the count value of the position deviation counter exceeds this parameter value.	(0~5000)*100pulse
45	Analog speed command input gain	•Sets the proportional relationship between the analog speed input voltage and the motor's actual operating speed.	10~3000 r/min/V
46	Analog speed command zero offset compensation	• Zero offset compensation for analog speed input.	-1000~1000
47	Analog speed dead band	• The analog speed dead band is a defined threshold range that limits low-amplitude positive and negative analog speed command signals.	0~2000Hz
48	Analog speed command filtering	• Sets the low-pass filter for the analog speed input. • A larger setting results in faster response to the analog speed input but greater impact from signal noise; a smaller setting results in slower response but less impact from signal noise.	0~1000Hz
49	CAN communication group number	• Group member number for Can communication.	0~255
50	CAN automatic report content	• 1: voltage, current, speed. • 2: current, speed. • 3: voltage, speed.	0-3
51	CAN automatic report time	• Sets the CAN automatic report interval time.	0-3000ms
52	External pulse control mode	• 0: Defines as pulse + interface mode. • 1: Defines as Double Pulse Mode. • 2: Defines as A,B quadrature pulse mode.	0-2
53	Positioning Completion Range	• Sets the motor positioning lock.	0~100%

Chapter 5 Protective Function

5.1 Alarm List

Table 5.1 alarm list

Alarm code	Alarm description	Cause of alarm
3	Main circuit overvoltage	Main circuit power supply voltage is too high.
6	Overload	Overload (instantaneous overheating) of the servo drive and motor.
2	Main circuit undervoltage	Main circuit power supply voltage is too low.
5	Overspeed	Servo motor speed exceeds the set value.
6	Overcurrent	Motor current is too large.
7	Position deviation	The value of the position deviation counter exceeds the set value.
8	Encoder fault	Encoder signal error.
9	Drive prohibition abnormality	Both CCW and CW drive prohibition inputs are ON.
10	Power transistor fault	Power transistor short circuit.
11	EEPROM error	EEPROM damage.

5.2 Alarm Handling Methods

Table 5.2 alarm handling methods

Alarm code	Alarm name	Operation status	Cause	Handling method
5	Overspeed	Occurs when the control power is turned on	• Control circuit board failure. • Encoder fault.	• Replace the servo drive. • Replace the servo motor.
		Occurs during motor operation	The input command pulse frequency is too high.	Correctly set the input command pulse.
			Acceleration/deceleration time constant is too small, so that the speed overshoot is too large.	Increase the acceleration /deceleration time constant.
			The input electronic gear ratio is too large.	Correctly set the parameter.
			Encoder fault.	Replace the servo motor.

			Poor encoder cable	Replace the encoder cable.
			Servo system instability causing overshoot.	•Reset the relevant gain. •If the gain cannot be set to an appropriate value, reduce the load moment of inertia ratio.
		Occurs when the motor just starts	Excessive load inertia	• .Reduce the load inertia. • Replace with a higher-power drive and motor.
			Encoder zero position error.	• Replace the servo motor. • Ask the manufacturer to readjust the encoder zero position
			• Incorrect wiring of the motor's U, V, W leads. • Incorrect wiring of the encoder cable leads.	• Wire correctly.
3	Main circuit overvoltage	Occurs when the control power is turned on	Circuit board failure.	Replace the servo drive.
		Occurs when the main power is turned on	• Power supply voltage is too high. • Power supply voltage waveform is abnormal.	Check the power supply.
		Occurs during motor operation	The braking resistor wiring is disconnected.	Rewire.
			• Brake transistor damaged. • Internal braking resistor damaged.	Replace the servo drive.
			Insufficient braking circuit capacity.	• Reduce start-stop frequency. • Increase the acceleration / deceleration time constant.

				•Reduce the torque limit value. • Reduce load inertia. • Replace with a higher-power drive and motor.
2	Main circuit undervoltage	Occurs when the control power is turned on	• Circuit board failure. • Power fuse damaged. • Soft start circuit failure. • Rectifier damaged.	Replace the servo drive.
			• Low power supply voltage. • Temporary power outage of more than 20ms.	Check the power supply.
		Occurs during motor operation	• Insufficient power supply capacity. • Instantaneous power failure.	Check the power supply.
			Overheating of the radiator.	Check the load condition.
9	drive disable abnotmal		Both CCW and CW drive prohibition input terminals are disconnected.	Check the wiring.
7	Position deviation	Occurs when the control power is turned on.	Circuit board failure.	Replace the servo drive.
		When the main power and control lines are connected, the command pulse is input, but the motor does not rotate or reverses.	• Incorrect wiring of the motor's U, V, W leads. • Incorrect wiring of the encoder cable leads.	Correct wiring
			• Encoder zero point changed. • Encoder fault.	• Readjust or replace the encoder zero point. • Replace the servo motor.
		Occurs during motor operation	The set position deviation detection range is too small.	Increase the position deviation detection range.
			Position proportional gain	① Increase the gain.

			is too small.	
			Insufficient torque.	• Check the torque limit value. • Reduce the load capacity. • Replace with a higher-power drive and motor.
			Command pulse frequency is too high.	Reduce the frequency.
			Encoder zero point changed.	Readjust the encoder zero point.
8	Encoder fault		Incorrect encoder wiring.	Check the encoder wiring.
			Encoder damaged.	Replace the servo motor.
			Poor encoder cable.	Replace the encoder cable
			The encoder cable is too long, resulting in low encoder supply voltage.	Shorten the cable. Use multi-core parallel power supply.
2	Control power undervoltage		The input control power is too low.	Check the control power supply.
			•Poor internal connectors of the drive. •Switching power supply abnormality. • Chip damage.	• Replace the drive. • Check the connectors. • Check the switching power supply.
10	Power transistor fault	Occurs when the control power is turned on	Circuit board failure.	Replace the servo drive.
		Occurs during motor operation	• Low power supply voltage. • Overheating	• Check the drive. • Power on again. • Replace the drive.
			Short circuit between the drive's U, V, W.	Check the wiring
			Poor grounding	Ground correctly.
			Motor insulation damaged.	Replace the motor.
			Be interfered.	• Add line filter. • Keep away from the interference sources.
6	Overcurrent		Short circuit between the	Check the wiring

			drive's U, V, W.	
			Poor grounding	Ground correctly.
			Motor insulation damaged.	Replace the servo motor
			drive damaged.	Replace the servo drive.
6	Overload	Occurs when the control power is turned on	Circuit board failure. Operating beyond the rated torque.	Replace the servo drive.
		Occurs during motor operation.	Operating beyond the rated torque.	• Check the load. • Reduce the start-stop frequency. •Reduce the torque limit value. • Replace with a higher power drive and motor.
			Holding brake not released.	Check holding brake.
			Motor unstable oscillation.	• Adjust gain • Increase acceleration / deceleration time. • Reduce load inertia.
			•One phase of U, V, W is disconnected. • Incorrect encoder wiring.	Check wiring.
11	EEPROM error		Chip or circuit board damage.	• Replace the servo drive. • After repair, the drive parameters must be reset and then the default parameters restored.

Chapter 6 Display and Keyboard Operation

The panel consists of a 5-digit LED display and 4 keys (↑ , ↓ , ← , Enter). It is used to display various system statuses and to set parameters.

Operation is hierarchical:

- ← & Enter : Navigate backward and forward.
- Enter : Enter/Confirm (select items or confirm settings).
- ← : Exit/Cancel.
- ↑ & ↓ : increase or decrease the serial number or numerical value.
- Press the key ↑ & ↓ and hold it, it will have a repeat effect, the longer the hold time, the higher the repeat rate.

If the digital display flashes, it indicates an alarm has occurred.

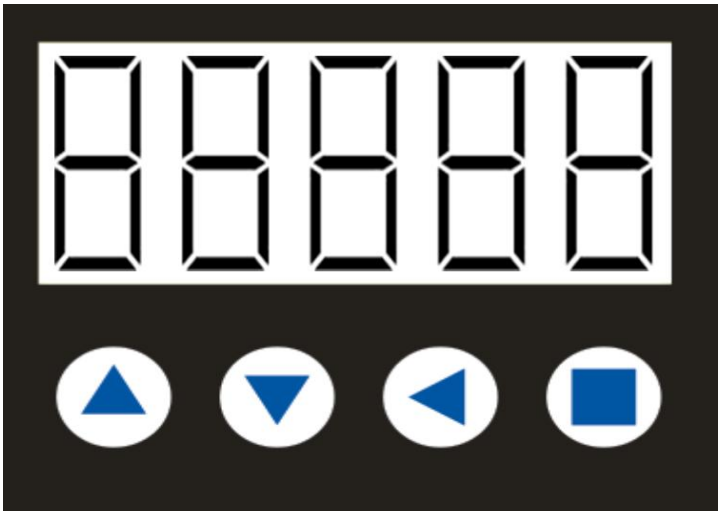


Figure 6.0 Panel

6.1 Level 1

Level 1 is used to select the operation mode. There are 7 modes in total. Use the ↑ and ↓ keys to change the mode, press the Enter key to enter Level 2 of the selected mode, and press the ← key to return to Level 1 from Level 2.

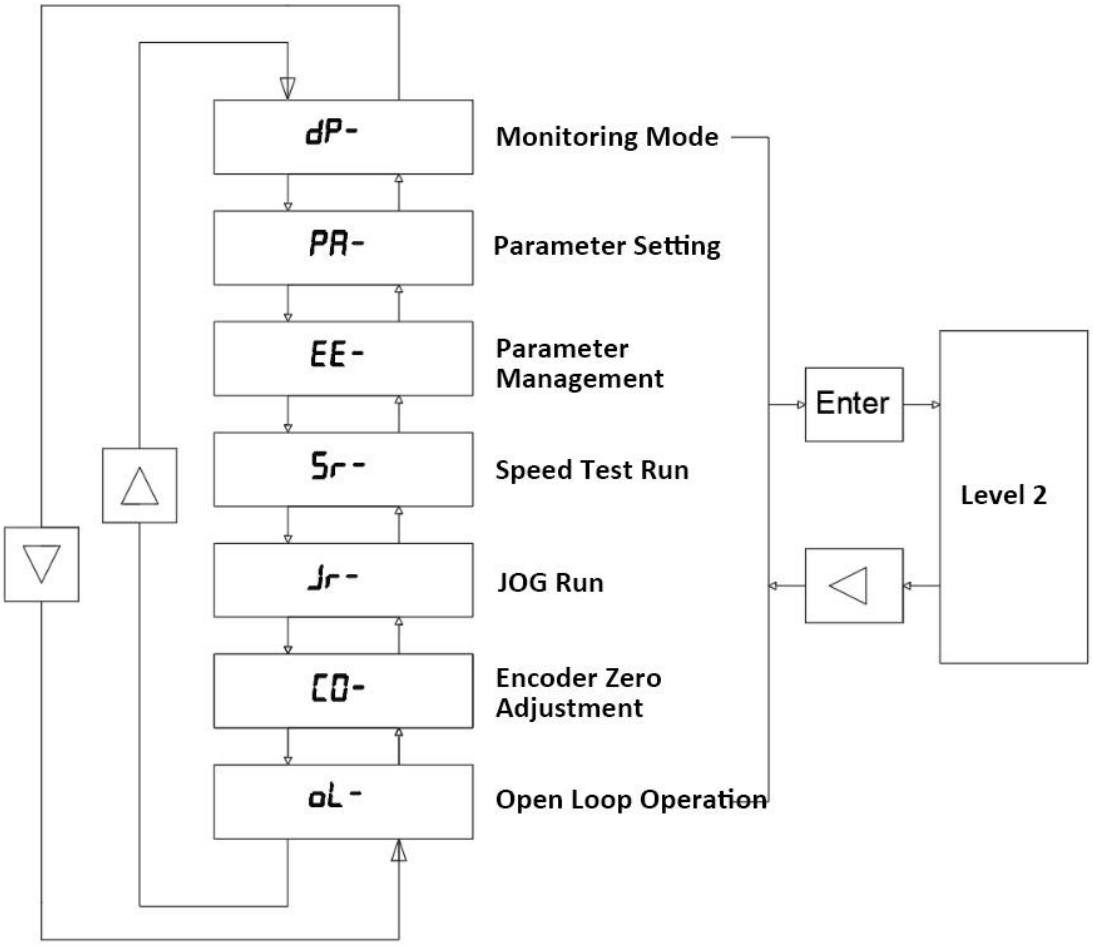


Figure 6.1 Method selection operation block diagram

6.2 Level 2

6.2.1 Monitoring Method

Select ″dP-″ in Level 1, and then press Enter key to enter the monitoring mode. There are 7 display states in total. Use the ↑ & ↓ keys to select the desired display mode. Then press Enter key to enter the specific display state.

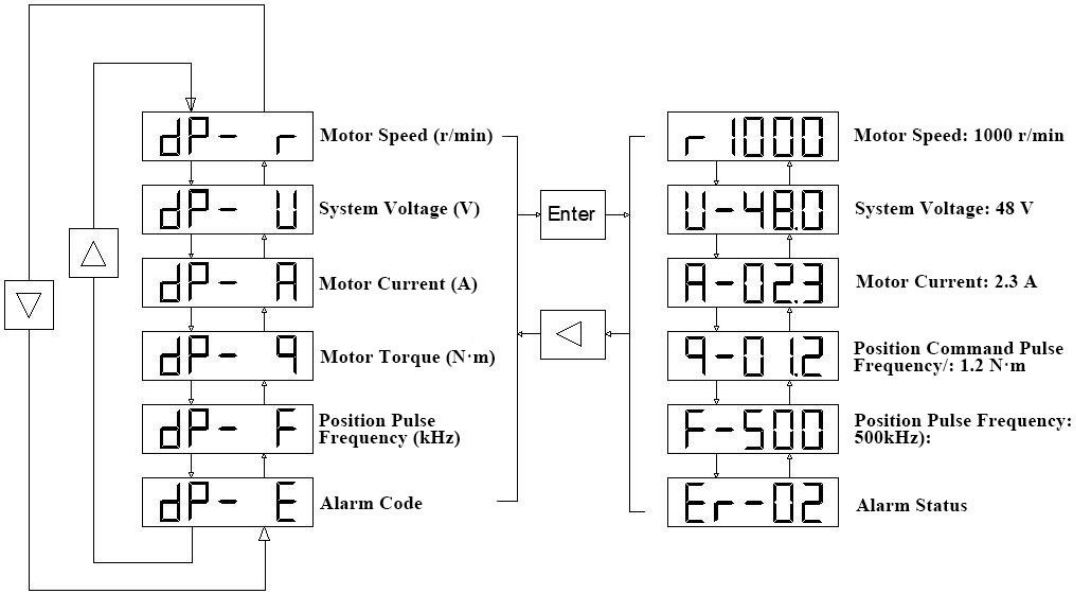


Figure 6.2 Monitoring mode operation block diagram

6.2.2 Parameter Setting

② At Level 1, select "PA-" and press Enter key to enter parameter setting mode.

③ Use ↑ & ↓ keys to select parameter numbers.

④ Press Enter key to display the value of the selected parameter.

⑤ Use ↑ & ↓ keys to modify the parameter value

- Press ↑ or ↓ once to increase or decreased the value by 1.
- Pressing and holding a key changes the value continuously at an increasing rate.

⑥ While a value is being modified, the decimal point on the rightmost LED digit turns on.

⑦ Press Enter key to make sure the modified value is valid. At this time, the right LED is off, and the modified value will be reflected in the control immediately.

⑧ To cancel the change (before pressing Enter key): Press ←. The parameter value reverts to its original setting, and you return to the parameter selection list.

⑨ After saving a change (step 7), you can continue to modify other parameters by repeating steps 2-6.

⑩ When finished, press ← to exit the parameter setting mode and return to the main menu.

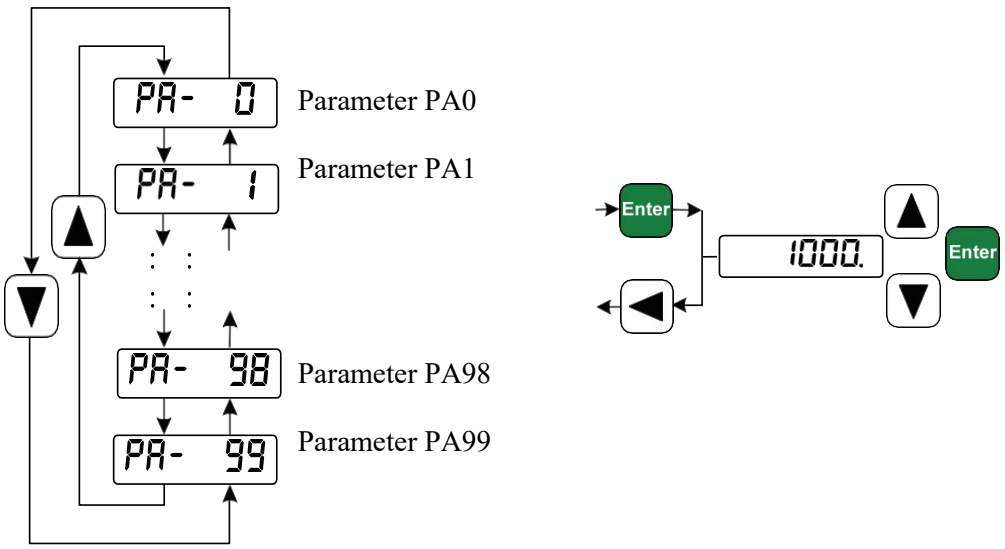


Figure 6.3 Parameter setting operation block diagram

6.2.3 Parameter Management

Parameter management mainly handles operations between the parameter table and EEPROM. Select "EE-" in Level 1 and press the Enter key to enter the parameter management mode. First, you need to select the operation mode; there are 2 modes in total, which can be selected with the ↑ and ↓ keys.

Taking "Parameter Writing" as an example, select "E-Set", then press and hold the Enter key for more than 3 seconds. The display shows "StArt", indicating that the parameters are being written to the EEPROM. After waiting for about 1~2 seconds, if the write operation is successful, the display shows "FInSh"; if it fails, it shows "Error". Then press the ← key to return to the operation mode selection state. After waiting for about another 1~2 seconds, it returns to "E-Set", indicating the operation is completed.

• EE-SET: Parameter Writing.

It means writing the parameters in the parameter table to the EEPROM parameter area. When the user modifies the parameters, only the parameter value in the parameter table is changed. The value will revert to its original value at the next power- on. If you want to permanently change the parameter values, you need to perform this parameter write operation to write the parameters in the parameter table to the EEPROM. After this, the modified parameters will be used on power-up.

• EE-dEF: Restore Defaults.

It means reading the default values (factory values) of all parameters into the parameter table and writing them to the EEPROM parameter area. The default parameters will be used at the next power-on. When the user messes up the parameters and cannot work normally, use this operation to restore all parameters to the factory state.

6.2.4 Speed Test Run Method

Select "Sr-" in Level 1 and press the Enter key to enter the test run mode. The prompt for speed test run is "r", and the unit of the value is r/min. The system is in the speed control mode, and the speed command is provided by the key. Use the ↑ and ↓ keys to change the speed commad, and the motor runs at the given speed

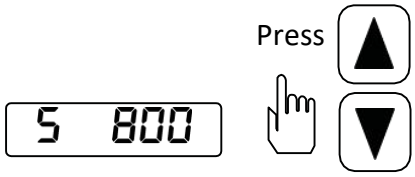


Figure 6.4 Speed test run operation block diagram

6.2.5 JOG Operation Method

Select "Jr-" in Level 1 and press Enter key to enter the JOG operation mode, that is, the jog mode. The prompt of JOG operation is "J", unit is r/min, the system is in the speed control mode, speed command is provided by the key. After entering the JOG operation, press the ↑ key and hold on, the motor runs at the JOG speed; release the key, the motor stops and maintains zero speed. Press the ↓ key and hold on, the motor runs reversely at the JOG speed; release the key, the motor stops and maintains zero speed. The JOG speed is set by parameter PA6.

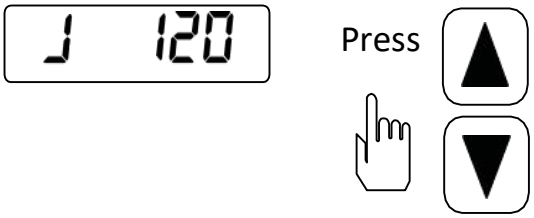


Figure 6.5 JOG operation block diagram

Chapter 7 Operation

7.1 Grounding

Ground the servo drive and motor reliably. In order to avoid electric shock, keep the protective grounding terminal of the servo drive connected to the protective grounding of the control box at all times. Since the servo drive uses PWM technology to supply power to the servo motor through power transistors, the drive and connecting wires may be affected by switching noise. To comply with EMC standards, use a grounding wire that is as thick as possible and achieve a grounding resistance as low as possible.

7.2 Working Sequence

7.2.1 Power-on Sequence

1. Approximately 1.5 seconds after the main circuit power is turned ON, the Servo Ready (SRDY) signal turns ON. At this point, the drive can accept the Servo ON (SON) signal. When a valid SON signal is detected, the base circuit is activated, the motor is energized, and the system enters the run state. If the SON signal becomes invalid or an alarm occurs, the base circuit is turned off, and the motor enters a free state.

2. When the Servo ON (SON) is turned on together with the power supply, the base circuit is turned on after approximately 1.5 seconds.

Caution:

- Frequent power cycling may damage the soft-start circuit and dynamic braking circuit. Limit the frequency of power ON/OFF cycles to a maximum of 5 times per hour and 30 times per day.
- If an overheat fault occurs in the drive or motor, the unit must cool down for at least 30 minutes after the root cause is corrected before power can be reapplied.

7.2.2 Timing Diagram

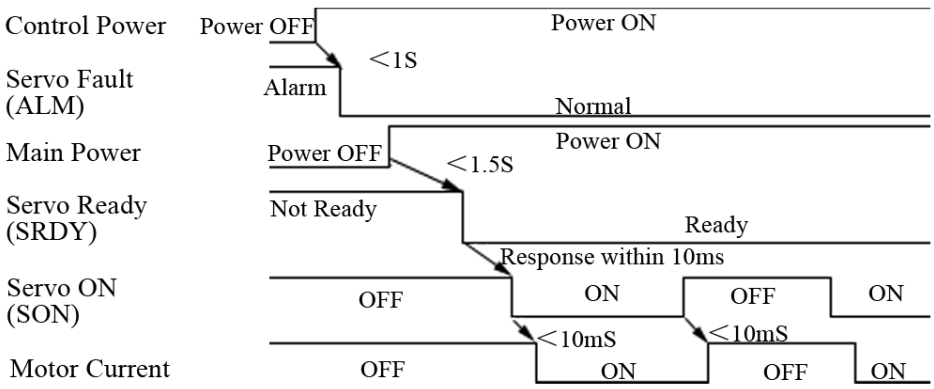


Figure 7.1 Power-on timing diagram

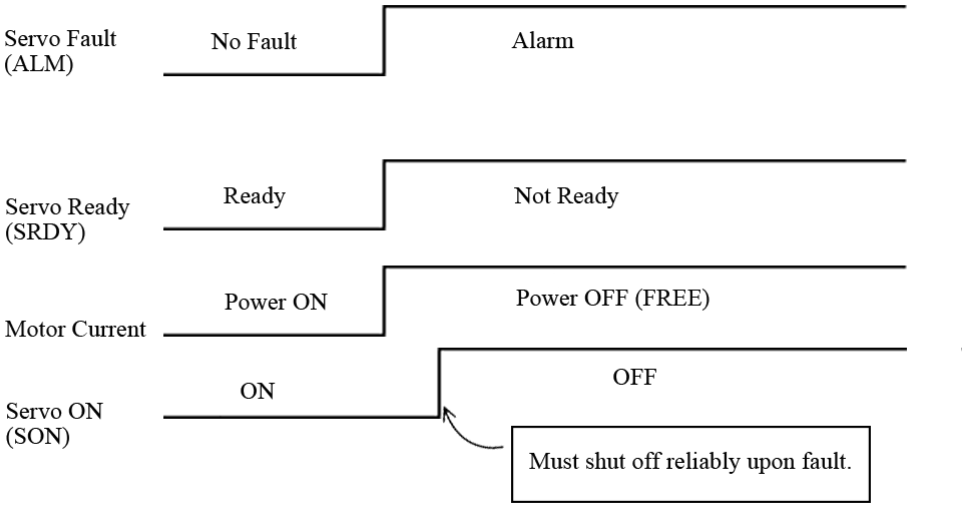


Figure 7.2 Alarm timing diagram

7.3 Use of Mechanical Brake

The mechanical brake (holding brake) is used to lock the vertical or inclined work table connected to the motor, preventing the work table from falling after servo power loss. To implement this function, a motor equipped with a holding brake must be selected.

Note: The brake is designed only to hold the load in position. It must never be used to slow down or stop the motor.

Figure 7.4 shows the brake wiring diagram.The brake is controlled by the Brake Release (BRK) signal from the drive. Note: The brake power supply must be provided by the user and must have 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 should be noted that it will cause a slight braking delay.

Figure 7.5 shows the action sequence of the mechanical brake after the motor stops stably under normal conditions. At this time, the motor continues to be energized to maintain the position. The brake switches from release to braking, and after a stable period of time (the time is determined by parameter PA8), the motor power supply is cut off.

Figure 7.6 shows that when the motor is running and the speed is over 30r/min, the motor current is cut off, and the brake continues to be released. After a period of delay, the brake brakes. This is to decelerate the motor from a high-speed rotation state to a low speed, and then activate the mechanical brake to avoid brake damage. The delay time is the shorter of two times: the value set by parameter PA7, or the time required for the motor speed to decelerate to the value of parameter PA8.

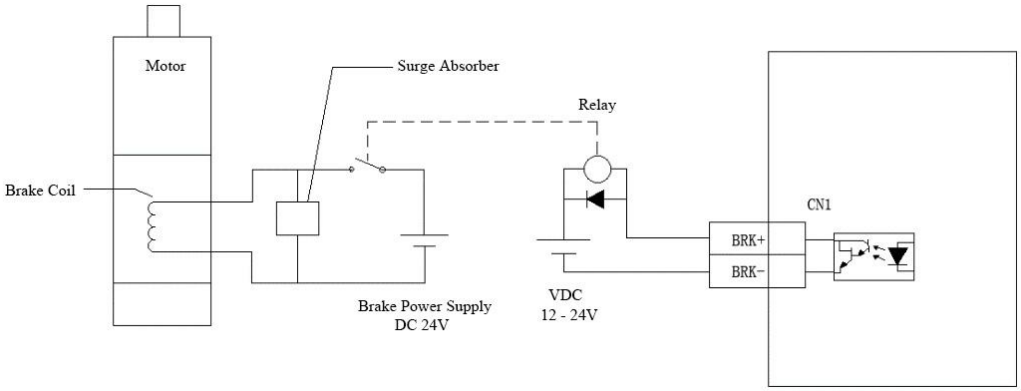


Figure 7.4 Mechanical brake wiring diagram

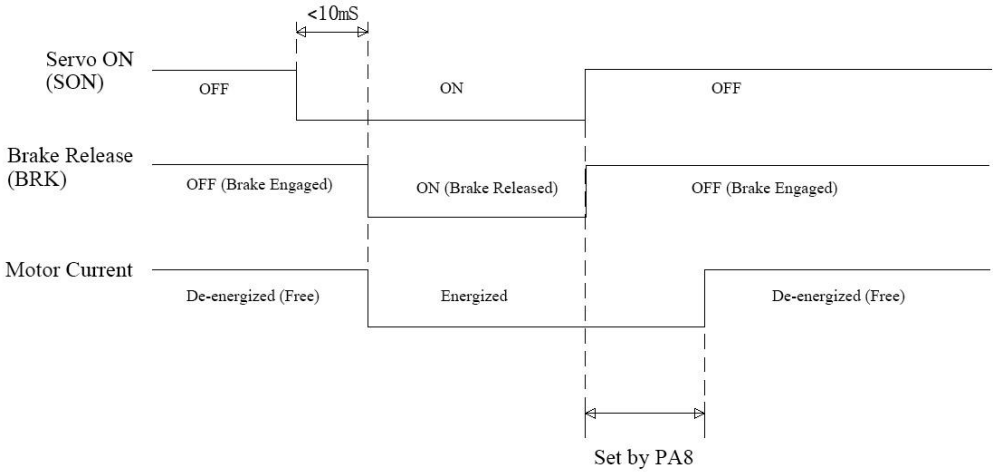


Figure 7.5 Mechanical brake action sequence when the motor stops (speed<30r/min)

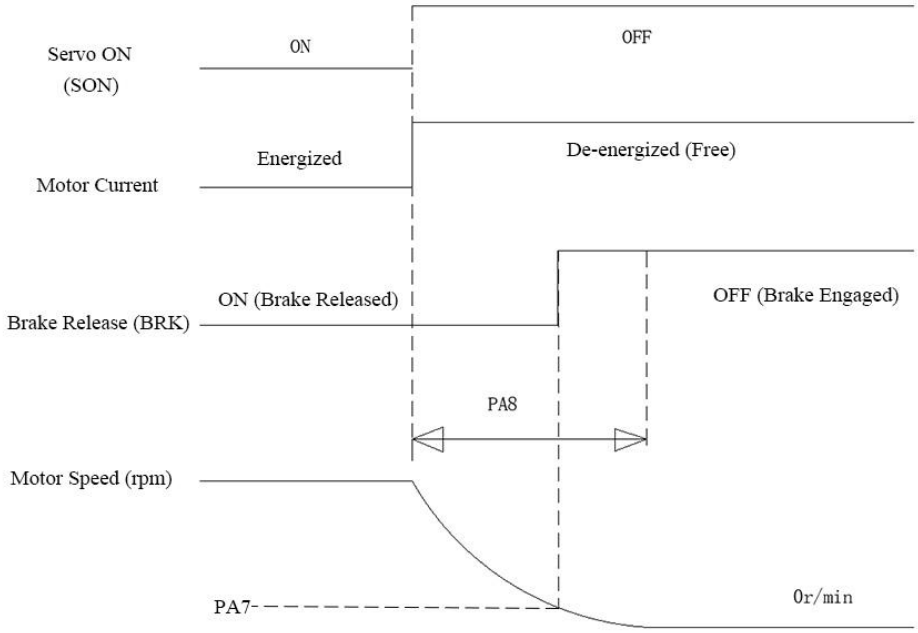


Figure 7.6 Mechanical brake action sequence when the motor is running

7.4 Precautions

For applications with high start-stop frequency, verify in advance that the operating frequency is within the permissible range. The allowable frequency range varies depending on motor type, capacity, load inertia, and motor speed.

First, set the acceleration/deceleration times to prevent excessive regenerative energy.

- In Position Control mode, set the acceleration/deceleration time of the output pulses from the host controller, or set drive parameters PA24 and PA25.
- In Speed Control mode, set drive parameters PA22 and PA23.

Under the condition that the load inertia is m times the motor inertia, the permissible start/stop frequency for the servo motor is as follows:

Load Inertia Ratio (m)	Allowable Start-Stop Frequency	Acceleration/Deceleration Time
m≤3	>100 times/min	60 ms or less
m≤5	60~100 times/min	150 ms or less
m>5	<60 times/min	150 ms or more

If the requirements are still not met, the methods of reducing the internal torque limit and lowering the maximum motor speed (parameter PA12) can be adopted. The allowable start-stop frequency of the servo motor varies with load conditions, operating time and other factors. Generally, the load inertia ratio is within 5 times. When used under large load inertia, main circuit overvoltage or brake abnormality may often occur during deceleration. At this time, the following methods can be used:

1. Reduce the motor's maximum speed (parameter PA12).
2. Install an external regenerative device.

The servo drive is equipped with a power supply for the encoder. To ensure the normal operation of the encoder, its output voltage must be maintained at 5V ± 5%. When the user uses a very long cable, it may cause voltage drop. In this case, please use multi-core wire to supply power to the encoder to reduce the voltage drop on the cable.

7.5 Test Run

7.5.1 Pre-operation Check

- Verify that all connections are proper, especially for VCC, GND, and U, V, W,and check for any loose connections.
- Verify the input voltage is correct.
- Check if the motor connection cable is short-circuited or grounded.
- Verify that the encoder cable is properly connected.

7.5.2 Power-on Text Run

1. Before power-on

• The motor is unloaded; do not add load to the motor shaft.

• Due to the impact of motor acceleration and deceleration, the motor must be fixed.

2. Wiring

• Main circuit terminals, DC 24-60V VCC and GND terminals.

• Connect the encoder signal connector CN2 to the servo motor.

• Connect the control signal connector CN1 to the servo motor.

3. JOG operation

• Turn on the circuit power; the drive display lights up. If an alarm occurs, check the wiring.

• Set the parameter values as follows:

Parameter No.	Meaning	Parameter value	Factory default
PA3	Control mode selection	7	0

• After confirming there is no alarm or any abnormality, activate Servo ON (SON); the motor is energized and in the zero-speed state.

•Through key operation, enter the **JOG** operation state. The prompt for speed test run is "**J 0**", and the unit of the value is r/min. The system is in speed control mode, and the speed command is provided by the keys. Press and hold the [↑] key, the motor runs at the **JOG** speed; release the key, the motor stops and maintains zero speed. Press and hold the [↓] key, the motor runs in the reverse direction at the **JOG** speed; release the key, the motor stops and maintains zero speed. The **JOG** speed is set by parameter PA6, and the default is 100r/min.

• If it is inconvenient to control Servo ON (SON) externally, set parameter PA5 to 1 to force Servo ON (SON) to be active, without the need for external wiring to control SON.

4. Manual speed control

• Turn on the control circuit power (do not connect the main circuit power temporarily); the drive display lights up. If an alarm occurs, check the wiring.

• Turn on the main circuit power; the POWER indicator lights up.

• Set the parameter values according to the following table:

Parameter No.	Meaning	Parameter Value	Factory Default Value
PA3	Control Mode Selection	8	0

• After confirming there is no alarm or any abnormality, activate Servo ON (SON); the motor is energized and in the zero-speed state.

•Through key operation, enter the **speed test run** state. The prompt for speed test run is "**S 0**", and the unit of the value is r/min. The system is in speed control mode, and the speed command is provided by the keys. Use the [↑] and [↓] keys to change the speed command, and the motor should run at the given speed.

• If it is inconvenient to control Servo ON (SON) externally, set parameter PA5 to 1 to force Servo ON (SON) to be active, without the need for external wiring to control SON.

7.6 Simple Wiring and Operation in Position Control Mode

1. Wiring

- Main circuit terminals, DC 24-60V VCC and GND terminals.
- Connect the encoder signal connector CN2 to the servo motor.
- Connect the control signal connector CN1 as shown in the figure.

2. Operation

- Turn on the main power; the display shows a reading.
- Set the parameter values according to the following table:

Parameter No.	Significance	Parameter value	Factory default
PA3	Control Mode Selection	0	0
PA14	Electronic Gear Numerator	Set by the user	1
PA15	Electronic Gear Denominator	Set by the user	1

•After confirming there are no alarms or abnormalities, activate Servo ON (SON). Then, send low-frequency pulses from the controller to the drive to run the motor at a low speed.

3. Electronic Gear Setting

The encoder installed on the drive is 10000 pulses per revolution. Any pulse equivalent can be obtained by setting the electronic gear parameters PA14 and PA15. Note: You can set any values for the numerator and denominator to get any ratio, but it is best not to exceed the range of 1/50~50.

Table 7.1 Relationship between input pulse number and rotation number

Input Pulse Number	Motor Rotation Number	Electronic Gear Numerator (PA14)	Electronic Gear Denominator (PA15)
Pulse	$\frac{\text{pulse x } PA14}{10000 \text{ x } PA15}$	PA14	PA15
10000	1	1	1
5000	1	2	1
3000	1	10	3
800	1	25	2
20000	1	1	2
1000	2/3	20	3
4000	3	30	4

Table 7.2 Relationship between input pulse frequency and rotation speed

Input Pulse Frequency (Hz)	Motor Speed (r/min)	Electronic Gear Numerator PA14	Electronic Gear Denominator PA15
Frequency	$\frac{\text{Frequency x 60 x } PA14}{1000 \text{ x } PA15}$	PA14	PA15
500k	3000	1	1
300k	1800	1	1
100k	1200	2	1
100k	1800	3	1
50k	1000	10	3
200k	800	2	3
100k	300	1	2

7.7 Simple Wiring and Operation in Speed Control Mode

1. Wiring

• Main circuit terminals, 24-60V voltage connected to VCC and GND terminals.

• Connect the encoder signal connector CN2 to the servo motor.

• Connect the control signal connector CN1 as shown in the figure.

• If only speed regulation control is performed, it is not necessary to connect the encoder output signal; if the external controller is a position controller, the encoder output signal needs to be connected.

2. Operation

• Turn on the control circuit power and main power; the display shows a reading, and the POWER indicator lights up.

• Set the parameter values according to the following table:

Parameter No.	Meaning	Parameter value	Factory default
PA3	Control Mode Selection	2	0
PA22	Acceleration Time Constant	10	10
PA23	Deceleration Time Constant	10	10
PA45	Analog Speed Command Gain	Set as needed	1500
PA46	Analog Speed Command Zero Offset Compensation	Set as needed	600

• After confirming there are no alarms or abnormalities, activate Servo ON (SON).

• Apply an adjustable DC voltage to the analog speed input terminal. Starting from 0V, gradually increase the voltage. The motor speed should change accordingly in response to the command. Applying a negative voltage should cause the motor to reverse.

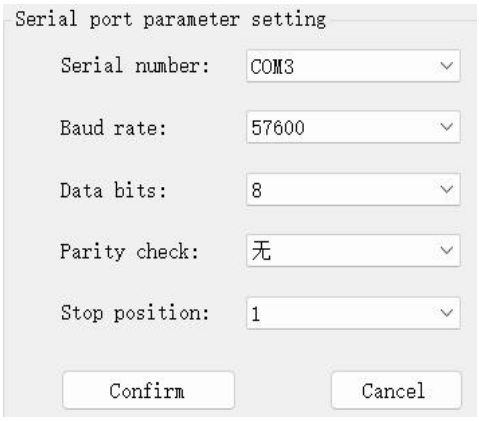
• When the given analog command voltage is at the zero-speed level (0V), the motor may still rotate at a low speed due to zero-offset voltage present in both the host controller and the drive. You can adjust parameter PA46 to compensate for this offset and bring the motor to a true zero speed.

Chapter 8 Software Debugging

1. Establish communication. First, make the hardware connection. Connect the debugging cable to the drive's RS232 or Type-C interface, and connect the other end to a USB-to-serial adapter.

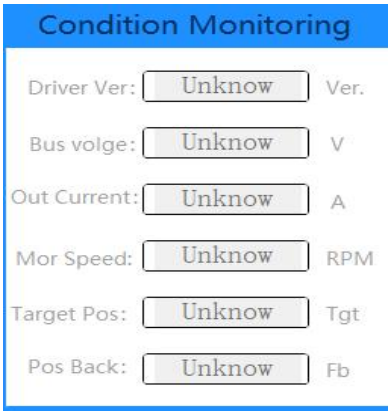
2. Check the PC COM port number. In Device Manager, view the Ports section to identify which COM port is assigned to the USB-to-Serial adapter. The figure below shows the port details under normal conditions. If the serial port drive is not installed, a yellow exclamation mark will be displayed, prompting you to install the drive.

3. After confirmation, power on the drive, open the debugging software, select "Serial Port Settings" from the File drop-down menu, select the corresponding COM port, and then open the serial port. (Under normal conditions, the software will automatically search for the serial port, no need for manual setting.)

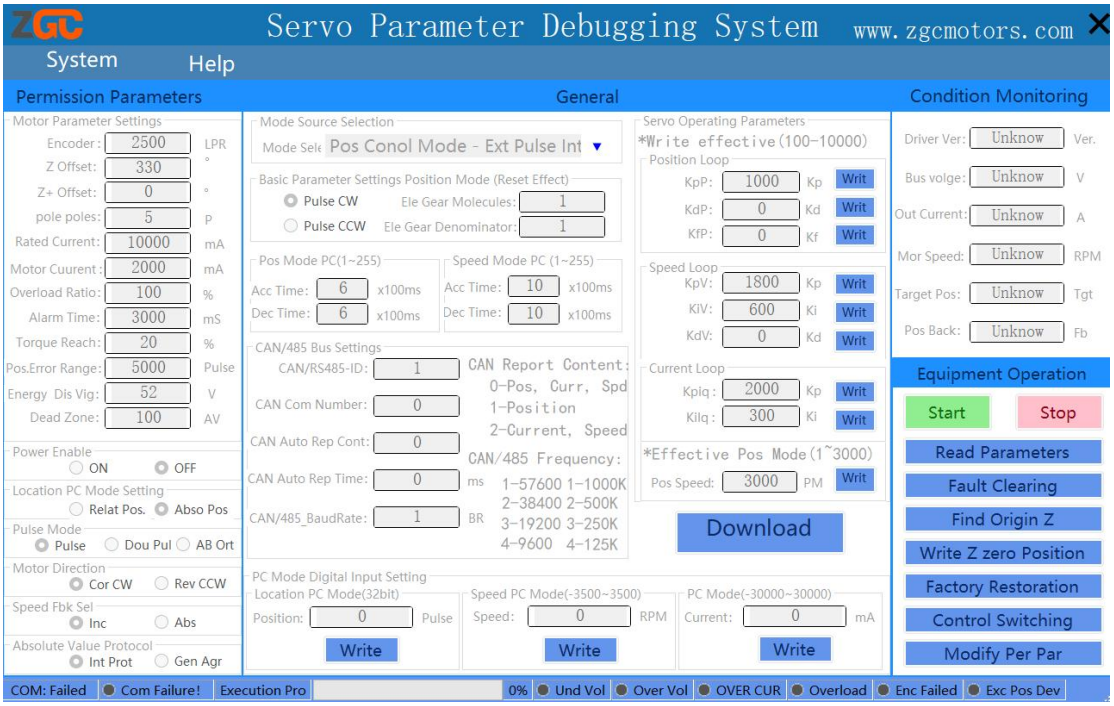


4. Verify communication. After opening the serial port, the software will automatically read the internal drive parameters for the first time. If communication fails, the lower left corner will display a communication fault or parameter read failure. Successful communication is determined by whether the drive version is read correctly. If the drive version shows

"UNKNOW", communication has failed. Please check the hardware connection.



5. After successful communication, the following parameters will be read.



NOTE: The gray area on the left contains manufacturer parameters. A password is required for modification. It is recommended to exercise caution when modifying motor parameters, as incorrect settings can easily cause alarms, abnormal operation, or damage to the drive and equipment. Consult the manufacturer before proceeding. Default password: 8888. If parameters are set incorrectly, consult the manufacturer to restore the default parameters.

6. Control source selection:

• If the control system is pulse positioning type, please select Position Mode, External Pulse Input, and the control state is PLC Control.

• If it is communication position control (CAN or 485), select Position Mode - PC Digital Input.

• For communication command control, please switch to PC control.

• Refer to the lower right corner for the current status.

• For PLC Control, start and stop operations are controlled by external enable IO.

• PC Control is operated by communication commands for start and stop.

7. Parameter settings of different modes, please browse the software parameter interface directly for details.

8. Accelerate time, decelerate time. Calibrated as the time to accelerate from 0 speed to 3000rpm.

9. Servo operation parameters:

• When adjusting the operating parameters, base the settings on the load.

•Position Proportional Gain: This relates to the response speed for reaching the target position. If set too high, it will cause overshoot. If set too low, the position response will be too slow or may not reach the target.

• Speed Proportional Gain: Adjusts the speed response. It also helps to match the load inertia. For high inertia loads, increase the speed proportional gain to around 5,000. If the operation seems jerky or sticky, reduce the speed integral gain to below 1,000.

• If there is overshoot and oscillation when reaching the target position, reduce the position proportional gain. A suggested range is between 100 and 500.

• Current loop parameters are not recommended for adjustment at this time. If necessary, please contact the manufacturer.

Chapter 9 Specification

9.1 Servo Drive Dimension

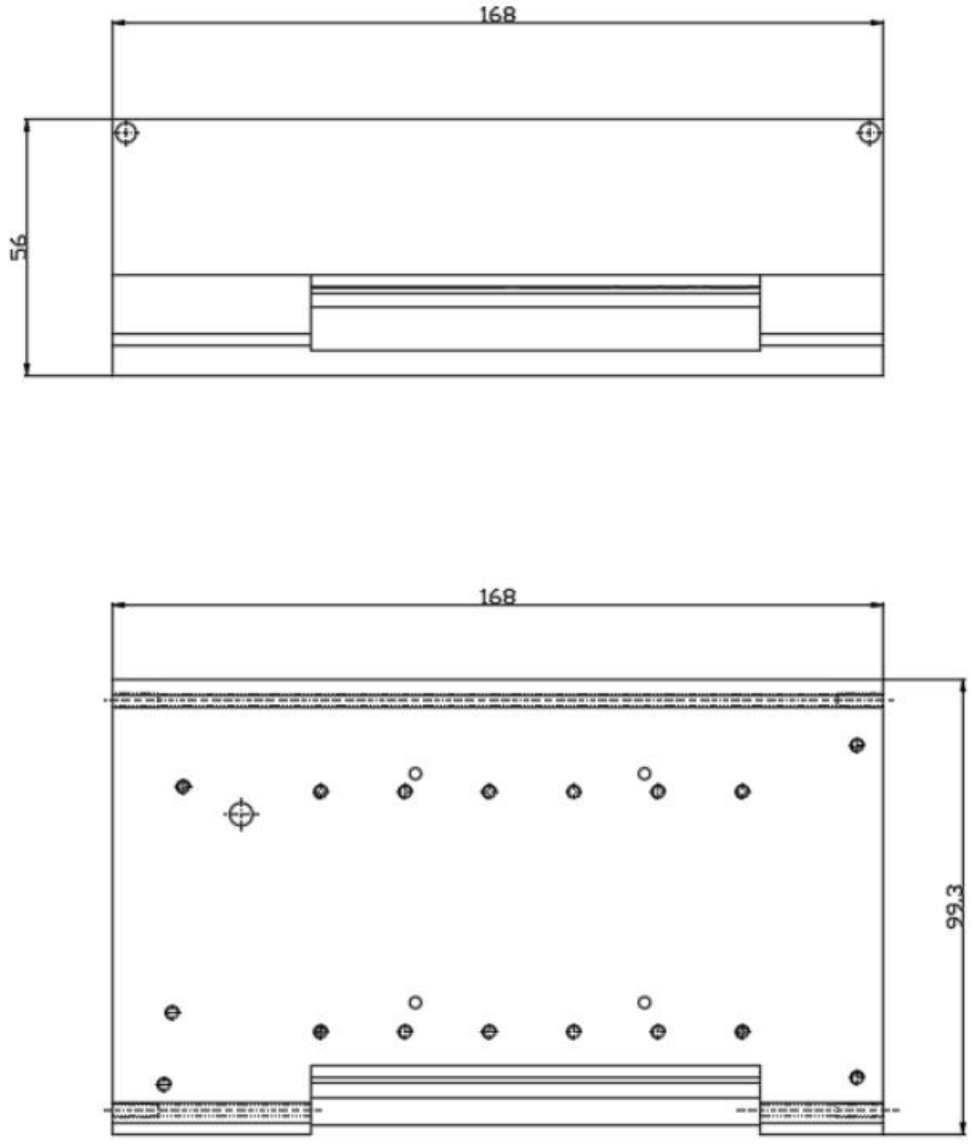


Figure 9.1 NSP-SERVO-DC-20 dimension drawing(mm)

9.2 Servo Drive Specification

Model		NSP-SERVO-DC-20
Input Power Supply		DC 24-60V
Operating Environment	Temperature	Operating: 0～40°C; Storage: -40°C～50°C
	Humidity	40%～80% (no condensation)
	Atmospheric Pressure	86~106kPa
Control Method	Position Control, Speed Control, Torque Control	
Regenerative Braking	External	
Characteristics	Speed Frequency Response	≥200Hz
	Speed Fluctuation Rate	<±0.03 (load 0～100%); <±0.02 (power supply -15%～+10%) (The value corresponds to the rated speed)
	Speed Ratio	1:3000
	Pulse Frequency	≤500kHz
Control Input	① Servo ON (SON) ② Alarm Reset (ALM-RST) ③ CCW Drive Inhibit ④ CW Drive Inhibit ⑤ Homing Control	
Control Output	① Servo Ready (SRDY)② Servo Fault (ALM) ③Positioning Complete (INP) ④Brake Release (BRK)	
Position Control	Input Mode	①Pulse + Direction ② CCW Pulse/CW Pulse ③ Two-phase A/B Quadrature Pulse④ Command Position via Communication
	Electronic Gear	1~1000/1~1000
	Feedback Pulse	Incremental 2500 lines/rev; Absolute 17-bit/131072 pulses
Speed Control	① Analog Speed Control ② Speed Control via Communication	
Acceleration/Deceleration Function	Parameter setting 1~10000ms / 1000r/min	
Monitoring Function	Speed, Motor Torque, Motor Current, Command Pulse Frequency, Voltage, Alarms, etc.	
Protection Function	Overspeed, Overvoltage, Undervoltage, Overcurrent, Overload, Brake Fault, Encoder Fault, Position Error, etc.	