SHENZHEN ECON TECHNOLOGY CO. LTD

ECON-G series AC Servo Drive
User's Manual

2015 (V1.0), applicable to drives of software version 1.19 or above

Safety Precautions

Before product storage, installation, wiring, operation, check or maintenance, users must be familiar with and observe the following important notes to ensure safety during use of the product.

1 ELECTRIC SHOCK INJURY WARNING

⚠ Warning
⚠ When the driver is powered on, do not open the housing of the machine for fear of electric shock.
⚠ When the housing is open, do not power on the driver for fear of touching any exposed high-voltage part.
⚠ In maintenance of the driver, wait for at lest five minutes after cutting off the power, and detect both ends of the high-voltage capacitor using a voltmeter. The maintaining operation is allowed only when it is confirmed that the safe voltage range is reached.
⚠ Power on only after reliable installation of the driver.
⚠ Servo driver and servo motor must be reliably grounded.
⚠ Do not touch the driver with wet hands for fear of electric shock.
⚠ Wrong voltage or power supply polarity may cause an explosion or operational accidents.
⚠ Ensure that the wire is properly insulated to avoid squeezing the wire and electric shock.

2 WARNING OF DAMAGE TO EQUIPMENT

⚠ Warning
⚠ Do not directly connect power to the U, V or W output ends of the driver for fear of damaging the driver.
⚠ The servo motor and servo driver should be directly connected. Do not connect the U, V or W output ends of the driver to any capacitive element (e.g. noise suppression filter, pulse interference limiter, etc.) for fear of improper work of the driver.
⚠ Connect the input end of the driver to a compliant power supply as required.
⚠ Please verify the correctness and reliability of the cable connections before energizing.
⚠ Please purchase and use motor as required, or damage to the driver or motor may occur.
⚠ The rated torque of the servo motor should be higher than the effective continuous load torque.
⚠ The ratio between the load inertia and servo motor inertia should be less than the recommended value.

3 FIRE WARNING

⚠ Warning
⚠ The driver should not be installed on the surface of a combustible and should be kept away from flammable materials. Otherwise, a fire accident may occur. ⚠ Do not use it at a place which is damp, full of corrosive gas or flammable gas for fear of a fire. ⚠ When any abnormal situation occurs while the driver operates, please immediately cut off the power for repair. Long-time overloaded operation of the driver may cause damage and fire.

4 ENVIRONMENTAL REQUIREMENTS

⚠ Warning	
Parameter	Conditions
Humidity	≤90% (no condensation)
Operating temperature	0 to +40 (non-condensing)
Storage temperature	-40 ~ +55°C
Elevation	Less than sea level 1,000m
Vibration	Less than 0.5G (4.9m/s ^{2}) 10-60HZ (non-continuous operation)
Air environment	No corrosive, flammable gas or oil mist

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Chapter I Product Inspection and Installation

1.1 Product Inspection

The product has been subject to the complete functional test before delivery. In order to prevent the product from anomaly caused by negligence in transportation, please carefully check the following items after unpacking.

1. Check whether the models of the servo drive and servo motor are the same as the ordered model.

2. Check whether the servo drive and servo motor are damaged and scratched. If damage is caused during transportation, wiring and power supply will be prohibited:

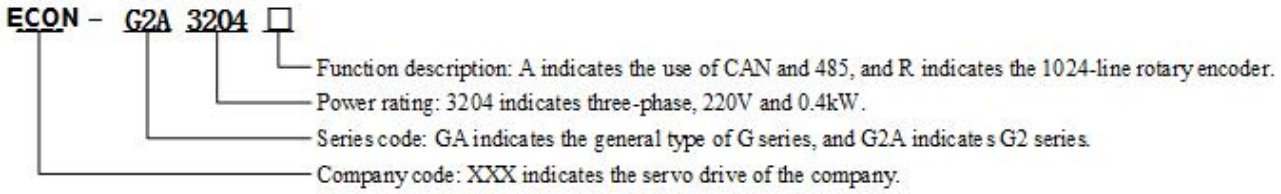
3. Check whether any component of the servo drive and servo motor is loose and whether any screw is loose or unlocked or falls off;

4. Check whether the rotor shaft of the servo motor can be rotated smoothly in a manual manner. The motor with brake cannot be rotated directly.

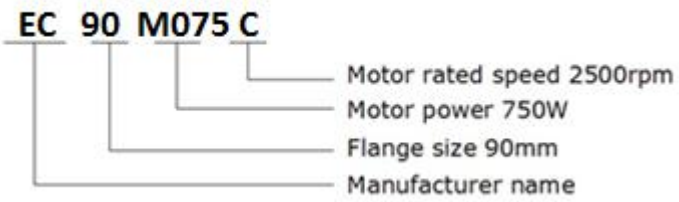
Immediately contact the dealer in case of any failure or anomaly of the above items.

1.2 Description of Servo Drive Model

Naming of G series servo drives:



1.3 Servo motor Model



1.4 Installation of servo driver

1.4.1 Installation environment conditions

The installation environment of the servo drive has direct effects on the normal functions and service life and thus must meet the following conditions.

1. Operation temperature: 0-40 ; operation humidity: below 40% to 80% (non-condensing). Storage temperature: -40 to 50 ; storage humidity: below 93% (non-condensing).

2. Vibration: below 0.5G.

3. Prevent rain or moisture.

4. Prevent direct exposure to sunlight.

5. Prevent erosion of oil mist and salt and intrusion of corrosive liquid, gas, dust, cotton fibers and metal chippings.

6. Keep the product away from radioactive materials and combustibles.

7. If several drives are installed in the control cabinet, pay attention to the locations and reserve sufficient space to facilitate air circulation and heat dissipation. Install a cooling fan to reduce the ambient temperature of the servo drive. The working temperature should be below 40 for long-time safe operation.

8. If the vibration source (such as punch) nearby is inevitable, please use the vibration absorber or anti-vibration rubber gasket;

9. The interference equipment nearby may cause misoperation of the servo drive due to interference to the power line and control line. Anti-interference measures such as the noise filter can be adopted to ensure normal operation of the drive. However, the leakage current will be increased by the noise filter, and an isolation transformer should be installed at the power input end of the drive.

1.4.2 Installation method

The servo drive should be installed in the vertical direction, with the top upward to facilitate heat dissipation. Tighten M5 fixing screws on the back of the servo drive during installation.

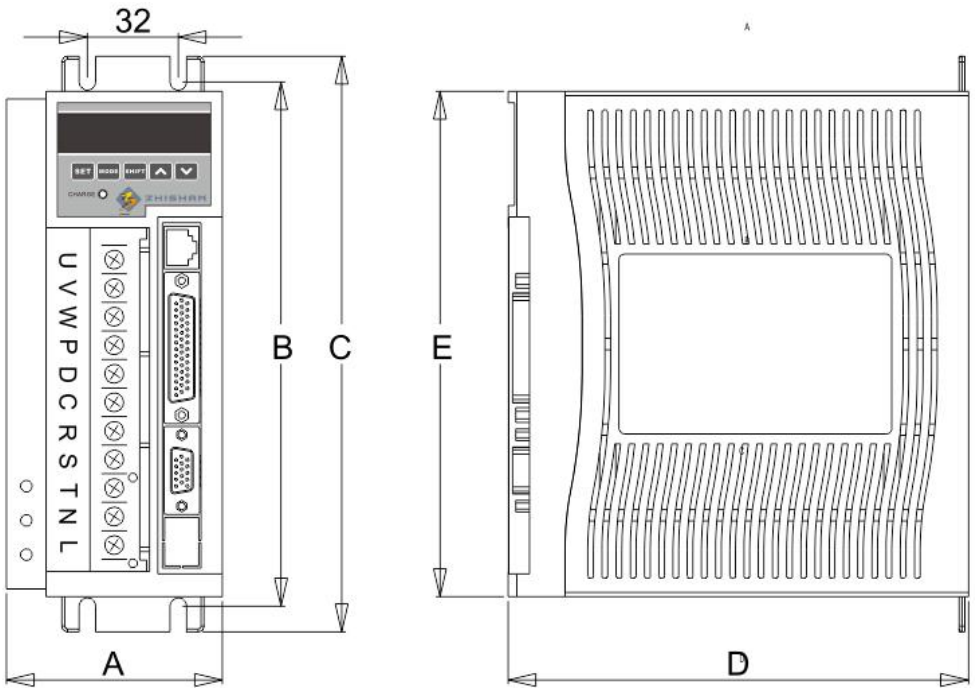
Refer to the figure for the installation spacing between servo drives and also between the servo drive and other equipment. In order to guarantee the performance and life of the drive, please reserve sufficient installation spacing as possible as practical.

The cooling fan must be installed in the electrical control cabinet to cool the radiator of the servo drive with air flow in the vertical direction.

The servo drive must be prevented from dust or iron chippings during installation of the electrical control cabinet.

1.4.3 Mounting dimensions

The installation and fixing dimension drawing of G series is as follows:



G-B series	A mm	B mm	C mm	D mm	E mm
ECN-G3207B	77	183	202	162	178
ECN-G3210 B ECN-G3215 B	80	183	202	191	178
ECN-G3230 B	93	183	202	191	178

1.4.4 Installation and stabilization

The four screws at the back of the driver should be tightened.

1.4.5 Installation clearance

Required clearance between the driver and control cabinet box and between other electronic equipment should be left. Minimum clearance requirements are shown in Figure 1-3.

1.4.6 Ventilation and heat dissipation

If more than one driver needs to be provided, the cooling requirements for each of them should be taken into account. Cooling fan should be provided in the electrical control cabinet, ensuring that there is wind to cool the driver at the vertical direction. The minimum clearance requirements for this purpose are shown in Figure 1-4.

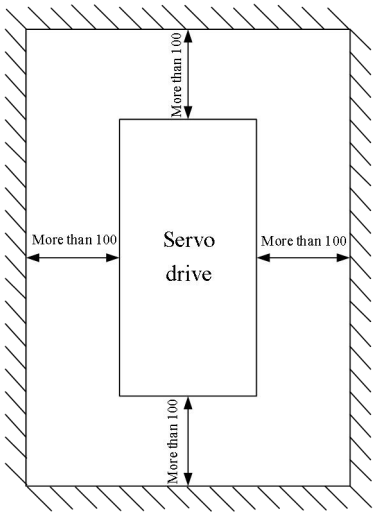


Figure 1-3 Minimum Installation Clearance Requirements

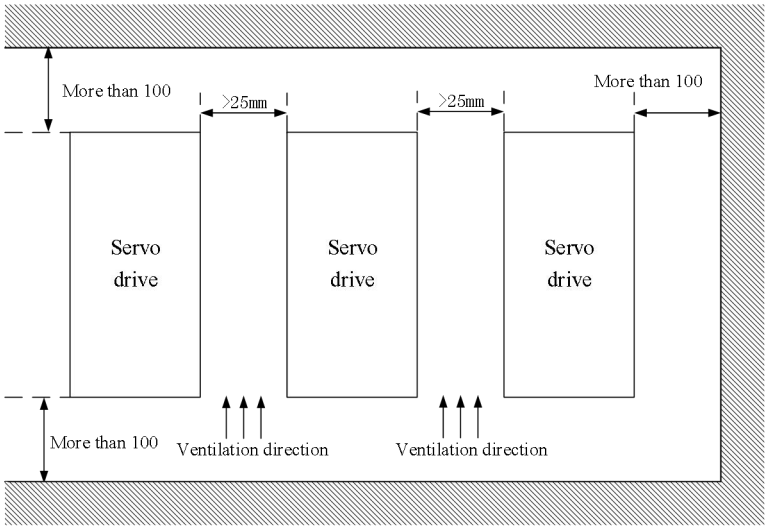


Figure 1-4 Minimal Installation Clearance and Cooling Requirements for Multiple Drivers

1.5 Installation of servo motor

1.5.1 Installation method

Horizontal installation: To avoid water, oil or liquid from flowing into the port of motor line, the cable outlet should be provided at the bottom

Vertical Installation: If the motor shaft is provided upward and a reducer is equipped, measures to prevent grease of the reducer from entering into the motor via the motor shaft.

1.5.2 Installation precautions

1. When the pulley is installed and removed, the motor or motor shaft must not be knocked with a hammer to prevent damage to the motor bearing and encoder. Instead, the pulley should be removed with the spiral pulling tool.

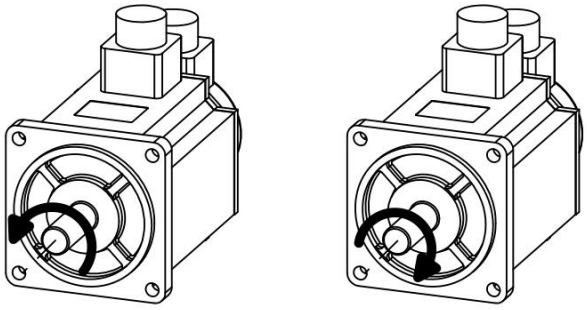
2. The motor shaft should have sufficient extension; otherwise, the motor may vibrate during operation.

3. Use loose washer to fasten the motor.

4. Do not apply excessive axial or radial force against the motor. A flexible coupling is recommended for the connection.

1.6 Determination of motor rotation direction

In this manual, the motor rotation direction is defined as follows: when you face the stretched part of the motor shaft, if the rotation axis rotates counterclockwise, it is called positive rotation; otherwise, it is negative rotation. See Figure 1-5.



CCW (counterclockwise) CW (clockwise)

Figure 1-5 Rotation Direction of Motor

Chapter II Wiring

2.1 Wiring Instructions and Precautions

1. Wiring materials should meet the wire specifications;
2. The command cable should be less than 3m long, and the encoder cable should be less than 20m long;
3. Check whether the power supply and wiring of R, S, T, L and N are proper. It is prohibited to connect 380V power supply;
4. The phase sequence of the output terminal U, V and W of the motor must correspond to the corresponding terminals of the motor. In case of improper wiring, the motor may fail or galloping may be caused. The motor must not be reversed by changing the three terminals. This is completely different from the asynchronous motor;
5. Ensure reliable one-point grounding.
6. The absorption diode of the output signal relay should be connected properly; otherwise, signal output will fail.
7. In order to prevent misoperation caused by noise, use the isolation transformer, noise, etc. for the power supply.
8. Keep the spacing between power lines (power cores, motor lines and other strong current circuits) more than 30cm. Power lines must not be set in the same wiring tube.
9. Please provide a non-fuse circuit breaker to promptly cut off the external power supply in case of drive failure.

2.2 Descriptions of Terminals

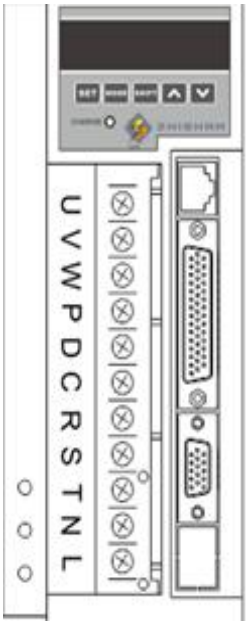


Table 2.1 Descriptions of terminals of driver panel

Terminal	Functions	Precautions for Use
U, V and W ⏚	Power terminal and grounding terminal of motor	Corresponding to the motor terminal U, V and W.
R S T	Terminal of main power supply	3-phase or single phase AC 220V (-15% to 10%, 50/60Hz),if the power supply is single phase ,connect R T ,S no need connect
L N	Terminal of control power supply	Single-phase AC 220V (-15% to 10%, 50/60Hz)
P D C	Terminal of braking resistor	Connect the external braking resistor between D and P When the internal braking resistor is used, short-circuit D and C (D and C have been short-circuited in the factory).
CN1	Input and output terminal	Pay attention to the terminal definitions. See 2.2.2 of the Specifications.
CN2	Terminal of motor encoder	Pay attention to the terminal definitions. See 2.3 of the Specifications.
CN3	RS232 Communication terminal	Pay attention to the terminal definitions. See 2.2.1 of the Specifications.

Figure 2-1 DriverTerminal Blocks

As shown in Figure 2-1, the power indicator shows whether the power is connected. If the power indicator is still on, it means that electricity remains in the capacitance. Please do not open the housing or start wiring operations in order to avoid electric shock. Buttons and nixie tubes are components for settings and display. Refer to Table 2.1 for designations of other terminals in the driver panel and their respective functions.

2.2.1 RS232 communication and connection terminal CN3 (for PC)

The signal name and function of the communication connector are as follows:

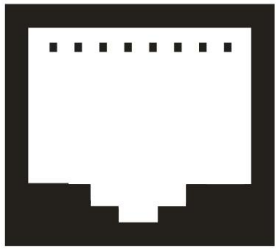


Fig. 2-2 Communication Interface

Terminal No.	1	2	3	4	5	6	7	8
CN3		DGND				232-R1OUT	VCC	232-T1IN

2.2.2 Configuration of CN1 terminal

Figure 2-3 shows the configuration of the upper computer communication terminal CN1. CN1 is a 44-pin socket.

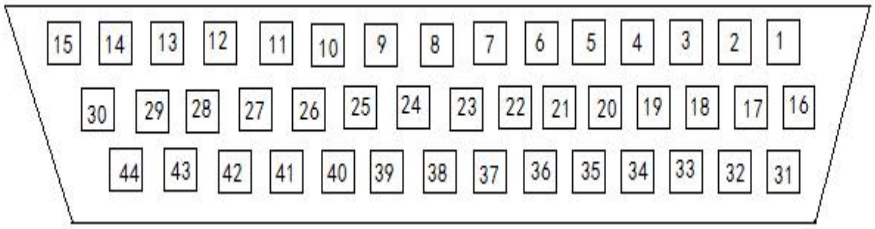


Figure 2-3 Upper PC communication terminals (facing the weld piece of plug)

2.2.3 CN2 functional descriptions

Table 2.2 CN2 functional descriptions of upper PC communication terminals

Definition	Terminal No.	Signals	I/O mode	Functions
COM+	18	Anode of power supply of control signal input and output		Anode of the power supply of input terminal, used for driving the photoelectric coupler of the input terminal, DC12-24V, with the current no less than 100mA.
P24V+ P24V-	44 43	24VDC power supply for external components		The power supply for external components DC24V 2V current 100mA
DI1 DI2 DI3 DI4 DI5 DI6 DI7 DI8	10 14 12 13 16 17 15 11	Control sequence of input IO port command	Type1	Input IO command control sequence. The input IO function involves the parameters P0-06 and P1-06 to P1-09. Factory default: DI1: servo enabling SON Note: the SON signal is controlled according to the parameter P0-06. In the default mode, SON_ON appears at low level, and SON_OFF appears at high level. DI2: reserved DI3: reserved DI4: reserved DI5: single-end analog control direction IO DI6: mode switching DI7: SC1 (speed option 1) DI8: SC2 (speed option 2)

DO1+ DO1- DO2+ DO2- DO3+ DO3- DO4+ DO4-	8 25 26 27 28 29 30 31	Control sequence of output IO power command	Type2	Output IO command control sequence. The parameter P1-07 is involved in output inversion. Factory default: DO1: servo readiness signal output SRDY; DO2: servo alarm signal output ALM; DO3: In the position mode, the default is the positioning output COIN; In the speed mode, the default is to reach the speed. DO4: mechanical brake release BRK
IN-PS IN-DS PULS+ PULS- SIGN+ SIGN-	41 42 32 33 34 35	Pulse string input sequence	Type3	IN-PS/IN-DS is the positive end of single-end pulse input and can be connected to the 12-24V power supply, and PULS-/SIGN- is the negative end of single-end pulse input. PULS+/SIGN+ is the positive end of differential pulse input. PULS-/SIGN- is the negative end of differential pulse input. When the 5V single-end pulse input is used, PULS+/SIGN+ can be used as the positive end and PULS-/SIGN- can be used as the negative end.
SAIN AGND AGND AGND AS+ AS-	21 24 22 23 20 19	Analog control sequence	Type4	SAIN/AGND is used as the single-end input of analog control, and the factory default voltage range is 0-10V. AS+/AS-/AGND is used as the differential input of analog control, and the factory default voltage range is from -10V to 10V.
A+ A- B+ B- Z+ Z-	1 2 3 4 5 6	Encoder feedback series	Type5	A+, A-, B+, B-, Z+ and Z- are used for the frequency-dividing output of encoder feedback, which will be provided for the host, and can be set according to the parameter P1-07 and P2-13.
CZ DGND	7 9		Type6	CZ/DGND is used for Z signal output of the open circuit of the collector, which will be provided for the host.

2.3 Motor encoder terminal CN2

2.3.1 Configuration of CN2 terminal

Figure 2-4 shows the configuration of the motor encoder terminal CN1. CN1 is a 15-pin socket.

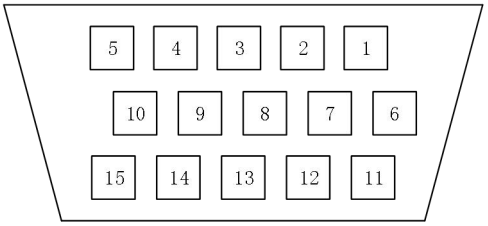


Figure 2-4 Motor encoder terminal (facing the weld piece of plug)

2.3.2 CN1 functional descriptions

Table 2.3 Functional descriptions of motor encoder terminal CN1

Terminal No.	Signals	Code	Functions
6	Power output	+5V	The servo motor photoelectric encoder uses +5 V power supply; when the power cable is long, use multi-core lines for parallel connection.
1	Power supply	GND	
2	Encoder A + input	A+	Connected to servo motor photoelectric encoder A+ phase
3	Encoder A - input	A-	Connected to servo motor photoelectric encoder A- phase
4	Encoder B + input	B+	Connected to servo motor photoelectric encoder B+ phase
5	Encoder B - input	B-	Connected to servo motor photoelectric encoder B- phase
10	Encoder Z + input	Z	Connected to servo motor photoelectric encoder Z+ phase
15	Encoder Z - input	Z-	Connected to servo motor photoelectric encoder Z- phase
14	Encoder U + input	U+	Connected to servo motor photoelectric encoder U+ phase
9	Encoder U - input	U-	Connected to servo motor photoelectric encoder U- phase
13	Encoder V + input	V+	Connected to servo motor photoelectric encoder V+ phase
8	Encoder V - input	V-	Connected to servo motor photoelectric encoder V- phase
12	Encoder W + input	W+	Connected to servo motor photoelectric encoder W+ phase
7	Encoder W - input	W-	Connected to servo motor photoelectric encoder W- phase
11	Shielding	FG	Shielding ground line terminal

2.4 Input/output Interface Types

2.4.1 Type1 switch input interface

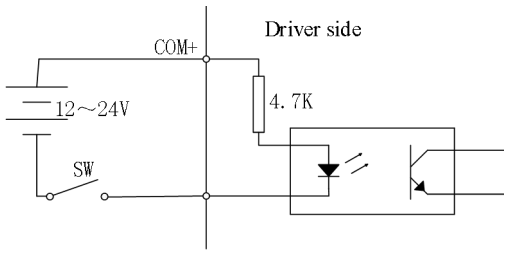


Fig. 2-5: Type1 Switch Input Interface

Power supply provided by the user, input DC 12-24V from the COM + terminal, current ≥ 100mA;

Note that if the current polarity is reversed, the servo driver will not work;

2.4.2 Type2 switch input interface

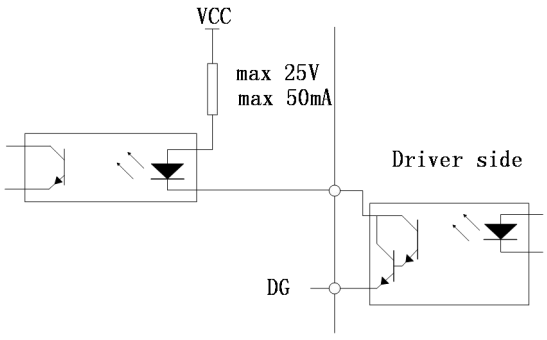


Fig. 2-6a: Type2 Switch Output Interface (photoelectric coupler)

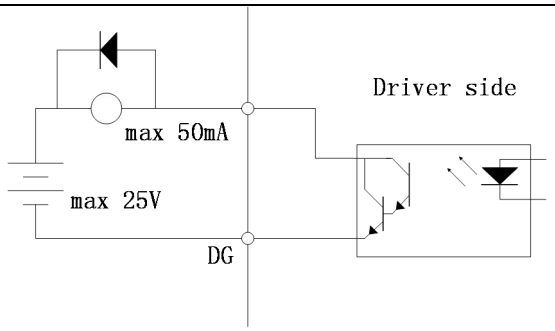


Fig. 2-6b: Type2 Switch Output Interface (relay)

1. The DO4 output transistor is a Darlington transistor, which will be connected to the photoelectric coupler (Fig. 2-6a) or relay (Fig. 2-6b).
2. External power supply is provided by the user, but note that if the power supply polarity is reversed, the servo driver would be damaged;
3. The output is of an open-collector, with the maximum current of 50mA, and external power supply voltage of 25V. Therefore, the load of switch output signal must meet this limit. If it exceeds this limit or the output is directly connected to the power supply, the servo driver would be damaged;
4. If the load is inductive load (e.g. relay), anti-parallel of freewheeling diode at both ends of the load is required. If the freewheeling diode is reversed, damage to the servo driver may occur;
5. The output transistor is a Darlington transistor. When the transistor is connected, the voltage drop between the collector and emitter is about 1V and does not meet the TTL low level requirements.
Therefore, the transistor cannot be directly connected to the TTL integrated circuit.

2.4.3 Type3 pulse input interface

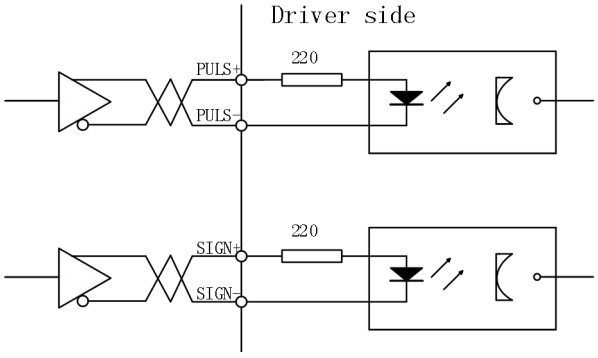


Fig. 2-7 Differential Drive Mode of Type3 Pulse Input Interface

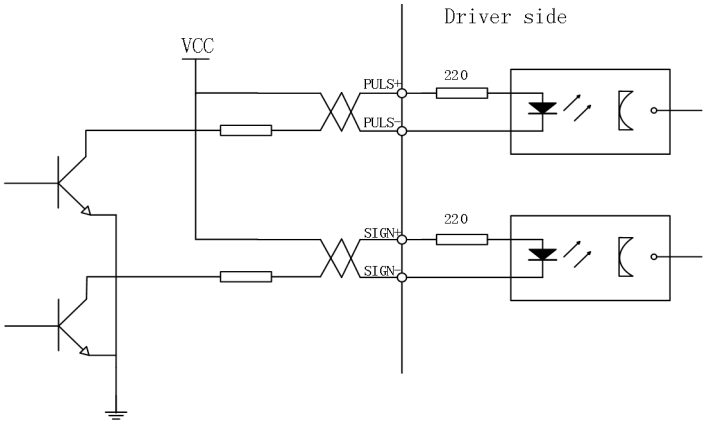


Fig. 2-7b: Single-end Drive Mode (VCC=5V, 12V and 24V) of Type3 Pulse Input Interface

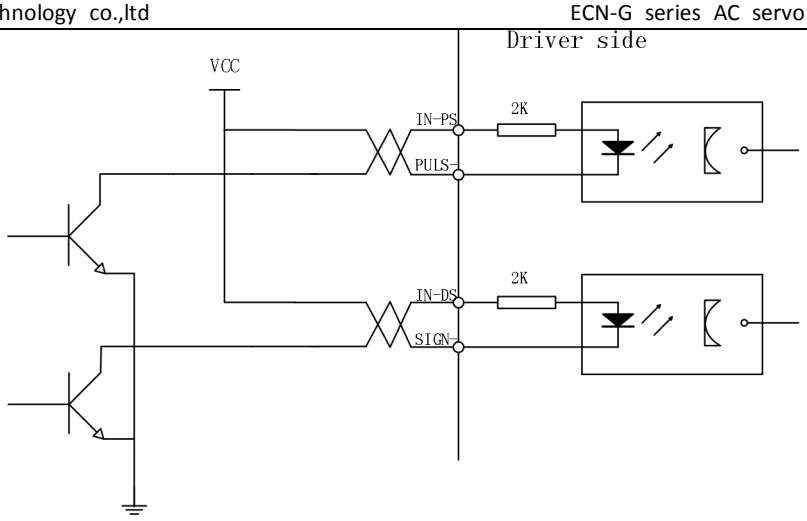
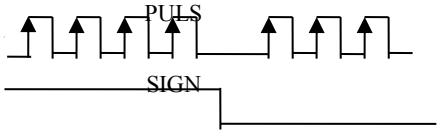
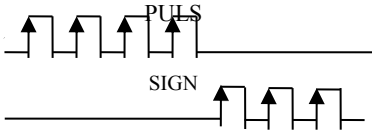
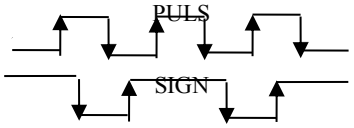


Fig. 2-7c: Single-end Drive Mode (VCC=24V) of Type3 Pulse Input Interface

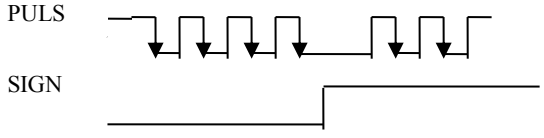
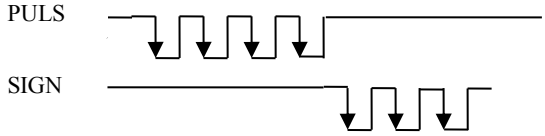
1. In order to properly transmit pulse volume data and improve anti-jamming capability, differential drive mode (Figure 2-7a) is recommended;
2. Differential drive mode adopts AM26LS31, MC3487 or similar RS422 line driver;
3. Using single-ended driver to reduce the movement frequency. According to the pulse input circuit, the driver current is 10-15mA. The maximum voltage of the external power supply is 25V in order to determine the resistor R. Empirical data: VCC=24V. R=2K; VCC=12V. R=1K; VCC=5V. R=100Ω.
4. When the single-ended drive mode is adopted, the external power supply needs to be provided by the user. Note that if the power supply polarity is reversed, the servo driver would be damaged.
5. The pulse input mode is shown in Table 2.4. The arrow indicates the count. Table 2.5 shows the timing and parameters of pulse input. When the 2-phase input mode is used, its four-octave pulse frequency is ≤ 500kH.
6. If the pulse quantity is 24V, the port IN-PS, PULS-, IN-DS and SIGN- can be used, as shown in Fig. 2-7(c). In this case, no external resistor is required.

Table 2.4: Pulse input mode

Positive logic:

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

Negative logic

Pulse command form	CCW CW	Parameter Setting
Pulse train symbol		0 Command pulse + symbol
CCW pulse train CW pulse train		1 CCW pulse/CW pulse

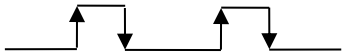
A-phase pulse train	PULS		2
B-phase pulse train	SIGN		2-phase command pulse

Table 2.5: Pulse input timing and parameters

Parameter	Differential drive input	Single-end drive input
t_{ck}	2 S	5 S
t_h	1 S	2.5 S
t_l	1 S	2.5 S
t_{rh}	S	S
t_{rl}	S	S
t_s	S	S
t_{qck}	S	S
t_{qh}	S	S
t_{ql}	S	S
t_{qrh}	S	S
t_{qrl}	S	S
t_{qs}	S	S

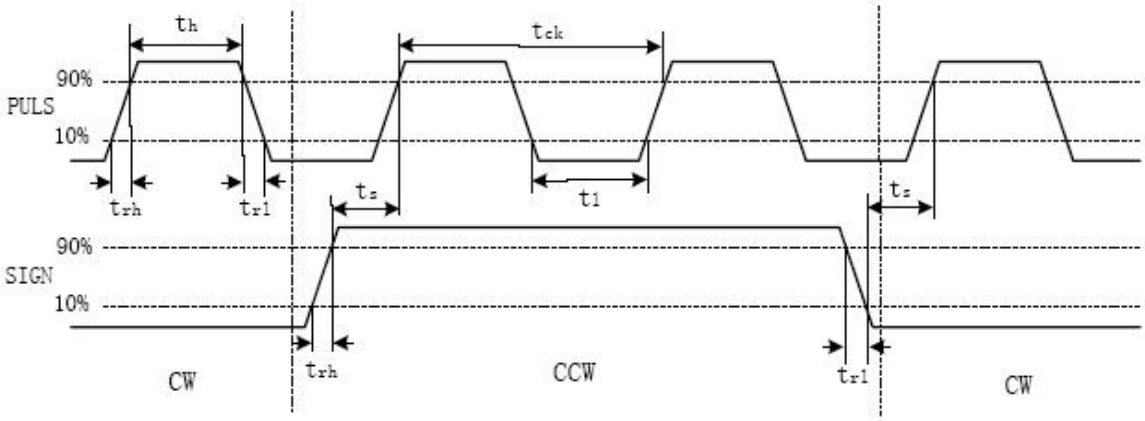


Fig. 2-8: Time Sequence of Pulse + Symbol Input Interface (maximum pulse frequency: 500kHz)

2.4.4 Type4 analog input interface

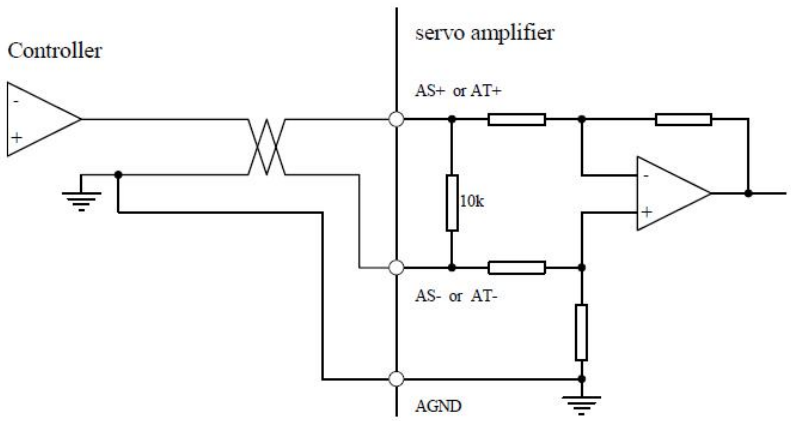


Fig. 2-9a: Type4 Analog Differential Input Interface

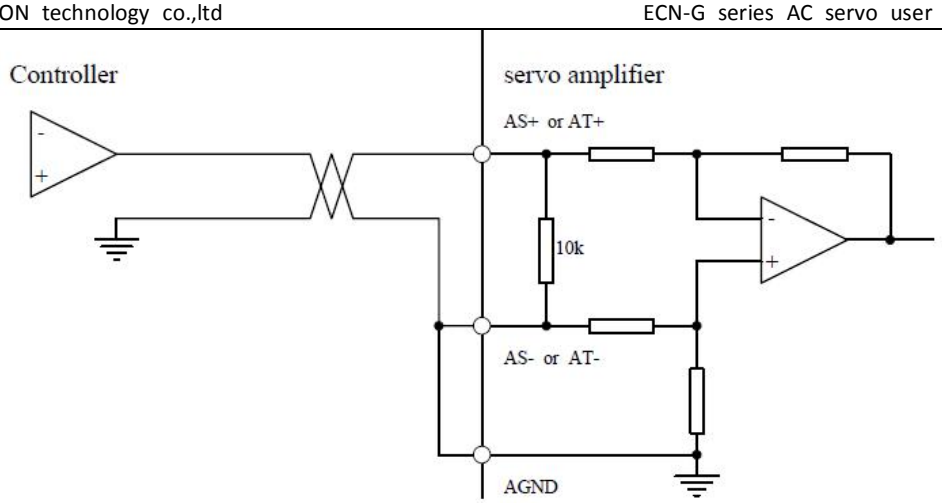


Fig. 2-9b: Type4 Analog Single-end Input Interface

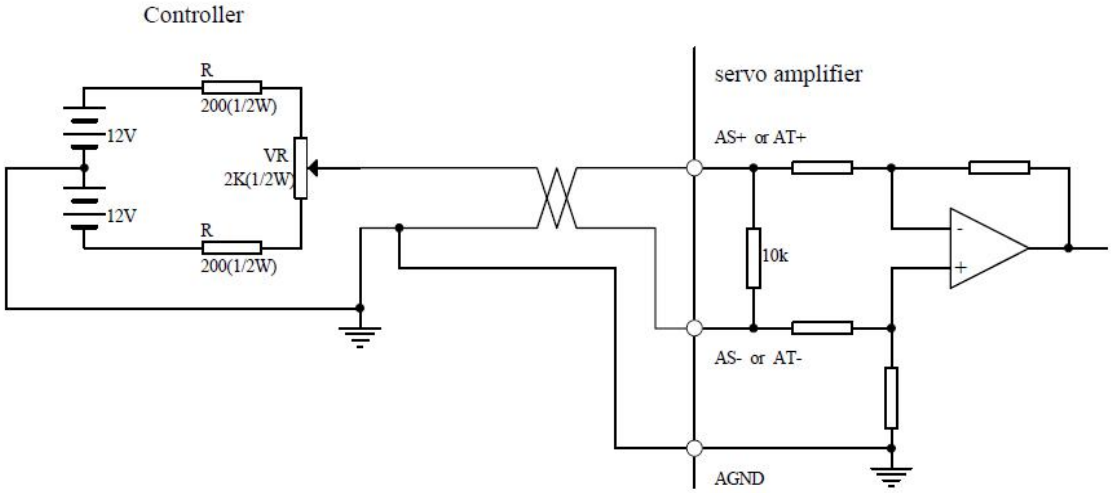


Fig. 2-9c: Type4 Analog Differential Potentiometer Input Interface

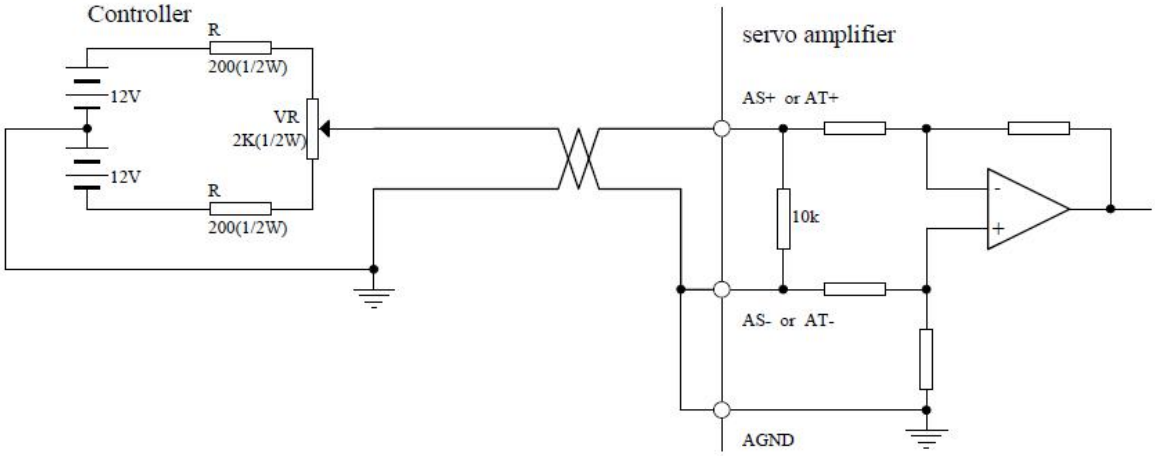


Fig. 2-9d: Type4 Analog Single-end Potentiometer Input Interface

1. The analog input interface is of differential type. Wiring can be divided into the differential and single-end type. The input impedance is 10kΩ. The input voltage range is from -10V to +10V.

2. In the differential wiring mode, the analog ground wire is connected to the negative end of input on the controller side, and the controller is connected to the drive with three wires.

3. In the single-end wiring mode, the analog ground wire is connected to the negative end of input on the drive side, and the controller is connected to the drive with two wires.

4. Differential wiring is superior to single-end wiring, and common-mode interference can be suppressed in differential wiring.

5. The input voltage should be from -10V to +10V; otherwise, the drive may be damaged.

6. It is recommended to use shielded cables in connection to reduce noise.

7. Zero offset of the analog input interface is normal and can be compensated by means of parameter adjustment.

8. The analog interface is not isolated (non-insulated).

2.4.5 Type5 encoder signal output interface

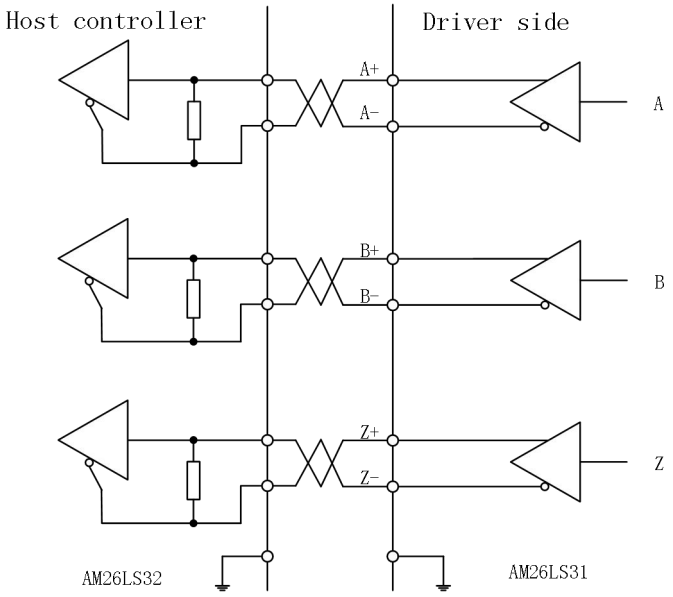


Fig. 2-10a: Type5 Output Signal of Photoelectric Encoder

1. The encoder signal is outputted by the differential drive (AM26LS31).

2. The ATM26LS32 receiver can be applied at the input end of the controller. The terminal resistor (about 330Ω) must be connected.

3. The ground wire of the controller must be reliably connected to that of the drive.

4. The output is not isolated, as shown in Fig. 2-10a.

5. The input end of controller may be an optocoupler for the receiving purpose, but high-speed optocoupler (e.g. 6N137) (as shown in Figure 2-10b) must be used;

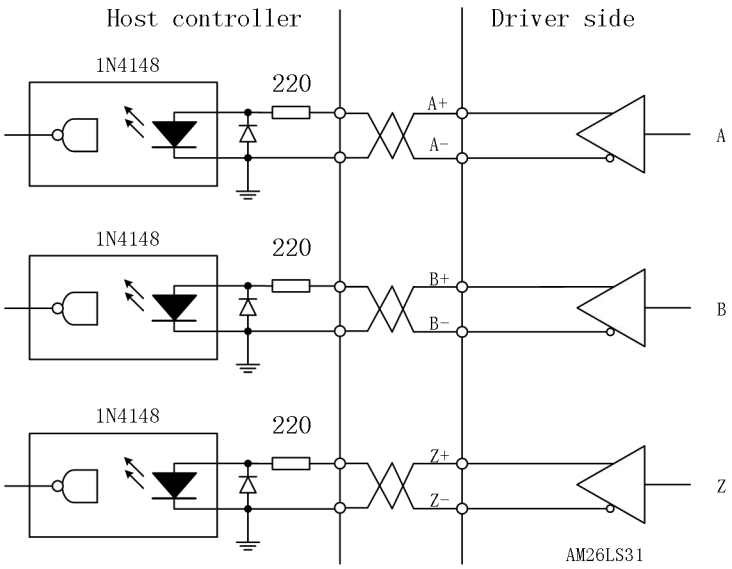


Fig. **2-10b**: Type5 Output Signal of Photoelectric Encoder

2.4.6 Type6 encoder Z phase signal open-collector output interface

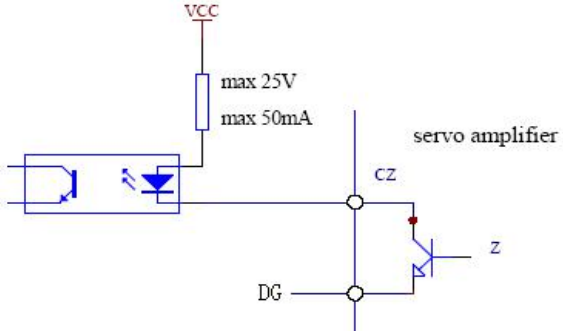


Figure 2-11: Type6 photoelectric encoder output interface

1. The Z-phase signal of the encoder is outputted by the open circuit of the collector. When the Z-phase signal of the encoder appears, the output is ON (connected); otherwise, the output is OFF (cut off).
2. As the Z-phase signal pulse of the host is generally narrow, use the high-speed photoelectric coupler (such as 6N137).

2.4.7 Type7 input interface of photoelectric encoder of servo motor

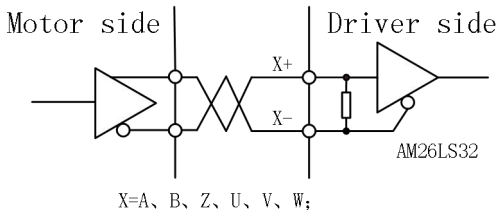


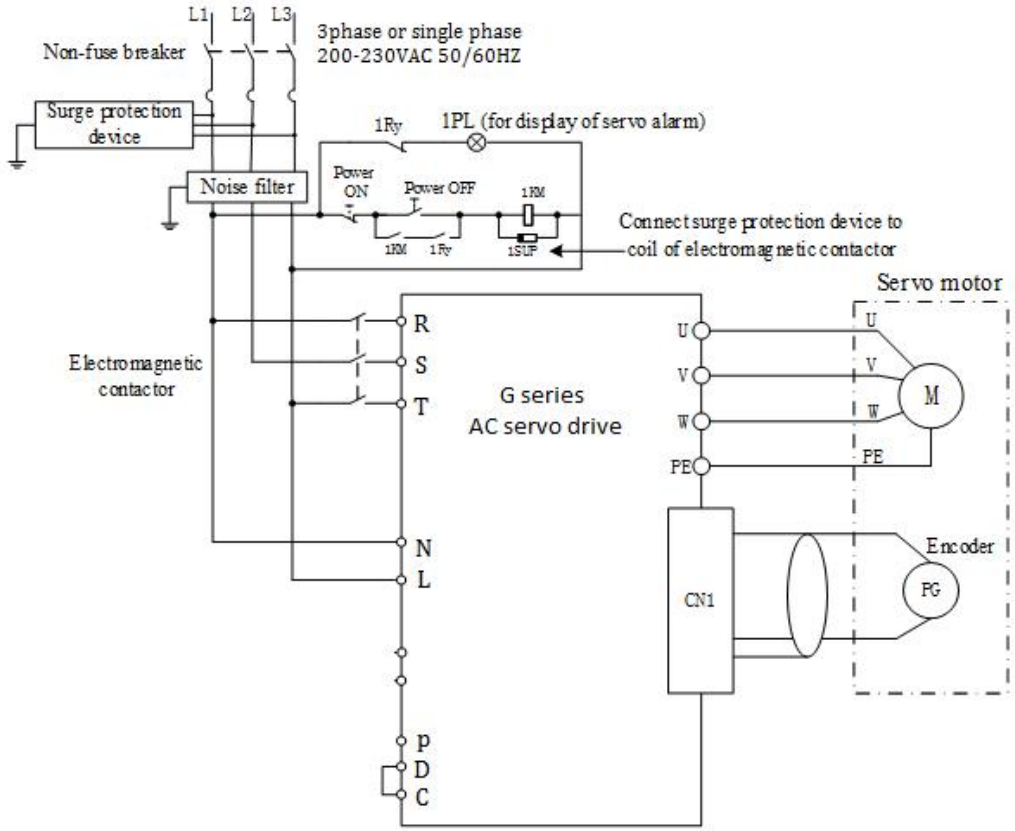
Figure 2-12: Type7 servo motor photoelectric encoder input interface

2.5 Connection Requirements

1. A three-phase isolation transformer is recommended to supply power, as this reduces the possibility of electric shock;
2. Noise filter is recommended to improve anti-jamming capability;
3. Please provide a non-fuse short-circuiter to promptly cut off the external power supply in case of driver failure;
4. The grounding line should be ≥ 2.5mm², as thick as possible, and is of a single-point grounding mode. The ground terminal of the servo motor and the ground terminal PE of servo driver must be connected;
5. To prevent malfunction due to interference, noise filter is recommended and note that:
    1) noise filter, servo driver and the host controller should be provided as close as possible;
    2) relay, AC contractor, brake and other coils should be provided with surge suppressor;
    3) the power circuit cables and signal lines should not be bundled together;
6. Proper connection of the shield layer of cables;

2.6 Standard Wiring Diagram

2.6.1 Wiring of Main Circuit



Note: If the power input is single phase(220VAC),please keep S freely(no need connect S,connect R,T only)

2.6.2 Wiring diagram of position mode

■ Position control mode

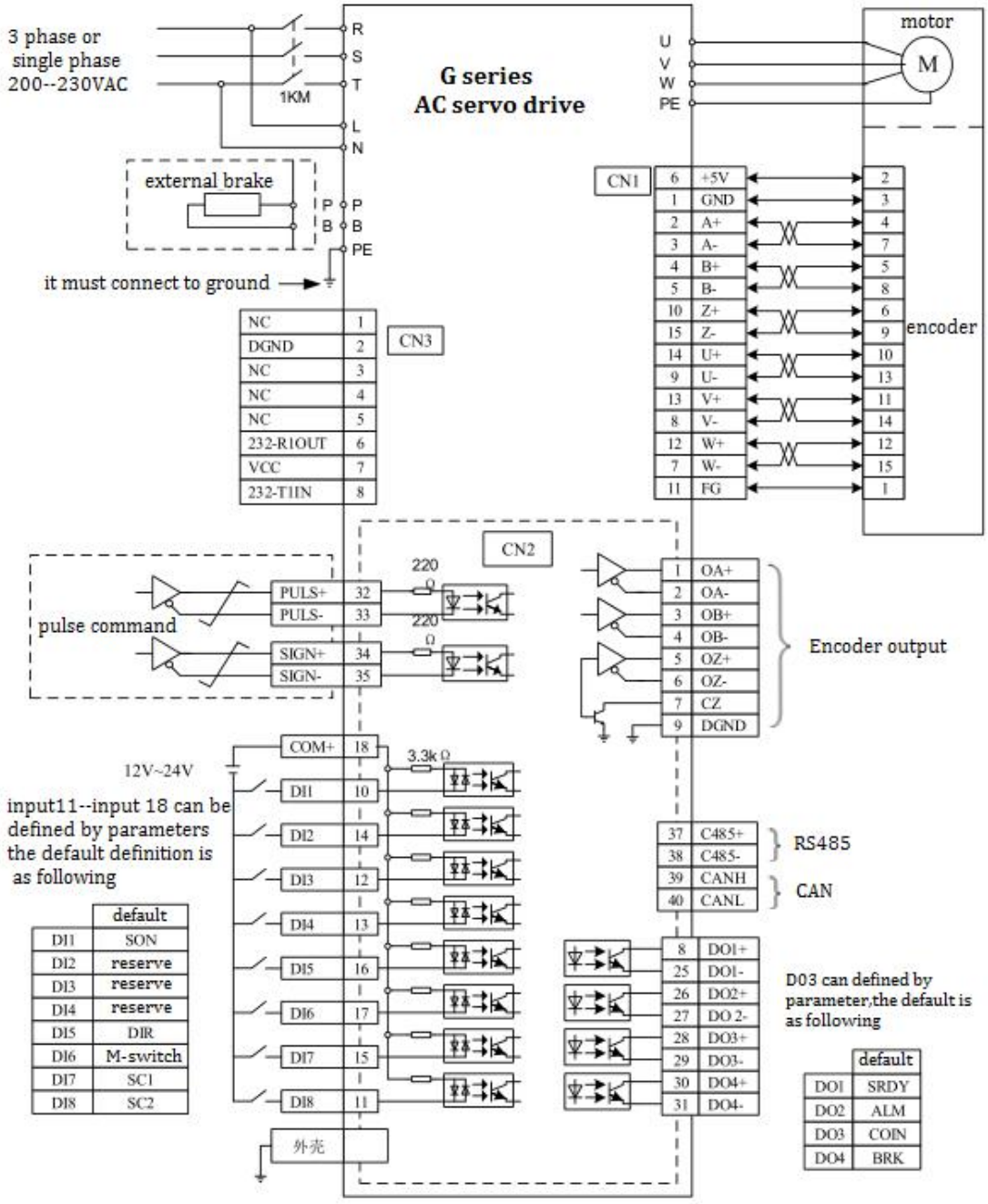


Fig. 2-13: Wiring of Position Control Mode

2.6.3 Wiring diagram of speed/torque mode

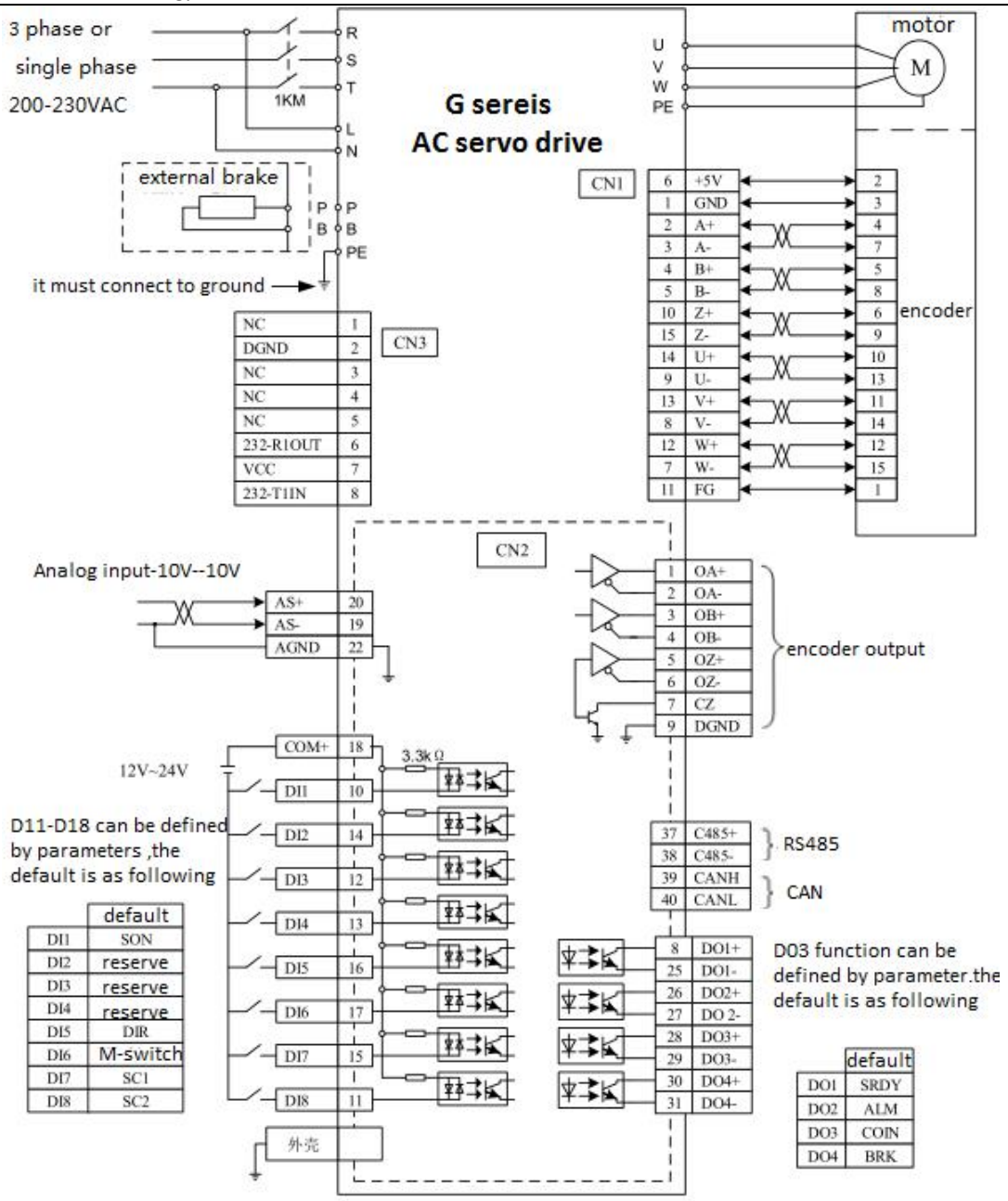


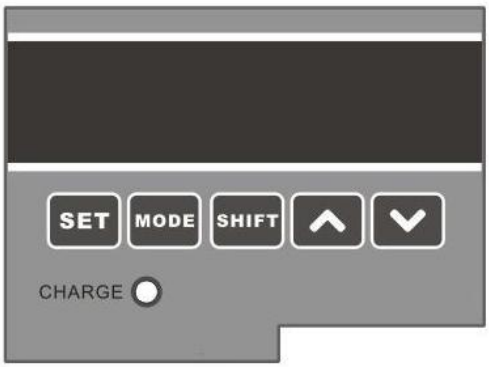
Fig. 2-14: Wiring of Speed/Moment Mode

Chapter III Panel Operation

3.1 Drive Panel

3.1.1 Panel composition

The driver panel consists of five LED digital displays and five keys ↑, ↓, ← and Enter to display various states and for setting parameters.



Button	Items	Functions
MODE	Mode keys	Switch basic modes: status display, auxiliary function, parameter setting and monitoring
∧	UP key	Press UP to increase the setting. It can be used to start forward JOG operation in the auxiliary function mode.
∨	DOWN key	Press DOWN to reduce the setting. It can be used to start reverse JOG operation in the auxiliary function mode.
SHIFT	Shift key	Press "Shift" to move the selected bit (the corresponding decimal point flashes) for one position to the left.
SET	Set key	Press "Set" to display the parameter settings and set values, enter the parameter setting mode and clear the alarm.

3.1.2 Function switching

Press M to switch the functions as follows. Read the references for the operations of each function.

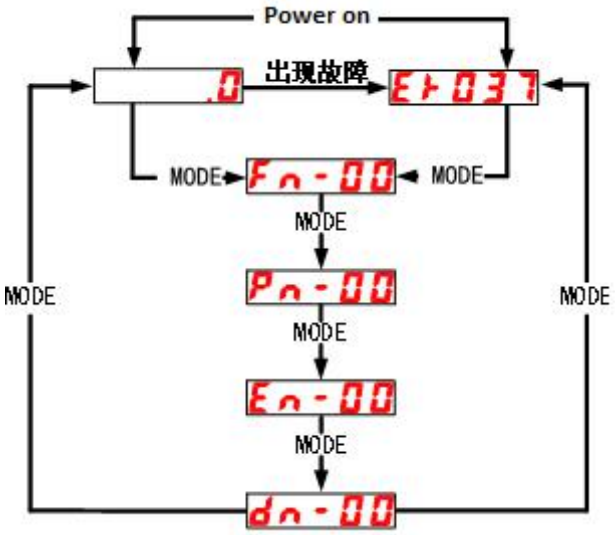


Fig. **3- 1**: Mode Switching Diagram

3.2 Parameter (Pn-xx) Operations

1. Parameter classification

Parameters are divided into 7 segments according to the functions, from P0-xx to P6-xx. The parameters within the P6 segment are internal parameters which cannot be modified without the password of the manufacturer.

2. Parameter display mode

Parameter display mode: the corresponding parameter display of G series can be divided into two types: hexadecimal display, starting from the letter “H”; and decimal display, with no special sign.

3. Operation case of parameter setting

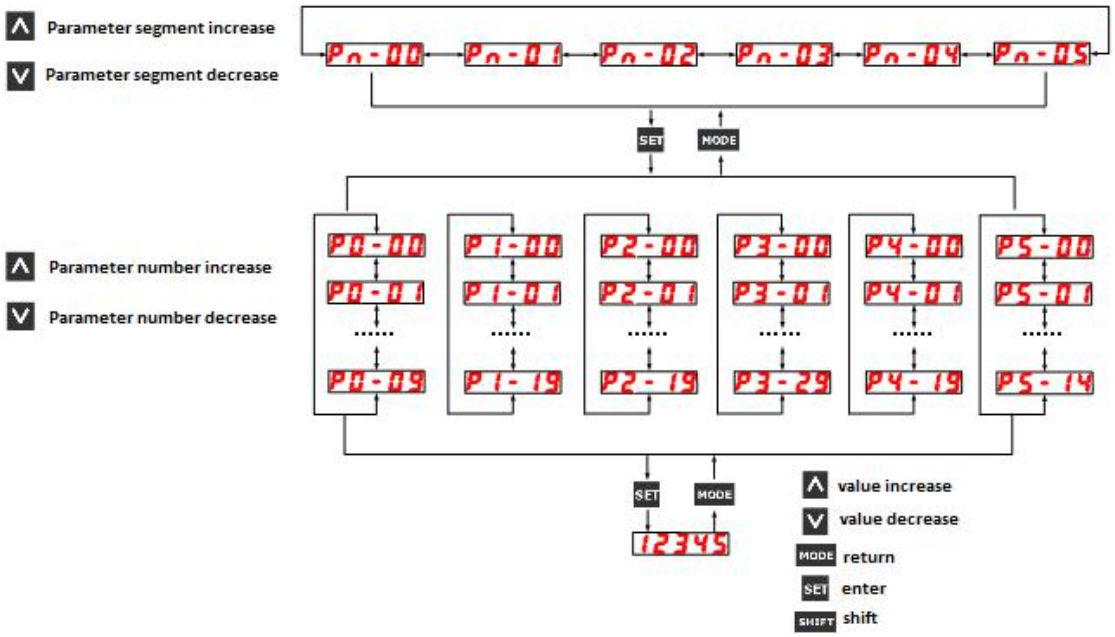


Fig. 3-2: Operation Case of Parameter Setting

Note: This operation can be done in combination with the “Shift” key. The “Shift” key is valid in the above-mentioned menu of any level. Once the operation is done, the “Shift” key moves for one position to the left from the current position, and the corresponding position flashes.

3.3 Monitor/Display (Fn-xx) Operation

This function is used to monitor (display) the command value set in the servo unit, the status of input and output signal and the internal status of the servo unit. The number, starting with Fn, will be displayed on the panel operation instrument.

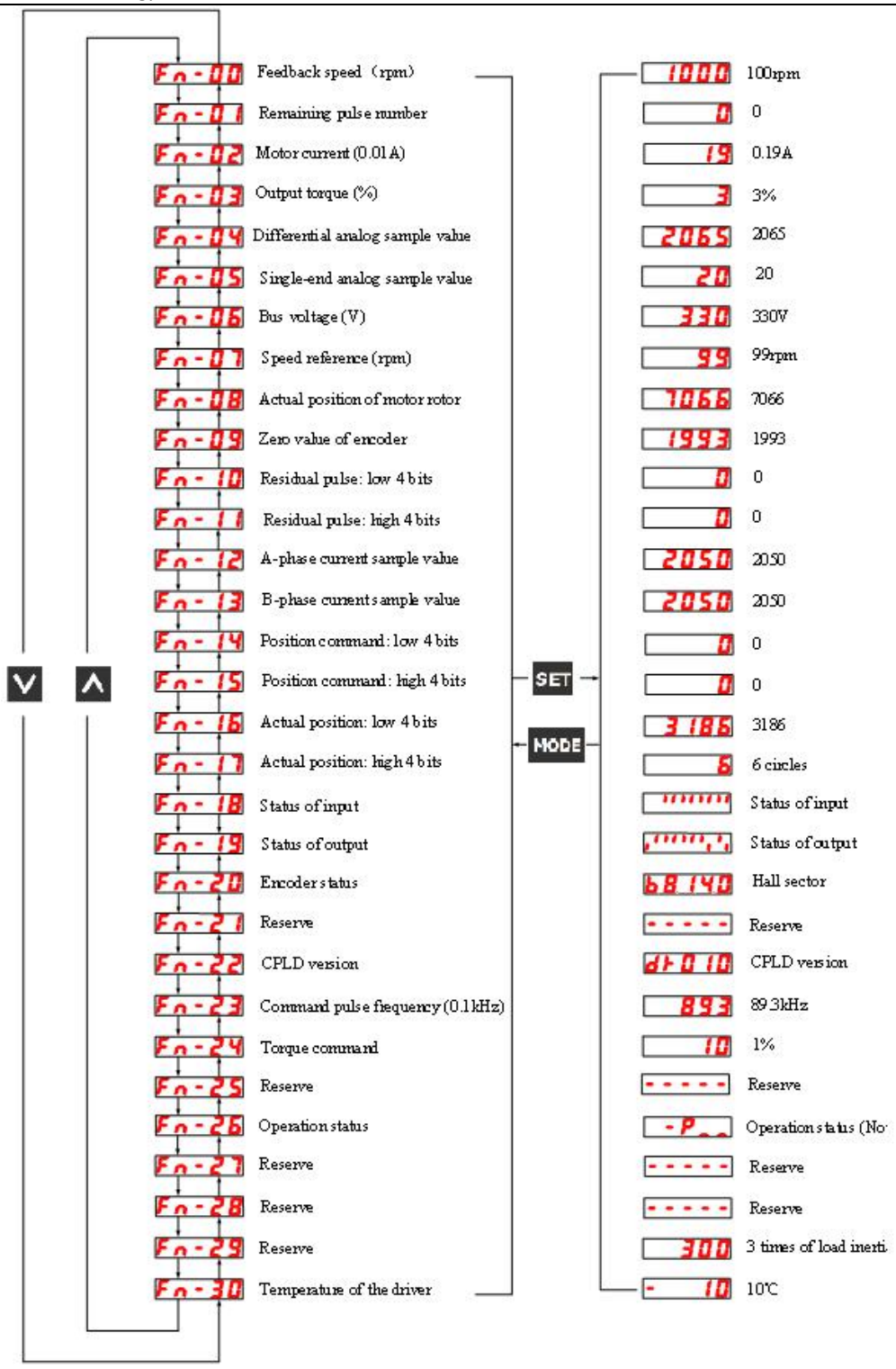
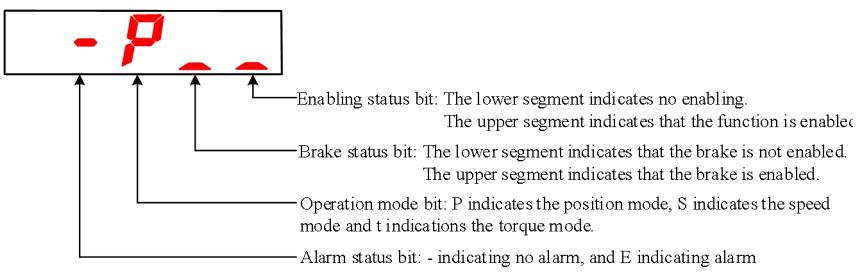


Fig. 3-4: Contents of Monitoring Menu

(1) Operation status



3.4 Operation of Historical Fault Display (En-xx)

Record the faults in operation of the servo unit and store the last four faults. The number, starting with En, will be displayed on the panel operation instrument.

is displayed in case of no fault. The current fault code is displayed in case of any failure.

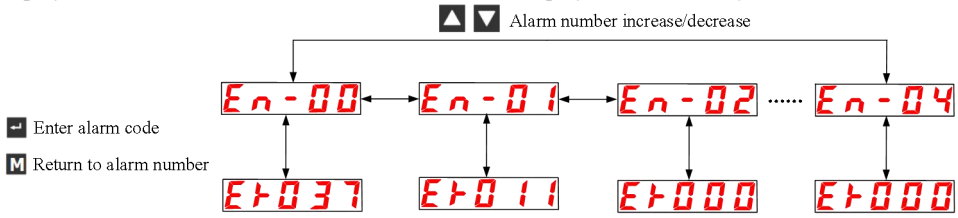


Fig. 3-5: Operation Case of Historical Fault Menu

3.5 Operation of Auxiliary Function (dn-xx)

The auxiliary function is mainly used to improve the flexibility and application of the servo motor, and includes the brake release test, JOG operation and drive initialization. The number, starting with Fdn, will be displayed on the panel operation instrument.

3.5.1 Brake Release Test

At first, remove the brake resistor of the drive and set P0-02 as 05555. Then perform dn-00 operation to start the brake release test.

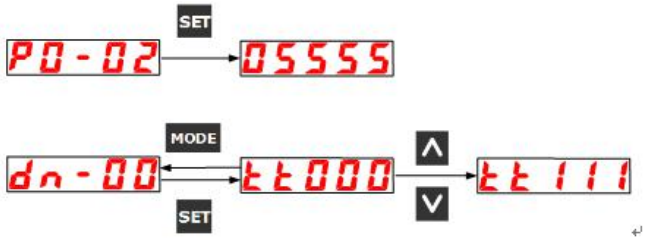


Fig. 3-6: Operation Case of Brake Resistor Release

3.5.2 JOG Operation

At first, set P0-04 in the speed mode, P0-02 password as 1234 and JOG operation speed P3-19 as the required value. Then perform dn-01operation to start JOG operation.

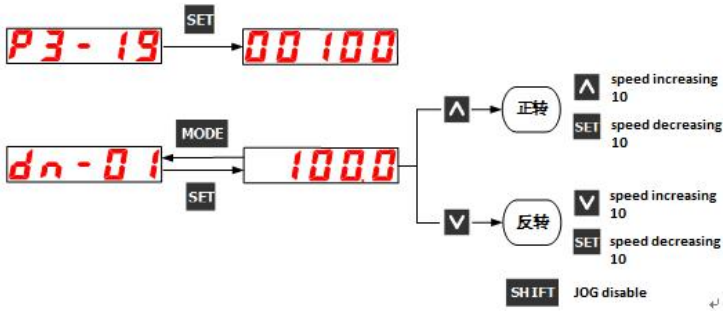
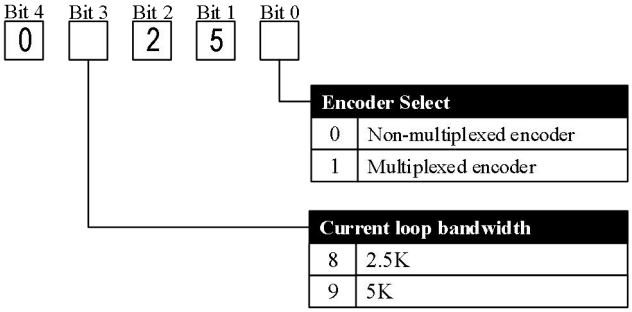


Fig. 3-7 Operation Case of Speed Commissioning

3.5.3 Drive initialization

At first, set P0-01 as the corresponding motor model (see the motor configuration sheet in Appendix C) and P0-02 initialization password with reference to the following table.



It is generally recommended to set the current loop bandwidth as 5K. If the electromagnetic noise of the motor is high, the P0-02 can be changed into 2.5K.

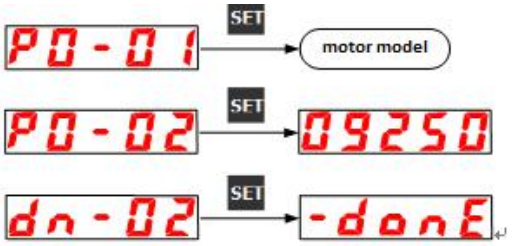


Fig. 3-8: Operation Case of Drive Initialization

3.5.4 Drive resetting

Drive resetting is equivalent to restart of the power supply in case of failure. Find dn-06 and press “Enter”. The DSP program version number will flash on the panel, and the relay actuation sound will be uttered. Thus, resetting is completed.

Note: The multiplexed encoder does not support soft resetting.

Chapter IV Parameters

4.1 Summary of Parameters

Parameters are divided into 7 segments: P0-P6. 60ST-M06020 (with G drive) is taken as an example of factory settings in the following table.

P0 segment parameters

S/N	Items	Default value	Unit	Manufacturer code
0	Version No.	67		0
1	Motor code	0		1
2	Password	0		2
3	Initial status display	0		3
4	Control mode selection	0		4
5	Alarm shield	0		5
6	Function option 1	0		6
7	Drive configuration	0		7
8	Function option 2	0		8
9	Maximum current limit of drive	3000		9

P1 segment parameters

S/N	Items	Default value	Unit	Manufacturer code
0	232 interface configuration and 1# oscilloscope channel display	1		10
1	2# and 3# oscilloscope channel display	0		11
2	485 communication protocol	0		12
3	485 address	0		13
4	Command pulse filter	0	10ns	14
5	Feedback pulse bandwidth filtering number	0	10ns	15
6	Inversion of input port of low four bits	0		16
7	Inversion of input port of high four bits	0		17
8	Input IO port repositioning 1	Hd410		18
9	Input IO port repositioning 2	H657A		19
10	Output port inversion	0		20
11	Input command inversion	0		21
12	DO3 output selection control	0		22
13	E2PROM protection	0		23
14	Parameter protection	0		24
15	Input port filter	0	0.5ms	25
16	MODBUS frame interval setting	0		26
17	CAN communication baud rate	0		27
18	CAN sending Email ID	0		28
19	CAN receiving Email ID	0		29

P2 segment parameters

S/N	Items	Default value	Unit	Manufacturer code
0	Position loop proportion	30	1/s	30
1	Reserve			
2	Position loop feedforward	0	1%	32
3	Denominator 1 of electronic gear ratio	1		33
4	Numerator 1 of electronic gear ratio	1		34
5	Denominator 2 of electronic gear ratio	1		35
6	Numerator 2 of electronic gear ratio	1		36
7	Filter cutoff frequency of position loop feedforward	0	Hz	37
8	Filter cutoff frequency of position loop output	0	Hz	38
9	Numerator of electronic gear ratio of encoder output	0		39
10	Positioning completion range	10	Pulse	40
11	Position-tolerance detection range	0	100 Pulse	41
12	Oblique wave function of position command	5000	2*Pulse/ms	42
13	Denominator 1 of electronic gear ratio of encoder output	1		43
14	Command pulse mode	0		44
15	Delay time setting of release signal of output brake after switching-on of SON	0	ms	45
16	Delay time setting of lock signal of output brake after switching-off of SON	0	ms	46
17	Minimum speed setting corresponding to lock signal output of output brake after switching-off of SON	0	rpm	47
18	Output phase inversion	0		48
19	Position command source	0		49
20	Primary filter cutoff frequency of position command	0	Hz	50
21	Average filter time 1 of position command	0	0.5ms	51
22	Average filter time 2 of position command	0	0.5ms	52
23	Reserve			
24	Reserve			
25	Reserve			
26	Reserve			
27	Reserve			
28	Reserve			
29	Reserve			

P3 segment parameters

S/N	Items	Default value	Unit	Manufacturer code
0	Speed loop refreshing frequency	0		60
1	Speed loop ratio 1	100	Hz	61
2	Speed loop integral time constant 1	10	ms	62
3	Speed loop ratio 2	100		63
4	Speed loop integral time constant 2	10		64
5	PDF coefficient	1000	1%	65

S/N	Items	Default value	Unit	Manufacturer code
6	Speed loop feedforward coefficient	0	1%	66
7	Speed detection filter	-1	Hz	67
8	Speed detection filter 2	-1	Hz	68
9	Cutoff frequency of speed observer	1000	Hz	69
10	Compensation coefficient of speed observer	0	1%	70
11	Reserve	0	1/100	71
12	Speed loop output filter	-1	Hz	72
13	Maximum forwarding speed limit	-1	rpm	73
14	Maximum reversing speed limit	-1	rpm	74
15	Acceleration time	-1	ms	75
16	Deceleration time	-1	ms	76
17	Disabling delay time	0	ms	77
18	Speed loop command source	0		78
19	JOG speed	100	rpm	79
20	Center frequency of wave trap	0	HZ	80
21	Width of wave trap	0	HZ	81
22	Attenuation ratio of wave trap	0	1/1000	82
23	Multiple of rotation inertia	30	1/10	83
24	P-PI switching mode	1		84
25	Threshold of P-PI switching speed error	30		85
26	Temperature alarm threshold		0	86
27	Acceleration/deceleration time setting in position mode	2*Pulse /ms	0	87
28	Fan start-up temperature setting		0	88
29	Fan shutdown temperature		0	89

P4 segment parameters

S/N	Items	Default value	Unit	Manufacturer code
0	Positive limit of internal moment	2000		90
1	Negative limit of internal moment	2000		91
2	Positive limit of external moment	1000		92
3	Negative limit of external moment	1000		93
4	Current detection filter	-1	Hz	94
5	Current loop output filter	-1	Hz	95
6	Current overload value	1200	1/1000	96
7	Allowable current overload time	60	0.1s	97
8	Brake cycle	10		98
9	Brake duty cycle	5		99
10	Brake threshold voltage value	380		100
11	Brake close voltage value	370		101
12	Set value of overvoltage	410		102
13	Set value of undervoltage	120		103

S/N	Items	Default value	Unit	Manufacturer code
14	Maximum allowable working time of braking resistor	1000	10ms	104
15	Command source in moment mode	0		105
16	Basic value of software overcurrent	0	1/1000	106
17	Reaching of set value of moment	0	1/1000	107
18	Speed limit selection source in moment mode	0		108
19	Moment reaching time	0	0.2ms	109

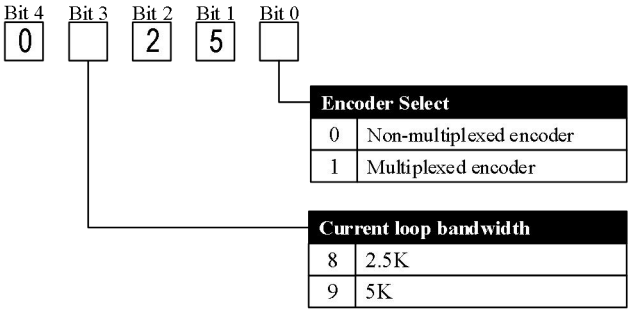
P5 segment parameters

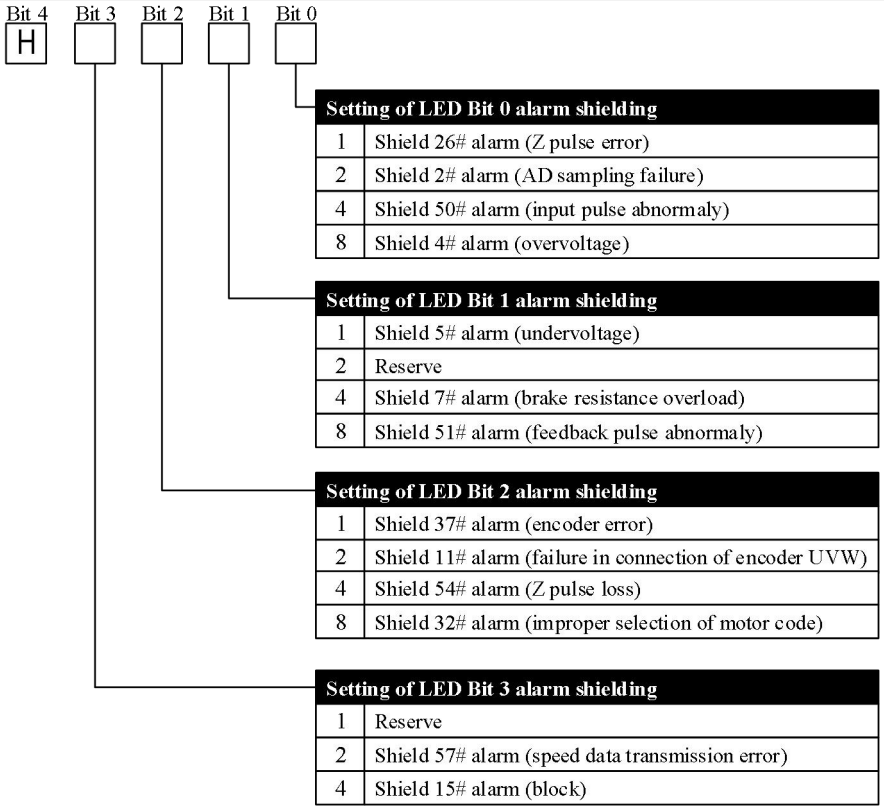
S/N	Items	Default value	Unit	Delivery code
0	Speed amplitude limit in moment mode	100	rpm	110
1	Zero offset setting of single-end analog	0		111
2	Gain setting of single-end analog control	100	rpm/v	112
3	Dead zone setting of single-end analog control	300	mv	113
4	Internal speed 1	0	rpm	114
5	Internal speed 2	0	rpm	115
6	Internal speed 3	0	rpm	116
7	Internal speed 4	0	rpm	117
8	Negative pressure treatment of single-end differential analog	0	0	118
9	Filter coefficient of single-end analog	990	1/1000	119
10	Zero drift setting of differential analog	0		120
11	Gain of differential analog	0		121
12	Dead zone of differential analog	0		122
13	Filter coefficient of differential analog	990	1/1000	123
14	Reaching set value of speed in speed mode	0	rpm	124

4.2 Parameter Details

4.2.1 Details of P0 segment parameters

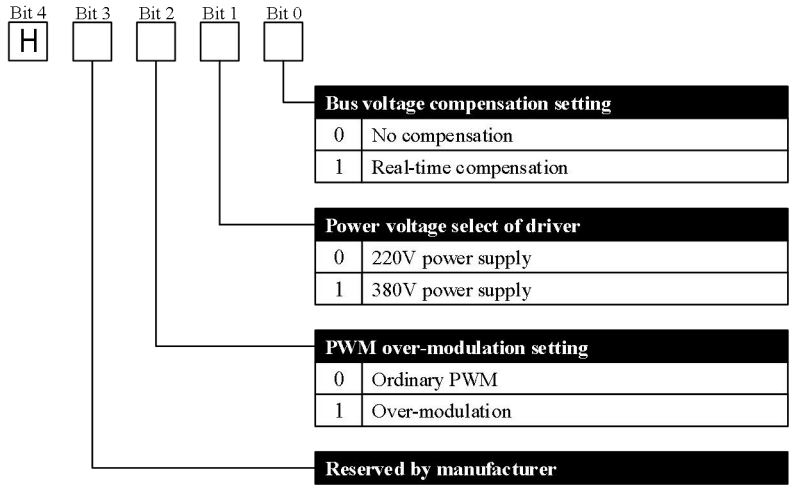
S/N	Items	Functions	Parameter range
0	Software version	To inquire software version number, but no change is allowed.	0-9999
1	Motor code	See the current motor model in the motor configuration sheet in Appendix C (the displayed code of the multiplexed motor is +1000 in Appendix C). The parameter should be modified when various motors are used. After the motor is selected, the password must be set in the Dn-02 interface to initialize motor settings; otherwise, the alarm (24) will be sent.	0-51
2	Password	The motor initialization password is set according to the following figure.	1100-1999

<table>
<tr><th>S/N</th><th>Items</th><th>Functions</th><th>Parameter range</th></tr>
<tr><td></td><td></td><td>


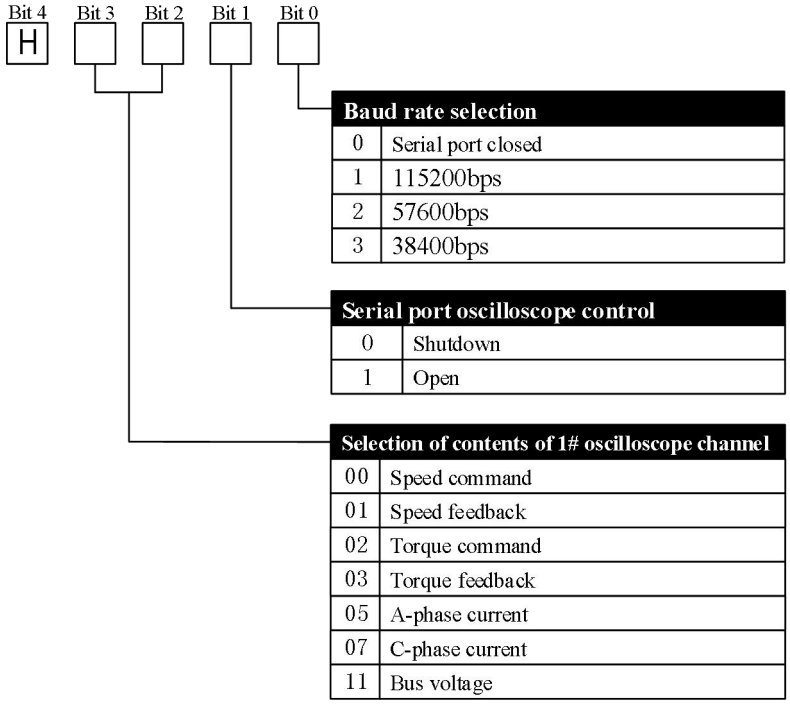
The password of braking resistor test is 5555.
The password of zero adjustment and self-test of the encoder is 1234.
</td><td></td></tr>
<tr><td>3</td><td>Initial status display</td><td>The offset of the displayed value corresponds to the menu Fn. Specific offsets are as follows: 0 corresponds to Fn-00, 1 to Fn-01, and so on.</td><td>0-28</td></tr>
<tr><td>4</td><td>Control mode selection</td><td>To set the control mode of the driver via this parameter:
0: Position mode
1: Speed mode
2: Moment mode
3: Moment and position mixed mode
4: Moment and speed mixed mode
5: Speed and position mixed mode</td><td>0-5</td></tr>
<tr><td>5</td><td>Alarm shield setting</td><td>The parameters are set based on the 5-digit display panel. The corresponding functions of each display panel are as follows.</td><td>0-0ffff</td></tr>
<tr><td colspan="4">


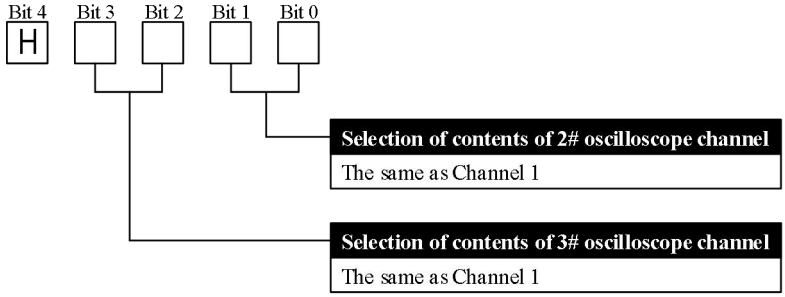
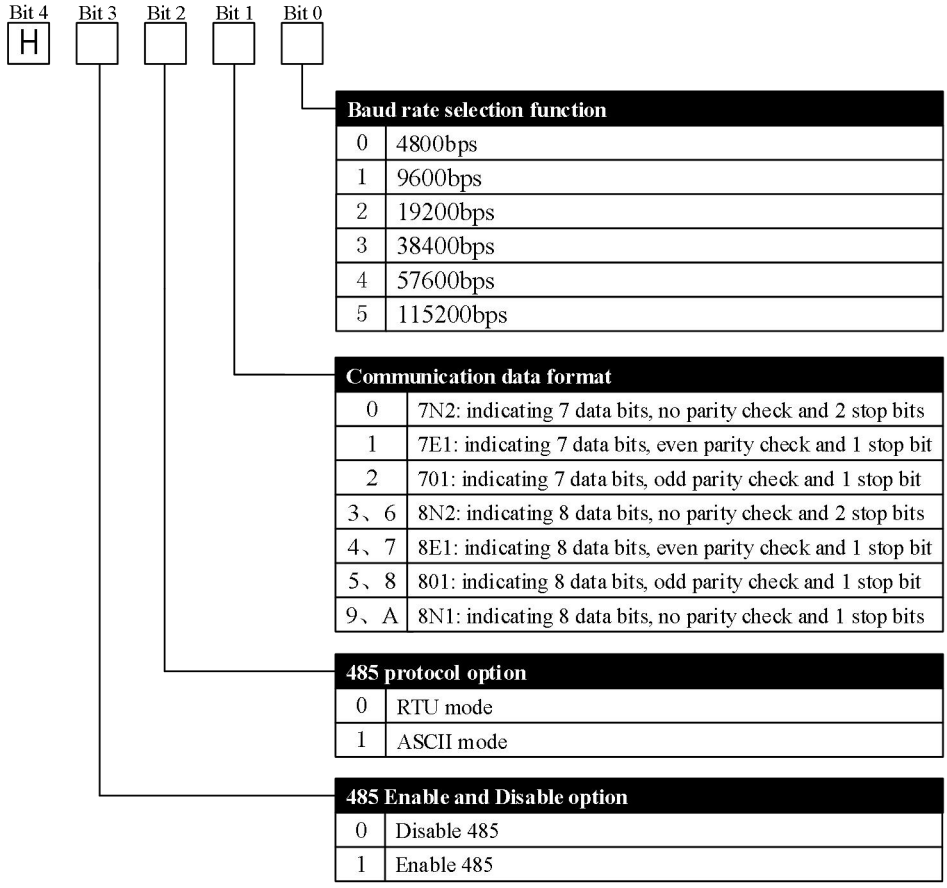
When several alarms should be shielded, increase the shield value of the corresponding display panel.
Example:
To shield No. 26 and 2 alarm, the parameter should be set as 00003:
To shield No. 37, 11 and 54 alarm, the parameter should be set as 00700:
</td></tr>
</table>

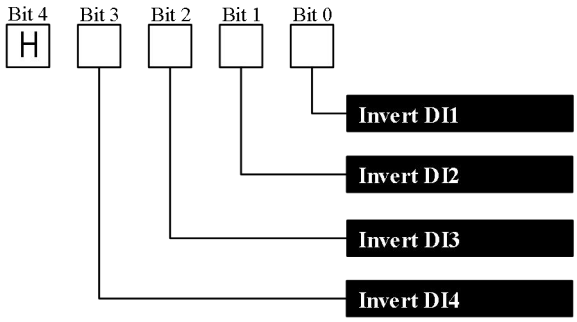
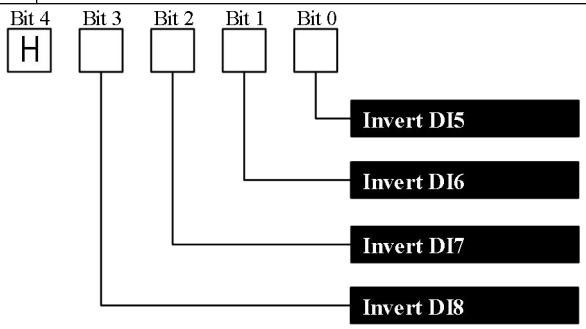
<table>
<tr><th>S/N</th><th>Items</th><th>Functions</th><th>Parameter range</th></tr>
<tr><td></td><td colspan="3">To shield No. 26, 11, 54 and 32 alarm, the parameter should be set as 00E0 1:
To shield all alarms included in the parameter description, the parameter should be set as 06FdF:</td></tr>
<tr><td rowspan="2">6</td><td>Function option 1</td><td>The parameters are set based on the 5-digit display panel. The corresponding functions of each display panel are as follows.</td><td>0-16</td></tr>
<tr><td colspan="3">Bit 4 Bit 3 Bit 2 Bit 1 Bit 0
H
Enabling mode select
0 External terminal enabling
1 Internal parameter enabling
Internal parameter enabling
0 Ineffective internal parameter enabling
1 Effective internal parameter enabling
External communication enabling
0 Ineffective transmission of enabling signal in communication
1 Effective transmission of enabling signal in communication
Set mode of input port status
0 Ordinary mode of input port
1 The input port status is set by MODBUS.</td></tr>
<tr><td rowspan="2">7</td><td>Drive configuration</td><td>The parameters are set based on the 5-digit display panel. The corresponding functions of each display panel are as follows.</td><td></td></tr>
<tr><td colspan="3">Bit 4 Bit 3 Bit 2 Bit 1 Bit 0
H
Current sampling mode
0 No precharge and no bootstrap
1 Precharge with bootstrap
Drive model selection
0 G2A3204
1 G2A3208
Temperature sensor enabling
0 Disable
1 Enable
Reserved by manufacturer</td></tr>
<tr><td>8</td><td>Function option 2</td><td>The parameters are set based on the 5-digit display panel. The corresponding functions of each display panel are as follows.</td><td></td></tr>
</table>

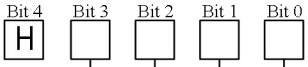
<table>
<tr><th>S/N</th><th>Items</th><th>Functions</th><th>Parameter range</th></tr>
<tr><td></td><td colspan="3"> 
</td></tr>
<tr><td>9</td><td>Maximum current limit of drive</td><td>Unit: 0.01A</td><td></td></tr>
</table>

4.2.2 Details of P1 segment parameters

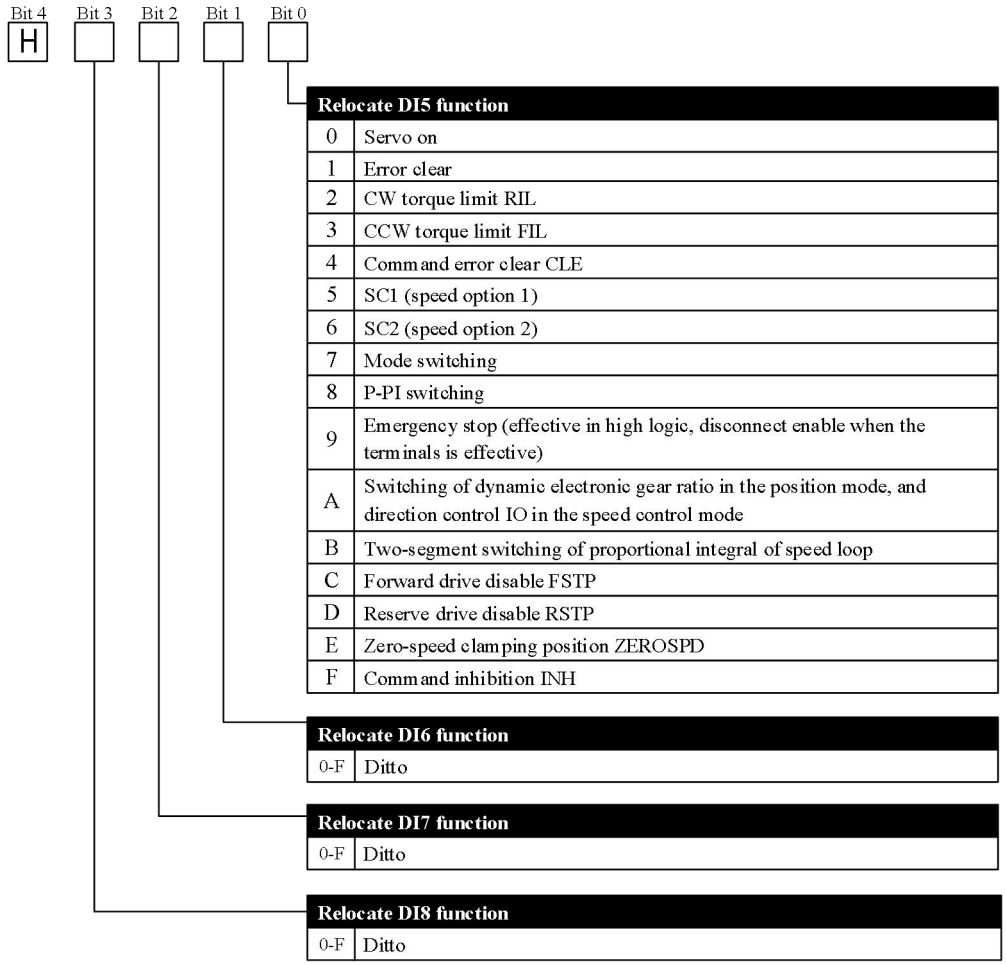
<table>
<tr><th>S/N</th><th>Items</th><th>Functions</th><th>Parameter range</th></tr>
<tr><td rowspan="2">0</td><td>232 interface configuration and 1# oscilloscope channel display</td><td>The parameters are set based on the 5-digit display panel. The corresponding functions of each display panel are as follows.</td><td></td></tr>
<tr><td colspan="3"> 
</td></tr>
<tr><td>1</td><td>Display of 2# and 3# oscilloscope channel</td><td>The parameters are set based on the 5-digit display panel. The corresponding functions of each display panel are as follows.</td><td></td></tr>
</table>

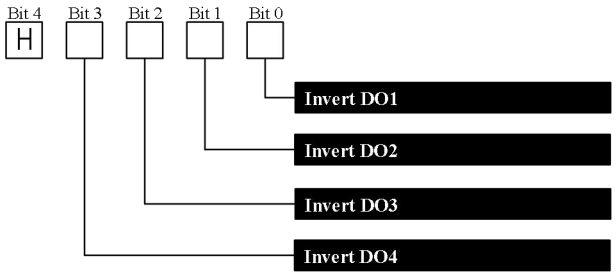
<table>
<tr><th>S/N</th><th>Items</th><th>Functions</th><th>Parameter range</th></tr>
<tr><td></td><td colspan="3"> 
</td></tr>
<tr><td rowspan="2">2</td><td>485 serial protocol</td><td>The parameters are set based on the 5-digit display panel. The corresponding functions of each display panel are as follows.</td><td></td></tr>
<tr><td colspan="3"> 
</td></tr>
<tr><td>3</td><td>ID address of 485</td><td>ID address of 485: to set the equipment address in 485 communication.</td><td>0-127</td></tr>
<tr><td>4</td><td>Command pulse filter</td><td>The input command is filtered, with the basic time unit of 10ns. If the parameter is set as 5, the command filtration time is 5*10ns=50ns.
Conclusion: the longer the command filtration time is, the better the anti-jamming performance of signal is. However, the set value must not be too large; otherwise, the normal signal will be affected.</td><td>0-255</td></tr>
<tr><td>5</td><td>Feedback pulse bandwidth filtering number</td><td>The same as the parameter P1-04.</td><td>0-255</td></tr>
<tr><td>6</td><td>Inversion of input port of low four bits</td><td>The parameters are set based on the 5-digit display panel. The corresponding functions of each display panel are as follows.</td><td></td></tr>
</table>

S/N	Items	Functions	Parameter range
			
7	Inversion of input port of high four bits	The parameters are set based on the 5-digit display panel. The corresponding functions of each display panel are as follows.	
			
8	Input IO port repositioning 1	The parameters are set based on the 5-digit display panel. The corresponding functions of each display panel are as follows.	

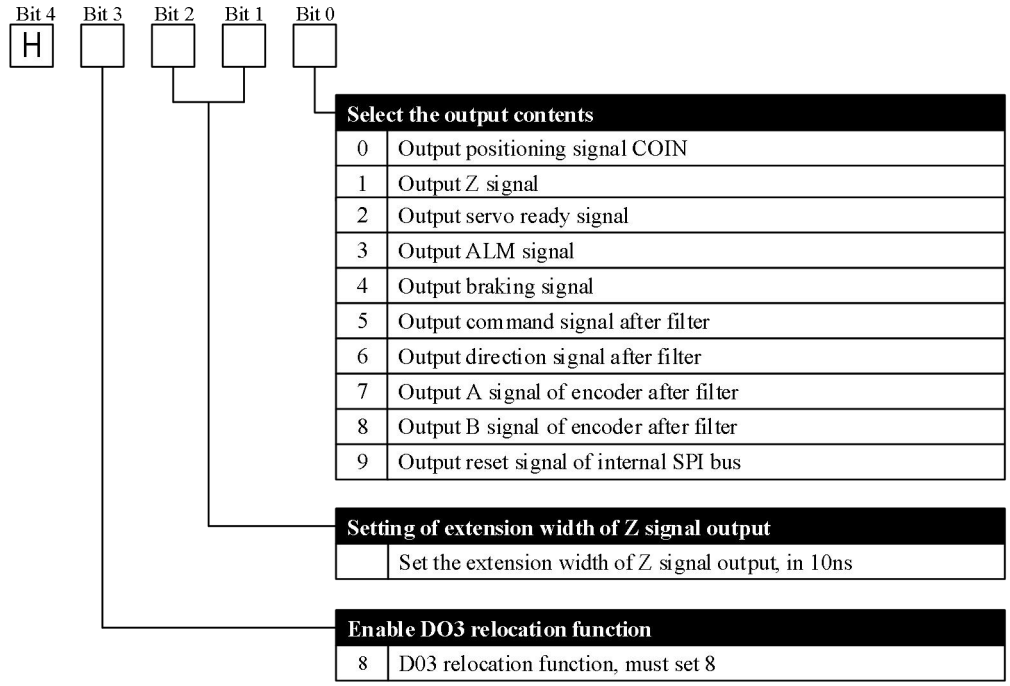
<table>
<tr><th>S/N</th><th>Items</th><th>Functions</th><th>Parameter range</th></tr>
<tr><td></td><td colspan="2">


<table>
<tr><th colspan="2">Relocate DI1 function</th></tr>
<tr><td>0</td><td>Servo on</td></tr>
<tr><td>1</td><td>Error clear</td></tr>
<tr><td>2</td><td>CW torque limit RIL</td></tr>
<tr><td>3</td><td>CCW torque limit FIL</td></tr>
<tr><td>4</td><td>Command error clear CLE</td></tr>
<tr><td>5</td><td>SC1 (speed option 1)</td></tr>
<tr><td>6</td><td>SC2 (speed option 2)</td></tr>
<tr><td>7</td><td>Mode switching</td></tr>
<tr><td>8</td><td>P-PI switching</td></tr>
<tr><td>9</td><td>Emergency stop (effective in high logic, disconnect enable when the terminals is effective)</td></tr>
<tr><td>A</td><td>Switching of dynamic electronic gear ratio in the position mode, and direction control IO in the speed control mode</td></tr>
<tr><td>B</td><td>Two-segment switching of proportional integral of speed loop</td></tr>
<tr><td>C</td><td>Forward drive disable FSTP</td></tr>
<tr><td>D</td><td>Reserve drive disable RSTP</td></tr>
<tr><td>E</td><td>Zero-speed clamping position ZEROSPD</td></tr>
<tr><td>F</td><td>Command inhibition INH</td></tr>
</table>
<table>
<tr><th colspan="2">Relocate DI2 function</th></tr>
<tr><td>0-F</td><td>Ditto</td></tr>
</table>
<table>
<tr><th colspan="2">Relocate DI3 function</th></tr>
<tr><td>0-F</td><td>Ditto</td></tr>
</table>
<table>
<tr><th colspan="2">Relocate DI4 function</th></tr>
<tr><td>0-F</td><td>Ditto</td></tr>
</table>
</td><td></td></tr>
<tr><td>9</td><td>Input IO port repositioning 2</td><td>The parameters are set based on the 5-digit display panel. The corresponding functions of each display panel are as follows.</td><td></td></tr>
</table>

<table>
<tr><th>S/N</th><th>Items</th><th>Functions</th><th>Parameter range</th></tr>
<tr><td></td><td colspan="3">


</td></tr>
<tr><td rowspan="2">10</td><td>Output port inversion</td><td>The parameters are set based on the 5-digit display panel. The corresponding functions of each display panel are as follows.</td><td>0-30000</td></tr>
<tr><td colspan="3">


</td></tr>
<tr><td>11</td><td>Input command inversion</td><td>Inversion of input command.
0: no inversion.
1: inversion.</td><td></td></tr>
<tr><td>12</td><td>DO3 output selection control</td><td>The parameters are set based on the 5-digit display panel. The corresponding functions of each display panel are as follows.</td><td></td></tr>
</table>

S/N	Items	Functions	Parameter range
			
13	Write 485 data into E2PROM.	0: not write into E2PROM. 1: write into E2PROM.	
14	Parameter protection	0: the parameter panel can be modified. 1: the parameter panel cannot be modified.	
15	Input port filter	Unit: 0.5ms Valid for all input IO.	
16	MODBUS frame interval setting	Unit: 0.1ms 0: default 1.5 characters.	
17	CAN communication baud rate	0: 50K 1: 100K 2: 125K 3: 250K 4: 500K 5: 1M	
18	CAN sending Email ID		
19	CAN receiving Email ID		

4.2.3 Details of P2 segment parameters

S/N	Items	Functions	Parameter range
0	Position loop proportion	The position loop proportion is directly related to the response speed of the position loop. On the premise of no vibration or noise, the position loop gain of the mechanical system can be increased to accelerate the system response, and reduce the positioning error and time. If the gain is too large, the mechanical vibration may be caused and the system position may be subject to excessive adjustment.	0-9999
1	Reserve		
2	Position loop feedforward coefficient	In the case of smooth change of position control command, the gain can be increased to increase the position follow-up error; otherwise, the gain can be decreased to reduce rotational	0-500

S/N	Items	Functions	Parameter range
		vibration of the mechanism. The feedforward coefficient can be set according to the percentage.	
3	Denominator 1 of electronic gear ratio	To set the frequency division of the position command pulse (electronic gear). In the position control mode, P2-03 and P2-04 parameter settings easily match a variety of pulse sources in order to achieve the desired control resolution (i.e., the angle / pulse). P×G = N×C×4 P: number of pulses of the input command; G: electronic gear ratio, P2-04/P2-03. N: number of motor coils; C: Photoelectric encoder resolution/rotation, the system motor adopts encoder 2500 resolution. ● For example, if input 8000 pulses, motor operates a cycle Then N=1; P=8000; and C=2500. Thus, G=5/4. Set P2-04 as 5 and P2-03 as 4. The recommended range of electronic gear rate: 1/50 ≤ G ≤ 50	1-32767
4	Numerator 1 of electronic gear ratio		1-32767
5	Denominator 2 of electronic gear ratio		
6	Numerator 2 of electronic gear ratio		
7	Filter cutoff frequency of position loop feedforward	● Set the cutoff frequency (Hz) of the low-pass filter of the position loop feedforward. ● Improve the stability of composite position control. ● The larger the parameter is, the higher the cutoff frequency of the filter is. Noise can be easily generated in motor operation, and the position may be subject to excessive adjustment. ● Filtration will not be done when the value is no more than 0.	0-30000
8	Filter cutoff frequency of position loop output	● Set the cutoff frequency (Hz) of the low-pass filter of the position loop output. ● Filtration will not be done when the value is no more than 0.	0-30000
9	Numerator of electronic gear ratio of encoder output	Divide the frequency of the encoder output pulse in the integer or decimal form, in combination with P2-13. Note: The parameter should be smaller than that of P2-13 to ensure frequency-dividing output. Example: 2-frequency output of encoder: P2-09 = 1 P2-13 = 2 2.5-frequency output of encoder P2-09 = 2 P2-13 = 5	
10	Positioning completion range	● The parameter is a basis to judge whether the drive is positioned in the position control mode. When the number of residual pulses in the offset counter is less than or equal to the set value, the drive positioning is completed. The signal will be COIN ON after positioning; otherwise, the signal will be COIN OFF. ● The positioning signal COIN will be outputted in the position control mode. The speed signal SCMP will be outputted in other control modes. ● The basic unit is one pulse.	0-30000

<table>
<tr><th>S/N</th><th>Items</th><th>Functions</th><th>Parameter range</th></tr>
<tr><td></td><td></td><td>● AS one output port is used for position, speed and moment output, the priority of the three effective parameters is as follows: moment > speed > position.
If the moment value is negative, the moment will not be outputted.
If the speed value is negative, the moment will not be outputted.
To output the position, the speed and moment value must be negative.</td><td></td></tr>
<tr><td>11</td><td>Position-tolerance detection range</td><td>● In the position control mode, when the count value of the position deviation counter exceeds the value of this parameter, the servo driver sends the position tolerance alarm.
● When the parameter is less than or equal to 0, the position offset detection will not be effective.
● The basic unit is 100 pulses.</td><td>0/30000</td></tr>
<tr><td>12</td><td>Oblique wave function of position command</td><td>This function is used for smoothly filtering the position pulse input. When this function is applied, the pulse may be subject to lagging, but will not be lost. The set value is the pulse limit within 1ms.</td><td>0-30000</td></tr>
<tr><td>13</td><td>Denominator 1 of electronic gear ratio of encoder output</td><td>Divide the frequency of the encoder output pulse in the integer or decimal form, in combination with P2-09.
Note: The parameter should be smaller than that of P2-09 to ensure frequency-dividing output.
Example: 2-frequency output of encoder:
P2-09 = 1
P2-13 = 2
2.5-frequency output of encoder
P2-09 = 2
P2-13 = 5</td><td>1-10000</td></tr>
<tr><td rowspan="2">14</td><td>Command pulse input mode</td><td>The command parameters are set according to the hexadecimal requirements.</td><td></td></tr>
<tr><td colspan="3">
<table>
<tr><th>bit15~bit6</th><th>bit5</th><th>bit4</th><th>bit3</th><th>bit2</th><th>bit1</th><th>bit0</th></tr>
</table>
<table>
<tr><th colspan="2">Select the pulse input form</th></tr>
<tr><td>00</td><td>Pulse + direction</td></tr>
<tr><td>01</td><td>Dual edge technology of pulse and direction</td></tr>
<tr><td>10</td><td>AB orthogonal code</td></tr>
<tr><td>11</td><td>CW/CCW mode</td></tr>
</table>
<table>
<tr><th colspan="2">Select the positive and negative logic of pulse</th></tr>
<tr><td>0</td><td>Positive logic sequence</td></tr>
<tr><td>1</td><td>Negative logic sequence</td></tr>
</table>
<table>
<tr><th colspan="2">CW/CCW selection standard in CW/CCW mode</th></tr>
<tr><td>000</td><td>Rising edge + high level mode</td></tr>
<tr><td>100</td><td>Rising edge + low level mode</td></tr>
</table>
<table>
<tr><th>Reserved by manufacturer</th></tr>
</table>
</td></tr>
<tr><td>15</td><td>Delay time setting of release signal of output brake after switching-on of SON</td><td>Unit: ms
Note: If the set value is 0, the brake signal will not act.</td><td></td></tr>
<tr><td>16</td><td>Delay time setting of lock signal of output brake after switching-off of SON</td><td>Unit: ms
Note: If the set value is 0, the brake signal will not act.</td><td></td></tr>
</table>

S/N	Items	Functions	Parameter range
17	Minimum speed setting corresponding to lock signal output of output brake after switching-off of SON	Unit: rpm	
18	Inversion of encoder output phase	0: no inversion. 1: inversion.	
19	Position command source	0: set the external pulse. 1: 485 sending of pulse command.	
20	Primary filter cutoff frequency of position command	Unit: Hz	
21	Average filter time 1 of position command	Unit: 0.5ms (range: 0-256)	0-256
22	Average filter time 2 of position command	Unit: 0.5ms (range: 0-256)	0-256
23	Reserve		
24	Reserve		
25	Reserve		
26	Reserve		
27	Reserve		
28	Reserve		
29	Reserve		

4.2.4 Details of P3 segment

S/N	Items	Functions	Parameter range
0	Speed measurement mode	0: speed loop refreshing frequency 20K 1: speed loop refreshing frequency 2K	0-1
1	Speed loop proportional gain 1	The gain can be increased to improve the speed response. If the set value is too large, vibration and noise may be easily caused.	0-30000
2	Speed loop integral time constant 1	● This parameter can be reduced to improve the speed response and reduce the speed control error. If the set value is too small, vibration and noise may be easily caused. ● The larger the parameter is, the poorer the rigidity is.	1-30000
3	Speed loop proportional gain 2	It has the same effects as P3-01 and should be switched by the switch in the second segment of speed loop proportional integral control.	0-30000
4	Speed loop integral time constant 2	It has the same effects as P3-02 and should be switched by the switch in the second segment of speed loop proportional integral control.	1-30000
5	PDF coefficient	The speed loop PI is subject to composite PDFF control, and the PDF coefficient is the composite PI control coefficient.	0-1000
6	Speed loop feedforward coefficient	In the case of smooth change of speed control command, the gain can be increased to increase the speed follow-up error. In the case of non-smooth change of speed control command, the gain can be decreased to reduce the operational vibration of the mechanism.	0%-500%
7	Speed detection filter 1	The low-pass filter is used for low speed detection. The cutoff frequency of the filter can be reduced to improve the anti-jamming performance of the system. If the set value is too small, the dynamic response of the system, and even the motor may be abnormal.	5000
8	Speed detection filter 2	Hz	5000
9	Cutoff frequency of speed	Cutoff frequency of speed observer	100-30000

S/N	Items	Functions	Parameter range
	observer		
10	Compensation coefficient of speed observer	The higher the speed is, the stabler the observer is, but the delay in observation may be caused. The lower the speed is, the more sensitive the observer is, but oscillation may be caused.	100-1000
11	Reserve		
12	Speed loop output filter	The filtration parameter has obvious effects on improvement of the stable torque and control of the operating noise of the motor. The above two aspects can be improved by reducing the cutoff frequency. However, the cutoff frequency must not be too low; otherwise, the system operation will be affected.	0-10000
13	Maximum forwarding speed limit	Maximum motor CCW speed limit, using RPM as the basic unit.	0-10000
14	Maximum reversing speed limit	Maximum motor CW speed limit, using RPM as the basic unit.	0-10000
15	Acceleration time	Set the time of motor speed increase from 0 to rated speed (unit: ms)	0-10000
16	Deceleration time	Set the time of motor speed decrease from rated speed to 0 (unit: ms)	0-10000
17	Disabling delay time	IO disabling delay time (unit: ms)	
18	Speed loop command source	0: position loop output; 1: single-end analog (SAIN and AGND) input; 2: P3-19 parameter setting; 3: Differential analog (AS+ and AS-) input; 4: Internal speed mode: speed source--P5-04\P5-05\P5-06\P5-07, with external IO speed selection control; 5: 485 sending of speed command. Note: If Mode 1 or 3 is selected, one IO port can be multiplexed into the analog + IO control direction mode. The IO port is used in the functions similar to command inversion.	
19	JOG speed	Set the JOG operation speed, with the basic unit of RPM.	0-3000
20	Center frequency of wave trap	It is the set value of mechanical resonance frequency. If P3-22 is set as 0, this function will be OFF. Unit: Hz	0-30000
21	Width of wave trap	Filter width of wave trap Unit: Hz	0-30000
22	Attenuation coefficient of wave trap	Refer to the filter attenuation coefficient within the filter width of the wave trap. The large this value is, the smaller the attenuation proportion is. Unit: 1/1000	0-1000
23	Rotation inertia ratio	Refer to the ratio of the load inertia to motor shaft inertia, in 0.1.	0-100
24	P-PI switching mode	0: no switching 1: switch according to the set current. 2: switch according to the external IO.	0-2
25	Threshold of P-PI switching speed error	When the P-PI switching mode (P3-24) is set as 1, set the switching threshold of the set current, in 1/1000.	0-3000
26	Temperature alarm threshold	The parameter setting is not valid until the temperature detection function is enabled (enable the temperature sensor through P0-07).	0~999
27	Acceleration/deceleration time in position mode	The larger this value is, the smaller the acceleration/deceleration is, and the longer the delay time is. In this case, the operation will be stable. (the acceleration is 150RPM/MS is the value is set as “1”)	0-999
28	Fan start-up temperature setting	This parameter is used to set the fan start-up temperature.	0~999
29	Setting of fan shutdown	● When the parameter is more than 0, the fan will be started at the	

S/N	Items	Functions	Parameter range
	temperature	temperature higher than the value of P3-28 and shut down at the temperature lower than the value of P3-29. ● When the parameter is 0, the fan will be kept ON. ● When the parameter is less than 0, the fan will be kept OFF.	

4.2.5 Details of P4 segment parameters

S/N	Items	Functions	Parameter range
0	Positive limit of internal moment	Unit: 1/1000. The internal torque is continuously valid.	0-3000
1	Negative limit of internal moment	Unit: 1/1000. The internal torque is continuously valid.	0-3000
2	Positive limit of external moment	Unit: 1/1000. The external torque and internal torque are continuously valid and limited according to the minimum value.	0-3000
3	Negative limit of external moment	Unit: 1/1000. The external torque and internal torque are continuously valid and limited according to the minimum value.	0-3000
4	Current detection filter	Filter the actually detected current, in Hz.	0-30000
5	Current loop output filter	Filter the current loop output in Hz.	0-30000
6	Current overload value	Set the current overload value. This value is used in combination with the allowable P4-07 overload time. If the continuous output torque of the motor is larger than the set value and the time reaches the set time of P4-07, the drive will send the overload alarm. Unit: 1/1000.	0-3000
7	Allowable current overload time	Set the allowable P4-06 overload time. Unit: 0.1s.	0-30000
8	Brake cycle	Set the braking cycle of the braking resistor, in 100us.	0-30000
9	Brake duty cycle	Set the duty ratio of release of the braking resistor (unit: 100us). The duty ratio of the brake must be less than or equal to the set braking cycle of P4-08.	0-30000
10	Brake threshold voltage value	Used to set brake threshold voltage value, unit: V.	
11	Brake close voltage value	Used to set brake close voltage value, unit: V.	
12	Set value of overvoltage	Used to set overvoltage alarm threshold, unit: V.	
13	Set value of undervoltage	Used to set undervoltage alarm threshold, unit: V.	
14	Maximum allowable working time of braking resistor	If the time of continuous operation of the braking resistor is more than P4-14×10ms, the braking resistor will send the overload alarm. Unit: 10ms.	
15	Command source in moment mode	0: speed loop output; 1: single-end analog (SAIN and AGND) input; 2: value corresponding to the internal parameter P3-19. 3: Differential analog (AS+ and AS-) input; 5: 485 sending of moment command.	
16	Basic value of overload alarm start-up	The software overcurrent alarm 12 is determined in combination with P4-06 and P4-07, generally set as 1000. The rated torque of the motor is used as the basic value. Unit: 1/1000;	
17	Moment setting	As one output port is used for position, speed and moment output, the priority of the three effective parameters is as follows: moment > speed > position.	

S/N	Items	Functions	Parameter range
		If the moment value is negative, the moment will not be outputted. If the speed value is negative, the moment will not be outputted. To output the position, the speed and moment value must be negative.	
18	Speed limit selection in moment mode	0: limited by the P5-0 parameter 1: jointly limited by the P5-0 parameter and single-end input 2: jointly limited by the P5-0 parameter and differential input	0-18
19	Torque complete time	0.5 ms	0-1

4.2.6 Details of P5 segment parameters

S/N	Items	Functions	Parameter range
0	Speed amplitude limit in moment mode	● The maximum speed is limited in the moment control mode. Unit: rpm.	0-9999
1	Zero drifting of single-end analog control	The zero point of analog is mainly used to eliminate the zero drift of analog command, set as follows: ● SAIN is connected to AGND in the single-end mode. SAIN is connected to the positive end, while AGND is connected to the negative end of analog. The voltage between SAIN and AGND is the zero-point voltage, generally 0V. ● Select the appropriate control functions corresponding to the parameter P3-18 in the speed mode and P4-15 in the moment analog mode. ● Select the appropriate negative pressure treatment mode according to the parameter P5-08. ● Adjust the parameter into the P5-01 interface and press OK. Then press UP to adjust the zero drift. Finally press OK to save the setting. Refer to AD zero adjustment.	0-51
2	Gain of single-end analog control	Motor speed corresponding to the external input voltage of 1V, in rpm/V.	
3	Dead zone of single-end analog control		0-38
4	Internal speed 1	Select the internal speed 1 as the speed command in the SC1Z OFF and SC2Z OFF mode of speed control.	0-5
5	Internal speed 2	Select the internal speed 2 as the speed command in the SC1Z ON and SC2Z OFF mode of speed control.	
6	Internal speed 3	Select the internal speed 3 as the speed command in the SC1Z OFF and SC2Z ON mode of speed control.	
7	Internal speed 4	Select the internal speed 4 as the speed command in the SC1Z ON and SC2Z ON mode of speed control.	
8	Optional bit of negative pressure treatment of single-end differential analog	● Negative pressure treatment of single-end differential analog Bit0: negative pressure treatment of single-end analog, relative to the single-end ad zero point. Bit1: negative pressure treatment of differential analog, relative to the differential ad zero point. ● Bitx bit operation instructions 0: no negative pressure treatment. 1: the command of negative pressure treatment is considered 0.	
9	Filter coefficient of single-end analog	Filter the single-end input analog. 0 indicates no filter.	0-999
10	Zero drift of differential analog control	The zero point of analog is mainly used to eliminate the zero drift of analog command, set as follows:	

S/N	Items	Functions	Parameter range
		● The differential part of external analog input is connected to AS+/AS-. The voltage between AS+ and AS- is the zero-point voltage, generally 0V. ● Select the appropriate control functions corresponding to the parameter P3-18 in the speed mode and P4-15 in the moment analog mode. ● Select the appropriate negative pressure treatment mode according to the parameter P5-08. ● Adjust the parameter into the P5-10 interface and press OK. Then press UP to adjust the zero drift. Finally press OK to save the setting. Refer to AD zero adjustment.	
11	Gain of differential analog	Motor speed corresponding to the external input voltage of 1V, in rpm/V.	
12	Dead zone of differential analog		
13	Filter coefficient of differential analog	Filter the differential input analog. 0 indicates no filter.	0-999
14	The speed reaches the set value in the speed control mode.	The parameter is a basis to judge whether the drive reaches the set speed in the speed control mode. When the actual speed is less than or equal to the set value, the drive is considered conforming. The signal will be COIN ON when the speed is conforming; otherwise, the signal will be COIN OFF. As one output port is used for position, speed and moment output, the priority of the three effective parameters is as follows: moment > speed > position. If the moment value is negative, the moment will not be outputted. If the speed value is negative, the moment will not be outputted. To output the position, the speed and moment value must be negative.	

Chapter V Operation

5.1 Working Sequence

5.1.1 Power-on sequences

1. Connect power to the main circuit power input terminals (three phases to L1, L2 and L3, single phase to L1 and L3) via the AC contactor.

2. Switch on the power L1 and L2 of the control circuit at the same time with or before the main circuit power. If only the control circuit power is connected, the servo readiness (SRDY) signal is OFF.

3.After the main circuit power is turned on, servo readiness signal (SRDY) is ON (with delay 1.5s). Then it receives servo enabling (SON) signal, servo enabling is effective, the driver output is effective and it is in the running state. If the servo enabling is ineffective, alarm may be sent, the base circuit would be shut down, and the motor is in a free state.

4. When the servo enabling is connected concurrently with the power, the base circuit is connected in 1.5 seconds.

5. Frequent connection and disconnection to the power may damage the soft-start circuit and the dynamic braking circuit. On/off frequency should be no more than five times per hour and less than 30 times a day. If the driver or motor is overheated, wait for 30 minutes after troubleshooting before connecting it to the power.

5.1.2 Timing diagram

Power connection sequences and alarm sequences:

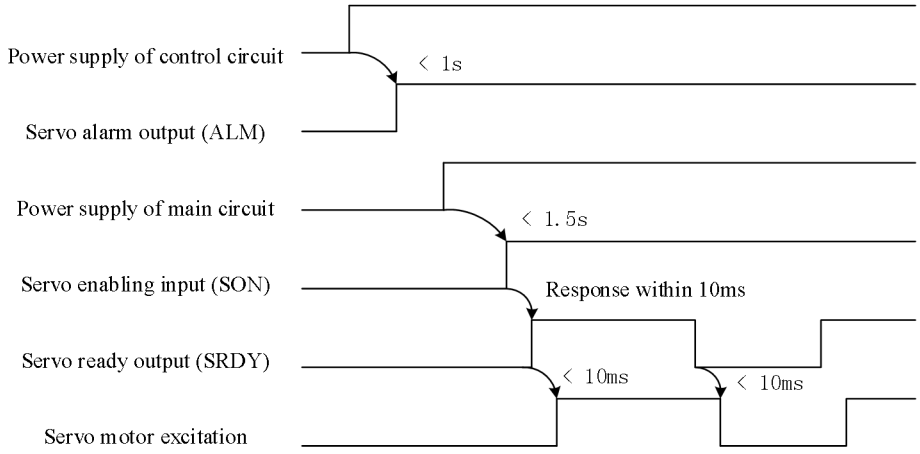


Fig. **6- 1**: Power-on Sequence Diagra m

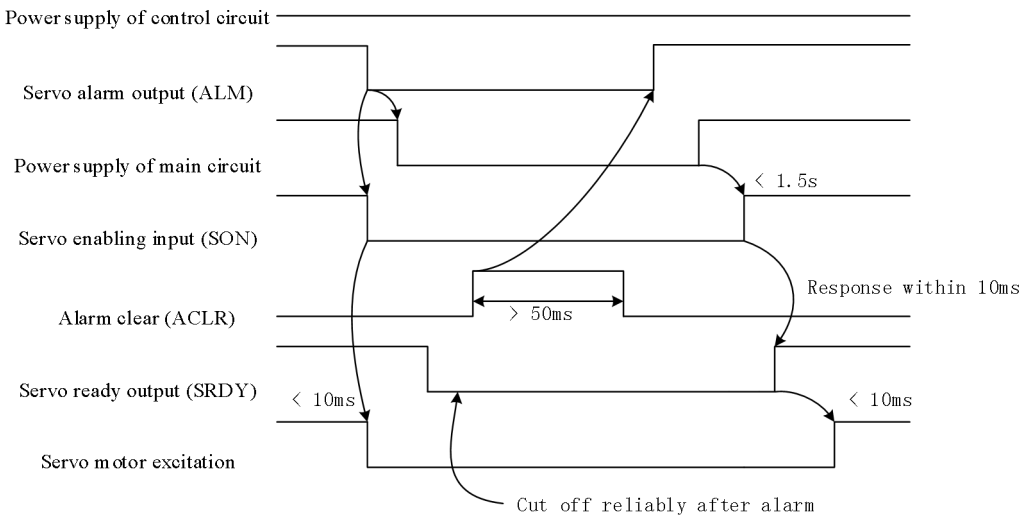


Fig. **6- 2**: Alarm Sequence Diagram

5.2 NOTES

1. The start/stop frequency is limited by the servo drive and motor and must meet the two conditions at the same time.

1) Allowable frequency of servo drive

If high frequency is required, check whether it is within the allowed frequency range. The allowed frequency range varies along with the motor type, capacity, load inertia and motor speed. Firstly set the deceleration time to prevent too large renewable energy (in the position control mode, set the output pulse acceleration and deceleration time for the host controller). When the load inertia is m times of the motor inertia, the frequency allowed for the servo motor is as follows:

Multiple of load inertia	Allowed frequency
m≤3	> 100 times / minute; acceleration and deceleration time: 60 ms or less
m≤5	60 to 100 times / minute; acceleration and deceleration time: 150 ms or less
m>5	< 60 times / minute; acceleration and deceleration time: 150 ms or less

If it still fails to meet the requirements, reduce the internal torque limit (parameter P4-00 and P4-01) and lower down the maximum motor speed (parameter P3-13 and P3-14).

2) The allowed frequency for the servo motor varies with the load conditions, running time and other factors. Please refer to the motor manual.

2. Generally, if the multiple of load inertia is less than five times, use the motor under large inertia conditions. Main circuit over voltage or braking anomalies may occur from time to time and the countermeasures are as follows:

1) Reduce the internal torque limit (Parameter P4-00 and P4-01).

2) Reduce the maximum speed of the motor (Parameter P3-13 and P3-14).

3) Providing an additional regeneration device.

3. As the servo driver is provided with a power supply for the encoder, to ensure normal operation of the encoder, the output voltage should be maintained at 5V ± 5%. If long cables are used, voltage loss may occur. In this case, please use the multi-core encoder for power supply in order to reduce the voltage drop of the cable line.

5.3 Check before Operation

After completing installation and wiring, check the following items before power connection:

1. Whether TB wiring of power terminal is correct and reliable and whether the input voltage is correct;
2. Whether power line or the motor line is short circuit or properly grounded;
3. Whether the encoder cable is connected correctly;
4. Whether the control signal terminal is properly connected? Whether the power polarity and size are correct;
5. Whether the driver and the motor are firmly fixed;
6. Whether the motor shaft is not connected to the load.

5.4 Position control mode

5.4.1 Wiring

1. The 3-phase AC220V terminal of the main circuit should be connected to the terminal R, S and T, and if the power input is single-phase AC220V, terminal should be connected to the terminal R and T.
2. The control voltage terminal L and N should be connected to the single-phase AC220V terminal.
3. Encoder signal connector CN1 should be properly connected with the servo motor;
4. Control signal connector CN2 should be connected as per the figure shown.

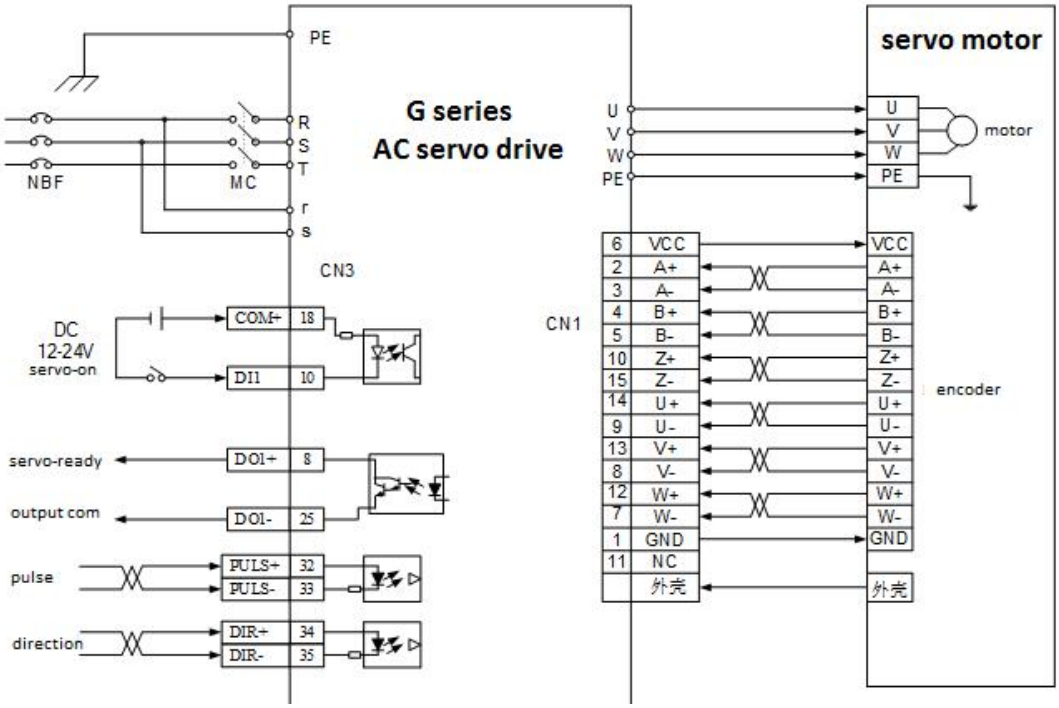


Fig. 6-4: Simple Wiring Diagram of Position Control Mode

5.4.2 Operations

1. Turn on the control circuit power supply and main power and the monitor displays;
2. Set parameter values according to in the table below and write the parameters into EEPROM

Parameter No.	Meanings	Parameter value	Default value
P0-04	Control mode selection	0	0
P2-14	Pulse input mode selection	To be set by the user	0
P1-04	Command pulse filter	To be set by the user	0
P1-05	Feedback pulse bandwidth filtering number	To be set by the user	0
P1-06	Inversion of input IO port	To be set by the user	0
P1-08	Input IO port repositioning 1	To be set by the user	Hd410
P1-09	Input IO port repositioning 2	To be set by the user	H657A
P2-00	Position loop proportion	To be set by the user	30
P2-02	Position loop feedforward	To be set by the user	0
P2-04	Electronic gear numerator	To be set by the user	1
P2-03	Electronic gear denominator	To be set by the user	1
P2-12	Smooth filter of position command	To be set by the user	5000
P4-19	Invalid acceleration/deceleration control in position mode	To be set by the user	0

Instructions of parameter setting:

At first, set the parameter of P0-04 control as 0, select the position control mode, and set the parameter P2-14 of input command as pulse + direction, CW/CCW or AB quadrature pulse. For interference resistance in the application environment, set the appropriate number of command and feedback filters, with the basic unit of 10ns. Refer to the parameter P1-04 and P1-05 for filter setting.

Secondly, relocate all input IO ports of G series. The default configuration is set in the factory. Select the appropriate repositioning mode according to the parameter P1-08 and P1-09. Refer to P1-06 for input port inversion.

Again, the factory settings of pulse frequency and control speed of the system may not meet the requirements. The user can select the appropriate electronic gear ratio with reference to P2-03 and P2-04. The electronic gear ratio can be set with reference to 6.4.3. If the host acceleration/deceleration curve cannot meet the system requirements, the user can select the appropriate function of smooth filtration of position command with reference to P2-12.

Finally, disconnect the power supply and start the control motor after setting the control parameter of the upper layer of position control according to the basic parameters of the motor, including the rated current, rated torque and rated speed of the motor, relevant moment limits, etc.

3. After the alarm and anomaly are eliminated, enable the servo drive (SON-ON). Send the low-frequency pulse signal from the controller to the drive to make the motor operate at a low speed. If the motor operation cannot meet the user's requirements, relevant setting can be done according to the way of gain adjustment in 6.4.4.

5.4.3 Setting of Electronic gear

The unit pulse command input into the device can be defined through the electronic gear to move the transmission device into any position. The gear ratio and reduction ratio of the transmission system and the wire number of the motor encoder are not required for the pulse command generated in host control. The following table describes the variables of the electronic gear.

Variable	Variable description	Drive value
C	Encoder wire number	2500
P_t	Encoder wire number (pulse/turn)	4*C pulses
R	Reduction ratio	R=H/K, where: H: number of motor turns; K: load shaft turns.
ΔP	Amount of movement of one command pulse	
P_C	Number of command pulses within one turn of load shaft	
Pitch	Screw pitch (mm)	
D	Roller diameter (mm)	

Formula:

$$\text{Electronic gear ratio} \quad \frac{N}{M} = \frac{P_t}{P_C \times (R)}$$

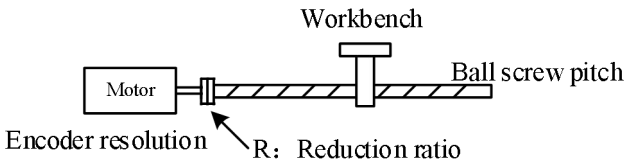
P_t = Encoder resolution P_c = Number of command pulses within one turn of load shaft R = Reduction ratio

Where,

$$P_C = \frac{\text{Number of amount of movement within one turn of load shaft}}{\text{Amount of movement of one pulse} \quad \Delta P}$$

The final result should be subject to reduction until the numerator and denominator are no more than 32767, and the ratio should be guaranteed $\frac{1}{100} \le \text{Electronic gear ratio} \quad \frac{N}{M} \le 100$;

1. Analysis of electronic gear with ball screw



Ball screw:

$$\text{Electronic gear ratio} \quad \frac{N}{M} = \frac{P_t}{P_C \times R} \quad \text{Where,} P_C = \frac{P\text{itch}}{\Delta P}$$

Example analysis:

The encoder wire number C is 2500, the reduction ratio is 0.5, the pitch is 10mm, and the equivalent of one pulse is 0.001mm. The calculated electronic gear ratio is:

Calculate one encoder turn P_t

$$P_t = 4 \times C = 4 \times 2500 = 10000$$

Calculate P_C

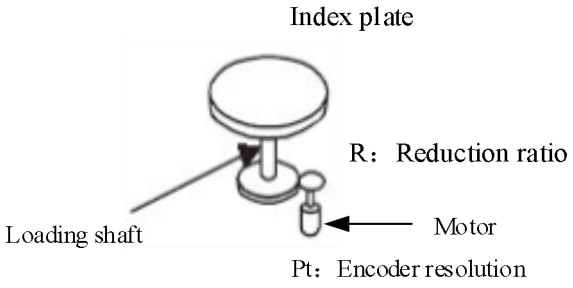
$$P_C = \frac{P\text{itch}}{\Delta P} = \frac{10}{0.001} = 10000$$

Calculate the electronic gear ratio

$$\text{Electronic gear ratio} \quad \frac{N}{M} = \frac{P_t}{P_C \times R} = \frac{10000}{10000 \times 0.5} = \frac{2}{1}$$

Set the numerator of the electronic gear ratio as 2 and the denominator as 1.

1. Analysis of electronic gear ratio with index plate



Load on the index plate:

$$\text{Electronic gear ratio} \quad \frac{N}{M} = \frac{P_t}{P_C \times R} \quad \text{Where} \quad P_C = \frac{360^\circ}{\Delta P}$$

Example analysis: given that the encoder wire number is 2500, the pulse equivalent is 0.1° and the reduction ratio is 1/5, the electronic gear ratio is calculated as follows.

Calculate one encoder turn P_t

$$P_t = 4 \times C = 4 \times 2500 = 10000$$

Calculate P_C

$$P_C = \frac{360^\circ}{\Delta P} = \frac{360^\circ}{0.1^\circ} = 3600$$

Calculate the electronic gear ratio

$$\text{Electronic gear ratio} \quad \frac{N}{M} = \frac{P_t}{P_C \times R} = \frac{10000}{3600 \times \frac{1}{5}} = \frac{125}{9}$$

Set the numerator of the electronic gear ratio as 125 and the denominator as 9.

2. Analysis of electronic gear with conveyor belt

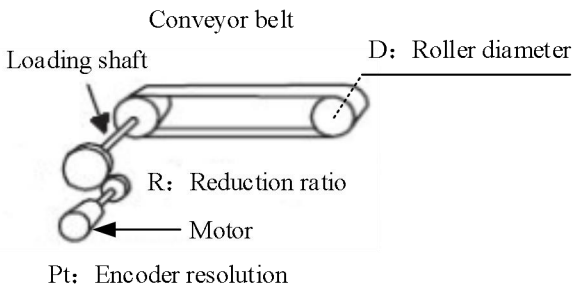


Fig. 6-5 Working Diagram of Belt

Loads on the conveyor belt:

$$\text{Electronic gear ratio}\quad \frac{N}{M}=\frac{P_t}{P_C\times R}\quad \text{Where}\quad P_C=\frac{\pi D}{\Delta P}$$

Given that the encoder wire number is 2500, the reduction ratio is 1/10, the diameter of the roller screw is 200mm and the pulse equivalent is 0.001mm, the electronic gear ratio is calculated as follows.

Calculate one encoder turn P_t

$$P_t=4\times C=4\times 2500=10000$$

Calculate P_C

$$P_C=\frac{\pi D}{\Delta P}=\frac{3.14\times 200}{0.001}=628000$$

Calculate the electronic gear ratio

$$\text{Electronic gear ratio}\quad \frac{N}{M}=\frac{P_t}{P_C\times R}=\frac{10000}{62800\times\frac{1}{10}}=\frac{2500}{157}$$

Set the numerator of the electronic gear ratio as 2500 and the denominator as 157.

4. Relation Table of Electronic Gear Ratio and Motor Rotation Turns

Table 6.1: The relationship between pulse number and number of rotations

Number of pulses	Number of motor rotations; $\frac{(P2-04)}{10000\times(p2-03)}$	Numerator of electronic gear ratio: P2-04	Denominator of electronic gear ratio: P2-03
10000	1	1	1
5000	1	2	1
3000	1	10	3
800	1	25	2
20000	1	1	2
1000	2/3	20	3
4000	3	30	4

5. Relation Table of Electronic Gear Ratio and Rotational Speed

Table 6.2: The relationship between pulse frequency and rotation speed

Input pulse frequency (Hz)	Motor speed (r/min) $\frac{Frequency\times 60\times(P2-04)}{10000\times(p2-03)}$	Numerator of electronic gear ratio: P2-04	Denominator of electronic gear ratio: P2-03
300k	1800	1	1
500k	3000	1	1
100k	1200	2	1
100k	1800	3	1
50k	1000	10	3
200k	800	2	3
100k	300	1	2

5.4.4 Gain adjustment

The position and speed bandwidth must be selected according to the mechanical rigidity and application. The mechanical rigidity of the conveyor connected by the belt is low, so the bandwidth can be set as a small value. The mechanical rigidity of the ball screw driven by the reducer is medium, the bandwidth can be set as a medium value. The rigidity of the direct drive type ball screw or linear motor is high, the bandwidth can be set as a large value. If the mechanical properties are unknown, the gain can be increased gradually to increase the bandwidth until resonance occurs. Then the gain can be reduced.

If one parameter of the servo gain is changed, the other parameters should be adjusted. Any parameter must not be changed significantly. Generally the following principles should be observed for servo parameter modification steps.

Increase the response.	Decrease the response and inhibit the vibration and excessive adjustment.
1. Increase the proportional coefficient of the speed loop. 2. Reduce the integral time constant of the speed loop. 3. Increase the position loop gain.	1. Decrease the position loop gain. 2. Increase the integral time constant of the speed loop. 3. Reduce the position loop gain.

Steps of gain adjustment of speed control:

1. Set the appropriate load moment of inertia.
2. Set the integral time constant of the speed loop as the larger value.
3. Increase the proportional coefficient of the speed loop gain while avoiding system oscillation.
4. Decrease the integral time constant of the speed loop while avoiding system oscillation.
5. If the gain cannot be increased and the expected response cannot be achieved as a result of resonance of the mechanical system, motor noise, etc., adjust the time constant of the torque filter and continue the above steps.

Steps of gain adjustment of position control:

1. Set the appropriate load moment of inertia.
2. Set the integral time constant of the speed loop as the larger value.
3. Increase the proportional coefficient of the speed loop gain while avoiding system oscillation.
4. Decrease the integral time constant of the speed loop while avoiding system oscillation.
5. Increase the position loop proportion while avoiding system oscillation.
6. If the gain cannot be increased and the expected response cannot be achieved as a result of resonance of the mechanical system, motor noise, etc., adjust the time constant of the torque filter and continue the above steps.
7. If smaller positioning error and rapider positioning are required, the position feedforward can be increased properly.

5.4.5 Overtravel limit

The overtravel limit function is a safety function used to enable the limit switch to stop the motor in a forced manner when the mechanical movement is beyond the design range of safety travel.

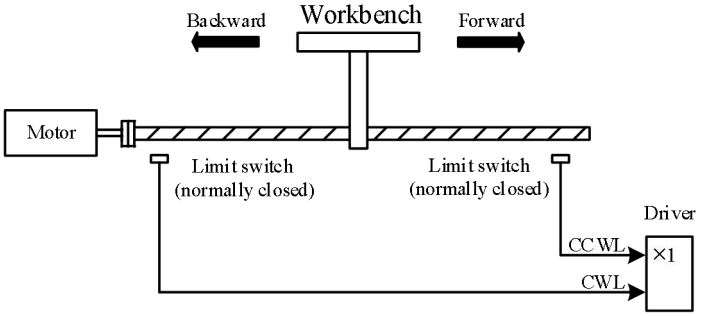


Fig. 6-6 Workbench Table

It is recommended to use the normally closed contact of the limit switch. The limit switch should be closed within the safety scope and open in the case of overtravel. When the limit switch is connected to Forward Drive Stop (FSTP) and Reverse Drive Stop (RSTP), this function will fail if the drive stop input function is not selected according to the parameter P1-8 and P1-9. If selected in P1-8 and P1-9 input port repositioning, the drive stop function will be enabled.

5.5 Speed control mode

5.5.1 Analog input speed mode

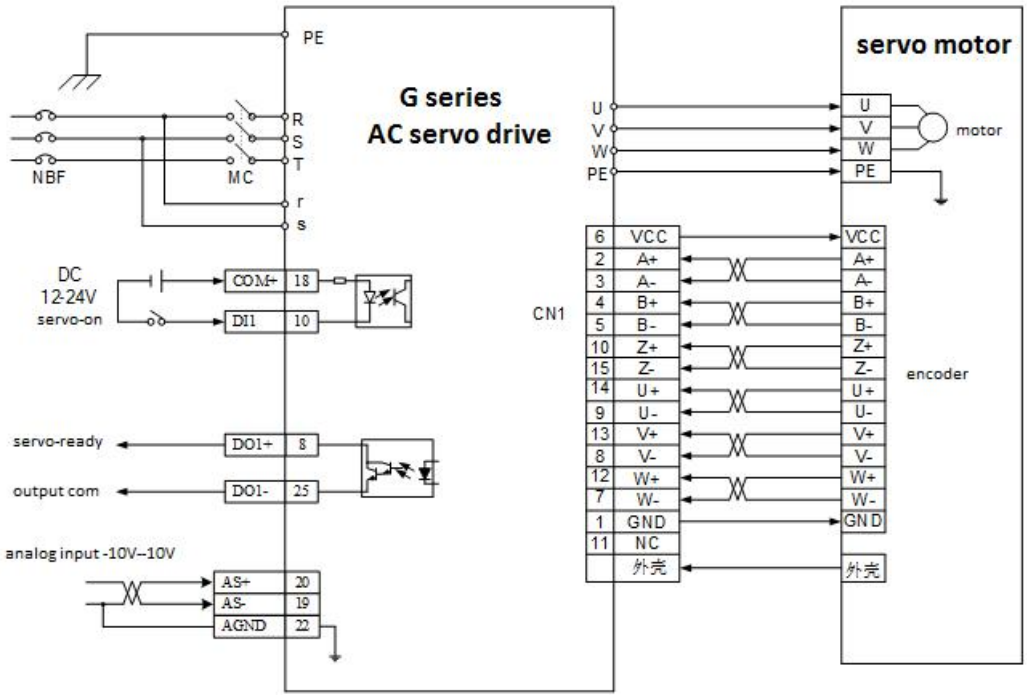


Fig. 6-7 Wiring Diagram of Speed Control Model

Turn on the control circuit power supply and main power and the monitor displays;

Set parameter values according to in the table below and write the parameters into EEPROM

Parameter No.	Meanings	Parameter value	Default value
P0-04	Control mode selection	1	0
P3-18	Speed command source	To be set by the user	0
P5-08	Negative pressure treatment of analog	To be set by the user	0
P5-09	Filter coefficient of single-end analog	To be set by the user	990
P5-13	Filter coefficient of differential analog	To be set by the user	990
P5-01	Zero adjustment parameter of single-end analog	To be set by the user	0
P5-10	Zero adjustment parameter of differential analog	To be set by the user	2048
P1-06	Inversion of input IO port	To be set by the user	0
P1-08	Input IO port repositioning 1	To be set by the user	Hd410
P1-09	Input IO port repositioning 2	To be set by the user	H657A
P1-12	Output IO port DO3 repositioning	To be set by the user	0
P3-00	Selection of speed PI mode	To be set by the user	0
P3-01	Speed loop proportion	To be set by the user	100
P3-02	Speed loop integral	To be set by the user	10
P3-05	PDFF coefficient of speed loop	To be set by the user	1000
P3-06	Speed loop feedforward coefficient	To be set by the user	0
P3-07	Speed detection filter 1	To be set by the user	-1
P3-08	Speed detection filter 2	To be set by the user	-1
P3-09	Cutoff frequency of speed observer	To be set by the user	100
P3-10	Weight setting of detector 1 and detector 2	To be set by the user	0
P3-12	Speed loop output filter	To be set by the user	-1
P3-13	Setting of maximum forwarding speed	To be set by the user	-1
P3-14	Setting of maximum reversing speed	To be set by the user	-1
P3-15	Setting of acceleration time	To be set by the user	-1

P3-16	Setting of deceleration time	To be set by the user	-1
P3-19	JOG speed setting	To be set by the user	100
P5-02	Gain of analog control	To be set by the user	100
P5-03	Dead zone of analog control	To be set by the user	300
P5-04	Internal speed 1	To be set by the user	0
P5-05	Internal speed 2	To be set by the user	0
P5-06	Internal speed 3	To be set by the user	0
P5-07	Internal speed 4	To be set by the user	0

Instructions of parameter setting:

At first, set the P0-04 control mode as the speed control mode, and determine the source of command speed according to the speed command source parameter P3-18.

Set the parameter P3-18 in the speed control mode.

0: the speed command comes from the PULSE and DIR terminal of CN2;

1: set the speed command source designated in the parameter P5-08 in the differential analog control mode.

2: the operation speed is the value designated in the parameter P3-19 in the JOG mode.

3: select the analog + IO port mode.

4: select the internal register model. In this case, the speed is controlled through the DI port designated in P1-08 and P1-09. Adjust specific settings with reference to the parameter P5-04 to P5-07.

Remark:

1) Two-way AD mode: the zero speed locking port can be specified through P1-08 and P1-09.

2) Single-end AD + direction mode: the zero speed locking port and direction control port can be specified through P1-08 and P1-09.

Then, reposition the corresponding IO port according to the applied external IO port. Refer to P1-08 and P1-09 for repositioning parameters. If inversion of input IP logic level is required, refer to P1-06. If the output IO is related, refer to P1-12 to select multiple output functions of DO3, and DO1 and DO2 cannot be used to achieve the repositioning function. DO1 is used for servo readiness signal output, and DO2 for servo alarm signal output.

Again, specific operations should be done according to the control source.

Before using external AD for speed input, it is necessary to conduct the following steps for speed zero setting:

1) Set the external input voltage as 0V.

2) Set P0-04 as the speed mode.

3) Specify the parameter P3-18 as the speed command source.

4) Set the drive in the parameter setting mode. The parameter should be set through P5-01 in the single-end mode and P5-10 in the differential mode.

5) Press UP. In this case, the zero-point value will be sampled and calculated automatically by the drive. Continuously adjust the zero point several times. If the zero-point change is not large but close to 2048 (close to 0 in the single-end mode), zero adjustment can be considered successful. Press ENTER to save the zero-point value. Thus zero adjustment is finished, as shown in the following figure.

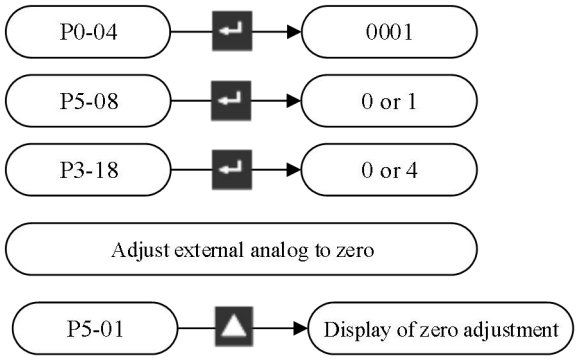


Fig. 6-8 Block Chart of Zero Adjustment

6) Select the appropriate control gain and dead zone according to P5-02 and P5-03 in the single-end mode and according to P5-11 and P5-12 in the differential mode.

5.5.2 Internal speed control

Set the internal speed parameter P5-04 to P5-07.

Select the internal speed switching IO function by IO port repositioning. Refer to the parameter P1-08 and P1-09.

5.5.3 JOG operation

Set the JOG speed with reference to the parameter P3-19.

◯ Refer to Chapter III “Instructions of JOG Operation” of the Operation Manual.

Finally, select the appropriate deceleration parameter P3-15 and P3-16 according to the host control curve. If pulse control is involved, refer to the guide of position control. Set the basic parameters of the motor according to the nameplate, such as the rated current, rated speed, rated torque and inertia. Select the appropriate inertia according to the load inertia. JOG operation will be started after the power supply is cut off.

After the alarm and anomaly are eliminated, enable the servo drive (SON-ON). Send the low-frequency pulse signal from the controller to the drive to make the motor operate at a low speed. If the motor operation cannot meet the user’s requirements, relevant setting can be done according to the way of gain adjustment in 6.4.4.

5.6 Torque Control Mode

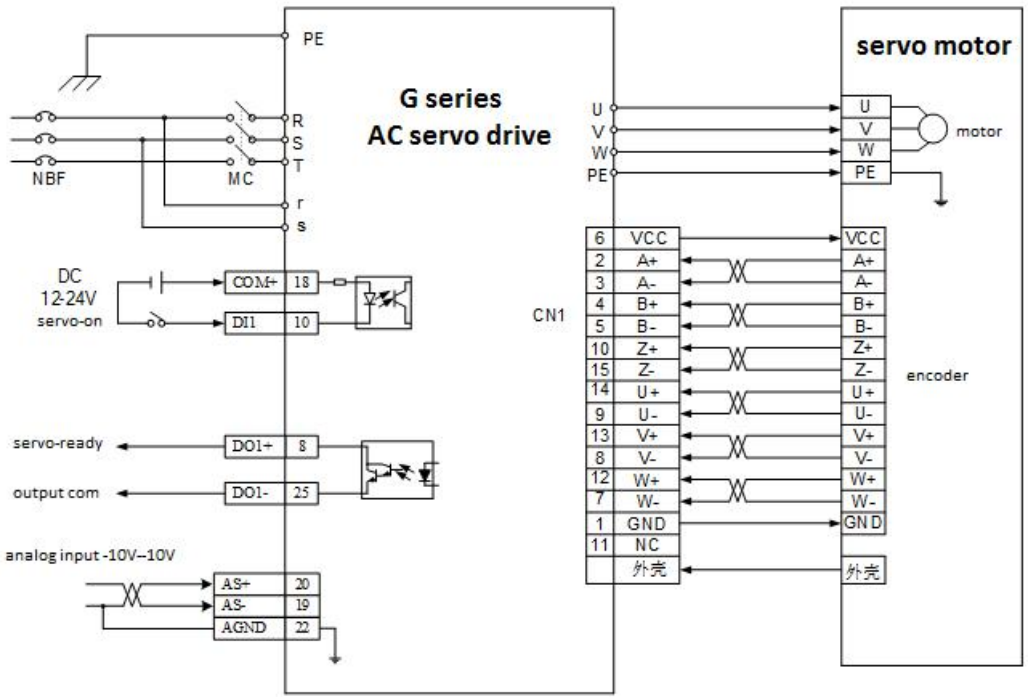


Fig. 6-9 Wiring Diagram of Torque Control Mode

1. Turn on the control circuit power supply and main power and the monitor displays;
2. Set parameter values according to in the table below and write the parameters into EEPROM

Parameter No.	Meanings	Parameter value	Default value
P0-04	Control mode selection	2	0
P4-15	Torque command source	To be set by the user	0
P5-08	Negative pressure treatment of analog	To be set by the user	0
P5-01	Zero adjustment parameter of single-end analog	To be set by the user	10
P5-02	Gain of single-end analog	To be set by the user	100
P5-03	Dead zone of single-end analog	To be set by the user	10
P5-09	Filter coefficient of single-end analog	To be set by the user	990
P5-10	Zero adjustment parameter of differential analog	To be set by the user	0
P1-06	Inversion of input IO port	To be set by the user	0
P5-11	Gain of single-end analog	To be set by the user	100
P5-12	Dead zone of single-end analog	To be set by the user	10
P5-13	Filter coefficient of differential analog	To be set by the user	990
P1-08	Input IO port repositioning 1	To be set by the user	Hd410
P1-09	Input IO port repositioning 2	To be set by the user	H657A
P1-12	Output IO port DO3 repositioning	To be set by the user	0
P4-00	CCW maximum torque limit	To be set by the user	3000
P4-01	CW maximum torque limit	To be set by the user	3000
P4-18	Speed limit selection in moment mode	To be set by the user	0
P5-00	Speed limit of torque mode	To be set by the user	500

Parameter description:

At first, select the torque control mode according to the control mode parameter P0-04 and the appropriate torque source according to the torque source parameter P4-15. The analog control of the same speed mode is set in the same method. Select the negative pressure treatment of analog according to P5-08.

Then select the analog control mode. If zero adjustment of analog is involved, refer to zero adjustment requirements in 6.5. For repositioning of the input and output IO port, refer to the parameter P1-08 and P1-09. For IO port inversion, refer to the parameter P1-06. For DO3 repositioning of the output port, refer to the parameter P1-12.

Again, several limit parameters should be set in the torque control mode, including the maximum torque limit. Set the torque limits in both directions with reference to the parameter P4-06 and P4-01. Set the speed limit of the torque mode with reference to the parameter P5-00.

Finally, after setting the function parameters, set the appropriate motor parameters according to the nameplate, including the rated current, rated torque, rated speed and inertia. Start operation after the power supply is cut off.

3. After the alarm and anomaly are eliminated, enable the servo drive (SON-ON). Send the low-frequency pulse signal from the controller to the drive to make the motor operate at a low speed. If the motor operation cannot meet the user's requirements, relevant setting can be done according to the way of gain adjustment in 6.4.4.

Chapter VI Communication Function

6.1 Communication Overview

The G series general AC servo drive has the function of RS485 and 232 serial communication. With the third-party PLC or PC, this function can be used, through the Modbus protocol, to read and set the internal parameters of the drive, monitor the internal status of the drive, complete specific functions, etc.

The 232 serial communication function can be applied in combination with the PC debug software to realize parameter reading, parameter setting, parameter export, parameter import, and monitoring of internal operation curve of the drive. Refer to the instructions of PC debug software for specific operations.

6.2 Overview of Communication Parameters

P1-03	Drive communication address number	Parameter range	Default value	Unit	Remark
		0-32	0	None	0 is the broadcast address.

When RS-485 is used, the communication address numbers of different drives on the same bus should be set according to the parameter in the communication address of the servo drive. These communication address numbers should be unique on the same bus. The drives on the same bus must have different address numbers; otherwise, abnormal communication will be caused. Refer to the following table for the parameter setting range and method.

P1-02	Drive communication protocol	Parameter range	Default value	Unit	Remark
		0-65535	0	None	Set according to the hexadecimal requirements.

When RS-485 is used, the Modbus communication protocol format, communication speed, communication mode, 485 communication ON/OFF and other functions of the servo drive should be set according to the parameter P1-02. Refer to the following table for P1-02 parameter setting. The specific parameters are displayed in sequence in the ABCD form, starting with “H”. A indicates the thousands place, B indicates the hundreds place, C indicates the decade place and D indicates the units place.

LED bits	H	A-	B-	C	D
LED contents	Indicate the	1: enable 485.	1: ASSCI	0: 7N2	0: 4800

It can be seen in the table that 485 communication can be enabled or disabled according to the value of A and select the Modbus communication form according to the value of B, the communication protocol according to the value of C and the communication baud rate according to the value of D. In the C form, N indicates no parity check, E indicates even parity check and O indicates odd parity check. The digits 7 and 8 indicates 7bit or 8bit, followed by 1 and 2 indicating the stop bit. Example: 7N2 means the data bit width 7bit, with no parity check and 2 stop bits.

6.3 MODBUS Communication Protocol

When the RS-232/485 serial communication interface is used, a unique address number must be preset in P1-03 for each servo drive. The drive is controlled by the host according to the set address number. The MODBUS communication protocol is used in communication. MODBUS can be applied in two modes: ASCII mode and RTU mode. The user can perform corresponding settings according to the parameter P1-02. The details of specific commands of MODBUS are shown below.

6.3.1 Code meaning

(1) ASCII mode

Each 8-bit digit is composed of two ASCII characters. For example, 46H, a one-byte digit (hexadecimal) is expressed as ASCII“46”, including “4” as the ASCII code (34H) and ‘6’ as the ASCII code (34H).

The ASCII code includes the number from 0 to 9 and letter from A to F, as shown in the following table.

Character Symbol	‘0’	‘1’	‘2’	‘3’	‘4’	‘5’	‘6’	‘7’
(2) RTU mode	30H	31H	32H	33H	34H	35H	36H	37H
Character Symbol	‘8’	‘9’	‘A’	‘B’	‘C’	‘D’	‘E’	‘F’
(2) RTU mode	38H	39H	41H	42H	43H	44H	45H	46H

(2) RTU mode

Each 8-bit digit is composed of two 4-bit hexadecimal characters, such as 46H, a one-byte digit.

6.3.2 Character structure

10bit character box (for 7-bit characters)

11 bit character box (for 8-bit characters)

6.3.3 Communication data structure

(1) Communication data format box

ASCII mode:

STX	Starting character “:” (3AH)
ADR	Communication address: one byte includes two ASCII codes.
CMD	Command code: one byte includes two ASCII codes.
DATA(n-1)	Data contents: n characters = 2*n bytes, including 4*n ASCII codes, n≤12
……..	
DATA(0)	
LRC	Checksum: one byte includes two ASCII codes.
End 1	End code 1: (0DH) (CR)
End 0	End code 0: (0AH) (LF)

RTU mode:

STX	The idle bus space is larger than 10ms.
ADR	Communication address: one byte
CMD	Command code: one byte
DATA(n-1)	Data contents: n characters =2*n bytes, n≤12
……..	
DATA(0)	
CRC	Checksum: one byte
End 1	The idle bus space is larger than 10ms.

(2) Description of communication data format box

The details of the communication data format box are described as follows:

STX (communication start)

ASCII mode: the ASCII code using “:” as the starting symbol of the data frame is 3AH.

RTU mode: use the idle bus space of more than 10ms as the starting symbol of the data frame.

ADR (communication address)

Set the ADR value according to the set value of P1-03. See the limits of legal characters within the range of P1-03.

ASCII mode: ADR=16, corresponding to the hexadecimal value 10H and ASCII code 31H and 30H.

RTU mode: ADR=16, corresponding to the hexadecimal value 10H and RTU value 10H.

CMD (command code) and DATA (data character)

The data character format is related to the command code. The commonly used command codes are introduced in details as follows:

(3) Command code: 03H, N-word reading.

The maximum value of N is 12. Take the starting address 0002H of No. 01H servo drive as an example. Continuously read two characters.

ASCII mode:

Command information

STX	':'
ADR	'0'
	'1'
CMD	'0'
	'3'
Starting data position	'0'
	'0'
	'0'
	'2'
Number of data	'0'
	'0'
	'0'
	'2'
LCR Check	'F'
	'8'
End 1	(0DH)(CR)
End 0	(0AH)(LF)

Respond information

STX	':'
ADR	'0'
	'1'
CMD	'0'
	'3'
Number of data (calculated by byte)	'0'
	'4'
Content of starting data address (0002H)	'0'
	'0'
	'B'
	'1'
Content of address (0003H)	'1'
	'F'
	'4'
	'0'
LCR Check	'E'
	'8'
End 1	(0DH)(CR)
End 0	(0AH)(LF)

RTU mode:

Command information

ADR	01H
CMD	03H
Starting data position	00H(high byte)
	02H(low byte)
Number of data (calculated by word)	00H
	02H
CRC Check Low	65H(low byte)
CRC Check High	CBH(high byte)

Respond information

ADR	01H
CMD	03H
Number of data (calculated by byte)	04H
Content of address (0002H)	00H(high byte)
	B1H(low byte)
Content of address (0003H)	1FH(high byte)
	40H(low byte)
CRC Check Low	A3H(low byte)
CRC Check High	D4H(high byte)

(4) Command code: 06H, one-word character.

Example: write 100 (0064H) into the address 0002H of the 01H servo drive.

ASCII mode:

Command information

STX	':'
ADR	'0'
	'1'
CMD	'0'
	'6'
Starting data position	'0'
	'0'
	'0'
	'2'
Content of data	'0'
	'0'
	'6'
	'4'
LCR Check	'9'
	'3'
End 1	(0DH)(CR)
End 0	(0AH)(LF)

Respond information

STX	':'
ADR	'0'
	'1'
CMD	'0'
	'6'
Starting data position	'0'
	'0'
	'0'
	'2'
Content of data	'0'
	'0'
	'6'
	'4'
LCR Check	'9'
	'3'
End 1	(0DH)(CR)
End 0	(0AH)(LF)

RTU mode:

Command information

ADR	01H
CMD	06H
Starting data position	00H(high byte)
	02H(low byte)
Content of data	00H(high byte)
	64H(low byte)
CRC Check Low	29H(low byte)
CRC Check High	E1H(high byte)

Respond information

ADR	01H
CMD	06H
Starting data position	00H(high byte)
	02H(low byte)
Content of data	00H(high byte)
	64H(low byte)
CRC Check Low	29H(low byte)
CRC Check High	E1H(high byte)

(5) LRC (ASCII mode) and CRC (RTU mode) check and calculation:

ASCII mode:

LRC check is applied in the ASCII mode. The LRC frame errors are added from ADR to the last data. The part of the result exceeding 256 is eliminated based on 256 (example: if the result is hexadecimal 128H, and the result is 28H after elimination). Then the binary complementary code is calculated. The final result is the LRC checksum.

Example: read one word from the 0003H address of No. 01H servo drive.

STX	':'
ADR	'0'
	'1'
CMD	'0'
	'3'
Location of initial data	'0'
	'0'

	‘0’
	‘3’
Number of data	‘0’
	‘0’
	‘0’
	‘1’
LRC	‘F’
	‘8’
End 1	(0DH) (CR)
End 0	(0AH) (LF)

01H + 03H + 00H + 03H + 00H + 01H = 08H. The binary complementary code of 08H is F8h, and the final LRC is ‘F’ and ‘8’.

RTU mode:

CRC checksum calculation is applied in the RTU mode.

Steps of CRC checksum calculation:

1.Load an FFFFH 16-bit register, named as [CRC] register.

2. Perform XOR operation of the first byte of the command information and the low byte of the 16-bit CRC register, and save the result into the CRC register.

3. Check the lowest bit (LSB) of the CRC register. If the bit is 0, move one position to the right. If the bit is 1, move the value of the CRC register one position to the right. Perform XOR operation with A001H.

4. Return to Step 3. Step 5 must not be started until Step 3 is performed more than 8 times.

5. Repeat Step 2 to 4 to next byte of the command information, until all bytes are processed. In this case, the value of the CRC register is the CRC checksum.

Note: For the calculated CRC, fill the low byte and high byte of CRC in succession.

End1 and End0 (communication end)

ASCII mode:

Use (0DH) (i.e. character “\r”) and (0AH) (i.e. character “\n”) to indicate the end of communication.

RTU mode:

If the idle bus space exceeds 10ms, the communication ends.

Example:

```
INT16U crc16(unsigned char *buf,unsigned short length)
{
  INT16U shift,data,val;
  int i;
   shift = 0xFFFF;
  for(i=0;i<length;i++) {
    if((i % 8) == 0)
      data = (*buf++)<<8;
    val = shift ^ data;
    shift = shift<<1;
    data = data <<1;
    if(val&0x8000)
      shift = shift ^ POLY16;
  }
  return shift;
}
```

0x3 function

Address	Functions	Description
0x8000	Enable	0: disable 1: enable
0x8001	Working mode	0: Position mode 1: Speed mode 2: moment mode
0x8002	Position command: low 16 bits	\
0x8003	Position command: high 16 bits	\
0x8004	Speed command: low 16 bits	
0x8005	Speed command: high 16 bits	
0x8006	Torque command: low 16 bits	
0x8007	Torque command: high 16 bits	
0x8008	Maximum speed limit in position mode: low 16 bits	Unit: P/0.2ms P: pulse number
0x8009	Maximum speed limit in position mode: high 16 bits	Unit: P/0.2ms P: pulse number
0x800A	Acceleration/deceleration limit in position mode: low 16 bits	Unit: P/0.2ms/s P: pulse number
0x800B	Acceleration/deceleration limit in position mode: high 16 bits	Unit: P/0.2ms/s P: pulse number
0x800C	Alarm register: low 16 bits	
0x800D	Alarm register: high 16 bits	
0x800E	Present speed: low 16 bits	Unit: rpm
0x800F	Present speed: high 16 bits	Unit: rpm
0x8010	Present current: low 16 bits	
0x8011	Present current: high 16 bits	
0x8012	Present torque: low 16 bits	
0x8013	Present torque: high 16 bits	

0x6 or 0x10 commands

Address	Functions	Description
0x8000	Enable	0: disable 1: enable
0x8001	Working mode	0: Position mode 1: Speed mode 2: moment mode
0x8002	Position command	Pulse number
0x8004	Speed command	Unit: rpm
0x8006	Torque command	100 indicates 0.1 time of rated torque.
0x8008	Maximum speed limit in position mode	Unit: P/0.2ms P: pulse number

The address (no more than 154) indicates the drive parameter (see the manufacturer code column of parameter description in Chapter IV). When P1-13=0, the data will not be written into EEPROM according to the default setting. When P1-13=1, the data will be written into EEPROM.

Chapter VII Product Warranty and Maintenance

1. WARRANTY PERIOD

The Company provides one-year warranty for its products in terms of raw materials and defective workmanship from date of shipment. We provide repairing services on a free of charge basis within the warranty period.

2. EXEMPTIONS

1) Inappropriate wiring, such as incorrect polarity connection and hot plugging.

2) Unauthorized change to any internal device.

3) Using product exceeding the electrical and environmental requirements.

4) Poor dissipation of heat.

3. REPAIRING PROCEDURES

Follow such procedures to apply for repairing the product:

1) Contact the Company via phone call before delivery, explaining the failure conditions.

2) Enclose a written explanation with the product, giving descriptions on the failure of the driver; the voltage, current, and the environment when the failure occurs; name, phone number and mailing address information of the contact person.

4. WARRANTY LIMITATIONS

1) The warranty is limited to devices and processes of the product (i.e. consistency).

2) The Company does not guarantee that the product is suitable for any specific purpose intended by the user, as the suitability is also subject to technical indicator requirements and use conditions. This product is not recommended for any clinical use.

5. MAINTENANCE REQUIREMENT

The user should fill true information in the Maintenance Report (obtained from our company) to facilitate maintenance analysis.

Appendix A Performance Indicators

Model		ECON-GA3202	ECON-GA3204/ GA3207	ECON-GA3210/ GA3215
Rated Output Power		200W	400W/750W	1KW/1.5KW
Input power		Three-phase AC220V(-15% to +10%), 50-60HZ / single-phase AC220V (-15% to +10%), 50-60HZ		
Encoder Specification		Incremental Encoder (2500 ppr, 5V)		
Control Mode		1. Position Control Mode 2, Pulse Speed Control Mode 3, CAN Control Mode4, 485 Control Mode 5 and 232 Control Mode 1. Position Control Mode 2, Speed Control Mode 3, CAN Control Mode4, 485 Control Mode 5 and 232 Control Mode		
Regenerative Brake		External	Internal or External	Internal or External
Control Characteristics	Speed Frequency Response	≥200HZ		
	Speed fluctuation rate:	±3% (Load fluctuation 0-100%); ±2% (power -15% to +10%) (at Rated Speed)		
	Speed ratio	1:5000		
	Pulse frequency	≤500KHz		
Position control	Input mode	◯ Pulse + direction CW pulse + CCW pulse A/B quadrature pulse		
	Electronic gear ratior	Setting Range: 1-9999 1-9999		
	Feedback pulse	Adjustable according to the number of encoder wires		
Feedback Type		Feedback from incremental pulse encoder on motor shaft		
Parameter Setting Type		Button on Driver or From the PC		
Applicable load inertia		Less than 3 times of the motor inertia		
Regenerative Brake Type		Resistance Consumption Brake		
Installation Type		Wall-mounting Installation		
Grounding Type		Shell grounding: grounding Resistance ≤0.1Ω		
Monitoring functions		Rotation speed, current position, command pulse accumulation, positional deviation, motor current, command pulse frequency, operating status, input and output terminal signal		
Protection functions		Over-speed, main power supply overvoltage / undervoltage, overcurrent, overload, braking abnormity, encoder abnormity, position-tolerance		
Display and Operation		5-digit LED display panel with 4 keys		
Working environment	Temperature	Operation temperature: 0-55 / Storage temperature: -20 to 80		
	Humidity	Less than 90% (no condensation) <90%(Non-condensing)		
	Vibration	<0.5G(4.9m⁄S²) , 10-60HZ(Non-continuous Operation)		

Appendix B Definition of Motor Plug

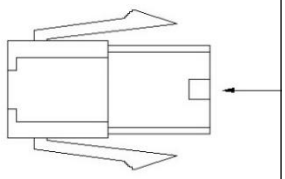
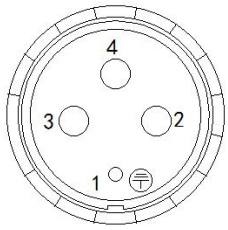
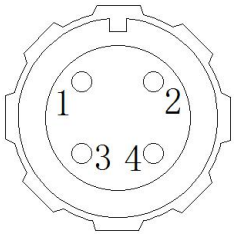
(1) Power plug

Power plug (4-core AMP plug) of motor on flange 90 or below

Terminal pin number	1	2	3	4
Signals	U-	V-	W-	PE

Power plug (4-core aerial plug) of motor on flange 100 or above

Terminal pin number	1	2	3	4
Signals	PE	U-	V-	W-

4-core AMP plug	4-core bent aerial plug	4-core straight aerial plug
		
1-U, 2-V, 3-W and 4-PE	1-PE, 2-U, 3-V and 4-W	1-U, 2-V, 3-W and 4-PE

(2) Encoder plug

Incremental non-multiplexed encoder (15-core AMP plug) of motor on flange 90 or below

Terminal No.	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
Signal name	PE	5V	GND	B+	Z-	U+	Z	U-	A+	V+	W+	V-	A-	B-	W-

Incremental non-multiplexed encoder (15-core aerial plug) of motor on flange 110 or above

Terminal No.	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
Signal name	PE	5V	GND	A+	B+	Z	A-	B-	Z-	U+	V+	W+	U-	V-	W-

Incremental multiplexed encoder (3-terminal 9-core AMP plug)

Terminal No.	1	2	3	4	5	6	7	8	9
Signal name	5V	GND	A+	A-	B+	B-	Z	Z-	PE

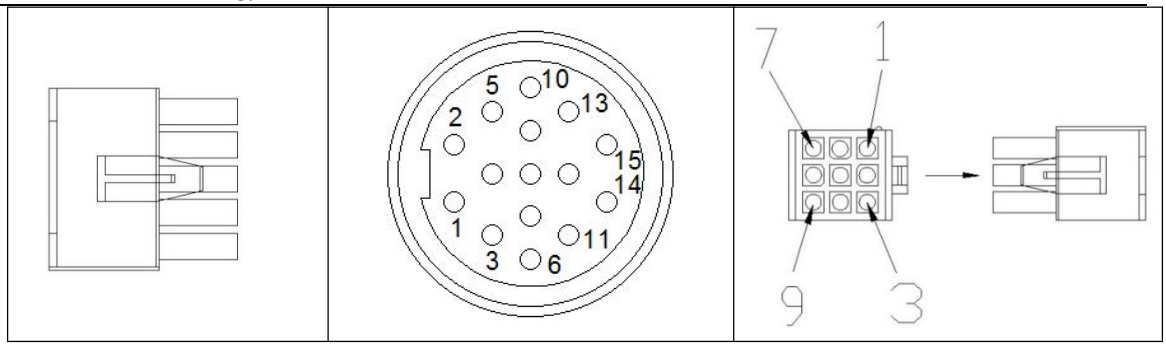
Incremental multiplexed encoder (15-core aerial plug)

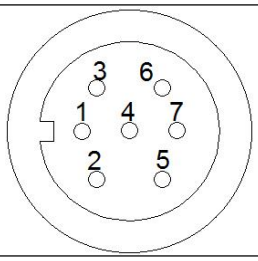
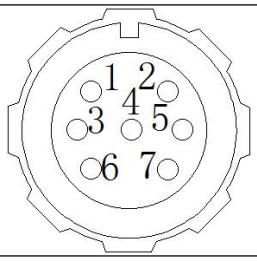
Terminal No.	1	2	3	4	5	6	7	8	9
Signal name	PE	5V	GND	A+	B+	Z	A-	B-	Z-

Absolute encoder plug (7-core)

Terminal No.	1	2	3	4	5	6	7
Signal name	PE	E-	E+	SD-	GND	SD-	+5V

3-terminal 15-core non-multiplexed AMP plug	15-core bent multiplexed/non-multiplexed aerial plug	3-terminal 9-core AMP plug



Absolute encoder	
7-core bent aerial plug	7-core straight aerial plug
	

Appendix C Motor Configuration Sheet

Refer to Fig. 1 for the motor model setting and initialization password selection. Initialization steps are as follows.

Steps	Operating instructions	Display after operation
1	Turn on the power supply, and press **MODE** to switch to the parameter Pn-00.	Pn-00
2	Press **SET** to enter the parameter P0-00.	P0-00
3	Press and select P0-01.	P0-01
4	Press **SET** to enter the parameter and display the present parameter.	00000
5	According to the motor configuration sheet, set the motor code by pressing **SHIFT**, such as ECN-09075DC. Set 12.	00012
6	Press **SET** to confirm the modification and the display panel will flash. -donE	P0-01
7	Press and select P0-02.	P0-02
8	Press **SET** to enter the parameter and display the present parameter.	00000
9	Set the initialization password by pressing **SHIFT**, 9251 for the multiplexed mode and 9250 for the non-multiplexed mode.	09250
10	Press **SET** to confirm the modification and the display panel will flash. -donE	P0-02
11	Press **MODE** to switch to the auxiliary function dn-00.	dn-00
12	Press to enter dn-02.	dn-02
13	Press **MODE** to initialize the drive. The display panel will flash. -donE	dn-02

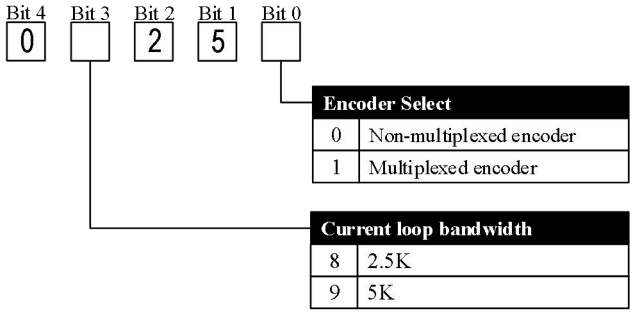


Fig. 1 Setting of Initial Password

1. EC series motors

Parameter Code	Motor model	Rated voltage V-	Rated moment N.m	Rated speed r/min	Rated power kW
0	EC130M100C	220	5.0	2000	1.0
1	EC130M150A	220	10	1500	1.5
2	EC130M100A	220	10	1000	1.0
3	EC130M150CC	220	6	2500	1.5
4	EC130M130CC	220	5	2500	1.3
5	EC130M100CC	220	4	2500	1.0
6	EC110M180D	220	6	3000	1.8
7	EC110M120C	220	6	2000	1.2
8	EC110M150D	220	5	3000	1.5
9	EC110M120D	220	4	3000	1.2
10	EC110M080D	220	4	2000	0.8

Parameter Code	Motor model	Rated voltage V-	Rated moment N.m	Rated speed r/min	Rated power kW
12	EC90M075D	220	2.4	3000	0.75
13	EC90M073C	220	3.5	2000	0.73
14	EC90M100CC	220	4	2500	1.0
15	EC80M040D	220	1.27	3000	0.4
16	EC80M075D	220	2.39	3000	0.75
17	EC80M073C	220	3.5	2000	0.73
18	EC80M100CC	220	4	2500	1.0
19	EC60M060D	220	1.91	3000	0.6
20	EC60M040D	220	1.27	3000	0.4
21	EC60M020D	220	0.637	3000	0.2
40	EC80M100D	220	3.5	3000	1.0
41	EC80M095D	220	3.2	3000	0.95
43	EC80M050D	220	0.16	3000	0.05
44	EC40M010D	220	0.32	3000	0.1
50	EC100M100D	220	3.2	3000	1.0
51	EC100M200D	220	6.4	3000	2.0
52	EC130M200CC	220	7.7	2500	2.0
53	EC130M300CC	220	11	2500	3.0
54	EC130M380CC	220	15	2500	3.8
61	EC180M270B	220	17	1500	2.7
62	EC180M300B	220	19	1500	3.0
63	EC180M450C	220	21.5	2000	4.5
64	EC180M290A	220	27	1000	2.9
65	EC180M430B	220	27	1500	4.3
66	EC180M370A	220	35	1000	3.7
67	EC180M550B	220	35	1500	5.5
68	EC180M750B	220	48	1500	7.5
69	EC80M120D	220	4	3000	1.2
70	EC90M120D	220	4	3000	1.2
71	EC110M150B	220	10	1500	1.5
72	EC130M075B	220	5	1500	0.75
73	EC130M090B	220	6	1500	0.9
74	EC130M250D	220	7.7	3000	2.5
75	EC130M150A	220	15	1000	1.5
76	EC130M300C	220	15	2000	3.0
77	EC110M060D	220	2	3000	0.6

Appendix D Alarms

Alarm code	Alarms	Countermeasures
1	Parameter verification error	Re-initialize parameter
2	Error of zero point detection of current	Contact the manufacturer.
3	AD sampling time out	Contact the manufacturer.
4	Overvoltage	Check whether grid voltage is not stable and too large Check whether motor is overloaded Replace high-power brake resistance
5	Undervoltage	Check whether supply voltage is too low
6	Position loop tracking error is too large	Increase position loop gain parameter Decrease input pulse frequency
7	Brake resistance overload	Increase power of brake resistance
8	Improper parameter setting	The rated current is beyond the specified range, and the initial motor code or password is wrong.
9	Hardware overcurrent	Check whether encoder is well wired Check whether power lines of motor UVW are correctly connected Check whether motor and driver match each other Check whether power module of driver is damaged
11	Failure in connection of encoder UVW	Correctly connect wiring of encoder again
12	Overload	Reduce motor load
15	Locked rotor	Check whether encoder wiring looses and whether motor power lines loose
17-22	CAN error	Contact the manufacturer.
24	Incorrect setting of motor model	Refer to the motor configuration sheet. Properly set the motor model.
26	Z pulse error	Check whether encoder wiring looses and whether motor power lines loose
27	Incorrect setting of speed detection parameter	Reset the speed detection parameter.
31	Bus voltage anomaly	Contact the manufacturer.
32	Incorrect motor code	
34	Setting error of frequency division parameter	Reset frequency division parameter
36	Setting error of pulse mode	Reset the pulse mode.
37	Encoder error (A+A- B+B- Z+Z- U+U- V+V- W+W- anomaly)	Check whether encoder wiring looses and whether motor power lines loose
50	Input pulse anomaly	Check whether the control line is loose.
51	Feedback pulse anomaly	Check whether the encoder wire is loose.
52	Incorrect setting of filter parameters	Reset the filter parameters.
54	Z pulse loss	Check whether the encoder wire and the motor power line are loose. Cut off and reconnect the power supply.
55	CAN buffer overflow	Contact the manufacturer.
56	Parameter error	Check the parameters of the position loop and speed loop.
57-58	SPI communication error	Contact the manufacturer.
59	Zero adjustment UVW error	Check the encoder.
60	Error of zero adjustment direction	Check the winding wire and encoder.

61	Loss of Z signal of zero adjustment	Check the encoder.
63	Over-temperature	Check whether the fan is started.

Contact us

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