BONMET MOTION GMBH

Manual For Servo Drive

2010.01

Preface

Thank you for choosing BONMET's AC servo products.

This manual is a user guide that provides the information on how to install, operate and maintain SA series AC servo drive. The contents of this manual include the following topics:

- Installation of AC servo drives and motors
- Configuration and wiring
- Trial run steps
- Control functions and adjusting methods of AC servo drives
- Parameter settings
- Inspection and maintenance
- Troubleshooting
- Application examples

Before using the product, please read this manual to ensure correct use. Users should thoroughly understand all safety precautions (DANGERS and WARNINGS) before proceeding with the installation, wiring and operation. If you still have any problem, please contact with the local BONMET sales representative. Place this user manual in a safe location for future reference.

Safety Precautions

● *To prevent electric shock, note the following:*

DANGEROUS
• Before wiring or inspection, switch power off and wait for more than 10 minutes. Then, confirm the voltage is safe with voltage tester. Otherwise, you may get an electric shock. • Wiring must be carried by electrical engineer. • Connect the servo drive and servo motor to ground. • Operate the switches with dry hand to prevent an electric shock. • The cables should not be damaged, stressed, loaded, or pinched. Otherwise, you may get an electric shock.

● *To prevent fire, note the following:*

CAUTION
• Do not install the servo drive, servo motor and regenerative brake resistor on or near combustibles. Otherwise a fire may cause. • When the servo drive has become faulty, switch off the main power. Continuous flow of a large current may cause a fire. • When there is a signal faulty as a regenerative brake resistor is used, please switch the main power off. Otherwise, a regenerative brake transistor fault may overheat the regenerative brake resistor and cause a fire.

● *Wiring Precautions*

CAUTION
• Wire the equipment correctly and securely. • Connect the output terminals (U, V, W) correctly. • Do not connect AC power directly to the servo motor.

● *Operation and Adjustment Precautions*

CAUTION
• Do not touch the radiator and the regenerative brake resistor as they are overheated. • Do not set parameter value unduly. If so, system would be instable. • Do not touch the rotating parts of the servo motor in operation. Doing so may cause injury.

● *Others*

CAUTION
• Do not attempt to remold the servo drive.

CONTENTS

Chapter 1 Model and Specifications

1.1 Nameplate

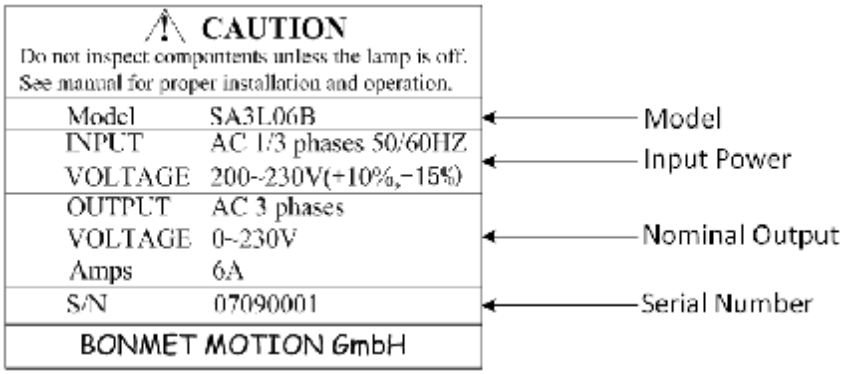


Figure 1-1 Nameplate

1.2 Model Designation

SA	3L	10	B	XX
1	2	3	4	5

1. Product type: SA- Series AC servo drive;
2. Power supply;

1L	3L	3H
1-phase AC220V （1Φ220V）	3-phase AC220V （3Φ220V）	3-phase AC380V （3Φ380V）

3. Nominal current：

04	06	10	15	25
4A	6A	10A	15A	25A

4. Power specification code;
5. Software customized logo.

1.3 Model

Specification		Model
1/3-phase AC220V	4A	SA3L04C
	6A	SA3L06B
	10A	SA3L10B
	15A	SA3L15C
	25A	SA3L25C
3-phase AC380V	10A	SA3H10C

1.4 Outline Dimension Drawings (Unit: mm)

1.4.1 SA3L04C Dimension Drawings

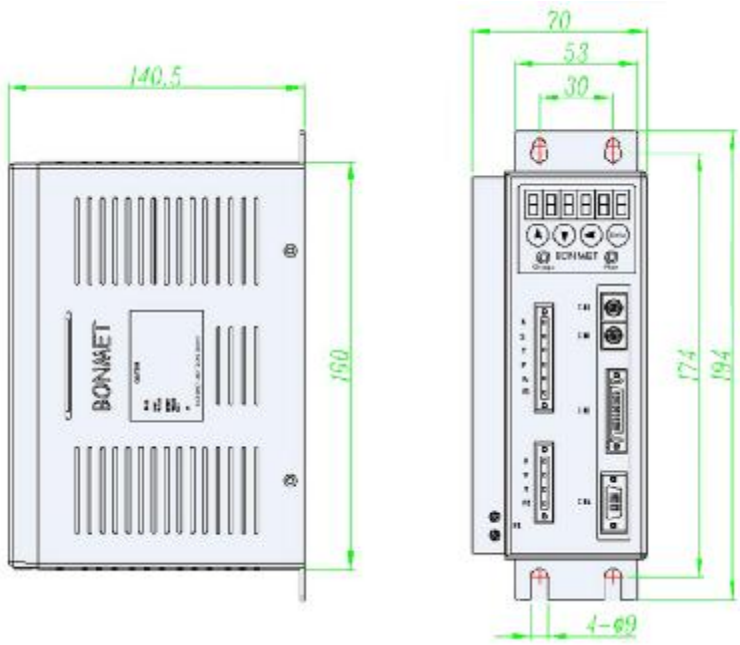


Figure 1-2 SA3L04C dimension drawings

1.4.2 SA3L06B /SA3L10B Dimension Drawings

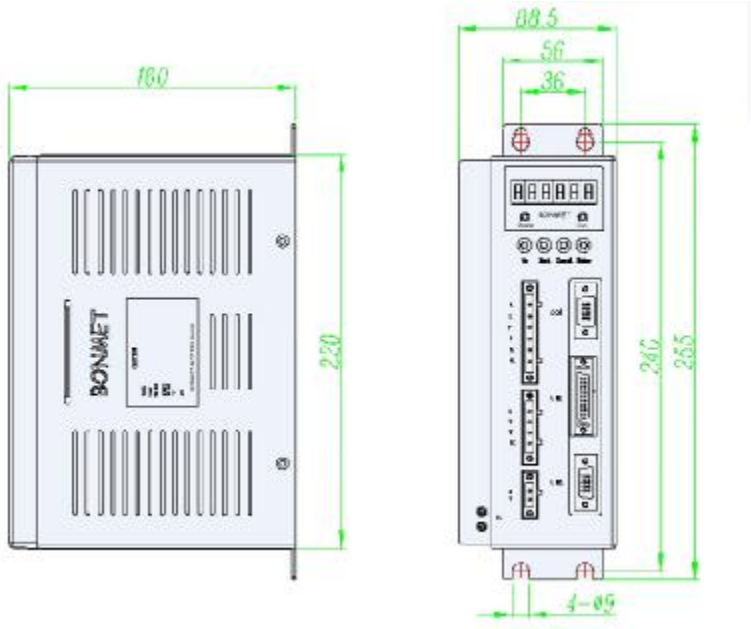


Figure 1-3 SA3L06B/SA3L10B dimension drawings

1.4.3 SA3L15C/SA3L25C Dimension Drawings

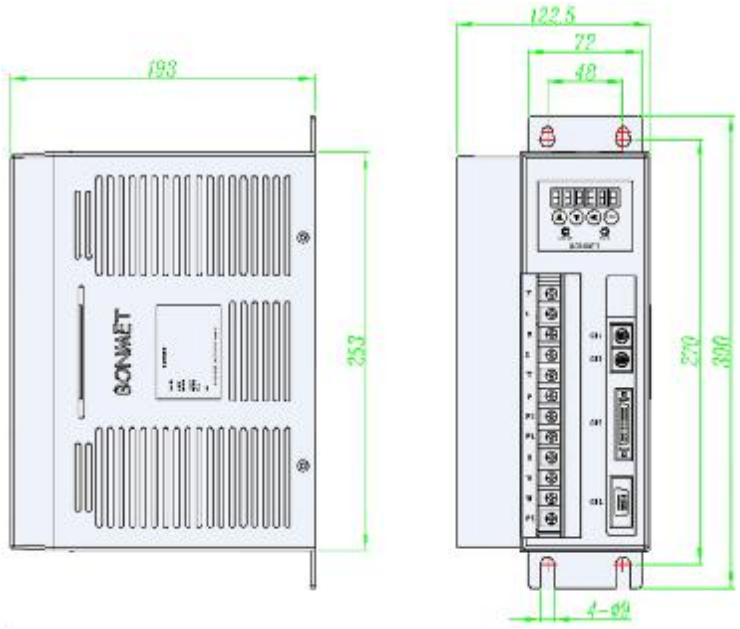


Figure 1-4 SA3L15C/SA3L25C dimension drawings

1.4.4 SA3H10C Dimension Drawings

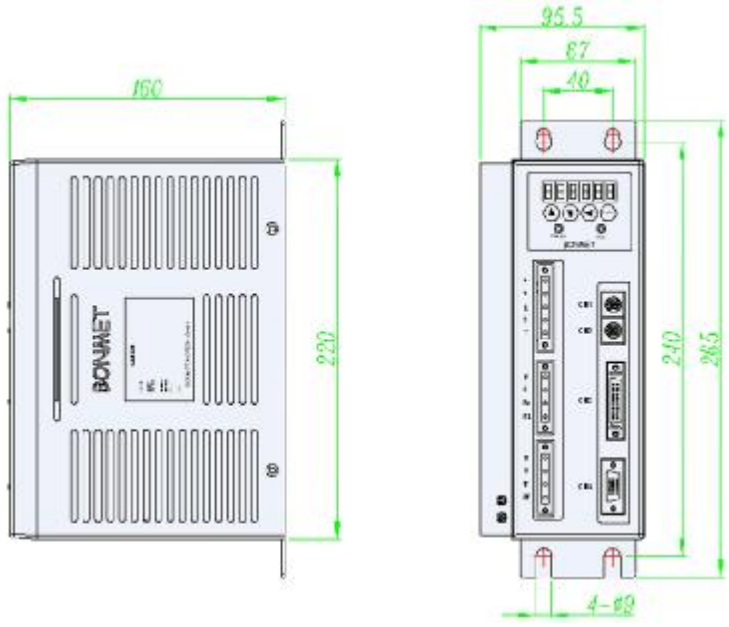


Figure 1-5 SA3H10C dimension drawings

1.5 Technical Specifications

1.5.1 General Specifications

Input power supply		Single-phase or three-phase AC220V -15~+10% 50/60Hz	three-phase AC380V -15~+10% 50/60Hz
Operation environment	Ambient temperature	Operation：0~40℃ Storage：-40℃~50℃	
	Ambient humidity	40%~80%(non-condensing)	
	Atmospheric pressure	86~106kPa	
Control mode		①Position ②Speed ③Torque ④JOG ⑤Point-to-Point	
Regenerative braking		Internal/External connection	
Features	Speed frequency response	≥200Hz	
	Speed fluctuation ratio	<±0.03(Load 0~100%)；<± 0.02(Power Supply -15~+10%) (Value corresponds to the nominal speed)	
	Speed ratio	1:5000	
	Pulse frequency	≤500kHz	
Input signals		①Servo enable ②Alarm clear ③CCW drive forbidden ④CW drive forbidden ⑤Deviation counter reset/ speed select 1/ zero speed clamp ⑥Command pulse forbidden/ speed select 2 ⑦CCW torque limit ⑧CW torque limit	
Output signals		①Output ready ②Alarm output ③Positioning completed / speed reached	
Position control mode		Pulse type	①Pulse + Direction ②CCW pulse / CW pulse ③A phase and B phase
		Electronic gear	1~32767/1~32767
		Feedback pulse	2500 C/T
Speed control mode		Four kinds of internal speed	
Acceleration and deceleration function		Parameter setting :1~10000ms or 1~1000r/min	
Monitoring function		Speed, current position, accumulation of command pulse, position deviation, motor torque, motor current, linear speed, rotor absolute position, command pulse frequency, operation state, I/O terminal signals, etc.	
Protective functions		Overspeed, overvoltage, undervoltage, over current, Motor overheated , overload, Brake error, encoder error, control power error, location tolerance, etc.	
Applicable load inertia		Less than five times of motor inertia	

1.5.2 Single Specification list

Model	SA3L04C	SA3L06B	SA3L10B	SA3L15C	SA3L25C	SA3H10C
Input power supply	1/3 phases AC 220V	1 /3 phases AC 220V	1/3 phases AC 220V	1/3 phases AC 220V	1/3 phases AC 220V	3-phaseAC 380V/220V
Nominal current	4A	6A	10A	15A	25A	10A
Maximum instant current	11.312A	16.968A	28.28A	42.42A	70.7A	28.28A
Line diameter of terminal R,S,T	≥1.5mm^2 (AWG14-15)	≥2.0mm^2 (AWG12-13)	≥2.0mm^2 (AWG12-13)	≥2.5mm^2 (AWG11)	≥2.5mm^2 (AWG11)	≥2.0mm^2 (AWG12-13)
Line diameter of terminal U,V,W,PE						
Line diameter of terminal r,t	≥1.0mm^2 (AWG16-18)	≥1.0mm^2 (AWG16-18)	≥1.0mm^2 (AWG16-18)	≥1.0mm^2 (AWG16-18)	≥1.5mm^2 (AWG14-15)	≥1.0mm^2 (AWG16-18)

Note: Momentary maximum current equals to the maximum theoretical value for drive, please do not operate the servo system in the state of overcurrent for long-term to avoid damage.

Chapter 2 Wiring and Operation

2.1 Installation Sites

- Please install the servo system in the place without oil mist, dust or electrical control cabinet (ensure the temperature below 50℃, relative humidity below 80%. The long-term safety temperature below 40℃).
- Please install the servo system in the place without radioactive matters and combustibles.
- Take an anti-vibration measure to guarantee that the servo drive is free from vibration impact, ensuring the vibration under 0.5G (4.9m/s^2).
- Please install the servo system in the place without direct sunlight.
- Interferential equipment nearby would take great effects to the power wire and control wire which will cause misoperation. For normal operation, a noise filter or any other anti-jamming measures is necessary to be carried out. Leakage current would increase after installing a noise filter; therefore an isolation transformer can be used to avoid this problem. Possessing a reasonable alignment and inhibit measures is very important because the control signal wire is easy to be interfered.

2.2 Installation Direction and Space

- The equipment must be installed in the specified direction. Otherwise, a fault may occur.
- Leave specified clearances between the servo drive and control box inside walls or other equipment.
- Leave a large clearance between the top of the servo drive and the internal surface of the control box, and install a fan to prevent the internal temperature of the control box from exceeding the environmental conditions.
- When using heat generating equipment such as the regenerative brake option, install them with full consideration of heat generation so that the servo drive is not affected. Install the servo drive on a perpendicular wall in the correct vertical direction.

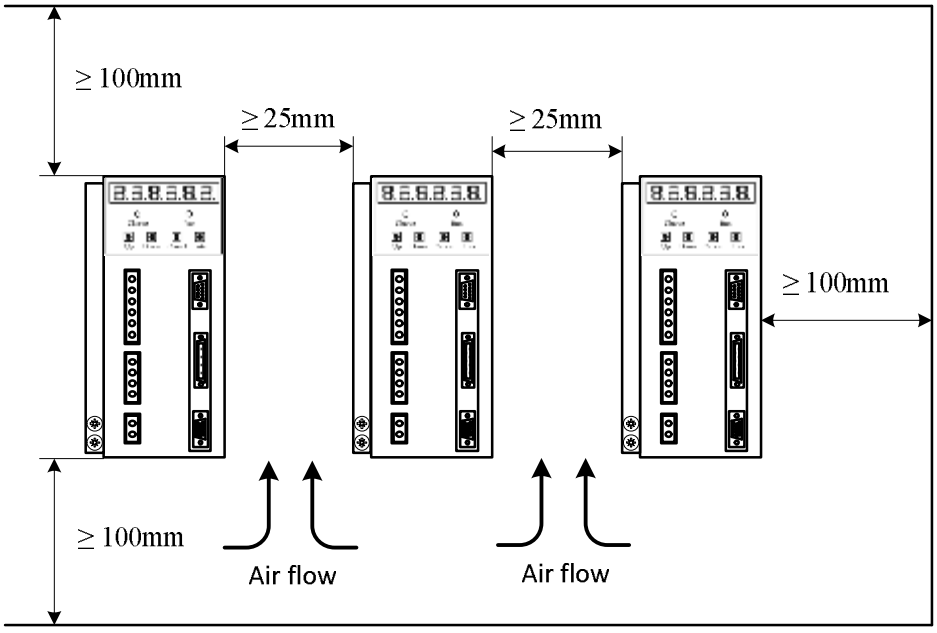


Figure 2-1 installation schematic diagram for drives

2.3 Connection

2.3.1 SA3L04C Connection Graph

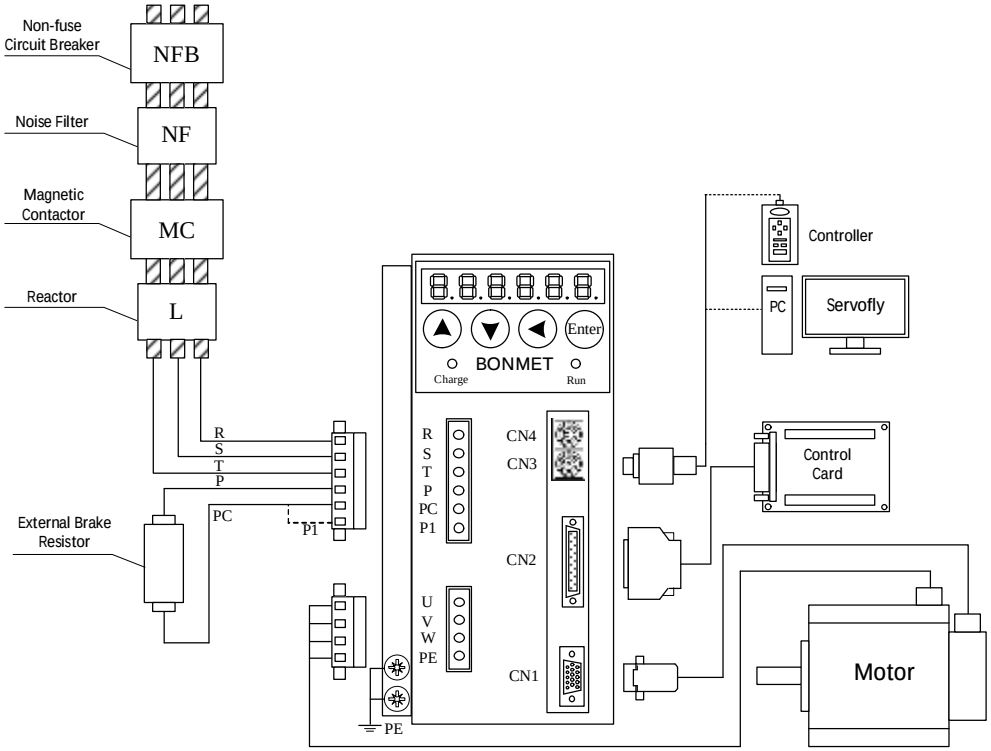


Figure 2-2 Connection graph of SA3L04C

2.3.2 SA3L06B/SA3L10B Connection Graph

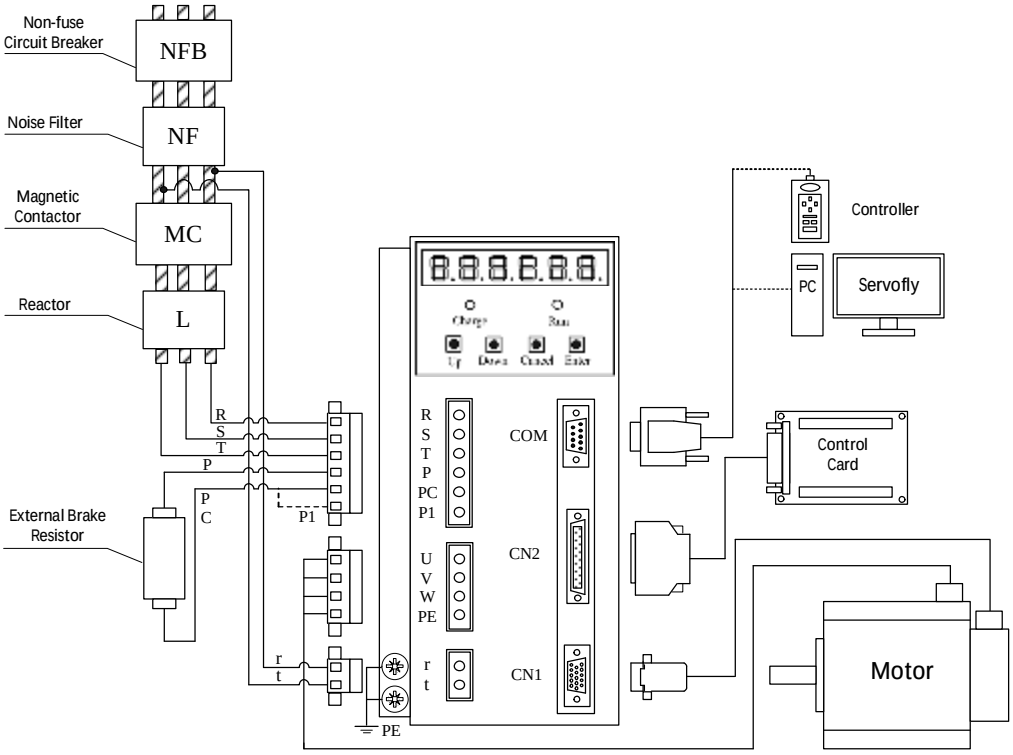


Figure 2-3 Connection graph of SA3L06B/SA3L10B

2.3.3 SA3L15C/25C Connection Graph

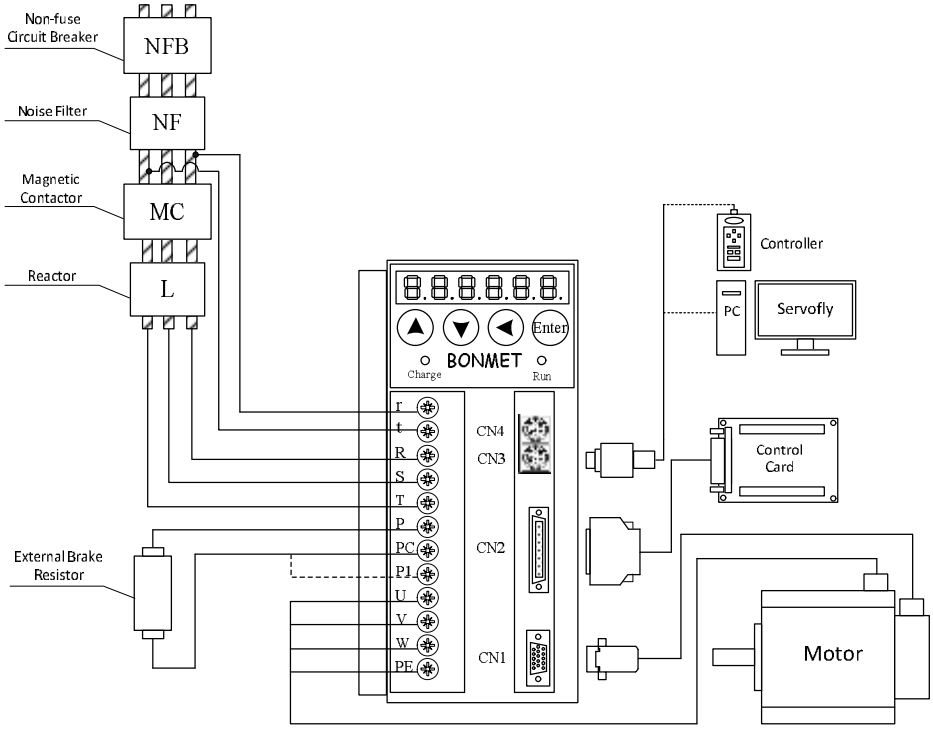


Figure 2-4 Connection graph of SA3L15C/SA3L25C

2.3.4 SA3H10C Connection Graph

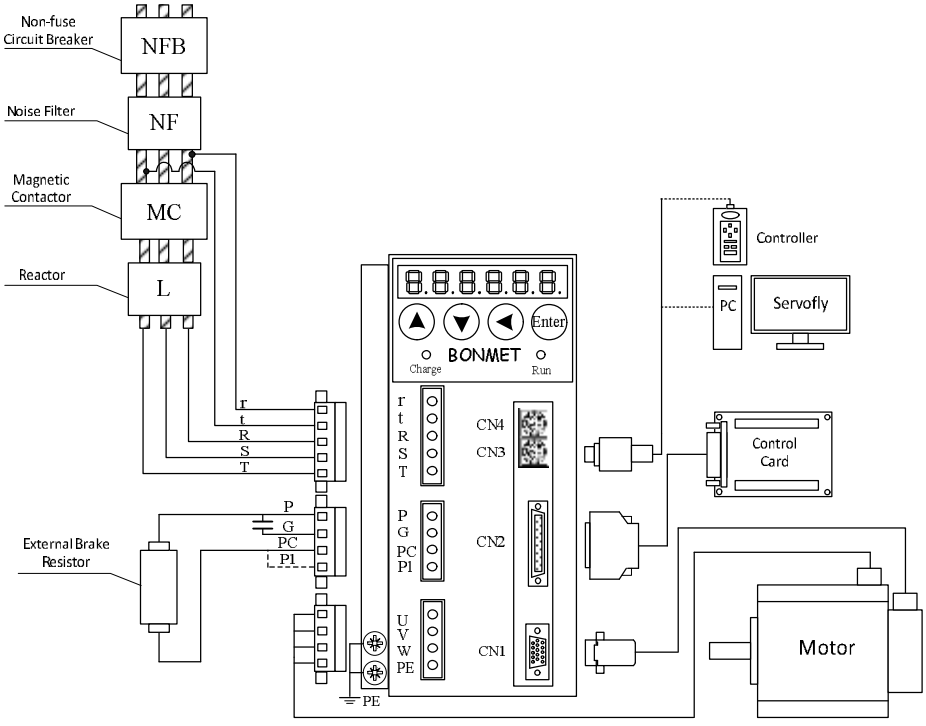


Figure 2-5 Connection graph of SA3H10C

Note: ①Connect PC with P1 when using the internal brake resistor, connect the external brake resistor between terminal PC and P when using an external brake resistor.

②SA3L04C: The terminals r, t are integrated with main circuit power supply terminals;

③SA3H10C: It is necessary to connect a capacitance between terminal P and G under high-voltage operation.

2.6 Cable Type

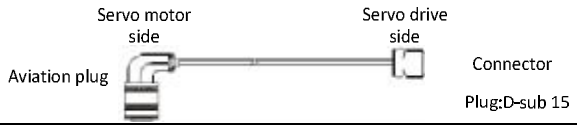
Type	Model	Adapter model	Cable icon
Encoder cable	BON-SA24	110-series motor 130-series motor 150-series motor	
	BON-SB24	80-series motor	
Power cable	BON-HA	110-series motor 130-series motor 150-series motor	
	BON-HB	80-series motor	
RS232 serial cable	BON-COM9	SA3L06B SA3L10B	
	BON-PS2-8	SA3L04C SA3L25C SA3H10C	
Cable for PC interface	BON-CN2A	SA3L06B SA3L10B SA3L04C SA3L25C SA3H10C	

Table 2-1 Cable type list

2.7 Wiring Notes

- Please use the recommended electric cable or similar inhibit wire as for the I/O signal wires and encoder signal wires. Cable specifications: the length of input/output signal wire should be 3 meters or less; the length of encoder signal wire should be 20 meters or less; the main circuit wire and the signal wire should be separated.
- Terminal PE of the servo drive and motor should be connected to ground.
- It is suggested to install a noise filter to prevent from malfunctions caused by interference, please notice the followings:
  1） Install the noise filters, servo drives and the host controller at a close range.
  2） Install a surge suppressor in the coil of relays, electromagnetic contactors and brakes.
  3） Do not tie up the main circuit and signal wires together or cross the same pipe.
- In the event that there is strong sources of interference nearby (such as electric welder, electro discharge machine, etc.), an input power isolation transformer can be use to prevent malfunctions caused by interference.
- Please install a non-fuse circuit breaker (NFB) so that the external power would be cut off in time when there comes an alarm.
- Connect the cable inhibit correctly.

Chapter 3 Interface

3.1 Power Supply Terminals

Terminals for per drive

Model	Terminal symbol
SA3L04C	R、S、T、P、PC、P1、U、V、W、PE.
SA3L06B/SA3L10B/SA3L25C	R、S、T、r、t、P、PC、P1、U、V、W、PE.
SA3H10C	R、S、T、r、t、P、G、PC、P1、U、V、W、PE.

Table 3-1 Power supply terminals list

Terminal	Name	Function
R	Main circuit power supply (1-phase or 3-phase)	Main circuit power supply terminals(AC 380V/220V 50Hz for SA3H10C, AC 220V 50Hz for other models) Note: Do not connect with the servo motor power supply terminals (U, V, W).
S		
T		
r	Control circuit power supply (1-phase)	Power supply terminals for control circuit.(AC220V 50Hz)
t		
P	External braking resistor terminal	1. When using the internal brake resistor, please connect P1 with PC, and leave P open. 2. When using the external brake resistor, please connect the external brake resistor between P and PC, and leave P1 open. 3. Terminal G is the proprietary terminal of SA3H10C, when operating on 380V, please connect the high-voltage capacitance between P and G.
G	External capacitor terminal	
PC	Public contact of braking resistor	
P1	Internal braking resistor terminal	
U	Servo motor output	Connect to the servo motor power supply terminals (U, V, W).
V		
W		
PE	Protective earth	Grounding terminal.

3.2 Encoder Signal Input Terminal CN1

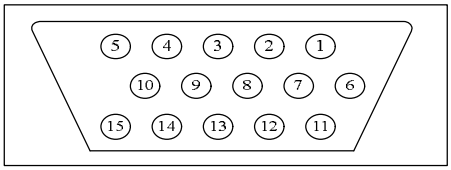


Figure 3-1 Plug-welding of plug CN1 (encoder FEEDBACK) (face to plug-welding)

Table 3-2 Encoder signal input terminal CN1

Terminal number	Name	Function		
		Symbol	I/O	Description
12	Power supply(5V)	+5V		The power supply and public ground of encoder. It is necessary to use a parallel multi-cored wire to reduce the pressure drop of wires.
13	Public ground	0V		
1	Encoder A+ input	A＋	Type7	Connect with the electro-optic encoder A+.
6	Encoder A- input	A－		Connect with the electro-optic encoder A-.
2	Encoder B+ input	B＋	Type7	Connect with the electro-optic encoder B+.
7	Encoder B- input	B－		Connect with the electro-optic encoder B-.
3	Encoder Z+ input	Z＋	Type7	Connect with the electro-optic encoder Z+.
8	Encoder Z- input	Z－		Connect with the electro-optic encoder Z-.
4	Encoder U+ input	U＋	Type7	Connect with the electro-optic encoder U+.
9	Encoder U- input	U－		Connect with the electro-optic encoder U-.
5	Encoder V+ input	V＋	Type7	Connect with the electro-optic encoder V+.
10	Encoder V- input	V－		Connect with the electro-optic encoder V-.
14	Encoder W+ input	W＋	Type7	Connect with the electro-optic encoder W+.
15	Encoder W- input	W－		Connect with the electro-optic encoder W-.
11	Inhibit ground	FG		Terminal of Inhibit ground

3.3 Control Signal I/O Terminals CN2

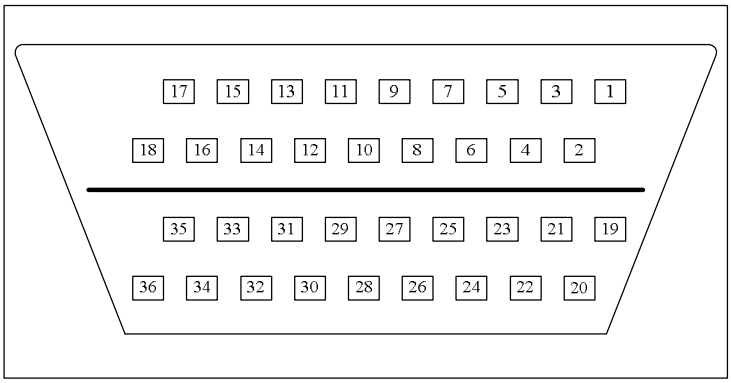


Figure 3-2 Plug-welding of plug CN2 (encoder FEEDBACK) (face to plug-welding)

Control mode： P stands for position control mode；S stands for speed control mode；T stands for torque control mode.

Table 3-3 Control signal I/O terminals CN2

Terminal number	Name	Terminal symbol			Function
		Symbol	I/O	mode	
18	Anode of input power	VCCCOM	Type1		The anode of input terminal is used to drive the photoelectric coupler of input terminal (DC12~24V, current≥100mA).
10	Servo enable	ServoEn	Type1		Servo enable input terminal. ServoEn ON: Operation enabled; ServoEn OFF: Operation disabled. [Note 1]: Make sure the servo motor is quiescent before "ServoEn OFF" turns to "ServoEn ON" [Note 2]: Please wait for 50 ms before inputting any command in the State of "ServoEn ON".
11	Alarm clear	AlarmClr	Type1		Alarm clear input terminal. AlarmClr ON: Clear the system alarm; AlarmClr OFF: Maintain the system alarm. [Note]: As the alarm code is less than 12, please cut off the power supply and repair the drive.
12	CCW drive forbidden	CCWDis	Type1		CCW (anti-clockwise) drive forbidden input terminal. CCWDis ON: motor is not allowed to rotate with anti-clockwise as CW drive forbidden; CCWDis OFF: motor is allowed to rotate with anti-clockwise as CW drive permitted. Note 1: Used in condition that mechanical over limitation, CW torque is zero when switch is OFF. Note 2: Inhibit this function by setting parameter PN8=001000, CW is permitted without connecting the terminals.
13	CW drive forbidden	CWDis	Type1		CW (clockwise) drive forbidden input terminal. CWDis ON: motor is not allowed to rotate with clockwise as CW drive forbidden; CWDis OFF: motor is allowed to rotate with clockwise as CW drive permitted. Note 1: Used in condition that mechanical over limitation, CW torque is zero when switch is OFF. Note 2: inhibit this function by setting parameter PN8=000100, CW is permitted without connecting the terminals.

14	Offset counter clear	CLE	Type1	P	In position control mode (PN4=2), input terminal of position deviation counter clear. CLE ON: Clear deviation counter in position mode.
	Speed choose1	SC1	Type1	S	In speed mode, you can choose different internal speed by setting the value of SC1 and SC2. SC1 OFF, SC2 OFF: Internal speed 1; SC1 OFF, SC2 ON : Internal speed 2; SC1 ON , SC2 OFF: Internal speed 3 SC1 ON , SC2 ON : Internal speed 4;
	Zero clamp	ZEROSPD	Type1	S	In speed mode (PN4=1), when choosing outer stimulant speed (PN9=1000): ZEROSPD ON: No matter what the simulative value is, the speed command is forced to zero; ZEROSPD OFF: speed command equals to the simulative value.
15	Command pulse forbidden	INH	Type1	P	Command pulse forbidden under position control (parameter PN4=2). INH ON: Command pulse input forbidden; INH OFF: Command pulse input efficient.
	Speed choose 2	SC2	Type1	S	In speed mode, you can choose different internal speed by setting the value of SC1 and SC2. SC1 OFF, SC2 OFF: Internal speed 1; SC1 OFF, SC2 ON : Internal speed 2; SC1 ON , SC2 OFF: Internal speed 3 SC1 ON , SC2 ON : Internal speed 4;
16	CCW torque limit	CCWTLtd	Type1		CCW (anti-clockwise) torque limit input terminal. CCWTLtd ON:CCW external torque is limited in Scope of PN28; CCWTLtd OFF: CCW torque is not limited by parameter PN28. [Note]: Whether CCWTLtd is valid or not, CCW torque is limited by parameter PN42.
17	CW torque limit	CWTLtd	Type1		CW (clockwise) torque limit input terminal. CWTLtd ON:CW torque is limited in Scope of PN27; CWTLtd OFF:CW torque is not limited by parameter PN27; [Note]: Whether CWTLtd is valid or not, CW torque is limited by PN42.
8	Servo ready	SRDY＋	Type2		SRDY ON: Control power supply and main power supply are both in ordinary condition, and there is no alarm, servo ready output is ON; SRDY OFF: Main power supply is detached or there is any alarm, servo ready output is OFF.
27		SRDY－	Type2		
25	Servo alarm output	ALM＋	Type2		Output terminal of servo alarm. ALM ON: Servo alarm output ON as there is no alarm; ALM OFF: Servo alarm output OFF as there is any alarm.
26		ALM－			
28	Positioning completed output (position control); speed reached output (speed control)	COIN＋	Type2	P	Positioning completed output terminal: COIN ON:Positioning completed terminal outputs ON as the value of position offset counter is in the setting range, otherwise outputs OFF; Speed reached output terminal: COIN ON:Speed reached terminal outputs ON as the speed is equal to or over the selected speed, otherwise outputs OFF;
				S	
29		COIN－		P	
				S	

30	Mechanical brake release	BRK＋	Type2		This terminal can be used to control the brake when the motor equipped with mechanical brakes (power-loss holder). BRK ON: When power is on, the brake is invalid, and motor runs; BRK OFF: When power is off, the brake is effective, motor is locked and cannot move; Note: BRK function is controlled by servo drive.
31		BRK－			
32	Command pulse PLUS input	PulseInv＋	Type3	P	External command pulse input terminal. Note: pulse type is selected by parameter PN52. ①PN52=0, command pulse+ signal mode(default state); ②PN52=1, CCW/CW command pulse mode; ③PN52=2, 2-phase command pulse mode.
33		PulseInv－			
34	Command pulse SIGN input	SignInv＋	Type3	P	
35		SignInv－			
22	Analog speed command input	ASPEED＋	Type4	S	Command input terminal for external analog speed (difference mode), the impedance is 10kΩ, the voltage is -10V~+10V.
21		ASPEED－			
23	Analog ground	AGND			The grounding line of analog input.
20	Analog torque command input	ATORQUE＋	Type4	T	Command input terminal for external analog torque (difference mode), the impedance is 10kΩ, the voltage is -10V~+10V.
19		ATORQUE－			
24	Analog ground	AGND			The grounding line of analog input.
1	Encoder Phase-A signal	PhaseA＋	Type5		1. Encoder signal A, B, Z for difference drive output (output through 26LS31, corresponding to RS422); 2. Non-isolative output (non-insulation).
2		PhaseA－			
3	Encoder phase-B signal	PhaseB＋	Type5		
4		PhaseB－			
5	Encoder phase- Z signal	PhaseZ＋	Type5		
6		PhaseZ－			
7	Encoder phase-Z collector opening output	ZOC	Type6		1. Phase-Z signal is output through open collector, when the encoder Z signal appears, outputs ON (output breakover), otherwise outputs OFF (output closure) 2. Non-isolative output (non-insulation); 3. Please use a high speed electro-optical coupler to receive the signal.
9	Encoder public ground	GND			Encoder public ground.
36	Inhibit ground	FG			Terminal of inhibit ground.

3.4 Line-Line Serial Terminal COM/CN3

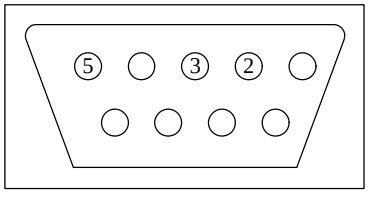


Figure 3-3 Type-1 serial-line terminal plug COM

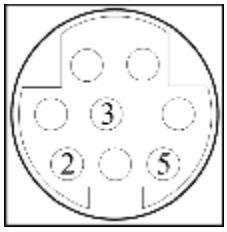


Figure 3-4 Type-2 serial-line terminal plug CN3

Table 3-4 Serial-line terminals COM/CN3

Terminal number	Name	Function	
		Symbol	Description
2	Receive data	RXD	Receive data signal.
3	Transmit data	TXD	Transmit data signal.
5	Signal earth	GND	Inhibit signal earth.

3.5 I/O Interface Type

3.5.1 Switching Input Interface

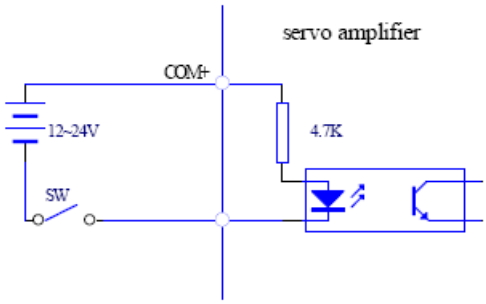
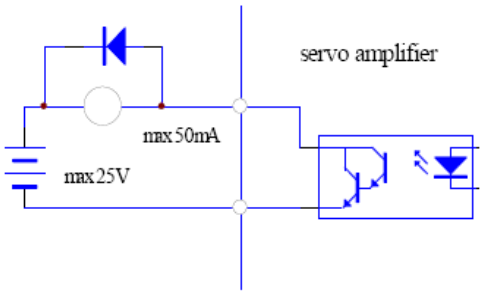


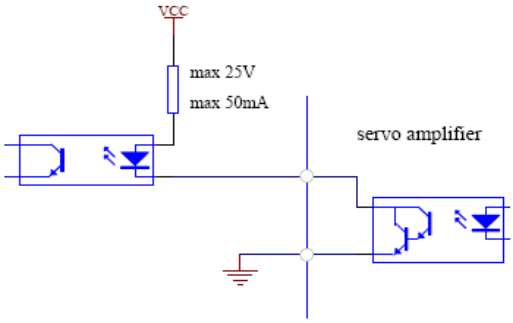
Figure 3-5 Type1 Switching input interface

(1) Power supply provided by customers, DC12~24V, current≥100mA;
(2) Servo drive could not work in the event of the reversed polarity for power supply.

3.5.2 Switching Output Interface



a. Relay connection figure



b. Electro-optical coupler connection figure

Figure 3-6 Type2 switching output interface

(1) The output is the Darington transistor, with relay or electro-optical coupler connection;
(2) The external power supply provided by users may damage the drive because of the reversed polarity;
(3) The output works in collecting electrode opening form, the maximum current is up to 50mA while the maximum external voltage is 25V. Therefore, the switch output signal's load must satisfy this definition request. If it surpasses the definition request or the output is directly connected with the power supply will cause damage.
(4) Users should connect inverse parallel freewheel diode in case of the inductive load such as relays. If the freewheel diode is reversed, servo drive may be damaged;
(5) As Darlington transistor is used for output, as breakover, the pressure drop (Vce) between collector and launch is about 1V which could not meet the low-level requirements, so it could not be connected with TTL integrated circuits directly.

3.5.3 Pulse Input Interface

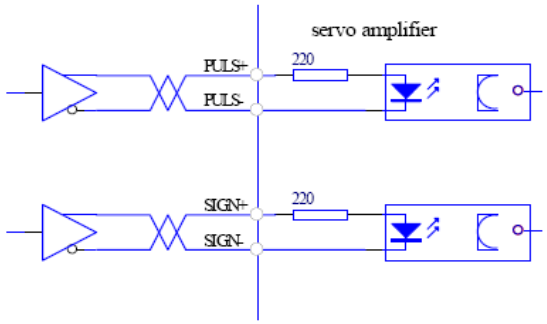


Figure 3-7 difference drive mode for Type3 pulse input interface

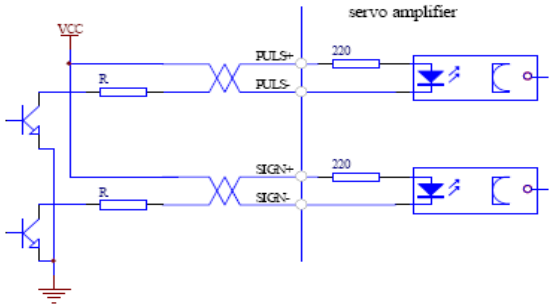


Figure 3-8 single-ended drive mode for Type3 pulse input interface

(1) To transmit the pulse correctly, it is suggested to use the difference drive type.
(2) Using AM26LS31, MC3487 or similar RS422 drive in difference drive mode.
(3) Action frequency will be reduced as using single-ended drive mode. According to the pulse input circuit, the drive current is 10 to 15mA and limitation for external maximum voltage is 25V to determinate the resistance R. Empirical data: VCC=24V，R=1.3~2kΩ；VCC=12V，R＝510~820Ω；VCC=5V，R=82~120Ω.
(4) External power is provided by users as adopting single-ended drive, and the servo drive may be damaged because of the anti-polarity.
(5) Table 3-1 for pulse input mode, Table 3-2 for pulse input timing and parameter. When operating in 2-phase input mode, its 4 times pulse frequency will be less than 500 kHz.

Table 3-1 Pulse input mode

Pulse command	CCW	CW	Setting value for parameters
pulse train symbol	PULS SIGN	PULS SIGN	0 Command pulse+symbol
CCW pulse train CW pulse train	PULS SIGN	PULS SIGN	1 CCW pulse/CCW pulse
Phase-A pulse train Phase-B pulse train	PULS SIGN	PULS SIGN	2 2-phase command pulse

Table 3-2 Pulse input mode timing and parameter

Parameter	Difference drive input	Single-ended drive 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

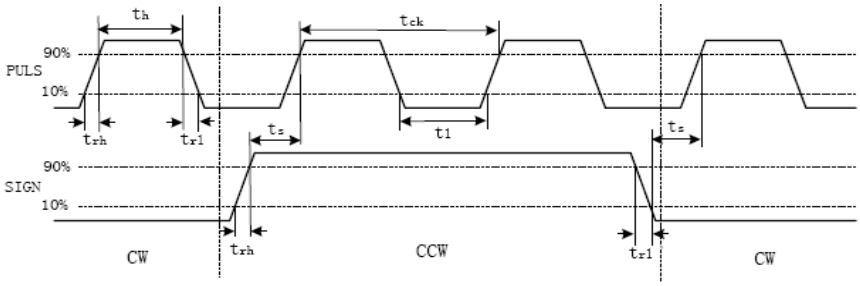


Figure 3-9 Pulse and symbol input interface timing chart (The maximum pulse frequency: 500 kHz)

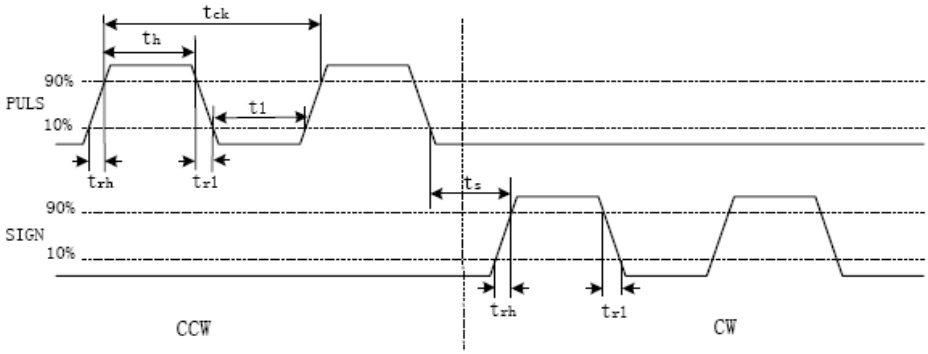


Figure 3-10 CCW /CW pulse input interface timing chart (The maximum pulse frequency: 500 kHz)

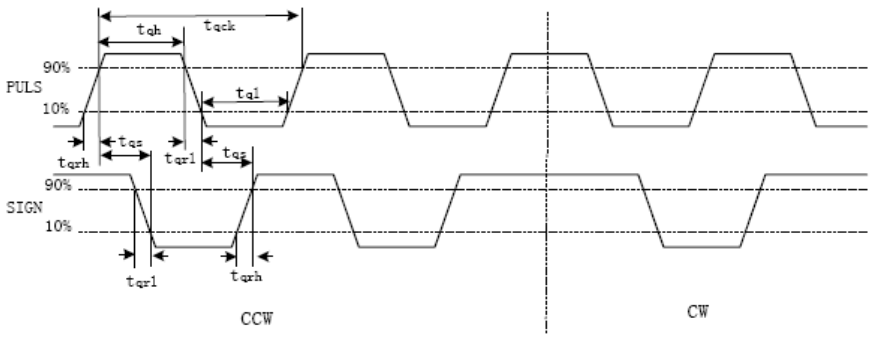


Figure 3-11 2-phase command pulse input interface timing chart (The maximum pulse frequency: 125 kHz)

3.5.4 Analog Input Interface

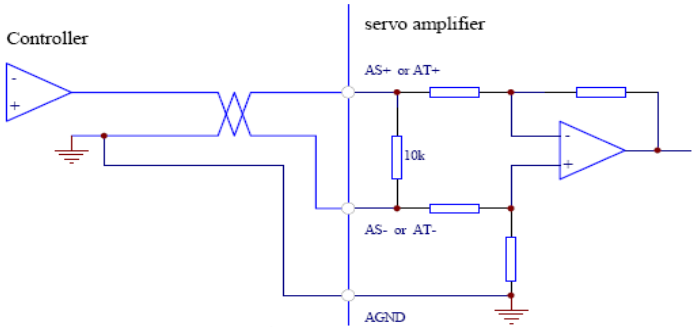


Figure 3-12 (a) Difference analog input interface（type4）

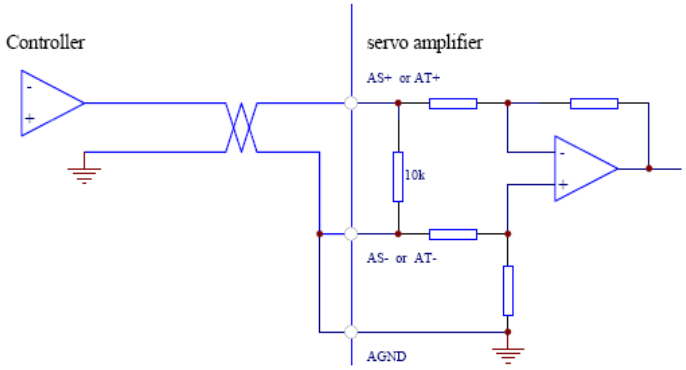


Figure 3-12 (b) Single-ended analog input interface（type4）

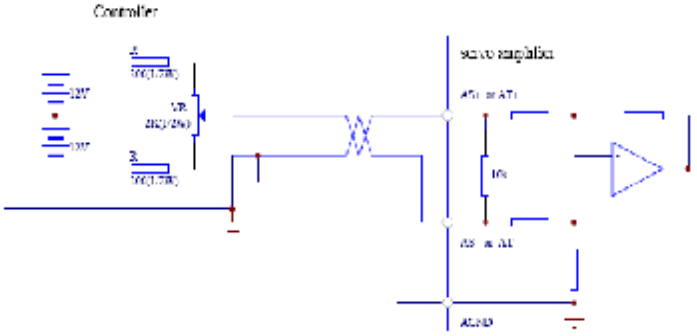


Figure 3-12 (c) Difference analog potentiometer input interface（type4）

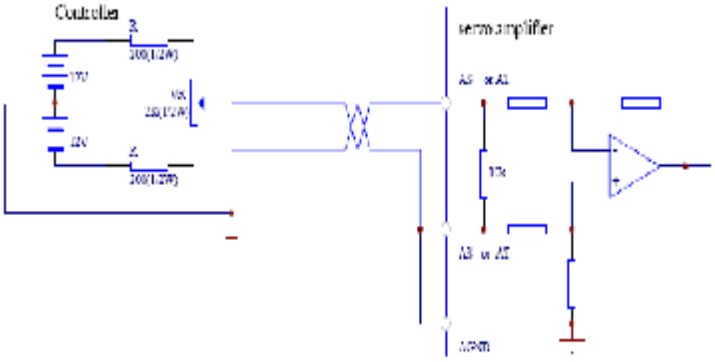


Figure 3-12 (d) Single-ended analog potentiometer input interface（type4）

(1) Analog input interface works in difference mode, there are two modes according to the connection: difference mode and single-ended mode, the input impedance is 10kΩ and the range of input voltage is-10V~+10V;

(2) In the difference connection, the analog grounding and input negative end should be connected at the controller side, needing three line connections from the controller to the driver;

(3) In the single end connection, the analog grounding and input negative end should be connected at the drive side, needing two line connections from the controller to the driver;

(4) Difference mode which could suppress common code interference performances better than single-ended mode;

(5) Drive may be damaged on condition that input voltage exceeds the range of -10~+10;

(6) It is suggested to connect with inhibit cable to reduce noise interference;
(7) It is normal that there is zero-bias at the analog input interface, you can compensate it by adjusting PN16 or PN19;
(8) Analog interface is non-insulated.

3.5.5 Encoder Signal Output Interface

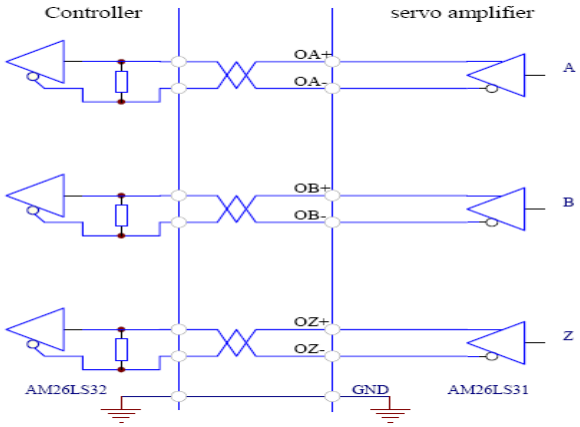


Figure 3-13 a Optical encoder output interface（Type5）

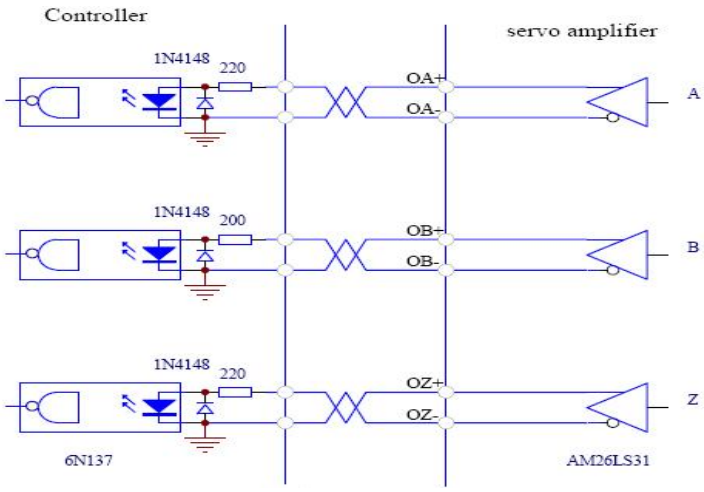


Figure 3-13 b Optical encoder output interface（Type5）

(1) AM26LS31 outputs encoder signals;
(2) AM26LS32 is used as the input end of the controller，it is necessary to connect a terminal resistor about 330Ω (Figure 3-13 a);
(3) The grounding line of controller and servo drive must be connected reliably;
(4) Non-isolative output (non-insulative).
(5) A high speed electro-optical coupler can be used as the controller input instead (Figure3-13 b).

3.5.6 Open Collector Output Interface for Encoder Phase-Z Signal

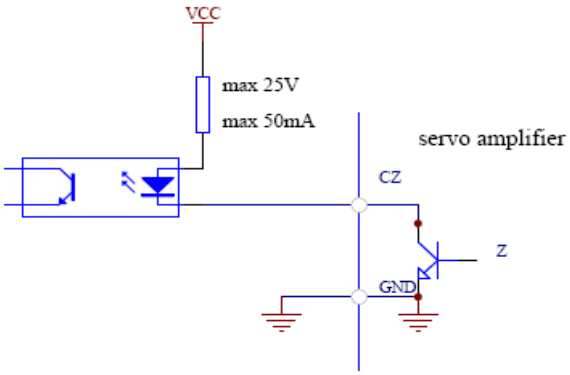


Figure 3-14 Optical encoder output interface（Type6）

(1) Phase-Z signal is output through open collector, when Phase-Z signal appears, outputs ON, otherwise, outputs OFF;
(2) Non-isolative output (non-insulative).
(3) Please use a high speed electro-optical coupler to receive the signal.

3.5.7 Optical Encoder Input Interface for Servo Motor

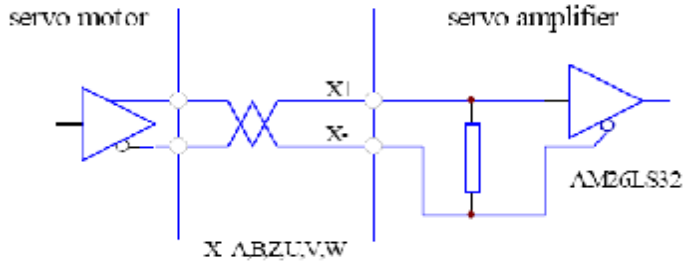


Figure 3-15 Servo motor optical encoder input interface

3.6 Brake Resistor Terminals P, PC, P1

External brake resistor is suggested to be used as the power limitation of the internal brake resistor. Acceleration/deceleration time is increased properly to avoid the phenomenon that the internal brake resistor can't absorb and Err-8, Err-10 or Err-14 would happen which caused by the excessive regenerative energy as deceleration. If there is still any warning, it is necessary to connect an external brake resistor between P and P1 to enhance the braking effect. The impedance range is 40~200Ω, power is 100W~1 kW. The smaller the impedance is, the greater the braking current is, while the required power is larger, the braking energy grows greater, but too small impedance may result in damage to the drive, a test method is to descend the impedance until there is no warning. The external brake resistor which can be used with the internals (about 50Ω) in parallel or alone must be operated after 5 minutes the drive power on and the internal high-voltage has tapped completely.

Do not touch terminal PC、P1 to prevent electrocution unless the power is cut off 5 minutes later. In order to avoid the short circuit and damaging the drive, terminal PC, P1 can not be connected with others.

3.7 External Capacitor Terminal G

The external capacitor terminal G is a specific terminal for SA3H10C. When the drive is connected to 380V input power supply, please connect an external capacitor between terminal P and G to prevent from damage. The maximum voltage is up to 537V, please choose an external capacitor which can bear high-voltage.

Chapter 4 Operation

4.1 Operation Procedure

Item	Content	Reference
Mounting and installation	Install the motor and servo drive according to the installation conditions. (Do not connect the motor to the mechanical system before checking the no-load operation.)	Chapter 2- Section 2.1 , Section 2.2
↓		
Wiring and connections	Connect to power supply and peripheral devices. Specified installation and wiring requirements must be satisfied.	Chapter2- Section 2.3~ Section 2.5
↓		
Preparing for operation	Before turning ON the power supply, check the necessary items. Check by means of the displays to see whether there are any internal errors.	Chapter 4 -Section 4.2
↓		
Checking operation	Check the operation of the motor and servo driver alone by performing a jogging operation without a load.	Chapter 4- Section 4.6
↓		
Function settings	By means of the user parameters, set the functions according to the operating conditions.	Chapter 5- Section 5.2
↓		
Trial operation	Turn on the power, and check whether protective functions such as emergency stop and operational limits are working reliably. Check operation at both low speed and high speed (using instructions from the Host Controller).	Chapter 4- Section 4.3~4.7
↓		
Adjustments	Manually adjust the gain as required. Further adjust the various functions to further improve the control performance as required.	Chapter 4- Section 4.8
↓		
Operation	Operation can now begin. If any trouble occurs, refer to Chapter 6 Troubleshooting.	Chapter 6- Section 6.2

4.2 Preparing For Operation

4.2.1 Turning Power ON and Checking Indicators

■ Checking Power Supply Voltage

- Check to be sure that the power supply voltage is within the ranges shown below：

Model	SA3L04C	SA3L06B	SA3L10B	SA3L15C	SA3L25C	SA3H10C
Power supply	Single-phase /Three-phase AC 220V					Three-phase AC 380V

■ Checking Terminal Block Wiring

- The main-circuit power supply inputs （R、S、T） and the control-circuit power supply inputs （r、t）must be properly connected to the terminal block.
- The servo motor's power line（U、V、W、PE）must be properly connected to the terminal block.

■ Checking the servo motor

- The Encoder Cable must be securely connected to the Encoder Connector at the motor side.
- The power lines at the servo motor must be securely connected.

■ Checking the Control Connectors

- The Control Cable must be securely connected to the I/O Control Connector (CN2).。
- The ServoEn command must be OFF

4.2.2 Power Connecting Sequence

1) The power supply is accessed to the main circuit power input terminals through the electromagnetic contactor (three-phase AC power connects with R, S, T, single-phase AC power connects with R, T).

2) The control circuit power terminal r, t should be connected at the same time or before the main circuit power ON. If only connect the control circuit, the servo ready (SRDY) signal would be OFF.

3) After 1.5 seconds as the main circuit power is turned on, the servo enable (ServoEN) signal can be received on the basis of the servo ready (SRDY) signal ON, and effective servo enable opens the base circuit and brings the motor into operation state. If Servo Enable inefficiency or alerting, the base circuit will be closed and motor would not work.

4) The base circuit will be connected after about 1.5 seconds as servo enable signal and power supply are turned on.

The ON-OFF frequency should be less than 5 times per hour and below 30 times per day, because the frequent ON-OFF power may damage the soft start circuit and energy-consumption braking circuit. After excluding the failure cause, the power supply is allowed to be connected after 30 minutes cooling because of overheat.

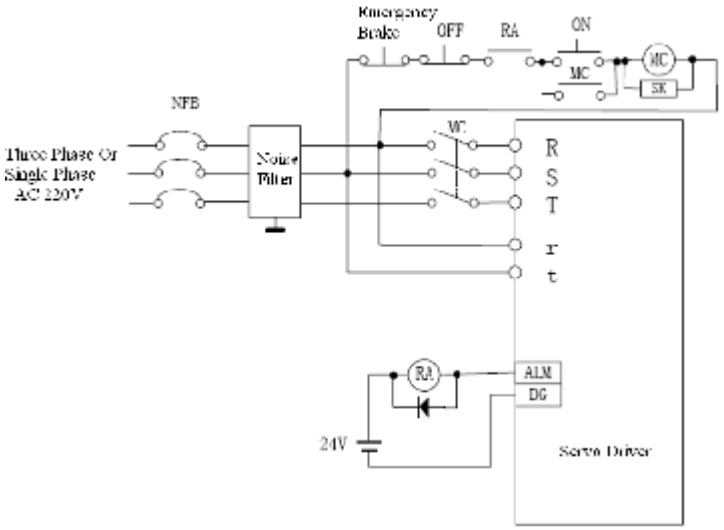


Figure 4-1 Power hookup

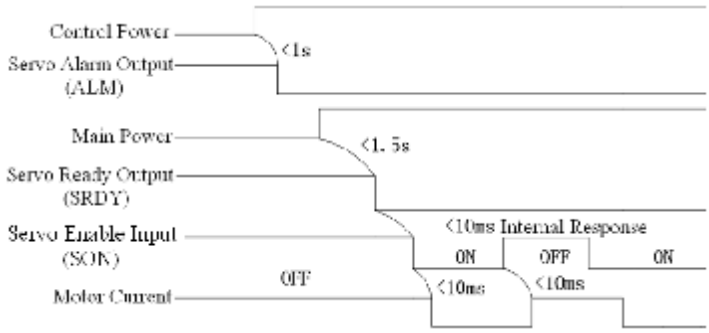


Figure 4-2 Power Supply Timing Diagram

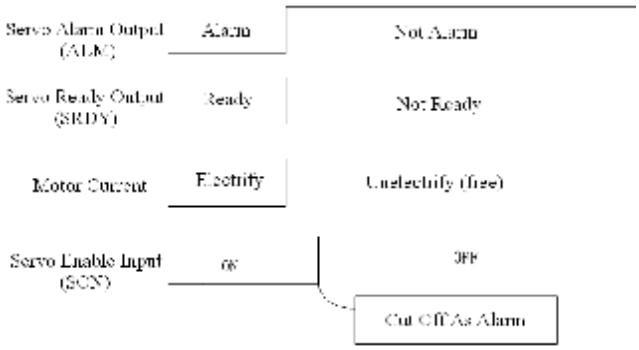


Figure 4-3 Alarm Timing Diagram

4.3 Position Control Mode

- Perform position control using the pulse train input from PulseInv+ (CN2-Pin32), PulseInv-(CN2-Pin33), SighInv+ (CN2-Pin34), SighInv- (CN2-Pin35).
- The servo motor rotates using the value of the pulse train input multiplied by the electronic gear(Pn48, Pn49, Pn50)
- The encoder line is 2500C/T， users can get feedback signals A+(CN2-Pin1), A-(CN2-Pin2), B+(CN2-Pin3), B-(CN2-Pin4), Z+(CN2-Pin5), Z-(CN2-Pin6)through CN2.

4.3.1 Schematic Diagram Of Position Control Mode

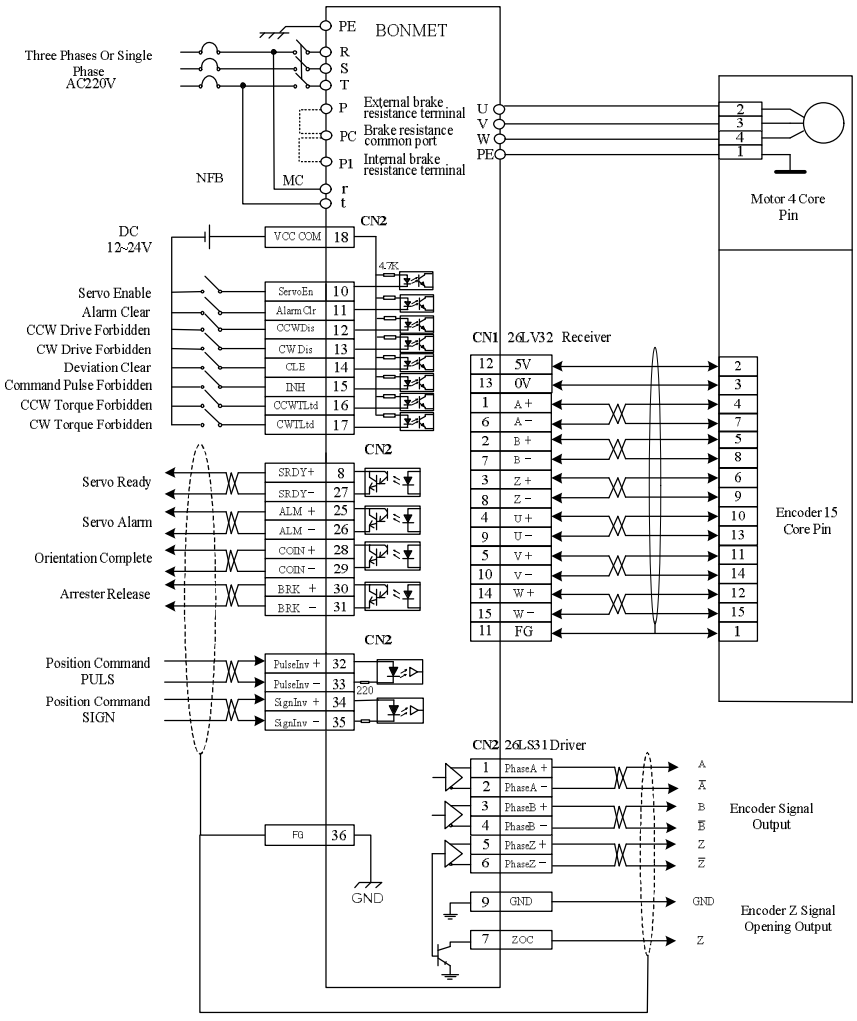


Figure 4-4 Schematic diagram of torque control mode

Note: In position control mode, if using external ServoEn function, please connect Pin18，Pin10，Pin32，Pin33，Pin34，Pin35，Pin36(Plug CN2) to control the servo system at least.

4.3.2 Parameters In Position Control Mode

No.	Parameter	Function
4	Motor control mode	Select the control mode of servo drive.(Set the parameter to 2 for position control mode)
48	Denominator of position gearbox	The electronic gear ratio is $G = \frac{N \times C \times 4}{P}$ G: Electronic gear ratio; P: Input command pulse number; N: The revolving circle of the motor; C: The photoelectric encoder C/T, this system is C=2500. Recommendatory range of electronic gear ratio: $\frac{1}{50} \le G \le 50$
49	Divider numerator of the first position command pulse	
50	Divider numerator of the second position command pulse	
51	Dynamic electronic gear enable	①Set to 0, dynamic electronic gearbox is inactive. ②Set to 1, dynamic electronic gearbox is active.
52	Position command pulse input mode	Set the parameter to match with the controller command pulse status.
53	Invert direction of position command pulse	Select the rotation direction
54	Positioning completed range	If the position error drops in the target position range, the output terminal COIN turns active, otherwise COIN remains inactive.
55	Range of position super-homodyne detection	The drive will issue position tolerance alarm when the position offset counter value exceeds the selected value×100 in position control mode.
56	Enable position error	Set the parameter select using the position tolerance alarm or not.
57	Position pulse feedback ratio	The feedback ratio of position pulse determines the ratio of the internal and output position pulse.

4.3.3 Operation

1. Connect the servo system correctly and turn on the power supply.
2. Select the command pulse type and rotation direction.
   ①Set Pn52 to choose position command pulse type. Set Pn52 to 0, the position command type is pulse and symbol; set Pn52 to 1, the position command type is CW/CCW pulse; set Pn52 to 2, the position command type is two-phase orthogonal pulse.
   ②Set Pn53 to select the rotation direction. (0 for normal rotation direction and 1 for the opposite rotation direction)
3. Select electronic gear ratio.
   ①Set Pn51 to choose whether use dynamic electronic gear function or not. Set Pn51 to 0, dynamic electronic gear function is invalid, users can only use the first electronic gear ratio; Set Pn51 to 1, there are two electronic gear ratios and users can switch the ratios during the operation.
   ②Set Pn48, Pn49 and Pn50 to select two proper electronic gear ratios, the value of Pn49/Pn48 is the first electronic gear ration while the value of Pn50/Pn48 is the second electronic gear ratio. Users can adjust terminal INH(CN2-Pin15) to switch the electronic gear ratio, set INH(CN2-Pin15) ON to choose the first electronic gear ratio while set INH(CN2-Pin15) OFF to choose the second electronic gear ratio.
4. Running.
   Set Pn4 to 2 to select position control mode, set ServoEn (CN2-Pin 10) ON. Users can adjust the input pulse to control the motor.
5. Other functions.
   ①Positioning completed: In position control mode, if the position error drops in the target position range, the output terminal COIN turns active, otherwise COIN remains inactive.
   ②Position error function: Set Pn56 to 0, position tolerance alarm detection is enabled; Set Pn56 to 1, position tolerance alarm detection is disabled and position tolerance error detection is stopped.
   ③Position pulse feedback ratio: The feedback ratio of position pulse determines the ratio of the internal and output position pulse: the parameter is a decimal number, change it into a binary, we divide the binary into two parts, the high-5-bit value is the numerator while the low-5-bit is the denominator , then the fraction is the feedback ratio (Normal setting: 33 (00001_00001) for 1:1; 34 (00001_00010) for 1:2; 36 (00001_00100) for 1:4; 37

(00001_00101) for 1:5; 42 (00001_01010) for 1:10).

4.4 Speed Mode

- Internal speed mode
  ①Set parameters to select internal speed(Internal speed 1 ～ internal speed 4).
  ②Set time constant of linear speed acceleration/ deceleration.
  ③Switch the internal speed through SC1 (CN2-Pin14) and SC2 (CN2-Pin15).
- External speed mode
  ①Set analog voltage input as the speed command (ASPEED-: CN2-Pin21, ASPEED+: CN2-Pin22).
  ②Select a proper bias compensation for a perfect performance.

4.4.1 Schematic Diagram Of Speed Control Mode

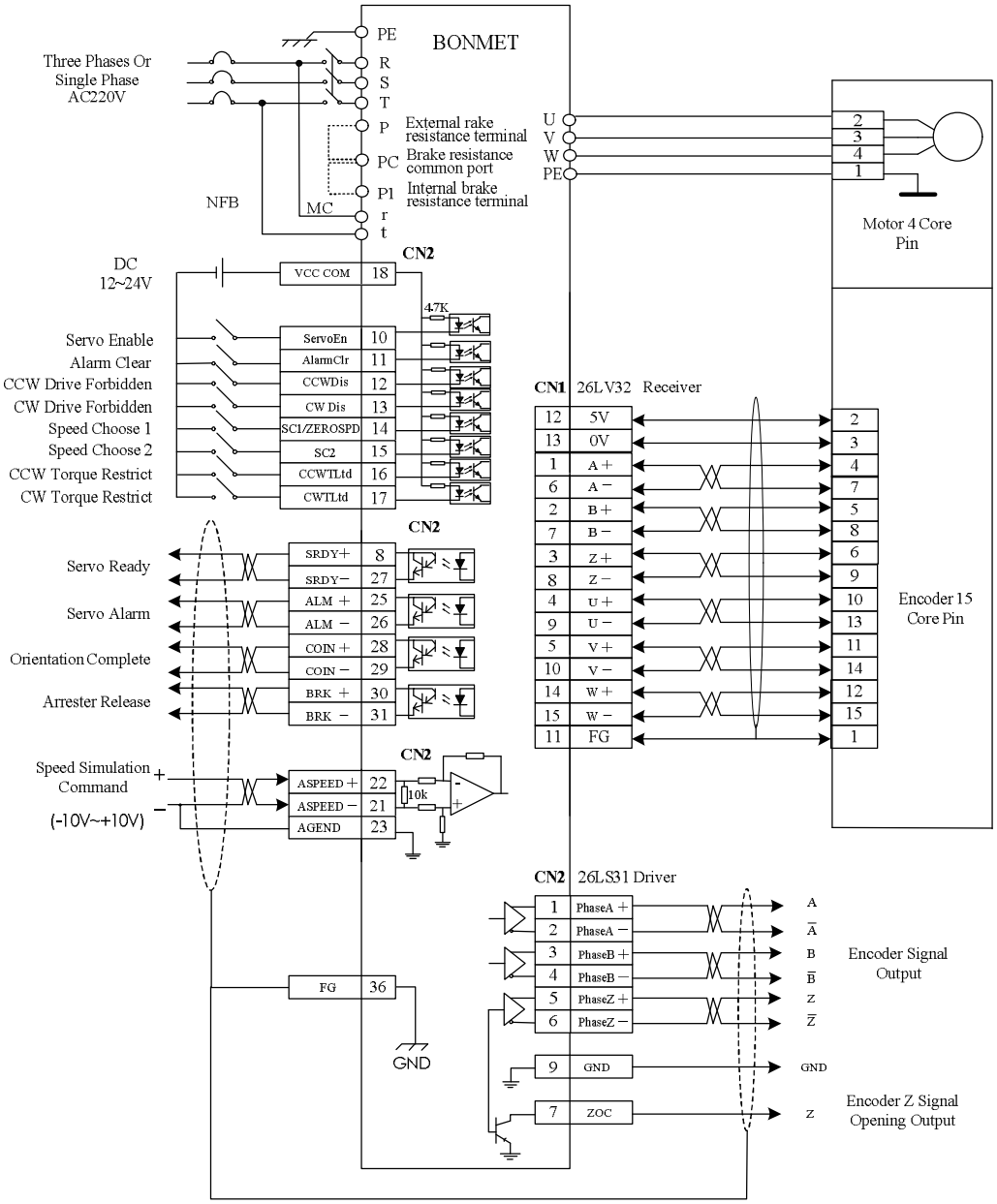


Figure 4-5 Schematic diagram of speed control mode

Note: In internal speed control mode, if users want to switch different speed, please connect pin18, pin 10, pin 36(Plug CN2) at least. In external speed control mode, users need to connect pin18, pin10, pin21, pin22, pin23, pin 36(Plug CN2) at least.

4.4.2 Parameters In Speed Control Mode

No.	Parameter	Function
4	Motor control mode	Select the control mode of servo drive.(Set the parameter to 1 for speed control mode)
18	Gain of analog speed command input	Set the ratio between the input voltage of analog speed and actual motor speed.(Effective in external speed mode)
19	The bias compensation of analog speed input	The zero-bias compensation for the analog speed input.(Effective in external speed mode)
20	Invert enable of analog speed input	Set the rotation direction.(Effective in external speed mode)
21	Low-pass bandwidth of analog speed input	Set the response time of speed analog input.
34	Time constant of linear speed acceleration	Set the time constant of linear speed acceleration (Effective in internal speed mode).
35	Time constant of linear speed deceleration	Set the time constant of linear speed deceleration (Effective in internal speed mode).
36	Internal speed 1	Set internal speed, users can switch different internal speed by select the combination of SC1, SC2.
37	Internal speed 2	
38	Internal speed 3	
39	Internal speed 4	
40	Internal or external speed command selection	Select internal or external speed command to control the motor.
42	Peak speed limitation	Set the maximum speed limitation of servo motor.
43	Target speed	In speed control mode, if the motor speed exceeds the selected value, then COIN turns to ON, otherwise COIN remains OFF.

4.4.3 Operation

1. Connect the servo system correctly and turn on the power supply.
2. Limitation of acceleration/ deceleration and maximum speed.
   ①Set Pn34 and Pn35 to select the acceleration time constant and the deceleration time constant.
   ②Set Pn42 to select the maximum speed.
3. Operation in internal speed mode.
   Set Pn40 to 0 to select internal speed control mode, there are 4 internal speed (Pn36, Pn37, Pn38 and Pn39) in total, users can choose different speed by selecting the combination of digital value SC1(CN2-Pin14) and SC2(CN2-Pin15). Otherwise, Users can also adjust Pn9 to switch the speed. Set Pn9 to 0000, motor would run at the first internal speed; set Pn9 to 0100, motor would run at the second internal speed; set Pn9 to 1000, motor would run at the third internal speed; set Pn9 to 1100, motor would run at the forth internal speed.
   Set Pn4 to 1 to select speed control mode, then set ServoEn (CN2-Pin 10) ON, the motor starts running.

Speed command	SC1	SC2
Internal speed 1	OFF	OFF
Internal speed 2	OFF	ON
Internal speed 3	ON	OFF
Internal speed 4	ON	ON

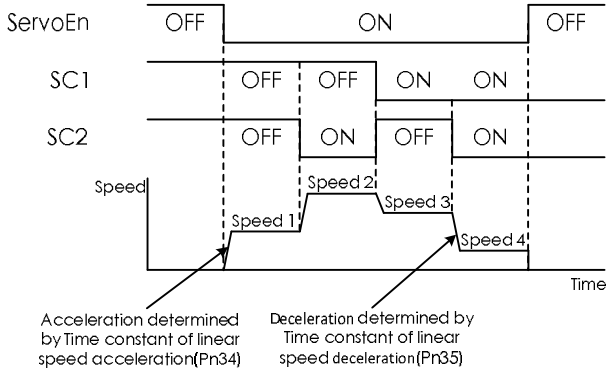


Figure 4-6 Internal speed switch

4. Operation in external speed mode.
   Set Pn40 to 1to select external speed control mode, users can adjust the external input command to control the motor. In external speed control mode, users can select Pn18 to set analog speed input gain (for example, the default value is 100, it means 10V input stands for 3000rpm). Set Pn20 to select the rotation direction (0 for reverse rotation (CW) direction and 1 for forward rotation (CCW) direction when the value of Pn15 is a positive number). Set Pn4 to 1 to select speed control mode, then set ServoEn (CN2-Pin 10) ON, users can adjust the external input command to control the motor, and set Pn19 to rectify the speed command for an accurate value.
5. Other functions.
   Target speed: Set Pn43 to a proper value, as the current speed is over or the same with the selected value, the signal "COIN" will turn to ON.
   Zerospeed: This function is effective in external speed mode. Set ZEROSPD (CN2-Pin14) ON, speed command would be invalid, and the motor would not move; set ZEROSPD OFF, speed command would be effective, and the motor would run at selected speed.

4.5 Torque Control Mode

- Set analog voltage input as the torque command(ATORQUE-: CN2-Pin19，ATORQUE+: CN2-Pin20).
- Select a proper bias compensation for a perfect performance.

4.5.1 Schematic Diagram Of Torque Control Mode

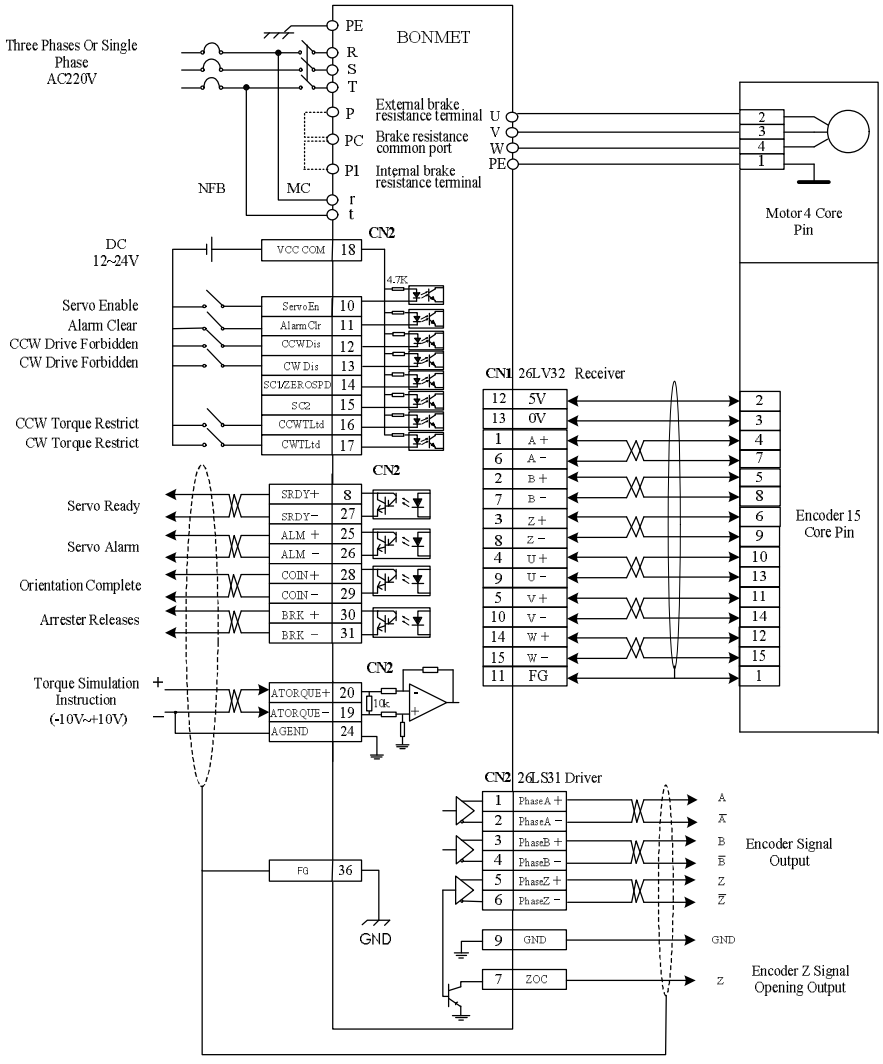


Figure 4-7 Schematic diagram of torque control mode

Note: Users need to connect pin18, pin10, pin19, pin20, pin24, pin 36(Plug CN2) at least.

4.5.2 Parameters In Torque Control Mode

No.	Parameter	Function
4	Motor control mode	Select the control mode of servo drive.(Set the parameter to 0 for torque control mode)
15	Gain of analog torque command input	Set proportion relationship between analog torque input voltage and actual motor torque.
16	The bias compensation of analog torque input	The zero-bias compensation for the analog torque input.
17	Invert enable of analog torque input	Set the rotation direction.
22	Torque overload alarm value	Torque overload alarm value. The value is the percentage of nominal torque which effects both direction
23	Torque overload testing time	Torque overload alarm test time.
25	Internal reverse rotation (CW) torque limit	Used to limit the torque in the reverse rotation driving mode.
26	Internal forward rotation (CCW) torque limit	Used to limit the torque in the forward rotation driving mode.
27	External reverse rotation (CW) torque limit	Used to limit the torque in the reverse rotation driving mode.
28	External forward rotation (CCW) torque limit	Used to limit the torque in the forward rotation driving mode.
29	Speed limit during torque control	Limit the maximum speed in torque control mode.

4.5.3 Operation

1. Connect the servo system correctly and turn on the power supply.
2. Torque command.
   ①Set Pn15 to a proper value (Associated with the external input power) to select the analog torque input gain (For example, the default value is 100, it means 10V input stands for nominal torque).
   ②Set Pn17 to select the rotation direction (0 for reverse rotation (CW) direction and 1 for forward rotation (CCW) direction when the value of Pn15 is a positive number).
3. Limitation of speed and torque.
   ①Set Pn29 and Pn42 to select the maximum speed in torque control mode (The current speed is limited by both Pn29 and Pn42).
   ②Set Pn25，Pn26，Pn27，Pn28 to select the maximum torque, the actual torque will be limited less than the selected value. As using internal torque limit function, users can directly select parameter Pn25, Pn26 to limit the torque; as using external torque limit function, users need to connect CCWTLtd (CN2-Pin16), CWTLtd (CN2-Pin17) for external torque limit function. Set Pn27 and Pn28 to proper value, set the digital signal ON when users want to use the function.
4. Running.
   Set Pn4 to 0 to select torque control mode, then set ServoEn (CN2-Pin 10) ON. Users can adjust the external input command to control the motor, and set Pn16 to rectify the torque command for an accurate value.
5. Other functions.
   Overtorque alarm function: Set Pn22 and Pn23 to send an alarm as overtorque.

4.6 JOG Control Mode

- Set rotation speed in JOG control mode, control the motor by UP button and DOWN button.

4.6.1 Schematic Diagram Of JOG Control Mode

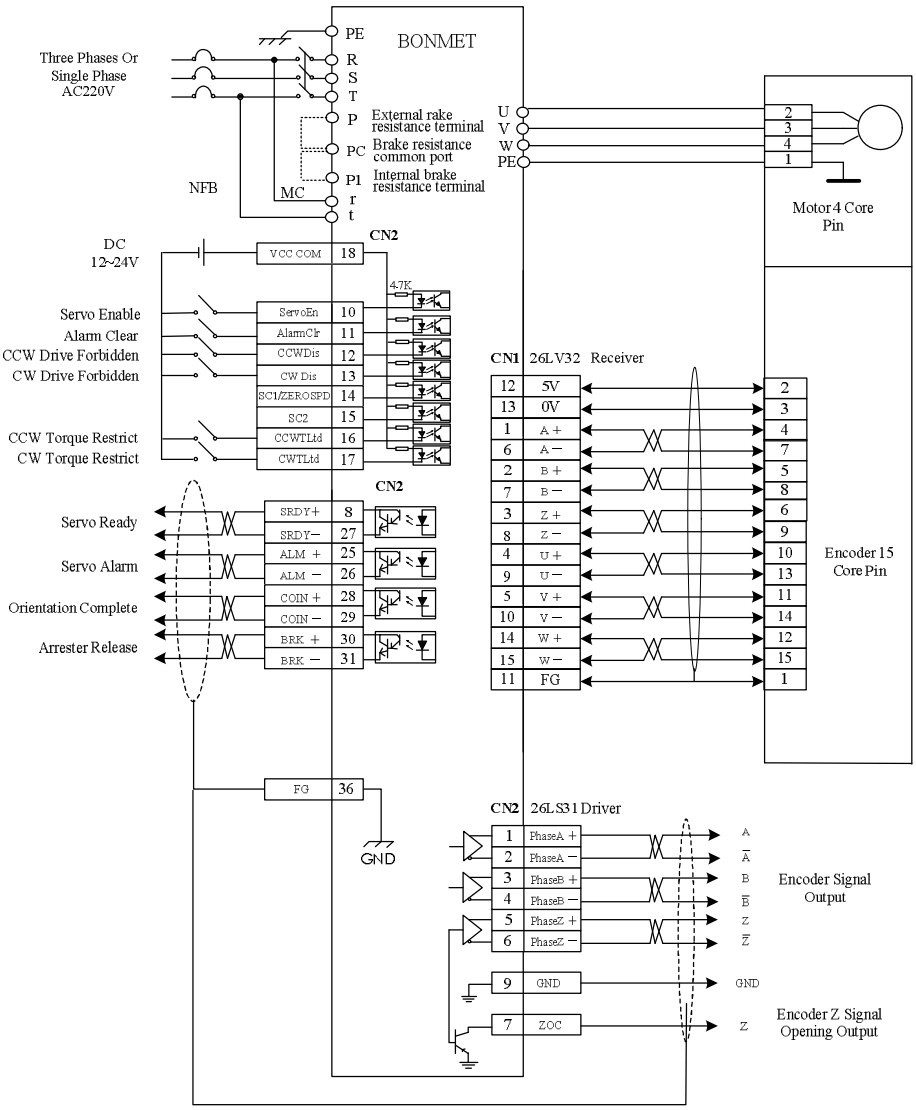


Figure 4-8 Schematic diagram of JOG control mode

Note: In JOG mode, if users want to use external ServoEn function, please connect Pin18 and Pin10 (Plug CN2) at least.

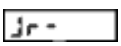
4.6.2 Parameters In JOG Control Mode

No.	Parameter	Function
4	Motor control mode	Select the control mode of servo drive.(Set the parameter to 3 for JOG control mode)
41	Speed setting in JOG mode	Set the operation speed in JOG control mode.
42	Peak speed limitation	Set the maximum speed limitation of servo motor;

4.6.3 Operation

1. Connect the servo system correctly and turn on the power supply.
2. Speed settings.

   Set Pn41 to select the speed in JOG control mode. Set Pn42 to select the maximum speed, when the value of Pn41 is larger than Pn42, motor runs at the speed of Pn42.
3. Running

   Set Pn4 to 3 to select JOG control mode, then set “Servo Enable” (Pin 10) ON; select  menu, press UP button and hold, motor runs in forward rotation (CCW) direction, release UP button, motor stops; press DOWN button and hold, motor runs in reverse rotation (CW) direction, release DOWN button, motor stops.

4.7 Point To Point Control Mode

- Before operating in point to point control mode, we should adjust the drive to find home position first.
- Users can select absolute value mode and increment mode.
  ①In the absolute value mode, as position command is sent, motor would run to the selected position;
  ②In the increment mode, as position command is sent, motor would run a selected journey every time.

4.7.1 Schematic Diagram Of Point To Point Control Mode

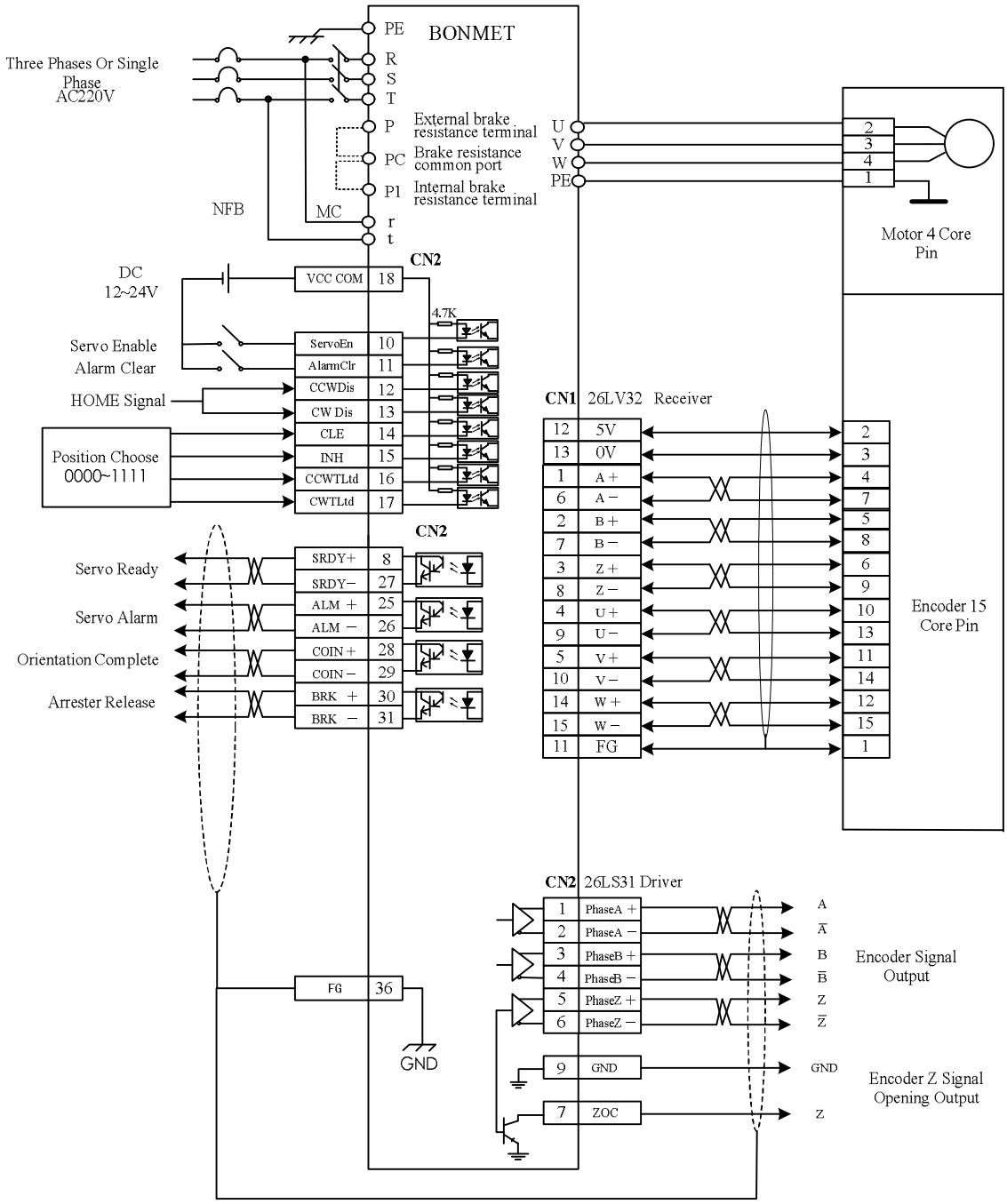


Figure 4-9 Schematic diagram of Point to point control mode

Note: In point to point control mode, if users want to use external ServoEn function, please connect Pin18，in10，Pin14，Pin15，Pin16，Pin17 (Plug CN2) at least.

4.7.2 Parameters In Point To Point Control Mode

No.	Parameter	Function
4	Motor control mode	Select the control mode of servo drive.(Set the parameter to 6 for point to point control mode)
58	Home position	The mode of capture home signal. Three homing methods are supported.
59	Homing speed	The maximum running speed for motor in the process of seeking home position.
60	Homing acceleration/ deceleration speed	The acceleration and deceleration value in the process of seeking home position;
61	High bit of home offset	Offset value of home position.
62	Low bit of home offset	
63	Demo or point-to-point mode	Select the control mode of point to point mode.(Set to 3 for absolute value point-to-point mode and 4 for Increment point-to-point mode.)
104	High bit of position command 1 in position mode	Set the first position command.
105	Low bit of position command 1 in position mode	
106	Speed of position command 1 in position mode	The speed value of position 1;
107	Acceleration/deceleration of position command 1 in position mode	The acceleration / deceleration in position 1;
108	Peak torque of position command 1 in position mode	The maximum torque in position 1;
⋮		
179	High bit of position command 16 in position mode	Set the sixteenth position command.
180	Low bit of position command 16 in position mode	
181	Speed of position command 16 in position mode	The speed value of position 16;
182	Acceleration / deceleration of position command 16 in position mode	The acceleration / deceleration in position 16;
183	Peak torque of position command 16 in position mode	The maximum torque in position 16;

4.7.3 Operation

1. Home search

Connect the servo system correctly and turn on the power supply.

Set Pn4 to 6, select Pn63 to choose control mode(Set Pn63 to 3 for absolute value mode as Pn63 to 4 for increment mode), set Pn58 to choose the homing method, set Pn59, Pn60, Pn61 and Pn62 to select the speed, acceleration/ deceleration speed and the offset of home position while searching home position. There are 3 methods to find home position below.

①Set Pn58 to 0 and ServoEn (CN2-Pin 10) ON, Servo would move in rotation (CW) direction until meets CW limit switch, then turns back and treats the first Index signal as home position and motor would stop.

②Set Pn58 to 1 and ServoEn (CN2-Pin 10) ON, Servo would move in forward (CCW) direction until meets CCW limit switch, then turns back and treats the first Index signal as home position and motor would stop.

③Set Pn58 to 3 and ServoEn (CN2-Pin 10) ON, the servo drive will define the current position as home position and motor would not move.

2. Absolute value mode

Set Pn63 to 3 to select absolute value mode. Set Pn104~Pn108 to select the position command, acceleration time constant , deceleration time constant, speed, maximum torque. As the servo system finds the home position, motor would immediately run to position 1(Associated to Pn104 and Pn105).

Users can switch different 16 position commands by selecting the combination of digital value CCWTLtd(CN2-Pin16), CWTLtd(CN2-Pin17), SC1(CN2-Pin14) and SC2(CN2-Pin15) to operate the servo system.

Position command	CCWTLtd	CWTLtd	SC1	SC2
Position 1	0	0	0	0
Position 2	0	0	0	1
Position 3	0	0	1	0
⋮				
Position 12	1	0	1	1
⋮				
Position 15	1	1	1	0
Position 16	1	1	1	1

3. Increment mode

Set Pn63to 4 to select increment mode. Set Pn104~Pn108 to select the position command, acceleration time constant , deceleration time constant, speed, maximum torque. As the servo system finds the home position, motor would stay at the home position.

Users can switch different 16 position commands by selecting the combination of digital value CCWTLtd(CN2-Pin16), CWTLtd(CN2-Pin17), SC1(CN2-Pin14) and SC2(CN2-Pin15) to operate the servo system.

Position command	CCWTLtd	CWTLtd	SC1	SC2
Position 1	0	0	0	0
Position 2	0	0	0	1
Position 3	0	0	1	0
⋮				
Position 12	1	0	1	1
⋮				
Position 15	1	1	1	0
Position 16	1	1	1	1

4.8 Gain Adjustment

- Adjust the gain parameters in order to get a perfect performance.
- The wrong parameter settings may lead to equipment failure and accidents, users should confirm the correctness of the parameters before operation.
- It is suggested that operate without load for testing first.

4.8.1 Speed Loop

■ Speed loop gain（Parameter-Pn30）

The larger the value is, the greater the stiffness would be. The value is determined by the type of servo and the load condition. In general, larger load inertia needs larger value. If there is no oscillation, the larger the value is the better the servo system performs.

- Speed loop integral time constant（Parameter-Pn31）
  The smaller the value is, the greater the stiffness is. The value is determined by the type of servo and the load condition. In general, larger load inertia needs larger value. Set the parameter as small as possible without oscillation.
- Low-pass bandwidth of speed loop（Parameter-Pn32）
  Normally, smaller value results in slower and smoother speed response. Too small value may cause system oscillation.
- Low-pass filter bandwidth of torque command（Parameter-Pn33）
  Normally, smaller value results in slower and smoother speed response. But too much small value may cause system oscillation.

4.8.2 Position Loop

- Position loop gain（Parameter-Pn44）
  Higher gain results in greater mechanical stiffness and less position tracking error. Too large value may cause overshoot or oscillation. The value is determined by the type and the load of servo drive.
- Difference coefficient ratio of position loop（Parameter-Pn45）
  Higher gain results in greater mechanical stiffness and less position tracking error. Too big value may cause overshoot or oscillation; This parameter is usually set to zero unless very fast response is required.
- The cut-off frequency of position feed forward filter（Parameter-Pn46）
  The filter is used to increase the stability of compound position control. Normally, users do not need to change the default value.

4.8.3 Parameters Settings

- The default parameter value is the recommended value in condition that operating without load, users can adjust parameters follow the instructions below.
- As the load inertia increases, the maximum value of Pn30 rises, the minimum value of Pn31 increased, Pn32 did not change significantly, Pn33 could remain unchanged, the maximum value of Pn44 reduces.
- As load inertia rises from 1 time to 5 times, Pn30 roughly increases the proportion of 1 ~ 5 times (Pn31 remain unchanged); Pn44 roughly reduces the proportion of 1 ~ 5 times.
- As the load inertia increases, it may lead to oscillation (whistle), users can reduce the response rate to solve the problem (increase Pn31 or reduce Pn32; recommended that Pn31 rises 50%, reduce Pn32).
  Set SM 110-060-20 LFB for example：

Load inertia	Pn30	Pn31	Pn32	Pn33	Pn44
0	45	15	800	1000	2100
1.07×10^{-3}	100	15	800	1000	1600
1.98×10^{-3}	140	15	800	1000	1180
3.15×10^{-3}	220	15	600	1000	840
4.02×10^{-3}	250	15	600	1000	700
5.25×10^{-3}	320	15	600	1000	580

Chapter 5 Parameters

Warning

- Any person who attempts to adjust the parameters should be very familiar with the drive. Inappropriate parameter settings may cause damage to the operator.
- It is strongly recommended that operate the servo system without saving as modifies the parameters at the first time.

5.1 Parameter List

NO.	Parameter	Mode	Range	Default value	Unit
0	Software edition	P, S, T	—	—	
1	Motor type code	P, S, T	0~21		
2	User constants protection code	P, S, T	0~32767	28977	
3	Display mode	P, S, T	0~18	0	
4	Motor control mode	P, S, T	0~6	5	
5	Mechanical brake delay time	P, S, T	1~1000	10	ms
6	Current turn off delay time	P, S, T	1~1000	10	ms
7	Mechanical brake speed	P, S, T	0~6000	30	rpm
8	Anti-control of low-6-bit input terminal for PC interface	P, S, T	0~63	0	
9	Anti-control of high-4-bit input terminal for PC interface	P, S, T	0~15	0	
10	Anti-control of encoder input terminals	P, S, T	0~63	0	
11	Force-ON of low-6-bit input terminal for PC interface	P, S, T	0~63	0	
12	Force-ON of high-4-bit input terminal for PC interface	P, S, T	0~15	0	
13	Anti-control of high-4-bit output ports for PC interface	P, S, T	0~15	0	
14	Anti-control of low-3-bit output ports for PC interface	P, S, T	0~7	0	
15	Gain of analog torque command input	T	10~300	100	
16	The bias compensation of analog torque input	T	-30000~30000	0	mV
17	Invert enable of analog torque input	T	0~1	0	
18	Gain of analog speed command input	S	10~300	100	
19	The bias compensation of analog speed input	S	-30000~30000	0	mV
20	Invert enable of analog speed input	S	0~1	0	
21	Low-pass bandwidth of analog speed input	S	0~1000	300	Hz
22	Torque overload alarm value	T	1~400		
23	Torque overload testing time	T	1~32767		ms
24	Internal brake resistor temperature alarm	P, S, T	0~1	1	
25	Internal reverse rotation (CW) torque limit	P, S	1 ~ 400	300	
26	Internal forward rotation (CCW) torque limit	P, S	1 ~ 400	300	
27	External CW torque limit	P, S	1 ~ 400	100	
28	External CCW torque limit	P, S	1 ~ 400	100	
29	Speed limit during torque control	T	0~3000	2000	rpm
30	Speed loop gain	S	1~8000		

31	Speed loop integral time constant	S	1~8000		
32	Low-pass bandwidth of speed loop	S	1~1000	500	Hz
33	Low-pass filter bandwidth of torque command	T	50~1000	800	Hz
34	Time constant of linear speed acceleration	P, S, T	0~10000	0	0.1s
35	Time constant of linear speed deceleration	P, S, T	0~10000	0	0.1s
36	Internal speed 1	S	-6000~6000	1500	rpm
37	Internal speed 2	S	-6000~6000	1500	rpm
38	Internal speed 3	S	-6000~6000	1500	rpm
39	Internal speed 4	S	-6000~6000	1500	
40	Internal or external speed command selection	S	0~1	0	
41	Speed setting in JOG mode		0~3000	1500	rpm
42	Peak speed limitation	P, S, T	0~6000	3000	rpm
43	Target speed	S, T	1~6000	1500	rpm
44	Position loop gain	P	1~10000		
45	Difference coefficient ratio of position loop	P	0~8000		
46	The cut-off frequency of position feed forward filter	P	1~300	100	Hz
47	Constant of position command filter	P	0~1000	0	
48	Denominator of position gearbox	P	1~30000	20	
49	Divider numerator of the 1nd position command pulse	P	1~30000	20	
50	Divider numerator of the 2nd position command pulse	P	1~30000	20	
51	Dynamic electronic gear enable	P	0~1	0	
52	Position command pulse input mode	P	0~2	0	
53	Invert direction of position command pulse	P	0~1	0	
54	Positioning completed range	P	0~30000	1	
55	Range of position super-homodyne detection	P	1~30000	30000	
56	Enable position error	P	0~1	1	
57	Position pulse feedback ratio	P	0~3	0	
58	Home position		0~2	0	
59	Homing speed		1~6000	100	rpm
60	Homing acceleration/ deceleration speed		1~1000	50	R / (s*s)
61	High bit of home offset		-30000~30000	0	
62	Low bit of home offset		-9999~9999	0	
63	Demo or point-to-point mode		0~4	2	
64	Torque value 1 in torque mode		-400~400	10	
65	Demo time 1 in torque mode		0~3600	60	s
66	Torque value 2 in torque mode		-200~200	-10	
67	Demo time 2 in torque mode		0~3600	60	s
68	Torque value 3 in torque mode		-200~200	20	
69	Demo time 3 in torque mode		0~3600	60	s
70	Torque value 4 in torque mode		-200~200	-20	
71	Demo time 4 in torque mode		0~3600	60	s

72	Torque value 5 in torque mode		-200~200	30	
73	Demo time 5 in torque mode		0~3600	60	s
74	Torque value 6 in torque mode		-200~200	-30	
75	Demo time 6 in torque mode		0~3600	60	s
76	Torque value 7 in torque mode		-200~200	80	
77	Demo time 7 in torque mode		0~3600	60	s
78	Torque value 8 in torque mode		-200~200	-80	
79	Demo time 8 in torque mode		0~3600	60	s
80	Torque value 9 in torque mode		-200~200	100	
81	Demo time 9 in torque mode		0~3600	60	s
82	Torque value 10 in torque mode		-200~200	-100	
83	Demo time 10 in torque mode		0~3600	60	s
84	Speed value 1 in speed mode		-6000~6000	10	rpm
85	Demo time 1 in speed mode		0~3600	60	s
86	Speed value 2 in speed mode		-6000~6000	50	rpm
87	Demo time 2 in speed mode		0~3600	60	s
88	Speed value 3 in speed mode		-6000~6000	250	rpm
89	Demo time 3 in speed mode		0~3600	60	s
90	Speed value 4 in speed mode		-6000~6000	1250	rpm
91	Demo time 4 in speed mode		0~3600	60	s
92	Speed value 5 in speed mode		-6000~6000	2500	rpm
93	Demo time 5 in speed mode		0~3600	60	s
94	Speed value 6 in speed mode		-6000~6000	-10	rpm
95	Demo time 6 in speed mode		0~3600	60	s
96	Speed value 7 in speed mode		-6000~6000	-50	rpm
97	Demo time 7 in speed mode		0~3600	60	s
98	Speed value 8 in speed mode		-6000~6000	-250	rpm
99	Demo time 8 in speed mode		0~3600	60	s
100	Speed value 9 in speed mode		-6000~6000	-1250	rpm
101	Demo time 9 in speed mode		0~3600	60	s
102	Speed value 10 in speed mode		-6000~6000	-2500	rpm
103	Demo time 10 in speed mode		0~3600	60	s
104	High bit of position command 1 in position mode		-30000~30000	50	
105	Low bit of position command 1 in position mode		-9999~9999	0	
106	Speed of position command 1 in position mode		0~6000	2000	
107	Acceleration/deceleration of position command 1 in position mode		1~1000	25	R / (s*s)
108	Peak torque of position command 1 in position mode		0~400	125	N.M
109	High bit of position command 2 in position mode		-30000~30000	10	
110	Low bit of position command 2 in position mode		-9999~9999	0	
111	Speed of position command 2 in position mode		0~6000	2000	
112	Acceleration / deceleration of position command 2 in position mode		1~1000	25	

113	Peak torque of position command 2 in position mode		0~400	125	N.M
114	High bit of position command 3 in position mode		-30000~30000	90	
115	Low bit of position command 3 in position mode		-9999~9999	0	
116	Speed of position command 3 in position mode		0~6000	2000	
117	Acceleration / deceleration of position command 3 in position mode		1~1000	25	
118	Peak torque of position command 3 in position mode		0~400	125	N.M
119	High bit of position command 4 in position mode		-30000~30000	20	
120	Low bit of position command 4 in position mode		-9999~9999	0	
121	Speed of position command 4 in position mode		0~6000	2000	
122	Acceleration / deceleration of position command 4 in position mode		1~1000	25	
123	Peak torque of position command 4 in position mode		0~400	125	N.M
124	High bit of position command 5 in position mode		-30000~30000	50	
125	Low bit of position command 5 in position mode		-9999~9999	0	
126	Speed of position command 5 in position mode		0~6000	2000	
127	Acceleration / deceleration of position command 5 in position mode		1~1000	25	
128	Peak torque of position command 5 in position mode		0~400	125	N.M
129	High bit of position command 6 in position mode		-30000~30000	80	
130	Low bit of position command 6 in position mode		-9999~9999	0	
131	Speed of position command 6 in position mode		0~6000	2000	
132	Acceleration / deceleration of position command 6 in position mode		1~1000	25	
133	Peak torque of position command 6 in position mode		0~400	125	N.M
134	High bit of position command 7 in position mode		-30000~30000	50	
135	Low bit of position command 7 in position mode		-9999~9999	0	
136	Speed of position command 7 in position mode		0~6000	2000	
137	Acceleration / deceleration of position command 7 in position mode		1~1000	25	
138	Peak torque of position command 7 in position mode		0~400	125	N.M
139	High bit of position command 8 in position mode		-30000~30000	30	
140	Low bit of position command 8 in position mode		-9999~9999	0	
141	Speed of position command 8 in position mode		0~6000	2000	
142	Acceleration / deceleration of position command 8 in position mode		1~1000	25	
143	Peak torque of position command 8 in position mode		0~400	125	N.M
144	High bit of position command 9 in position mode		-30000~30000	10	
145	Low bit of position command 9 in position mode		-9999~9999	0	
146	Speed of position command 9 in position mode		0~6000	2000	
147	Acceleration / deceleration of position command 9 in position mode		1~1000	25	
148	Peak torque of position command 9 in position mode		0~400	125	N.M
149	High bit of position command 10 in position mode		-30000~30000	80	
150	Low bit of position command 10 in position mode		-9999~9999	0	
151	Speed of position command 10 in position mode		0~6000	2000	

152	Acceleration / deceleration of position command 10 in position mode		1~1000	25	
153	Peak torque of position command 10 in position mode		0~400	125	N.M
154	High bit of position command 11 in position mode		-30000~30000	50	
155	Low bit of position command 11 in position mode		-9999~9999	0	
156	Speed of position command 11 in position mode		0~6000	2000	
157	Acceleration / deceleration of position command 11 in position mode		1~1000	25	
158	Peak torque of position command 11 in position mode		0~400	125	N.M
159	High bit of position command 12 in position mode		-30000~30000	60	
160	Low bit of position command 12 in position mode		-9999~9999	0	
161	Speed of position command 12 in position mode		0~6000	2000	
162	Acceleration / deceleration of position command 12 in position mode		1~1000	25	
163	Peak torque of position command 12 in position mode		0~400	125	N.M
164	High bit of position command 13 in position mode		-30000~30000	30	
165	Low bit of position command 13 in position mode		-9999~9999	0	
166	Speed of position command 13 in position mode		0~6000	2000	
167	Acceleration / deceleration of position command 13 in position mode		1~1000	25	
168	Peak torque of position command 13 in position mode		0~400	125	N.M
169	High bit of position command 14 in position mode		-30000~30000	50	
170	Low bit of position command 14 in position mode		-9999~9999	0	
171	Speed of position command 14 in position mode		0~6000	2000	
172	Acceleration / deceleration of position command 14 in position mode		1~1000	25	
173	Peak torque of position command 14 in position mode		0~400	125	N.M
174	High bit of position command 15 in position mode		-30000~30000	100	
175	Low bit of position command 15 in position mode		-9999~9999	0	
176	Speed of position command 15 in position mode		0~6000	2000	
177	Acceleration / deceleration of position command 15 in position mode		1~1000	25	
178	Peak torque of position command 15 in position mode		0~400	125	N.M
179	High bit of position command 16 in position mode		-30000~30000	50	
180	Low bit of position command 16 in position mode		-9999~9999	0	
181	Speed of position command 16 in position mode		0~6000	2000	
182	Acceleration / deceleration of position command 16 in position mode		1~1000	25	
183	Peak torque of position command 16 in position mode		0~400	125	N.M

Note: The default value of PN1、PN22、PN23、PN25、PN26、PN27、PN28、PN30、PN31、PN44、PN45 is related with the motor model.

5.2 Parameter Contents

NO	Parameter	Parameter description	Range
0	Firmware edition	Firmware edition of servo drive. Can't be modified by users.	—
1	Motor type code	The type code of motors;	0~21
2	User constants protection code	It is used to prevent the parameters from being changed accidentally. The parameters can be modified as the value is set to 28977. We suggest users to change it into a value other than 28977 after the parameters having been adjusted.	0~32767

3	Display mode	Select the information displaying on the panel: 0: Motor's current torque; 1: Motor's current speed; 2: Low-5-bit of current position; 3: High-5-bit of current position; 4: Torque command; 5: Speed command; 6: Low-5-bit of position command(command pulse accumulation); 7: High-5-bit of position command(command pulse accumulation); 8: Motor's current; 9: Counter of encoder output; 10: Linear speed; 11: Low-5-bit of position deviation; 12: High-5-bit of position deviation; 13: Control mode; 14: Alarm code; 15: States of low part input terminals in CN2; 16: States of high part input terminals in CN2; 17: State of output terminals in CN2; 18: State of the optical encoder in input terminals;	0~18
4	Motor control mode	①Select the control mode of servo drive: 0: Torque control mode; 1: Speed control mode; 2: Position control mode; 3: JOG control mode; 4: Speed trial operation control mode; 5: Auto-correction mode(used to correct ports and internal control parameter for motor); 6: Demo mode (Torque/Speed/Position)/point to point mode; ②In speed control mode, speed command transmits from input terminals (PN40).Set SC1 and SC2 to choose the internal speed: SC1 OFF, SC2 OFF: Internal speed 1; SC1 OFF, SC2 ON : Internal speed 2; SC1 ON , SC2 OFF: Internal speed 3 SC1 ON , SC2 ON : Internal speed 4; ③In position control mode, position command transmits from pulse input ports. ④In JOG control mode, press Up continuously, the motor is running at JOG speed, release the key, motor stops and keeps zero-speed; Press Down continuously, the motor is running in the reverse direction, release the ke motor stops and keeps zero-speed; ⑤In speed trial control mode, speed command is input from keyboard to test the drive and motor; ⑥In auto-correction mode, users can adjust the zero-compensation for analog, torque and speed input port as well as the internal control parameters.	0~6
5	Mechanical brake delay time	①Set the delay time from the moment that mechanical brake available (output terminals BRK changes from OFF to ON) to the time motor current is cut off. ②This parameter should be bigger than mechanical braking delay time to avoid motor for micro-displacement or falling.	1~1000ms
6	Current turn off delay time	①Set the delay time from the moment the motor current is cut off to the time mechanical brake available (output terminals BRK changes from OFF to ON). ②This parameter will protect the mechanical brake as the motor runs from a high speed to a low speed. ③The actual time is the minimum value between PN5 and the time speed falls to PN6.	1~1000ms
7	Mechanical brake speed	①Set the motor speed ensuring that mechanical brake is active (output terminal BRK changes from OFF to ON) when motor is running. ②The actual time is the minimum value between PN5 and the time speed falls to PN6.	0~6000

<table>
<tr><td>8</td><td>Anti-control of low-6-bit input terminal for PC interface</td><td>①Inverting enable of input terminals. Invert the input signal when the corresponding enable setting is active.
②This parameter is expressed by a 6-bit binary number. 0 stands for original state, 1 stands for invert state. Here's a input terminal of binary number below:
<table><tr><td>5</td><td>4</td><td>3</td><td>2</td><td>1</td><td>0</td></tr><tr><td>ServoEn</td><td>AlarmClr</td><td>CCWDis</td><td>CWDis</td><td>CCWTLtd</td><td>CWTLtd</td></tr></table>ServoEn: Servo enable;
AlarmClr: Alarm clear;
CCWDis: CCW(counter-clockwise) drive forbidden;
CWDis: CW(clockwise) drive forbidden;
CCWTLtd: CCW torque limited;
CWTLtd: CW torque limited;</td><td>0~63</td></tr>
<tr><td>9</td><td>Anti-control of high-4-bit input terminal for PC interface</td><td>①Inverting enable of input terminals. Invert the input signal when the corresponding enable setting is active.
②This parameter is expressed by a 4-bit binary number. 0 stands for original state, 1 stands for invert state. Here's a input terminal of binary number below:
<table><tr><td>3</td><td>2</td><td>1</td><td>0</td></tr><tr><td>CLE/SC1/ZEROSPD</td><td>INH/SC2</td><td>SignInv</td><td>PulseInv</td></tr></table>CLE/SC1/ZEROSPD: Offset counter clear / Speed selector 1 / Zero clamp;
INH/SC2: Command pulse forbidden（dynamic electronic gear switch）/Speed selector 2;
SignInv: Position command pulse symbol bit;
PulseInv: Position command pulse bit;</td><td>0~15</td></tr>
<tr><td>10</td><td>Anti-control of encoder input terminals</td><td>①Inverting enable of input terminals. Invert the input signal when the corresponding enable setting is active.
②This parameter is expressed by a 6-bit binary number. 0 stands for original state, 1 stands for invert state. Here's a input terminal of binary number below::
<table><tr><td>5</td><td>4</td><td>3</td><td>2</td><td>1</td><td>0</td></tr><tr><td>PhaseU</td><td>PhaseV</td><td>PhaseW</td><td>PhaseA</td><td>PhaseB</td><td>PhaseZ</td></tr></table>Phase U: Photoelectric incremental encoder phase U;
Phase V: Photoelectric incremental encoder phase V;
Phase W:Photoelectric incremental encoder phase W;
Phase A: Photoelectric incremental encoder phase A;
Phase B: Photoelectric incremental encoder phase B;
Phase Z: Photoelectric incremental encoder phase Z;</td><td>0~63</td></tr>
<tr><td>11</td><td>Force-ON of low-6-bit input terminal for PC interface</td><td>①Force the input signal active when the corresponding enable setting is active;
②This parameter is expressed by a 6-bit binary number. 0 stands for the unforce-ON for input terminal, 1 stands for the force-ON for input terminal. Here's a input terminal of binary number below:
<table><tr><td>5</td><td>4</td><td>3</td><td>2</td><td>1</td><td>0</td></tr><tr><td>ServoEn</td><td>AlarmClr</td><td>CCWDis</td><td>CWDis</td><td>CCWTLtd</td><td>CWTLtd</td></tr></table>ServoEn: Servo enable;
AlarmClr: Alarm clear;
CCWDis: CCW(counter-clockwise) drive forbidden;
CWDis: CW(counter-clockwise) drive forbidden;
CCWTLtd: CCW torque limited;
CWTLtd : CW torque limited;</td><td>0~63</td></tr>
<tr><td>12</td><td>Force-ON of high-4-bit input terminal for PC interface</td><td>①External connection to control ON / OFF，for the terminal of force-ON, the drive can set ON automatically at internal without external connection.
②This parameter is expressed by a 4-bit binary number. 0 stands for the unforce-ON for input terminal, 1 stands for the force-ON for input terminal. Here's a input terminal of binary number below:
<table><tr><td>3</td><td>2</td><td>1</td><td>0</td></tr><tr><td>CLE/SC1/ZEROSPD</td><td>INH/SC2</td><td>SignInv</td><td>PulseInv</td></tr></table>CLE/SC1/ZEROSPD: Offset counter clear / Speed selector 1 / Zero clamp;
INH/SC2: Command pulse forbidden（dynamic electronic gear switch）/Speed selector 2;
SignInv: Position command pulse symbol bit;
PulseInv: Position command pulse bit;</td><td>0~15</td></tr>
</table>

<table>
<tr><td>13</td><td>Anti-control of high-4-bit output ports for PC interface</td><td>①Inverting enable of output terminals. For the anti-control terminal, turn-on and cut-off definition are opposite from standard definition.
②This parameter is expressed by a 4-bit binary number. 0 stands for the no anti-control output terminal, 1 stands for the anti-control output terminal. Here's a input terminal of binary number below:<table><tr><td>3</td><td>2</td><td>1</td><td>0</td></tr><tr><td>SRDY</td><td>ALM</td><td>COIN</td><td>BRK</td></tr></table>SRDY: Servo ready;
ALM: Servo alarm;
COIN: Positioning complete / Reach speed
BRK: Mechanical brake release.</td><td>0~15</td></tr>
<tr><td>14</td><td>Anti-control of low-3-bit output ports for PC interface</td><td>①Inverting enable of output terminals. For the anti-control terminal, turn-on and cut-off definition are opposite from standard definition.
②This parameter is expressed by a 3-bit binary number. 0 stands for the no anti-control output terminal, 1 stands for the anti-control output terminal. Here's a input terminal of binary number below:<table><tr><td>2</td><td>1</td><td>0</td></tr><tr><td>PhaseA_O</td><td>PhaseB_O</td><td>PhaseZ_O</td></tr></table>PhaseA_O:Phase A output of rotor position;
PhaseB_O:Phase B output of rotor position;
PhaseZ_O: Phase Z output of rotor position.</td><td>0~7</td></tr>
<tr><td>15</td><td>Gain of analog torque command input</td><td>①Set proportion relationship between analog torque input voltage and actual motor torque;
②Parameter unit is 100%/0.1V;
③The default value is 100, corresponding to 100%/10V (Input 10V to generate 100% of nominal torque).</td><td>10~300</td></tr>
<tr><td>16</td><td>The bias compensation of analog torque input</td><td>①The zero-bias compensation for the analog torque input;
②Parameter unit is mV.</td><td>-30000~ 30000mV</td></tr>
<tr><td>17</td><td>Invert enable of analog torque input</td><td>①Set the parameter to 0, as the analog torque command is positive, motor runs in reverse rotation (CW) direction,;
②Set the parameter to 1, as the analog torque command is positive, motor runs forward rotation (CCW) direction.</td><td>0~1</td></tr>
<tr><td>18</td><td>Gain of analog speed command input</td><td>①Set proportion relationship between the input voltage of analog speed and actual motor speed;
②Parameter unit is 3000rpm/0.1V;
③The default value is 100, corresponding to 3000rpm/10V.</td><td>10~300</td></tr>
<tr><td>19</td><td>The bias compensation of analog speed input</td><td>①The zero-bias compensation for the analog speed input;
②Parameter unit is mV.</td><td>-30000~ 30000mV</td></tr>
<tr><td>20</td><td>Invert enable of analog speed input</td><td>①Set the parameter to 0, as the analog speed command is positive, motor runs in reverse rotation (CW) direction,;
②Set the parameter to 1, as the analog speed command is positive, motor runs forward rotation (CCW) direction.</td><td>0~1</td></tr>
<tr><td>21</td><td>Low-pass bandwidth of analog speed input</td><td>① Low-pass filter of the analog speed input.
②The greater the value is, it would bring faster response of analog speed input and more signal noise; The smaller the value is, it would bring slower response of analog speed input and less signal noise.</td><td>1~1000Hz</td></tr>
<tr><td>22</td><td>Torque overload alarm value</td><td>①Torque overload value. The value is the percentage of nominal torque which effects both direction(CW/CCW);
②As the motor torque > PN22 and lasting time > PN23, the drive will alarm Err-18 the motor will stop.</td><td>1~400</td></tr>
<tr><td>23</td><td>Torque overload testing time</td><td>①Parameter unit is ms;
②As the motor torque > PN22 and lasting time > PN23, the drive will alarm Err-18, the motor will stop.</td><td>1~32767ms</td></tr>
<tr><td>24</td><td>Internal brake resistor temperature alarm</td><td>①Set 1, internal brake resistor temperature alarm enabled;
②Set 0, internal brake resistor temperature alarm disabled.</td><td>0~1</td></tr>
<tr><td>25</td><td>Internal reverse rotation (CW) torque limit</td><td>①Used to limit the torque in the reverse rotation driving mode;
②Parameter value is the percentage of nominal torque, for example, the value of 200 if it is set to 2 times of the nominal torque;
③This limitation is valid all time;
④Actual torque limit equals to the allowed peak overload on the condition that the setting value exceed the allowed peak overload.</td><td>1~400</td></tr>
</table>

26	Internal forward rotation (CCW) torque limit	①Used to limit the torque in the forward rotation driving mode ②Parameter value is the percentage of nominal torque, for example, the value of 200 if it is set to 2 times of the nominal torque; ③This limitation is valid all time; ④Actual torque limit equals to the allowed peak overload on the condition that the setting value exceed the allowed peak overload.	1~400
27	External CW torque limit	①Set the external torque limit for motor CW; ②Parameter value is the percentage of nominal torque, for example, the value of 100 if it is set to 1 time of the nominal torque; ③The limitation is valid only when the CW torque limit input terminal ON; ④The actual torque limit is the minimum value among allowed peak overload, CW internal torque limit and CW external torque limit as the limitation is valid.	1~400
28	External CCW torque limit	①Set the external torque limit for motor CCW; ②Parameter value is the percentage of nominal torque, for example, the value of 100 if it is set to 1 time of the nominal torque; ③The limitation is valid only when the CCW torque limit input terminal ON; ④The actual torque limit is the minimum value among allowed peak overload, CCW internal torque limit and CCW external torque limit as the limitation is valid.	1~400
29	Speed limit during torque control	①Limit the maximum speed in torque control mode, parameter unit is rpm; ②Avoid overspeed when the motor unloaded.	0~3000
30	Speed loop gain	①Set the speed loop proportional gain; ②The larger the value is, the greater the stiffness would be. The value determined by the type of servo and the load condition. In general, larger lo inertia needs larger value. ③If there is no oscillation, the higher the value is the better the servo syst performs.	1~8000
31	Speed loop integral time constant	①Set the speed loop integral time constant; ②The smaller the value, the greater the stiffness. The value is determined by the type of servo and the load condition. In general, larger load inertia ne larger value. ③Set the parameter as small as possible without oscillation.	1~8000
32	Low-pass bandwidth of speed loop	①Set the characteristics of speed detection filter; ②Normally, smaller value results in slower and smoother speed response. Too small value may cause system oscillation.	1~1000Hz
33	Low-pass filter bandwidth of torque command	①Set the characteristics of speed detection filter; ②Normally, smaller value results in slower and smoother speed response. But too much small value may cause system oscillation.	50~1000Hz
34	Time constant of linear speed acceleration	①The value means motor accelerates from 0 to 1000 r/min, the unit ×0.01s; ②Characteristics of acceleration and deceleration is linear; the range of valid value from 1 to 10000; ③Affective in speed control mode only; ④If the drive works in position control mode or the external position loop, the parameter should be set to 0.	0~10000
35	Time constant of linear speed deceleration	①The value means motor decelerates from 1000 to 0 r/min, the unit ×0.01s; ②Characteristics of acceleration and deceleration is linear; the range of valid value from 1 to 10000; ③Affective in speed control mode only; ④If the drive works in position control mode or the external position loop, the parameter should be set to 0.	0~10000
36	Internal speed 1	①Set the first internal speed; ②In speed control mode, select the first internal speed as the speed command when SC1 OFF, SC2 OFF.	-6000~6000
37	Internal speed 2	①Set the first internal speed; ②In speed control mode, select the second internal speed as the speed command when SC1 OFF, SC2 ON.	-6000~6000
38	Internal speed 3	①Set the first internal speed; ②In speed control mode, select the third internal speed as the speed command when SC1 ON, SC2 OFF.	-6000~6000

39	Internal speed 4	①Set the first internal speed; ②In speed control mode, select the fourth internal speed as the speed command when SC1 ON, SC2 ON.	-6000~6000
40	Internal or external speed command selection	①Set the parameter to 0, select the internal speed control mode; ②Set the parameter to 1, select the external speed control mode.	0~1
41	Speed setting in JOG mode	Set the operation speed in JOG control mode.	0~3000
42	Peak speed limitation	①Set the maximum speed limitation of servo motor; ②The function is effective in both CCW and CW direction; ③The selected speed equals to actual peak speed if it is smaller than the value.	0~6000
43	Target speed	①Position target speed, the unit is r/min; ②In non-position control mode, if the motor speed exceeds the set value, then COIN ON, otherwise COIN OFF; ③This parameter is not effective in position control mode,; ④CCW and CW directions are both effective; ⑤The comparator has hysteresis characteristics.	1~6000
44	Position loop gain	①Set the speed loop proportional gain; ②Higher gain results in greater mechanical stiffness and less position tracking error. Too large value may cause overshoot or oscillation. ③The value is determined by the type and the load of servo drive.	1~10000
45	Difference coefficient ratio of position loop	①Set the difference gain of position loop; ② Higher gain results in greater mechanical stiffness and less position track error. Too big value may cause overshoot or oscillation; ③This parameter is usually set to zero unless very fast response is required.	0~8000
46	The cut-off frequency of position feed forward filter	①Set the low-pass filter cut-off frequency of position loop feed forward. the unit is Hz; ②The filter is used to increase the stability of compound position control.	1~300
47	Constant of position command filter	①Smoothen filter for the command pulse with the accelerate of index form, the value stands for time constant. The unit is ms; ②Filter would not lose input pulse but may lead to delay; ③The filter works in the follow conditions: ● Host controller has not acceleration and deceleration function; ● Larger electronic gear ratio (＞10); ● Lower command frequency; ● Motor running with jumps or other unstable conditions; ④Filter is inactive as set to 0.	0~1000
48	Denominator of position gearbox	①Set the denominator of sub-octave for position command pulse (electric gear); ②In the position control mode, conveniently match with any pulse source setting parameters PN48 and PN49 to meet the ideal control resolut (angle/pulse); ③P×G=N×C×4 P : Input command pulse number; G: Electronic gear ratio; N: The revolving circle of the motor; C: The photoelectric encoder C/T, this system is C=2500; ④For example, the motor runs one circle when the input command pulse is 60 $G=\frac{N\times C\times 4}{P}=\frac{1\times 2500\times 4}{6000}=\frac{5}{3}$ So please set PN49=5, PN48=3 ⑤Recommendatory range of electronic gear ratio: 1/50≤G≤50	1~30000
49	Divider numerator of the first position command pulse	①Set the first position command pulse sub-octave (electronic gear); ②Set parameter PN51 to 1 as using the dynamic electronic gear, meanwhile the function of input terminal INH (command pulse forbidden) translates into control terminal of electronic gear switching input.	1~30000

50	Divider numerator of the second position command pulse	①Set the second position command pulse sub-octave (electronic gear); ②Set parameter PN51 to 1 as using the dynamic electronic gear, meanwhile the function of input terminal INH (command pulse forbidden) translates into control terminal of electronic gear switching input.	1~30000
51	Dynamic electronic gear enable	①Set to 0, dynamic electronic gearbox is inactive. ②Set to 1, dynamic electronic gearbox is active. ③When dynamic electronic gearbox is active, the input terminal INH(Inhibit Position instruction) functions as a switch to select electronic gear ratio generated by the first or the second numerator; ④When dynamic electronic gearbox is active, if INH terminal is inactive, the active G=PN50/PN48; If INH terminal is active, the active G=PN49/PN48; By controlling INH terminal, PLC cant switch the electronic gear ratio.	0~1
52	Position command pulse input mode	①Set the input form of position command pulse; ②Three position command types are supported as following: 0: Pulse + symbol; 1: CCW pulse / CW pulse; 2: Two-phase orthogonal pulse input; ③CCW is defined as positive direction on the condition that it rotates with anti-clockwise direction from the axial view.	0~2
53	Invert direction of position command pulse	Select condition: 0: Normal; 1: Reverse the direction of position command pulse.	0~1
54	Positioning completed range	①Position range indicates the motor has reached the target location; ②In position control mode or point to point mode, if the position error drops in the target position range, the output terminal COIN turns active, otherwise COIN remains inactive.	0~30000
55	Range of position super-homodyne detection	①Set the detection range for position tolerance alarm; ②The drive will issue position tolerance alarm when the position offset counter value exceeds the selected value×100 in position control mode.	1~30000
56	Enable position error	Select condition: 0: position tolerance alarm detection enabled; 1: position tolerance alarm detection disabled and position tolerance error detection is stopped.	0~1
57	Position pulse feedback ratio	①The feedback ratio of position pulse determines the ratio of the internal and output position pulse: ②[4:0] : Feedback setting: B, Ratio=A/B. ③[9:5] : Feedback setting: A, Ratio=A/B. ④[15:10] : Reserved. ⑤Normal setting : 1:1 => 33 (00001_00001) 1:2 => 34 (00001_00010) 1:4 => 36 (00001_00100) 1:5 => 37 (00001_00101) 1:10 => 42 (00001_01010) ⑥(Ratio x Encoder pulse number) should be a integer.	1~1023
58	Home position	The mode of capture Home signal. Three homing methods are supported. ①Set PN58 to 0, the servo seeks home position with CW limit switch; Servo would move in CW direction until meets CW limit switch, then turns back and treats the first Index signal as home position; ②Set PN58 to 1, the servo seeks home position with CCW limit switch. Servo would move in CCW direction until meets CCW limit switch, then turns back and treats the first Index signal as home position; ③Set PN58 to 2, the current position is set as home position.	0~3
59	Homing speed	①The maximum running speed for motor in the process of seeking home position; ②The speed value is effective in both CCW and CW direction. The unit is r/min; ③Caution: Too fast homing speed may cause mechanical damage at limit switch.	1~6000
60	Homing acceleration/ deceleration speed	①The acceleration and deceleration value in the process of seeking home position; ②The value is effective in both CCW and CW direction. The unit is r/(s*s); ③Caution: Too weak acceleration and deceleration speed may cause mechanical damage at limit switch.	1~1000

61	High bit of home offset	①A 16-bit space is narrow for a 32-bit. So the home offset is stored to high-bit and low-bit; ②The actual origin offset = PN61×10000+PN62.	-30000~ 30000
62	Low bit of home offset	①A 16-bit space is narrow for a 32-bit. So the home offset is stored to high-bit and low-bit; ②The actual origin offset = PN61×10000+PN62.	-9999~9999
63	Demo or point-to-point mode	①Demo mode or point-to-point mode; ②Set to 0, the drive will work in torque demo mode. From step 1 to 10, servo runs each step one by one and loops forever. In every step torque value and lasting time can be set independently. ③Set to 1, the drive will work in speed demo mode. From step 1 to 10, servo runs each step one by one and loops forever. In every step torque value and lasting time can be set independently. ④Set to 2, the drive will work in position demo mode, From step 1 to 10, servo runs each step one by one and loops forever. In every step position, speed, acceleration and maximum torque value can be set independently. ⑤Set to 3, the drive will work in absolute value point-to-point mode. ⑥Set to 4, the drive will work in increment point-to-point mode.. ⑦There are four parameters can be selected independently: Position, Speed, Acceleration and Maximum Torque in point-to-point mode. The position index is determined by input terminals { CCWTLtd, CWTLtd, SC1, SC2 }: If CCWTLtd=0, CWTLtd=0,SC1=0, SC2=0, then select position 1; If CCWTLtd=0, CWTLtd=0,SC1=0, SC2=1, then select position 2; If CCWTLtd=0, CWTLtd=0, SC1=1, SC2=0, then select position 3; ..... If CCWTLtd=1, CWTLtd=0,SC1=1, SC2=1, then select position 12; ..... If CCWTLtd=1, CWTLtd=1, SC1=1, SC2=0 then select position 15; If CCWTLtd=1, CWTLtd=1, SC1=1, SC2=1, then select position 16;	0~3
64	Torque value 1 in torque mode	①Set the first torque value in torque demo mode; ②Parameter value is the percentage of the nominal torque, for example, if you want to set maximum torque to the 1 times of the nominal torque, the parameter is 100.	-400~400
65	Demo time 1 in torque mode	①Set the first duration in torque demo mode. ②Parameter unit is second.	0~3600
66	Torque value 2 in torque mode	①Set the second torque value in torque demo mode; ②Parameter value is the percentage of the nominal torque, for example, if you want to set maximum torque to the 1 times of the nominal torque, the parameter is 100.	-200~200
67	Demo time 2 in torque mode	①Set the second duration in torque demo mode. ②Parameter unit is second.	0~3600
68	Torque value 3 in torque mode	①Set the third torque value in torque demo mode; ②Parameter value is the percentage of the nominal torque, for example, if you want to set maximum torque to the 1 times of the nominal torque, the parameter is 100.	-200~200
69	Demo time 3 in torque mode	①Set the third duration in torque demo mode. ②Parameter unit is second.	0~3600
70	Torque value 4 in torque mode	①Set the fourth torque value in torque demo mode; ②Parameter value is the percentage of the nominal torque, for example, if you want to set maximum torque to the 1 times of the nominal torque, the parameter is 100.	-200~200
71	Demo time 4 in torque mode	①Set the fourth duration in torque demo mode. ②Parameter unit is second.	0~3600
72	Torque value 5 in torque mode	①Set the fifth torque value in torque demo mode; ②Parameter value is the percentage of the nominal torque, for example, if you want to set maximum torque to the 1 times of the nominal torque, the parameter is 100.	-200~200
73	Demo time 5 in torque mode	①Set the fifth duration in torque demo mode. ②Parameter unit is second.	0~3600
74	Torque value 6 in torque mode	①Set the sixth torque value in torque demo mode; ②Parameter value is the percentage of the nominal torque, for example, if you want to set maximum torque to the 1 times of the nominal torque, the parameter is 100.	-200~200

75	Demo time 6 in torque mode	①Set the sixth duration in torque demo mode. ②Parameter unit is second.	0~3600
76	Torque value 7 in torque mode	①Set the seventh torque value in torque demo mode; ②Parameter value is the percentage of the nominal torque, for example, if you want to set maximum torque to the 1 times of the nominal torque, the parameter is 100.	-200~200
77	Demo time 7 in torque mode	①Set the seventh duration in torque demo mode. ②Parameter unit is second.	0~3600
78	Torque value 8 in torque mode	①Set the seventh torque value in torque demo mode; ②Parameter value is the percentage of the nominal torque, for example, if you want to set maximum torque to the 1 times of the nominal torque, the parameter is 100.	-200~200
79	Demo time 8 in torque mode	①Set the eighth duration in torque demo mode. ②Parameter unit is second.	0~3600
80	Torque value 9 in torque mode	①Set the ninth torque value in torque demo mode; ②Parameter value is the percentage of the nominal torque, for example, if you want to set maximum torque to the 1 times of the nominal torque, the parameter is 100.	-200~200
81	Demo time 9 in torque mode	①Set the ninth duration in torque demo mode. ②Parameter unit is second.	0~3600
82	Torque value 10 in torque mode	①Set the tenth torque value in torque demo mode; ②Parameter value is the percentage of the nominal torque, for example, if you want to set maximum torque to the 1 times of the nominal torque, the parameter is 100.	-200~200
83	Demo time 10 in torque mode	①Set the tenth duration in torque demo mode. ②Parameter unit is second.	0~3600
84	Speed value 1 in speed mode	①Set the first speed value in the speed demo mode; ②Parameter unit is rpm.	-6000~6000
85	Demo time 1 in speed mode	①Set the first duration in the speed demo mode; ②Parameter unit is second.	0~3600
86	Speed value 2 in speed mode	①Set the second speed value in speed demo mode; ②Parameter unit is rpm..	-6000~6000
87	Demo time 2 in speed mode	①Set the second duration of speed value in speed demo mode; ②Parameter unit is second.	0~3600
88	Speed value 3 in speed mode	①Set the third speed value in speed demo mode; ②Parameter unit is rpm.	-6000~6000
89	Demo time 3 in speed mode	①Set the third duration of speed value in speed demo mode; ②Parameter unit is second.	0~3600
90	Speed value 4 in speed mode	①Set the fourth speed value in speed demo mode; ②Parameter unit is rpm.	-6000~6000
91	Demo time 4 in speed mode	①Set the fourth duration of speed value in speed demo mode ②Parameter unit is second.	0~3600
92	Speed value 5 in speed mode	①Set the fifth speed value in speed demo mode; ②Parameter unit is rpm.	-6000~6000
93	Demo time 5 in speed mode	①Set the fifth duration of speed value in speed demo mode; ②Parameter unit is second.	0~3600
94	Speed value 6 in speed mode	①Set the sixth speed value in speed demo mode; ②Parameter unit is rpm.	-6000~6000
95	Demo time 6 in speed mode	①Set the sixth duration of speed value in speed demo mode; ②Parameter unit is second.	0~3600
96	Speed value 7 in speed mode	①Set the seventh speed value in speed demo mode; ②Parameter unit is rpm.	-6000~6000
97	Demo time 7 in speed mode	①Set the seventh duration of speed value in speed demo mode; ②Parameter unit is second.	0~3600
98	Speed value 8 in speed mode	①Set the eighth speed value in speed demo mode; ②Parameter unit is rpm.	-6000~6000
99	Demo time 8 in speed mode	①Set the ninth duration of speed value in speed demo mode; ②Parameter unit is second.	0~3600
100	Speed value 9 in speed mode	①Set the ninth speed value in speed demo mode; ②Parameter unit is rpm.	-6000~6000

101	Demo time 9 in speed mode	①Set the ninth duration of speed value in speed demo mode; ②Parameter unit is second.	0~3600
102	Speed value 10 in speed mode	①Set the tenth speed value in speed demo mode; ②Parameter unit is rpm.	-6000~6000
103	Demo time 10 in speed mode	①Set the tenth duration of speed value in speed demo mode; ②Parameter unit is second.	0~3600
104	High bit of position command 1 in position mode	①Set the first high bit command value in position demo mode; ②The value of position 1 equals to high-bit value×10000+low-bit value. Parameter unit is pulse.	-30000~30000
105	Low bit of position command 1 in position mode	①Set up the first low bit command value in position demo mode. ②The value of position 1 equals to high-bit value×10000+low-bit value. Parameter unit is pulse.	-9999~9999
106	Speed of position command 1 in position mode	①The speed value of position 1; ②Parameter unit is rpm.	0~6000
107	Acceleration/deceleration of position command 1 in position mode	①The acceleration / deceleration in position 1; ②The acceleration and deceleration share the same value.	1~1000
108	Peak torque of position command 1 in position mode	①The maximum torque in position 1; ②The value is the percentage of the nominal torque, for example, if you want to set maximum torque value as same as the nominal torque value, the parameter would be 100.	0~400
109	High bit of position command 2 in position mode	①Set the second high bit command value in position demo mode; ②The value of position 2 equals to high-bit value×10000+low-bit value. Parameter unit is pulse.	-30000~30000
110	Low bit of position command 2 in position mode	①Set the second low bit command value in position demo mode; ②The value of position 2 equals to high-bit value×10000+low-bit value. Parameter unit is pulse.	-9999~9999
111	Speed of position command 2 in position mode	①The speed value of position 2; ②Parameter unit is rpm.	0~6000
112	Acceleration / deceleration of position command 2 in position mode	①The acceleration / deceleration in position 2; ②The acceleration and deceleration share the same value..	1~1000
113	Peak torque of position command 2 in position mode	①The maximum torque in position 2; ②The value is the percentage of the nominal torque, for example, if you want to set maximum torque value as same as the nominal torque value, the parameter would be 100.	0~400
114	High bit of position command 3 in position mode	①Set the third high bit command value in position demo mode; ②The value of position 3 equals to high-bit value×10000+low-bit value. Parameter unit is pulse.	-30000~30000
115	Low bit of position command 3 in position mode	①Set the third low bit command value in position demo mode; ②The value of position 3 equals to high-bit value×10000+low-bit value. Parameter unit is pulse.	-9999~9999
116	Speed of position command 3 in position mode	①The speed value of position 3; ②Parameter unit is rpm.	0~6000
117	Acceleration / deceleration of position command 3 in position mode	①The acceleration / deceleration in position 3; ②The acceleration and deceleration share the same value..	1~1000
118	Peak torque of position command 3 in position mode	①The maximum torque in position 3; ②The value is the percentage of the nominal torque, for example, if you want to set maximum torque value as same as the nominal torque value, the parameter would be 100.	0~400
119	High bit of position command 4 in position mode	①Set the fourth high bit command value in position demo mode; ②The value of position 4 equals to high-bit value×10000+low-bit value. Parameter unit is pulse.	-30000~30000

120	Low bit of position command 4 in position mode	①Set the fourth low bit command value in position demo mode; ②The value of position 4 equals to high-bit value×10000+low-bit value. Parameter unit is pulse.	-9999~9999
121	Speed of position command 4 in position mode	①The speed value of position 4; ②Parameter unit is rpm.	0~6000
122	Acceleration / deceleration of position command 4 in position mode	①The acceleration / deceleration in position 4; ②The acceleration and deceleration share the same value..	1~1000
123	Peak torque of position command 4 in position mode	①The maximum torque in position 4; ②The value is the percentage of the nominal torque, for example, if you want to set maximum torque value as same as the nominal torque value, the parameter would be 100.	0~400
124	High bit of position command 5 in position mode	①Set the fifth high bit command value in position demo mode; ②The value of position 5 equals to high-bit value×10000+low-bit value. Parameter unit is pulse.	-30000~ 30000
125	Low bit of position command 5 in position mode	①Set the fifth low bit command value in position demo mode; ②The value of position 5 equals to high-bit value×10000+low-bit value. Parameter unit is pulse.	-9999~9999
126	Speed of position command 5 in position mode	①The speed value of position 5; ②Parameter unit is rpm.	0~6000
127	Acceleration / deceleration of position command 5 in position mode	①The acceleration / deceleration in position 5; ②The acceleration and deceleration share the same value..	1~1000
128	Peak torque of position command 5 in position mode	①The maximum torque in position 5; ②The value is the percentage of the nominal torque, for example, if you want to set maximum torque value as same as the nominal torque value, the parameter would be 100.	0~400
129	High bit of position command 6 in position mode	①Set the sixth high bit command value in position demo mode; ②The value of position 6 equals to high-bit value×10000+low-bit value. Parameter unit is pulse.	-30000~ 30000
130	Low bit of position command 6 in position mode	①Set the sixth low bit command value in position demo mode; ②The value of position 6 equals to high-bit value×10000+low-bit value. Parameter unit is pulse.	-9999~9999
131	Speed of position command 6 in position mode	①The speed value of position 6; ②Parameter unit is rpm.	0~6000
132	Acceleration / deceleration of position command 6 in position mode	①The acceleration / deceleration in position 6; ②The acceleration and deceleration share the same value..	1~1000
133	Peak torque of position command 6 in position mode	①The maximum torque in position 6; ②The value is the percentage of the nominal torque, for example, if you want to set maximum torque value as same as the nominal torque value, the parameter would be 100.	0~400
134	High bit of position command 7 in position mode	①Set the seventh high bit command value in position demo mode; ②The value of position 7 equals to high-bit value×10000+low-bit value. Parameter unit is pulse.	-30000~ 30000
135	Low bit of position command 7 in position mode	①Set the seventh low bit command value in position demo mode; ②The value of position 7 equals to high-bit value×10000+low-bit value. Parameter unit is pulse.	-9999~9999
136	Speed of position command 7 in position mode	①The speed value of position 7; ②Parameter unit is rpm.	0~6000
137	Acceleration / deceleration of position command 7 in position mode	①The acceleration / deceleration in position 7; ②The acceleration and deceleration share the same value..	1~1000

138	Peak torque of position command 7 in position mode	①The maximum torque in position 7; ②The value is the percentage of the nominal torque, for example, if you want to set maximum torque value as same as the nominal torque value, the parameter would be 100.	0~400
139	High bit of position command 8 in position mode	①Set the eighth high bit command value in position demo mode; ②The value of position 8 equals to high-bit value×10000+low-bit value. Parameter unit is pulse.	-30000~ 30000
140	Low bit of position command 8 in position mode	①Set the eighth low bit command value in position demo mode; ②The value of position 8 equals to high-bit value×10000+low-bit value. Parameter unit is pulse.	-9999~9999
141	Speed of position command 8 in position mode	①The speed value of position 8; ②Parameter unit is rpm.	0~6000
142	Acceleration/ deceleration of position command 8 in position mode	①The acceleration / deceleration in position 8; ②The acceleration and deceleration share the same value..	1~1000
143	Peak torque of position command 8 in position mode	①The maximum torque in position 8; ②The value is the percentage of the nominal torque, for example, if you want to set maximum torque value as same as the nominal torque value, the parameter would be 100.	0~400
144	High bit of position command 9 in position mode	①Set the ninth high bit command value in position demo mode; ②The value of position 9 equals to high-bit value×10000+low-bit value. Parameter unit is pulse.	-30000~ 30000
145	Low bit of position command 9 in position mode	①Set the ninth low bit command value in position demo mode; ②The value of position 9 equals to high-bit value×10000+low-bit value. Parameter unit is pulse.	-9999~9999
146	Speed of position command 9 in position mode	①The speed value of position 9; ②Parameter unit is rpm.	0~6000
147	Acceleration / deceleration of position command 9 in position mode	①The acceleration / deceleration in position 9; ②The acceleration and deceleration share the same value..	1~1000
148	Peak torque of position command 9 in position mode	①The maximum torque in position 9; ②The value is the percentage of the nominal torque, for example, if you want to set maximum torque value as same as the nominal torque value, the parameter would be 100.	0~400
149	High bit of position command 10 in position mode	①Set the tenth high bit command value in position demo mode; ②The value of position 10 equals to high-bit value×10000+low-bit value. Parameter unit is pulse.	-30000~ 30000
150	Low bit of position command 10 in position mode	①Set the tenth low bit command value in position demo mode; ②The value of position 10 equals to high-bit value×10000+low-bit value. Parameter unit is pulse.	-9999~9999
151	Speed of position command 10 in position mode	①The speed value of position 10; ②Parameter unit is rpm.	0~6000
152	Acceleration / deceleration of position command 10 in position mode	①The acceleration / deceleration in position 10; ②The acceleration and deceleration share the same value..	1~1000
153	Peak torque of position command 10 in position mode	①The maximum torque in position 10; ②The value is the percentage of the nominal torque, for example, if you want to set maximum torque value as same as the nominal torque value, the parameter would be 100.	0~400
154	High bit of position command 11 in position mode	①Set the eleventh high bit command value in position demo mode; ②The value of position 11 equals to high-bit value×10000+low-bit value. Parameter unit is pulse.	-30000~ 30000
155	Low bit of position command 11 in position mode	①Set the eleventh low bit command value in position demo mode; ②The value of position 11 equals to high-bit value×10000+low-bit value. Parameter unit is pulse.	-9999~9999

156	Speed of position command 11 in position mode	①The speed value of position 11; ②Parameter unit is rpm.	0~6000
157	Acceleration / deceleration of position command 11 in position mode	①The acceleration / deceleration in position 11; ②The acceleration and deceleration share the same value..	1~1000
158	Peak torque of position command 11 in position mode	①The maximum torque in position 11; ②The value is the percentage of the nominal torque, for example, if you want to set maximum torque value as same as the nominal torque value, the parameter would be 100.	0~400
159	High bit of position command 12 in position mode	①Set the twelfth high bit command value in position demo mode; ②The value of position 12 equals to high-bit value×10000+low-bit value. Parameter unit is pulse.	-30000~ 30000
160	Low bit of position command 12 in position mode	①Set the twelfth low bit command value in position demo mode; ②The value of position 12 equals to high-bit value×10000+low-bit value. Parameter unit is pulse.	-9999~9999
161	Speed of position command 12 in position mode	①The speed value of position 12; ②Parameter unit is rpm.	0~6000
162	Acceleration / deceleration of position command 12 in position mode	①The acceleration / deceleration in position 12; ②The acceleration and deceleration share the same value..	1~1000
163	Peak torque of position command 12 in position mode	①The maximum torque in position 12; ②The value is the percentage of the nominal torque, for example, if you want to set maximum torque value as same as the nominal torque value, the parameter would be 100.	0~400
164	High bit of position command 13 in position mode	①Set the thirteenth high bit command value in position demo mode; ②The value of position 13 equals to high-bit value×10000+low-bit value. Parameter unit is pulse.	-30000~ 30000
165	Low bit of position command 13 in position mode	①Set the thirteenth low bit command value in position demo mode; ②The value of position 13 equals to high-bit value×10000+low-bit value. Parameter unit is pulse.	-9999~9999
166	Speed of position command 13 in position mode	①The speed value of position 13; ②Parameter unit is rpm.	0~6000
167	Acceleration / deceleration of position command 13 in position mode	①The acceleration / deceleration in position 13; ②The acceleration and deceleration share the same value..	1~1000
168	Peak torque of position command 13 in position mode	①The maximum torque in position 13; ②The value is the percentage of the nominal torque, for example, if you want to set maximum torque value as same as the nominal torque value, the parameter would be 100.	0~400
169	High bit of position command 14 in position mode	①Set the fourteenth high bit command value in position demo mode; ②The value of position 14 equals to high-bit value×10000+low-bit value. Parameter unit is pulse.	-30000~ 30000
170	Low bit of position command 14 in position mode	①Set the fourteenth low bit command value in position demo mode; ②The value of position 14 equals to high-bit value×10000+low-bit value. Parameter unit is pulse.	-9999~9999
171	Speed of position command 14 in position mode	①The speed value of position 14; ②Parameter unit is rpm.	0~6000
172	Acceleration / deceleration of position command 14 in position mode	①The acceleration / deceleration in position 14; ②The acceleration and deceleration share the same value..	1~1000
173	Peak torque of position command 14 in position mode	①The maximum torque in position 14; ②The value is the percentage of the nominal torque, for example, if you want to set maximum torque value as same as the nominal torque value, the parameter would be 100.	0~400

174	High bit of position command 15 in position mode	①Set the fifteenth high bit command value in position demo mode; ②The value of position 15 equals to high-bit value×10000+low-bit value. Parameter unit is pulse.	-30000~ 30000
175	Low bit of position command 15 in position mode	①Set the fifteenth low bit command value in position demo mode; ②The value of position 15 equals to high-bit value×10000+low-bit value. Parameter unit is pulse.	-9999~9999
176	Speed of position command 15 in position mode	①The speed value of position 15; ②Parameter unit is rpm.	0~6000
177	Acceleration / deceleration of position command 15 in position mode	①The acceleration / deceleration in position 15; ②The acceleration and deceleration share the same value..	1~1000
178	Peak torque of position command 15 in position mode	①The maximum torque in position 15; ②The value is the percentage of the nominal torque, for example, if you want to set maximum torque value as same as the nominal torque value, the parameter would be 100.	0~400
179	High bit of position command 16 in position mode	①Set the sixteenth high bit command value in position demo mode. ②The value of position 16 equals to high-bit value×10000+low-bit value. Parameter unit is pulse.	-30000~ 30000
180	Low bit of position command 16 in position mode	①Set the sixteenth low bit command value in position demo mode; ②The value of position 16 equals to high-bit value×10000+low-bit value. Parameter unit is pulse.	-9999~9999
181	Speed of position command 16 in position mode	①The speed value of position 16; ②Parameter unit is rpm.	0~6000
182	Acceleration / deceleration of position command 16 in position mode	①The acceleration / deceleration in position 16; ②The acceleration and deceleration share the same value.	1~1000
183	Peak torque of position command 16 in position mode	①The maximum torque in position 16; ②The value is the percentage of the nominal torque, for example, if you want to set maximum torque value as same as the nominal torque value, the parameter would be 100.	0~400

5.3 Model Code and Motor Synopsis

SM series servo motor		Main parameters				SA series servo drive		
Model code	Motor model	Nominal torque	Nominal speed	Nominal power	Nominal current(A)	SFC	SFC+	380V AC input power
1	SM 080-013-30 LFB	1.3Nm	3000rpm	0.4Kw	2.6	SA3L04C	SA3L06B	SA3H10C
2	SM 080-024-30 LFB	2.4Nm	3000rpm	0.75Kw	4.2	SA3L04C	SA3L06B	SA3H10C
3	SM 080-033-30 LFB	3.3Nm	3000rpm	1.0Kw	4.2	SA3L04C	SA3L06B	SA3H10C
4	SM 110-020-30 LFB	2 Nm	3000rpm	0.6 Kw	4	SA3L04C	SA3L06B	SA3H10C
5	SM 110-040-30 LFB	4 Nm	3000rpm	1.2 Kw	5	SA3L06B	SA3L10B	SA3H10C
6	SM 110-050-30 LFB	5 Nm	3000rpm	1.5 Kw	6	SA3L06B	SA3L10B	SA3H10C
7	SM 110-060-20 LFB	6 Nm	2000rpm	1.2 Kw	6	SA3L06B	SA3L10B	SA3H10C
8	SM 110-060-30 LFB	6 Nm	3000rpm	1.6 Kw	8	SA3L10B	SA3L15C	SA3H10C
9	SM 130-040-25 LFB	4 Nm	2500rpm	1.0 Kw	4	SA3L04C	SA3L06B	SA3H10C
10	SM 130-050-25 LFB	5 Nm	2500rpm	1.3 Kw	5	SA3L06B	SA3L10B	SA3H10C
11	SM 130-060-25 LFB	6 Nm	2500rpm	1.5 Kw	6	SA3L06B	SA3L10B	SA3H10C
12	SM 130-077-20 LFB	7.7 Nm	2000rpm	1.6 Kw	6	SA3L06B	SA3L10B	SA3H10C
13	SM 130-077-30 LFB	7.7 Nm	3000rpm	2.4 Kw	9	SA3L10B	SA3L15C	SA3H10C
14	SM 130-100-15 LFB	10 Nm	1500rpm	1.5 Kw	6	SA3L06B	SA3L10B	SA3H10C
15	SM 130-100-25 LFB	10 Nm	2500rpm	2.6 Kw	10	SA3L10B	SA3L15C	SA3H10C
16	SM 130-150-15 LFB	15 Nm	1500rpm	2.3 Kw	9.5	SA3L10B	SA3L15C	SA3H10C
17	SM 130-150-25 LFB	15 Nm	2500rpm	3.8 Kw	17	SA3L15C	SA3L25C	SA3H25C
18	SM 150-150-25 LFB	15 Nm	2500rpm	3.8 Kw	16.5	SA3L15C	SA3L25C	SA3H25C
19	SM 150-180-20 LFB	18 Nm	2000rpm	3.6 Kw	16.5	SA3L15C	SA3L25C	SA3H25C
20	SM 150-230-20 LFB	23 Nm	2000rpm	4.7 Kw	20.5	SA3L25C	SA3L25C	SA3H25C
21	SM 150-270-20 LFB	27 Nm	2000rpm	5.5 Kw	20.5	SA3L25C	SA3L25C	SA3H25C

Configuration explanation: SFC series suit for low overload, low on-off frequency in unit time, high speed and small load modes; SFC+ series suit for high overload, high on-off frequency in unit time, high speed and large load modes.

Chapter 6 Protective Functions

6.1 Warning List

Table 6-1 Warning list

Alarm code	Name
--	Normal state
1	System initialization error alarm
2	Phase-Z pulse missing
3	Illegal code for encoder signal U/V/W
4	Encoder difference signal error
5	Encoder counter missing error
6	IPM module faulty
7	Main circuit relay disconnected
8	Main circuit overvoltage
9	Main circuit undervoltage
10	Motor (IR^2) temperature alarm
11	Motor phase current gain alarm
12	EEPROM access fault
13	Overcurrent alarm
14	Internal brake resistor overtemperature alarm
15	Drive forbidden abnormal
16	Position offset counter overflow
17	Position command overflow error
18	Torque overload alarm
19	Overspeed or larger offset alarm

6.2 Remedies for Alarms

Table 6-2 Remedies for alarms

Alarm code	Name	Running status	Reason	Processing method
1	System initialization error alarm		Power supply overvoltage	Reduce the power supply voltage.
2	Phase-Z pulse missing		①Z pulse does not exist, encoder faulty. ②Bad cables inhibit. ③Inhibit ground is not connected well. ④Encoder interface circuit faulty.	①Change the encoder. ②Check the encoder interface circuit.
3	Illegal code for encoder signal U/V/W		①Encoder signal U/V/W faulty. ②Bad cable inhibit. ③Inhibit ground is not connected well. ④Encoder interface circuit faulty.	①Change the encoder. ②Check the encoder interface circuit.
4	Encoder difference signal faulty		Connector disconnected.	Check the control power supply
			Encoder faulty.	Change the encoder.
5	Encoder counter missing error		①Encoder faulty. ②Wrong number of encoder lines. ③Encoder disc damaged. ④False signal Z in encoder	Change the encoder.
			Encoder wiring error.	Check wiring.
			Bad grounding.	①Grounding correct. ②Check the condition of inhibit ground.

6	IPM module faulty	Occurs When connected to the main power	①Circuit board faulty.	①Change the servo drive.
		Occurs as operating	①Low supply voltage. ②Overheat.	①Check the servo drive. ②Restart. ③Change the servo drive
			Short-circuit in U,V,W.	Check wiring.
			Bad grounding.	Grounding correct.
			Motor insulation faulty.	Change the servo motor.
			Interference nearby.	①Install a line filter. ②Leave away from interference source.
7	Main circuit relay disconnected	Occurs When connected to the main power	Power supply disconnected.	Check the main power supply.
		Occurs as operating	Motor faulty.	Change the servo motor.
8	Main circuit overvoltage	Occurs When connected to the main power	Circuit board faulty.	Change the servo drive.
			①Low supply voltage. ②Abnormal power supply voltage waveform.	Check the power supply.
		Occurs as operating	Brake resistor wiring disconnected.	Check wiring.
			①Brake transistors damaged. ②Internal brake resistor damaged.	Change the servo drive.
			Insufficient capacity for braking circuit.	①Reduce stop-start frequency. ②Increase acceleration / deceleration time constant ③Reduce the torque limit. ④Reduce the load inertia. ⑤Chang a larger power drive and motor.
9	Main circuit undervoltage	Occurs When connected to the main power	①Circuit board faulty. ②Power supply insurance faulty. ③Soft-start circuit faulty. ④Rectifier failure.	Change the servo drive.
			①Low supply voltage. ②Temporary power failure for more than 20ms.	Check the power supply.
		Occurs as operating	① Insufficient capacity for power. ②Instantaneous power-off.	Check the power supply.
			Radiators overheat.	Check load.
10	Motor (IR^2) over temperature	Occurs as operating	Overcurrent	①Check the parameter is correct or not. ②Change the servo drive.
			Motor overloaded	Chang a larger power drive and motor.
11	Motor phase current gain alarm		Motor overcurrent	Change the servo drive.
12	EEPROM access fault		Chip or circuit board failure.	①Change the servo drive. ②Reset the parameters after repairing.

13	Overcurrent alarm		Short-circuit in U,V,W.	Check wiring.
			Bad grounding.	Ground correct.
			Motor insulation damaged.	Change the servo motor
			Servo drive damaged.	Change the servo drive.
14	Internal brake resistor overtemperature alarm		Main power supply overvoltage.	Reduce the main supply voltage.
			The impedance of the brake resistor is too large.	Reduce the impedance of the brake resistor.
			Motor overloaded	Reduce the load.
15	Drive forbidden abnormal		Disconnect CCW/CW drive forbidden input terminals.	Check the power for wiring and input terminal.
16	Position offset counter overflow	Occurs as operating	①Motor is blocked up. ②Abnormal input pulse.	①Check the mechanical parts of load. ②Check the command pulse. ③Check whether the motor works correctly.
17	Position command overflow error	Occurs When connected to the main power	Circuit board faulty.	Change the servo drive.
		Connect main power and control wire, input command pulse, motor does not operate or with opposite direction	①Wrong wiring of U, V, W. ②Wrong wiring of the encoder cable.	Connect correctly.
			①Zero point changed. ②Encoder faulty.	①Re-adjust the zero point. ②Change the servo motor.
		Occurs as operating	Smaller detection range for position tolerance.	Increase detection range for position tolerance.
			Smaller position proportional gain is.	Increase the gain.
			Insufficient torque.	①Check the torque limit。 ②Reduce the load capacity. ③Change a servo system (including motor and drive) with larger power.
			Higher command pulse frequency.	Reduce the frequency.
			Zero point changed	Re-adjust the zero point.
18	Torque overload alarm		①Wrong Parameters. ②Happen to appear overload.	①Modify the parameters. ②Mechanical maintenance.
19	Overspeed or larger offset alarm	Occurs When connected to the main power	①Control circuit board faulty. ②Encoder faulty.	①Change the servo drive. ②Change the servo motor.
		Occurs as operating	Input command pulse overfrequency.	Set the input command pulse correctly.
			Too small acceleration / deceleration time constant can cause overshoot speed.	Increase the acceleration / deceleration time constant.
			Larger input electronic gear ratio.	Set correctly.
			Encoder faulty.	Change the servo motor.

Chapter 7 Display and Keyboard Operation

The panel is used to display system status, parameters setting and so on which composed by six LED digital tube displays and four buttons (Up, Down, Cancel, Enter). Cancel and Enter separately stand for Backward and Forward, Enter key means enter or determine, Cancel key means quit or cancel; Up key and Down key are separately used to increase or reduce value. They have repeat effect as pressed continuously and the longer the duration time is the higher the repeat speed is.

If the LED display twinkles it means error occurs. The main power supply on while CHARGE lamp turns on and RUN lamp turns on as motor runs.

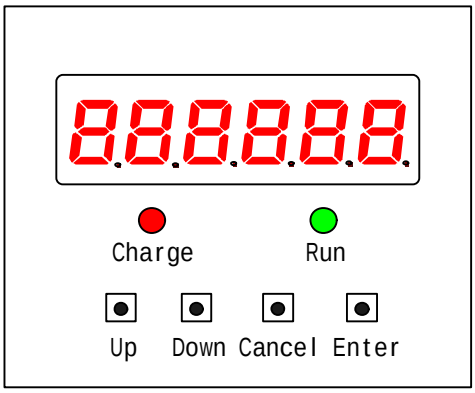


Figure 7-1 Panel

7.1 Layer 1

Users can select 7 operation modes in layer 1 through pressing UP key and DOWN key, press ENTER key to enter layer 2 and CANCEL key return to layer 1 from layer 2.

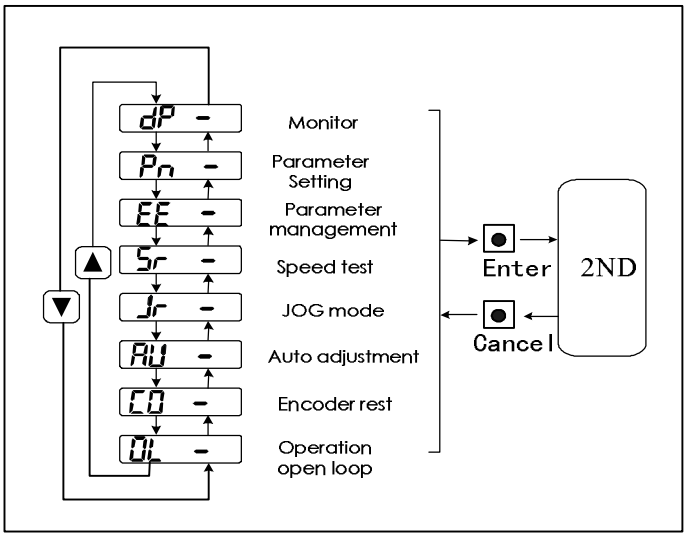


Figure 7-2 Operation selecting diagram

7.2 Layer 2

7.2.1 Monitor Mode

Entering into monitor mode by pressing ENTER key after selecting "dP -" in layer 1. There are 19 displaying statuses. Choose the required monitor mode by UP key and DOWN key firstly and then press ENTER to access to the display status.

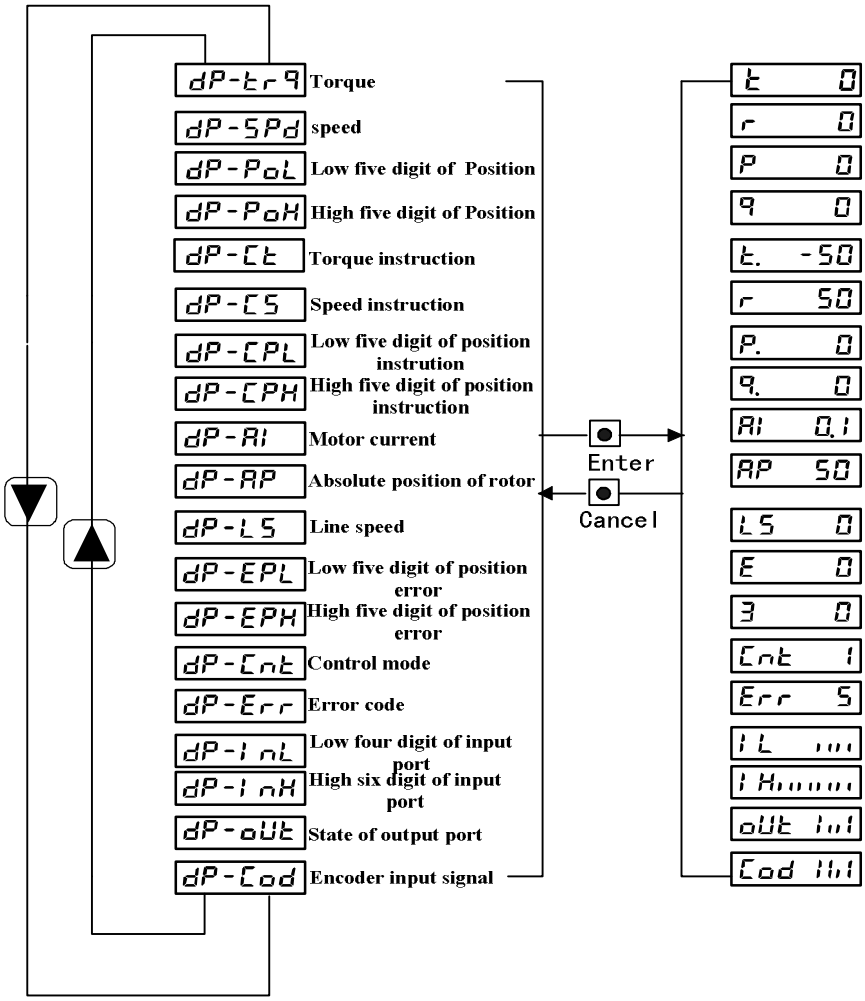


Figure 7-3 Monitor mode diagram

[Note 1] The input pulse equals to the pulse which amplified through the input electronic gear.

[Note 2] Pulse unit is the system pulse unit (10000 pulse /r).Pulse volume is indicated by high 5- bit + low 5-bit:
Pulse volume＝High 5-bit×100000＋Low 5-bit

[Note 3] Control mode: 0-Torque; 1-Speed; 2-Position; 3-JOG; 4-Speed trial running; 5-Auto-correction; 6- Demo (support for Torque/Speed/Position and point-to-point mode).

[Note 4] In the event of reaching 6-bit number (for example: -12345) it would not display prompt character.

[Note 5] Position command pulse frequency is the actual pulse frequency before amplified by the electronic gear. The minimum unit is 0.1 kHz, forward rotation displays a positive number and reverse rotation displays a negative number.

[Note 6] The calculation method for motor current (I)is:

$$I = \sqrt{\frac{1}{3}(I_U^2 + I_V^2 + I_W^2)}$$

[Note 7] The rotor absolute position rotates one cycle relative to the stator, one period means one cycle and the range from 0 to 9999 which has nothing to do with the electronic gear ratio.

[Note 8]

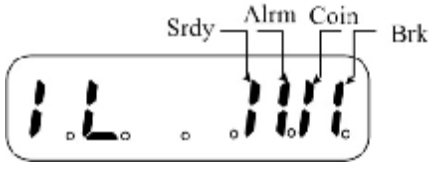


Figure 7-4(a) OUT terminal display(1 for ON， none for OFF)

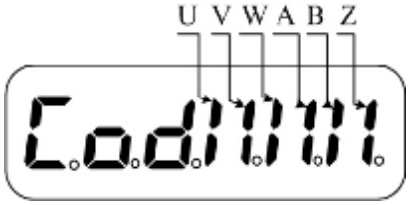


Figure 7-4(b) Encoder signal display(1 for ON， none for OFF)

[Note 9] Operation mode:

"cn-oFF": Main circuit OFF, the servo system stops;

"cn-cH" : Main circuit ON, the servo system stops (ServoEn OFF or alarm);

"cn-on" : Main circuit ON, the servo system works.

[Note 10] "Err -" means no error.

7.2.2 Parameter Setting

Enter into monitor mode by pressing ENTER after selecting "Pn-" in layer 1. Choose the parameter code by pressing UP key and DOWN key, modify the parameter value by pressing UP key or DOWN key. Pressing UP key or DOWN key once, the parameter will increase or decrease 1, and maintain pressing the button, the parameter can increase or the reduction continuously. The right side LED digital tube decimal point lightens as the parameter is being modified and it will disappear while pressing ENTER, the modified value will be reflected to the operation immediately, continuously pressing UP key or DOWN key to modify the parameter, it will return to the parameter selection status by pressing CANCEL after completing the modify. Press CANCEL to restore to the origin and return to the parameter selection status as the modifying value you are not satisfied.

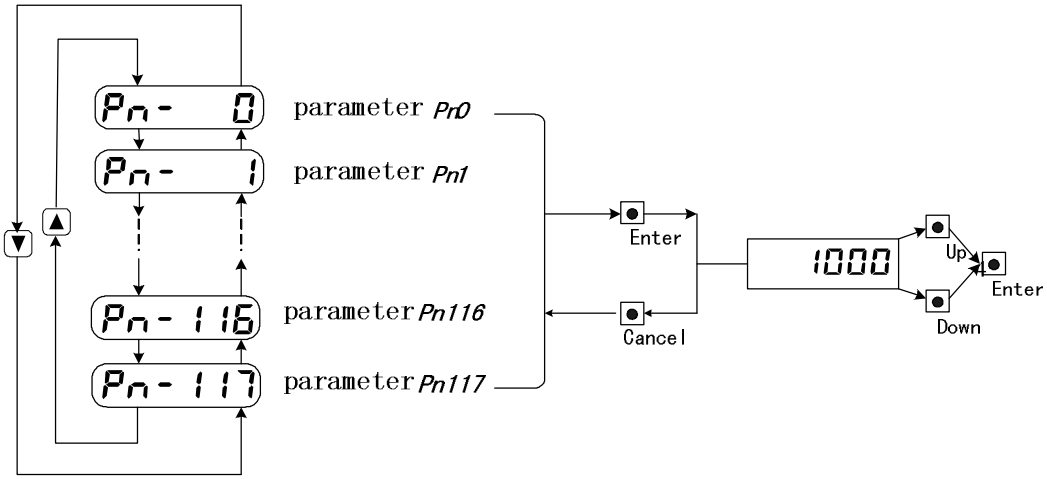


Figure 7-5 Parameter setting operation diagram

7.2.3 Parameter Management

Parameter management is mainly used to deal with the operation between memory and EEPROM, select the parameter management mode by pressing ENTER after selecting "EE-" in layer 1. Firstly press UP key and DOWN key to select the operation mode. Take "write parameter" for example, firstly, select "EE-SRO", then presses ENTER, it will display "Start" which means that the parameter is being wrote into EEPROM, after 1 or 2 seconds, it will display "FINISH" as the operation succeeds, otherwise, the LED will display "ERROR", at last, press CANCEL to return to the operation selection status.

- EE-SR0 Write parameter expresses saving data to EEPROM from table. Users only modify the parameter value and the original value will be restored as power turns on next time. Executing the Write parameter operation and writing the parameter to EEPROM from table will change the parameter value permanently.

- EE-LD0 Read parameter expresses reading the data from EEPROM. This process will carry out once automaticly and the parameter from table is the same value as from EEPROM at the beginning. When users adjust the parameter, the data from table will be also changed, executing Read parameter operation will read the data from EEPROM to the parameter table again and restore to the power on status for the unsatisfied or error parameter setting.
- EE-SR1 Backup parameter expresses writing the value into the backup area of EEPROM. EEPROM who divided into data area and backup area can store two sets of parameters. The system power turns on, Write parameter and Read parameter operation are in the parameter area of EEPROM as the Backup parameter and Restore backup are in the backup area of EEPROM. During the process of setting parameters, if users want to modify it without one set of satisfied parameter, Backup parameter operation is carried out and the memory parameter is saved to the backup area of EEPROM firstly and then modify the parameter, for the poor effect, the Restore backup operation is used to read the parameter stored at the last time from the backup area of EEPROM to the parameter table and then modify parameters again.
- EE-LD1 Restore backup expresses reading the data from the backup area of EEPROM to the parameter table. This operation will not write the data into EEPROM, so it will also read the date from the parameter area of EEPROM. Write parameter operation is also needed to be carried out as users want to permanently use the parameter from the EEPROM backup area.
- EE-dEF Restore default value expresses the drive read all default value from the memory and write into the parameter area of EEPROM, the default parameter would be effective at the next power on operation.
  All parameters are restored to status at delivery by using this operation for abnormal working.

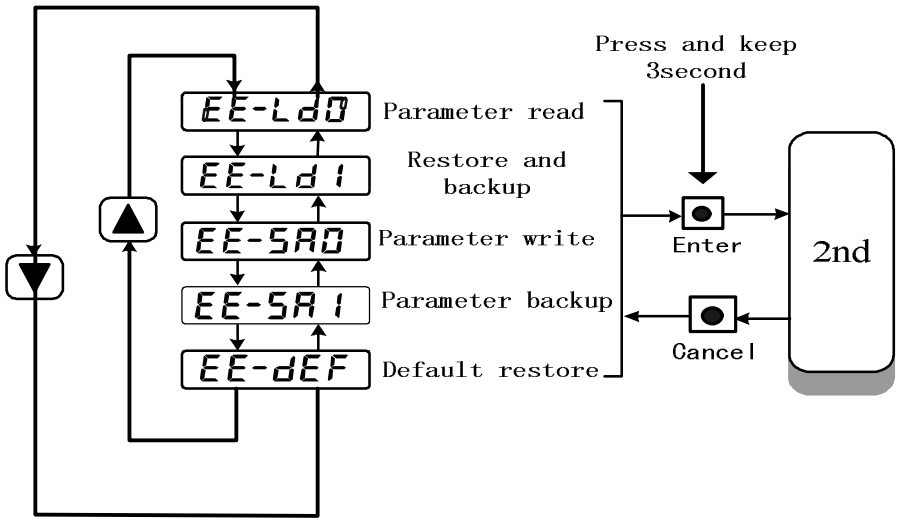


Figure 7-6 Parameter setting operation diagram

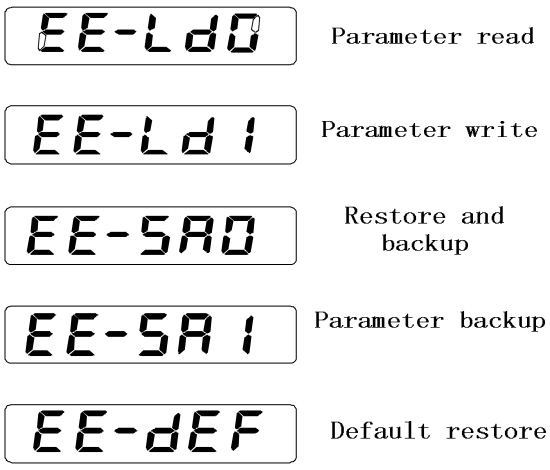


Figure 7-7 Parameter definition

7.2.4 Speed Trial Running

Entering into monitor mode by pressing ENTER after selecting "Sr -" in layer 1. The symbol of speed trial running is "S", unit is r/min. Users can adjust speed command by pressing UP key and DOWN key, motor would run at the selected speed.

Figure 7-8 Operation diagram of the speed testing mode

7.2.5 JOG Running

Entering into monitor mode namely crawl mode by pressing ENTER after selecting "Jr -" in layer 1. The symbol of JOG running is "J", the unit is r/min. In JOG control mode, press UP key and maintain the status, the motor will run at JOG speed, release UP key, the motor will stop and maintain zero-speed; press DOWN key and maintain the status, the motor will run at JOG speed, release DOWN key, the motor will stop and maintain zero-speed. JOG speed is set by parameter PN42.

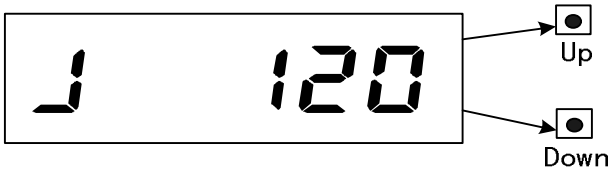


Figure 7-9 Operation diagram of JOG mode

7.2.6 Analog Auto-zero

Drive detects speed analog zero-bias automatically (or torque analog zero-bias), writes the zero-bias value to PN19 (or PN16) and restores it in EEPROM by using this operation. Entering into monitor mode namely crawl mode by pressing ENTER after selecting "AU -" in layer 1. After automatic zero-bias setting, users can set zero-bias manually.

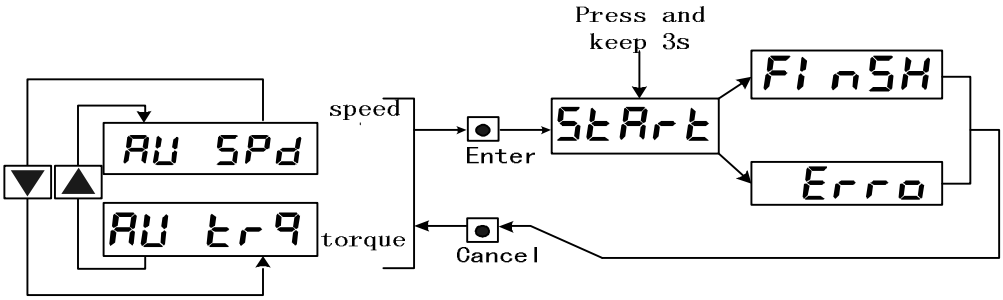


Figure 7-10 Analog Zero-bias Setting

Chapter 8 Function Description

8.1 Grounding

Connect the protective grounding terminal of servo drive and control box to avoid electrocution, the servo drive and motor should be connected to earth correctly. As the servo drive uses the PWM technology to provide power for servo motor through power tube, the drive and wires may be affected by the switching noise, for the purpose of confirming to EMC standard, the grounding line should be as thick as possible and the grounding resistance should be as small as possible.

8.2 Mechanical Brakes

Mechanical brake (maintain brake) is used to lock the vertical or tilt table which connects with motor, preventing table from falling off as the power OFF. In order to realize this function, you need to select the motor with maintain brake. The brake can not be used to slow down speed or stop the machine movement but only to maintain the table.

Figure 7-3 is the brake connection diagram, the mechanical brake release signal(BRK) from drive can be used to control the brake. Attention ,brake power should be provided by the customer and have enough capacity. It is suggested that a surge absorber should be installed to suppress surge voltage which caused by relay on or off action. The diode can be used as a surge absorber, but it may cause a little brake delay.

Figure 7-4 is the mechanical brake action time-series under normal circumstance as the motor completely stops. At this moment, motor must be continually electrified to maintain the position, the brake turns from release to brake and after a period of time (determined by parameter PN7) to cut off the power supply.

Figure 7-5 shows in the running process the motor current is cut off at speed larger than 30r/min while the brake maintains release condition, it will brake after delaying some time. All of measures are carried out in order to avoid damaging brake as the motor slow down and the mechanical brake run. The delay time is selected as the smaller value between PN7 and PN8.

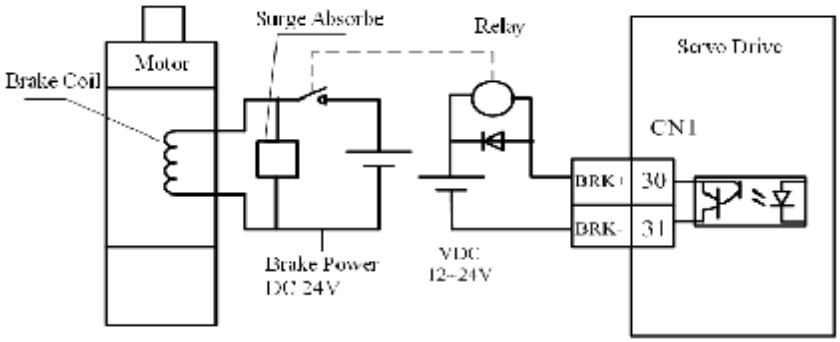


Figure 8-1 Mechanical Brakes Connection Diagram

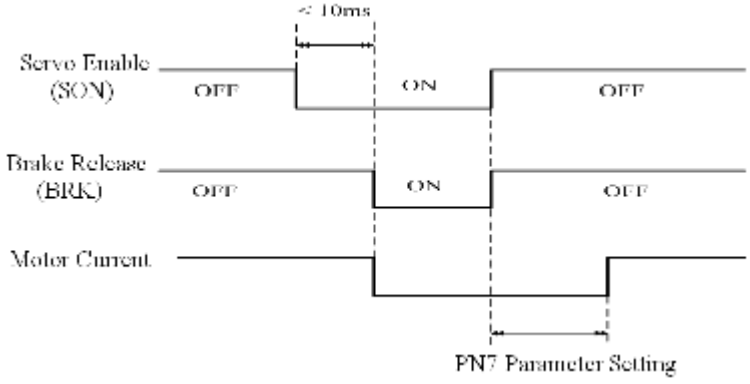


Figure 8-2 Mechanical Brake Action Time-series As Motor Stopping (motor speed<30r/min)

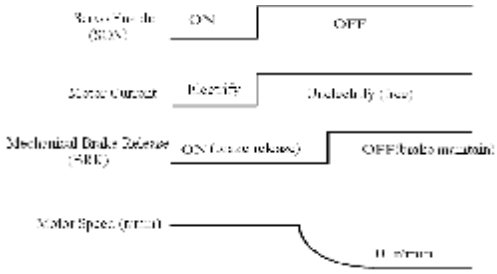


Figure 8-3Mechanical Brake Action Time-series As Motor Running

8.3 Dynamic Electronic Gear

Users can switch the electronic gear ratio by inputting control signals during the operation process. The function is that with a lower peak output pulse frequency for the host machine, as the gear ratio is set smaller/ larger we will get a higher/lower position resolution and lower/higher peak speed. In order to get a higher position resolution and higher peak speed, we have set two electronic gear ratios to control the servo system, users can switch dynamic electronic gear to get a perfect performance.

For example, users can set the first electronic gear ratio to a smaller value and the second ratio to a larger value for CNC machine. In machining process, a normal speed is enough, users can set the first gear ratio to a smaller value in order to get a higher position resolution. While in fast moving process, users can select a proper second gear ratio and switch the ratios through the host machine in order to get a higher moving speed.

8.3.1 Simple Connection

- Connect main circuit terminal R, S, T to three-phase AC 220V(connect to terminal R, S to single-phase AC 220V);
- Connect control circuit terminals r, t to single-phase AC 220V;
- Connect encoder signal connector CN1 with motor correctly;
- Connect control signal connector CN2 as the figure shows.

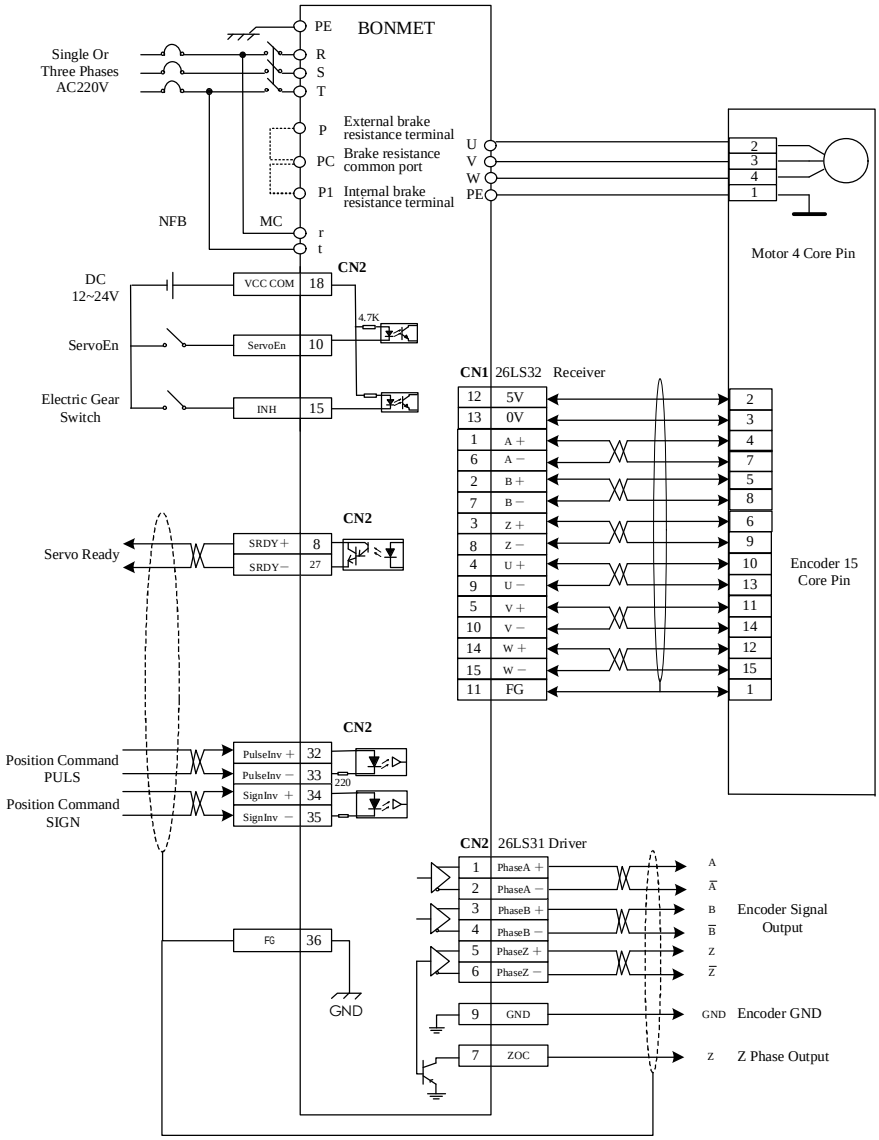


Figure 8-4 Dynamic electronic gear

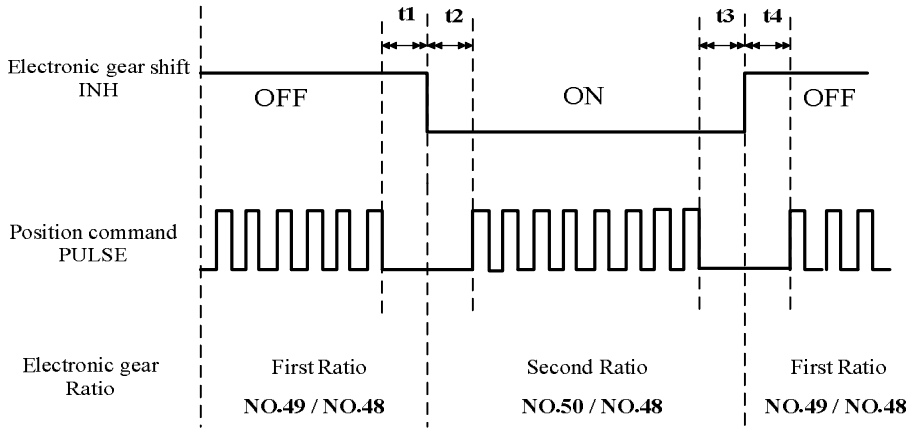
8.3.2 Operation

Set the parameters as following table and write data to EEPROM

Number	Function	Value	Default value
PN4	Control mode	2	1
PN49	first electronic gear numerator	Set by users	20
PN50	second electronic gear numerator	Set by users	20
PN48	Electronic gear denominator	Set by users	20
PN47	Smooth filter for position command	0	0
PN51	Dynamic electronic gear enable	1	0

Users can switch the electronic gear ratios by controlling input terminal INH. The electronic gear ratio is PN49/PN48 as INH is OFF while the value is PN50/PN48 as INH is ON.

The switch of electronic gear must meet the timing diagram, the pulse should not be sent fore or after 10ms as inputting INH signal.



t1，t2，t3，t4>10mS

Figure 8-5 Timing diagram

8.4 Attention Notes

·The frequency of starting and stopping is restricted by servo drive and motor and it must satisfy the following conditions.

1) The allowed frequency for servo drive

Used in the occasion of high start and stop frequency, the drive should be confirmed advance whether in the permitted range or not. The permitted frequency range is different with different motor types, capacity, load inertia and speed. Firstly, the acceleration and deceleration time must be set to prevent from larger renewable energy (in the position control mode, set the acceleration and deceleration time for host controller output pulse or parameter PN47; in the speed control mode, set parameter PN34 and PN35). Under the condition of the load inertia M times to the motor inertia, motors' allowed start and stop frequency is showed as follows:

Load inertia times	The allowed start and stop frequency
m≤3	＞100times /minutes; acceleration and deceleration time 60mS or less
m≤5	60 to 100times/minutes; acceleration and deceleration time 150mS or less
m＞5	＜60 times /minutes; acceleration and deceleration time more than 150mS

If it still does not satisfy the request, users can reduce the internal torque limit (parameter PN25, PN28) and slowing down the motors' highest rotation speed (parameter PN42).

2) The servo motors' allowed start and stop frequency is different from load condition and running time.

- Generally, the load inertia is less than 5 times, in the condition of large load inertia, it may cause over-voltage or abnormal brake in deceleration, the following suggestions can be carried out to deal with the problems:
  ① Reduce internal torque limit (parameter PN25,PN28);
  ② Slow down the motors' limited speed(parameter PN42);
  ③ Install an extra renewable device (an external braking resistance), the connection can be found in chapter 3.
- Encoder power supply is installed in the servo drive, the output voltage must be maintained at 5V±5% to ensure normal operation. Voltage may be loss as using long cable. In this case, please use a multi-core line to connect with the encoder power supply to reduce the pressure drop.

8.5 Torque Overload Alarm Function

In order to prevent accidents in some occasions, we have designed the torque overload alarm. The servo system will check the present torque, if the value is larger than the selected parameter for a period, the drive would alarm EER-18. Set PN23>0 as users need to use torque overload alarm function, reasonable settings(PN22,PN23)will help to send

alarm as soon as the accident happens.

8.6 Common Questions

8.6.1 Restore Default Parameters

Please use restores default parameter function in the following conditions:

- Inappropriate parameter brings the non-normal operation.
- The power turns off which causes the system to restore default parameter automaticly when saving parameters, but the PN1 is not matched with the drive and motor.
- Servo drive need change the original motor which has the different type with new motor.

Steps to restore default parameter:

1) Check the model of the servo drive and motor, error type of drive will cause the damagement.
2) Set PN2 to 28977;
3) Write the default value into EEPROM. Enter into the parameter management mode by pressing ENTER after selecting "EE-" in layer 1. Firstly use UP key and DOWN key to select the operation mode from 5 modes. Select "EE-SRO", then press ENTER and remain over 3 seconds ,it will display "Start" as the parameter is being wrote into EEPROM, after 1 or 2 seconds, it will display "FINISH" as the write operation succeeds, otherwise, the LED screen will display "ERROR".
4) Turn off the power after the last step has finished, and then re-power the operation winds up.

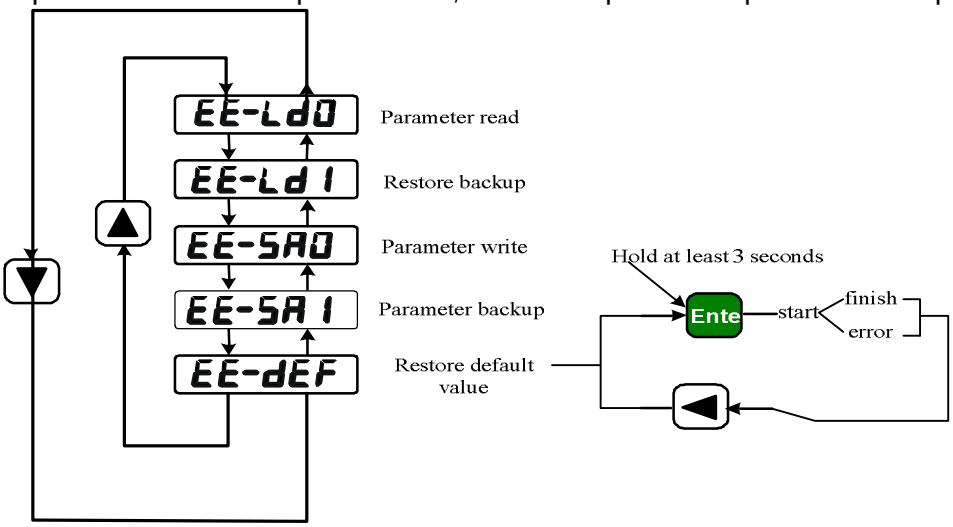


Figure 8-6 Operating diagram

8.6.2 Frequent Appearances Err-2、Err-3、Err-5

The alarm expresses that there are problems for the optical encoder and wiring. Please deal with the following things firstly:

- Wiring and plug are connected correctly or not;
- Inhibit lines are well welded;
- Grounding terminal PE is well or not;
- The grounding terminals of motor and drive are connected perfectly;
- Too long cable may cause excessive pressure drop, please change it with 5V and 0V power of multi-cored wire encoder.
- Do not put cables with heavy-current cables in the same wire channel.

Please contact with us if the above measures are invalid.

8.6.3 POWER Lamp OFF

If Digitron can display data and no alarm appears, but the POWER light is OFF and drive can not run, mostly the reason is that the internal brake circuit malfunctions forcing the drive into the protection state, please contact us for help.

8.7 Relevant Knowledge

8.7.1 Position Resolution and Settings for Electronic Gear

The position resolution (an impulse stroke △l) is decided by the traveling schedule per round (△S) for servo motor and encoder feedback pulse per round (Pt).

△l = △S/Pt

△l: a pulse travel (mm);

△S: traveling schedule per round for servo motor (mm/r);

Pt: encoder feedback pulse per round (pulse/r).

Because there are four doubling circuits in the system, therefore, Pt=4C, C is encoder line per round. In the system, C=2500 line/round, therefore Pt=10000 pulse/round.

The dictate pulse can be transformed to position control pulse by multiplying the electronic gear ratio G, therefore a dictate pulse traveling schedule △l* is expressed:

△l* = (△S/Pt) *G

In the formula, G= dictate pulse division member/command pulse division denominator.

8.7.2 Lag Pulse in Position Control Mode

In the position control mode, between the dictate pulse and the feedback pulse there is a differential value called the lag pulse. This value accumulates in the position deviation counter, it has following relationships with command pulse frequency, the electronic gear ratio and the position proportional gain:

ε= (f* *G)/Kp

In the formula, ε: Lag pulse (pulse); f*: dictate pulse frequency (Hz); Kp: Position proportional gain (1/S); G: Electronic gear ratio.

[Note] The relations above are obtained when position forward feed gain is 0%, if position forward feed gain >0%, the value will be smaller than the predicted one above.