✵ This user manual describes all proceedings concerning the operations of GS series AC servo products in details as much as possible. However, it is impractical to give particular descriptions for all unnecessary or unallowable system operations due to the manual text limit product specific applications and other causes. Therefore, the proceedings not indicated herein should be considered impractical or unallowable.

Foreword

Dear user,

It's our great pleasure for your patronage and selects our company products!

The capability, installation, connection, debugging, use as well as maintenance of GS2000T series AC servo drive unit are described in this manual. In order to guarantee the product safety and the work can be effectively performed, the user must read carefully the manual before installing and using the drive unit.

To avoid the injury of the operators and the others, and the damage of the drive device, please pay special attention to the following alarms before reading this manual:

⚠ Danger   Incorrect operation may result in death or severe injury.

⚠ Caution   Operating the machine incorrectly may result in injured or flesh wounded, as well as the loss in material.

Notice   If the approved procedure is not observed, it may result in the machine behaving unexpectedly.

☞   The vital requests and important indications are indicated during operating.

🚫   It means Forbiddance (absolutely can not be done)

①   It means Compulsion (must be done)

Safety Warnings

⚠ Danger

To fasten each of the main circuit wiring terminal with appropriate strength

If the approved instruction is not observed, it may cause the wiring loose, easily result in the fire.

Do not install the drive unit and brake resistance on the flammable objects, and keep it away from the inflammable objects.

If the approved instruction is not observed, it may cause the fire.

Do confirm whether the input power is turned off before wiring.

If the approved instruction is not observed, it may cause electric shock hazard.

The servo drive unit protection terminal PE should be certainly grounded.

If the approved instruction is not observed, it may cause electric shock.

Wiring or check should be performed by the professional electric engineer

If the approved instruction is not observed, it may cause electric shock or fire.

If the remove, wiring, check or maintenance is required, please carry them on after the power is turned off for 5min.

If this approved instruction is not observed, it may cause electric shock.

If the approved instruction is not observed, it may cause the equipment being damaged or electric shock.

It is necessary to fasten the power terminal and the motor output terminal.

If the approved instruction is not observed, it may cause the fire.

Do not operate the switch with wet hand.

If the approved instruction is not observed, it may cause electric shock hazard.

Do not put the wet hand into inner of the servo drive unit.

If the approved instruction is not observed, it may cause electric shock hazard.

Do not open the cover board of terminal block while the power is on or in moving.

If the approved instruction is not observed, it may cause electric shock hazard.

Do not touch main circuit wiring terminal of the drive unit directly.

If the approved instruction is not observed, it may cause electric shock hazard.

⚠️ Danger

It possibly starts up suddenly after the power recovering. Do not operate the shaft connection equipment of the motor.

🚫 If the approved procedure is not observed, it may cause the user injury.

Never attempt to prevent the thermodiffusion or put the foreign matter into the cooling fan and the radiator.

🚫 If the approved instruction is not observed, it may damage the machine itself, or cause the fire.

Never attempt to put the cable on the sharp edge or make it heavy load or tension.

🚫 If the approved instruction is not observed, it may cause electric shock, malfunction and damage the machine itself.

Never attempt to operate the drive unit with power on when the cover board was removed from the terminal block.

🚫 If the approved instruction is not observed, it may cause electric shock hazard.

⚠️ Caution

The motor should be matched with suitable servo unit

ℹ️ If the approved instruction is not observed, it may damage the machine itself.

On-load voltage class on each terminal must meet the one described in the user manual.

ℹ️ If the approved instruction is not observed, it may damage the machine itself.

The load operation can be performed after the motor dry trial run is successful.

ℹ️ If the approved instruction is not observed, it may damage the machine itself.

Please firstly eliminate the malfunction, then run the machine, after an alarm occurs.

ℹ️ If the approved instruction is not observed, it may damage the machine itself.

Never attempt to hold the cable or the motor shaft when the motor is being transported.

🚫 If the approved instruction is not observed, it may damage the machine itself.

Never attempt to operate the spindle drive unit if the components are lacked or damaged, it is very necessary to touch the dealer immediately.

🚫 If the approved instruction is not observed, it may damage the machine itself.

Safety Warnings

⚠Caution

Never attempt to connect the power input wires R, S and T to the motor U, V and W output terminals.

🚫 If the approved instruction is not observed, it may damage the machine itself.

Do not switch on/off the input power frequently.

🚫 If the approved instruction is not observed, it may damage the machine itself.

Never attempt to touch the motor and brake resistance, as well the cooling equipments of the servo motor, maybe the high temperature will be produced.

🚫 If the approved instruction is not observed, the user may be injured.

Do not adjust and modify the parameters extremely

🚫 If the approved instruction is not observed, it may damage the machine itself.

Never attempt to modify, disassemble or repair the drive unit privately.

🚫 If the approved instruction is not observed, it may damage the machine itself.

The internal parts of an abandoned drive unit was disposed as industrial waste, and can not use repeatedly.

🚫 If the approved instruction is not observed, it may cause accidents.

Safety Responsibility

Manufacturer's Responsibility

——Be responsible for the danger which should be eliminated and/or controlled on design and configuration of the provided Servo drive unit and accessories.

——Be responsible for the safety of the provided Servo drive unit and accessories.

——Be responsible for the provided information and advice for the users.

User's Responsibility

——Be trained with the safety operation of Servo drive unit and familiar with the safety operation procedures.

——Be responsible for the dangers caused by adding, changing or altering to the original Servo drive units and the accessories.

——Be responsible for the failure to observe the provisions for operation, adjustment, maintenance, installation and storage in the manual.

All specifications and designs herein are subject to change without further notice.

This manual is reserved by end user.

We are full of heartfelt gratitude to you for supporting us in the use of GSK's products.

Contents

CHAPTER ONE   PRODUCT INTRODUCTION

1.1   Basic Knowledge

➢   **Fundamental of AC Servo Drive Unit**

The AC Servo Drive Unit is composed of the AC servo drive unit and the AC servo motor (Three-phase permanent magnet synchronous servo motor, hereinafter referred to as Servo motor). The drive unit is treated the three-phase AC integrated current as AC current (i.e. AC－DC), and ON or OFF of the power switch tube is controlled, the approximate sine wave current (that is DC—AC) of the phase potential difference 120° may occur in the three-phase stator winding of the servo motor. A rotation magnetic field is formed of this current in the servo motor, and the servo motor rotor may be introduced a sensitive current based on the rotation magnetic filed, the electromagnetic torque drive motor rotor rotation may create based on the interaction between the rotation magnetic field and the induction current. The higher the current frequency of the servo motor winding is, the faster the speed of the servo motor is; the higher current magnitude of amplitude value of the servo motor winding is, the bigger the torque (torque=force × arm length) output by the servo motor is.

The main circuit frame is shown in Fig. 1-1, and PG described in the figure is an encoder.
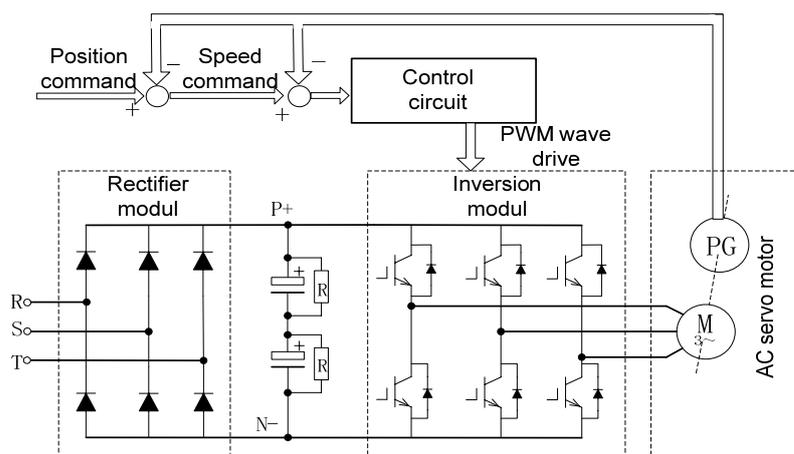
Fig. 1-1   Main circuit frame of servo drive unit

➢   **The basic structure of the AC servo drive device**

The drive unit accepts the speed (or position) command of the control equipment (It is also called PC) including the CNC. The frequency and magnitude of the servo motor winding current can be controlled, so that the speed (or corner) of the servo motor rotor approximates the speed (or position) command value, and the error between the actual value of the servo motor rotor speed (corner) and the command value which can be gained by examining the encoder of servo motor. The frequency and magnitude of the current flowing through the servo motor winding is continuously adjusted by the servo motor, so that the error between the actual value of servo motor rotor speed (or corner) and command value which should be controlled within the required range. The basic structure of the servo system is shown in Fig. 1-2.
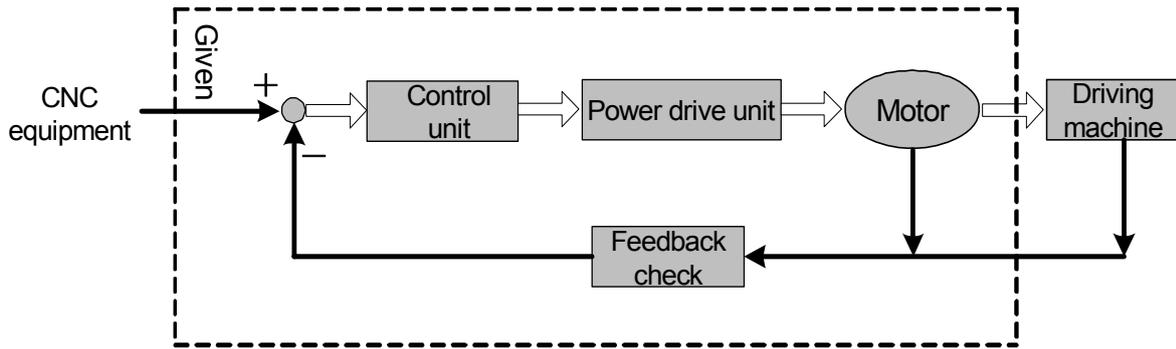
Fig.1-2 The basic structure of AC servo device

- ➢ **The general concept of control**

  Control: It is called control that the process making the characters (for example: speed) of the object (for example: servo motor) reach or approximate the anticipated value, and the former object is called as **the controlled**; the character of the controlled object is regarded as **controlled amount**, and the unit to be achieved which is called **controllable unit**; the expected value (command value) of the controlled amount received from the control unit is called the **given**; the controlled amount is assumed to the input of control unit, which is affected the process of controlled amount, is called **the feedback**, check the unit of being controlled amount is called **feedback unit**. The feedback can be divided into **positive** (same direction) and **negative** (reverse direction) based upon the controlled amount and the given direction output by the control unit. The **drive equipment** is composed of the control unit controlled by the controllable amount, the controlled object and the feedback unit. Drive units can be divided into closed-loop and open-loop equipments in terms of whether there is feedback unit or not or the position of the feedback unit in the drive unit. The closed-loop control equipments introduced in this manual are all negative feedback.

  In the AC servo drive equipment introduced in this manual, the drive unit is control unit, the servo motor is controlled object, the motor speed (the corner of rotor) is controlled amount, the servo motor encoder is feedback unit, and the actual speed of the encoder motor detection is used for speed control to achieve the speed feedback. Therefore, the AC servo drive belongs to the close-loop control equipment.

- ● **Open-loop control equipment:** A feedback unit is not performed in control equipment, and the actual value of controlled amount is not affected to the output of control unit. For example, the step motor drive equipment, the rotor of stepper motor should be varied from the current phase-sequence changes after the stepper motor drive unit outputs the current phase-sequence and changes. Generally, the motor rotor may not follow the current phase-sequence when the overload occurs or the high acceleration/deceleration issues, due to the step motor does not install speed or position feedback unit, eventually, the "step-out" may cause.

  Open-loop control is shown in Fig.1-3.
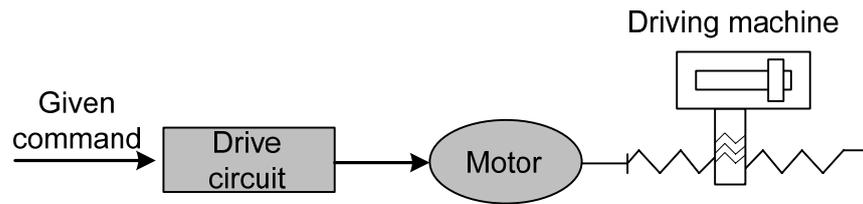
Fig.1-3   Open-loop control

● **Closed-loop control:** The controlled amount of the control equipment is detected by the feedback unit and sent to the control unit, and the control equipment changes the controlled variable through controlling the output of the control unit. The close-loop control equipment is divided into **the full closed-loop control equipment** and **the semi-closed-loop control equipment** based upon the check position of feedback unit. The feedback unit directly detects the controlled amount for feedback which is called the complete closed-loop control equipment (see Fig. 1-4), and the mechanical position is regarded as the controlled amount, the grating rule installed on the machine is regarded as a position feedback unit, and the encoder mounted on the servo motor is treated as a speed feedback unit, and then the equipment achieves a full closed-loop control in the mechanical position. If the grating rule is not mounted, the encoder of servo motor is simultaneously regarded as the position and speed feedback unit (see Fig. 1-5). Therefore, this is a semi-closed-loop control equipment of a machine position.
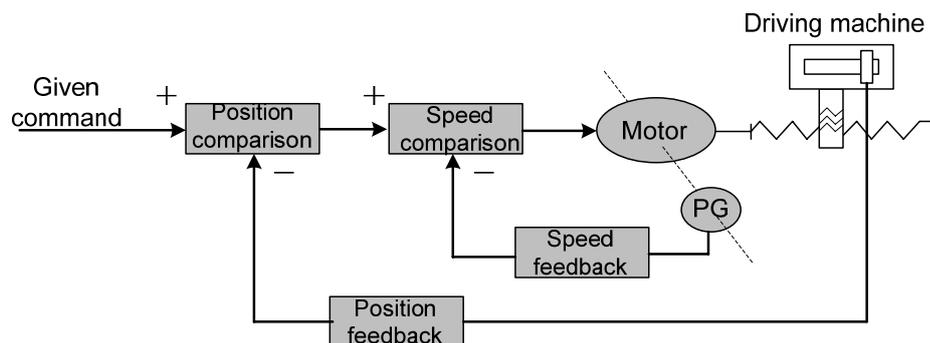
Fig. 1-4   Full closed-loop control equipment
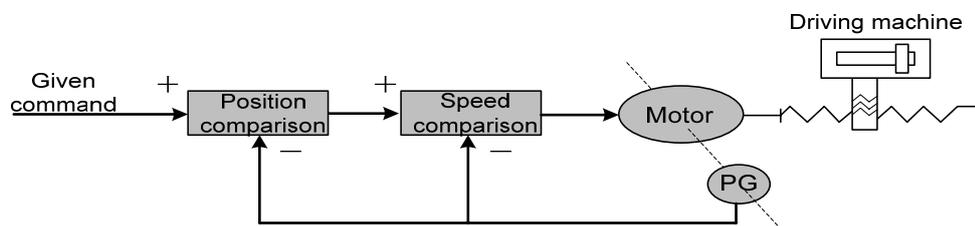
Fig. 1-5   Semi-closed-loop control equipment

● **PID control**: It is also called PID adjustment, which is common calculation of control unit is treated the mathematical treatment for the input data (given, feedback). P is proportional, which is indicated that both input and output of control unit are composed of the linear proportional relation, the bigger the proportional control coefficient is, the more sensitive the system reacts, the less steady-state errors is (it can not be eliminated). The system vibration and unsteadiness may occur due to the excessive proportional control coefficient. "I" means integral, it is indicated that the input of the control unit is affected to the time integral output

(the input is gradually affected the output), the bigger the integral time constant is, the more steady the system is, and the steady-state error can be eliminated, but the system may respond slowly. "D" means differential, it is indicated that the input differential (input the changeable slope) is affected to the output. The differential control can be forecasted the error, produced the advancing check function and reduce the follow error, as well improved the dynamic capability. The vibration and steadiness may cause due to the excessive differential coefficient. The proportion, integral and differential are interacted. The PID control parameters are adjusted to the balance for the system reaction rate, control accuracy and steadiness. Because the differential adjust is easily caused by the impact and vibration, the servo drive in the manual adopts PI adjustment, that is the proportion and integral are performed only.

➢ **The concepts related to serve control**
Three kinds of basis control modes of the servo drive equipment are available, such as: position, speed and torque. Its frame is shown in Fig.1-6.
● Position control: The motor rotation direction and angle are given by using the numerical pulse or data communication mode, the drive unit controls motor rotor that rotates a corresponding angle in terms of the given direction. The rotation angle (position) and speed can be controlled.
● Speed control: The motor rotation direction and speed are given by using the analog voltage or data communication mode, the drive unit controls the motor rotor that rotates based upon the given direction and speed.
● Torque control: The output torque size and direction are given by using the analog voltage or data communication mode, the rotor rotation direction and torque output size of motor are controlled by the drive unit.

Currently, the servo drive device introduced in the manual does not accept the signal given from torque, the torque control operation mode is not offered temporarily.
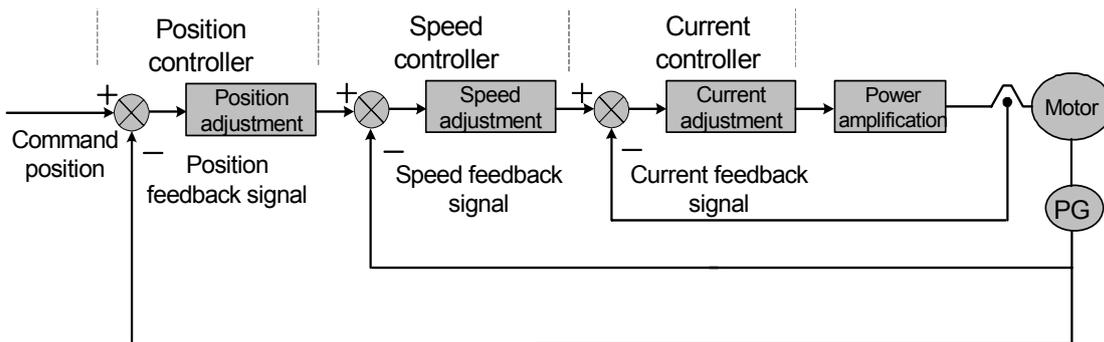
Fig. 1-6　Tricyclic control system frame

➢ **Servo drive unit performance index**
Servo drive unit dynamic response characteristic: the reaction speed, dynamic control error and stable control error of the servo drive equipment are performed when the specification or the load is changed. Fig. 1-7 is the response characteristic figure in which the servo drive device offers a step signal. (The actual line is given signal, and the broken line is the output signal of the drive unit equipment, same as below):
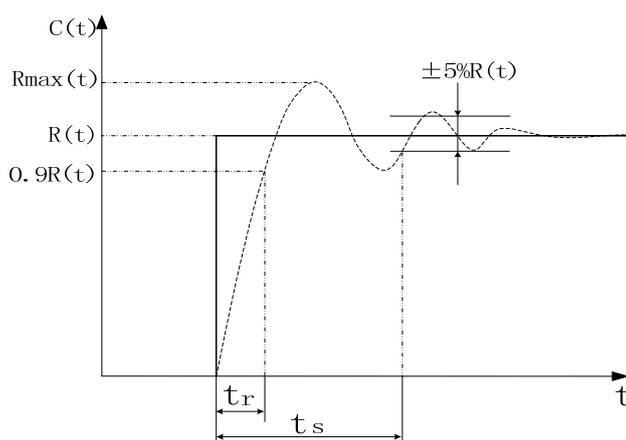
Fig. 1-7 Servo dynamic response curve

Rising time t_r: It means that the time that the rotation output amount is risen from zero for the first time to 90% of steady-state value R (t) , and it also means the dynamic response rapidity.

Regulation time t_s: The ±5％ of steady-state value near to the step response curve steady-state value R (t) is regarded as the allowance error area. The required least time is the adjust time that the responding curve arrival does not overstep the error area, It is measured the regulation processing speed of the equipment.

Overshoot σ: It indicates that the speed output amount exceeds the rate between maximum speed D-value (Rmax (t)-R (t)) and stationary-state value R (t), it reflects relative stability of a servo device, and it also can be expressed by the percentage, that is:

$$\sigma(\%) = \frac{R_{max}(t) - R(t)}{R(t)} \times 100\%$$

Steady-state error: The D-value of the equipment between the expected output steady-state value and the actual output value are performed, after the equipment response is entered to the rotational speed.

Servo drive equipment static capability: In the drive control equipment, it is very important to stability. The steady-state capability index of servo drive equipment is a positioning accuracy, to be exact, the different degree between the actual and expectative states are generated when the device transition is ended. The reasons affecting the servo drive device steady-state accuracy is both the errors of the position measure device and the system error, which is regardless of the structure and parameter of the system. The position servo static curve is shown in Fig.1-8.
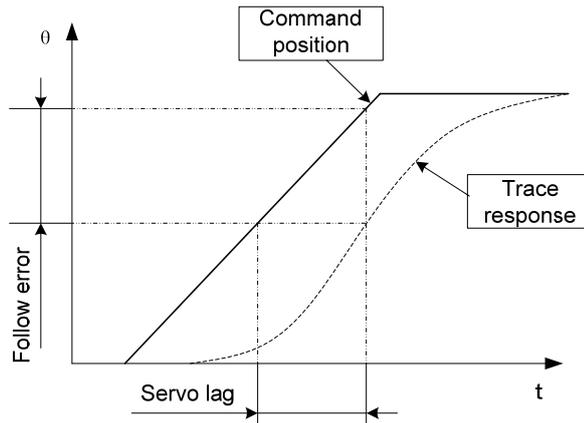
Fig. 1-8   Position servo static curve

Follow error: It is indicated that the position difference between the moved worktable position (command position) required by the command signal and the actual moved worktable position, that is, the fellow error = (the command position value) – (the value of actual position).

Servo rigid: The servo drive unit is caused position error capability against the load interference.

1.2   The Confirmation of the Products Arrival

Check each item after receiving the products immediately, if any problems, please contact the supplier or our company freely.

Checked item	Remark
Check the drive unit and servo motor, which are the ordered products;	It is confirmed by the drive unit and servo motor's nameplate.
Check whether the fittings are assembled;	Confirm the content of packing list, if this content is inconsistent with the accessories, and refer to the section 1.4 for the order instruction.
Check whether the products are damaged due to the transportation;	The integrated appearance of the products should be complete and without damage.
Check whether the screws are loose.	Check whether the screws are loose with the screwdriver

Caution

1. The damaged AC servo drive unit or the incomplete accessories can not be mounted;

2. The AC drive unit should be matched with the servo motor;

3. GS2000T series products is divided into the D-SUB and MDR based on its interface types, and they must meet the requirements.

1.2.1 Servo Motor Model

Rate speed

Rated voltage and current

Motor model

Rated torque

GSK AC Servo Drive unit CE

TYPE：130SJT-M100D（A4I）

U_N:220V	I_N: 10A	T_S/T_N: 10/10 N·m
n_N: 2500r/min		n_{max}: 3000r/min
INS. CLASS. B		IP65 M: 17 bit

S/N: 081016100D0000107H

广州数控设备有限公司
GSK CNC EQUIPMENT CO.,LTD.

Serial number

Protection class and encoder lines

Insulation class

Max. speed

Servo motor model:

130   SJT   － M   Z   150   D   （A□ Y□ X□）

Seat No.

AC Synchronous Servo motor

M：Optical encoder

None: No safe brake #1
Z： Safe brake

Zero-speed torque   #2
150 means   15 N·m

Rated speed	A：1000 r/min
	B：1500 r/min
	C：2000 r/min
	D：2500 r/min
	E：3000 r/min

None：Aviation socket
X: Cable linearity

Shaft extension or installation #3

None:：Standard shaft extension
Y□: Ball shaft extension
Z□:Taper shaft extension
S□: Step motor installation structure

Encoder model

A or none： Incremental 2500 p/r
A2: incremental 5000 p/r
A3:incremental 2500 p/r
A4: absolute 17 bit
A 4I: Dana Hector multi-circle 17 bit absolute
A4SI: Dana Hector single-circle 17 bit absolute

#1：Working power supply of safe brake is DC,（0.9～1.1）×24V，the interface is 3-core socket, 1, 2 pin are power supply terminals, 3 pin is an earthing terminal. When 1, 2 pins are turned on, the safe brake is not activated; when they are turned off, it is activated, and the safe brake time is ≤0.1s.

#2：Using three digits 150 means its value is three digits $150×10^{-1}=15$，its unit is N·m.

#3：'□' means the digital code, and some digit means the special shaft extension needs to consider the installation appearance figure of the motor.

1.2.2　Servo drive unit model

Name plate sample:

Motor model corresponded to factory parameter of servo drive unit

Servo drive unit model

Full Digital AC Servo Drive Unit

Model：　GS2050T-CA1　　Software Version：　V1.05　　← Servo drive unit software version

Adaptive motor: 130SJT-M150D（A4I）

Input power supply: 3-phase 220V(-15%～+10%)50/60Hz

Serial No.:　E03DN00088　　　　Date: 2010/9　　← Factory date of servo drive unit

广州数控设备有限公司
GSK Tel.020-83969288 Fax.81997083

Factory serial No. of servo drive unit

Input power specification of servo drive unit

Model explanation:

GS ② 050 T - C A 1
① ② ③ ④ ⑤ ⑥ ⑦

①	"GS" series servo drive unit, G：GSK；S：SERVO.
②	Voltage class code, 2：220V；3：380V；4：440V.
③	Power component nominal current, 3 digits means：025,030,045,050,075,100（unit A）, the leading zero cannot be omitted.
④	Adaptive motor model: T：adaptive to synchronous servo motor; Y：adaptive to asynchronous servo motor.
⑤	Communication bus code, N：no bus; C：GSK-CAN bus; L：GSK-Link bus.
⑥	Feedback(encoder) interface model code, P：only adaptive incremental encoder; A：adaptive to absolute encoder, without standby battery; B：adaptive to absolute encoder, without standby battery(used to circle count of memory absolute encoder when power off). B：adaptive to absolute encoder, with standby battery.
⑦	Feedback (encoder)interface allocation code which is presented by one digit. '1' means there is only the motor feedback(1st position feedback) input interface（CN2）; '2' means the motor feedback input （CN2） and the 2nd position feedback input interface（CN3）.

Position feedback signal interface model and allocation table:

⑥	⑦	Feedback（encoder）interface model, allocation explanation
P	1	There is only the motor feedback input interface, adaptive to incremental encoder and there is no the 2nd position feedback input interface.
	2	There are two position feedback input interfaces, adaptive to incremental encoder.
A（B）	1	There is only the motor feedback input interface, adaptive to incremental and absolute encoder(be compatible with Biss, TAMAGAWA communication protocol which can be identified automatically), and there is no the 2nd position feedback input interface.
	2	There are two position feedback input interface, adaptive to incremental encoder and absolute encoder (be compatible with Biss, and TAMAGAWA communication protocol which can be identified automatically).

1.2.3　Servo drive unit appearance

GS series AC servo drive unit is divided into the D-SUB and MDR series products according to the signal interfaces, uses the servo drive unit with D-SUB interfaces provided by WIESON, which is the D-SUB product, allocated with an incremental motor, and without GSK-CAN bus; uses the drive unit with high density interface provided by 3M, which is the MDR product, be compatible with absolute encoder motor, and with GSK-CAN bus.

● **GS series AC servo drive unit appearance（D-SUB）**

D-SUB products of GS series AC servo drive unit: GS2025T-NP1, GS2030T-NP1, GS2045T-NP1, GS2050T-NP1, GS2075T-NP1, GS2100T-NP1, which are adaptive to incremental encoder motor.

▲	Parameter serial No. and value increasing.
▼	Parameter serial No. and value decreasing.
⇄	Modified data digit for cycle movement.
◄	Return to the previous page or cancel operations.
↵	Return to the next page or confirm operations.

LED monitor window

Can monitor run states, modify and manage parameters.

'CHARGE' is high-pressure indicator for main circuit DC bus of the drive unit.

ON：DC bus high-pressure exists.

OFF：DC bus high-pressure is discharged completely.

🚫 Must not dismount and install the drive unit, power lines, motor lines and brake lines when 'CHARGE' indicator is ON.

It is a earthing terminal of input power ⏚ earthing or the motor's protective earthing.

'POWER' is a indicator for the drive unit to control circuit or power supply.

ON：control circuit or power supply is normal.

OFF：control circuit is broken down.

CN1：control signal interface (44 hole DB interface)

Connect the external speed command, position command, input/output signal.

CN2：connect with the motor's encoder feedback input (25 holde DB interface)

Incremental encoder difference signal and motor's position feedback input.

Open cover plate

Wiring terminals of main circuit

❗ Carefully check the product brand, R, S, T, r, t input power supply voltage, the motor's lines are connected U, V,W correctly according to the marked!

Fig.1-9 GS series D-SUB product appearance

● **GS series AC servo drive unit appearance** （**MDR**）

MDR products of GS series AC servo drive unit: GS2030T-CA1, GS2050T-CA1, GS2075T-CA1, GS2100T-CA1，which are adaptive to absolute encoder motor.

Installation position for standby battery for absolute encoder.(See the drive unit model explanation).

LED monitor window

Can monitor run states, modify and manage parameters.

'CHARGE' is high-pressure indicator for main circuit DC bus of the drive unit.

ON：DC bus high-pressure exists.

OFF：DC bus high-pressure is discharged completely.

🚫 Must not dismount and install the drive unit, power lines, motor lines and brake lines when 'CHARGE' indicator is ON.

Wiring terminals of main circuit

Carefully check the product brand, R, S, T, r, t input power supply, voltage , the motor's lines are connected U, V,W correctly according to the marked!

It is a earthing terminal of input power earthing or the motor's protective earthing.

⬆	Parameter serial No. and value increasing.
⬇	Parameter serial No. and value decreasing.
⟳	Modified data digit for cycle movement.
◄	Return to the previous page or cancel operations.
↵	Return to the next page or confirm operations.

'POWER' is a indicator for the drive unit to control circuit or power supply.

ON：control circuit or power supply is normal.

OFF：control circuit is broken down.

CN1：control signal interface (50PIN interface)

Connect the external speed command, position command, input/output signal.

CN2：connect with the motor's encoder feedback input (26 interface)

Connected with incremental or absolute encoder feedback input signal.

CN4, CN5：GSK-CAN communication interface CNC system realizes debugging and real-time monitoring of the drive unit by GSK-CAN bus.

Fig. 1-10 GS series MDR product

👉 GS series AC servo drive unit is divided into D-SUB and MDR products according to different control signals, the D-SUB products are allocated with incremental encoder motors without GSK-CAN bus; the MDR products are allocated with the absolute encoder motor, with high precision and GSK-CAN bus.

The user selects the motor according to the motor's precision when it orders.

1.3   Technical Specification

1.3.1   Servo Motor Technical Specification

Table 1-1   Main technical parameter of 80SJT series motor

Model / Item	80SJT-M024C	80SJT-M024E	80SJT-M032C	80SJT-M032E
Rated power（kW）	0.5	0.75	0.66	1.0
Pole-pairs	4			
Rated current（A）	3	4.8	5	6.2
Zero-speed torque	2.4	2.4	3.2	3.2
Rated torque（N·m）	2.4	2.4	3.2	3.2
Max. torque（N·m）	7.2	7.2	9.6	9.6
Rated speed（r/min）	2000	3000	2000	3000
Max. speed（r/min）	2500	4000	2500	4000
Rotation inertia（kg·m^2）	0.83×10^{-4}	0.83×10^{-4}	1.23×10^{-4}	1.23×10^{-4}
Weight（kg）	2.8	2.9	3.4	3.5
Insulation grade	F（GB 755—2008）			
Vibration grade	R（GB 10068—2008）			
Guard grade	IP65（GB 4208—2008/IEC 60529：2001，GB/T 4942.1—2006）			
Installation type	IMB5（flanged installation）（GB/T 997—2008 / IEC 60034-7:2001）			
Working hour	S1（continuous working）（GB 755—2008）			
Safe brake	none			
Adaptive encoder	Incremental 2500 p/r, 5000 p/r，absolute encoder17bit single-circle or multi-circle.			

The following is torque character diagram（T－M）of one rotation of the servo motor , A: continuous working area; B: short time working area.
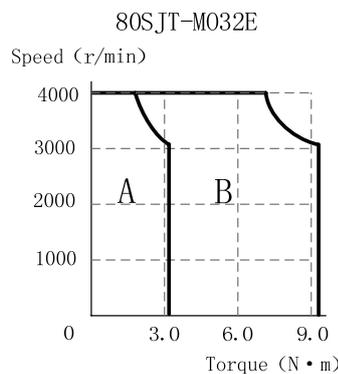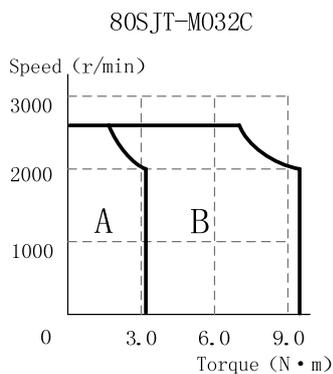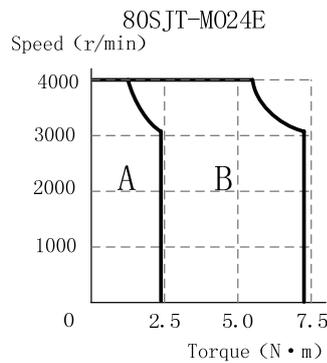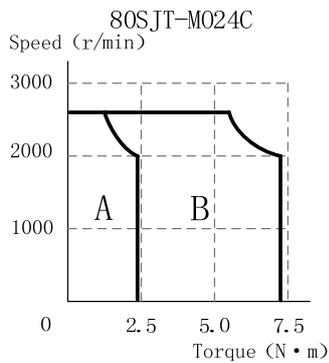
Table 1-2   Main technical parameters of 110SJT series, 130SJT series motor

Item ＼ Type	110SJT-M 040D	110SJT-M 040E	110SJT-M 060D	110SJT-M 060E	130SJT-M 040D	130SJT-M 050D
Rated power（kW）	1.0	1.2	1.5	1.8	1.0	1.3
Pole-pairs	4					
Rated current （A）	4.5	5	7	8	4	5
Zero-speed torque(N·m)	4	4	6	6	4	5
Rated torque（N·m）	4	4	6	6	4	5
Max. torque （N·m）	12	10	12	12	10	12.5
Rated speed/min）	2500	3000	2500	3000	2500	2500
Max. speed（r/min）	3000	3300	3000	3300	3000	3000
Rotation inertia(kg·m^2)	$0.68×10^{-3}$	$0.68×10^{-3}$	$0.95×10^{-3}$	$0.95×10^{-3}$	$1.1×10^{-3}$	$1.1×10^{-3}$
Weight （kg）	6.1	6.1	7.9	7.9	6.5	6.5
Motor weight with safe brake （kg）	7.7	7.7	9.5	9.5	8.1	8.1
Insulation grade	F（GB 755-2008）					
Vibration grade	R（GB 10068-2008）					
Guard grade	IP65（GB/T4942.1-2006）					
Installation type	IMB5（flanged installation）（GB/T 997-2008 / IEC 60034-7:2001）					
Working hour	S1（Continuous working）（GB 755-2008）					
Adaptive encoder	Incremental 2500 p/r, 5000 p/r，absolute encoder 17bit single-circle or multi-circle.					

The following is torque character diagram（T－M）of one rotation of the servo motor , A: continuous working area; B: short time working area.

13

Table 1-2(continuous)   Main technical parameters of 110SJT series, 130SJT series motor

Item \ Type	130SJT-M 060D	130SJT-M 075D	130SJT-M 100B	130SJT-M 100D	130SJT-M 150B	130SJT-M 150D
Rated power（kW）	1.5	1.88	1.5	2.5	2.3	3.9
Pole-pairs	4					
Rated current （A）	6	7.5	6	10	8.5	14.5
Zero-speed torque （N·m）	6	7.5	10	10	15	15
Rated torque（N·m）	6	7.5	10	10	15	15
Max. torque（N·m）	18	20	25	25	30	30
Rated speed/min）	2500	2500	1500	2500	1500	2500
Max. speed（r/min）	3000	3000	2000	3000	2000	3000
Rotation inertia （kg·m^2）	1.33×10^{-3}	1.85×10^{-3}	2.42×10^{-3}	2.42×10^{-3}	3.1×10^{-3}	3.6×10^{-3}
Weight （kg）	7.2	8.1	9.6	9.7	11.9	12.7
Motor weight with safe brake （kg）	10.1	11	12.5	12.6	14.8	15.6
Insulation grade	F（GB 755-2008）					
Vibration grade	R（GB 10068-2008）					
Guard grade	IP65（GB/T4942.1-2006）					
Installation type	IMB5（flanged installation）（GB/T 997-2008 / IEC 60034-7:2001）					
Working hour	S1（continuous working）（GB 755-2008）					
Adaptive encoder	Incremental 2500 p/r, 5000 p/r, absolute encoder 17bit single-circle or multi-circle.					

The following is torque character diagram（T－M）of one rotation of the servo motor , A: continuous working area; B: short time working area.

Table 1-3   Main technical parameters of 175SJT series motor

Item \ Type	175SJT-M120E	175SJT-M150B	175SJT-M150D	175SJT-M180B	175SJT-M180D
Rated power（kW）	3	2.4	3.1	2.8	3.8
Pole-pairs	3				
Rated current （A）	13	11	14.5	15	16.5
Zero-speed torque（N·m）	12	15	15	18	18
Rated torque（N·m）	9.6	15	12	18	14.5
Max. torque（N·m）	19.2	30	24	36	29
Rated speed/min）	3000	1500	2500	1500	2500
Max. speed（r/min）	3300	2000	3000	2000	3000
Rotation inertia（kg·m^2）	5.1×10^{-3}	5.1×10^{-3}	5.1×10^{-3}	6.5×10^{-3}	6.5×10^{-3}
Weight （kg）	18.9	18.5	19	22.8	22.9
Motor weight with safe brake（kg）	24.5	24.1	24.6	28.4	28.5
Insulation grade	F （GB 755-2008）				
Vibration grade	R （GB 10068-2008）				
Guard grade	IP65（GB/T4942.1-2006）				
Installation type	IMB5（flanged installation）（GB/T 997-2008 / IEC 60034-7:2001）				
Working hour	S1（continuous working）（GB 755-2008）				
Adaptive encoder	Incremental 2500 p/r, 5000 p/r, absolute encoder17bit single-circle or multi-circle				

The following is torque character diagram（T－M）of one rotation of the servo motor , A: continuous working area; B: short time working area.

175SJT-M120E

175SJT-M150B

175SJT-M150D

175SJT-M180B

175SJT-M180D

Table 1-3(continuous)   Main technical parameters of 175SJT series motor

Item \ Type	175SJT-M220B	175SJT-M220D	175SJT-M300B	175SJT-M300D	175SJT-M380B
Rated power（kW）	3.5	4.5	3.8	6	6
Pole-pairs	3				
Rated current （A）	17.5	19	24	27.5	29
Zero-speed torque（N·m）	22	22	30	30	38
Rated torque（N·m）	22	17.6	24	24	38
Max. torque （N·m）	44	35.2	48	48	76
Rated speed/min）	1500	2500	1500	2500	1500
Max. speed（r/min）	2000	3000	2000	3000	1800
Rotation inertia（kg·m^2）	9.0×10^{-3}	9.0×10^{-3}	11.2×10^{-3}	11.2×10^{-3}	14.8×10^{-3}
Weight （kg）	28.9	29.2	34.3	34.4	42.4
Motor weight with safe brake（kg）	34.5	36.8	42	42.1	50.1
Insulation grade	B（GB 755-2008）				
Vibration grade	F（GB 10068-2008）				
Guard grade	IP65（GB/T4942.1-2006）				
Installation type	IMB5（flanged installation）（GB/T 997-2008 / IEC 60034-7:2001）				
Working hour	S1（continuous working）（GB 755-2008）				
Adaptive encoder	Incremental 2500 p/r, 5000 p/r, absolute encoder17bit single-circle or multi-circle.				

The following is torque character diagram（T－M）of one rotation of the servo motor , A: continuous working area; B: short time working area.

175SJT-M220B

175SJT-M220D

175SJT-M300B

175SJT-M300D

175SJT-M380B

1.3.2　Technical Specification of Servo Drive Unit

Drive unit type	GS2025T	GS2030T	GS2045T	GS2050T	GS2075T	GS2100T
Rated current of adaptive servo motor （A）	I≤4	4＜I≤6	6＜I≤7.5	7.5＜I≤10	10＜I≤15	15＜I≤29
Outline size（mm）（W×H×D）	90×190×182			112×230×182	120×270×218	130×305×248.5
Main power supply	3-phase AC(0.85～1.1)220V50/60Hz ^{Remark 1}					
Brake resistance	Built-in brake resistance（optionally external brake resistance）			External brake resistance（without built-in brake resistance）		
Timing ratio	5000：1					
Speed fluctuation rate	＜rated speed×0.01%;					
Speed frequency response	≥300Hz					
Working mode	Manual, Jog, Internal Speed, External Speed, Position.					
Internal speed mode	The servo motor driven by the servo drive unit runs with the speed(speed closed-loop control) set by the internal parameter,3-section speed is selected by the input signal.					
External speed mode	The servo motor driven by the servo drive unit runs with the speed(speed closed-loop control) set by the external analog voltage speed command.					
External speed command mode	－10V～+10V or 0V～+10V is selected by the parameter.					
Position mode	The servo motor driven by the servo drive unit runs based on the position command pulse(position closed-loop control), the direction and the quantity of the position command pulse determine the rotary direction and the angle of the servo motor's rotor, and the frequency of the position command pulse determines the speed of the motor's rotor.					
Position command pulse mode	Pulse/direction, CCW pulse/CW pulse, A/B orthogonality pulse, max. pulse frequency: 1MHz.					
Electronic gear of position command	Command pulse multiplier coefficient: 1～32767; command pulse division coefficient: 1～32767.					
Orientation precision	±0.005°(adaptive 17bit absolute encoder）; ±0.018°(adaptive 5000-line incremental encoder).					
Motor's feedback input	GS2□□□T-NP□（D-SUB）：adaptive incremental encoder; GS2□□□T-CA□（MDR）： adaptive absolute encoder（compatible Biss, two kinds of communication protocol of Tamagawa）and incremental encoder.					
The 2nd feedback input(adaptive interface)	GS2□□□T-NP2（D-SUB）: adaptive incremental encoder; GS2□□□T-CA2（MDR）:adaptive absolute encoder（compatible Biss, two kinds of communication protocol of Tamagawa）and incremental encoder.					
Position feedback output	GS2□□□T-NP□（D-SUB）: motor's feedback input signal: 1:1 output; GS2□□□T-CA□（MDR）：division output of motor's feedback input signal; motor rotating one-rotation corresponding to feedback output pulse range: 16～32767.					
Communication bus	GS2□□□T-NP□（D-SUB）: without communication bus; GS2□□□T-CA□（MDR）：GSK-CAN bus					
Input signal	Servo enabling, alarm clear, CCW prohibited, CW prohibited, CCW started, CW started, zero-speed clamped, internal speed selection, selection 2.					

Output signal	Servo ready, servo alarm, position arrival/speed arrival, HOLD release, zero-speed output, Z-axis pulse (encoder zero-point) and so on.
Protective function	Protection functions for overvoltage, undervoltage, overcurrent, overload, drive unit overheating, encoder overheating, overspeed, and position out-of-tolerance, brake abnormality, motor overheating.
Operation and display	5 keys can execute the operation including the manual, Jog, modifying, setting, writing-in and copying parameter. 6-bit LED displays the speed, current position, command pulse accumulation, position offset, motor's torque, motor's current, rotor's absolute position, input/output signal state and so on.

Note: The motor which power is below 0.8KW can use single-phase 220V power supply input, and the drive unit's performance will reduce.

1. It can use single-phase 220V input with the servo motor below 0.8Kw, but the performance of the drive unit will reduce.

2. CCW means the motor is counter clockwise when it is watched from the shaft extension end of its installation surface（CCW-Counter Clockwise）;

   CW means the motor is counter clockwise when it is watched from the shaft extension end of its installation surface（CW- Clockwise）.

3. "*" in the type of the servo drive unit means to the type code of the optional configuration function.

1.4   Order Guide

1.4.1   Model selection flow

```
   ┌──────────────────┐        ┌─────────────────────────────────┐
   │  Motor's toque   │◄───────│  Torque range:（2.4～38）N·m    │
   └──────────────────┘        └─────────────────────────────────┘
           │
           ▼                    ┌─────────────────────────────────┐
   ┌──────────────────┐         │ A：motor's rated speed 1000r/min；│
   │                  │         │ B：motor's rated speed 1500r/min；│
   │ Motor rated speed│◄────────│ C：motor's rated speed 2000r/min；│
   │                  │         │ D：motor's rated speed 2500r/min；│
   └──────────────────┘         │ E：motor's rated speed 3000r/min. │
           │                    └─────────────────────────────────┘
           ▼                    ┌─────────────────────────────────┐
   ┌──────────────────┐         │ 1. Select different installation│
   │ Motor installation│        │    dimension of 80,110,130,175  │
   │      mode        │◄────────│ 2. Select whether the motor is  │
   └──────────────────┘         │    matched with keyseat.        │
           │                    └─────────────────────────────────┘
           ▼                    ┌─────────────────────────────────┐
   ┌──────────────────┐         │ 1. Be adaptive to 2500 lines    │
   │ Machining precision│       │    incremental encoder,         │
   │ decides the adaptive│◄─────│    position precision is ±0.036°；│
   │ encoder of the motor│      │ 2. Be adaptive to 5000 lines    │
   └──────────────────┘         │    incremental encoder,         │
           │                    │    position precision is ±0.018°；│
           │                    │ 3. Be adaptive to 17bit absolute│
           │                    │    encoder, position precision  │
           ▼                    │    is ±0.005°.                  │
   ┌──────────────────┐         └─────────────────────────────────┘
   │   Motor model    │
   └──────────────────┘         ┌─────────────────────────────────┐
           │                    │ Search models according to      │
           │                    │ Section 1.4.2. Confirm the      │
           ▼                    │ drive unit is the economical or │
   ┌──────────────────┐         │ popularized according to the    │
   │ Drive unit model │◄────────│ adaptive CNC system. The present│
   └──────────────────┘         │ popularized servo is matched    │
                                │ with GSK988T CNC system.        │
                                └─────────────────────────────────┘
```

After the motor's model is confirmed, the servo drive unit's model is done according to the corresponding relationship described in Section 1.4.2.

1.4.2   Order model example

1. GS series servo equipment (including SJT series AC servo motor）order model is shown below:

| GS servo drive unit model | — | SJT AC servo motor model |

Example：GS2030T-NP1—110SJT-M040D(A2)

Explanation：Order GS2030T-NP1 AC servo drive unit and its matched 110SJT-M040D（A2）
AC servo motor, and its accessories are standard configurations（See Section 1.4.3）.

2. GS series servo drive unit（without AC servo motor）order model is shown below:

| GS servo drive unit model | — （| AC servo motor model |）

Example：GS2030T-NP1—（110SJT-M040D(A2)）

Explanation: for only ordering the servo drive unit, the exfacotry parameters is based on the

servo motor allocation described in the brackets, and the accessories are standard configurations (see Section 1.4.3).

GS2000T-NP1 D-SUB series products matched with SJT series servo motors:

Drive unit model	Servo motor parameters					
	Motor model	Rated power	Rated current	Rated torque	Rated speed	Encoder
GS2030T-NP1	110SJT-M040D(A2) 110SJT-MZ040D(A2)	1.0kW	4.5A	4N·m	2500r/min	5000 lines increment
GS2030T-NP1	110SJT-M040E(A2) 110SJT-MZ040E(A2)	1.2kW	5A	4N·m	3000r/min	Incremental 5000 lines
GS2045T-NP1	110SJT-M060D(A2) 110SJT-MZ060D(A2)	1.5kW	7A	6N·m	2500r/min	Incremental 5000 lines
GS2050T-NP1	110SJT-M060E(A2) 110SJT-MZ060E(A2)	1.8kW	8A	6N·m	3000r/min	Incremental 5000 lines
GS2025T-NP1	130SJT-M040D(A2) 130SJT-MZ040D(A2)	1.0kW	4A	4N·m	2500r/min	Incremental 5000 lines
GS2030T-NP1	130SJT-M050D(A2) 130SJT-MZ050D(A2)	1.3kW	5A	5N·m	2500r/min	Incremental 5000 lines
GS2045T-NP1	130SJT-M060D(A2) 130SJT-MZ060D(A2)	1.5kW	6A	6N·m	2500r/min	Incremental 5000 lines
GS2050T-NP1	130SJT-M075D(A2) 130SJT-MZ075D(A2)	1.88kW	7.5A	7.5N·m	2500r/min	Incremental 5000 lines
GS2045T-NP1	130SJT-M100B(A2) 130SJT-MZ100B(A2)	1.5kW	6A	10N·m	1500r/min	Incremental 5000 lines
GS2050-TNP1	130SJT-M100D(A2) 130SJT-MZ100D(A2)	2.5kW	10A	10N·m	2500r/min	Incremental 5000 lines
GS2050T-NP1	130SJT-M150B(A2) 130SJT-MZ150B(A2)	2.3kW	8.5A	15N·m	1500r/min	Incremental 5000 lines
GS2075T-NP1	130SJT-M150D(A2) 130SJT-MZ150D(A2)	3.9kW	14.5A	15N·m	2500r/min	Incremental 5000 lines
GS2075T-NP1	175SJT-M180B(A2) 175SJT-MZ180B(A2)	2.8kW	15A	18N·m	1500r/min	Incremental 5000 lines
GS2100T-NP1	175SJT-M180D(A2) 175SJT-MZ180D(A2)	3.8kW	16.5A	14.5N·m	2500r/min	Incremental 5000 lines
GS2100T-NP1	175SJT-M220B(A2) 175SJT-MZ220B(A2)	3.5kW	17.5A	22N·m	1500r/min	Incremental 5000 lines
GS2100T-NP1	175SJT-M220D(A2) 175SJT-MZ220D(A2)	4.5kW	19A	17.6N·m	2500r/min	Incremental 5000 lines
GS2100-TNP1	175SJT-M300B(A2) 175SJT-MZ300B(A2)	4.7kW	24A	30N·m	1500r/min	Incremental 5000 lines
GS2100-TNP1	175SJT-M300D(A2) 175SJT-MZ300D(A2)	6kW	27.5A	24N·m	2500r/min	Incremental 5000 lines

GS2000T-CA1 MDR series products matched with SJT series servo motors:

Drive unit model	Servo motor parameters					
	Motor model	Rated power	Rated current	Rated torque	Rated speed	Encoder
GS2025T-CA1	80SJT-M024C(A4I)	0.5kW	3A	2.4N·m	2000r/min	Absolute 17bit multi-circle
GS2030T-CA1	80SJT-M024E(A4I)	0.75kW	4.8A	2.4N·m	3000r/min	Absolute 17bit multi-circle
GS2030T-CA1	80SJT-M032C(A4I)	0.66kW	5A	3.2N·m	2000r/min	Absolute 17bit multi-circle
GS2045T-CA1	80SJT-M032E(A4I)	1.0kW	6.2A	3.2N·m	3000r/min	Absolute 17bit multi-circle
GS2030T-CA1	110SJT-M040D(A4I) 110SJT-MZ040D(A4I)	1.0kW	4.5A	4N·m	2500r/min	Absolute 17bit multi-circle
GS2045T-CA1	110SJT-M060D(A4I) 110SJT-MZ060D(A4I)	1.5kW	7A	6N·m	2500r/min	Absolute 17bit multi-circle
GS2025T-CA1	130SJT-M040D(A4I) 130SJT-MZ040D(A4I)	1.0kW	4A	4N·m	2500r/min	Absolute 17bit multi-circle
GS2030T-CA1	130SJT-M050D(A4I) 130SJT-MZ050D(A4I)	1.3kW	5A	5N·m	2500r/min	Absolute 17bit multi-circle
GS2045T-CA1	130SJT-M060D(A4I) 130SJT-MZ060D(A4I)	1.5kW	6A	6N·m	2500r/min	Absolute 17bit multi-circle
GS2050T-CA1	130SJT-M075D(A4I) 130SJT-MZ075D(A4I)	1.88kW	7.5A	7.5N·m	2500r/min	Absolute 17bit multi-circle
GS2045T-CA1	130SJT-M100B(A4I) 130SJT-MZ100B(A4I)	1.5kW	6A	10N·m	1500r/min	Absolute 17bit multi-circle
GS2050T-CA1	130SJT-M100D(A4I) 130SJT-MZ100D(A4I)	2.5kW	10A	10N·m	2500r/min	Absolute 17bit multi-circle
GS2050T-CA1	130SJT-M150B(A4I) 130SJT-MZ150B(A4I)	2.3kW	8.5A	15N·m	1500r/min	Absolute 17bit multi-circle
GS2075T-CA1	130SJT-M150D(A4I) 130SJT-MZ150D(A4I)	3.9kW	14.5A	15N·m	2500r/min	Absolute 17bit multi-circle
GS2075T-CA1	175SJT-M150D(A4I) 175SJT-MZ150D(A4I)	3.1kW	14A	12N·m	2500r/min	Absolute 17bit multi-circle
GS2075T-CA1	175SJT-M180B(A4I) 175SJT-MZ180B(A4I)	2.8kW	15A	18N·m	1500r/min	Absolute 17bit multi-circle
GS2100T-CA1	175SJT-M180D(A4I) 175SJT-MZ180D(A4I)	3.8kW	16.5A	14.5N·m	2500r/min	Absolute 17bit multi-circle
GS2100T- CA1	175SJT-M220B(A4I) 175SJT-MZ220B(A4I)	3.5kW	17.5A	22N·m	1500r/min	Absolute 17bit multi-circle
GS2100T- CA1	175SJT-M220D(A4I) 175SJT-MZ220D(A4I)	4.5kW	19A	17.6N·m	2500r/min	Absolute 17bit multi-circle
GS2100T-CA1	175SJT-M300B(A4I) 175SJT-MZ300B(A4I)	4.7kW	24A	30N·m	1500r/min	Absolute 17bit multi-circle

Drive unit model	Servo motor parameters					
	Motor model	Rated power	Rated current	Rated torque	Rated speed	Encoder
GS2100T-CA1	175SJT-M300D(A4I) 175SJT-MZ300D(A4I)	6kW	27.5A	24N·m	2500r/min	Absolute 17bit multi-circle
GS2100T-CA1	175SJT-M380B(A4I) 175SJT-MZ380B(A4I)	6 kW	29 A	38 N·m	1500 r/min	Absolute 17bit multi-circle

1.4.3 Standard configuration accessories

The standard configuration accessories described in the following list are provided without the special requirements from the user. Please contact the sellers or allocate others after consulting our technical personnel when the user needs other accessories.

● GS2000T series D-SUB accessory list:

Order	Name	Model	Quantity	Explanation
Servo drive unit, servo motor and CNC whole set	Encoder line of motor	-00-761A	1 line	Standard length 3m
	Power line of motor	-00-765* (note 1)	1 line	Standard length 3m
	User Manual	GS2000T Series AC Servo Drive Unit User Manual	1 piece	Technical documents
	Brake resistor with aluminium shell	RXLG800W15RJM	1 piece	Provided only when it is adaptive to GS2075T-CA1 including 1m connection line，
	Brake resistor with aluminium shell	RXLG1200W10RJM	1 piece	Provided only when it is adaptive to GS2100T-NP1 including 1m connection line
Remark	Control signal line of servo drive unit are provided with CNC: its standard length is 3m.			
Servo drive unit and servo motor	Connector plug	DB44 pin socket	1 set	CN1 connector plug
	Encoder line of motor	-00-761A	1 line	Standard length 3m
	Power line of motor	-00-765* (note 1)	1 line	Standard length 3m
	User Manual	GS2000T Series AC Servo Drive Unit User Manual	1 piece	Technical documents
	Brake resistor with aluminium shell	RXLG800W15RJM	1 piece	Provided only when it is adaptive to GS2075T-CA1 including 1m connection line，
	Brake resistor with aluminium shell	RXLG1200W10RJM	1 piece	Provided only when it is adaptive to GS2100T-NP1 including 1m connection line

Order	Name	Model	Quantity	Explanation
Servo drive unit(without servo motor)	Connector plug	DB44 pin socket	1 set	CN1 connector plug
	Connector plug	DB25 pin socket	1 set	CN2 connector plug
	User Manual	GS2000T Series AC Servo Drive Unit User Manual	1 piece	Technical documents
	Brake resistor with aluminium shell	RXLG800W15RJM	1 piece	Provided only when it is adaptive to GS2075T-CA1 including 1m connection line，
	Brake resistor with aluminium shell	RXLG1200W10RJM	1 piece	Provided only when it is adaptive to GS2100T-NP1 including 1m connection line
Servo drive unit and CNC whole set(without servo motor)	Connector plug	DB25 pin socket	1 set	CN2 connector plug
	User Manual	GS2000T Series AC Servo Drive Unit User Manual	1 piece	Technical documents
	Brake resistor with aluminium shell	RXLG800W15RJM	1 piece	Provided only when it is adaptive to GS2075T-CA1 including 1m connection line，
	Brake resistor with aluminium shell	RXLG1200W10RJM	1 piece	Provided only when it is adaptive to GS2100T-NP1 including 1m connection line
Remark	Control signal line of drive unit are provided with CNC: its standard length is 3m.			

Note 1："*" is the undetermined suffix letter, its corresponding cable specification is referred to Power Line Specification List of Motor.

● Accessory list of GS2000T-CA1 series MDR product:

Order	Name	Model	Quantity	Explanation
Servo drive unit, servo motor and CNC set	Encoder line of motor	00-761A	1 line	Standard length 3m
	Power line of motor	00-765*（note 1）	1 line	Standard length 3m；
	User Manual	GS2000T Series Servo Drive Unit User Manual	1 line	Technical documents
	Brake resistor	RXLG800W15RJM	1 piece	Provided only when it is adaptive to GS2075T-CA1 including 1m connection line，
	Brake resistor	RXLG1200W10RJM	1 piece	Provided only when it is adaptive to GS2100-CA1 including 1m connection line，
Remark	Control signal line of servo drive unit, GSK-CAN communication line and SCR6 terminal socket are provided with CNC （note2） .			

Note 1：   "*" is the undetermined suffix letter, its corresponding cable specification is referred to Power Line Specification List of Motor.

Note 2：Presently, only GSK988T supports GSK-CAN serial bus, and is adaptive to GS2000T-CA1 series MDR servo drive unit.

The power line of the servo motor is selected based on its adaptive servo motor's rated current, which is shown below:

Power line specification list of motor:

Cable serial number	Cable parameter	Adaptive motor's rated current
-00-765C	4×1.0mm^2	Ⅰ≤6A
-00-765D	4×1.5mm^2	6A＜Ⅰ≤9A
-00-765E	4×2.5mm^2	9A＜Ⅰ≤15A
-00-765F	4×4.0mm^2	15A＜Ⅰ≤24A
-00-765G	4×6.0mm^2	24A＜Ⅰ≤36A

1. Must mark in detail the order products (servo drive unit, servo motor, isolation transformer, CNC model and quantity, exclusive software, hardware version, or required optional function and accessories);

2. Must mark clearly variety, specification and quantity of non-standard configuration accessories (such as special cable or cable length, cable technology and so on), otherwise, we supply products according to the standard accessories;

3. Must mark clearly the order servo motor's shaft extension, structure, and please remark in the order for the special;

4. When the user orders only the servo drive unit (without servo motor), *the servo motor model* following the servo drive unit is marked. ｛example：GS2030T-NP1 ［110SJT-M040D（A2）］｝，which is convenient that we set the matched parameters corresponding to the motor model before delievery. The servo drive unit and servo motor can get excellent control effect with adaptive parameters. Please contact with GSK R&D departements if the user allocates other manufactures' products by itself,

CHAPTER TWO   INSTALLATION

2.1   Servo Motor

2.1.1   Installation Dimension of the Servo Motor

➢ Outline installation dimension and connection of 80SJT series motor referred to Fig. 2-1, Table 2-1.

Industrial(aviation) socket →

Cable linear →
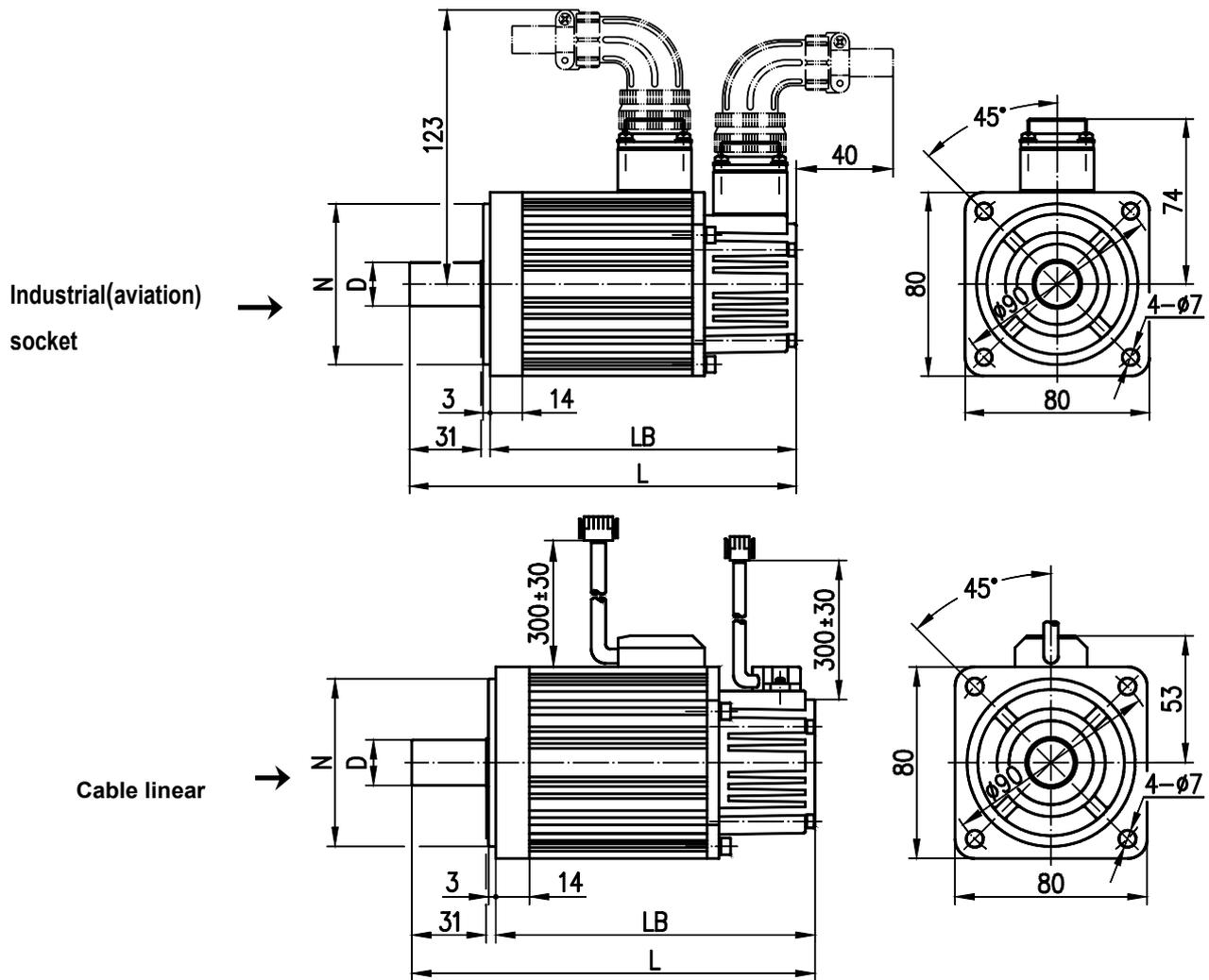
Fig. 2-1

Table 2-1

Type	D(mm)	N(mm)	LB(mm)	L(mm)
80SJT—M024C (A□)	$\varphi 19^{0}_{-0.013}$	$\varphi 70^{0}_{-0.03}$	163	198
80SJT—M024E(A□)	$\varphi 19^{0}_{-0.013}$	$\varphi 70^{0}_{-0.03}$	163	198
80SJT—M032C(A□)	$\varphi 19^{0}_{-0.013}$	$\varphi 70^{0}_{-0.03}$	181	216
80SJT—M032E(A□)	$\varphi 19^{0}_{-0.013}$	$\varphi 70^{0}_{-0.03}$	181	216

➢ Outline installation dimension and connection of 110SJT series motor referred to Fig. 2-2, Table 2-2.
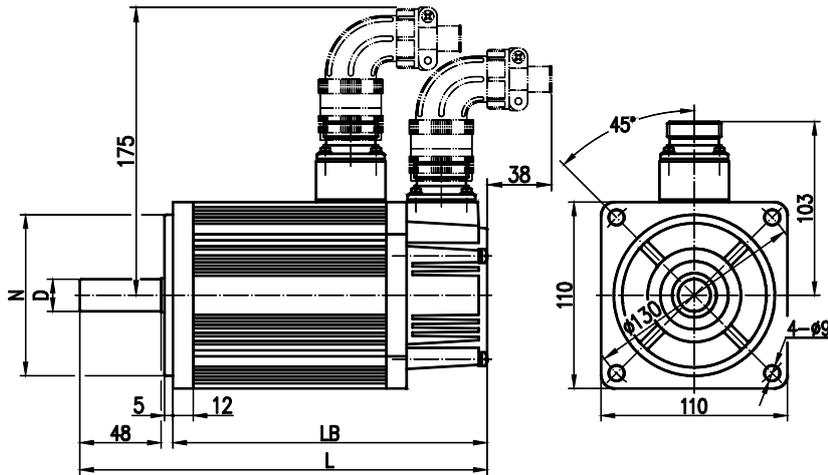
Fig. 2-2

Table2-2

Model	D(mm)	N(mm)	LB(mm)	L(mm)
110SJT—M040D(A□)	$\varphi19^{0}_{-0.013}$	$\varphi95^{0}_{-0.035}$	186 (237)	241 (292)
110SJT—M040E(A□)	$\varphi19^{0}_{-0.013}$	$\varphi95^{0}_{-0.035}$	186 (237)	241 (292)
110SJT—M060D(A□)	$\varphi19^{0}_{-0.013}$	$\varphi95^{0}_{-0.035}$	212 (263)	267 (318)
110SJT—M060E(A□)	$\varphi19^{0}_{-0.013}$	$\varphi95^{0}_{-0.035}$	212 (263)	267 (318)
Note: LB, L value in the brackets is the length value of motor with the corresponding specification and safe brake.				

➢ Outline installation dimension and connection of 130SJT series motor referred to Fig.2-3,Table2-3.
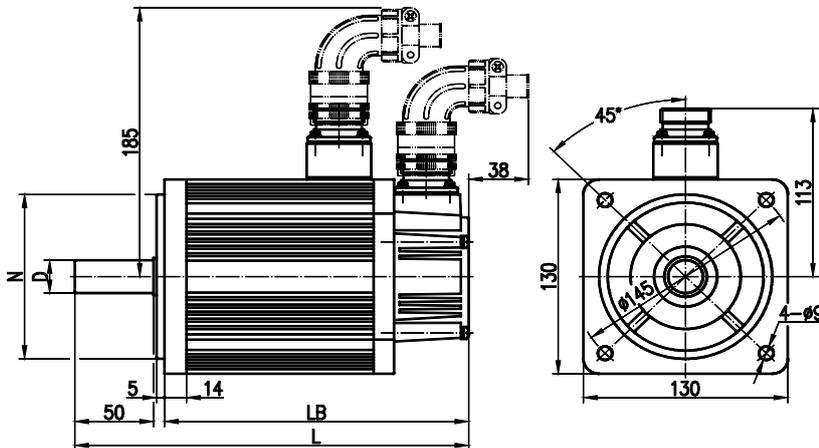
Fig. 2-3

Table2-3

Model	D(mm)	N(mm)	LB(mm)	L(mm)
130SJT—M040D(A□)	$\varphi22^{0}_{-0.013}$	$\varphi110^{0}_{-0.035}$	168 (227)	225 (284)
130SJT—M050D(A□)	$\varphi22^{0}_{-0.013}$	$\varphi110^{0}_{-0.035}$	168 (227)	225 (284)
130SJT—M060D(A□)	$\varphi22^{0}_{-0.013}$	$\varphi110^{0}_{-0.035}$	176 (235)	233 (292)
130SJT—M075D(A□)	$\varphi22^{0}_{-0.013}$	$\varphi110^{0}_{-0.035}$	188 (247)	245 (304)
130SJT—M100B(A□)	$\varphi22^{0}_{-0.013}$	$\varphi110^{0}_{-0.035}$	208 (267)	265 (324)
130SJT—M100D(A□)	$\varphi22^{0}_{-0.013}$	$\varphi110^{0}_{-0.035}$	208 (267)	265 (324)

130SJT—M150B(A□)	$\varphi 22^{0}_{-0.013}$	$\varphi 110^{0}_{-0.035}$	238 (297)	295 (354)
130SJT—M150D(A□)	$\varphi 22^{0}_{-0.013}$	$\varphi 110^{0}_{-0.035}$	248 (307)	305 (364)
Note: LB, L value in the brackets is the length value of motor with the corresponding specification and safe brake.				

➢ Outline installation dimension and connection of 175SJT series motor referred to Fig. 2-4, Table 2-4.
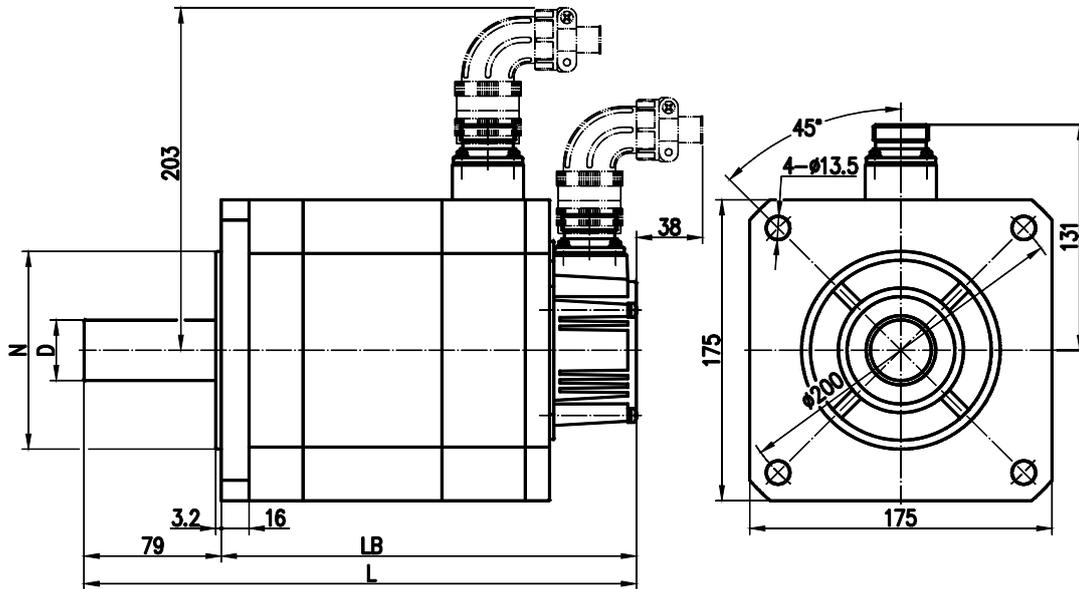
Fig. 2-4

Table 2-4

Type	D(mm)	N(mm)	LB(mm)	L(mm)
175SJT—M150D(A□)	$\varphi 35^{+0.01}_{0}$	$\varphi 114.3^{0}_{-0.025}$	224 (291)	303 (370)
175SJT—M180B(A□)	$\varphi 35^{+0.01}_{0}$	$\varphi 114.3^{0}_{-0.025}$	244 (311)	323 (390)
175SJT—M180D(A□)	$\varphi 35^{+0.01}_{0}$	$\varphi 114.3^{0}_{-0.025}$	244 (311)	323 (390)
175SJT—M220B(A□)	$\varphi 35^{+0.01}_{0}$	$\varphi 114.3^{0}_{-0.025}$	279 (346)	358 (425)
175SJT—M220D(A□)	$\varphi 35^{+0.01}_{0}$	$\varphi 114.3^{0}_{-0.025}$	279 (346)	358 (425)
175SJT—M300B(A□)	$\varphi 35^{+0.01}_{0}$	$\varphi 114.3^{0}_{-0.025}$	309 (382)	388 (461)
175SJT—M300D(A□)	$\varphi 35^{+0.01}_{0}$	$\varphi 114.3^{0}_{-0.025}$	309 (382)	388 (461)
175SJT—M380B(A□)	$\varphi 35^{+0.01}_{0}$	$\varphi 114.3^{0}_{-0.025}$	359 (432)	438 (561)
Note: LB, L value in the brackets is the length value of motor with the corresponding specification and safe brake.				

2.1.2 Installation of the servo motor

Installation and transportation environment of the servo motor:

Item	Index
Use temperature	0℃～40℃
Transportation temperature	-40℃～70℃
Humidity	30%～95%（No condensation）
Transportation humidity	≤95%（40℃）
Atmosphere condition	The control cabinet should be free of the corrosive gas, flammable gas, oil mist and dust.
Altitude	Below altitude1000m

Notice

1. Forbid beating the motor or the motor's shaft when installing the belt wheel to avoid damaging the internal encoder. Must use the spiral instruments to dismount components.

2. The servo motor cannot support the axial, radial load. It is suggested that the flexible shaft joint should be used to support the load.

3. Fixing the motor must use the anti-loose washer to avoid the motor loosing.

4. The motor installation must prevent the water, the oil because the cable in the water, oil may carry them to the motor.
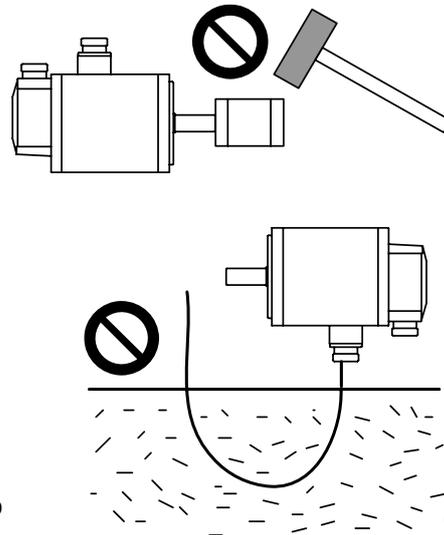
2.2 Servo drive unit

Installation environmental condition of the drive unit directly affects its function and service life. Please correctly install it according to the following items.

Notice ■ Prevent the rain from splashing and keep out of the sunshine directly.

■ The drive unit should be installed into the electric cabinet for preventing the dust, corrosive gas, as well as the electric conductions and inflammable objects.

■ Keep ventilated, damp-proof and guard against the dust in the installation place

■ Never attempt to install it near the flammable objects or on its surface, prevent the fire.

■ The installation place should be convenient for maintaining, checking.

Item	Index
Use temperature	0℃～40℃
Transportation temperature	-40℃～70℃
Humidity	30%～95%（no condensation）
Transportation humidity	≤95%（40℃）
Atmosphere condition	The control cabinet should be free of the corrosive gas, flammable gas, oil mist and dust.
Altitude	Below altitude1000m
Vibration	≤0.6G(5.9m/s^2)
Atmosphere pressure	86kPa～106kPa

2.2.1 Installation dimension installation dimension
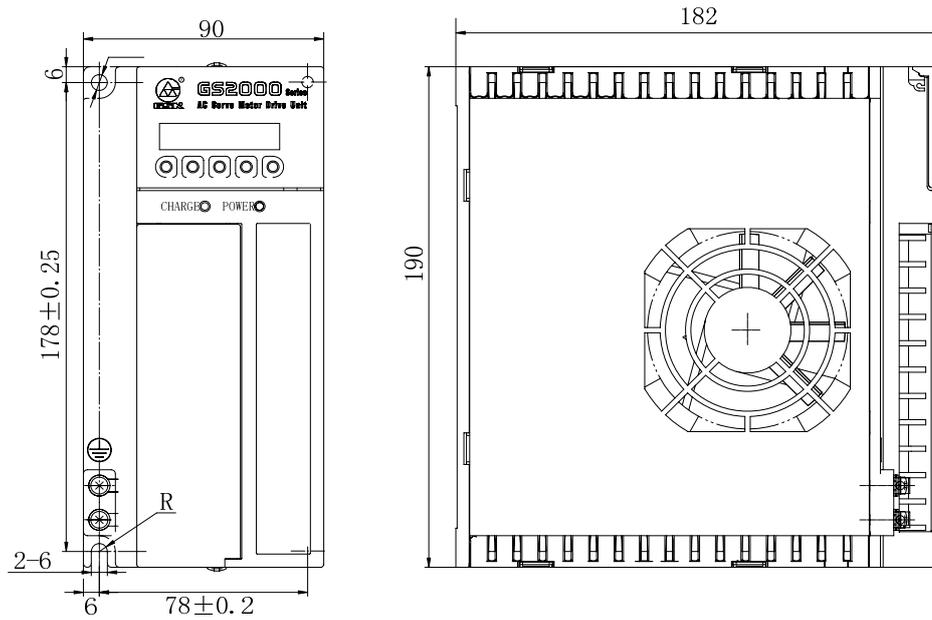
Fig.2-5   GS2025T, GS2030T, GS2045T installation dimension（unit: mm）
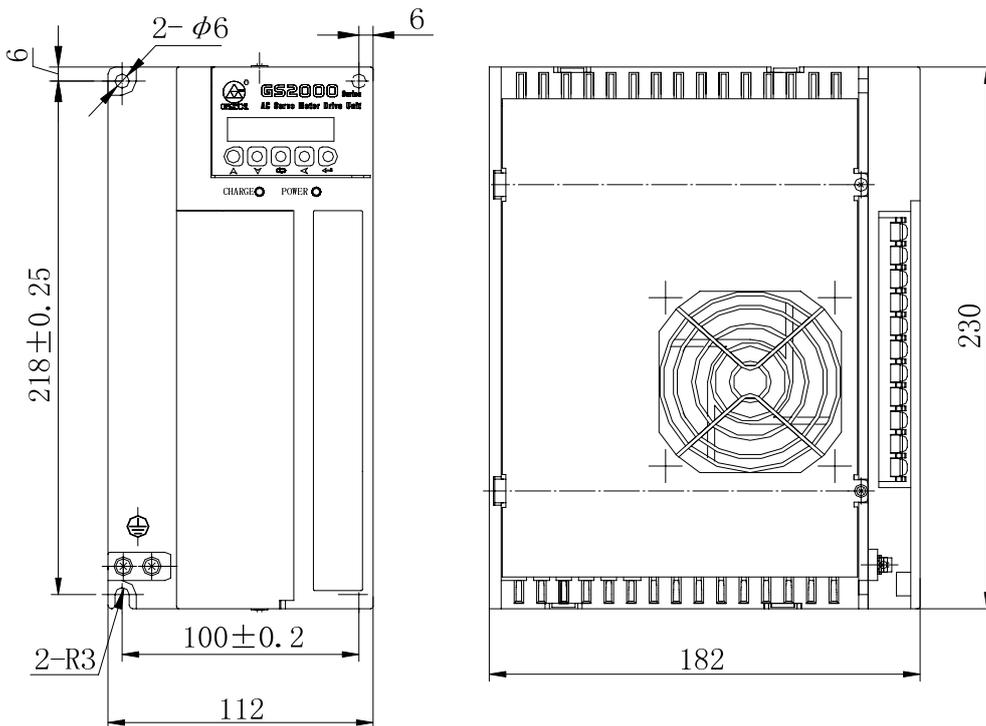
Fig.2-6   GS2050T installation dimension（unit：mm）
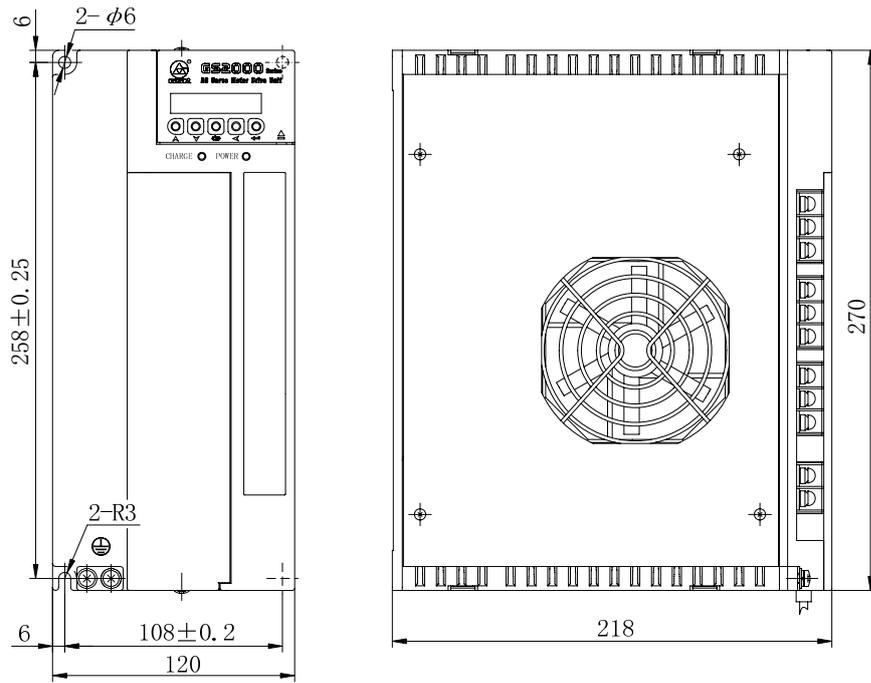
Fig.2-7 GS2075T installation dimension（unit：mm）
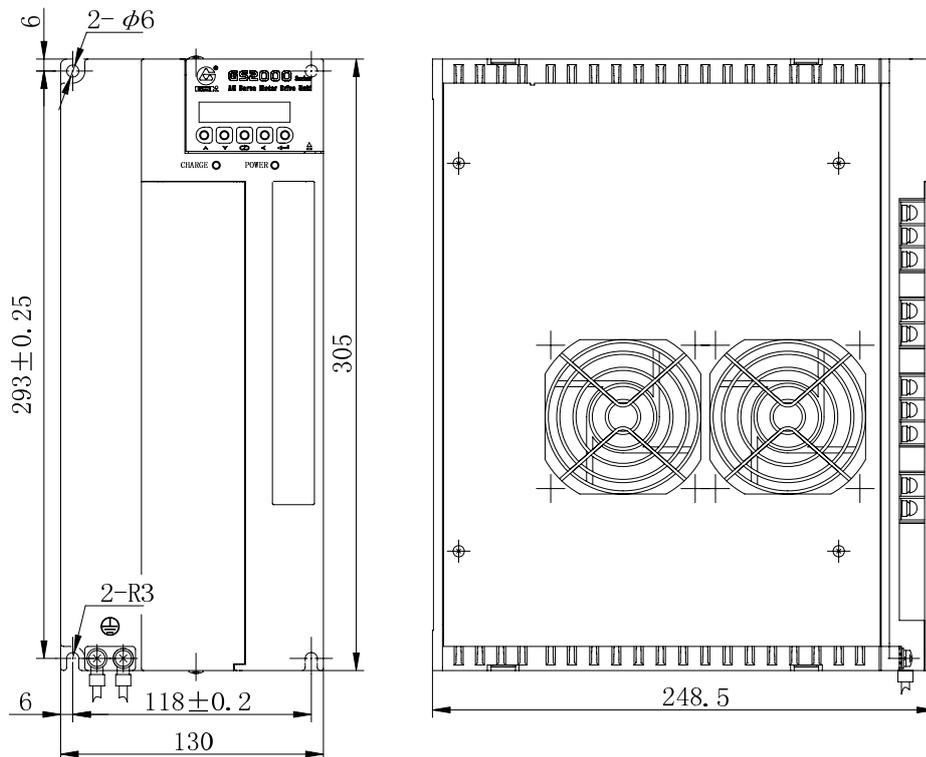
Fig.2-8 GS2100T installation dimension（unit：mm）

2.2.2 Installation interval

GS series servo drive unit uses the foot installation type, the installation direction should be perpendicular to its surface. For heat dissipation, the face of the drive unit is its front and the top

is upward when installation.

　　To avoid the environment temperature continuously rising of the servo drive unit, the convection wind in the electric cabinet blows to the radiator of the servo drive unit.
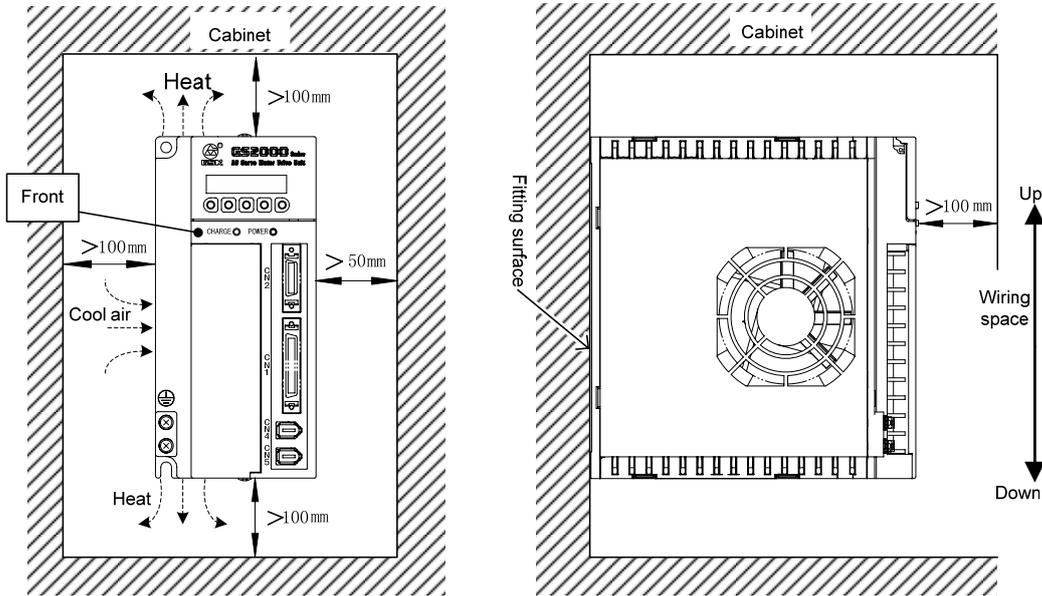
Fig.2-9　Installation interval of GS2025T, GS2030T, GS2045T servo drive unit
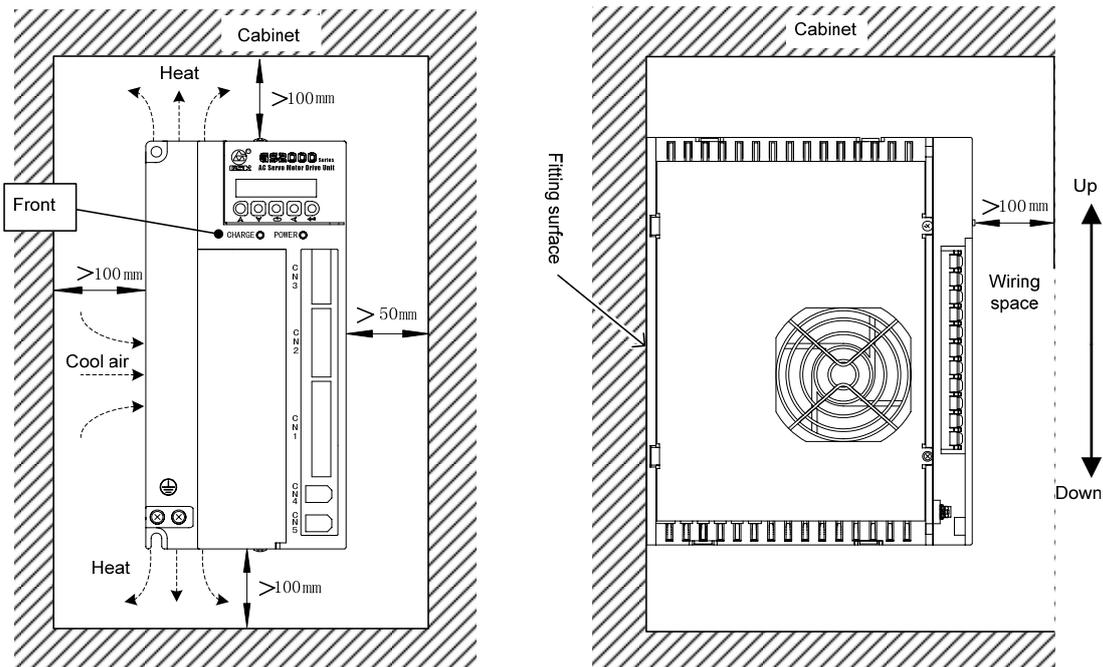
Fig.2-10　Installation interval of GS2050T servo drive unit
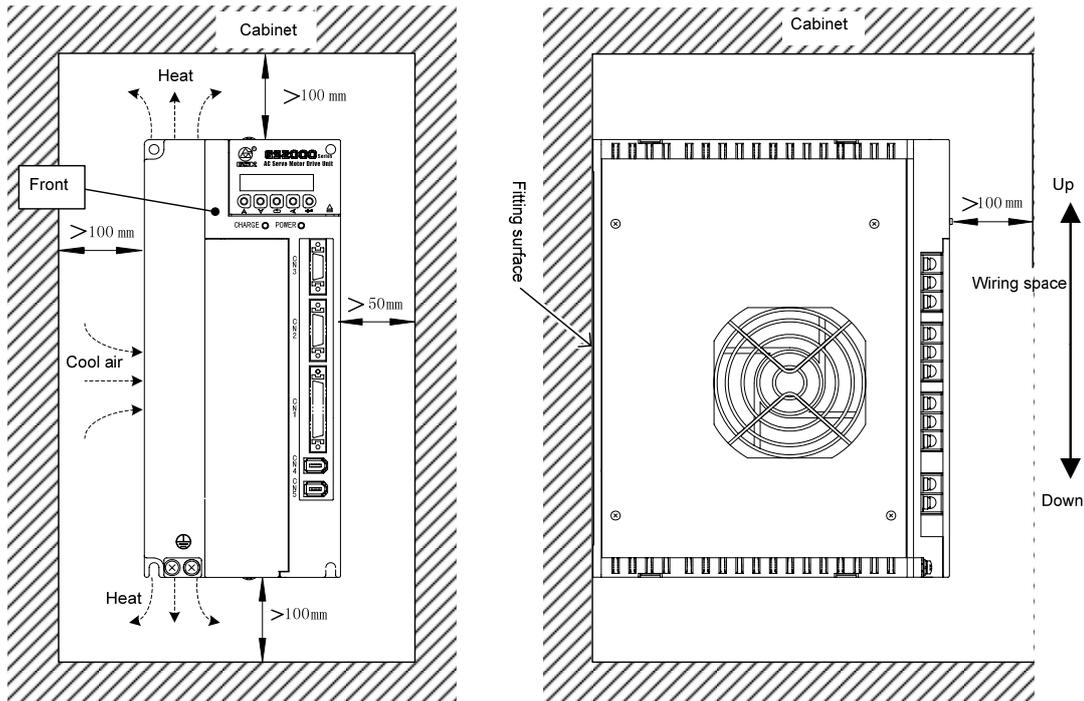
Fig.2-11 Installation interval of GS2075T servo drive unit
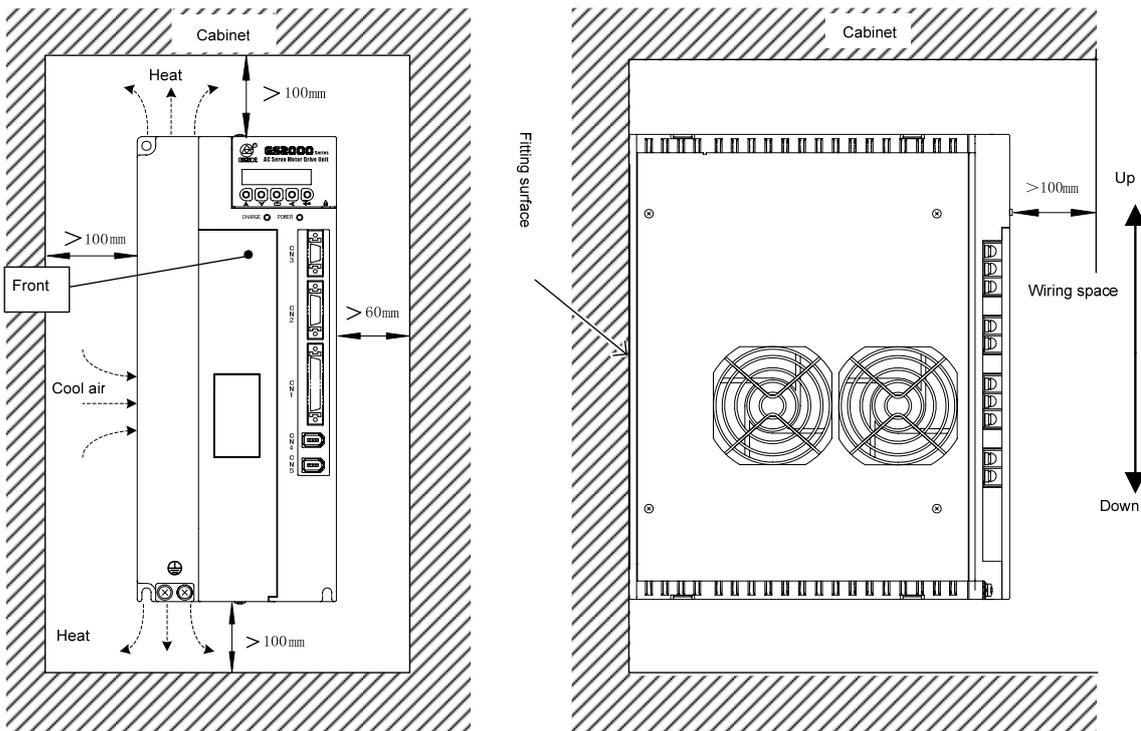
Fig.2-12 Installation interval of GS2100T servo drive unit

For installation interval of many servo drive units, the more interval should be given as possible as during the course of actual installation to get the good heat dissipation condition.

CHAPTER THREE   CONNECTION

It is very necessary to check the following notices, and the user should perform the connection in terms of the requirements for safety.

- ■   The wiring should be performed correctly by the professional and connected based on the relative specification.
- ■   The wiring and check should be performed after the drive unit is turned off for 5min by confirming the voltage of main circuit is safe with the multimeter; otherwise, it may be electric shock hazard.
- ■   Confirm the drive unit and servo motor grounding
- ■   The cable can not be damaged by sharp object and strongly drew; otherwise, the electric shock or bad circuit connection may occur.
- ■   Do not put the main circuit wiring and the signal wiring through a same tube or mix them. When the wiring is performed, the main circuit wiring should be divided from the signal wiring more than 30cm or crossed for preventing the strong circuit caused an interruption to the signal wiring, and then the drive unit can not be operated normally.
- ■   Do not turn ON/OFF frequently because there is the high capacitance within the drive unit and the heavy charging current may occur after the power is turned on; otherwise, the internal main circuit parts capacity may reduce due to the power is turned on/off frequently, so, the shifting between ON/OFF should be performed up to 3 minutes.
- ■   The equipments, such as the power capacitance, surge absorber and wireless noise filter, which can not be installed between the drive unit output side and servo motor.
- ■   The main circuit wiring and signal wiring should not be closed to the heat sink, brake resistance and motor, so that the insulativity is reduced due to the heat.
- ■   The terminal protection lid should be covered to avoid electric shock after the main circuit connection is performed.

3.1   Connection of Peripheral Equipment

Using the servo drive unit should be adapted with some peripheral equipments, the correct peripheral equipment makes the steady operation of the servo drive unit and the servo motor, and prolongs life of the servo drive unit.

The followings should be paid more attention in the connection diagram of the peripheral equipment.

- ●   The devices described in the broken line box should be allocated by the user, and ones in the solid box should be bought from GSK Equipment Co., Ltd..
- ●   The breaker, AC filter, isolation transformer, AC reactor, AC contactor should be referred to *Appendix B.*
- ●   The peripheral equipments with the mark "Must be Installed" in the figure ensures the user can safely use the servo equipment reliably, and reduces the loss caused by the damaged equipment as possible.
- ●   The peripheral equipments with the mark "Be Installed Optionally" in the figure can ensure the servo drive unit normally runs stably.

- **Peripheral equipment connection of D-SUB products**

Peripheral equipment connection of D-SUB products GS2025T-NP1, GS2030T-NP1, GS2045T-NP1 are shown in the following diagram.
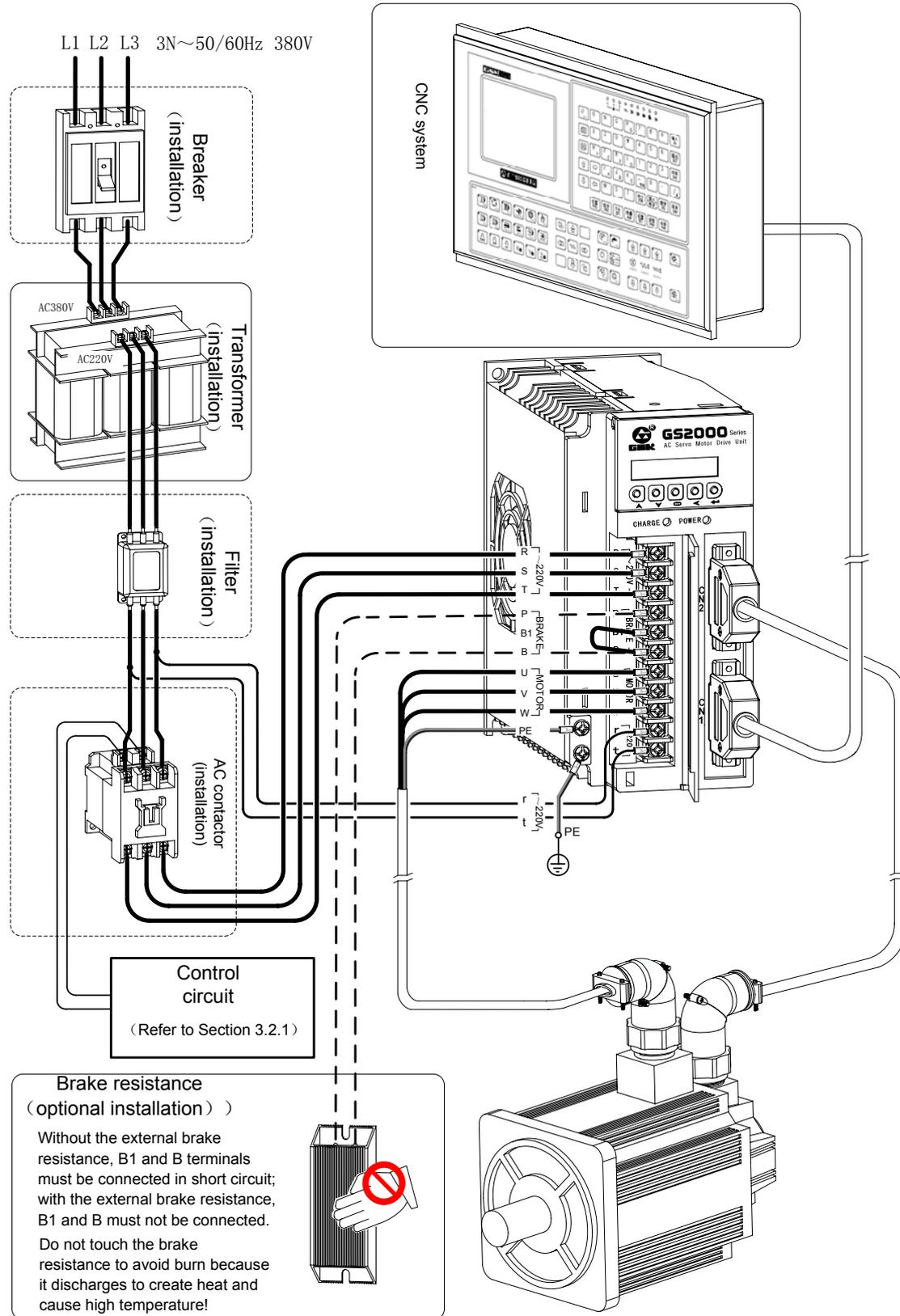
Fig. 3-1（a）peripheral equipment connection diagram of GS D-SUB servo drive unit

● **Peripheral connection of D-SUB products**

Peripheral equipment connection of D-SUB products GS2050T-NP1 are shown in the following diagram.

L1 L2 L3 3N～50/60Hz 380V

Breaker
（installation）

AC380V

Transformer
（installation）

AC220V

Filter
（installation）

AC contactor
（installation）

CNC system

GS2000 Series
AC Servo Motor Drive Unit

CHARGE○ POWER○

Optional CN3

CN2

CN1

R ⌐～220V⌐
S
T ⌐
P ⌐BRAKE⌐
B1
B ⌐
U ⌐MOTOR⌐
V
W ⌐
r ⌐～220V⌐
t

PE

Control
circuit
（Refer to Section 3.2.1）

Brake resistance
（**optional installation**）
Without the external brake resistance, B1 and B terminals must be connected in short circuit; with the external brake resistance, B1 and B must not be connected.
Do not touch the brake resistance to avoid burn because it discharges to create heat and cause high temperature!

Fig. 3-1（b）peripheral equipment connection diagram of GS D-SUB servo drive unit

● **Peripheral equipment connection of** D-SUB products

　　Peripheral equipment connection of D-SUB products GS2075T-NP1, GS2100T-NP1 are shown in the following diagram.
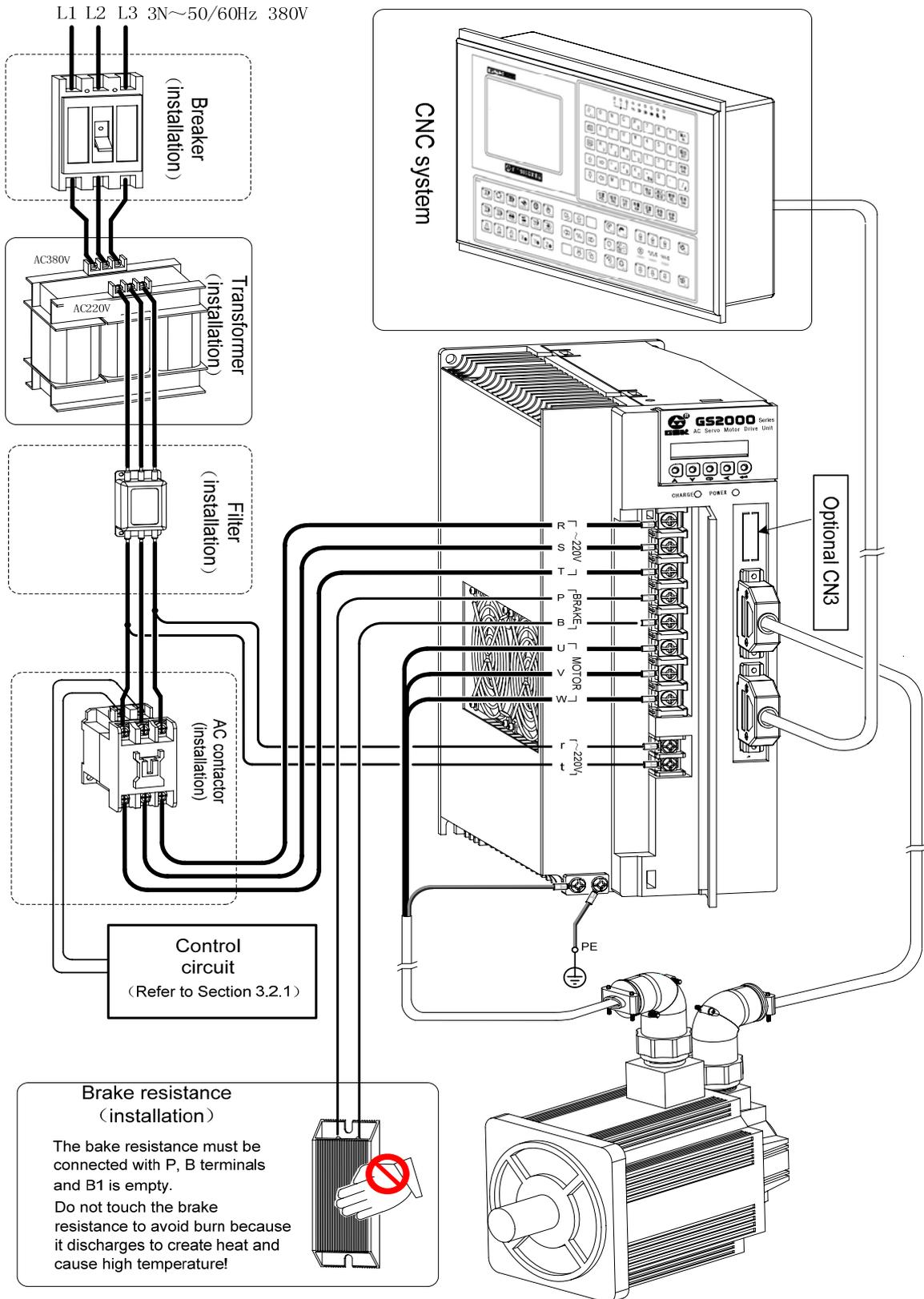
Fig. 3-1（c）　peripheral equipment connection diagram of GS D-SUB servo drive unit

● **Peripheral equipment connection of** MDR products

Peripheral equipment connection of MDR products GS2025T-CA1, GS2030T-CA1, GS2045T-CA1 are shown in the following diagram.

Fig. 3-2（a） peripheral equipment connection diagram of GS MDR servo drive unit

● **Peripheral equipment connection of** MDR products

Peripheral equipment connection of MDR products GS2050T-CA1 are shown in the following diagram.
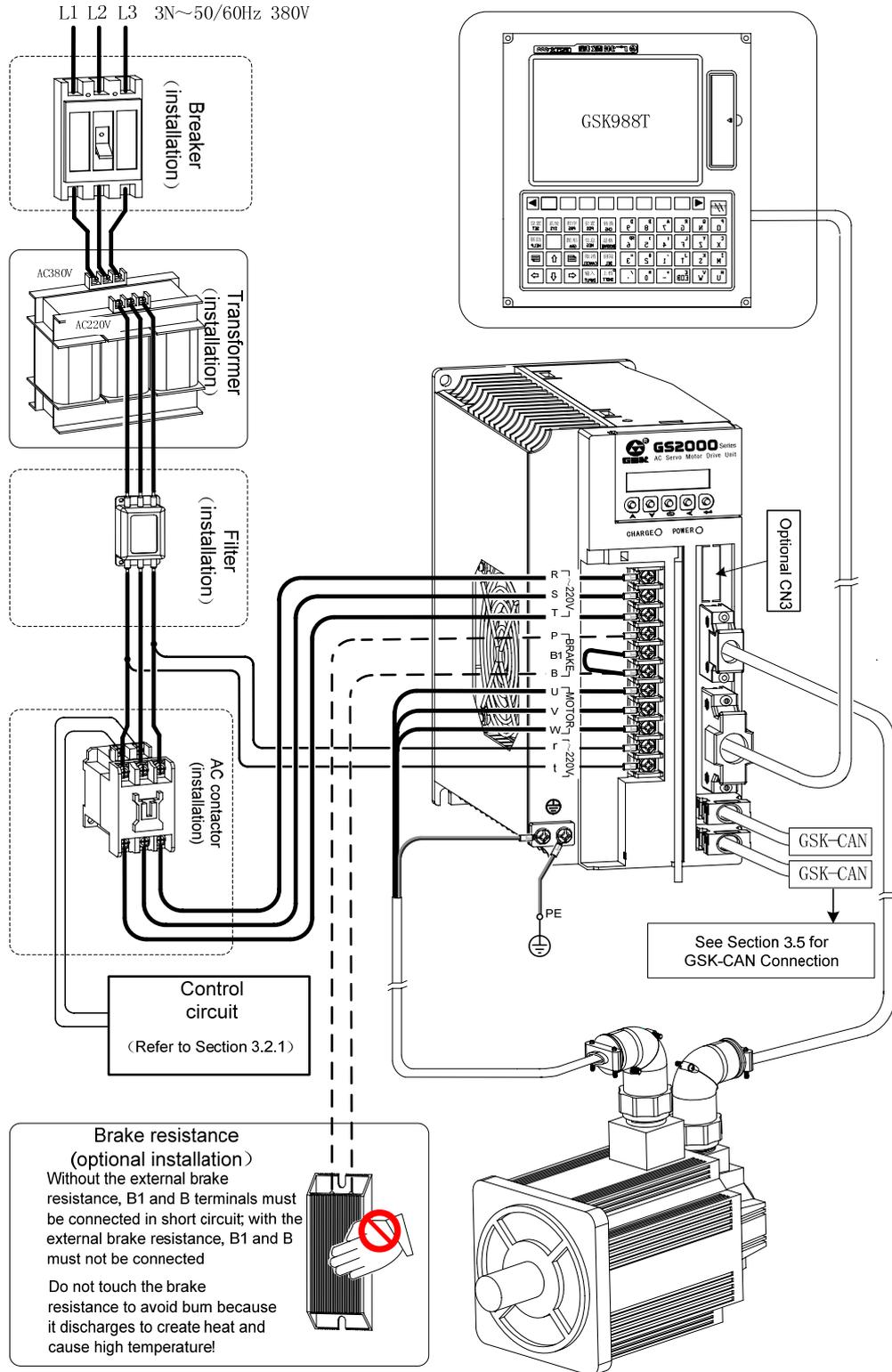
Fig. 3-2（b）　peripheral equipment connection diagram of GS MDR servo drive unit

● **Peripheral connection of MDR products**

Peripheral equipment connection of MDR products GS2075T-CA1, GS2100T-CA1 are shown in the following diagram.
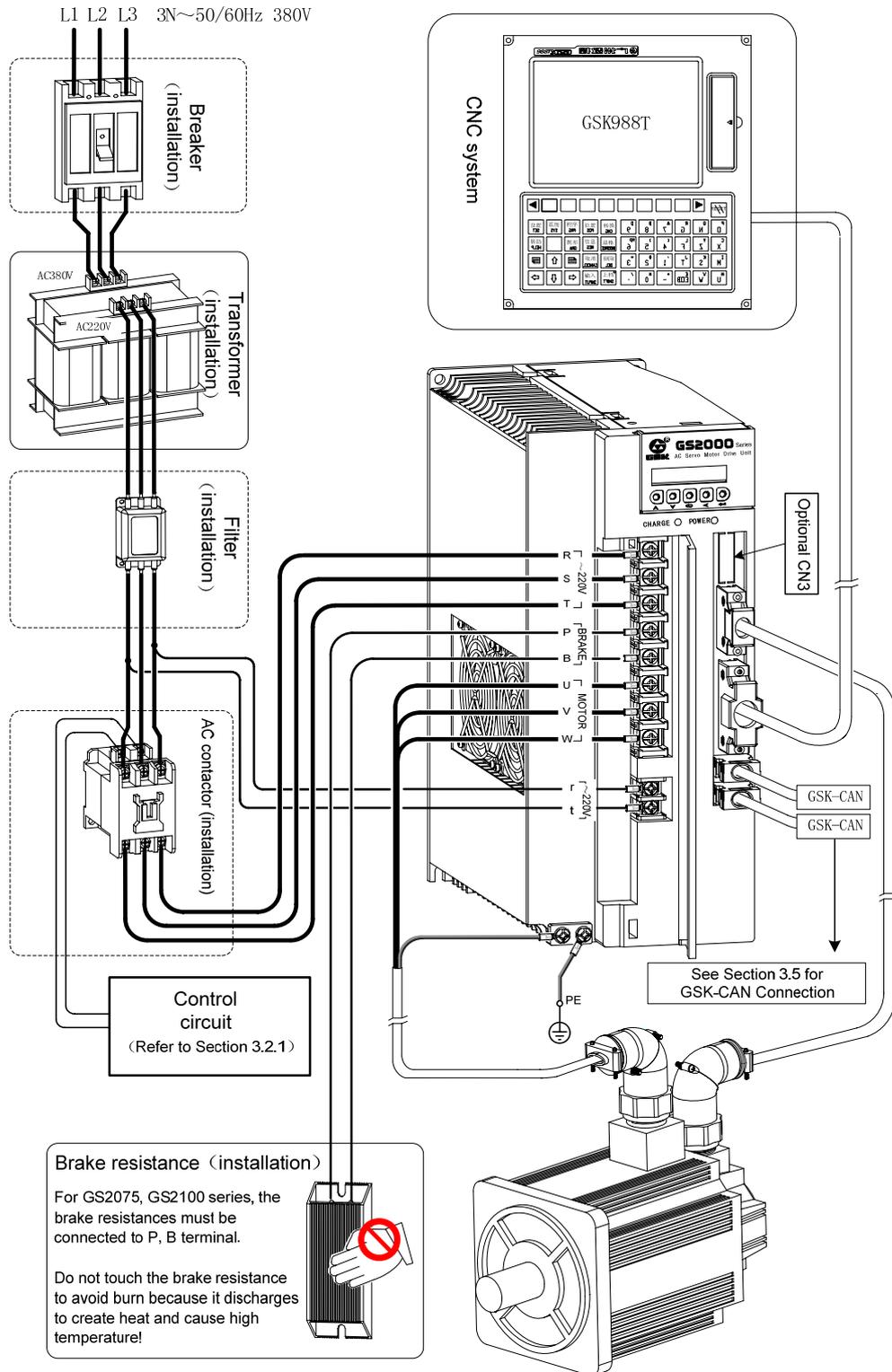
Fig. 3-2（c）　peripheral equipment connection diagram of GS MDR servo drive unit

3.2   Terminal connection of Main Circuit

3.2.1   Main circuit connection of the servo drive unit

● Main circuit connection of GS series servo drive unit
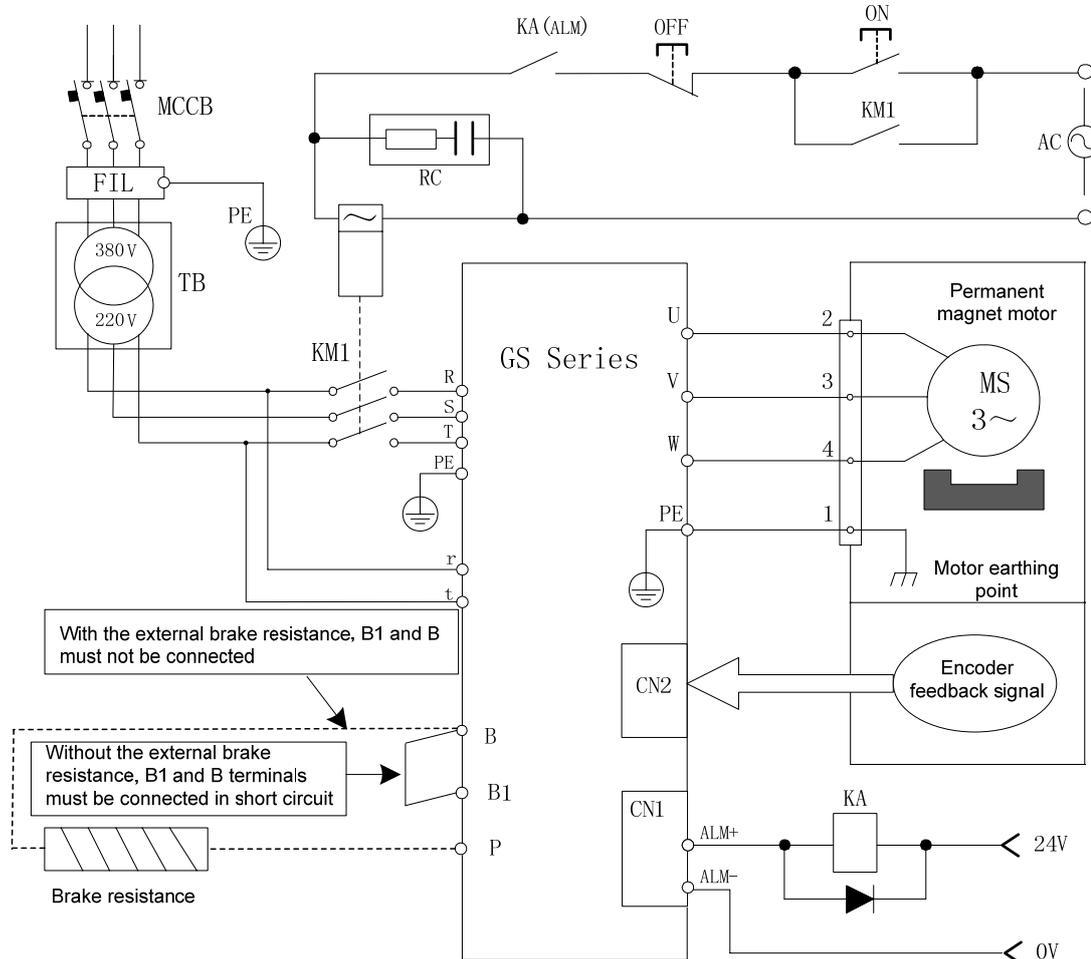
Fig.3-3   main circuit connection of GS series servo drive unit

Note	● Without the external brake resistance, B1 and B terminals must be connected in short circuit; with the external brake resistance, B1 and B must not be connected. ● Our matched motor's power supply wire has been marked with U, V, W, PE terminals, and their must correspond separately to the drive unit U, V, W, PE terminals, otherwise, the motor cannot normally run! ● Correctly connect with the protective earth terminal and the earth resistance should not be more than 10Ω.

3.2.2 Wiring of main circuit

Terminal label	Name	Explanation
R,S,T	AC power supply input terminal	3-phase AC power supply input.
U,V,W	3-phase AC output terminal	It is connected with the motor's 3-phase winding U, V, W.
PE ⏚	Protective grounding terminal	It is connected with the ground wires of the power supply and the motor, and the protective grounding resistance should be less than 1Ω.
P,B1,B	Brake resistance terminal	The brake resistance is used to the dynamic braking, and the servo drive unit should be connected externally with the brake resistance to work normally.

All cables and terminals for main circuit of the servo drive unit should meet the requirements described in the following table.

Type	Rated current I of adaptive motor (A)	R，S，T，U，V，W		r，t		P，B1，B		PE	
		Bolt size Φ mm	Cable's sectional area mm^2	Bolt size φ mm	Cable's sectional area mm^2	Bolt size Φ mm	Cable's sectional area mm^2	Bolt size Φ mm	Cable's sectional area mm^2
GS2025T	I≤4.5	3.5	1.5	3.5	1	3.5	1.5	3.5	1.5
GS2030T	4.5＜I≤6	3.5	1.5	3.5	1	3.5	1.5	3.5	1.5
GS2045T	6＜I≤7.5	3.5	2	3.5	1	3.5	2	3.5	2
GS2050T	6＜I≤10	3.5	2.5	3.5	1	3.5	2.5	4	2.5
GS2075T	10＜I≤15	4	4	4	1	4	2.5	5	2.5
GS2100T	15＜I≤29	6	4	4	1	6	4	5	4

3.2.3 Interfaces explanations of servo motor
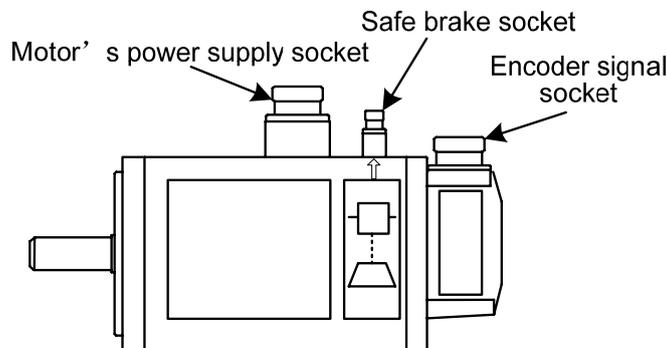
➤ Corresponding relationship between pins of socket of motor's power supply and output terminals of servo drive unit:

Socket pin number of motor's power supply	1	2	3	4
Terminal label of servo drive unit	PE	U	V	W
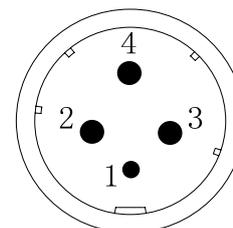
Motor's power supply socket

➤ Pins connection of safe brake's socket:

Safe brake socket
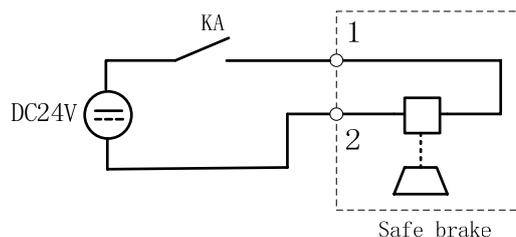
Safe brake

● Pin 1, Pin 2 is connected with DC 24V without positive/negative pole, and Pin 3 is grounded.

● The contactor KA control is referred to Section 6.2 Hold Releasing Signal Application.

The motor with different power is allocated with the safe brake with different power, and the motors with different specifications corresponding to the technical parameters of the matched brakes (described in the following table)should be referred when the user selects the 24V switch.

Motor's seat No.	Rated torque	20℃ brake coil power（unit W）	Release time（s）	Voltage	Power
110	4	20	0.037	24V DC	≥30W
130	8	25	0.042	24V DC	≥40W
175	32	40	0.135	24V DC	≥50W

➤ The connection of socket's pin of encoder's signal is referred to Section 3.4.

3.3   Connection of Control Signal

3.3.1   CN1 control signal layout

●   **CN1 signal layout of GS series D-SUB products**

Control signal interface CN1 of GS series D-SUB products is 44-pin female socket, and the connector for the control line is 44-pin male socket (type: G3101-44MBNS1X1 provided by WIESON) . Its pin definition is referred to the following diagram:
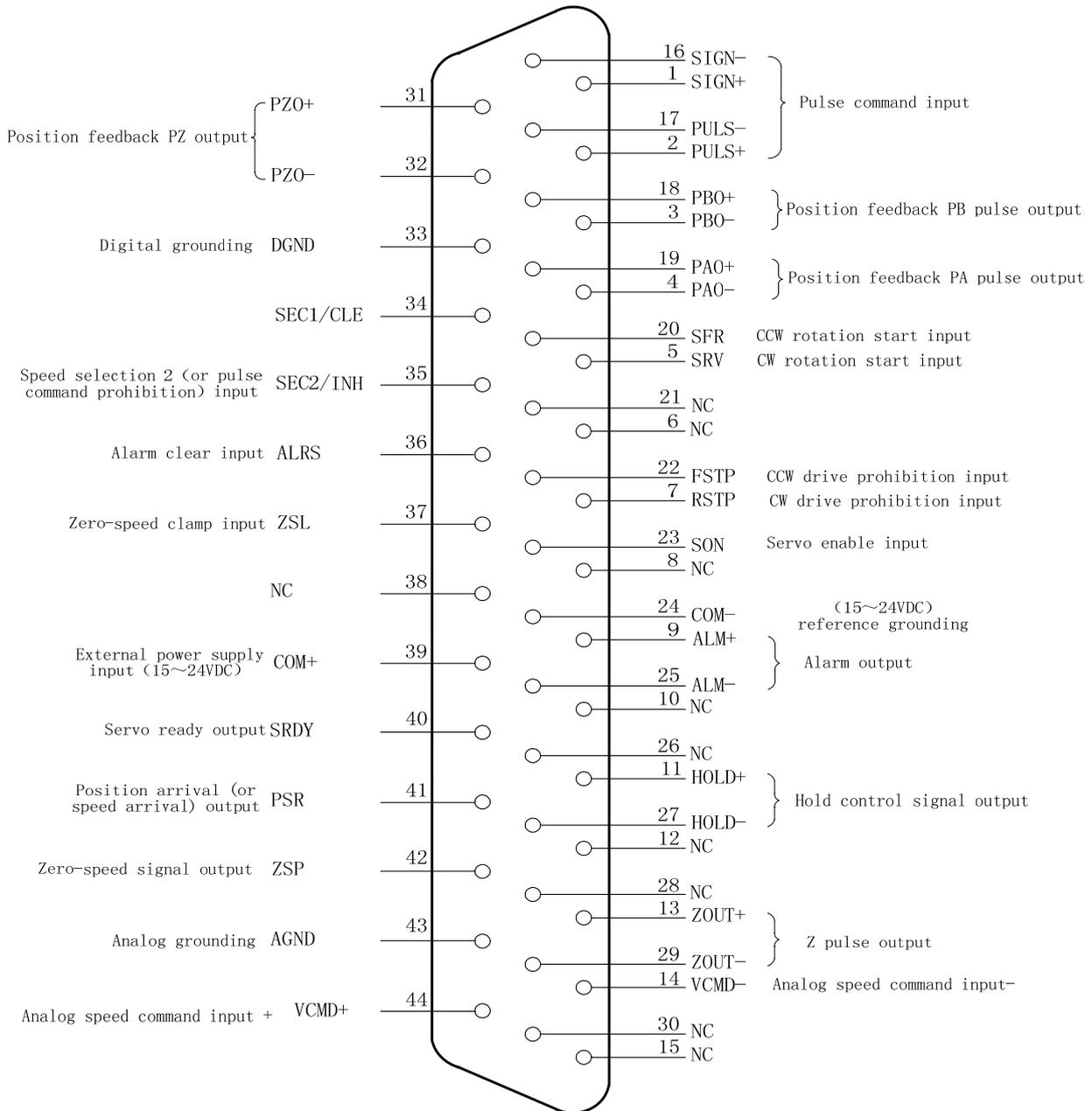
Fig.3-4   CN1 pin diagram

In the above figure, pins with the same name in the internal circuit board have executed the short circuit.

- ## CN1 signal layout of GS series MDR products

The control signal interface CN1 of GS series MDR products is 50-core socket (type: MDR10150-3000-PE, provided by 3M). Its pin definition is shown in the following table:

```
26  28  30  32  34  36  38  40  42  44  46  48  50
  27  29  31  33  35  37  39  41  43  45  47  49
  1  3  5  7  9  11  13  15  17  19  21  23  25
    2  4  6  8  10  12  14  16  18  20  22  24
```

Pin	Signal	Description
1	PBO–	Position feedback PB output -
2	PBO+	Position feedback PB output +
3	PAO–	Position feedback PA output -
4	PAO+	Position feedback PA output +
5	PULS–	Pulse input of pulse command -
6	PULS+	Pulse input of pulse command +
7	SEC2/INH	Speed selection 2 (or pulse prohibition) input
8	SEC1/CLE	Speed selection 1 (or position offset clear) input
9	NC	
10	SRV	CW rotation start input
11	SFR	CCW rotation start input
12	ALRS	Alarm clear input
13	SON	Servo enable input
14	COM–	(15~24VDC) reference earthing
15	PSR+	Position arrival (or speed arrival) output+
16	SRDY–	Servo ready output -
17	SRDY+	Servo ready output +
18	NC	
19	NC	
20	ZSP–	Zero speed signal output -
21	ZSP+	Zero speed signal output +
22	ALM–	Servo alarm output -
23	ALM+	Servo alarm output+
24	VCMD+	Analog speed command +
25	VCMD–	Analog speed command-
26	PZO–	Position feedback PZ output -
27	PZO+	Position feedback PZ output +
28	DGND	Digital earthing
29	NC	
30	SIGN–	Pulse command direction input -
31	SIGN+	Pulse command direction input +
32	RSTP	CW drive prohibition input
33	FSTP	CCW drive prohibition input
34	ZSL	Zero speed clamp input
35	NC	
36	NC	
37	NC	
38	COM–	(15~24VDC) reference earthing
39	COM+	External power input (15~24VDC)
40	PSR–	Position arrival (or speed arrival) output -
41	COM+	External power input (15~24VDC)
42	HOLD–	Hold control signal output -
43	HOLD+	Hold control signal output +
44	NC	
45	NC	
46	ZOUT–	Z signal output-
47	ZOUT+	Z signal output +
48	AGND	Analog earthing
49	NC	
50	NC	

Fig.3-5   CN1pin diagram

3.3.2   Speed command input

VCMD+/ VCMD- is a speed command input terminal, the maximum DC voltage signal is up to 10V, and the terminal input resistance is 15KΩ.

Note: VCMD+, VCMD- cannot be reversed, otherwise, the motor cannot run normally.

Drive unit

15V

VCMD+

VCMD−

R

R

R

0V

PE

The metal shell is connected to control plate by PE.

∅:metal shell of interface

Note: VCMD+, VCMD− cannot be reversed, otherwise the motor cannot run normally.

Drive unit

PC

−10V∼+10V or 0V∼10V

VC

0V

VCMD+

VCMD−

R

R

R

0V

∅:metal shell of interface PE
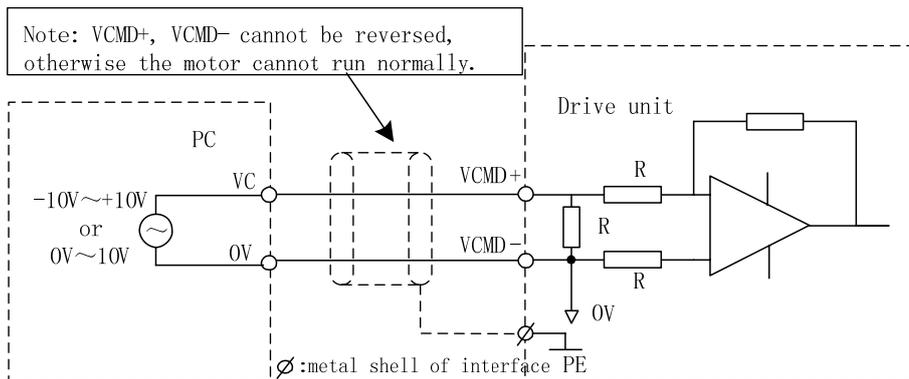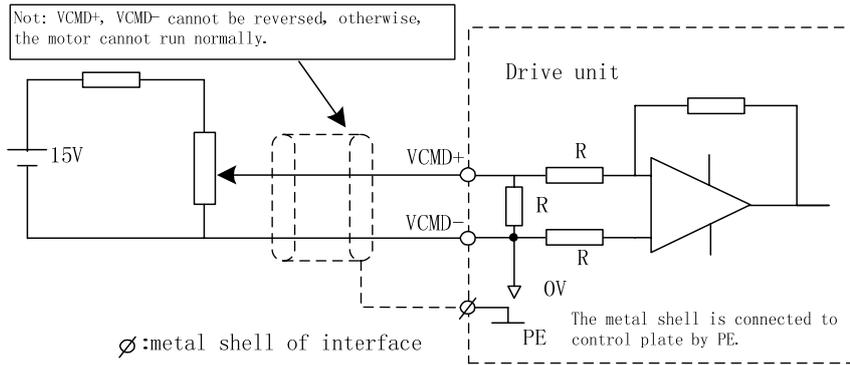
Note: It is recommended to use the twisted-pair signal cable and the shielded wiring method.

3.3.3　Position command input

The position command PULS+/PULS-，SIGN+/SIGN- use both the difference drive connection and the single-ended drive connection, which is shown in the following figure.

● Difference drive connection

Pulse command input

Drive unit

PC

PULS+

PULS−

SIGN+

SIGN−

270

4.7K

270

4.7K

PE

∅ :Metal shell of interface
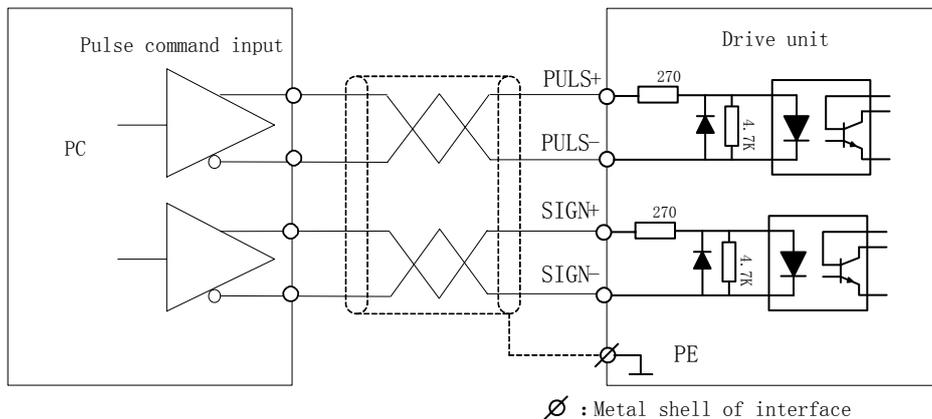
- Single-ended drive connection
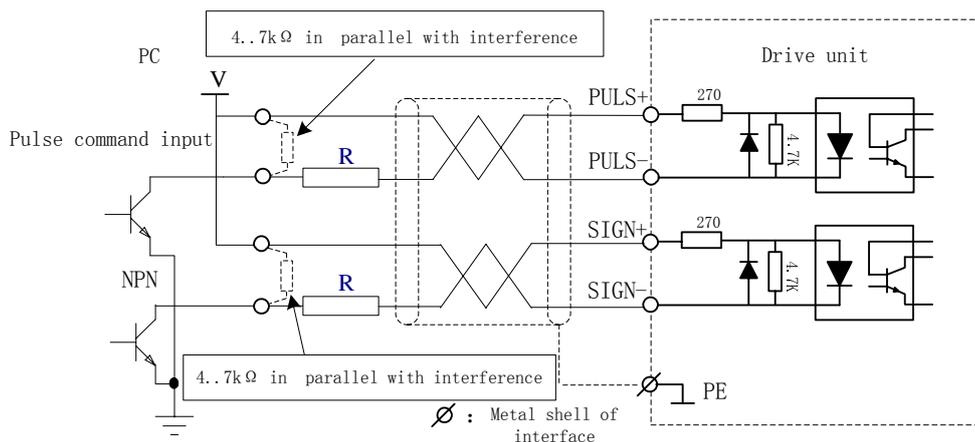
（a）　NPN single-ended drive connection
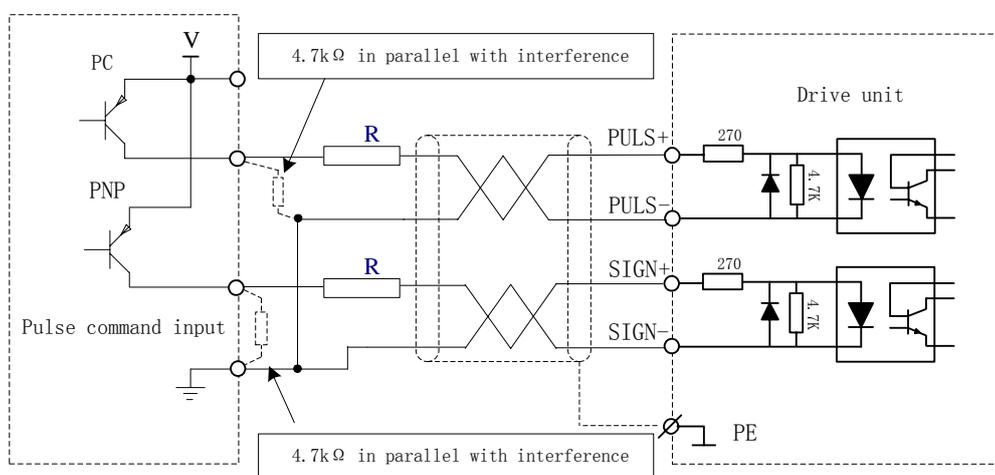
（b）　PNP single-ended drive connection

> 1. It is recommended that the difference drive should be adopted or improve the anti-interference ability; In the mode of the difference drive, it is recommended that AM26LS31, MC3487 or similar to RS422 drive chip should be used;
> 2. The operation frequency may decrease by using the single-ended drive mode, the circuit is input in terms of the pulse amount, and the drive current is 10 mA～15mA. The maximum voltage 25V in external power is restricted, and the resistance R is confirmed. The empirical data are: VCC=24V, R=1.3 kΩ～2kΩ; VCC=12V, R=510Ω～820Ω; VCC=5V, R=0Ω.

The position command input is divided into three modes set by PA5, which is shown in the following table and the arrow described in the table means the counting edge.

Standard mode： PA28=0			
Pulse command mode	CCW	CW	PA5 setting value
Pulse train direction	PULS+ SIGN+		PA5=0 Command pulse ＋direction
CCW pulse train CW pulse train	PULS+ SIGN+		PA5=1 CCW pulse ＋CW pulse
A-phase pulse train B-phase pulse train	PULS+ SIGN+		PA5=2 2-phase command pulse
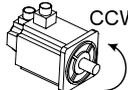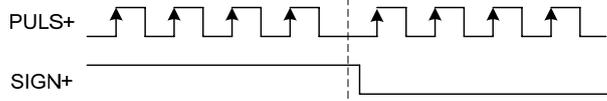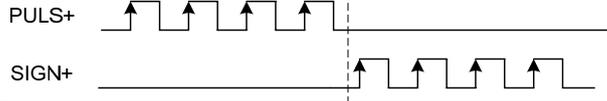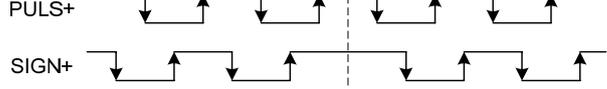
Reverse：PA28=1			
Pulse command mode	CW	CCW	PA5 setting value
Pulse train direction	PULS+ SIGN+		PA5=0 Command pulse＋direction
CCW pulse train CW pulse train	PULS+ SIGN+		PA5=1 CCW pulse＋CW pulse
A-phase pulse train B-phase pulse train	PULS+ SIGN+		PA5=2 2-phase command pulse
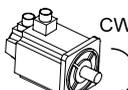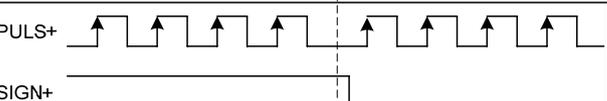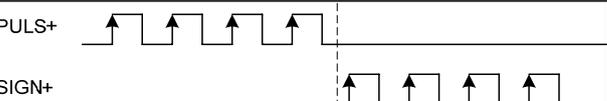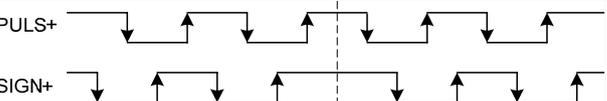
a. Time sequence diagram of pulse＋symbol input interface (max. pulse frequency: 1MHz）
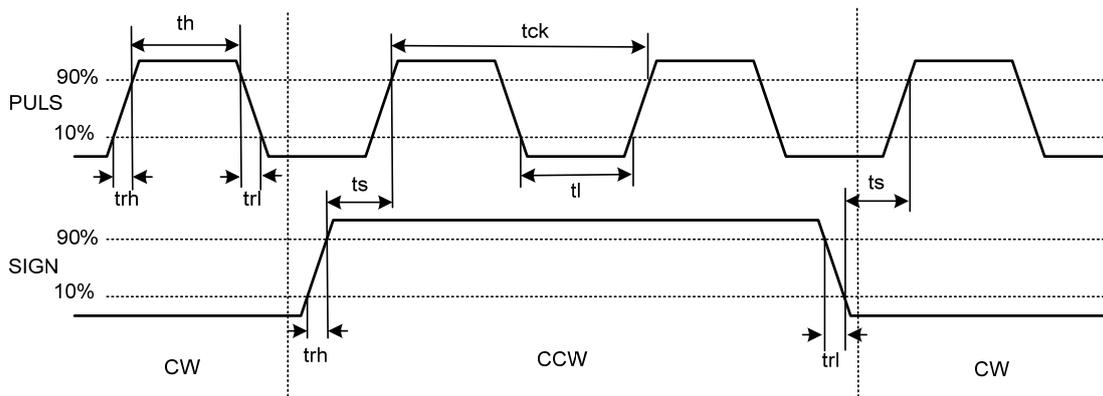
b. Time sequence diagram of CCW pulse/CW pulse input interface (max. pulse frequency: 1MHz）
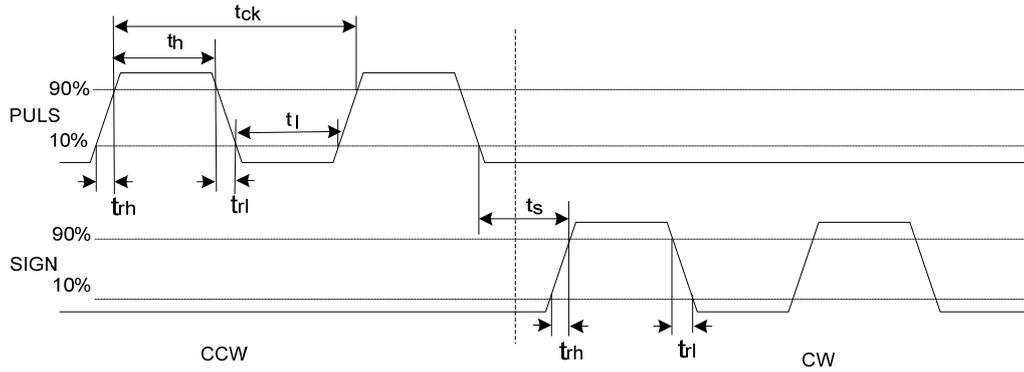
c. Time sequence diagram of 2-phase command pulse input interface (max. pulse frequency: 1MHz）
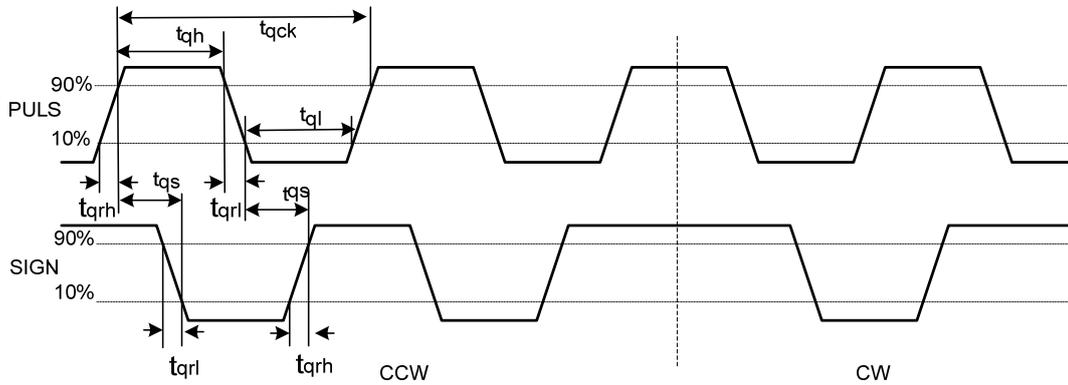
The following table shows the time sequence parameter of pulse input:

Parameter	t_{ck}	t_h	t_l	t_{rh}	t_{rl}	t_s	t_{qck}	t_{qh}	t_{ql}	t_{qrh}	t_{qrl}	t_{qs}
Difference drive input （μs）	>1	>0.3	>0.3	<0.2	<0.2	>2	>1	>0.3	>0.3	<0.2	<0.2	>0.2
Single-ended drive input （μs）	>5	>2.5	>2.5	<0.3	<0.3	>2.5	>10	>5	>5	<0.3	<0.3	>2.5

3.3.4　Switching value input

The following shows the two kinds of general connection and INx means an input point:
（SON, ALRS, FSTP, RSTP, SEC1/CLE, SEC2/INH, ZSL, SFR, SRV）.

External optical coupler example
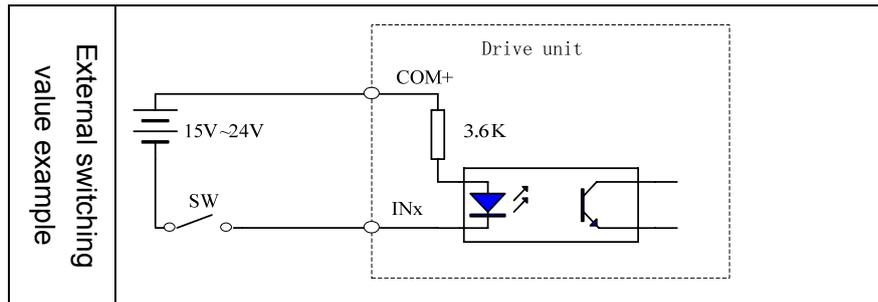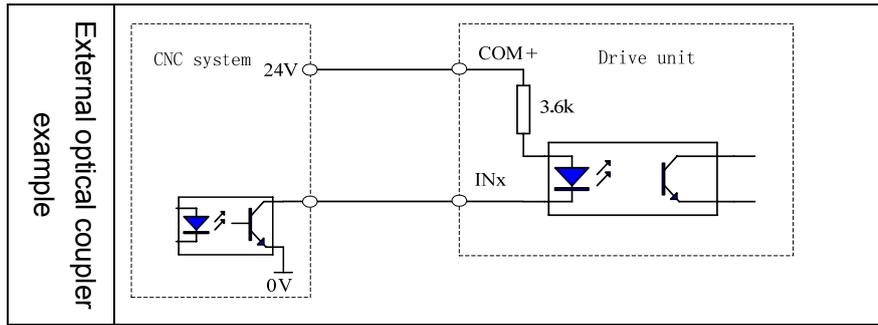
The servo unit is allocated with DC15V～24V externally, up to 1A, and it is suggested that it uses the same power supply with the output circuit.

When INX is connected with 0V, the input optical coupler is conducted, and the signal is ON, the input is then enabled. Check the monitoring window $\boxed{dP- \ ln}$ to judge, if the input point is ON, the corresponding nixie tube may light up; if the input point is cut off and the signal is OFF, the nixie tube is OFF. This monitoring window can be debugged, checked and repaired for the drive unit control signal.

RSTP   FSTP   SEC2   SEC1   SRV   SFR   ALRS   SON

ZSL
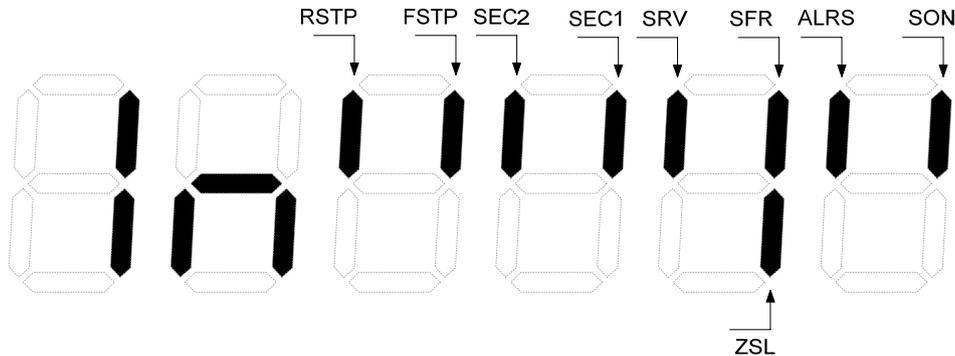
Input signal explanation:

➢ COM＋,COM－ are input ports of DC 15V～24V externally.

| Note | The power polar can not be connected reversely, otherwise, the drive unit can not work normally. |

➢ SON: When SON is ON, the servo enabling is started to check the monitor window $\boxed{dP- \ rn}$, and the $\boxed{dP- \ on}$ is displayed.

Relative parameter	Significance	Unit	Default	Applicable mode
PA118	The motor enabling is forced by the drive unit inner without the external SON input signal. PA118=0: the motor is enabled when the external input signal SON is ON. PA118=1: the motor is enabled by the servo drive unit inner without the external input signal SON.		0	P，S
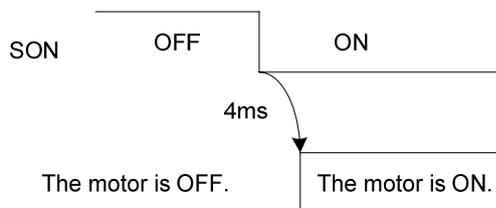
The drive unit is normal, and the motor is ON; the alarm code is displayed if the drive unit is out-of -order, refer to Chapter Eight: Abnormal and Troubleshooting.

➢ The alarm numbers from 1 to 9 generated on the drive unit can be reset when ARLS（CN1-8） is ON. The alarm number more than 9 can be only reset after the malfunction is eliminated till the power is turned on again. The reset function is disabled when SON is ON.
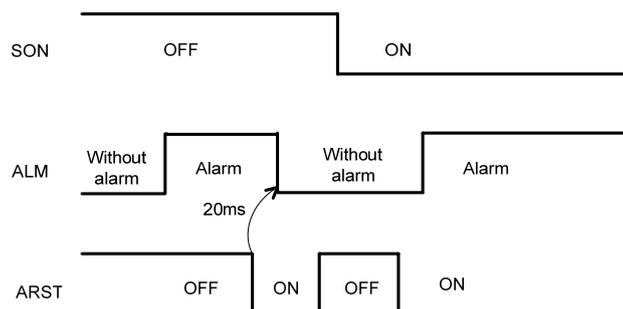
➢ FSTP,RSTP：the inhibit signal of drive is usually used with a travel switch to avoid the overtravel.

Input signal		Run	
FSTP	RSTP	CCW	CW
ON	ON	O	O
ON	OFF	O	Prohibition
OFF	ON	Prohibition	O
OFF	OFF	Prohibition	Prohibition

Note: O means the drive unit is normal. When the drive unit's inhibition function is not used, PA138 is set to 0 and the drive unit's inhibition function is shielded.

3.3.5 Switching value output

1. In the switching value output signal of GS series D-SUB products, ALM, SRDY, ZSP signal are single-ended transistor output, the output optical coupler emitting electrode has been connected with COM-, other output signals are double-ended transistor output.
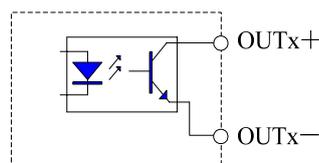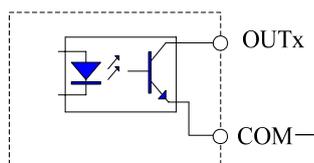
2. Some switching output signals of GS series D-SUB products and MDR products use double-ended transistor output, and the user must distinguish when connecting.

● Single-ended transistor output connection layout
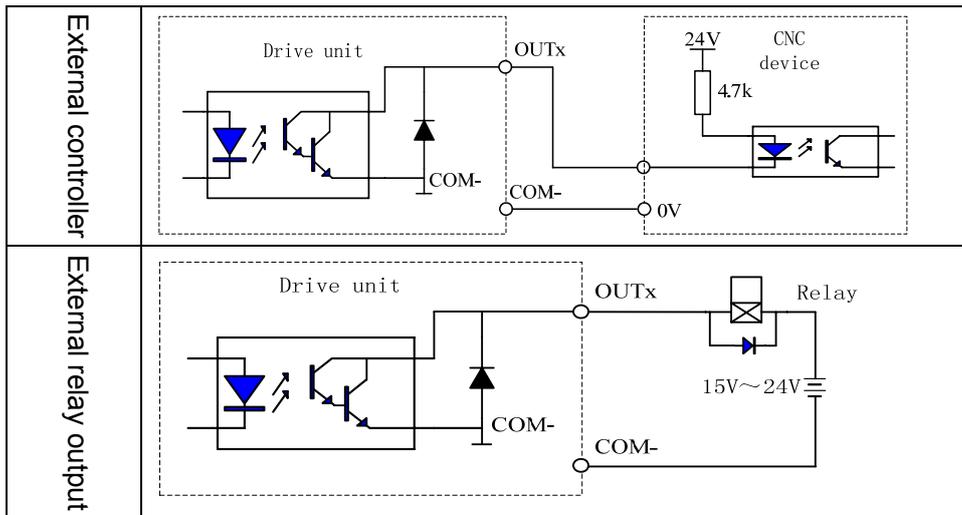
● Double-ended transistor output connection layout
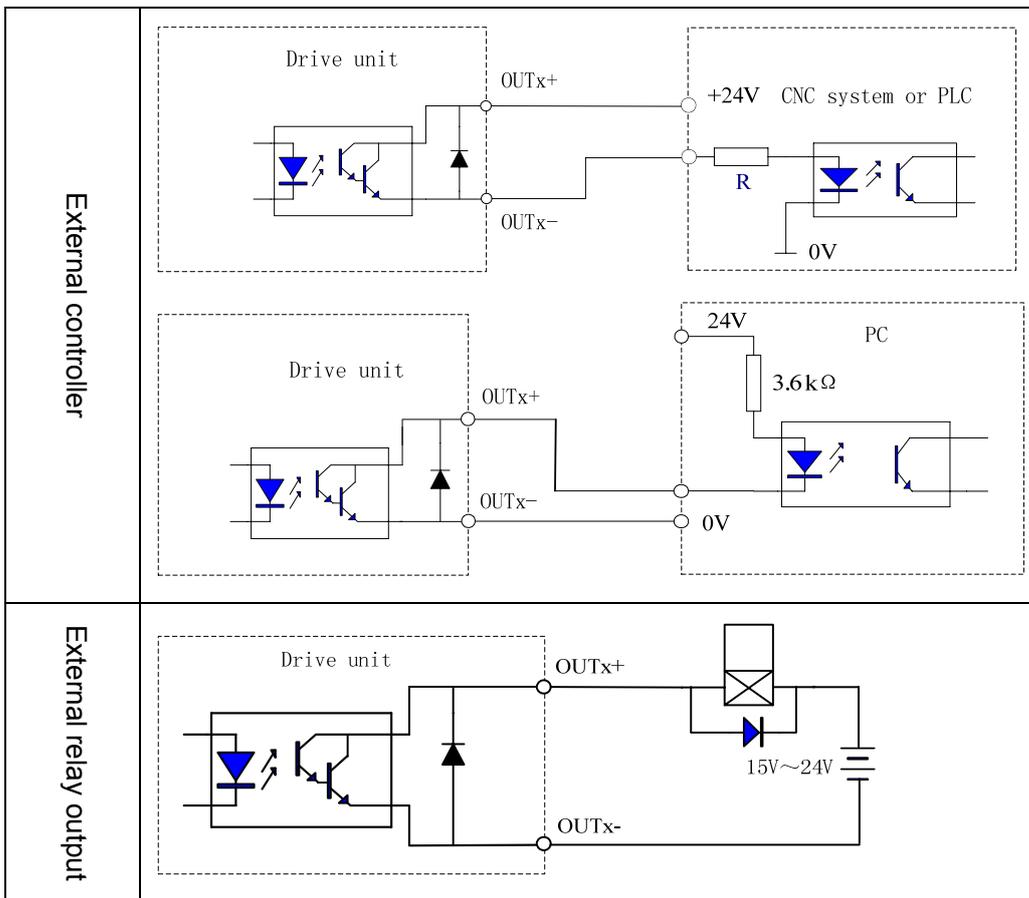
When OUTx+ is conducted with COM- or OUTx+ with OUTx-, and the output point are ON. The user can judge by the monitor window dP-OUt the corresponding LED lights when the output point is ON; the corresponding LED does not light when the output point is OFF.
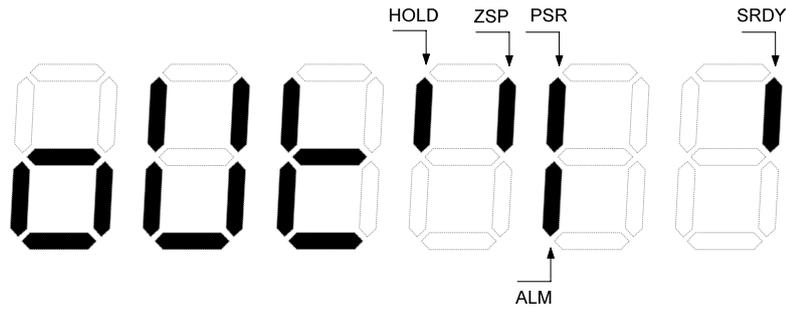
> ALM is an output signal when the servo unit is abnormal and the output state is related to PA122.

PA122=0	ALM signal outputs the optical coupler is not conducted when the servo drive unit alarms.
PA122=1	ALM signal outputs the optical coupler is conducted when the servo drive unit alarms.
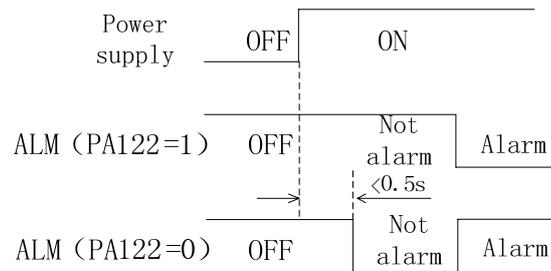
> SRDY is a ready signal of the servo drive unit. SRDY signal outputs the optical coupler conduction when the motor power-on is activated.
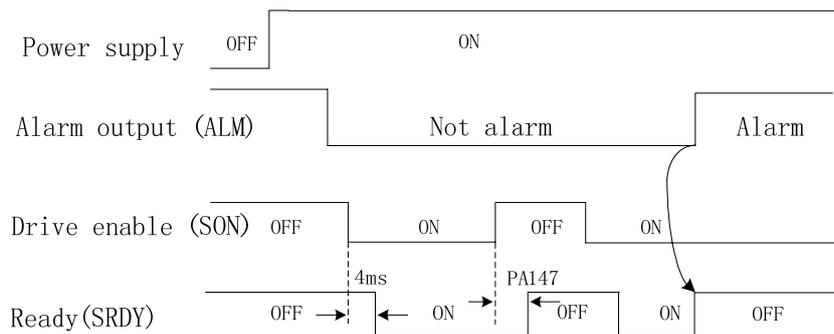
> ZSP is a signal of the zero-speed output：ZSP signal outputs the optical coupler conduction when the motor's speed is zero.
> ZOUT+/ZOUT- is a signal of encoder's zero point: Corresponding to an incremental encoder, the time sequence is the same with Z signal of motor feedback; corresponding to a single-coil absolute encoder, it is set by the servo parameter, and is a zero point signal sent by motor rotating per rotation in a fixed position, which is convenient that the CNC system executes the machine zero point return, and is the same with motor's Z-pulse signal of an incremental encoder.
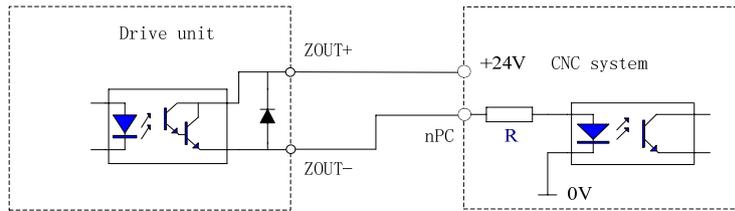
➢ HOLD is a release signal of motor's safe brake and its output is referred to Section 6.2.

> 1. The output is open-collector, the maximum load current is 100mA, and the external DC is up to 25V. The servo unit may damage if it exceeds the requirements or the output is connected with the power directly.
> 2. If the load is inductive, the inverse parallel and fly-wheel diode should be connected at the terminals of the load. The servo unit may get damaged if the fly-wheel diode is connected reversely.

3.3.6 Position feedback output

Position feedback signal processes the data from motor's encoder(PG) in the servo drive unit, outputs the set pulse quantity to the upper computer by CN1 to meet the computer's position closed-loop control functions.

GS series MDR servo drive unit is allocated with a motor with an absolute encoder, can set PA37, and set the position feedback output corresponding to pulse quantity when the motor rotates one rotation, and its setting range: 0～32767.

Output form	Output signal name	Function
Difference output	*PAO＋ *PAO－	Encoder position feedback signal phase A
Difference output	*PBO＋ *PBO－	Encoder position feedback signal phase B
Difference output	*PZO＋ *PZO－	Encoder position feedback signal phase Z
Connection layout is shown below:			
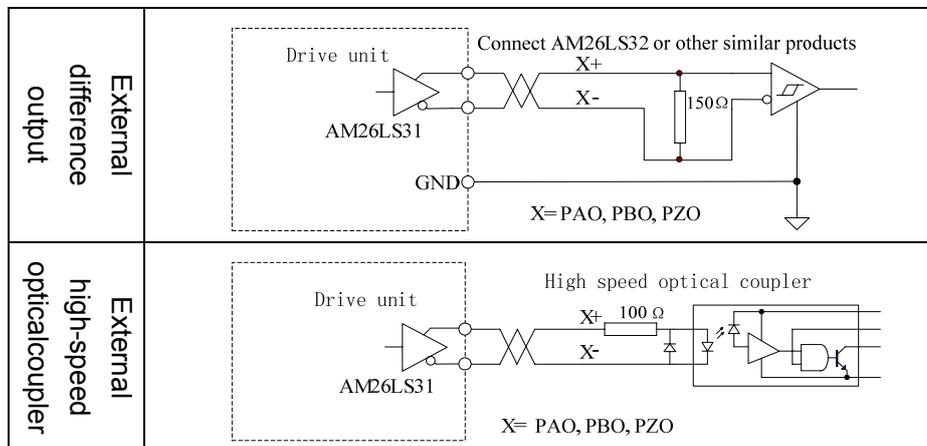
The output wave is dived into two types:

	Standard mode (PA34=0)	Reverse mode (PA34=1)

$$e=t\pm\frac{t}{2}$$

Related parameter	Description	Parameter range	Default	Applicable mode
PA34	Position output signal reverse	0～1	0	P，S
	PA34=0, Maintain the original relation of CN1 position feedback output signal; PA34=1, the phase-position relation of the position feedback output signals PA and PB is reverse, which is shown below:			
PA37	Output pulse quantity of position feedback	0～32767	10000	P,S
	When the motor's encoder signal is an absolute encoder one, the output pulse quantity of position feedback corresponded to every rotation of the motor is set. And the quantity is counted based on the command unit of the machine and the upper computer: Example： As the above figure, PA37 value means the edge signal of the phase A/B pulse is counted, the drive unit counts one time when it receives one edge signal. So, PA34=64 means that PAO (or PBO) pulse quantity by the servo drive unit feedback outputting when the motor rotating one rotation is 16. Example：PA37=10000，the actual position outputting the pulse quantity of phase PAO or PBO: Pulse quantity of phase PAO or PBO = $\frac{10000}{4}$ =2500（pulse/rev）			

3.4 Feedback Signal Connection

3.4.1 CN2 interface of GS series D-SUB servo drive unit

The motor's encoder feedback input interface CN2 of GS series D-SUB servo drive unit is 25-pin socket, and its connector is pin-25 male socket (type: G3151-25MBNS1X1 provided by WIESON). Its pin definition is shown below:
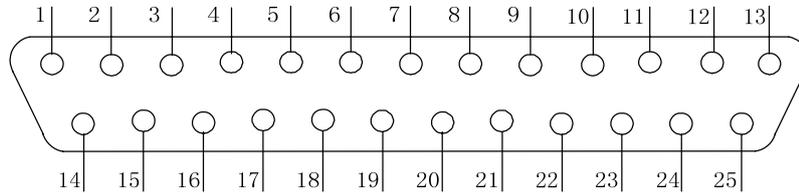
Fig.3-6   pin layout of CN2 DB25 female socket（bonding wire side）

Pin No.	Name	Meaning	Pin No.	Name	Meaning
1	0V	Encoder's power supply （－）	14	FG	Shielding grounding
2	0V		15	FG	
3	0V		16	0V	Encoder's power supply
4	0V		17	5V	Encoder's power supply （＋）
5	5V	Encoder's power supply （＋）	18	5V	
6	5V		19	W＋	Incremental encoder feedback W＋
7	W－	Incremental encoder feedback W－	20	V＋	Incremental encoder feedback V＋
8	V－	Incremental encoder feedback V－	21	U＋	Incremental encoder feedback U＋
9	U－	Incremental encoder feedback U－	22	Z＋	Incremental encoder feedback Z＋
10	Z－	Incremental encoder feedback Z－	23	B＋	Incremental encoder feedback B＋
11	B－	Incremental encoder feedback B－	24	A＋	Incremental encoder feedback A＋
12	A－	Incremental encoder feedback A－	25	NC	
13	OH	Temperature sensor input terminal of motor			

The interface is only applied to the incremental encoder feedback signal, and the signal wire uses the difference drive wiring scheme as follows:
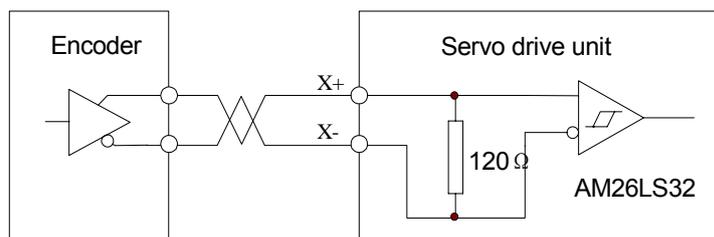
X=A, B, Z, U, V, W

OH (CN2-13) is used to connect the overheat checker in the servo motor to ensure the servo drive unit has the motor's overheat protection function, and its connection layout is shown in the following figure, OH must not be connected when the motor has no overheat checker.
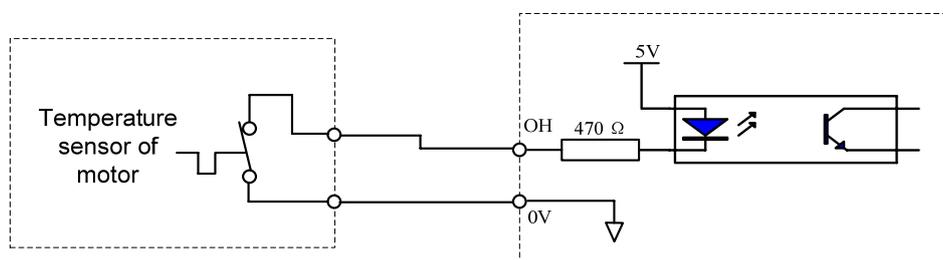
3.4.2 CN2 interface of GS series MDR servo drive unit

The motor's encoder feedback input interface CN2 of GS series D-SUB servo drive unit is 25-core socket, and its matched encoder's wiring is 26-core socket (type: MDR10126-3000-PE provided by 3M). Its pin definition is shown below:
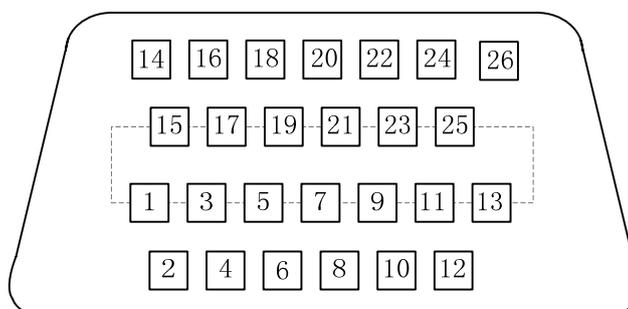
Fig. 3-7   pin layout of CN2 wiring socket（bonding wire side）

Pin No.	Name	Meaning	Pin No.	Name	Meaning
1	OH	Input terminal of motor's temperature sensor	14	BAT3V6	It is connected with the anode of 3.6V battery
2	W＋		15	0V	
3	W－		16	0V	Encoder's power supply（－）
4	V＋		17	0V	
5	V－		18	NC	
6	U＋	It is connected with the incremental encoder feedback signal	19	5V	Encoder's power supply（＋）
7	U－		20	5V	
8	Z＋		21	5V	
9	Z－		22	NC	
10	B＋		23	MA＋	Absolute encoder feedback signal
11	B－		24	MA－	
12	A＋		25	SL＋	
13	A－		26	SL－	

Pin 1～13 is compatible to the incremental encoder's interface (the interface layout method is referred to Section 3.4.1) and OH (CN2-1) is used to connect the overheat checker in the motor (the interface layout method is referred to Section 3.4.1).

Pin 23～26 are the absolute encoder feedback signals, the input circuit of the absolute encoder feedback signals uses the 4-channel difference which meets the standard ANSI EIA/TIA-422-B and RS-485, which wiring scheme is shown below:
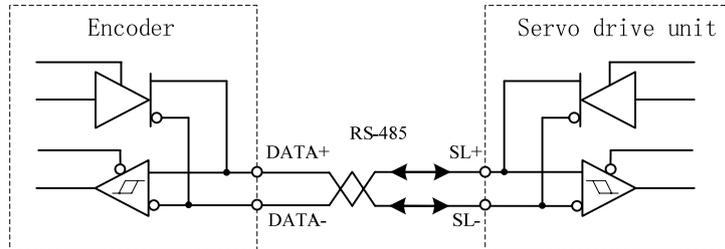
3.4.3 Connection of motor's encoder feedback input

The following figure is the standard connection of GS series D-SUB product connected with SJT series incremental encoder motor. Please refer the following standard connection when the user uses other manufacturer's motor or the customized encoder wire.

SJT series servo motor's encoder socket is 15-pin aviation socket, which is used to make the signal wire.
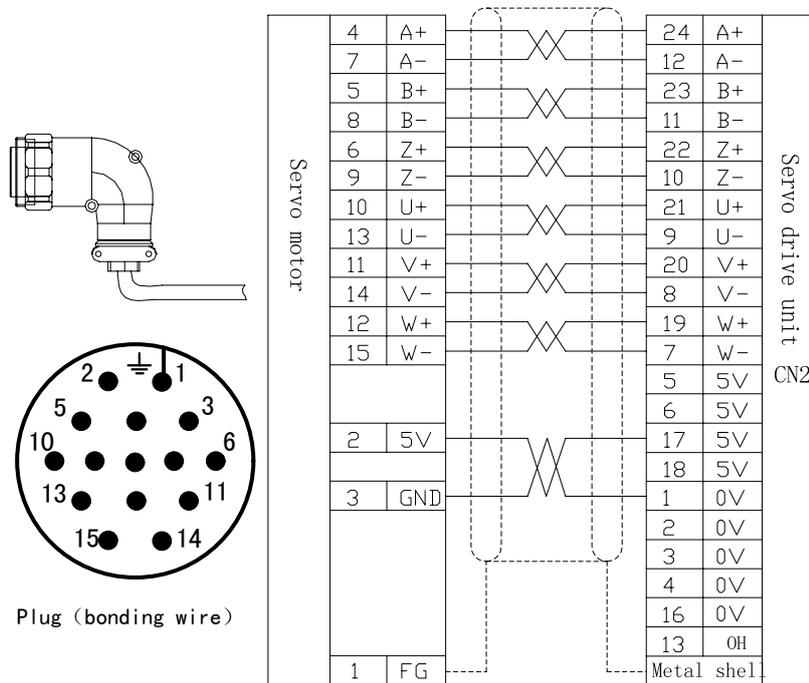
Fig.3-8 wiring scheme of D-SUB servo drive unit matched with an incremental motor encoder

The following figure is the standard connection of GS series MDR product connected with SJT series incremental encoder motor. Please use pin-15 aviation socket to make the signal wire.
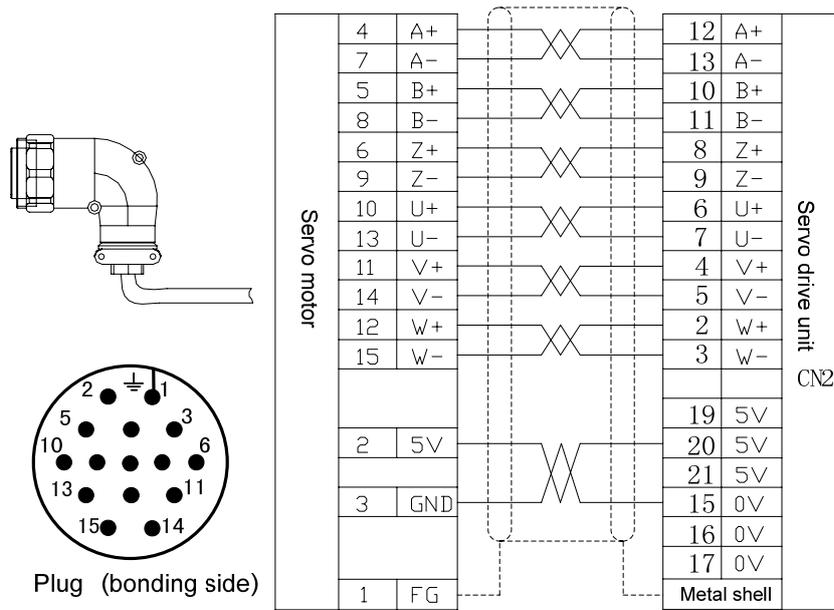
Fig.3-9 wiring scheme of MDR servo drive unit matched with an incremental motor encoder

The following figure is the standard connection of GS series MDR product connected with SJT series Danaher absolute encoder(A41) motor. Please use 15-pin aviation socket to make the signal wire.
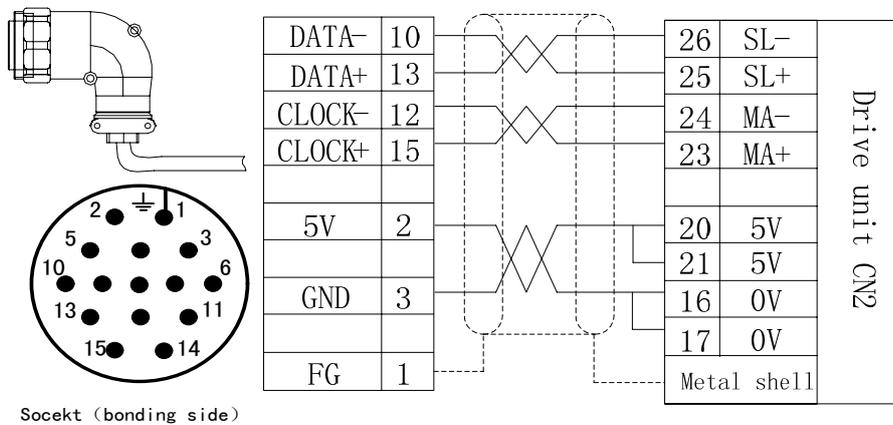
Fig.3-10 absolute encoder wiring

Note	1. Lengths of the motor's power supply wire and feedback signal wire must be within 20m, and their interval must be more than 30cm. The two wires cannot use the same pipe or cannot be tied up together.
	2. The signal wire must use twisted shield cable, and its section is $0.15mm^2 \sim 0.20mm^2$, and the shield lay must be connected with PE terminal.

3.4.4 Connection of the 2nd position feedback input

● Connection of GS series D-SUB servo drive unit CN3

The user can match the input interface CN3 of the 2nd position feedback signal according to the demand, the input interface is connected with the 2nd position encoder to form the 2nd position closed-loop with the servo drive unit.

CN3 interface of GS series D-SUB servo drive unit is 9-pin female socket, and its matched encoder's wiring is 9-pin male socket (type: G3151-09MBNS1X1 provided by WIESON).

Fig. 3-11　interface pin definition of CN3　DB9 male socket

Fig.3-12　Connection between Tamagawa TS5308N512 encoder as the 2nd position encoder and CN3

● Connection of GS series MDR servo drive unit CN3

The user can match the input interface CN3 of the 2nd position feedback signal according to the demand, the input interface is connected with the 2nd position encoder to form the 2nd position closed-loop with the servo drive unit.

CN3 interface of GS series MDR servo drive unit is 20-core female socket, and its matched encoder's wiring is 20-core socket (type: MDR10120-3000-PE provided by 3M), and its pin layout is shown below:
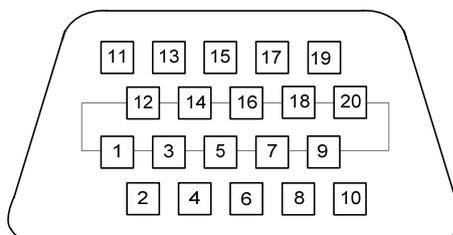
Fig. 3-13   pin layout of CN3 wiring socket（bonding wire side）

Pin No.	Name	Meaning	Pin No.	Name	Meaning
1	SCZ＋	The 2nd incremental encoder signal	11	BAT3V6	Power supply of absolute encoder's battery
2	SCZ－		12	0V	
3	SCB＋		13	NC	
4	SCB－		14	NC	
5	SCA＋		15	NC	
6	SCA－		16	NC	
7	SCSL－	The 2nd absolute encoder feedback signal	17	NC	
8	SCSL＋		18	NC	
9	SCMA－		19	0V	Encoder's power supply（－）
10	SCMA＋		20	5V	Encoder's power supply（＋）

The 2nd position encoder feedback signal interface of GS series servo drive unit can connect an incremental encoder or an absolute encoder.

3.5 GSK-CAN Communication Function

GS series MDR servo drive unit has GSK-CAN communication function. It is connected with GSK-CAN interface of GSK988T by CN4 or CN5 to realized real-time communication. The CNC system realizes the servo drive unit parameter function (saving, modifying and backuping parameters), real-time monitor the position, speed, current, temperature and I/O state information.

➢ Connection between the CNC system and the servo drive unit is shown below:
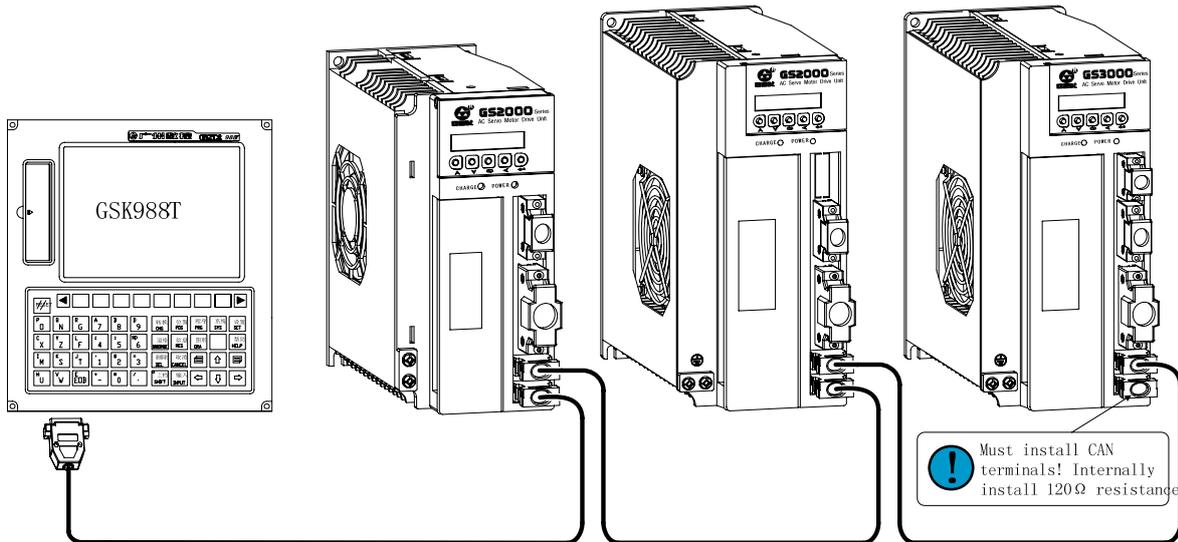
➢ GSK-CAN bus interfaces CN4,CN5 use IEEE1394，and its circuit diagram is shown below:
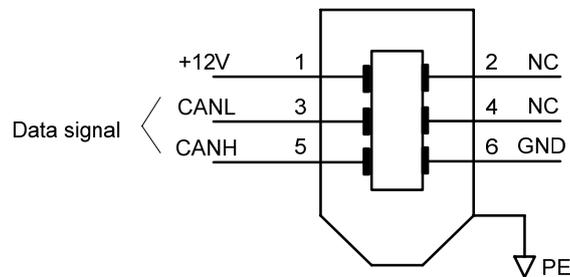
➢ Communication connection between GSK988T CNC system and the servo drive unit is shown below:
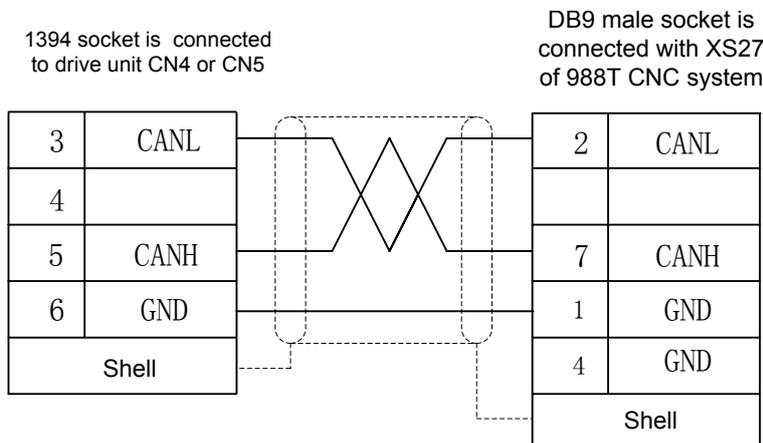
➢ Communication connection between two servo drive units is shown below:

A drive unit CN4 or CN5   B drive unit CN4 or CN5

3	CANL
4	
5	CANH
6	GND
Shell	

3	CANL
4	
5	CANH
6	GND
Shell	
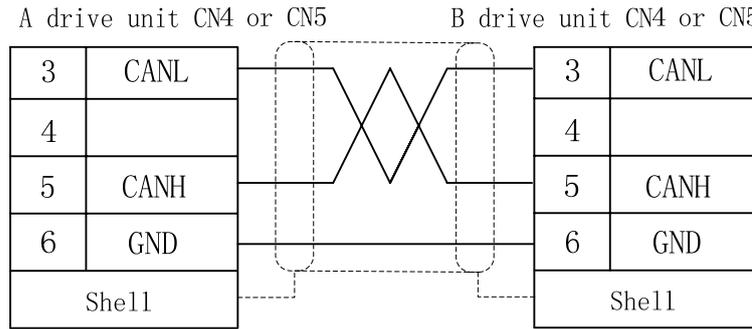
➢ GSK-CAN terminals:

At the terminal of GSK-CAN bus link, a GSK-CAN terminal must be installed and its internal must connect a 120Ω resistance between CANL and CANH terminal.

```
120Ω          1        2
        CANL  3        4
        CANH  5        6
```
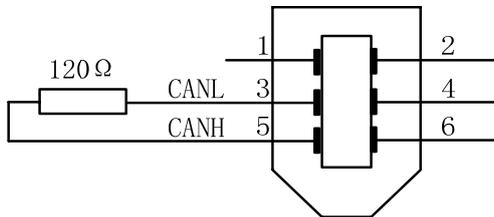
➢ Set the relevant parameters after correct connection:

Relevant parameter	Name	Unit	Parameter range	Default	Applicable mode
PA155	GSK-CAN communication baud rate selection		1～4	1	P，S
	PA155=1：baud rate is set to 500k； PA155=2：baud rate is set to 600k； PA155=3：baud rate is set to 800k； PA155=4：baud rate is set to 1M.				
PA156	Servo drive unit slave number		1～5	1	P，S
	There are many servo drive units to perform the serial communication with the CNC system, and a servo axis number corresponding to the CNC system is set to be convenient that the CNC controls some servo drive unit. The servo drive units connected to the same CNC system must not set the repetitive servo axis number. **Note:** The servo drive unit connected to the GSK-CAN communication bus must set slave numbers which must not be repetitive.				

3.6 Connection Sample in Working Modes

3.6.1 Connection in speed working mode

● Connection of D-SUB servo drive unit in speed working mode
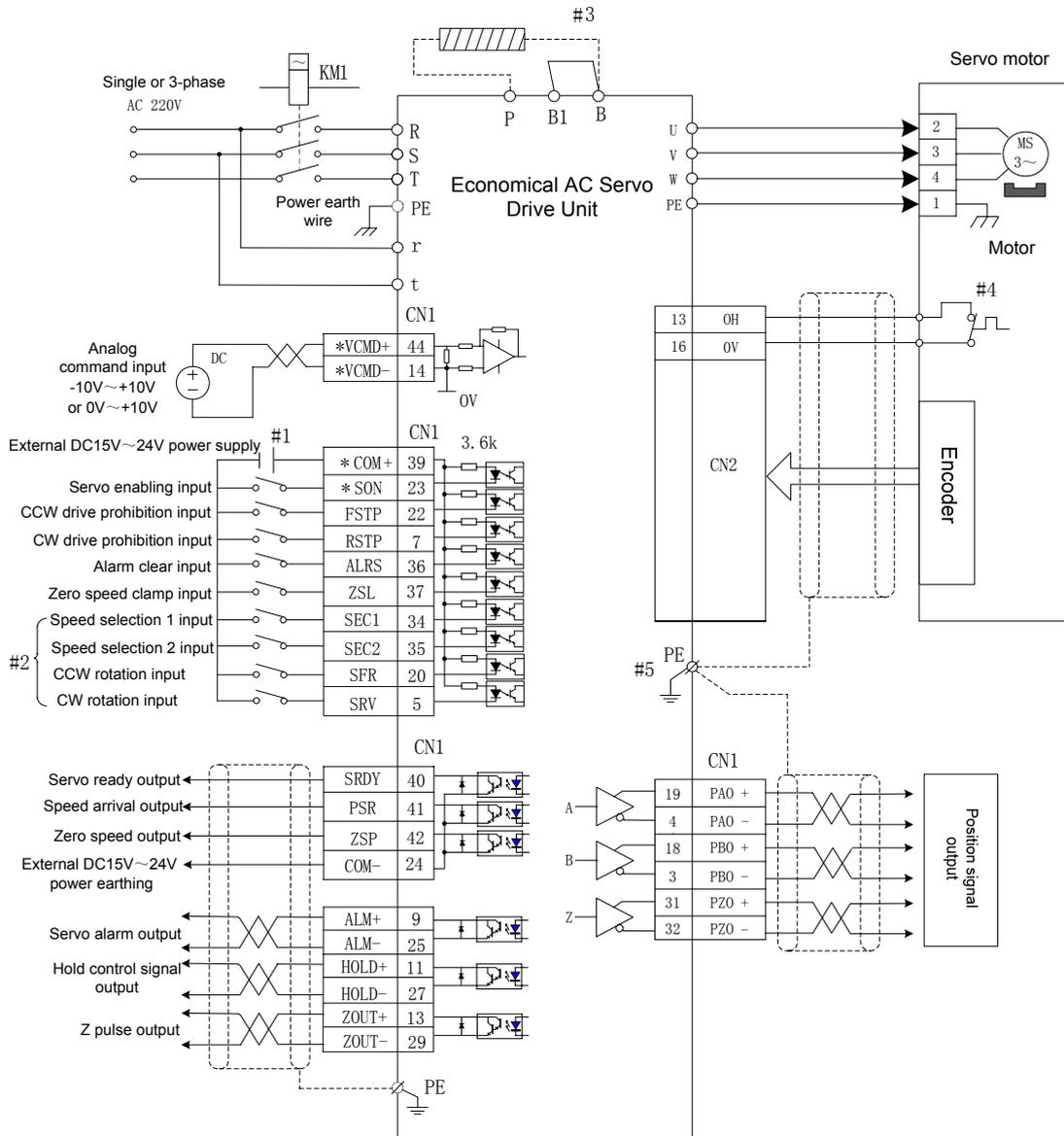
Fig. 3-14 Connection diagram of GS series D-SUB servo drive unit signal wire

The signals with * in the above figure is necessary connection ones.

#1：Exterbak specified DC 15V～24V switch power should be not less than 35W.

#2：PA6=2: SEC1, SEC2 are valid, and are the internal speed selection signals; PA6=1: SFR,SRV are valid and are CCW,CW start signals.

#3：B1 and B terminals must perform the short circuit when the drive unit is not matched with the resistance externally; B1 and B must disconnect when the drive unit is matched with the resistance externally.

#4：OH is not connected when there is no temperature sensor in the servo drive unit.

#5: The metal shell of each interface must be connected with PE, which is taken as the bonding point of the shielding wire.

● Connection of the MDR servo drive unit in speed working mode
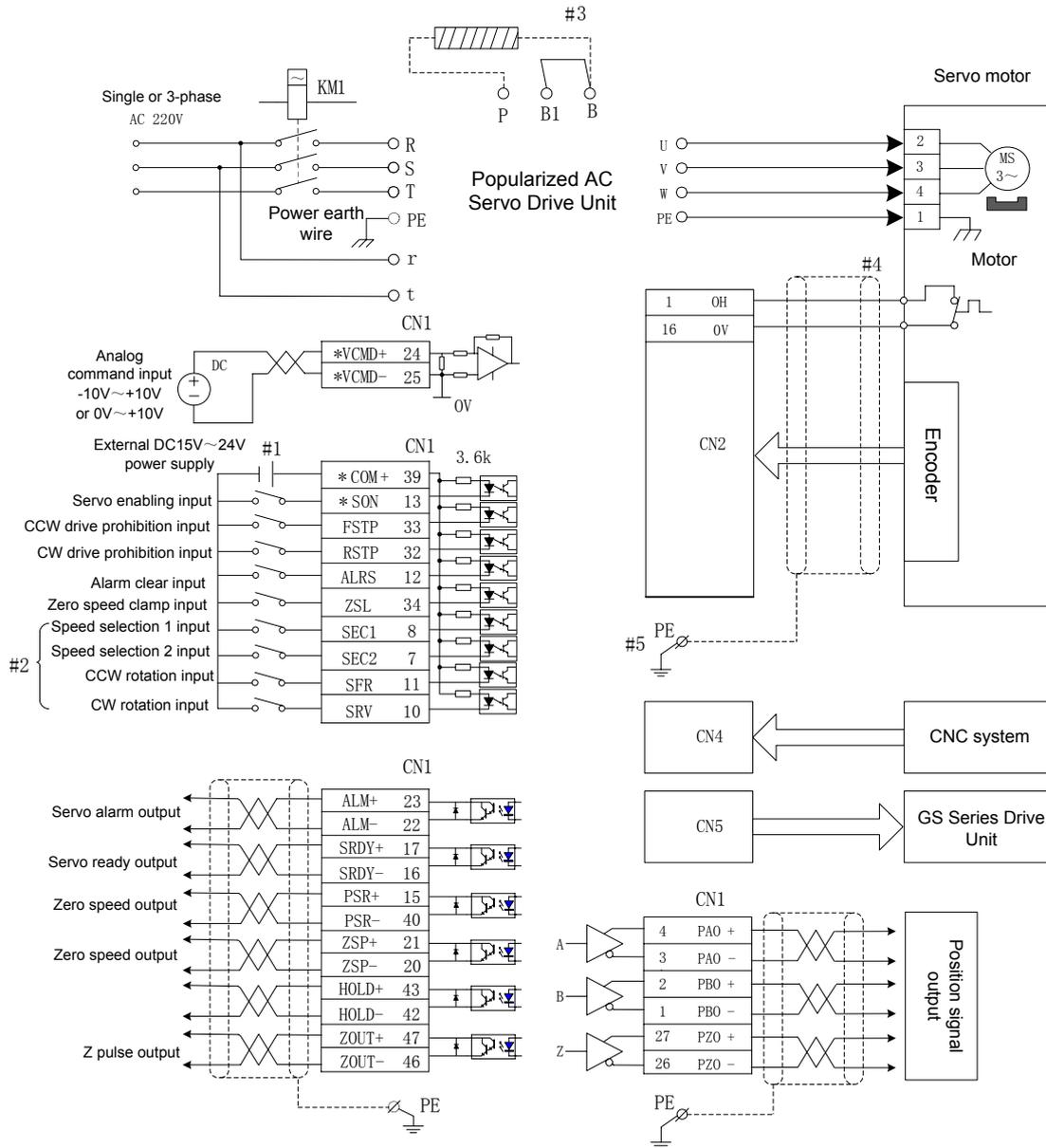
Fig. 3-15　Connection diagram of GS series MDR servo drive unit signal wire

The signals with * in the above figure is necessary connection ones.

#1：Exterbak specified DC 15V～24V switch power should be not less than 35W.

#2：PA6=2: SEC1, SEC2 are valid, and are the internal speed selection signals; PA6=1: SFR,SRV are valid and are CCW,CW start signals.

#3：B1 and B terminals must perform the short circuit when the drive unit is not matched with the resistance externally; B1 and B must disconnect when the drive unit is matched with the resistance externally.

#4：OH is not connected when there is no temperature sensor in the servo drive unit.

#5: The metal shell of each interface must be connected with PE, which is taken as the bonding point of the shielding wire.

3.6.2 Connection in position working mode

- Connection of D-SUB servo drive unit in position working mode
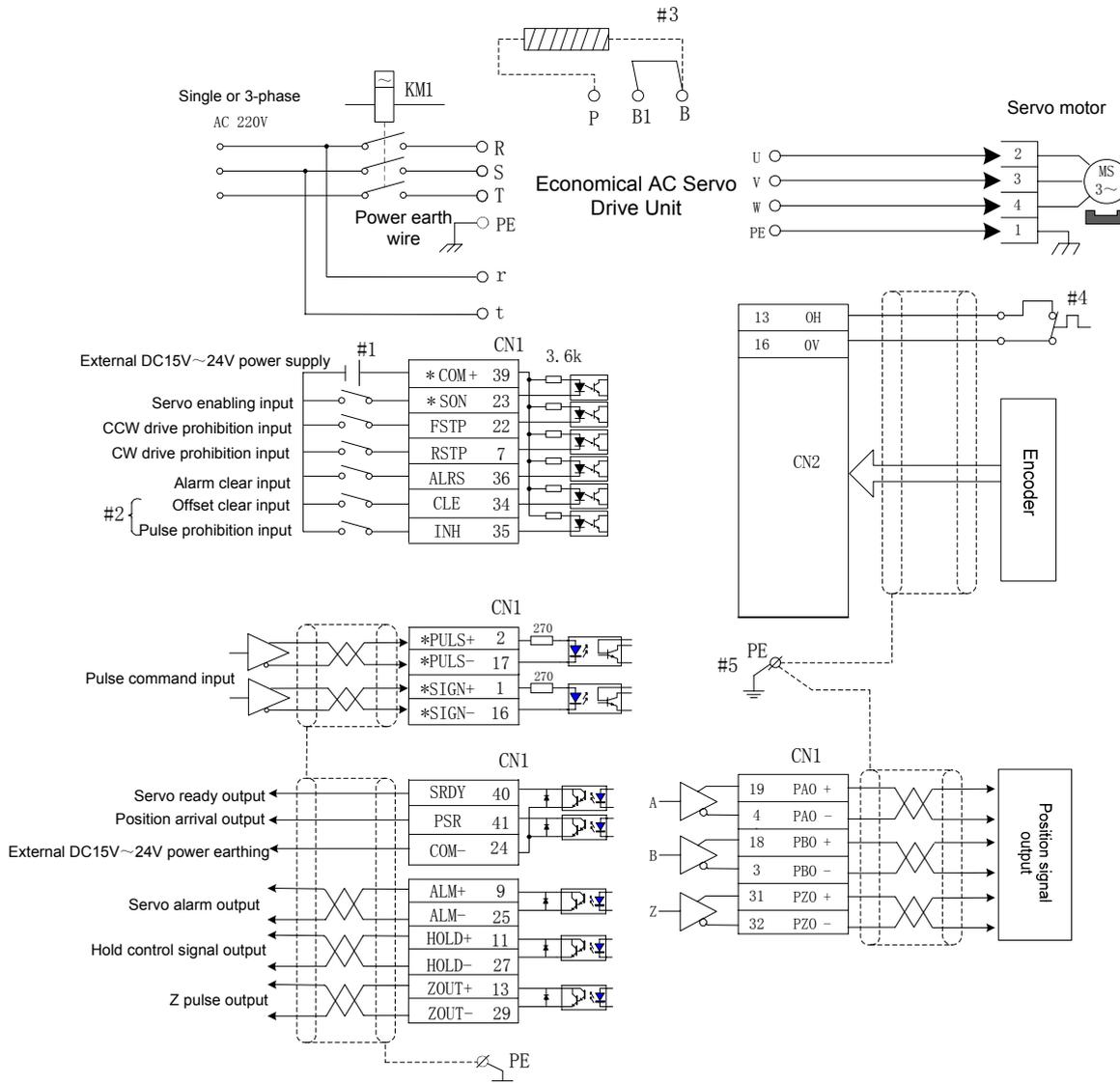
Fig.3-16 Connection diagram in position mode

The signals with * in the above figure is necessary connection ones.

#1：Exterbak specified DC 15V～24V switch power should be not less than 35W.

#2: CLE, INH are multiplexed by SEC1 and SEC2 in position working mode;PA6=2: SEC1, SEC2 are valid, and are the internal speed selection signals; PA6=1: SFR,SRV are valid and are CCW,CW start signals.

#3：B1 and B terminals must perform the short circuit when the drive unit is not matched with the resistance externally; B1 and B must disconnect when the drive unit is matched with the resistance externally.

#4：OH is not connected when there is no temperature sensor in the servo drive unit.

#5: The metal shell of each interface must be connected with PE, which is taken as the bonding point of the shielding wire.

● Connection of MDR servo drive unit in position working mode
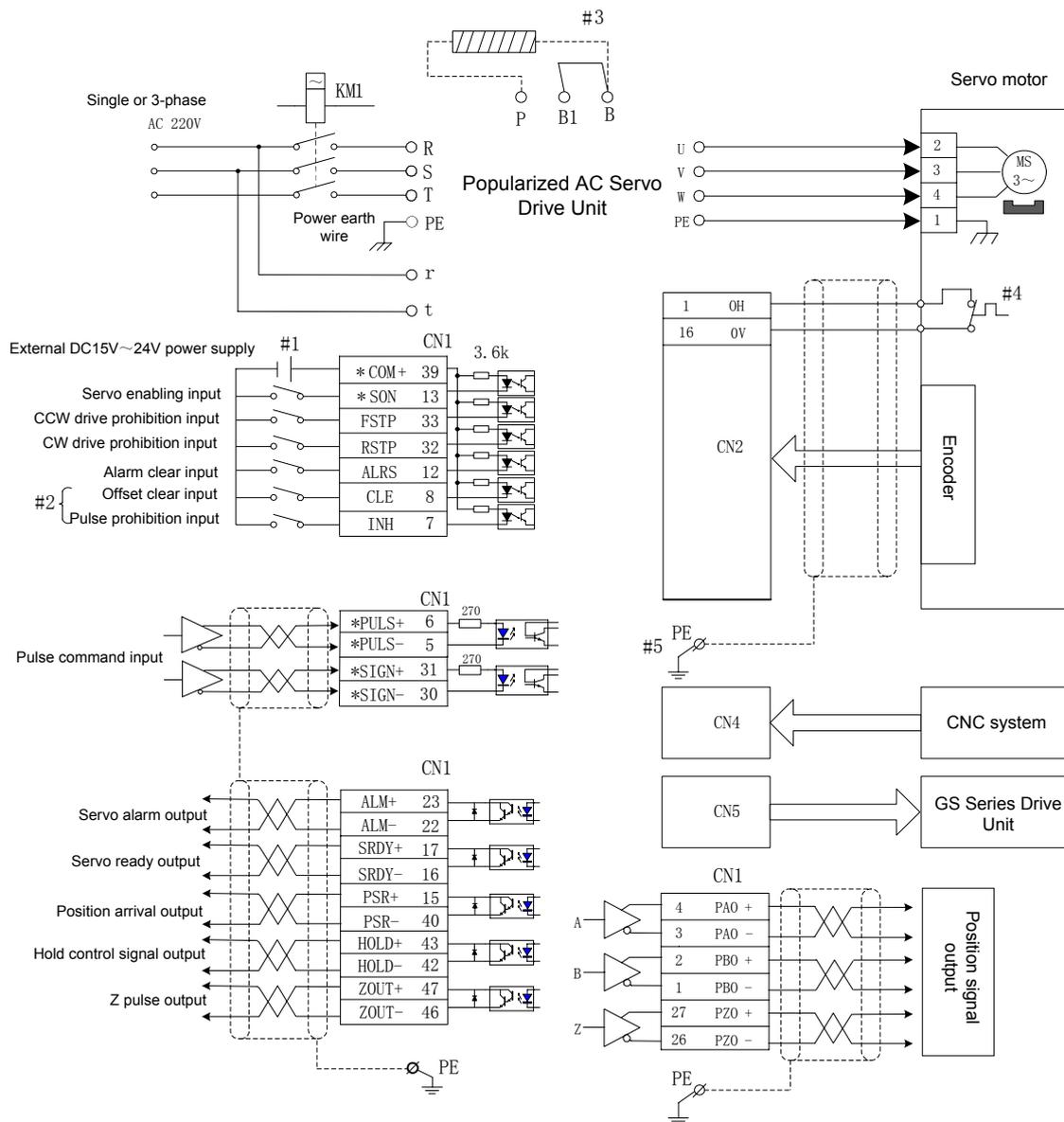
Fig.3-17　connection diagram in position working mode

The signals with * in the above figure is necessary connection ones.

#1：Exterbak specified DC 15V～24V switch power should be not less than 35W.

#2: CLE, INH are multiplexed by SEC1 and SEC2 in position working mode.PA6=2: SEC1, SEC2 are valid, and are the internal speed selection signals; PA6=1: SFR, SRV are valid and are CCW,CW start signals.

#3：B1 and B terminals must perform the short circuit when the drive unit is not matched with the resistance externally; B1 and B must disconnect when the drive unit is matched with the resistance externally.

#4：OH is not connected when there is no temperature sensor in the servo drive unit.

#5: The metal shell of each interface must be connected with PE, which is taken as the bonding point of the shielding wire.

CHAPTER FOUR   DISPLAY AND OPERATION

4.1   Operation Panel

➢   Refer to Section 1.2.2 about the functions of each component described on the servo drive unit's panel.

➢   The details of key-press functions are shown below:

Key-press	Name	Specification
(Ⓐ)	The key of 'Adding'	1. Add the parameter serial number, parameter value; 2. Upturning the 2nd level menu; 3. The motor operation is accelerated when the manual operation is performed; 4. Motor rotates CCW when JOG is performed.
(Ⓥ)	The key of 'Reduction'	1. Reduce the parameter serial number, parameter value; 2. The 2nd level menu downturn; 3. Motor operation decelerated when the manual operation is performed; 4. Motor rotates CW when JOG is performed.
(↩)	The key of 'Shift'	1. The Modified Bit of parameter serial number is selected; 2. The Modified Bit of parameter value is selected;
(◄)	The key of 'Return'	Return to the previous menu or cancel the operation
(↵)	The key of 'Enter'	Enter the next menu or confirm the data setting.

This introduces (↩) shift function in the parameter setting, taking example of PA126 value to modify -2045 into 2045:
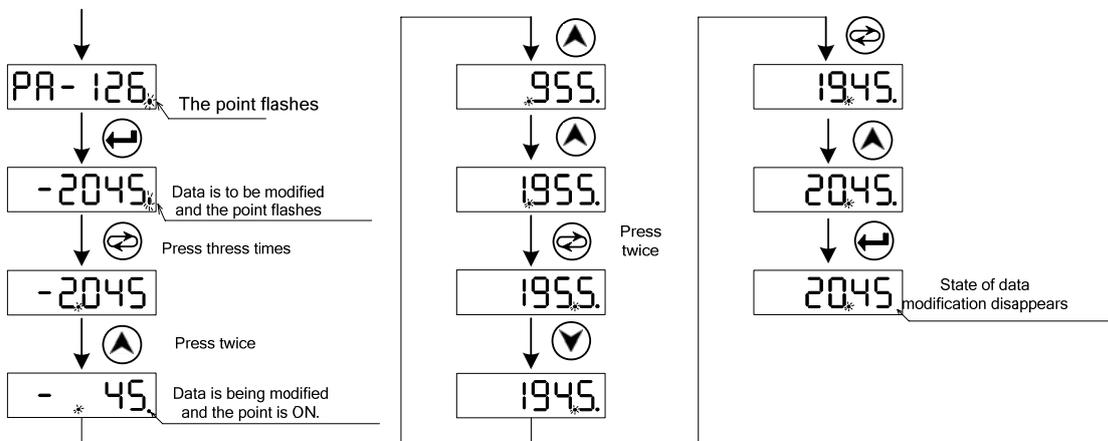
1. In the above example, using the shift key directly adds LED2's bit, -45 does not change to 1045 but -45+1000=955, which is the operation result of the servo drive unit.
2. The decimal point's indicator at the lower right corner of 6-bit LED has been ON when a parameter is modified, the indicator flashes after ⏎ is pressed, which means the value is valid. ◁ is pressed to return when the indicator does not flash, and the parameter setting is invalid.

4.2 Menu Display

GS drive unit monitor window is 6-bit LED digital tube, and its display content is controlled in terms of the menu's form.
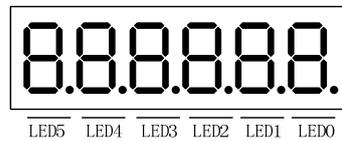
LED 5, LED4 flashing mean the drive unit is in the state of alarm.

The 1st menu is consisted of the state monitoring, parameter set, parameter administration, manual and JOG operation. Selection and operation of the 1st level is shown in Fig. 4.1:
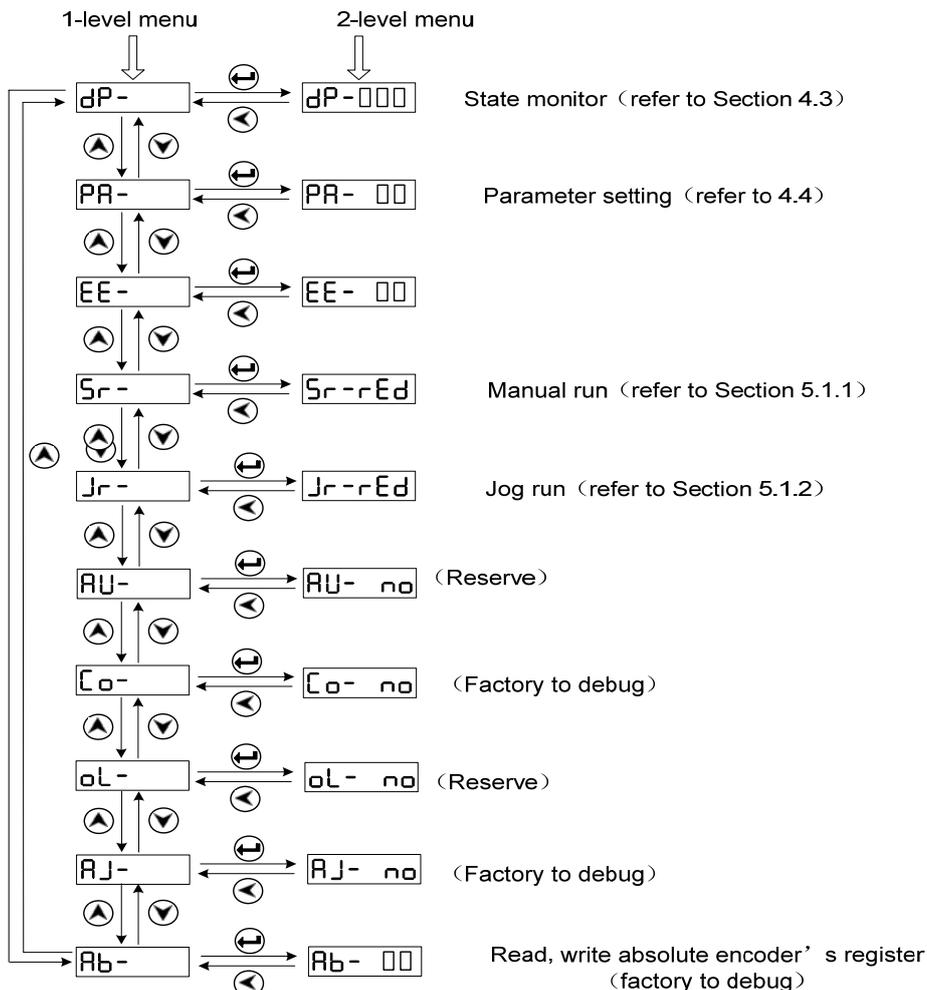
Fig.4.1   operation of display menu

4.3 **State Monitoring**

$\boxed{dP-}$ is a state monitoring, the user can select different monitoring states, set the value of parameter PA03, and can set the monitoring state when the drive unit is turned on.

Parameter value	Initialization when power on	Operation	Example	Description
PA3=0	$\boxed{dP-SPd}$		$\boxed{r\ \ 100.0}$	Current motor speed 100r/min
PA3=1	$\boxed{dP-PoS}$		$\boxed{P45806}$	Current motor position is the lower order 5 bits（pulse）【2】
PA3=2	$\boxed{dP-PoS.}$		$\boxed{P.\ \ \ \ 18}$	Current motor position is the high order 5 bits（×10000 pulse）
PA3=3	$\boxed{dP-CPo}$		$\boxed{C45810}$	Position command is the lower order 5 bits（pulse）【2】
PA3=4	$\boxed{dP-CPo.}$		$\boxed{C.\ \ \ \ 18}$	Position command is the high order 5 bits（×10000 pulse）
PA3=5	$\boxed{dP-EPo}$	$\leftrightarrow$	$\boxed{E\ \ \ 213}$	Position offset is lower order 5 bits（pulse）【2】
PA3=6	$\boxed{dP-EPo.}$		$\boxed{E.\ \ \ \ \ 0}$	Position offset is high order 5 bits（×10000 pulse）
PA3=7	$\boxed{dP-I}$		$\boxed{I\ \ \ \ 2.3}$	The motor's current is 2.3A
PA3=8	$\boxed{dP-ouC}$		$\boxed{n\ \ 1000}$	Speed corresponded to analog command is 1000r/min
PA3=9	$\boxed{dP-\ CS}$		$\boxed{r\ \ \ 210}$	Speed command is 210r/min
PA3=10	$\boxed{dP-Frq}$		$\boxed{F\ 283.8}$	Position command pulse frequency is 283.8KHZ
PA3=11	$\boxed{dP-\ Ct}$		$\boxed{t\ \ \ \ 20}$	Torque command is 20%
PA3=12	$\boxed{dP-trq}$		$\boxed{t\ \ \ \ 70}$	Motor torque is 70%
PA3=13	$\boxed{dP-tEP}$		$\boxed{C\ \ \ \ 32}$	Radiator temperature is 32C°
PA3=14	$\boxed{dP-rES}$			（Reservation）
PA3=15	$\boxed{dP-dC}$		$\boxed{dC\ 320}$	DC bus voltage is 320V
PA3=16	$\boxed{dP-Err}$		$\boxed{Err-\ 9}$	Display No.9 alarm
PA3=17	$\boxed{dP-rn}$		$\boxed{cn-\ on}$	Running 【4】
PA3=18	$\boxed{dP-Cod}$			（Reservation）
PA3=19	$\boxed{dP-In}$		$\boxed{In''''''II}$	Input terminal state 【3】

Parameter value	Initialization when power on	Operation	Example	Description
PA3=20	dP-oUt		oUt''''''	Output terminal state 【3】
PA3=21	dP-PLd			（Reservation）
PA3=22	dP-CPL		uEr 1.03	Hardware version number
PA3=23	dP-dSP		uEr 1.01	Software version number
PA3=24	dP-rES			（Reservation）
PA3=25	dP-rES			（reservation）
PA3=26	dP-APo		⊦ 3256	Lower order digit of encoder absolute position is 3256
PA3=27	dP-APo.		⊦ 6.	High order digit of encoder absolute is 6
PA3=28	dP-rES			（Reservation）
PA3=29	dP-rES			（Reservation）
PA3=30	dP-rES			（Reservation）
PA3=31	dP-rES			（Reservation）
PA3=32	dP-AbS		b 15038	Motor's single-circle position of absolute encoder is lower order digit 【5】
PA3=33	dP-AbS.		b. 30	Motor's single-circle position of absolute encoder is high order digit 【5】
PA3=34	dP-HbS		H 38	Current position of absolute encoder is lower order digit 【5】
PA3=35	dP-HbS.		H. 12	Current position of absolute encoder is high order digit 【5】

【1】 r 1000.0 : r is the motor's speed code, 1000 means that the motor's ccw speed is 1000r/min, the display is a negative speed - 1000.0 when the motor rotates CW. Its unit is r/min.

【2】The position measurement of the encoder feedback is composed of POS. (high order 5 bits+ POS (lower order 5 bits).

Example: P. 18 × 100000 ＋ P45806 ＝1845806 pulses

In a similar way, the pulse value of position command is composed of CPO. (high order 5 bits)+ CPO (lower order 5 bits).

Example：C. 18 × 100000 ＋ C45810 ＝1845810 pulses

Relationship between CPO and POS is shown below:

$$\boxed{\text{P.} \square\square\square\square\square} \times 100000 + \boxed{\text{P} \square\square\square\square\square} = \frac{PA29}{PA30} \left(\boxed{\text{C.} \square\square\square\square\square} \times 100000 + \boxed{\text{C} \square\square\square\square\square} \right)$$

When the electronic gear ratio is 1:1, the calculation formula of position offset (EPO) is shown below:

$$\boxed{\text{C.} \quad 18} - \boxed{\text{P.} \quad 18} = \boxed{\text{E.} \quad 0}$$

$$\boxed{\text{C45810}} - \boxed{\text{P45806}} = \boxed{\text{E} \quad 4}$$

【3】 Refer to Section 3.3.4 about the input terminal state, Section 3.3.5 about the output terminal state.

【4】 Run state display:

$\text{rn}^- \text{ on}$:   Main circuit of the drive unit has charged and enabled.

rn-oFF :   Main circuit of the drive unit has not charged.

$\text{rn}^- \text{ CH}$:   Main circuit of the drive unit has charged but not enabled.

【5】 When the drive unit uses 17-bit absolute encoder, $\boxed{\text{dP-AbS.}} + \boxed{\text{dP-AbS}}$ displays the position of the motor's rotor every rotation, the displayed value's range is 0～131071; the circle counting is 12-bit （0～4095）, so, the absolute position is consisted of $\boxed{\text{dP-HbS.}} + \boxed{\text{dP-HbS}}$ when the motor rotates, and the displayed value's range is 0～536870911.

☞ When the drive unit uses the single-coil absolute encoder, $\boxed{\text{dP-AbS.}} + \boxed{\text{dP-AbS}}$ value is consistent with that of $\boxed{\text{dP-HbS.}} + \boxed{\text{dP-HbS}}$.

4.4 Parameter Setting

● **Set operation method of state monitor**

Example: there is two kinds of method to call the lower order monitor state of the current position below:

Method 1: directly select the state monitor:

$\boxed{\text{r} \quad 0.0} \xrightarrow{\text{◄}} \boxed{\text{dP-SPd}} \xrightarrow{\text{▲}} \boxed{\text{dP-PoS}} \xrightarrow{\text{↵}} \boxed{\square\square\square\square}$

Method 2: select the state monitor:
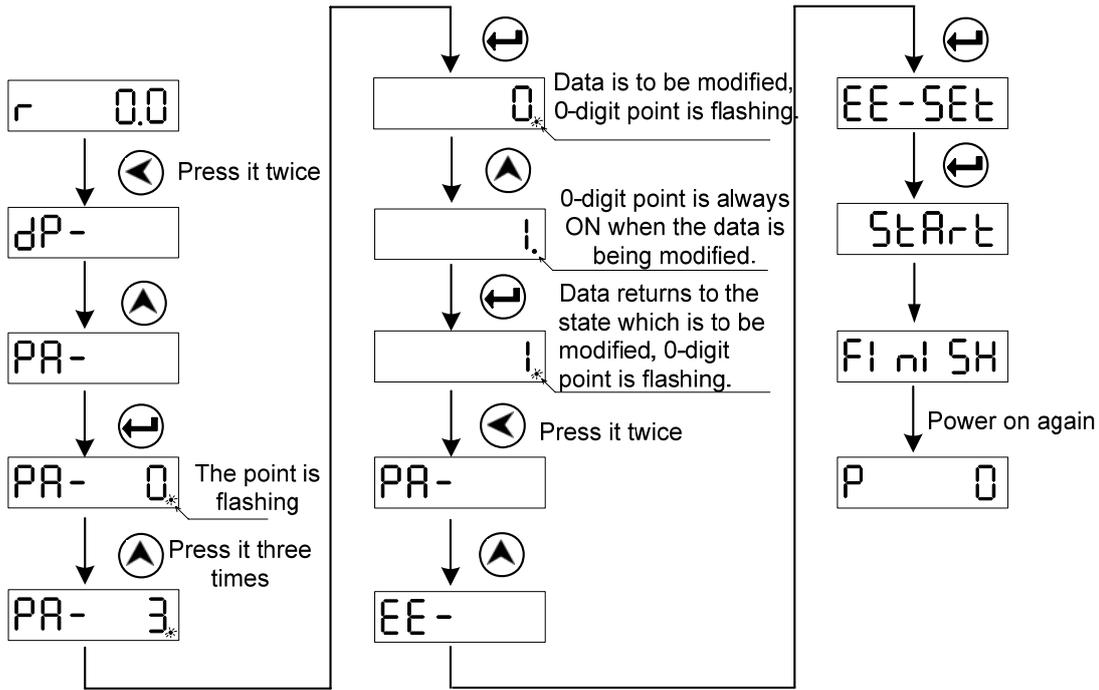
Fig.4-2   operations about state monitor by parameters

> After a parameter is modified, it is valid by pressing ⏎ , at the moment, and the modified parameter value immediately responses to the control. The parameter value being modified is not the required, ⏴ instead of ⏎ is pressed, and the parameter value recovers to the previous before modification. Execute the parameter writing opertion (EE-SEt) when the modified parameter is needed to be valid after power off.

● **Operations about recovering motor's default:**

> Default: according to the motor type code setting PA1, the corresponding parameter value is the default after ⌷EE-dEF⌷ operation is executed.

1.   Input the exclusive password for modifying the motor parameters, i.e.: PA0=385.
2.   Search the motor type code corresponding to the current motor according to *Appendix A, Motor Type Code*.
3.   Input PA1 to the motor type code, press ⏎ to enter the parameter management menu, execute ⌷EE-dEF⌷ operation, and the operation to recover the motor's default parameter is completed.
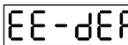
Parameter	Name	unit	Range	Default	Applicable mode
PA0	Modify password		0～9999	315	P，S
	PA0＝315: can modify the user parameter;				
PA1	Motor type		0～185	0	P，S

Taking example of recovering the motor's default parameter of 130SJT-M100D（A□）(motor's

type code is 50), the concrete operation is shown below:
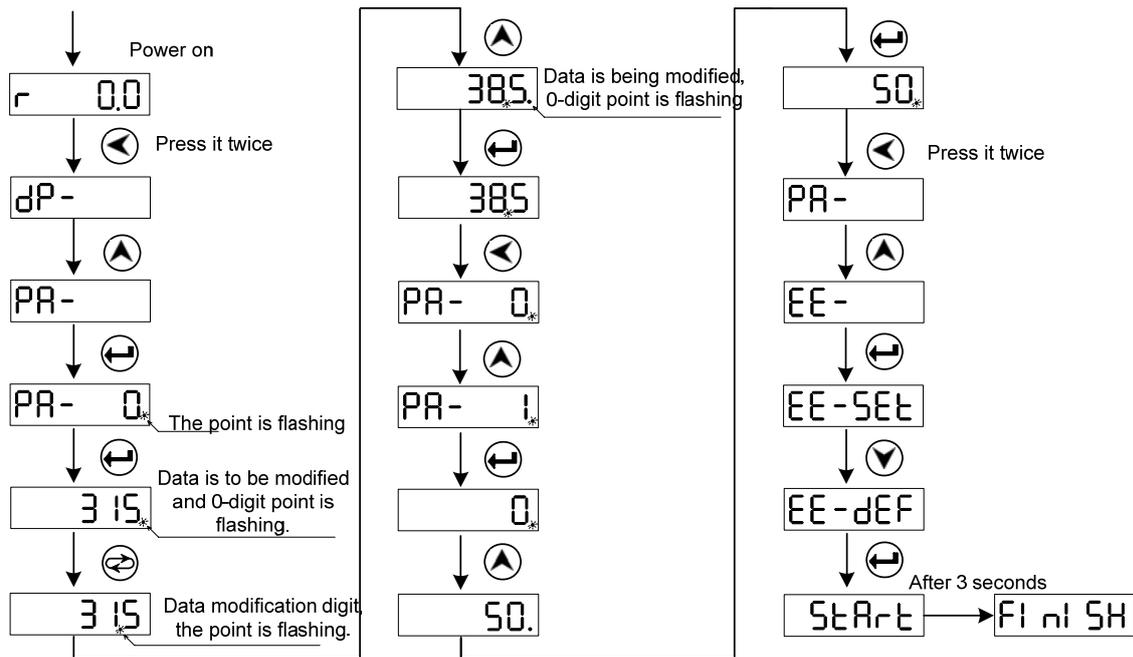
Fig.4.3　motor's default parameter export

1. 385 is the exclusive password to set the motor's default parameter. PA1 can be modified when PA0=385.

2. The parameter related to the motor is written into the default by setting the motor's default parameter, and the user can judge whether the default parameter of the servo drive unit meets the driven motor according to PA1 value (refer to *Appendix A*). The motor cannot run normally when PA1 value does not correspond to the motor model code.

4.5　Parameter Management

Here is introduced the operations about the parameter write-in, read-in, backup, backup recovery, export default. The data storage relationship of the parameter management is shown below:
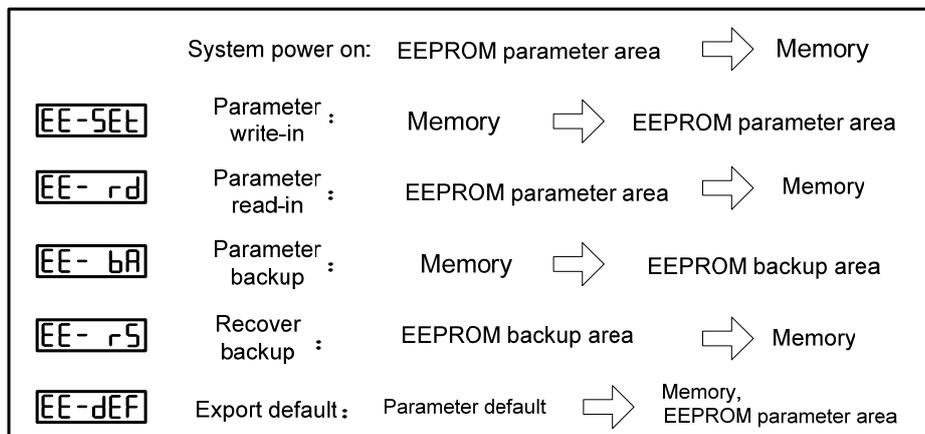
● **EE－SEt　parameter write-in**

It means the parameter in the memory is written into EEPROM area. The user modifying the parameter only change the value in the memory, and the value recovers the previous when power on again. Executing the parameter write operation can change the parameter value forever, the parameter value in the memory is written into EEPROM area and the modified value is valid after power on again.

● **EE－rd　　parameter read-in**

It means the data in the EEPROM area is read into the memory, which course is executed automatically when power on. At beginning, the parameter value in the memory is the same that of EEPROM area. Its value will be changed after the user modifies the parameter. When the modified parameter is not the required or arranged disorderly, executing the parameter read-in operation can read the data into EEPROM area to the memory, and recover to the parameter which is the one when power on.

● **EE－bA　parameter backup**

The parameter in the memory is written into EEPROM backup area, which function can avoid modifying the parameter by mistake not to return to the previous parameter. Firstly backup the parameter after the user debugs the motor's performance.

● **EE－rs　recover backup**

Parameters in EEPROM backup area is read into the memory. The parameter value is written in again, otherwise, it is the previous value after power on again.

● **EE－dEF export default**

It means the defaults of revenant parameters of some motor is read into the memory, and written into the parameter area of EEPROM, and they are used when power on again. (refer to Section 4.4)

Parameter management operation:
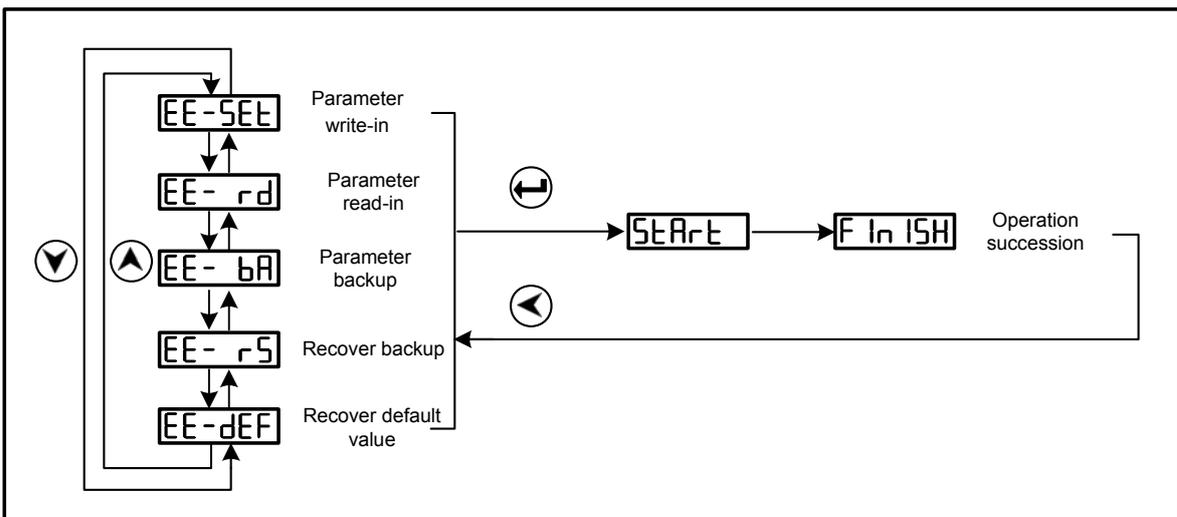
Parameter write-in operation example:
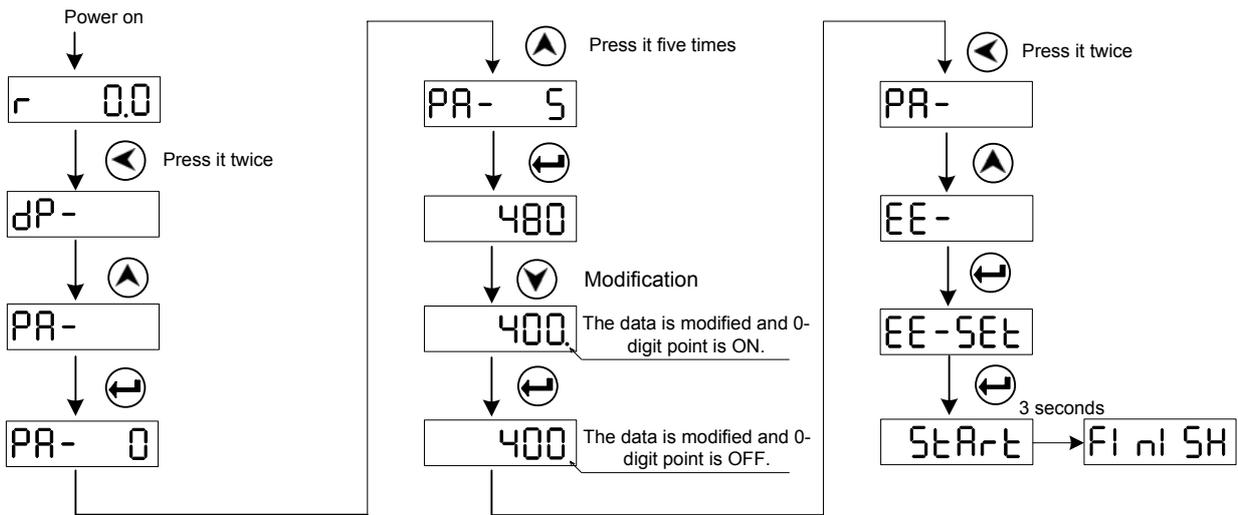
Fig.4-4   parameter write-in operation step

CHAPTER FIVE   DEBUGGING

Here is introduced the debugging method about the servo drive unit according to the working mode set by PA4 in the following table.

Relevant parameter	Name	Unit	Parameter range	Default	Applicable mode
PA4	Working mode selection		0～12	0	P，S

● PA4=0：position mode；

The rotation direction and angle of the motor are assigned by the digital pulse or data communication, the drive unit rotates the motor's rotor which is performed in terms of the specified direction and speed. Its angle (position) and speed can be controlled.

● PA4=1：speed mode；

The rotation direction and speed of the motor are assigned by the analog voltage or data communication, the drive unit rotates the motor's rotor which is performed in terms of the specified direction and speed.

● PA4=9：manual mode；

In the $\boxed{Sr-}$ menu, the acceleration or deceleration can be performed by pressing '▲ and ▼'.

● PA4=10：JOG mode；

In the $\boxed{Jr-}$ menu, the CCW or CW operation can be performed by pressing '▲ and ▼' at the set JOG speed by parameter.

Generally, a new drive unit should be performed by 4 steps which are shown below:

Correct wiring ⟹ Parameter setting ⟹ Basis debugging ⟹ Function debugging
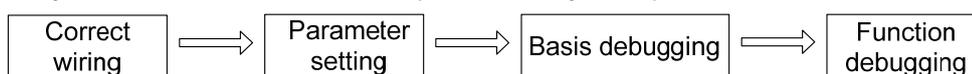
The chapter is mainly described the previous three steps, so that the user can use the servo drive device easily.

Refer to Chapter *6 Function Debugging* about function debugging, depended on the different requirements of users.

5.1 Manual, JOG Operation

☞
- It is suggested that the user should perform the manual or jog operation wihtout the load when the user uses the drive unit firstly. Ensure that the drive unit and the motor run normally after delivery, vibration and installation.
- Without load, after the drive unit runs normally, CN1 control signal is connected, and the user debug and run the unit in the speed mode or the position mode according to the requirements.
- Perform the load run after the signal connection, the parameter setting and the motor run are normal.

For manual, jog run, refer to Section 3.2.1 Main Circuit Connection Diagram of Servo Drive Unit *to* connect the drive unit and the motor, and disconnect the motor and the load. After the wires are connected correctly, the items described in the following table are check before power on.

Check item	Check method
Ensure the specifications of the drive unit are matched with that of the motor.	Check the brands of the drive unit and the motor compared to the user manual.
Ensure the breaker, contactor, and isolation transformer are connected correctly.	Refer to Appendix B Peripheral Equipment Selection.
Ensure that R, S, T, PE, P, B1, B are connected with U, V, W, PE correctly.	If necessary, use a multimeter to check the circuit.
Ensure that the wires of the motor's encoder feedback signal are connected correctly.	Refer to Section 3.4 in the user manual.
Ensure that the screws of the main circuit terminal are fixed.	Use the screwdriver to check whether there is the loose position.

The power supply is turned on after the wires are connected correctly. The power-on sequence is shown below:
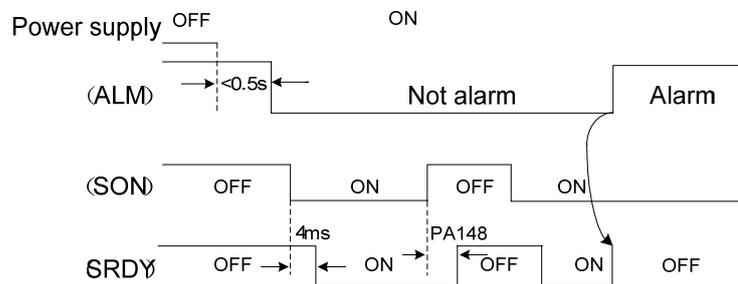
Note
When the user uses firstly the drive unit, the monitor window of motor's current is called. After SON is ON, the drive unit monitors real-time the motor's current. When the current exceeds the rated, the enabling is OFF immediately, wirings and parameter settings are checked, otherwise, the motor may be damaged.

5.1.1 Manual run

After the drive unit is turned on, $\boxed{\text{r} \quad 0.0}$ is displayed in a normal condition, otherwise, the alarm code $\boxed{\text{Err-}\square\square}$ is done. Refer to Chapter 8 Abnormality and Troubleshooting.

Required parameter	Name	Unit	Parameter range	Default	Applicability
PA4	Working mode selection		0～12	0	P，S
PA118	Internal enabling		0～1	0	P，S

Operation steps of manual run（PA4=9） are shown below:

$\boxed{\text{PA-118}}$ ◄ $\boxed{\text{PA-}}$ ▲ Press twice $\boxed{\text{Sr-}}$ ↵ $\boxed{\text{Sr-rEd}}$ ↵ $\boxed{\text{t - 0.0}}$ ▲ ▼ Acceleration Deceleration	1. The $\boxed{\text{r - 0}}$ is immediately displayed as long as the drive unit is ON, which is a monitoring window of motor operation speed.
	2. The servo motor corresponding default parameter is called out from the drive unit, and the correct parameter PA1 should be set. (Refer to Section 4.4 about the operation method).
	3. Set PA4=9, and the manual mode is selected.
	4. Set PA118=1, enforce the internal enable (Ensure that the motor axis rotation is not dangerous before enabling); the internal enable is cancelled when PA118=0.
	5. Enter the manual menu in terms of left figure (the previous parameter setting is ignored).
	6. Hold ▲, the motor accelerates, release the button, the speed remains unchanged; Hold ▼ , the motor decelerates to zero, and then, it accelerates in opposite direction again.

In manual run mode, when the monitor window displays $\boxed{\text{Sr-rEd}}$, $\boxed{\text{no-Enb}}$ is displayed by pressing confirmation, which means the drive unit has no enabling signal, at the moment, PA118 should be set to 1; when the monitor window displays $\boxed{\text{Sr- no}}$, $\boxed{\text{no-PA4}}$ is displayed by pressing confirmation, which means the drive unit working mode setting is mistaken, at the moment, PA4 should be set to 9.

> In manual run mode, when vibration, noise occur, the speed loop parameter such as PA15, PA16, PA18 should be debugged. The concrete debugging method is referred to Section 6.1.

5.1.2 Jog run

After the drive unit is ON, normally, the $\boxed{\text{r} \quad 0.0}$ is displayed in normal condition. When the drive unit has malfunction, the $\boxed{\text{Err-}\square\square}$ alarm code may occur. Refer to Chapter Eight Abnormity and Troubleshooting to settle the malfunction.

Necessary parameter	Meaning	Unit	Parameter range	Default	Applicability
PA4	Working mode selection		0～12	0	P，S
PA124	Jog run speed	r/min	-3000～3000	120	S
PA118	Internal enable		0～1	0	P，S

The jog run is also operated by the operator panel, which is same as the manual run.

The operation steps of JOG (PA4=10) are shown below:

$\boxed{\text{PA-118}}$ ◀ ↓ $\boxed{\text{PA-}}$ ▲ ↓ Press 3 times $\boxed{\text{Jr-}}$ ↵ ↓ $\boxed{\text{Jr-rEd}}$ ↵ ↓ $\boxed{\text{J} \quad .0}$ ▲↓ ▼ CCW CW	1. The $\boxed{\text{r} \quad 0.0}$ is immediately displayed as long as the drive unit is ON, which is a monitoring window of motor operation speed.
	2. Call out the corresponding default parameter of the servo motor in the drive unit, the correct parameter PA1 should be set. (Refer to Section 4.4)
	3. Set PA4=10 to select the JOG operation; Set PA124＝500, the JOG speed is set to 500 r/min.
	4. Set PA118＝1, enforce the internal enabling. (**Ensure that the motor axis rotates may not hazard before enabling**) (Set PA118＝0, the internal enabling is cancelled.)
	5. Enter the JOG menu based on the left figure (The previous parameter setting is omitted)
	6. Hold ▲, the motor runs based upon the speed of 500 r/min set by PA124; hold ▼ , the motor runs oppositely set by PA124; release the button, the motor stops at zero speed.

In jog run mode, when the monitor window displays $\boxed{\text{Jr-rEd}}$, $\boxed{\text{no-Enb}}$ is displayed by pressing confirmation, which means the drive unit has no enabling signal, at the moment, PA118 should be set to 1; when the monitor window displays $\boxed{\text{Jr- no}}$, $\boxed{\text{no-PA4}}$ is displayed by pressing confirmation, which means the drive unit working mode setting is mistaken, at the moment, PA4 should be set to 10.

> ☞ In manual run mode, when vibration, noise occur, the speed loop parameter such as PA15, PA16, PA18 should be debugged. The concrete debugging method is referred to Section 6.1.

5.2   Run in Speed Mode

5.2.1   External analog voltage command

① Wiring should be connected correctly in terms of the section 3.6.1 , note that the required input signals should be connected in the following table.

② After the correct connection is confirmed, all input signals are OFF, the required parameters are set after the power is turned on.

Required parameter	Parameter description
PA4	PA4=1: select speed mode.
PA6	Select the voltage range of analog control signal. PA6= 0：（－10V～＋10V） is valid. When the voltage command is positive, the motor rotates CCW; when the voltage command is negative, the motor rotates CW. PA6= 1：（0～＋10V）is valid. SFR,SRV are separate rotation CCW/CW state signal. PA6=2：internal speed

PA51	PA6= 0：（－10V～＋10V）is valid:
	    PA51= 0：The motor rotates CCW when the voltage command is positive.
	    PA51= 1：The motor rotates CW when the voltage command is positive.
	PA6= 1：（0～＋10V）is valid:
	    PA51= 0：SFR is ON. The motor rotates CCW or SRV is ON，the motor rotates CW.
	    PA51= 1：SFR is ON. The motor rotates CW or SRV is ON，the motor rotates CCW.

PA52	Analog command gain: Rated speed of the motor corresponding to 10V analog voltage is set by PA52. The different motor has different rated speed, So, PA52 value should be set based on the motor type. Example：Rated speed corresponding to GSK110SJT-M060D(A□) is 2500r/min. so, PA52=250. 10V command corresponds to motor run speed 2500r/min, 5V command corresponds to motor run speed 1250r/min, 1V command corresponds to motor run speed 250r/min.
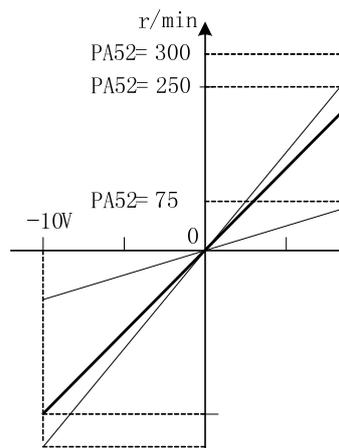
③ Basic debugging operation

1. The required parameter set is completed, the parameter write-in operation is performed (Refer to the $\boxed{\text{EE-SEt}}$ operation in parameter administration in section 4.5).

2. The least analog command is set and the SON is ON, and then the motor runs with the command.

PA6=0，analog command -10V～+10V is valid；such as the input analog command n (r/min)；SON ON/OFF controls the motor's start/stop; the command does not change, the motor's direction reverses, PA51 value can be changed.
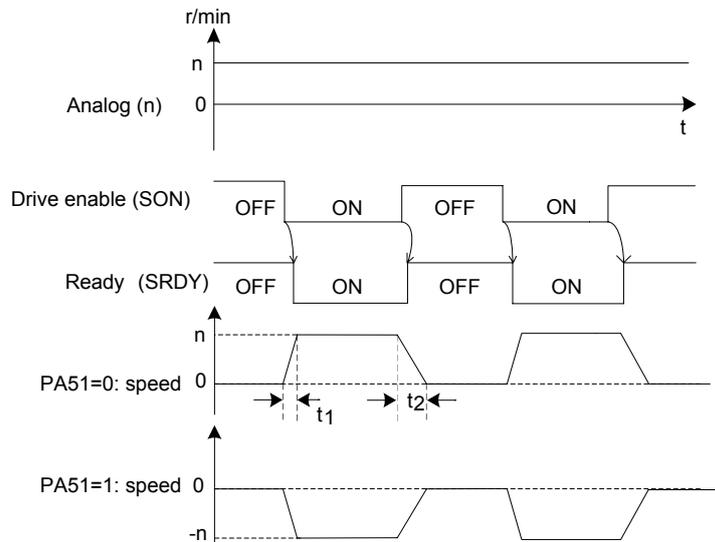
Fig.5-1　Motor run time sequence when PA6=0

When PA46=1, analog command 0～10V is valid. SFR, SRV is separate rotation CCW/CW start signal. The motor does not run when the analog voltage is negative, which is shown below:
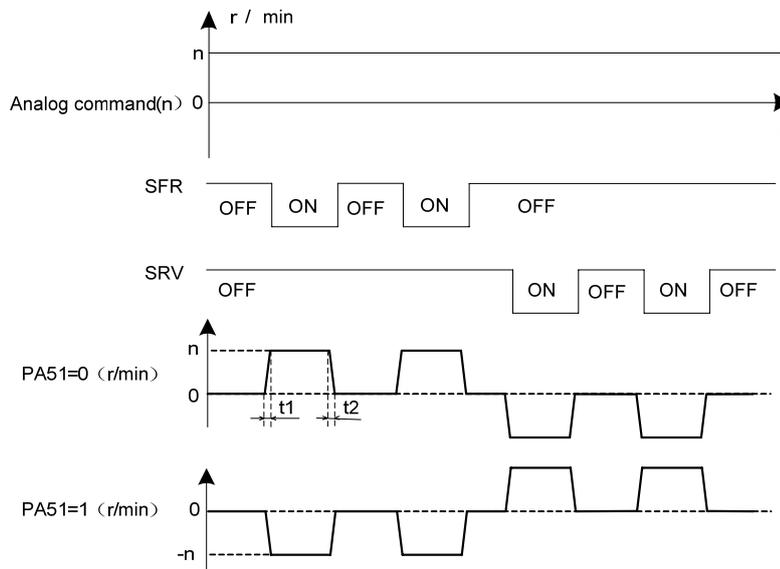
Fig.5-2　motor run sequence when PA6=1

> t1, t2 is motor's acceleration/deceleration time. The bigger the motor's load inertia is, the longer the acceleration/deceleration time is.

3. Enlarge the analog command gradually, and improve the operation speed of the motor step by step, at this time, monitor whether the vibration and noise are generated, the speed is stable, and whether the motor current exceeds the rated value when the motor runs. Observe the current of the motor by monitoring $\boxed{\text{dP-1}}$. The displayed current value may not exceed the rated one of the motor in the normal state.

4. When the motor runs from zero speed to the positive top speed or from the zero speed to the negative maximum speed normally, the user can debug other functions.

The abnormities and troubleshootings are shown below during in the mode of analog command speed:

No.	Abnormity during debugging	Troubleshooting
1	The motor rotation direction is not consistent;	Refer to Section 6.3 Switching Motor Rotation Direction.
2	The motor occurs vibration, noise and other abnormal conditions;	1. Ensure the shield wire is connected correctly. 2. Refer to Section 6.1 Basic Performance Parameter Debugging.
3	The motor only runs in one direction;	1. Check the command source mode, and PA6, PA51 setting; 2. Ensure the analog command input wire is connected correctly to avoid the reverse connection.
4	The motor can move little when 0V is commanded;	Refer Section 6.5.1 Adjusting Offset.

5.2.2   Internal speed command

① The required input signals described in the following table must be connected correctly.

Required input signals	Function
*COM＋	It is a common terminal of input points, and is an input terminal of the controllable power supply.
*SON	Servo enabling signal can independently control the motor's enabling.
*SEC1	Speed selection 1
*SEC2	Speed selection 2

②Ensure the wiring is connected correctly, all input signals are OFF and the power supply is ON, then required parameters are set.

Required parameter	Name	Unit	Parameter range	Default	Applicable mode
PA4=1	Select speed mode		0～12	0	P，S
PA6=2	Select internal speed command		0～2	0	S

PA126～PA128	Digital command default value	Run speed	I/O state of selected speed	
			SEC2	SEC1
	\	Zero-speed	OFF	OFF
	PA126＝1000	Internal speed 1	OFF	ON
	PA127＝-500	Internal speed 2	ON	OFF
	PA128＝2000	Internal speed 3	ON	ON

③ Basic debugging run

1. After the required parameters are set, the parameter write-in operation is executed（refer to Section 4.5 Parameter Management, $\boxed{\text{EE-SEt}}$ Operation Explanation. ）

2. Ensure the input signals SEC1 and SEC2 are OFF. When SON is ON, the motor is excited, runs at the zero speed. Observe the motor current amperage through monitoring $\boxed{\text{dP-1}}$. When $\boxed{\text{dP-1}}$ is normal, the displayed current value is about 0.2 of the motor's rated current.

3. Changing the combination state of SEC1, SEC2 can switch three kind of internal speed. At the same time, observe the motor run state whether there is vibration and noise, whether the run speed is stable and the motor current exceeds the rated value. The sequence of three kind of speed switching is shown below:
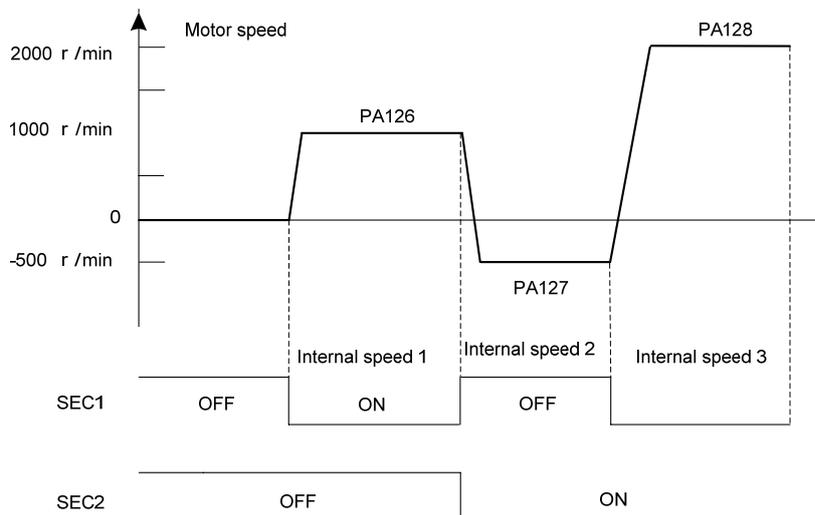
4. User can debug other functions when the motors' operations are normal at 3-stage internal speed.

Generally, the abnormities and troubleshootings are shown below when the internal digital command speed is performed:

No.	Abnormity during debugging	Troubleshooting
1	The motor rotation direction is not consistent;	Refer to Section 6.3 Motor Rotation Direction Switch.
2	The motor occurs vibration, noise and other abnormal conditions;	Refer to Section 6.1 Basic Performance Parameter Debugging.
3	The state of speed selection input signal is not consistent with the motor speed.	Check ⏹dP- ln⏹and ensure the input signal is correct (refer to Section 3.3.4 Switching Value Input Point).

5.3 Run in Position Mode

① Firstly refer to Section 3.6.2 Connection Diagram, and the required input signals described in the following table must be connected correction.

Required input signal	Function
*COM＋	It is a common terminal of input points, and is an input terminal of the controllable power.
*SON	It is a servo enabling signal, and can separately control the motor enable in position mode.
*PULS＋ *PULS－	Position command input Input mode: 1. pulse + direction；
*SIGN＋ *SIGN－	2. CCW pulse + CW pulse； 3. Orthogonal pulse A/B phase.

②Ensure the wiring is connected correctly, all input signals are OFF and the power supply is ON, then required parameters are set.

Required parameter	Parameter explanations
PA4	PA4=0 select position mode.
PA29 PA30	Electronic gear function of position command: PA29 is multiplication coefficient of pulse command; PA30 is division coefficient of pulse command.
	Set the electronic ratio of position command to match with all kinds of pulse commands. The computing formular of electronic gear ratio is shown below: $$S = \frac{I}{\delta} \cdot \frac{CR}{CD} \cdot \frac{PA29}{PA30} \cdot \frac{L}{4C} \cdot \frac{ZD}{ZM}$$ ，（Refer to Section 6.4.1 about computing method）
PA5	Position command pulse mode selection
	PA5=0：pulse + direction； PA5=1：CCW pulse＋CW pulse； PA5=2：two-phase orthogonal pulse input； （Refer to Section 3.3.3 Position Command Input）

PA28	Position command direction being reverse.
	PA28＝0：keep previous command direction；
	PA28＝1：put pulse command direction being reverse. （Refer to Section 6.3）

③Basic debugging operation

1. The required parameter setting is finished, and the parameter reading operation is performed (Refer to Section 4.5 Parameter Management, $\boxed{EE\text{-}SEt}$ operation explanation).

2. Firstly, the SON is set to ON, ensure the motor is zero-speed, the motor specified by smaller frequency is excited with the position pulse command. Observe the motor current amperage by monitoring $\boxed{dP\text{-}I}$. When $\boxed{dP\text{-}I}$ is normal, the displayed current value does not exceed the motor's rated current. Using PLUSE+ DIRECTOIN command drives the motor running, which is shown below:
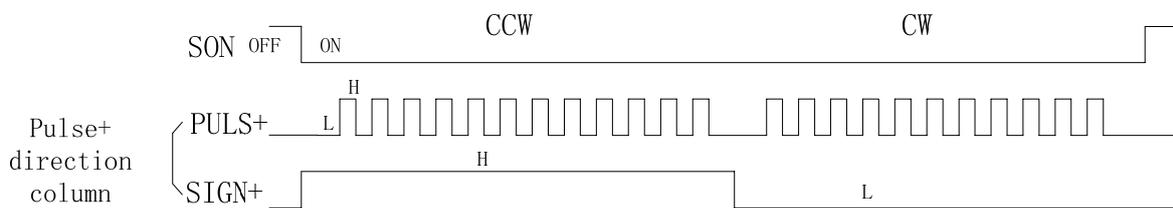
3. Enlarge the speed of position command gradually, improve the operation speed of the motor step by step, at the same time, and check whether the motor has vibration or voice, the speed is stable or the motor's current exceeds the rated value.

4. When the motor can run by the command in the rated speed, the displayed numbers $\boxed{dP\text{-}PoS}$ of position command pulse are equal to the displayed one of $\boxed{dP\text{-}CPo} \times \dfrac{PA29}{PA30}$, therefore, user can debug other functions.

Generally, the abnormities and troubleshootings are shown below during the position mode is performed:

No.	Abnormity in debugging	Troubleshooting
1	The motor does not run after enabling when there is noting data on the $\boxed{dP\text{-}CPo}$;	Check the command wiring and the instruction control unit.
2	$\boxed{dP\text{-}CPo}$ means that the data exists, but the motor does not run;	Check the enabling signal and the set of required parameters
3	Motor's rotation directions are not consistent;	Refer to Section 6.3 Switching Motor Rotation Directions
4	The abnormal, such as vibration or noise may occur.	Refer to Section 6.1 Basic Performance Parameter Debugging.
5	The motor can not run;	Note that the command source mode should be checked, and the correct set should be performed based upon PA5.
6	The displayed data by $\boxed{dP\text{-}CPo}$ is inconsistent with the pulse number of	Check the shielding treatment of the control signal cable.

	command source.	Be far from the strong interference source
7	Pulse value of $\boxed{\text{dP-CPo}} \times \dfrac{PA29}{PA30}$ is not consistent with the displayed pulse quantity of $\boxed{\text{dP-PoS}}$;	When there is a position command, SON becomes OFF, at the moment, the servo unit does not execute $\boxed{\text{dP-CPo}}$ command, so, ensure SON is ON when the PC sends the position command.

CHAPTER SIX　FUNCTION DEBUGGING

6.1　Basic Performance Parameter Debugging

Notice	The following figure is about the drive unit basic performance parameter adjustment. User should adjust some parameters in terms of the following schematic diagram due to the different motor or load during using, so that the spindle motor can be worked on the high level. **The drive unit may not be performed stably due to the overadjustment.**
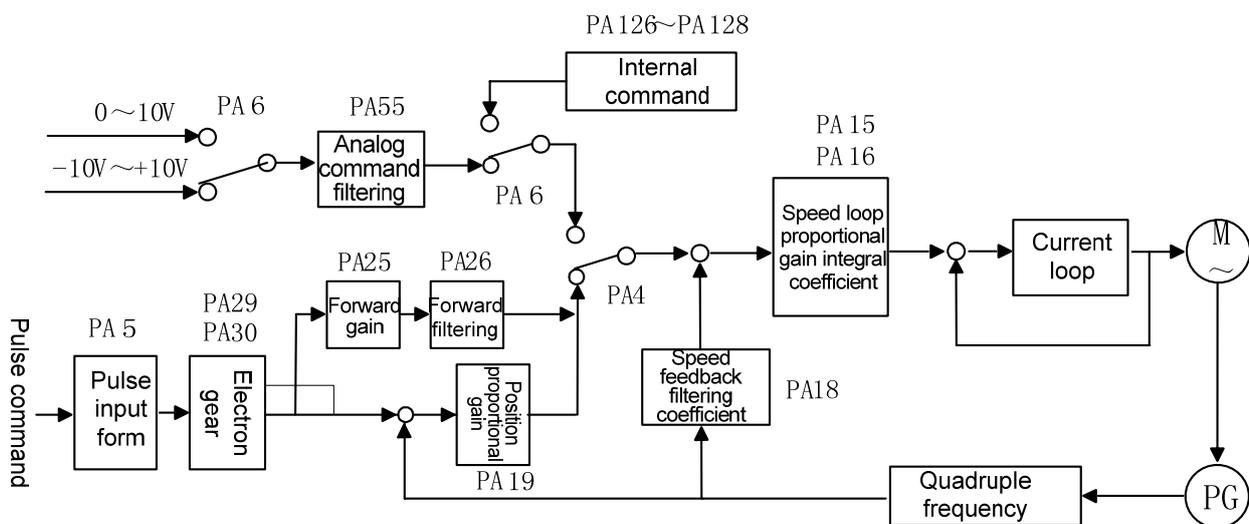
Fig.6-1　Basic performance parameter debugging

User should call out the motor's default parameter in terms of the (Appendix A) corresponding to the type code of the motor when the motor is debugged. If the abnormal case occurs, such as the vibration, noise, stumble and not enough torque when the motor is operated, and the basic performance parameter should be debugged. Generally, in the above figure, the parameters of the speed loop should be adjusted firstly, and the position loop is later.

● PA15 (speed loop proportional gain):：

The bigger value the PA15 speed loop proportional gain is, the bigger the servo rigid is, vice versa. However, the vibration (an abnormal voice in the motor) may occur when the value exceeds too much at starting or stopping. Add or reduce 20 at one time based on the default value when the user debugs the value, and then observes the result. Generally, PA15 value range is 80～1000.

● PA16 (speed loop integral coefficient)：

The bigger the PA16 speed loop integral coefficient is, the faster the response of the system is, the system may unstable when the setting value is exceeded, even the vibration may occur; the smaller the value is, the slower the response is. The integral may reduce when the setting is small, and the steady-state error can not be decreased. For example, the orientation axis always swing (the motor vibrates) even the orientation comes to nothing when the motor is performed an orientation, and the setting value of PA16 should be reduced. When the user adjusts the value, the value is increased or decreased 50 based on the default, and then the user observes the result. PA16 value range is 10～1000.

The proportional gain of the speed loop and the integrate coefficient should be debugged proportionally based upon the detailed servo motor's type and loading. Generally, the bigger the load inertia is, the smaller the setting value is. In the case of the system vibration is not issued, two parameter values should be set bigger as far as possible.

The response curve is generated by the step command with one inertia load for driving one motor. Refer to the Fig. 6-2.

Curve 1 indicates that the speed step input curve is displayed when PA16=0, the motor characteristic is soft, the dynamic response is slower and the bigger steady state error occurs.

Curve 2 indicates that the speed step input curve is displayed when the evaluation both PA15 and PA16 are suitable, the motor's rigidity is moderate and the dynamic response is fast;

Curve 3 indicates that speed step input curve is displayed when PA15 is less and PA16 is bigger, the instantaneous overshoot is the maximum and the motor vibration is easily caused.
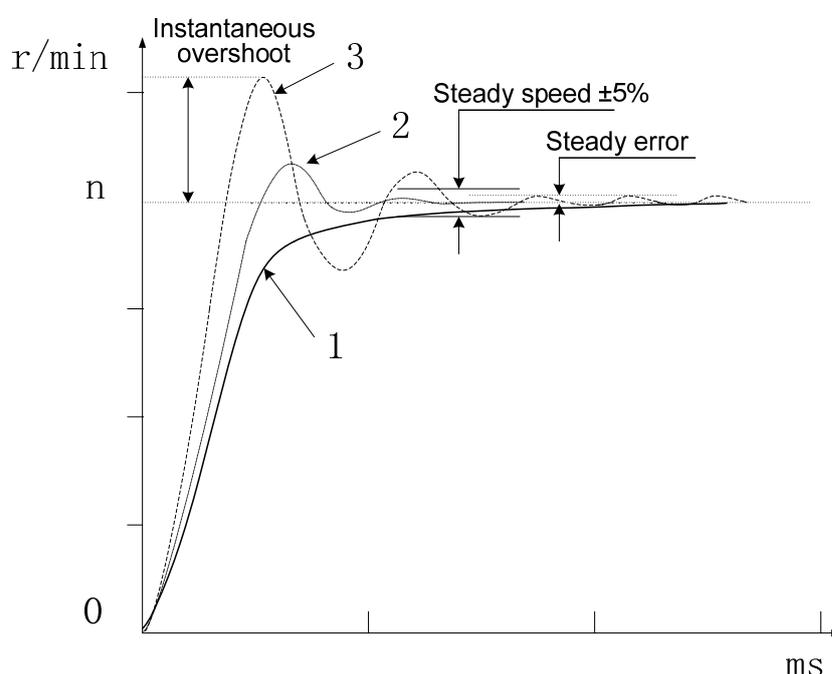
Fig.6-2   Response curve input by the step command

● PA18 (speed feedback filtering coefficient)：

The bigger the speed feedback filter coefficient value is, the faster the speed feedback responds. If the set value is excessive, the electromagnetic noise may occur in the motor; the less the set value is, the slower the speed feedback responds; if the set value is excessively small, the speed wave is increased, even the vibration may occur. User can increase or decrease 50 at the default value and then observe the result when the parameters are being adjusted. Note that the minimum value of PA18 should not be less than 50.

● PA19(position loop proportional gain):

The drive unit position loop adopts the simple P adjustment. When the orientation function is performed in the position and speed modes, the position closed-loop function is enabled.

The bigger the value of the position loop proportional gain is, the faster the position command responds, the bigger the rigid is. If the value is excessively big, the vibration occurs in the motor caused by the position overrun when the motor starts or stops; the less the setting value is, the slower the response is, the bigger the followed error is. Add or reduce 5 once at the default value when the user adjusts, then view the result. Note that the solution range of PA19 is 25～60.

● PA25 (position loop feedforward gain), PA26 (position loop feedforward filtering coefficient):

PA25 adjusts the speed loop with the speed information of the position command, the setting value is enlarged, while the followed error is reduced, the instantaneous overshoot and the vibration in the motor may easily occur.

Actually, the PA26 is smoothly treated the position command forward control, the bigger the setting value is, the faster the step speed command responds, the position overrun and vibration can be controlled while the command speed changes suddenly. When the speed is mutated, the less the setting value is, the less the result of feedforward control is, the less the vibration caused by the feedforward control is.

Generally, PA25 (position feedforward gain) and PA26 (position feedforward low-pass filter cut-off frequency) are not used possibly.

● PA55 (analog command filtering coefficient):

The less the analog command filtering cut-off frequency is, the stronger the interference signal supression capability is, the less the value is, the slower the speed command responds, and vice versa. Increase or decrease 50 at every turn based upon the default value when the user adjusts, and then observe the result. Note that the least value of PA55 can not be less than 50.

6.2 HOLD Release Signal Application

To lock the vertical or tilting table linked with the motor shaft, and prevent it from falling after the motor alarms or the power supply is OFF, the motor with safe brake, i.e. hold motor is used. To validly control the motor movement, the drive unit is allocated with the hold release signal (HOLD).

☞ The safe brake is only used to keep worktable instead of reducing or forcing to stop the movement.

① Correctly complete wiring according to Fig.6-3 and must connect input signals described in the following table.

Required input signals	Function
*COM＋	It is a common terminal of input point, and is an input terminal to control power supply.
*SON	Servo enable signal.
*HOLD＋ *HOLD－	Hold release signal.

Fig.6-3 is a actual application wring method for hold release signal controlling hold motor, 24V power supply is provided by the user. When the power is connected with the hold release signal（HOLD±）, the power polar should be paid. See below:
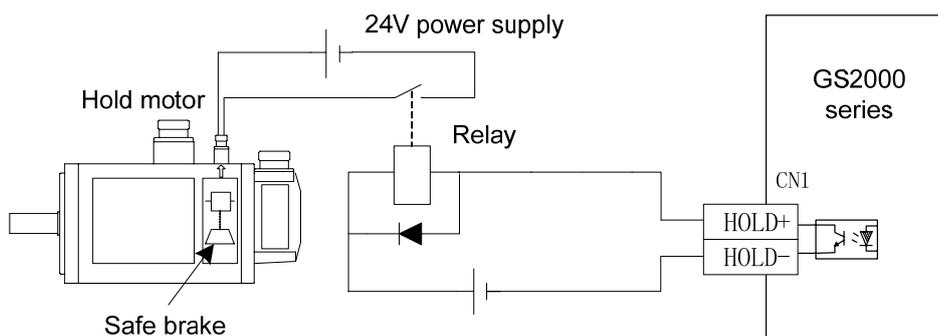
Fig.6-3   hold release signal (HOLD±) sample

Motors with different power should be allocated with safe brake with different power. Refer to the technical parameters of the brakes allocated with motors with different specifications described in the following table.

Motor seat No.	Rated torque	Power supply & voltage	20℃ brake power （unit W）	Release time(s)
110	4	24V DC	20	0.037
130	8	24V DC	25	0.042
175	32	24V DC	40	0.135

② After the wiring is correctly connected, the power supply is connected, the required parameters are set. When the machine or the worktable moves slightly by gravity, regulate the time by the following parameters related to the hold operations.

Relevant parameters	Name	Unit	Parameter range	Default	Applicability
PA147	Max. deceleration time of the motor before permitting safe braker operation	ms	0～30000	30	P，S
PA148	Servo locked delay time	ms	0～30000	100	P，S
PA149	Motor speed when safe brake operation	r/min	5～3000	30	P，S

Case 1: the power supply of the servo drive unit is suddenly turned off when the motor is in the state of the rest.
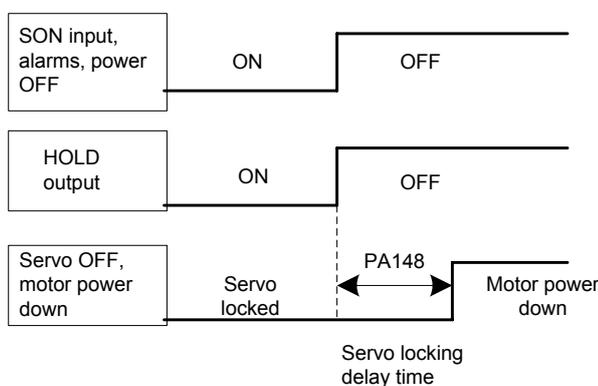
Generally, HOLD is OFF, in the meanwhile, the servo drive unit is turned off. Adjust PA148 to delay the drive unit OFF to avoid the slight movement when the machine or the worktable slightly moves by gravity.

When the drive unit is turned off, the energy is released by dynamic braking circuit in a short time, so, when PA148 is set to a big value, the actual servo locked delay time will not exceed that of energy release, the energy release time is related to the load inertia, or the motor's deceleration time.

Case 2: the servo drive unit is suddenly turned off when the motor runs.
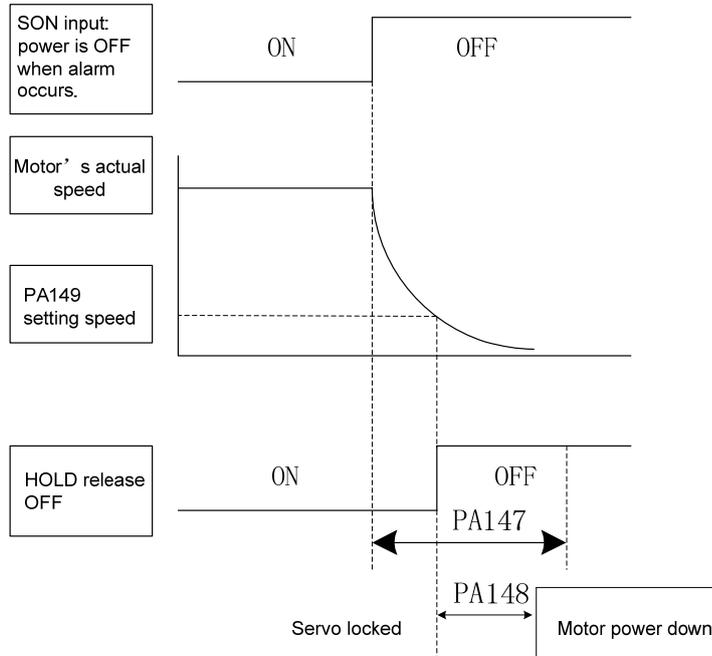
When the drive unit moves at high speed, it does not hold suddenly, otherwise it damages the brake, the HOLD signal should be OFF in a proper time. Properly adjust PA147，PA149 to decelerate the motor and hold. PA149 should be set to 30r/min. PA147 value should be set according to the actual mechanical operation.

When an unexpected interruption of power supply occurs, and because the delay effects of the periphery switch power supply and relay coil cause the machine or the worktable to move, the following solution should be used.
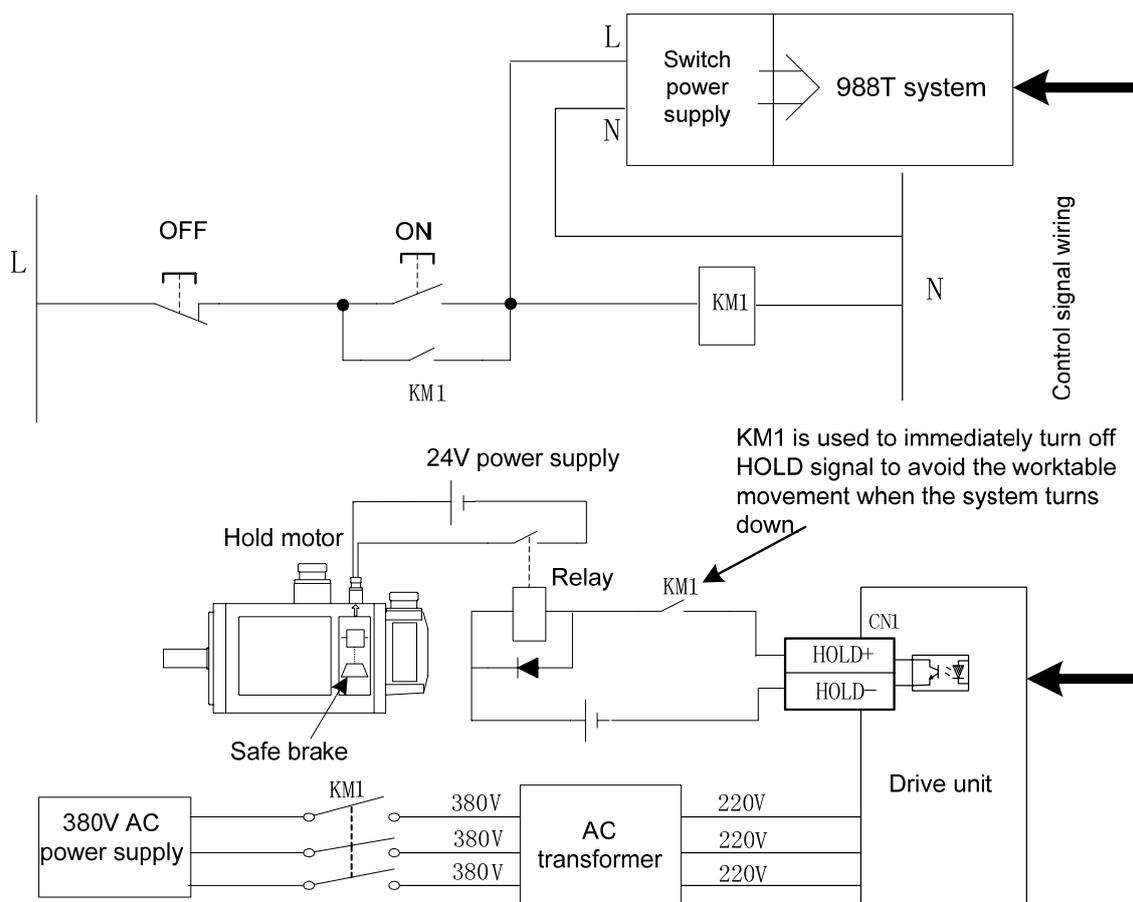
KM1 AC contactor is a control switch of the drive unit to connect with the power supply. A normally-open contactor of KM1 is connected to the circuit of the hold release signal. When the manual power-off or sudden power-off occurs, KM1 is turned off firstly, at the time, the normally-open contactor is OFF, the motor's brake holds after power off to eliminate the delay effect, which can ensure the machine or worktable does not move.

6.3 Switching the Motor Rotation Directions

■ Standard mode:

When all parameters of the drive unit are set to default values, the correspond relationship between the speed or position command and the motor's rotation direction is standard mode.

■ Reverse mode:

When the motor's wiring in Speed or Position command is not changed, the drive unit makes "Reverse mode" of the motor reversely rotation.

1. Position mode：

Relevant parameter	Description	Unit	Parameter range	Default	Applicability
PA28	Position command direction reversely		0～1	0	P
	PA28=0: maintain the original command direction; PA28=1: the input pulse command is reverse.				
Command	Standard set (PA28=0)		Reverse mode (PA28=1)		
CCW command	CCW		CW		
CW command	CW		CCW		
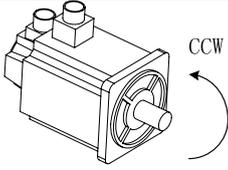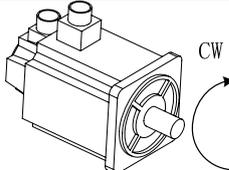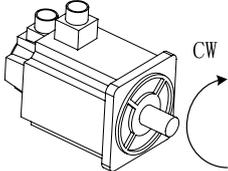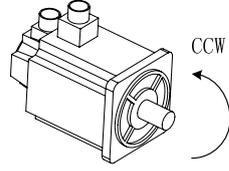
2. Speed mode：

Relevant parameter	Description	Unit	Parameter range	Default	Applicability
PA51	Analog command reverse/CCW, CW rotation start reversely		0～1	0	S
	① When the optional analog command is indicated as－10V～10V: (PA6=0) In the case of PA51=0, the motor rotates CCW or CW when the analog command is positive or negative; In the case of PA51=1, the motor rotates CW or CCW when the analog command is positive or negative. ② When the optional analog command is indicated as 0～10V: (PA6=1) In the case of PA51=0, the motor rotates CCW or CW when the rotation start signal is performed CCW or CW. In the case of PA51=1, the motor rotates CW or CCW when the rotation start signal is performed CW or CCW.				

	Standard setting（PA51=0）	Reverse mode（PA51=1）
CCW command (PA6=1)	CCW	CW
CW command (PA6=1)	CW	CCW
Positive voltage (PA6=0)	CCW	CW
Negative voltage (PA6=0)	CW	CCW
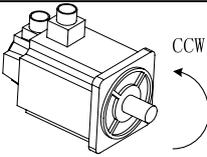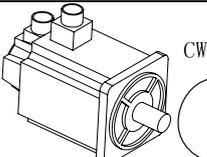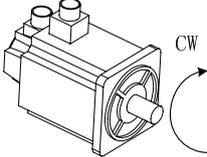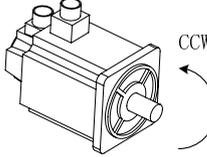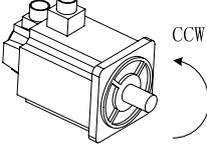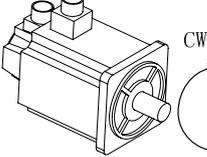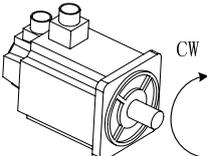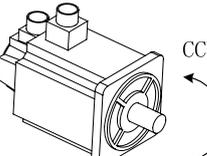
6.4   **Function Debugging of Position Mode**

6.4.1   Electronic Gear Ratio of Position Commands

Electronic Gear Function is defined to the relative mechanical change gear. When the gear is controlled, the motor movement which is equal to the input command can be set to arbitrary value by adjusting the servo parameter, regardless of the deceleration ratio of the machine and the resolution of the encoder.

Relevant parameter	Description	Unit	Parameter range	Default	Applicability
PA29	Pulse frequency multiplication of position command		1～32767	1	P
PA30	Pulse frequency division of position command		1～32767	1	P

It is very convenient to match the pulse sources by setting the parameters PA29 and PA30 so that a good distinguishability can be gained for the users (mm/pulse).

Actual load speed = command pulse speed × G × mechanical deceleration rate

The least actual load shift = the least command pulse stroke × G × mechanical deceleration rate

> When the electronic gear ratio G is not 1, the remainder may induce in the gear ratio division operation, in this case, the position error may occur, the maximum error is the least rotation amount of the motor (minimum resolution).

The operation of position electronic gear ratio is as follows:

$$S = \frac{I}{\delta} \cdot \frac{CR}{CD} \cdot \frac{PA29}{PA30} \cdot \frac{L}{C} \cdot \frac{ZD}{ZM}$$

$$\Longrightarrow \quad G = \frac{PA29}{PA30} = \frac{C}{L} \cdot \frac{ZM}{ZD} \cdot \frac{\delta}{I} \cdot \frac{CD}{CR} \cdot S$$

Note: Numerator should multiply 4, i.e. '4C' when the count is executed for the incremental encoder.

G：   Electronic gear ratio, the recommended range is $\frac{1}{50} \leq G \leq 50$；

C: The resolution of the motor encoder;

L：Screw lead (mm);

ZM: Gear quantity of the screw terminal (in the case of the deceleration cabinet).

ZD: Gear quantity of the motor terminal;

δ: The system's least output command unit (mm/pulse);

I: Command shift (mm);

S: Actual shift (mm);

CR: Frequency multiplication coefficient of PC command;

CD: Frequency division coefficient of PC command;.

[Example]: The machine system is 988T, its motor is directly connected with X axis screw (6mm lead), the motor encoder is 17-bit absolute, and the frequency multiplication and frequency division coefficient are not considered, instead of calculating the electronic gear ratio of the drive unit, the following description is the solution:

Answer: the motor is connected directly to the X axis, in this case, the ZM: ZD=1; usually, S =1, the command shift is equal to the actual shift; on the other hand, when GSK988T uses 0.1μ machining precision, the least output command unit of X axis $\delta = \frac{0.0001}{2}$ mm/pulse in diameter programming, the formula is shown below:

$$G = \frac{PA29}{PA30} = \frac{2^{17}}{6} \times 0.00005 = \frac{2048}{1875}$$

The parameter PA29 is set to 2048, and PA30 is set to 1875.

6.4.2 Position Arrival Signal

PSR is position arrival signal in the position mode.

The remain pulse in the position error counter is less than or equal to the setting value of PA31, the drive unit is consider that it has arrived the position, in this case, the output opticalcoupler of the

signal is conducted.

Relevant parameter	Description	Unit	Parameter range	Default	Applicability
PA31	Position arrival range	Pulse	0～30000	20	P
	When the remaining pulse amount within the position error counter(DP-EPO in the display menu) is less than or equal to the PA31 set value, the drive unit is regarded that the position has been arrived, the position arrival signal PSR is ON, otherwise, it is OFF.				
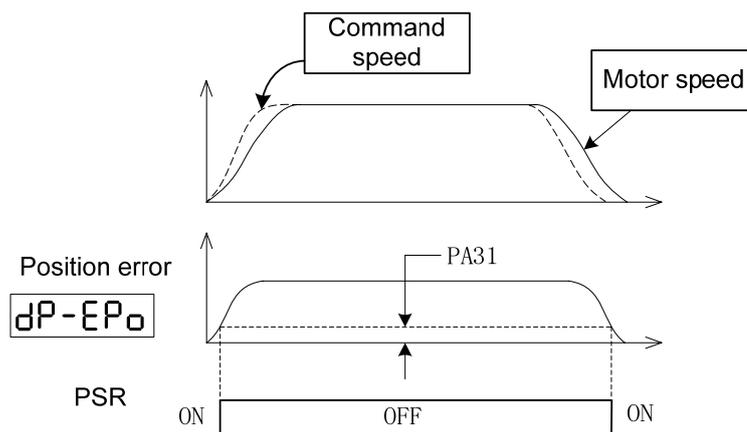
Relevant parameter	Description	Unit	Parameter range	Default	Applicability
PA32	Position error check range	×100 pulse	0～999	400	P
	When the position mode is operated and the counter value of the position error counter exceeds PA32 parameter value, the servo unit excess error alarm may occur. (Refer to Section 8.2 Err-4 Troubleshooting)				

6.4.3 Pulse offset clear（CLE）

CLE is a pulse offset clearing signal. When it is ON in Position mode, the detained pulse in the position error counter is cleared, i.e. the following error is cleared.
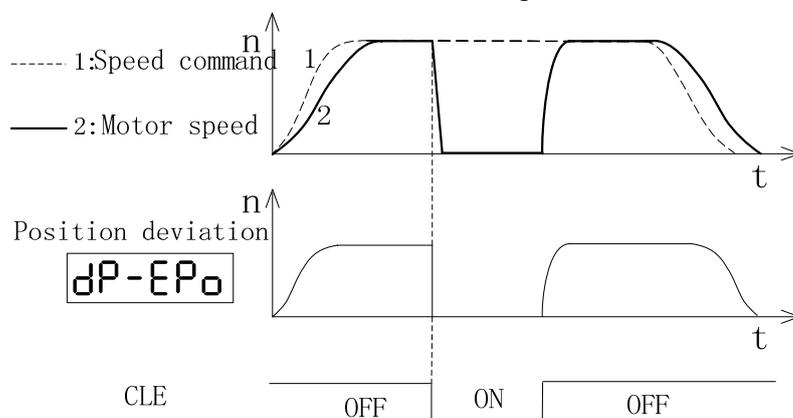
6.4.4　Pulse command prohibition（INH）

INH is a pulse command prohibition signal. When it is ON in Position mode, the drive unit prohibits receiving pulse command.
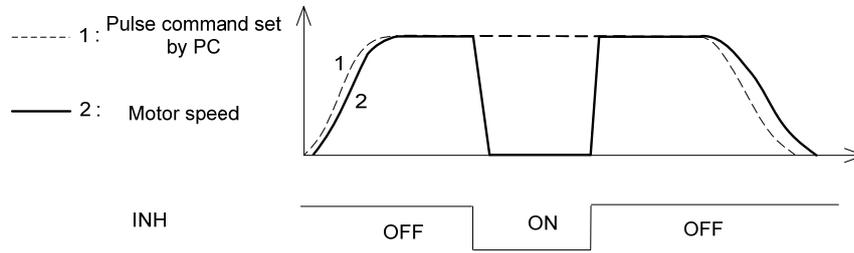
6.5　Function Debugging in Speed Mode

6.5.1　Analog Command Adjustment

The following parameters should be adjusted when the speed command is inconsistent with the actual motor speed:

Parameter	Description	Parameter range	Default	Applicability
PA56	Analog command zero drift compensation	-30000～30000	0	S
	The motor still rotates at a low speed sometimes when the command voltage is 0V, because it is caused by the "offset (=command offset)" from the PC or the small voltage (mV) of the external command voltage, PA56 can compensate the offset amount and its method is: When the motor offsets CCW, and reduces to PA56 value, up to zero speed. When the motor offsets CW, and increases to PA56 value, up to zero speed.			

It is recommended that the adjust sequence of the analog amount is shown below:

1. It is necessary to confirm the value of PA52, i.e. PA52 sets the motor speed corresponded to

1V;

2. Then, the motor stops after the "offset amount" is modified to "0V" by adjusting PA56.

3. Lastly, several speed commands are specified separately, such as 500r/min, 1500r/min and 2500r/min, whether the motor's speed slope is consistent with the command based upon the motor speed displays by LED.

6.5.2   Speed Arrival Signal

PSR speed mode is a speed arrival signal.

The actual speed = the [command speed × (100－PA61)% ～ command speed × (100＋PA61)%], the output optical coupler of the signal is conducted.

Relevant parameter	Description	Unit	Parameter range	Default	Applicable
PA61	Speed arrival valid range	%	0～100	10	S

Example: Set PA61 to 10, which indicates 10% of a command speed. When the actual speed is accelerated or decelerated to 900r/min～1100r/min and the specified speed has been set to 1000r/min, the speed arrival signal (PSR) is output, which is shown below:

Accelerate to 1000r/min from the speed less than 1000r/min   Decelerate to 1000r/min from the speed more than 1000r/min
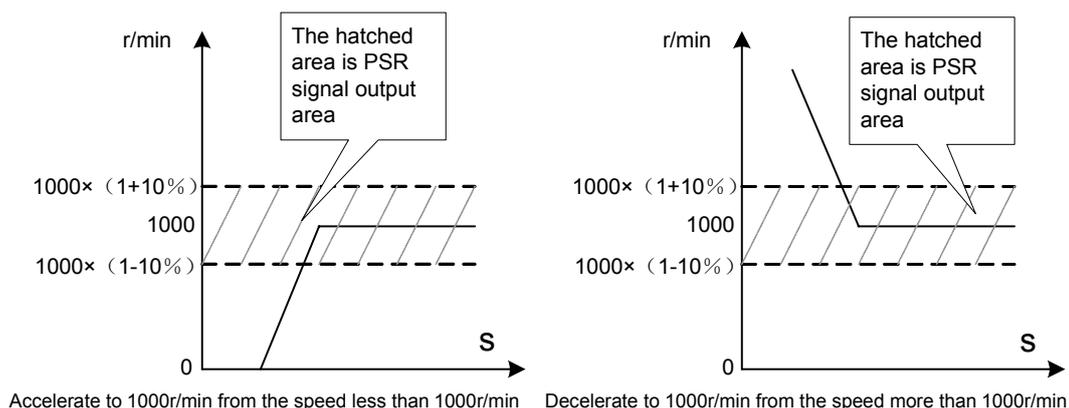
When the command speed is -1000r/min:

Accelerate to 1000r/min from the speed less than 1000r/min   Decelerate to 1000r/min from the speed more than 1000r/min
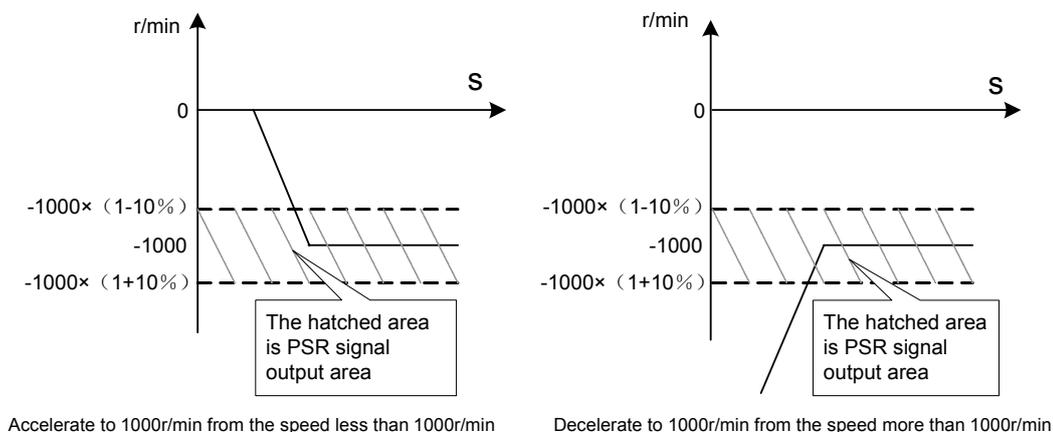
6.5.3 Zero-speed Clamping

It is valid in Speed mode.

When the instruction control unit is used an analog voltage command to control the drive unit, and if the command voltage is not "0V", the motor should be stopped and the servo is locked indeed, in this case, the "zero clamping" function can be executed.

There is a method to achieve the "zero-speed clamping" function:

ZSL zero-speed clamping input point control

In Speed mode, ZSL is ON and the motor is locked when the speed command is not 0V
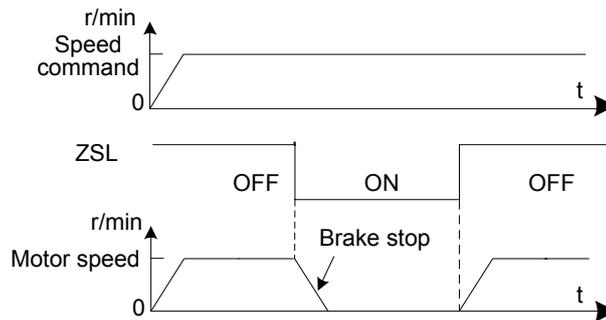
CHAPTER SEVEN PARAMETER

7.1 Parameter Table

P: Position control   S: Speed control

Parameter No.	Meaning		Setting range	Default	Unit	Applicable mode
PA0	Password		0 ~ 9999	315		P,S
	When PA0=315, parameters other than PA1, PA2 are modifiable; To modify PA1, it is needed to set PA0 to 385.					
PA1	Motor model code		0~185	0		P,S
	Set the model code of the drive motor according to *Motor Model Code List* (see APPENDIX A for details), then the default values of the motor can be restored. The exfactory parameter is correctly set already. Do not modify this default value in general condition.					
PA3	Monitoring setting at initialization		0~35	0		P，S

Parameter Value	Monitoring setting at initialization	Explanation	Parameter Value	Monitoring setting at initialization	Explanation
PA3=0	dP-SPd	Motor speed	PA3=16	dP-Err	Alarm display
PA3=1	dP-PoS	Current motor position low-order 5 digits (pulse)	PA3=17	dP-rn	Servo unit working mode
PA3=2	dP-PoS.	Current motor position high order 5 digits × 100000 (pulse)	PA3=18	dP-Cod	Encoder feedback signal
PA3=3	dP-CPo	Position command low order 5 digits (pulse)	PA3=19	dP-In	Input terminal status
PA3=4	dP-CPo.	Position command high-order 5 digits × 100000 (pulse)	PA3=20	dP-oUt	Output terminal status
PA3=5	dP-EPo	Position deviation lower order 5 digits (pulse)	PA3=21	dP-PLd	（Reserved）
PA3=6	dP-EPo.	Position deviation high-order 5 digits ×100000 (pulse)	PA3=22	dP-CPL	Hardware version No.
PA3=7	dP-I	Motor current	PA3=23	dP-dSP	Software version No.
PA3=8	dP-ouC	Rotation speed corresponding to analog command	PA3=26	dP-APo	Low order digits of encoder's absolute position
PA3=9	dP- CS	Speed command	PA3=27	dP-APo.	High order digits of encoder's absolute position
PA3=10	dP-Frq	Position command pulse frequency	PA3=32	dP-AbS	Single-circle position of motor

PA3=11	dP- Ct	Torque command	PA3=33	dP-AbS.	(Reserved)
PA3=12	dP-trq	Motor torque	PA3=34	dP-HbS	Low-order digits of motor's absolute position
PA3=13	dP-tEP	Radiator temperature	PA3=35	dP-HbS.	High order digits of motor's absolute position
PA3=15	dP-dC	DC bus voltage			

P: Position Control Mode   S: Speed Control Mode

Parameter No.	Meaning	Range	Default Value	Unit	Applicable Mode
PA4	Working mode selection	0~12	0		P, S
	PA4=0: Position mode; Digital pulses determine the rotation direction and angle. The servo unit makes the rotor rotate in the determined direction and at specified angle. In position mode, the rotation angle (position) and speed are controllable. PA4=1: Speed mode; The rotation direction and speed are determined by the analog voltage or parameters. The servo unit makes the rotor rotate in the determined direction and speed. This mode not only improves the motor response capability, but also enhances the capability of anti-disturbance. PA4=2:（Reserved） PA4=3: （Reserved） PA4=4: （Reserved） PA4=5: （Reserved） PA4=6: （Reserved） PA4=7: （Reserved） PA4=8: （Reserved） PA4=9: Manual mode It is operated in Sr— menu. Acceleration/deceleration can be performed through keys ▲，or ▼'. PA4=10: JOG mode; It is operated in Jr—menu. The motor works at the JOG speed set by parameter. CCW/ CW rotation can be selected through keys ▲ or ▼'. PA4=11: Encoder zeroing It is adjusted already before leaving factory and the user does not adjust it. PA4=12: Analog zeroing It is adjusted already before leaving factory and the user does not adjust it.				
PA5	Position command mode selection	0~2	0		P
	PA5=0: Pulse + Direction PA5=1: CCW/CW PA5=2: two-phase orthogonal input（Refer to Section 3.3.3 Input Command Explanations）				
PA6	Speed command mode selection	0~2	0		S
	PA6=0: －10V～＋10V analog voltage; PA6=1: 0～＋10V analog voltage; PA6=2: Internal speed.				
PA11	Communication mode selection	0~1	0		P,S
	PA11=0：No communication PA11=1：Can bus communication				

P: Position Control Mode   S: Speed Control Mode

Parameter No.	Meaning	Range	Default Value	Unit	Applicable Mode
PA15	★Speed loop proportional gain 1	5~2000	300	Hz	S
	The bigger the speed loop proportional gain, the greater the servo rigidity is. However, excessive value may easily lead to vibration (abnormal sound in the motor) during motor start or stop. The smaller the value is, the slower response is.				
PA16	★Speed loop integral time coefficient 1	10~1000	100		,S
	The greater the speed loop integral time constant value is, the quicker the system responds. However, excessive value may lead to instability of the system, or even cause vibration. Smaller value results in slower response, so, set the value as great as possible on condition that no vibration is generated.				
PA17	★Current command low pass filter	1~2048	800		P,S
	It is used to limit the current command belt, and avoid current rush and vibration. Set the value as great as possible on condition that on vibration is generated.				
PA18	★Speed feedback filter coefficient	10~4000	800		P,S
	The greater the speed feedback filter coefficient is, the quicker the speed feedback responds. However, excessive value may lead to electromagnetic noise. Smaller value results in slower response, larger speed fluctuation, or even vibration.				
PA19	★Position loop proportional gain 1	20~1000	40		P
	The greater the position loop proportional gain is, the quicker the response is and the greater the rigidity is. However, excessive value may lead to vibration during the motor start or stop. Smaller value results in slower response and greater following error.				
PA25	Position loop feedforward gain	0~100	0	%	P
	Position loop feedforward gain is to adjust the speed loop according to the speed information of position command. The greater the value is, the quicker the response is, and the smaller the following error is. However, excessive setting value may lead to instantaneous overshoot and vibration. When PA25 is set to 0, the position feedforward function is invalid.				
PA26	Position loop feedforward filter coefficient	10~3000	2000		P
	Position loop feedforward filter coefficient is used in the smoothing process of position command feedforward control. The greater the value is, the quicker the step response is, which will suppress the overshoot and vibration caused by sudden speed change. It is valid when PA25 is not set to 0.				
PA28	Position command direction reversed	0~1	0		P
	PA28＝0：remains the original commanded direction; PA28＝1：the input pulse direction is reversed.				
PA29	Pulse multiplication frequency of position command	1~32767	1		P
	（Refer to section 6.4.1 Electronic Gear Ratio）				
PA30	Pulse division frequency of position command	1~32767	1		P
	（Refer to section 6.4.1 Electronic Gear Ratio）				

P: Position Control Mode　**S: Speed Control Mode**

Parameter No.	Meaning	Range	Default Value	Unit	Applicable Mode
	Position arrival range	0~30000	20	Pulse	
PA31	When the position following error (displayed as DP-EPO in the menu) is less than or equal to the setting value of PA31, it means the position is reached, and position reached signal COIN outputs ON, otherwise, COIN outputs OFF.				
	Position deviation range	0~30000	400	×100 pulse	P
PA32	In position model, when the position following error exceeds the value set by parameter PA32, an alarm is generated. （Refer to Section 8.2 Err-4 for remedy）				
	Position feedback output is reversed	0~1	0		P，S
PA34	PA34＝0: maintain the original PAO, PBO phase relationship of CN1 position feedback output signal; PA34＝1，reverse the relationship between phases PA, PB of position feedback output signal. Shown is the following figure:				
	Multiplication frequency coefficient of position output pulse(reserved)	1～32	1		S
PA35	It is valid when the position feedback input signal is an incremental encoder signal. Set the pulse quantity of output position feedback signal (PA+, PA-, PB+, PB-) of the servo drive unit. When it forms the position closed-loop system with the PC, the position feedback signal of CN1 interface outputting to PC executes the electronic gear ratio change, which can meet devices with different gear drive ratio or screws with different pitch.				
	Division frequency coefficient of position output pulse	1～32	1		S
PA36	It is valid when the position feedback input signal is an increment encoder one. The parameter usage is referred to PA35. When the setting requirement of position feedback outputting pulse gear ratio is PA36≥PA35. When PA36<PA35, PA=PA35 output is executed.				

P: Position Control Mode   S: Speed Control Mode

Parameter No.	Meaning	Range	Default Value	Unit	Applicable Mode
PA37	Pulse quantity of position feedback output	16～32767	10000	Pulse	P,S
	When the motor encoder signal is an absolute encoder one, the position feedback output pulse quantity corresponding to the motor per rotation is set. It is calculated according to the machinery and the PC's command unit. Example: As the above figure, PA37 value means to count according to the edge signal of A/B phase pulse, i.e. one time is counted when one edge signal is received. So, PA37=64 means the pulse quantity of servo drive unit outputting PAO (or PBO) is 16 when the motor rotates one circle. Example: PA37=10000, the actual position outputting PAO phase or PBO phase quantity is:$$\text{Pulse quantity of PAO phase or PBO phase} = \frac{10000}{4} = 2500 \text{（pulse/rev）}$$				
PA51	When the analog speed command is valid, the motor rotation direction is reversed	0~1	0		S
	①When external analog voltage range is -10V~10V (PA6=0): PA51=0: Positive voltage corresponds to motor CCW rotation, negative voltage corresponds to motor CW rotation. PA51=1: Negative voltage corresponds to motor CCW rotation, positive voltage corresponds to motor CW rotation. ②When external analog voltage range is 0V~10V (PA6=1): PA51=0: SFR is ON, motor performs CCW rotation, SRV is ON, motor performs CW rotation; PA51=1: SFR is ON, motor performs CW rotation, SRV is ON, motor performs CCW rotation.				
PA52	★Servo analog command gain	0~350	250	r/min	S
	Set the motor rotation speed corresponding to 10V analog voltage. When the rated rotation speed corresponding to 10V is 2500r/min, this value is set to 250.				
PA54	★Maximum speed limit of speed command	1~3500	2500	r/min	P，S
	The maximum speed of motor is limited by PA54.				
PA55	Filter coefficient of analog speed command	1~3000	1000		S
	The smaller the analog command filter coefficient value is, the stronger the anti-disturbance capability is. However, when the value is too small, the response to the speed command will be slower; the greater the value is, the weaker the anti-disturbance capability is, and the quicker the response is.				
PA56	Analog command zero-drift compensation	-30000~30000	0	r/min	S
	Sometimes, when the command voltage is 0V, the motor still rotates at slowest. This is due to the slight "drift" of the PC or external command voltage. If zero-drift phenomenon occurs on a motor, modify the drift value to 0V in PA56.				

P: Position Control Mode　　S: Speed Control Mode

Parameter No.	Meaning	Range	Default Value	Unit	Applicable Mode
PA61	Valid range of speed arrival	0～100	10	%	S
	In speed mode, when the actual speed=［commanded speed×（100－PA61）%～ commanded speed×（100＋PA61）%］, corresponding optical coupler conducts when signal PSR is output. (see section 6.5.2 for details)				
PA62	Valid range of zero-speed output	0~1000	10	r/min	P, S
	When the actual rotation speed is less than or equal to the valid rang, corresponding optical coupler conducts when signal ZSP is output.				
PA118	Internal compulsive enable	0～1	0		P, S
	In case there is no SON input signal, the motor is enabled in servo unit compulsively. PA118=0: The motor is enabled only when the external input signal SON is on. PA118=1: The motor is enabled in the servo unit compulsively; signal SON is not needed.				
PA122	Alarm output reverse	0～1	0		P, S
	PA122=0:When a servo unit alarm is generated, ALM signal is output and optical coupler conducts. PA122=1:When a servo unit alarm is generated, ALM signal is output and optical coupler does not conduct.				
PA124	Set JOG run speed	－3000～3000	120	r/min	S
	It sets the running speed in JOG mode. The running mode is set by PA4.				
PA125	Torque limit in Manual or Jog mode	0～300	100	%	S
	Its setting value is percentage of motor's rated torque. The motor's output torque is limited by it.				
PA126 ～PA128	Inner speed 1～3	-3000~3000	500	r/min	S
PA133	Internal CCW torque limitation	0～300	300	%	P,S
PA134	Internal CW torque limitation	-300～0	-300	%	P,S
	It set the internal torque limitation value of servo motor CCW, CW rotation, and its setting value is percentage of rated torque. In any mode, two torque limitations are valid. When the setting value exceeds the system's permissive max. load, the actual torque limitation is the multiple of the system's permissive max. load.				
PA135	External CCW torque limitation	0～100	100	%	P,S

Table within PA126～PA128 row:

Default value of digit command	Run speed	Select the I/O state of speed	
		SEC1	SEC2
	0 r/min	OFF	OFF
PA126＝500	Internal speed 1	ON	OFF
PA127＝-100	Internal speed 2	OFF	ON
PA128＝1000	Internal speed 3	ON	ON

P: Position Control Mode　　S: Speed Control Mode

Parameter No.	Meaning	Range	Default Value	Unit	Applicable Mode
PA136	External CW torque limitation	-100～0	-100	%	P,S
	It sets the external torque limitation of servo motor CCW, CW rotation. When the input point CCW torque limitation (FIL) is ON, PA135 is valid; when the input point CW torque limitation (RIL) is ON, PA136 is valid. When the setting value exceeds the system's permissive max. load, the actual torque limitation is the max. load of the system permissive max. load.				
PA137	Position deviation alarm check selection	0～1	1		P
	In Position mode, the servo drive unit outputs Err-4 position deviation alarm when the following error exceeds PA32 setting range. PA137＝0：do not check position deviation alarm; PA137＝1：check the position deviation alarm.				
PA138	Drive prohibition function selection	0～1	1		P,S
	PA138＝0：drive prohibition function is invalid. PA138＝1: when FSTP is OFF, the servo motor rotation CCW is prohibited; when RSTP is OFF, the servo motor rotation CW is prohibited; When FSTP and RSTP are OFF simultaneously, the Err-7 fault occurs.				
PA139	Open phase alarm check selection	0～1	1		P,S
	When the 3–phase input power supply lacks one phase, the servo drive unit outputs Err-21 open phase alarm. PA139＝0：do not check the open phase alarm; PA139＝1：check the open phase alarm.				
PA143	Brake time	10～32000	600	ms	P,S
	（It is debugged by the factory and is not changed by the user！）				
PA145	Overcurrent time	0～32000	20	ms	P,S
	（It is debugged by the factory and is not changed by the user！）				
PA146	Alarm time for speed regulator being saturation for long time	0～30000	1000	ms	P,S
	（It is debugged by the factory and is not changed by the user！）				
PA147	Permit max. motor deceleration time before the safe brake being working.	0～30000	30	ms	P,S
	When the safe brake locks the running motor, the motor must decelerate firstly, in the deceleration time set by PA148, when the motor speed is motor PA149 setting speed, the safe brake is forced to lock the motor shaft. Refer to Section 6.2.				
PA148	Delay time for servo lock	0～30000	100	ms	P,S
	When the safe brake is needed to lock the motor, it is necessary to cut off SON signal after the motor stops (servo drive unit is locked), and then the safe brake is locked. In the course of the servo lock state to the safe brake lock state, the servo lock state must delay to behind PA147, which ensure the motor shaft does not change when the safe brake works. Refer to Section 6.2.				
PA149	Motor speed when safe brake being working	5～3000	30	r/min	P,S
	Permissive max. motor speed when the safe brake being working. Refer to Section 6.2				

P: Position Control Mode   S: Speed Control Mode

Parameter No.	Meaning	Range	Default Value	Unit	Applicable Mode
PA155	GSK-CAN communication baudrate selection	1～4	1		P,S
	PA155=1：baudrate is set to 500k; PA155=2：baudrate is set to 600k; PA155=3：baudrate is set to 800k; PA155=4：baudrate is set to 1M.				
PA156	GSK-CAN servo axis numbers	1～5	1		P,S
	There are more than one servo unit that has built up serial port communication with CNC; therefore, setting a servo axis number corresponding to CNC system makes it easy to control a servo unit. Do not set a repeat servo axis number for the same CNC system.				

The default setting of parameters marked with '★' is related to the motor model; therefore, the default value varies with motors.

Chapter Eight ABNORMALITY and TROUBLESHOTTING

> ⚠️ **Caution**
> When the servo drive unit or motor is needed to be dismantled for inspection or maintenance, please contact our technical personnel
> ■ or operate under guidance of professionals.
> ■ Once an abnormality occurs in servo drive unit, inspection or maintenance can only be done after cutting off the power for more than 5min till the "CHARGE" light is off to avoid residual voltage.

8.1 Abnormality for Abnormal Operations

8.1.1 Speed mode

Abnormality	Possible Reason	Check and Remedies
In analog command speed mode, the motor does not work when a speed command is specified..	1. The servo unit is in alarm state.	Clear the alarm or turn ON the power.
	2. Wrong working mode or wrong command mode is selected.	Check the setting of PA4 and PA6.
	3. No enable signal is input.	Check whether the SON connection is correct. Check $\boxed{dP - \ In}$ to see whether the enable signal is connected, or set PA118 to 1, to enable the motor compulsively.
	4. FSTP or RSTP is OFF.	1. Set PA138=0 when the drive prohibition function is not used. 2. Check the correctness of SFR or SRV connection, or check $\boxed{dP - \ In}$ to see whether the enable signal is connected.
	5. No 24V for the I/O connection line.	Check whether the GND and COM+ ends are 24V with a universal meter.
In analog command speed mode, motor rotates in single direction.	1. The command voltage is 0~10V, and the PA6 is set to 0 by mistake, therefore, the motor cannot perform reverse rotation.	Set the PA6 to 1; when SFR is ON, motor performs CCW rotation; when SRV is ON, motor performs CW rotation;
	2. Command voltage is 0~10V, PA6 is set to 1, but the signal SFR or SRV is invalid;	Check the input state of SFR or SRV through $\boxed{dP - \ In}$, and examine the signal connection to find out the reason.
	3. The command voltage is 0~10V, but the signal wires VCMD+ and VCMD- are connected inversely.	When signal wires VCMD+ and VCMD- are connected inversely, the motor rotates in single direction and the speed is uncontrollable. Turn off the power immediately to check the signal wires.
Large vibration occurs when the motor is running.	1. Improper speed loop gain setting	Restore the motor default parameter or manually set the PA15, PA16, PA18 according to section 6.1.1.
	2. Incorrect shielding line connection	Connect the line according to the connection diagram in speed mode described in section 3.3.2.
	3. Dynamic balance connected with	Perform dry run without the motor shaft, if the

	motor shaft is poor.	vibration disappears, then, re-adjust the dynamic balance.
Big vibration when motor is started and stopped.	The load inertia is large.	Reduce the speed loop integral time or lower down the motor rotation speed.
The temperature of servo unit or motor is too high;	1. Mechanical fault;	Disconnect the motor shaft and mechanical device for motor dry run. Usually, the no-load current is 0.2 times of the rated current. If the no-load current is proved to be normal, the problem may lie in large friction or running obstruction, or may be the servo device model is smaller than needed.
	2. The motor has a safe brake, and when the motor runs, the safe brake is not fully released.	Refer to (Section 6.2) to check the hold control circuit. The safe brake is fully released when the motor runs.
	3. The motor or servo unit is not grounded, which leads to interference to the servo unit, instability and high temperature of the motor.	Refer to Chapter 3 for details about grounding.

8.1.2 Position mode

Abnormality	Possible Reason	Check and Remedies
In position mode, when a pulse command is specified, the motor does not work.	1. The servo unit is in alarm state.	Clear the alarm or power on again.
	2. Wrong working mode or command mode is selected.	Check the setting of PA4, PA5.
	3. No enable signal is input.	Check whether the SON connection is correct. Check $\boxed{\text{dP - In}}$ to see whether the enable signal is connected, or set PA118 1, to enable the motor compulsively.
	4. 24V for the I/O connection line.	Check whether the GND and COM+ ends are 24V with a universal meter.
	5. When the command signal is connected at single terminal, the serial connection current-limiting resistance is wrong, which maybe damage the servo drive unit and cannot receive the pulse.	Select correctly the serial resistance according to (Section 3.3.3 Position Command Input) for the single terminal connection.
Large motor running vibration.	Inappropriate setting of speed loop proportional gain and integral coefficient. (PA15, PA16) Inappropriate setting of position loop proportional gain.(PA119)	Restore the motor default parameter or manually modify the parameter according to Section 6.1.1 (PA15, PA16, PA19).
	2. The command shield wire is not correctly connected, which influences the speed command.	Refer to Section 3.3.3 for the position command connection.
	3. Mechanical dynamic balance connected with the motor shaft is too bad or the linkage assembly at the motor shaft is improper.	The drive unit comes away the motor shaft to run, the vibration disappears, the linkage assembly or the mechanical dynamic balance is adjusted again.

Inaccurate position control	1. Electric gear ratio setting error;	Correct the electronic gear ratio according to Section 6.4.1.
	2. External interference causes the received pulses inaccurate.	When the command pulses are less than pulses displayed on dP-CPo, it means there is external interference. A. Use difference circuit as far as possible; B. Connect the shielding line correctly. C. Keep far away from the interference source. D. Add first-order RC circuit for wave filtering.
	3. When the pulse command is input (the drive unit is connected to single end), the current-limit resistance is not connected in series correctly.	Refer to the position command wiring diagram in Section 3.3.3.
	4. Machine connection failure	When the command pulses equal to the pulses displayed on dP-CPo (the pulses after electronic gear ratio calculation), it means the system controlled side is normal. Check whether the machine connection is loose or faulty.
The motor hunts greatly during start or stop.	The load inertia is great. The acceleration/deceleration time corresponding to PC commands are too small.	Increase the acceleration/deceleration time for smooth start or stop, or reduce the position loop proportion gain.

8.2 Alarms and Remedies

The servo drive unit is provided with multiple protection functions. When a fault is detected after power-on, the servo will stop the motor, and Err-□□ will be displayed on the operation panel. The alarm code can also be checked under menu dP-Err. This section also offers remedies for troubleshooting.

Alarm No.	Meaning	Main Reason	Remedy
Err-1	Motor speed exceeds the setting value of parameter PA54.	1. The encoder feedback signal is abnormal;	Check the motor and encoder and their signal connection state
		2. Parameter PA54 (peak speed limit) is set too small or encoder lines setting is smaller than the actual encoder lines;	Change a servo drive unit.
		3. Control panel fault	Change a servo drive unit.
Err-2	Main circuit DC bus voltage is excessive.	1. Braking resistor is disconnected or damaged;	Check braking resistor and its connection.
		2. Braking resistor is unmatched (resistance value is excessive) Note: Smaller resistance means greater current, which will easily cause damage to the braking pipe of the braking circuit.;	A. Change to a new braking resistor whose resistance is matched with the power. B. Reduce the ON/OFF frequency according to actual usage. C. Increase acceleration/deceleration time.

		3. Power supply voltage is instable;	Check the power supply.
		4. Internal braking circuit is damaged.	Change the drive unit.
Err-3	Main circuit DC bus voltage is too low	1. The input power capacity is insufficient, which leads to low voltage;	Check the power capacity and electrical control cabinet.
		2. When it occurs when the power is turned ON, it means the servo unit control panel is faulty.	Change a servo drive unit.
Err-4	The value in position deviation counter exceeds the setting value (refer to the range set by parameter PA32); (When PA137=0, detects the position deviation alarm, when PA137=1, does not detects the position deviation alarm)	1. The pulse command frequency is too high or the electronic gear ratio is too large;	Check the command frequency of principal PC; check the electronic gear ratio set by PA29/PA30.
		2. The load inertia is excessive or the drive unit torque is insufficient;	1. Motor parameter setting is wrong, call motor's default parameter; 2. Increase the drive unit and motor power; 3. Lighten the load.
		3. Motor encoder fault or wrong encoder line number;	Check the motor encoder and its connection.
		4. the motor U, V, W phase sequence is wrong;	Check motor wiring.
		5. The position loop or speed loop gain setting is too small (refer to parameter PA15, PA16, PA19);	Adjust the speed loop or position loop gain.
		6. The valid range of position deviation is set too small.	Set the PA32 correctly.
Err-5	Alarm for the motor's excessive temperature (Err-5 alarms when the motor's overheat protection function is used)	1. The motor loads for long time;	Reduce the load or increase the power of the motor and the drive unit.
		2. Start/stop frequency is high with heavy load;	Reduce start/stop frequency, and improve the motor's radiating condition.
		3. Check device of the motor's temperature is damaged, or the motor's internal is fault or radiating fan is damaged;	Change the motor.
		4. Check signal of the motor's temperature is normal and the control plate of the servo unit is fault.	Change the drive unit.
	Note: Presently, GSK's motor has no temperature sensor, and default device of its drive unit has no alarm function for the motor's excessive temperature. If necessary, the user can contact with GSK's technical department.		
Err-6	Speed amplifier saturation failure	1. U,V,W phase are connected reversely;	Connect correctly U,V,W.
		2. The motor's default parameter is wrong or the motor's characters are bad;	Check the motor model code corresponding to PA1, and call correctly the motor's default parameter.
		3. The torque limitation is too small and the motor rigidity is not enough;	Increase the torque limitation value （PA133～PA136）to increase its rigidity.
		4. The mechanical device connected with the motor shaft is blocked, which	Resolve the mechanical fault.

		causes the drive current is too big.	
Err-7	The drive prohibition is abnormal (occurs when PA138=1)	FSTP,RSTP drive prohibition input terminal is OFF.	A. Check the connection and 24V power supply of 24V. B. When the drive prohibition function is not used, PA138＝0，the alarm is shielded.
Err-8	Position deviation counter overflow（it occurs when Err-4 alarm is shielded）	1. The electronic gear ratio of position command is set too large;	Check the setting of PA29, PA30.
		2. The input command pulse is abnormal.	Ensure the PC command pulse frequency is not more than 1M.
Err-9	The motor encoder signal feedback is abnormal.	1. Motor encoder signal wire is poorly or wrong connected;	Check the connector and signal wire welding condition.
		2. The motor encoder signal feedback cable is too long, causing lower signal voltage;	Shorten the cable length within 30m.
		3. The motor encoder is damaged;	Change a motor or encoder.
		4. Servo unit control panel is faulty.	Change a servo unit.
Err-11	Servo unit internal IPM module failure	1. It occurs when the power is ON, and the drive unit is not enabled. It cannot be removed after power-on. A. drive unit failure B. Short circuit occurs when braking resistor terminal is grounding	Remedy for reason A is to change to a new drive unit. Remedy for reason B is to check the correct the braking resistor connection.
		2. It occurs when the power is ON, and the drive unit is not enabled. It is removed after power-on again.	It may be caused by external interference or poor grounding. Check the grounding status and interference source.
Err-11	Internal IPM module failure of servo drive unit	3. It occurs when the power is turned ON, and the drive unit is enabled. It cannot be removed after power-on. A. short circuit occurs among motor power line U, V, W, or between U, V, W and PE. B. The drive unit IPM module is damaged. C. The sample circuit of the drive unit's current is OFF.	The remedy for reason A is to change the motor line or the motor. The remedy for reasons B,C is to change the drive unit.
		4. It occurs when the motor is starting or stopping and it can be removed after re-power-on. A. The default parameter of the motor set by drive unit is wrong. B. Then load inertia is too large; the commanded accelerated speed is too large during starting or stopping.	The remedy for reason A is to restore the motor default parameter; The remedy for reason B is to increase the acceleration/ deceleration time, lower down the accelerated speed or load inertia.
Err-12	Alarm for overcurrent	1. Motor runs for long time with the excessive rated torque;	Reduce the load or change a motor with a bigger motor.
		2. The grounding is bad;	Ensure the grounding resistor must be less than 10Ω.
		3. The motor's insulation is damaged.	Change a motor.

Err-16	Motor's heat is overload	1. The motor's rated current parameter setting is wrong.	Set correctly the drive unit's parameter according to the motor brand.
		2. The motor runs for long time with excessive rated current.	A. Reduce the load; B. Change the drive unit and the motor with more power; C. Check if the mechanical part is abnormal.
Err-17	Braking time is too long	1. The input power voltage is excessive for a long time.	Apply a power which meets the working needs of servo unit.
		2. The braking resistance is too large. The energy cannot be released during braking, causing the rise of internal DC voltage.	Change a correct brake resistor.
Err-18	No braking feedback corresponds to braking enable signal	1. Braking circuit fault;	Change a servo drive unit.
		2. Excessive braking resistance;	Measure the braking resistance with a universal meter, and change a correct braking resistor.
Err-19	The DC bus voltage is excessive, but there is no braking.	1. Braking circuit fault;	Change the servo drive unit.
		2. Open circuit occurs on braking resistor or the braking resistor is not connected.	Check the connection of braking resistor.
Err-20	EEPROM alarm occurs in the servo unit after power-on.	1. Servo unit fails to read the data in EEPROM when power-on.	Restore the motor default parameter.
		2. EERPOM chip or circuit panel fault;	Change the servo unit.
Err-21	Open phase of power supply alarms	3-phase input power supply is open phase.	Check the input power supply.
Err-23	The current sample is wrong	1. The working voltage of current sensor is abnormal or the component is damaged.	Change the drive unit.
		2. The current sample circuit and the sample resistance are damaged.	
Err-28	Software upgrading parameter error	Parameters are not modified and saved after the software recording or upgrading.	Restore the default parameters and re-power on after the parameters are saved.
Err-29	Parameter error detected after power-on	Conflict occurs when software upgrading.	Re-write the parameter and turn on the power again.
Err-30	Excessive AC input voltage alarm	The three-phase AC power input voltage exceeds 115% of the rated voltage.	Adjust the grid voltage or increase some power-stabilizing devices such as AC reactor, AC filter.
Err-32	Encoder UVW signals are illegal codes.	1. The interface connection is not stable or the cable shield is bad;	Check the encoder's interface and shield wiring.
		2. The encoder UVW signals are damaged;	Change the encoder.
		3. The encoder's interface circuit is fault.	Change the drive unit.
Err-33	The power supply charge is fault	The charge circuit is damaged	Change the drive unit.
Err-34	Excessive pulse electronic gear ratio	The setting of gear ratio is inappropriate.	Re-set parameter PA29/PA30 correctly.

Err-35	The external brake pipe is fault	1. PA225 setting is wrong;	Set correctly PA225
		2.The brake pipe is damaged.	Change the drive unit.
Err-36	Three-phase main power down	1. 3-phase main power supply is power down or drops instantly;	Check the main power; ensure the power can be input regularly.
		2. Three-phase main power detection circuit is faulty.	Change the servo unit.
Err-37	Alarm occurs when the temperature of radiator is below -20℃.	The environmental temperature is too low.	Improve the environmental temperature.
Err-38	Alarm occurs when the temperature is higher than 75℃.	1. The motor overload running for a long time;	Reduce the load.
		2. The environmental temperature is too high;	Improve the ventilation condition.
		3. The servo drive unit is damaged.	Change the drive unit.
Err-39	For the absolute encoder, the read data is wrong in sensor mode.	1. PA1 parameter setting is wrong;	Call the correct motor's default value.
		2. The encoder feedback CN2 is disconnected or its connection is not stable.	Check CN2 wiring.
		3. The absolute encoder is damaged.	Change a new motor.
Err-42	Reading EEPROM in the absolute encoder is wrong	1. PA1 parameter setting is wrong;	Call the correct motor's default value.
		2. When power on, the drive unit reading the encoder EEPROM is wrong;	Check the encoder feedback CN2 wiring.
		3. The motor's encoder EEPROM is damaged.	Change the motor.
Err-43	The check is wrong when EEPROM is read in the absolute encoder	1. PA1 parameter setting is wrong;	Call the correct motor's default value.
		2. When power on, the data check is wrong after the drive unit reads EEPROM.	Execute Ab-Set encoder write operation.
Err-44	Allocation between single-circle and multi-circle of the encoder are wrong	PA1 parameter setting is wrong.	Call the correct motor's default value.
Err-45	The encoder data's check is wrong	The data check is wrong in sensor mode when the encoder's current position is read.	Check the grounding.

8.3   Remedies for not Displaying Alarm Code

Abnormality	Check items	Reasons
1. Not display when power on.	Fault exists when CN1,CN2,CN3 are pulled out;	A. The supply voltage is fault; B. The servo drive unit is fault.
	Fault exists when CN1, CN2 or CN3 is pulled out.	The signal wiring is short circuit.
2. 'POWER' indicator on panel is OFF.	Fault exists when CN1,CN2,CN3 are pulled out;	A. The supply voltage is fault; B. The servo drive unit is fault.
	Fault exists when CN1, CN2 or CN3 is pulled out.	The signal wiring is short circuit.
3. Power supply breaker trips after power on.	The drive unit is normal after it is turned on again;	More AC capacitance charging current in the drive unit is caused. The breaker is ON/OFF once or twice, and the drive unit is normal.
	The breaker still trips after the drive unit is turned on two or three times, please check the main circuit wiring.	A. The servo drive unit is fault and its internal is short circuit. B. The main circuit connection is wrong, or lead wire of the brake resistance, and the motor U, V, W are short circuit.
4. The servo drive unit is ON and the motor is free state, but they are turned off.	Check if its monitor window of the drive unit appears an alarm message;	There is alarm message currently. Refer to Section 8.2.
	Check $\boxed{\text{dP- In}}$, judge whether SON signal is connected. Judge whether SFR (or SRV) is connected in Analog command speed mode.	I/O signal wiring is wrong.
5. The servo drive unit enable and the motor be activated but the motor does not run.	1. Monitor $\boxed{\text{dP- l}}$. When the current is excessive big, exceeds the rated current of motor, the motor comes away the load, the motor can exactly position.	It is for short circuit of the motor's wiring or the motor is blocked for mechanical fault. Refer to Section 8.2.
	2. Monitor $\boxed{\text{dP- l}}$. When the current is excessive big, exceeds the rated current of motor, the motor comes away the load, the motor cannot run.	A. PA1（motor model code）setting is wrong, the motor default parameter should be called again; B. The motor's encoder is fault and the motor should be changed.
	3. Monitor $\boxed{\text{dP- l}}$. When the current is not excessive, does not exceed the rated current of the motor.	A. The working mode selection is wrong（Refer to Chapter Five）; B. The input command has not received（Refer to Chapter Five, check the command signal wire）.
	4. Monitor $\boxed{\text{dP- l}}$, and there is no current.	The servo drive unit is fault.
6. The servo motor runs only with low speed, and cannot be up to high speed.	1. Check whether the command is correct. Monitor $\boxed{\text{dP-CPo}}$ in Position mode, judge the position command ; Check $\boxed{\text{dP-uoC}}$ in Speed mode, judge the analog command;	PC command is fault.

	2. Refer to Appendix II Motor Model Code Table, check PA1 setting. Please set again when the setting is wrong. Execute $EE\text{-}dEF$ recover the default.	The default parameter of the motor is wrong.
	3. The setting of analog command gain is too low（PA52）.	The analog command gain should be modified.
7. The motor cannot run stably, and its speed wave is bigger.	The motor can stably run in Manual mode.	1. The mechanical is fault to check whether the drive part is blocked. 2. The input command is interfered strongly. The motor should be far away from the interference source and the shield wire should be done well.
	In Manual mode, the motor still unstably runs and its speed wave is big.	1. The setting of speed loop proportional gain is improper, and PA5, PA8 should be adjusted; 2. The parameter setting is wrong. Set the motor's default parameter again, specially set the motor's poles and the encoder's lines; 3. The motor's encoder is fault and the motor should be changed.
8. The motor cannot run stably, and its speed wave is bigger.	1. Check whether the acceleration/deceleration time is too short when the motor start/stop. 2. Check whether the parameter settings of speed loop, position loop proportional integral are big. (See Section 6.1 Parameter Setting)	The load inertia is more.
9. The motor is overheat.	1. Check the parameter of the motor model code;	The default parameter of the motor is wrong.
	2. Check radiating passageway;	The motor is blocked by other abnormal things.
	3. Check the environment temperature;	The environment temperature is too high, the radiation devices should be added or improved.
	4. Check the load state whether it exceeds the load.	The load is too weight and it should be reduced.
10. The motor appears abnormal noise.	1. Check whether the speed loop, the position loop parameter are properly set.	The default parameter of the motor is wrong.
	2.Check whether the analog command or the position command is interfered;	The input command is interfered strongly. The motor should be far way from the interference source and the shield wire should be done well.
	3. The motor comes away the load to check whether the load is blocked.	The load has other abnormal to block the run, or the load deforms.
	4. Stop the run at high speed to check whether noise occurs in the motor.	A. The bolt to fix the motor releases; B. The motor's internal is fault.
11. Motor rotates even if the speed command is 0V.	Check the compensation parameter PA56 of analog command zero drift.	Not execute proper zero drift compensation.

8.4　Inspection and Maintenance

- Do NOT use resistance meter or the like to make insulation inspection to the servo unit, otherwise, the servo unit may be damaged!
- Do NOT dismantle or repair the servo unit by yourself!
- Change the encoder backup battery half-yearly!
- Make sure that the average load rate of drive device is below 80%.

Category	Item	Period	Daily Maintenance
Electric cabinet environment	Abnormal odor	Every day	Properly eliminate the odor in time. If it is caused by aging equipment, make a replacement.
	Dust, vapor and oil	Once every month	Remove it with dry clean cloth or filtered high-pressure air gun.
	Power cable, connection terminals	Once every half-year	When the external insulation layer and insulation joints are damaged or aging, make a replacement soon; tighten the loose connection terminals with screw driver.
Servo drive unit	Radiation fan	Once every week	Check whether the wind speed and ventilation amount is normal, and whether the abnormal heating exists. Change the fan if any.
	Dirt retention on cooling plate	Once every month	Remove it with dry clean cloth or filtered high-pressure air gun.
	Loose screw	Once every half-year	Tighten the terminal strip, connector, and installation screw with screw driver.
Servo motor	Noise, vibration	Every day	When the noise or vibration is obviously greater than usual, check the machine connection and repair it.
	Radiation fan	Once every week	Check whether the wind speed and ventilation amount is normal, and whether the abnormal heating exists. Change the fan if any.
	Dust, vapor and oil	Once every month	Remove it with dry clean cloth or filtered high-pressure air gun.
	Measure the insulation resistance	Once every half-year	Measure it with a 500V resistance meter. When the resistance is below 10 MΩ, please contact our technical personnel.
	Motor and load connection	Once every half-year	Check the device wear status, connection and sundries with proper tools.

Appendix A Model Code Parameters and Motors Table

Model Code (set by PA01)	Servo motor model	Model Code (set by PA01)	Servo motor model
PA001=2	110SJT-M020E(A)	PA001=47	130ST-M07720H
PA001=3	130SJT-M075D(A)	PA001=49	130ST-M10015H
PA001=4	130SJT-M100D(A)	PA001=50	130ST-M10025H
PA001=5	110SJT-M040D(A)	PA001=51	130ST-M15015H
PA001=6	110SJT-M060D(A)	PA001=60	150ST-M27020H
PA001=7	130SJT-M050D(A)	PA001=65	80SJT-M024C
PA001=8	130SJT-M100B(A)	PA001=66	80SJT-M024E
PA001=9	130SJT-M150B(A)	PA001=67	80SJT-M032C
PA001=10	110SJT-M020E	PA001=68	80SJT-M032E
PA001=11	110SJT-M040D	PA001=76	110SJT-M040E（A2）
PA001=12	110SJT-M060D	PA001=77	110SJT-M060E（A2）
PA001=13	130SJT-M040D	PA001=78	110SJT-M040D(A2)
PA001=14	130SJT-M050D	PA001=79	110SJT-M060D(A2)
PA001=15	130SJT-M060D	PA001=81	130SJT-M150D(A)
PA001=16	130SJT-M075D	PA001=82	130SJT-M040D(A)
PA001=17	130SJT-M100D	PA001=83	130SJT-M060D(A)
PA001=18	130SJT-M100B	PA001=84	130SJT-M100D(A)
PA001=19	130SJT-M150B	PA001=85	130SJT-M040D（A2）
PA001=20	130SJT-M150D	PA001=86	130SJT-M050D（A2）
PA001=21	130SJT-MZ150B	PA001=87	130SJT-M060D（A2）
PA001=22	175SJT-M180B	PA001=88	130SJT-M075D（A2）
PA001=23	175SJT-M180D	PA001=89	130SJT-M100D（A2）
PA001=24	175SJT-M220B	PA001=90	130SJT-M100B（A2）
PA001=25	175SJT-M220D	PA001=91	130SJT-M150B（A2）
PA001=26	175SJT-M300B	PA001=92	130SJT-M150D(A2)
PA001=27	175SJT-M300D	PA001=93	175SJT-M180B(A2)
PA001=28	175SJT-M150D	PA001=94	175SJT-M180D(A2)
PA001=34	110ST-M02030H	PA001=95	175SJT-M220B(A2)
PA001=35	110ST-M04030H	PA001=96	175SJT-M220D(A2)
PA001=36	110ST-M05030H	PA001=97	175SJT-M300B(A2)
PA001=39	130ST-M04025H	PA001=98	175SJT-M300D(A2)
PA001=45	130ST-M05025H	PA001=99	175SJT-M150D(A2)
PA001=46	130ST-M06025H		

Model Code (set by PA01)	Servo motor model	Model Code (set by PA01)	Servo motor model
PA001=104	80SJT-M024C（A4I）	PA001=168	175SJT-M150D（A4I）
PA001=105	80SJT-M024C（A4SI）	PA001=169	175SJT-M150D（A4SI）
PA001=106	80SJT-M024E（A4I）	PA001=170	175SJT-M180B（A4I）
PA001=107	80SJT-M024E（A4SI）	PA001=171	175SJT-M180B（A4SI）
PA001=108	80SJT-M032C（A4I）	PA001=172	175SJT-M180D（A4I）
PA001=109	80SJT-M032C（A4SI）	PA001=173	175SJT-M180D（A4SI）
PA001=110	80SJT-M032E（A4I）	PA001=174	175SJT-M220B（A4I）
PA001=111	80SJT-M032E（A4SI）	PA001=175	175SJT-M220B（A4SI）
PA001=120	110SJT-M020E（A4I）	PA001=176	175SJT-M220D（A4I）
PA001=121	110SJT-M020E（A4SI）	PA001=177	175SJT-M220D（A4SI）
PA001=122	110SJT-M040D（A4I）	PA001=178	175SJT-M300B（A4I）
PA001=123	110SJT-M040D（A4SI）	PA001=179	175SJT-M300B（A4SI）
PA001=124	110SJT-M040E（A4I）	PA001=180	175SJT-M300D（A4I）
PA001=125	110SJT-M040E（A4SI）	PA001=181	175SJT-M300D（A4SI）
PA001=126	110SJT-M060D（A4I）	PA001=182	175SJT-M380B（A4I）
PA001=127	110SJT-M060D（A4SI）	PA001=183	175SJT-M380B（A4SI）
PA001=128	110SJT-M060E（A4I）		
PA001=129	110SJT-M060E（A4SI）		
PA001=140	130SJT-M040D（A4I）		
PA001=141	130SJT-M040D（A4SI）		
PA001=142	130SJT-M050D（A4I）		
PA001=143	130SJT-M050D（A4SI）		
PA001=144	130SJT-M060D（A4I）		
PA001=145	130SJT-M060D（A4SI）		
PA001=146	130SJT-M075D（A4I）		
PA001=147	130SJT-M075D（A4SI）		
PA001=148	130SJT-M100B（A4I）		
PA001=149	130SJT-M100B（A4SI）		
PA001=150	130SJT-M100D（A4I）		
PA001=151	130SJT-M100D（A4SI）		
PA001=152	130SJT-M150B（A4I）		
PA001=153	130SJT-M150B（A4SI）		
PA001=154	130SJT-M150D（A4I）		
PA001=155	130SJT-M150D（A4SI）		

Appendix B   Peripheral Equipment

B.1   External brake resistor

① Brake resistor model:

RXLG   500W   22R   J   J

Connection mode: M：terminal J：lead wire

Resistivity precision   K：±10%，J：±5%

Brake resistance value: 22R means to 22Ω

Brake resistance power ：100W～2000W

Product code
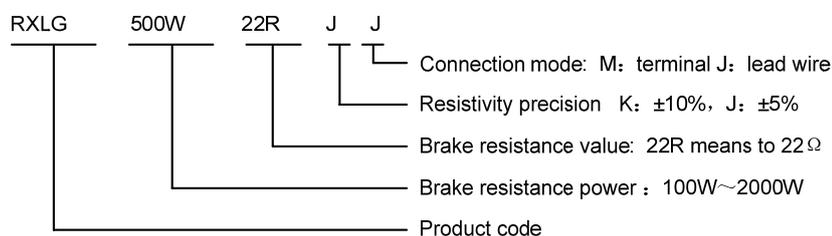
② Brake resistor dimension
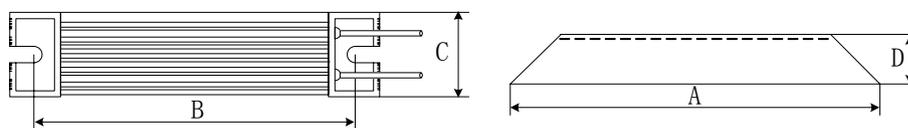
Servo drive unit	Brake resistor specifications （W/Ω）	Size （mm）				Wiring （mm²）	Lead wire lenght（m）	Terminal
		A	B	C	D			
GS2025T, GS2030-T	300/30(optional)	215	205	60	30	2.5	1	M5
GS2045T, GS2050-T	500/22(optional)	335	325	60	30	2.5	1	M5
GS2075-T	800/15	420	410	61	59	2.5	1	M5
GS2100-T	1200/10	485	473	50	107	2.5	1	M5

③ Installation interval of the brake resistor

＞100mm

＞150mm   ＞150mm

Drive unit and other devices
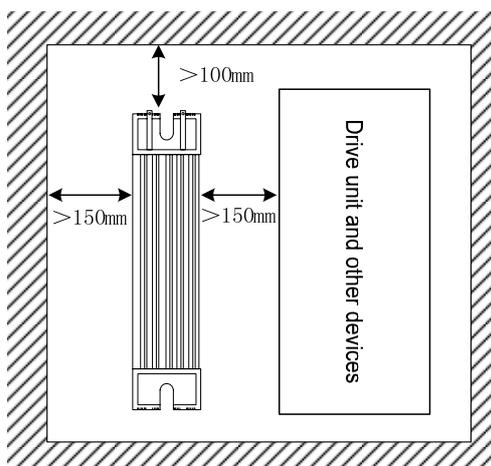
⚠️ Danger　1. When the servo drive unit is turned off or running, the surface of the brake resistor appears high pressure, high temperature. Do not touch!

2. Please install isolation shield!

3. When the servo drive unit is being checked or maintained and after it has been OFF for 10 min, the servo drive unit can be touched after the surface temperature of the brake resistor is reduced to the room temperature!

4. Surface temperature of the aluminum shell brake resistor reduces after the servo drive unit is turned off!

B.2　Circuit Breaker and Contactor (Necessary)

Circuit breaker and contactor should be installed between input power and AD servo unit. They are not just the power switch of servo unit but also a protection method for the power.

- Circuit breaker is a protection switch which can cut off the faulty circuit automatically. It can protect the circuit in case of overload, short circuit or undervoltage. To fully exert the servo unit overload capability, it is advised to choose the power distribution protection circuit breaker.
- AC contactor is to control the ON/OFF of the drive unit through electric protection circuit. It can cut off the power once a system fault is detected, to prevent the fault from expanding.

The following technical data table is for your consideration.

Servo drive unit	GS2025T	GS2030T	GS2045T	GS2050T	GS2075T	GS2100T
Adaptive motor current I(A)	I≤4	4＜I≤6	6＜I≤7.5	7.5＜I≤10	10＜I≤15	15＜I≤29
Rated current of circuit breaker (A)（AC380V）	6	6	9	9	20	30
Rated current of contactor (A)（AC220V）	9	9	15	15	30	42

NOTE　The breaker's rated current data described in the above table meets AC380V voltage class. When the user has used 3-phase AC220V and do not need an AC isolation transformer, the breaker should select AC220V voltage class, and the rated current data should be consistent with the rated current class of the contactor.

B.3　Three-phase AC filter (recommended)

Three-phase AC filter is a passive low-pass filter. The frequency range is 10kHz～30MHz. It is used to suppress the high-frequency noise from the power end of servo unit. When other equipments are interfered by this noise, the three-phase AC filter is recommended.

The following technical data table is for your consideration.

Servo drive unit	GS2025T	GS2030T	GS2045T	GS2050T	GS2075T	GS2100T
Adaptive motor's current I(A)	I≤4	4＜I≤6	6＜I≤7.5	7.5＜I≤10	10＜I≤15	15＜I≤29
Rated current of 3-phase AC filter （A）	9	9	15	20	30	42
Rated voltage of 3-phase AC filter （V）	AC220V					
Leakage current of 3-phase AC filter （mA）	≤5mA					

Attentions for filter installation:

➢ Make sure the metal shell of the filter and electric cabinet is well connected and grounded;

➢ There should be a certain distance between filter input and output lines (parallel connection is forbidden) in case that the effectiveness of the filter is reduced;

➢ The filter should be installed at the entrance of power line to the device, and the filter input line in the cabinet should be as short as possible, so as to lower down the radiation interference.

B.4 Isolation transformer (necessary)

The isolation transformer providing the power supply for the servo drive unit can reduce the interference from the power supply and the electromagnetic field to the servo drive unit. Its model selection should be according to rated capacity, load rate and of the drive unit:

① Servo motor power ≥1kW: must use 3-phase isolation transformer to provide power supply;

Single axis: isolation transformer capacity ≥ servo motor power ×80％ is suitable, and the user can select the isolation capacity according to 70%-100% of the servo motor power;

② Two or more axes: isolation transformer capacity ≥ total motor power ×70％ is suitable, and the user can select the isolation capacity according to 60%-80% of the total servo motor power.

Table B-1　isolation transformer specifications

Model	Capacity（kVA）	Phase	Input voltage(V)	Output voltage(V)
BS--120	1.2	3-phase	380	220
BS--200	2.0			
BS--300	3.0			
BS--400	4.0			
BD--80	0.8	Single-phase		
BD--120	1.2			

The following figure is isolation transformer dimension, unit：mm
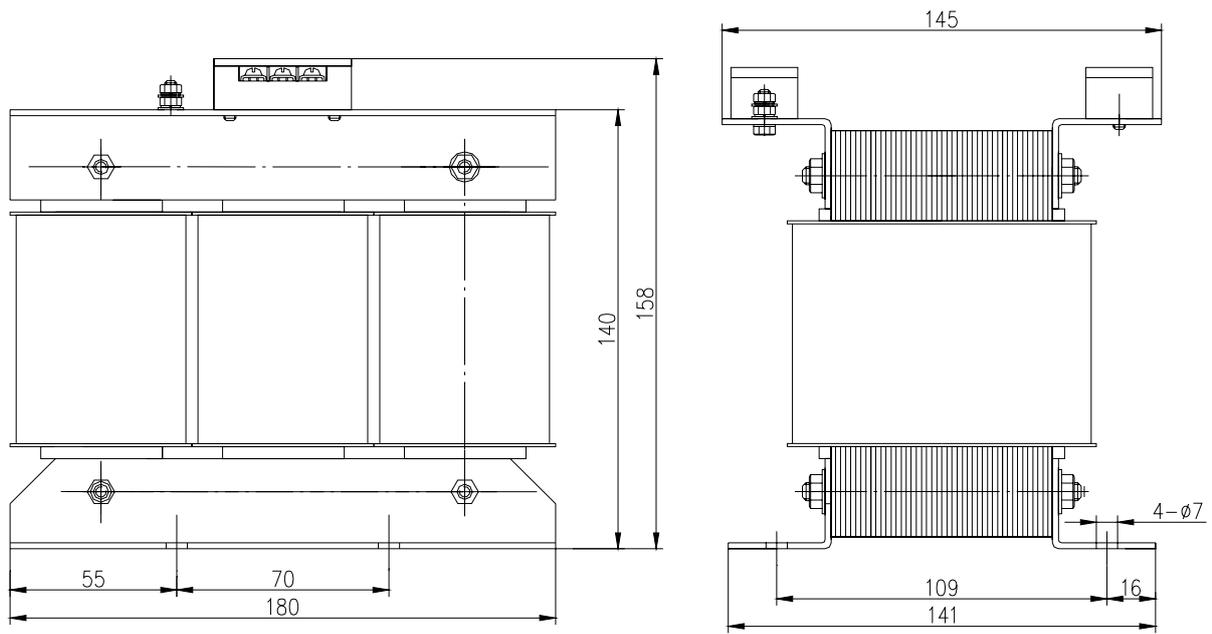
Fig.B-1 BS—120 appearance and installation dimension
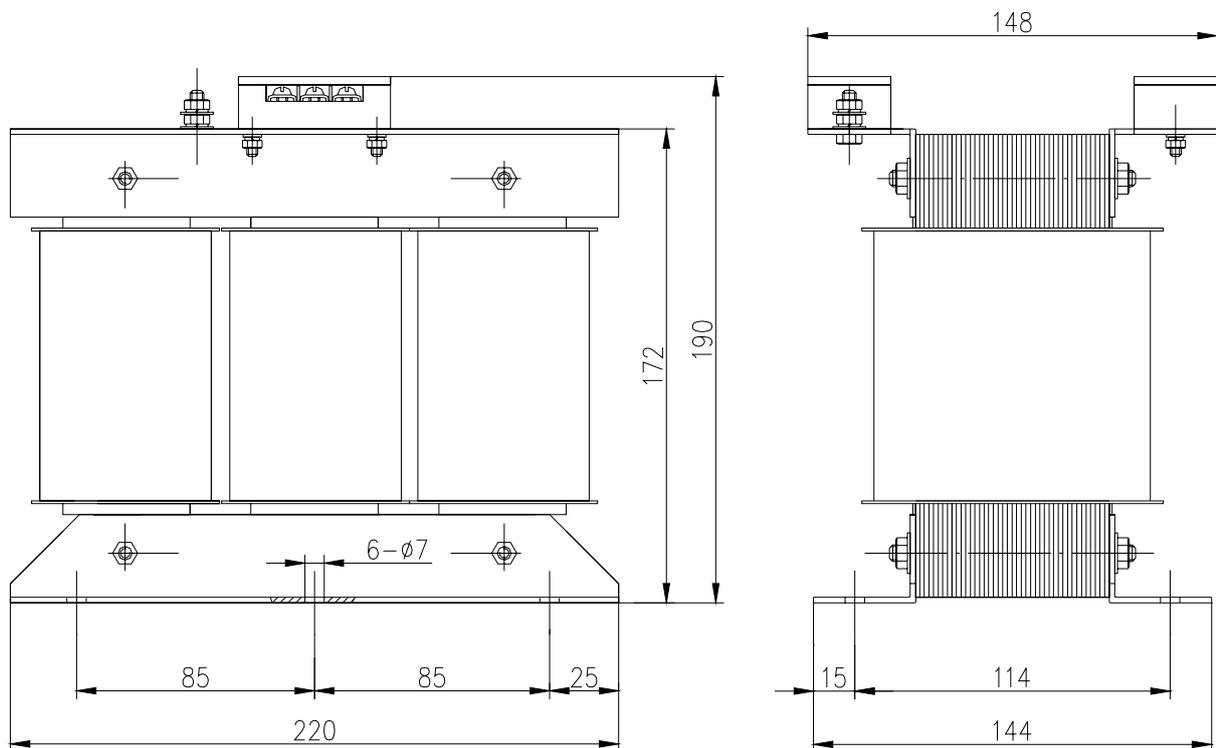
Fig.B-2 BS—200 appearance and installation dimension
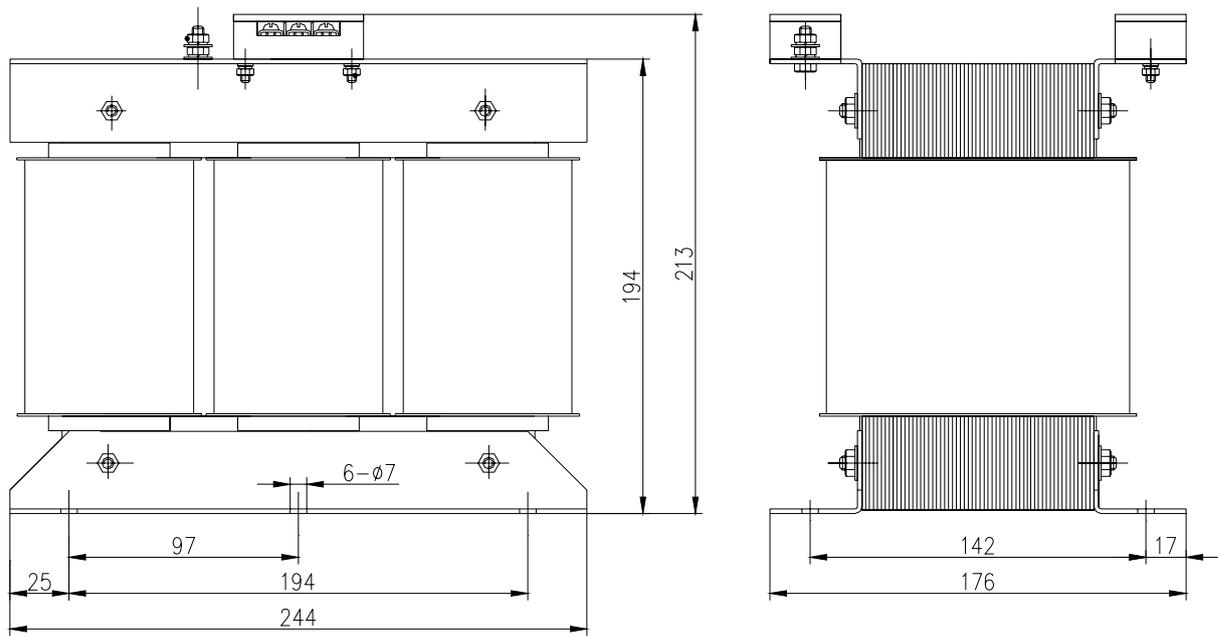
Fig.B-3   BS—300   appearance and installation dimension
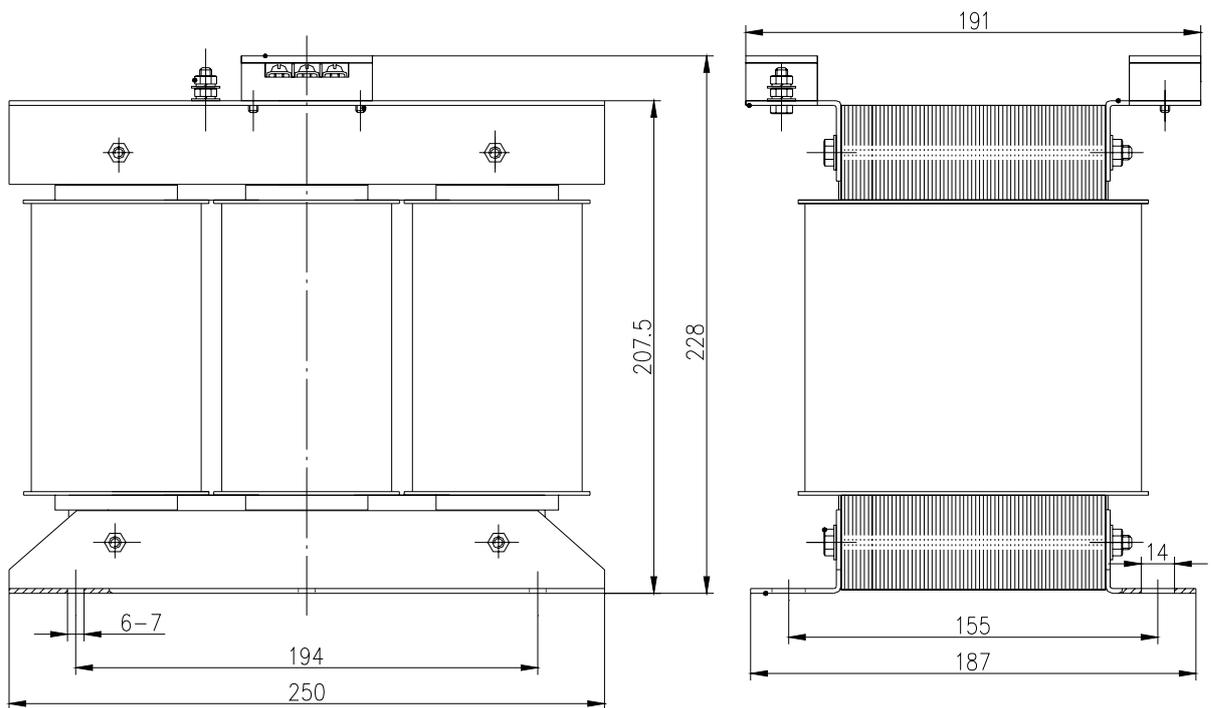
Fig.B-4   BS—400   appearance and installation dimension
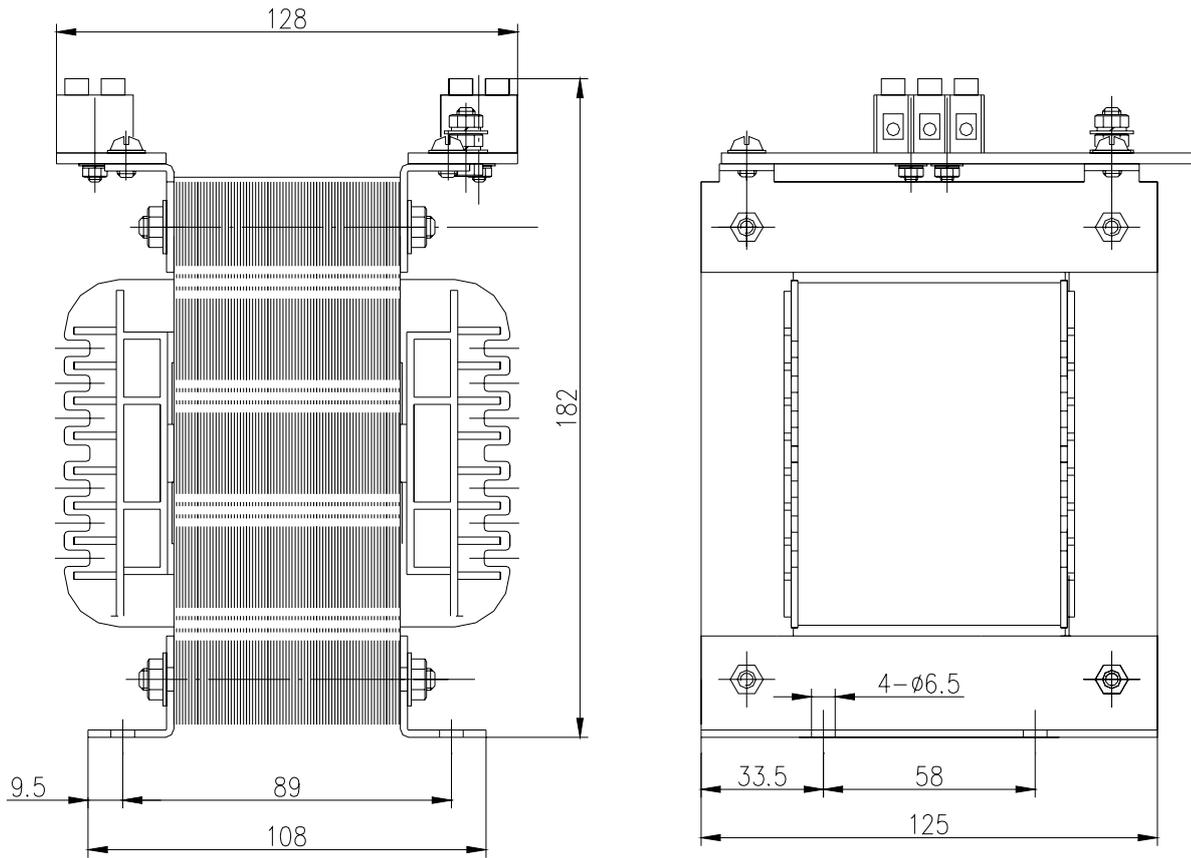
Fig.B-5 BD—80   appearance and installation dimension
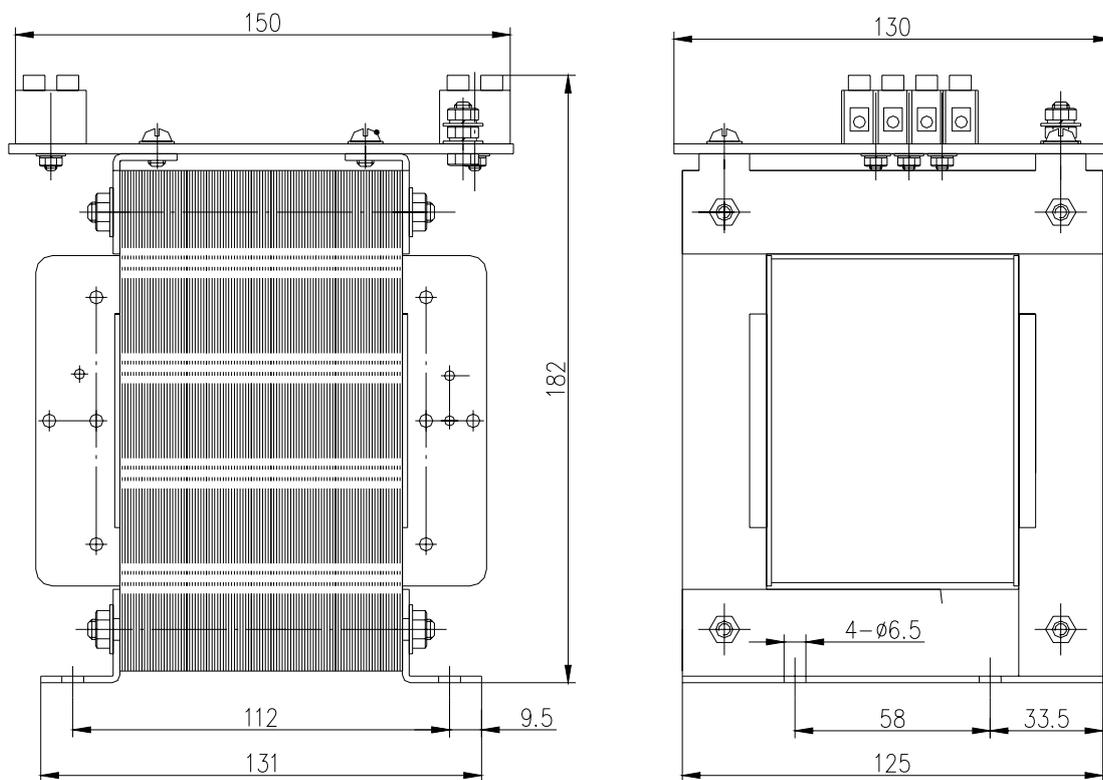
Fig.B-6   BD—120   appearance and installation dimension