DA98D Digital AC Servo Drive Unit

User Manual

(V5.00)

GSK

广州数控设备有限公司
GSK CNC EQUIPMENT CO., LTD.

✦ In this User manual, we will exert ourselves to describe each item related to operation of this drive unit. But due to reasons like limit in space and specific product uses, detailed description of unnecessary or impossible operation of this drive unit will be not included. Therefore, items that are not specially indicated in this manual will all be regarded as "impossible" or "disallowed" operations.

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Company Profile

Currently, GSK Equipment Co., Ltd (hereafter GSK for short) is a China's company with the domestically largest sale volumes of digital control systems. As the digital control industry base in Southern China and one of the 20 manufacturers of key equipment in Guangzhou, GSK is an undertaker of key projects listed in State 863 Supporting Technology for Middle-Grade Digital Control Industrialization. For more than a decade, the company has been dedicated to professional research & development, designing and manufacturing of such products as digital control systems for machine tools, digital control devices, drive units and servo motors. By launching campaign on popularization of digital control machine tools and developing trade in digital control machine tool, the company has developed into a large hi-tech company that integrates science, education, industry and trade into itself. Currently the company has more than 1,400 employees, among whom there are 4 doctors, more than 50 masters and over 500 engineering technicians (more than 50 technicians with senior professional titles). With a superior cost performance, GSK series of products have a very good sale in China and far in Southeastern Asia. Between 2000 and 2006, its market share has ranked No.1 in China for 7 consecutive years and its yield and sale volumes have led the peers for 7 consecutive years, which have consolidated its position as the biggest domestic production base of digital control system for machine tools.

Our main products include digital control equipment and devices like GSK series of machine tools, milling machine and digital control system for processing centers as well as Da98, DA98A, DA98B and DA98D series of full digital AC servo drive units, DY3 series of hybrid stepper motor driver, DF3 series of reaction stepper motor driver, GSK·SJT series of AC servo motors and CT-L digital control slipway. All the products follow state standards (international standards), industry standards and supplementary company standards (or internal control standards) in an all-round way. With powerful strength in technology development and improved production and quality assurance system, GSK has satisfied requirements of vast number of its customers with stable and reliable product quality. Its improved and sound

service mechanisms as well as the more than ten service offices set up in domestic and foreign provinces and cities can guarantee swift and convenient technical support and services within 24 to 48 hours. "Excellent products and outstanding services" have built a brilliant GSK. Abiding by the operation concept of "creating century-old company and molding gold brand", GSK people will make unrelenting efforts to build a digital control industry base in Southern China and push forward national digital control industry.

Field Technical Support Services

If you have problems that cannot be resolved through phone calls, you can receive our technical support on the spot. GSK will authorize technical support engineer to the field to resolve your technical problems.

Foreword

Distinguished Customers,

It is a great honor for us to have you buy DA98D full digital AC servo drive units of GSK Equipment Co., Ltd.

This manual will introduce requirements and notes about operation of DA98D full digital AC servo drive unit.

⚠ Improper operation will cause accidents, and the drive unit must be operated by personnel with related qualifications

Please see to it that you have carefully read the manual prior to operation!

If there are changes to specifications and designs, we will not provide further notices.

Sincere thanks to your friendly support for using products of GSK Equipment Co., Ltd.!

Chinese version of all technical documents in Chinese and English languages is regarded as final.

- Due to improvement in products, contents of this manual will have some changes, for which we will not provide further notices.
- We will not be held accountable for any change made by the customer on the product and the warranty form will hereby go invalid.

Please give special attention to the following warning sings when reading the manual!

⚠ **Warning**	Wrong operation may lead to disastrous consequences---death or serious injury
⚠ **Attention**	Wrong operation may hurt the operator and the equipment may also be damaged!
⚠ **Attention**	Improper operation may damage the product and equipment!

Safety Warning

⚠ **Warning**
● The product is not designed and manufactured to be used in machines or systems threatening personal safety.
● When selecting the product, the customers shall consider safety protection measures when designing and manufacturing their machines and systems, so as to avoid improper operation or irregular accidents of the product.

Acceptance

⚠ **Attention**
● Damaged or broken-down products shall not be put into use.

Transportation

⚠ **Attention**
● Products must be stored and transported under conditions for storage and transportation. ● Over-height piling shall not be allowed to prevent products from falling. ● When being transferred, the products concerned shall be properly packed. ● The servo motor shall not be moved by drawing its wire, motor shaft or encoder. ● Outside force and impact shall not be imposed on servo drive units and servo motors.

Installment

⚠ **Attention**
Servo drive units and servo motors: ● Shall not be installed above or around combustible articles to prevent fire disaster. ● Shall avoid vibration. Impact shall be strictly forbidden. ● Shall not be installed when they are damaged or the parts are incomplete **Servo Drive unit:** ● Must be installed in the control panel with sufficient degree of protection. ● Must keep sufficient intervals away from other equipment. ● Must have good conditions for heat emitting. ● Must prevent invasion of dust, corrosive air, conductive matters, liquid, combustible and explosive substances. **Servo motors:** ● Must be firmly installed to prevent loosening under vibration ● Must prevent motor and encoder from being damaged by the invaded liquids ● Shock on motor and motor shaft shall be strictly forbidden to prevent the encoder from being damaged. ● Load surpassing its limit shall not be imposed on the motor shaft.

Wiring

⚠ **Attention**
● Personnel involved in wiring or examination must possess sufficient competence in this task.
● Wiring and examination must be conducted 5 minutes after the power is switched off.
● Servo drive units and servo motors must have good ground contact.
● Wrong voltage or electrode may cause explosion or operation accidents.
● Only after the servo drive unit and servo motor are properly installed can the wiring be conducted.
● Ensure insulation of the wire and avoid pressing the wire to prevent electric shock.

⚠ **Attention**
● Wires must be connected in a correct and firm manner, otherwise, the servo motor may run by error or the equipment may be damaged due to bad contact.
● Terminals of U, V and W in servo motor shall not be connected reversely, nor be connected to AC power.
● Servo motor and servo drive unit must be directly connected and they shall not be connected with capacitor, inductor or wave filter.
● Prevent conductive fastening elements and wire heads from entering in the servo drive unit.
● The wire and substances not resistant to heat shall not close up to the servo drive unit's radiator and servo motor.
● Continuous current diode connected in parallel to the DC relay for output signals shall not be connected reversely.

Commissioning and Runing

⚠ **Attention**
● Confirm that the servo drive unit and servo motor have been properly and firmly installed and that the power voltage and wiring are correct before switching on power.
● When commissioning, first run the servo motor without load; and after confirming that the parameters are correctly set, run the servo motor with load. In this process, improper operation shall be avoided to prevent the machine and equipment from being damaged.

Operation

⚠ **Attention**
● An emergency stop circuit shall be coupled in to ensure that the equipment can immediately stop by timely switching off power in case of accidents.
● Confirm that the operation signal has been cut off before resetting an alarming signal; otherwise, the signal will be restarted suddenly.
● Servo drive unit must be operated together with its matched set of servo motor.
● Do not frequently switch off or on power of the servo drive unit to prevent the system from being damaged.
● The servo drive unit and servo motor may be very hot after long hours of operation, so do

not touch the servo drive unit's radiator or the servo motor with your hand within a short time after the power is off.
● Do not refit the servo drive unit.

Failure Handling

⚠**Attention**

● Even after the power of servo drive unit has been cut off, the voltage will remain for some time. So do not dismantle the wire or touch the plate of terminals.
● Personnel involved in dismantlement and repair must possess corresponding professional knowledge and working capacity.

⚠**Attention**

● In case of alarming, the trouble must be shot. Before restarting the machine, the alarming signal shall be reset.
● Keep away from the machine when re-switching on the power after instantaneous power failure, for the machine may be restarted suddenly (when designing the machine, make sure that there will be no danger when restarting the machine).

System Selecting and Matching

⚠**Attention**

● Rated torque of the servo motor shall be greater than the valid continuous load torque.
● The ratio of load inertia to servo motor inertia shall be less than the recommended value.
● When selecting servo drive unit and servo motor, they shall be matched with each other.

Table of Contents

Chapter One Overview

1.1 Product Introduction

The AC servo technology has undergone a rapid development since the beginning of 1990s, during which period this technology has been increasingly mature and its performance has been constantly improved. Now this technology has been widely applied to such automatic fields as CNC machine tools, printing and packing machines, textile machinery and automatic production lines.

DA98D AC servo drive unit (all called full digital AC servo drive device) is a new generation of full digital AC servo drive unit produced by our company. This product includes two control modes of speed and position. It can be matched with various open-loop and closed-loop control systems and has been widely applied to CNC machine tools and automatization industry. Internationally advanced special-purpose chip for motor control (TMS320LF2407A DSP), complex programmable logic display (CPLD) and MITSUBISHI intelligent power module (IPM) are adopted inside the servo, so it has such advantages as high degree of integration, compact, perfect protection and good reliability. The optimal PID is employed to achieve PWM control. Performance of this product has reached internationally advanced level among its peers at home and aboard.
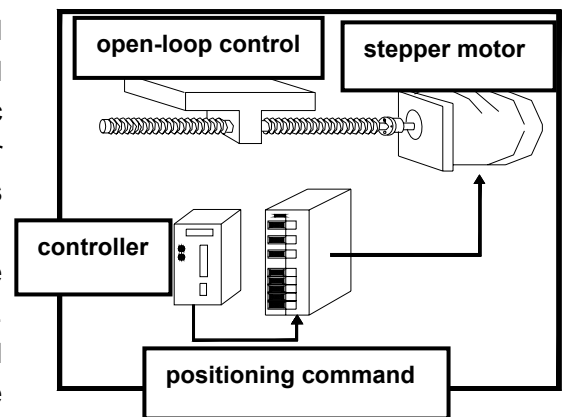
Compared with stepper drive, DA98D AC servo unit has the following strong points:

- **Avoid out-of-Synchronization Phenomena**
  Servo motor has encoder on itself and the position signal will be fed back to the servo drive unit, forming a semi-closed loop system together with the open-loop position controller.

- **Wide speed ratio and constant torque**
  Speed ration is 1:5000, with stable torque characteristics from low speed to high speed.

- **High speed and precision**
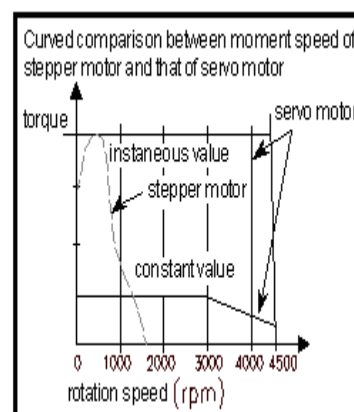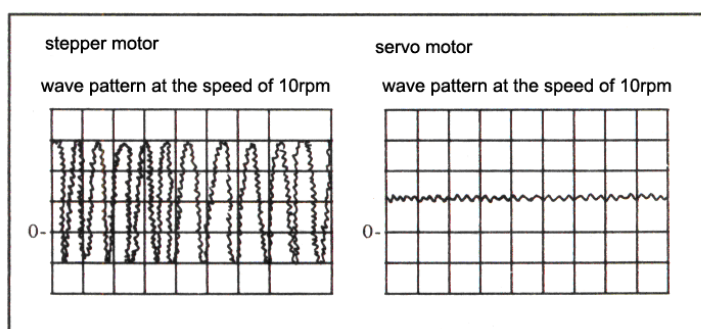 The maximal rotation rate of servo motor can reach 3000r/min, with a rotary positioning precision 1/10000r.
  Notes: maximal rotatation rate is not the same with different models of servo motor.

- **Easy and flexible control**
  Through parameter changing, working methods and characteristics of the servo drive unit can be properly set to comply with different requirements.

1

1.2 Arrival Examination

1) After the product arrives, please see to examine the following aspects:

（**1**） Whether the packing case is in good conditions, and whether the product is damaged during transportation?

（**2**） Check nameplates of the servo drive unit and servo motor to confirm whether the products received comply with the order.

（**3**） Check packing list to confirm whether the accessories are complete.

⚠ **Attention**
● Servo system shall not be installed when it is damaged or does not have complete parts. ● Servo drive unit must be used together with the servo motor whose performance matches that of the former. ● If there is any doubt about the products received, please contact supplier or us.

2) Model meaning:

a) Models of servo drive unit

DA98D-06-110SJT-M020E

Model matching servo motor (indicate GSK SJT series) ※1

Output power: two-digit (04, 06……23) correspond to 0.4~2.3KW ※2

Series Code

※**1:** It can be matched with other domestic or imported servo motor. If there is no parameter in the drive unit, it can only be matched with SJT and ST series of servo motors.

※**2:** Small power (1.5KW or less) means standard configuration; medium power (more than 1.5KW but less than 1.6KW) means thicker radiator.

Notes: when the product is delivered from the factory, the product model has been completed in the above column. Please check them with the product nameplate.

b) Models of servo motor

DA98D AC servo drive unit can be matched with many domestic or exported servo motors, which is at your option. Chapter Eight of this manual will provide information about **SJT**

series of servo motor from GSK and **ST** series of servo motor from New Motor Company of Huazhong University. Information about other models will be provided with the servo motor delivered.

2）**Accessories**

    a) **Standard Accessories of DA98D servo drive unit**

      ① User Manual (this manual)   **1**

      ② **M4×8** countersunk head screws   **4**

      ③ **CN1** Plug (**DB44** female)   **1**   (**note** 1)

      ④ **CN2** Plug (**DB25** male)   **1**   (**note** 2)

    Note 1: For matching our position controller, it will be provided together with the signal cable, whose standard length is 3 meters.

    Note 2: when we provide servo motor, you can ask us to provide its matching feedback cable, whose standard length is 3 meters.

    b) **Standard accessories of servo motor will be provided according to user instructions.**

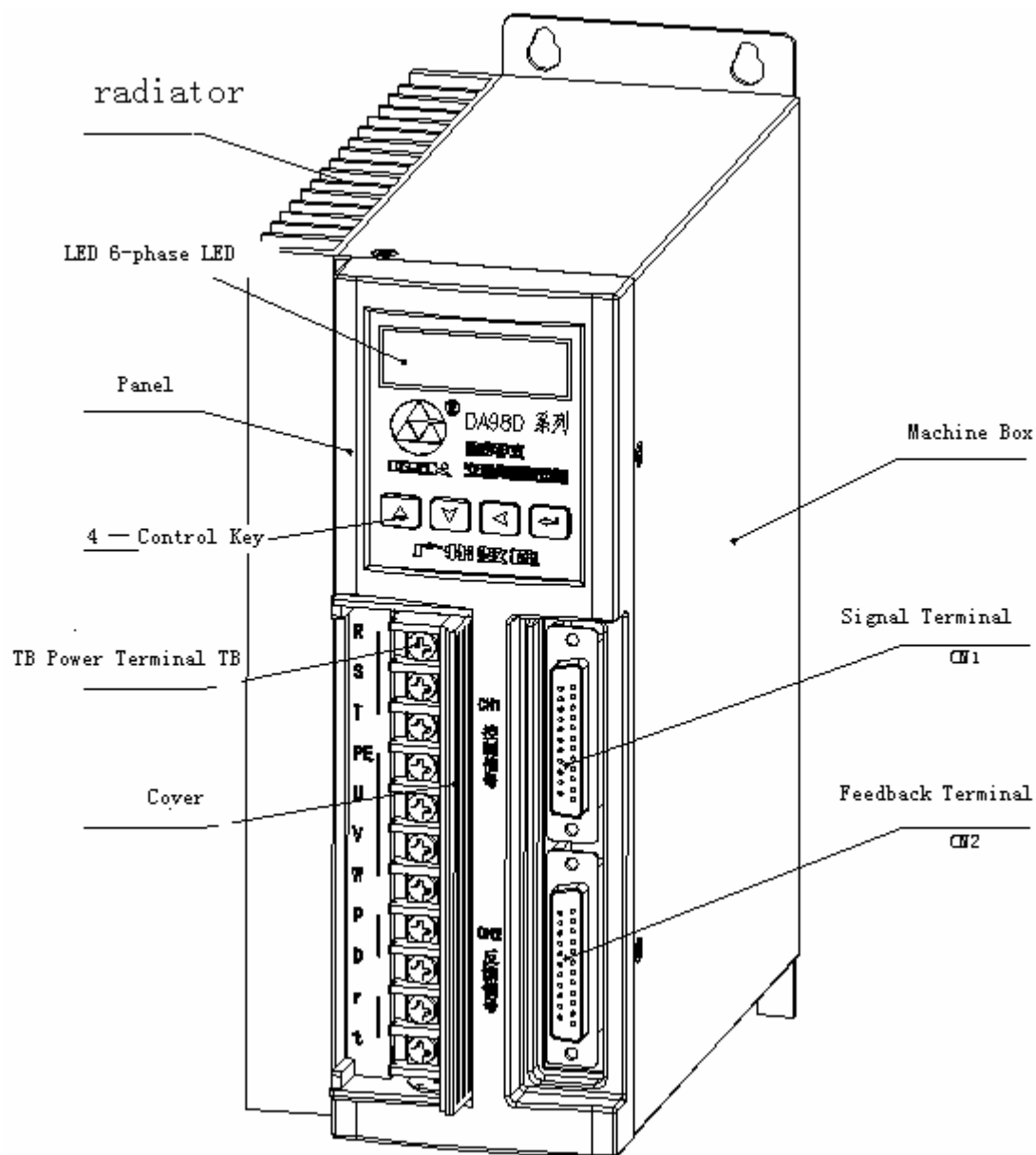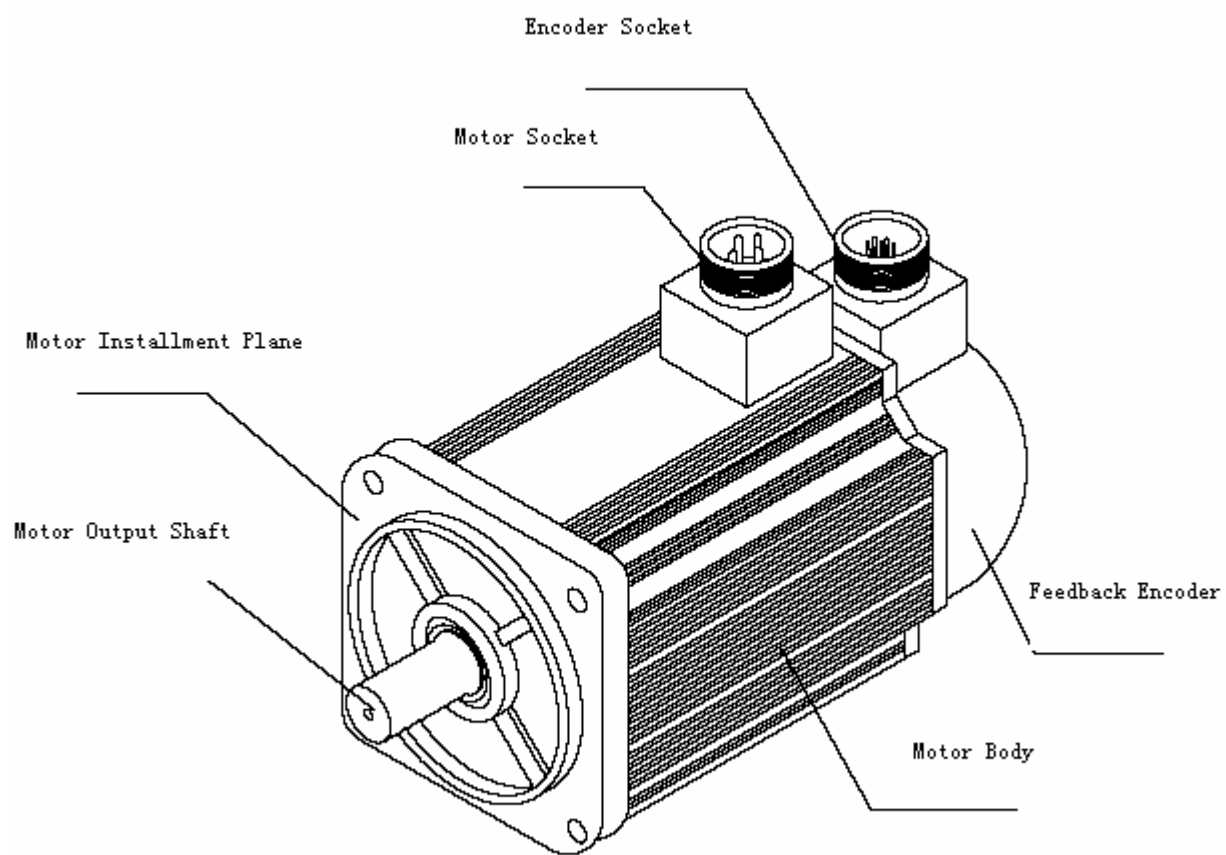## 1.3 Product Appearance

    1) **Appearance of servo drive unit**

Fig. 1-1 Appearance of Servo Drive unit

2) Servo motor appearance

Fig. 1-2 Servo Motor Appearance

Chapter Two Installment

<table>
<tr><td colspan="2" align="center">⚠️ **Attention**</td></tr>
<tr><td colspan="2">

● The products must be stored and installed according to the requirements for environmental conditions.

● The products can be piled up with a limited number; over-piling shall not be allowed to prevent the products from being damaged or falling.

● The products must be stored and transported with original package.

● Product shall not be installed when it is damaged or does not have complete parts.

● Fireproof material is needed for the product installment; the product shall not be installed above or around combustible article to prevent fire.

● Servo drive unit must be installed within electric cabinet to prevent invasion of dust, corrosive air, conductive matters, liquid, combustible and explosive substances.

● Servo drive unit and servo motor shall avoid vibration. Impact shall be strictly forbidden.

● It is forbidden to draw wire, motor shaft and encoder of the servo motor.

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2.1 Environmental Conditions

Items	DA98DServo Drive unit	GSK SJT Series of AC Servo Motor
Operation Temperature/ Humidity	0℃～55℃ (no frozen frost) Less than 90%RH (no dew condensation)	-10℃～40℃ (no frozen frost)) 90%RH (no dew condensation)
Storage Temperature/ Humidity	-20℃～80℃ 90%RH(no dew)	-40℃～55℃ 85%RH (no dew)
Atmospheric Environment	Within the control panel, there shall be not corrosive air, combustible air, oil fog or dust.	Within the room (no insolation), there shall be not corrosive air, combustible air, oil fog and dust.
Height	Less than 1000m above sea level	Less than 1000m above sea level
Vibration	Less than 0.5G(4.9m/s2)10 Hz -60Hz (non-continuous operation)	
Degree of Protection	IP00	IP54

2.2 Installment of Servo Drive unit

<table>
<tr><td align="center">⚠️ **Attention**</td></tr>
<tr><td>

● Servo drive unit must be installed in the electric cabinet with good protection.

● Servo drive unit must be installed according to direction and interval as stipulated. Good conditions for heat radiating should be guaranteed.

● It shall not be installed above or around combustible articles to prevent fire.

</td></tr>
</table>

1）Installment Environment

（1） Protection

The servo driver does not have any protection within its own structure, so it must be installed within the electric cabinet with good protection and prevented from contact of corrosive and combustible air. Conductive matters, metal dust, oil fog or liquid shall be prevented from entering inside.

（2） **Temperature and Humidity**

The environmental temperature shall be kept between 0℃ and 50℃, while temperature for long-term safety operation shall be kept below 45℃. Good conditions for heat radiating shall be guaranteed.

（3） **Vibration and Impact**

When installing the drive unit, vibration shall be avoided. Vibration reduction measures shall be taken to control the vibration below 0.5G (4.9m/S2).

2） **Installment Methods**

(1) **Ways of Installment**

The user can adopt the ways of installment by back panel or panel. The installment shall form an upward right angle with the installment plane. Fig. 2.1 is a schematic diagram for installment by back panel and Fig. 2.2 is a schematic diagram for installment by panel.
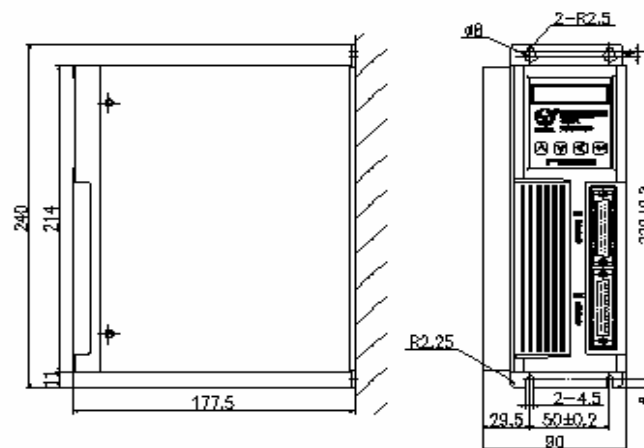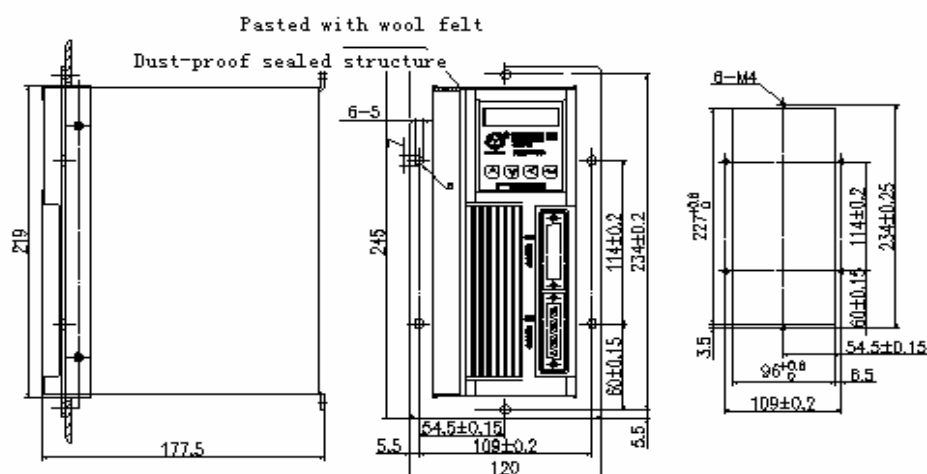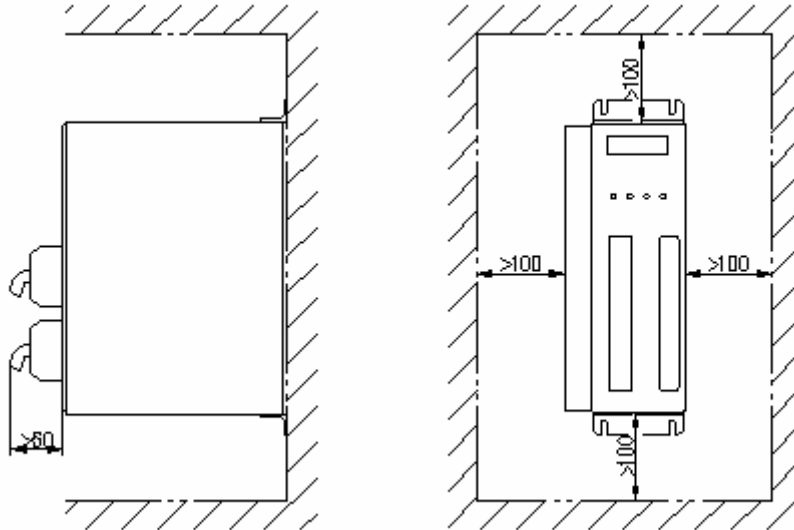
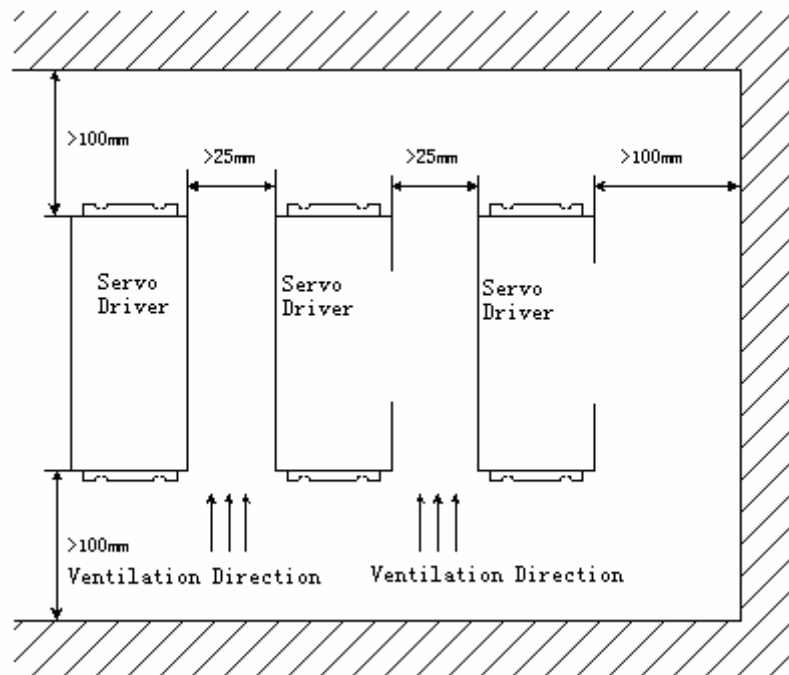Fig. 2.1 Installment method of driver back panel

Fig. 2.2 Installment method of driver panel

(2) Installment Interval

Fig. **2.3** shows the installment interval for single drive unit and Fig. **2.4** shows the installment interval for multiple drive units. In actual installment, the interval shall be as great as possible to ensure good conditions for heat radiating.

Fig. 2.3 Installment for Single Drive unit

Fig. 2.4 Installment Interval for Multiple Drive units

(3) Heat Radiating

To ensure that surrounding temperature of the drive unit will not be constantly increased, there shall be convective-current wind blowing towards radiator of the drive unit within the electric cabinet.

2.3 Installment of Servo Motor

⚠ **Attention**
● Shock on the motor shaft or encoder shall be forbidden to prevent the motor from vibration or impact. ● The motor shall not be moved by drawing motor shaft, leading-out wire or encoder. ● Load on the motor shaft shall not surpass its limit; otherwise, the motor may be damaged. ● The motor must be firmly installed with anti-loosening measures.

1) Installment Environment

（1）   **Protection**

Currently, GSK **SJT** series and Huazhong Series of servo motor are not water resistant, so liquid must not be spattered on the motor during installment. Oil or water must be prevented from entering inside the motor through leading-out wire or the motor shaft.

Notes: if the user needs water-resistant servo motor, please make a clear indication in the order.

（2）   **Temperature and Humidity**

The environmental temperature shall be kept between -10℃ and 40℃. After long hours of operation, the motor will have an increasingly hot temperature, so compulsory heat radiating shall be considered when the surrounding space is relatively small or there are heating equipment.

The humidity shall not be more than 90%RH, without dew condensation.

（3）   **Vibration**

Servo motor shall not be installed at places with vibration. The vibration inflicted on the motor shall not be more than 0.5G (4.9m/s^2).

2) Installment Methods

(1) Ways of Installment

Currently, **SJT** and **ST** series of motors adopt the way of installment by the flange with arbitrary installment direction.

(2)   Notes:

● When dismantling or installing the belts and wheels, shock on the motor or motor shaft shall be forbidden to prevent the encoder from being damaged. Screw pressing tools shall be employed in the dismantlement or installment.

● Currently, most of the **SJT** and **ST** series of motors cannot bear shaft-direction or radial-direction loads. Coupling is recommended for connecting the loads.

● When fastening the motor, the anti-loosening washer shall be used to prevent the motor from loosening.

Chapter Three Wiring

> ⚠️ **Warning**
>
> ●Personnel involved in wiring or examination must possess sufficient abilities in this task.
> ●Wiring and examination must be conducted 5 minutes after the power is off for preventing electric shock.

> ⚠️ **Attention**
>
> ●The wires must be connected according to terminal voltage and electrode to prevent the equipment from being damaged or personnel from being hurt.
> ● The drive unit and servo motor must have good ground contact.

3.1 Standard Wiring

External connection of the drive unit is related to the control modes.

1）**Position Control Mode**

Fig. 3.1 shows standard wiring for the position control mode.

2）**Speed Control Mode:**

Fig. 3.2 shows the standard wiring for the speed control mode.

3）**Wire Distributing**

（1）**Power Terminal TB**

● Wire cross-sectional area: Terminals of R, S, T, PE, U, V and W have an area 1.5mm^2(AWG14-16) and more while terminals of r and t have an area 1.0 mm^2 (AWG16-18) and more.

● Grounding: the grounding wire shall be as thick as possible. The servo driver and motor has ground contact at the point of PE terminal with a grounding resistance less than 100Ω.

● Terminal connection adopts SVM2-4 pre-insulation cold pressing terminal. The connection must be fastened.

● It is recommended to supply power with three-phase isolating transformer, which will reduce the possibility of electric shock.

● It is recommended that the power supply gives power through noise filter for enhancing anti-jamming ability.

● Please install non-fuse breaker (NFB) in order to cut off external power supply when the driver breaks down.

（2）**CN2Contrl Signal CN1 and Feedback Signal CN2**

● Wire material selecting: employ shielding cable (best with inter-twisted shielding cable), the cross-section area of the core shall be 0.12mm^2(AWG24-26) and more. The shielding layer shall be connected with FG terminal.

● Wire and cable length: wire and cable shall be as short as possible; control signal CN1 shall not be longer than 3 meters while the feedback signal CN2 cable shall not be longer than 20 meters.

● Wire laying: Wire shall be laid far away from the power circuit to prevent jamming.

● Please install surge absorbing elements in sensible elements (loop) in related circuits: DC loop is reversely connected in parallel with continuous current diode while AC loop is connected in parallel with capacitance-resistance absorbing return circuit.

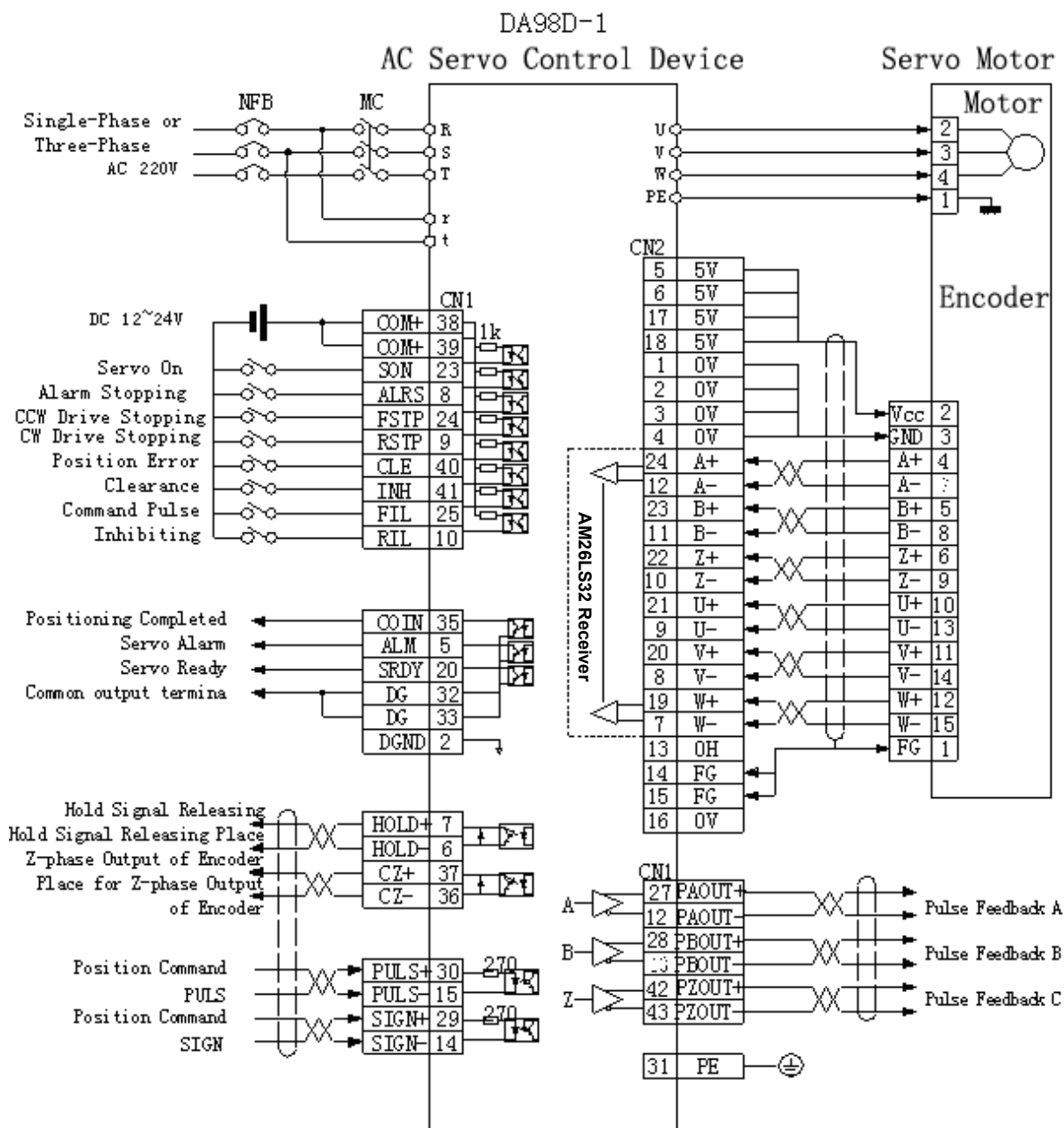| ⚠ **Attention** |
|---|
| U, V and W shall be connected with motor winding in the way of one-to-one correspondence. Reverse connecting shall be forbidden.
The wires and leads shall be fastened firmly and avoid approaching radiator of the drive unit and the motor for the fear that the insulation performance will be reduced due to heat.
There will remain large quantities of electrolyzed capacitance in the servo drive unit, so there will a high remaining voltage even after the power is cut off. Do not touch drive unit or motor within 5 minutes after the power is off! |

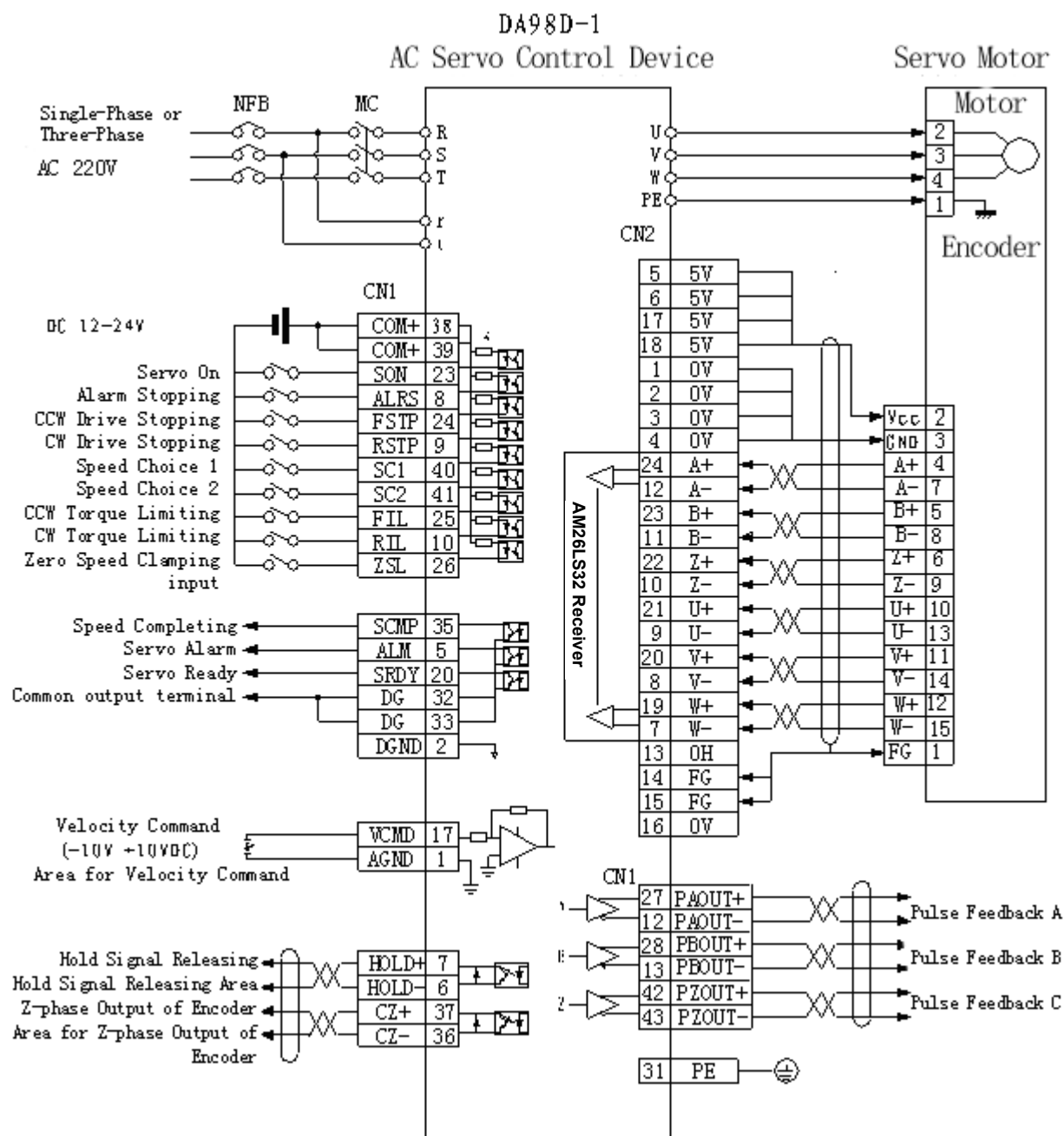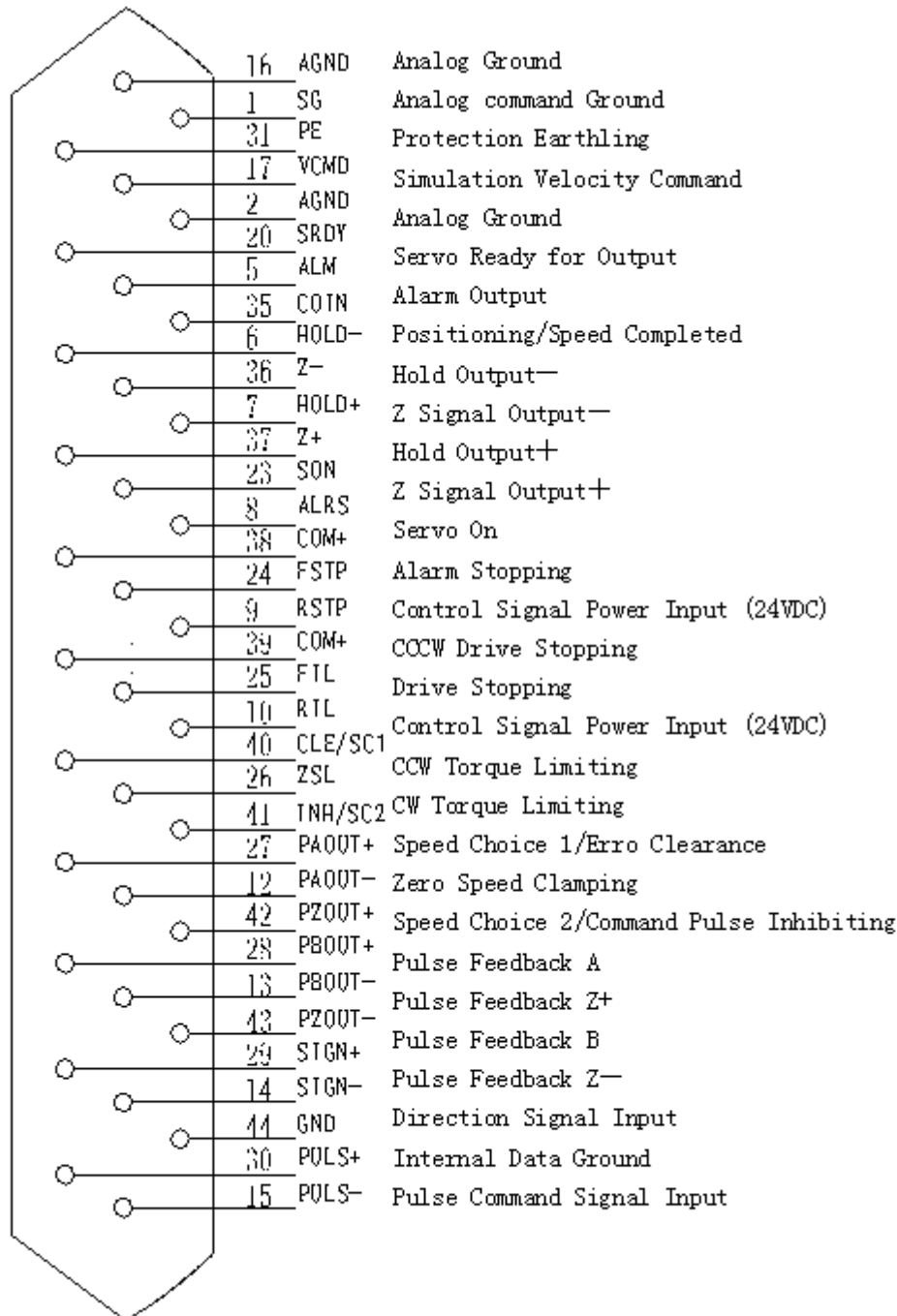**Fig. 3.1 Standard Wiring for Position Control Mode**

Fig. 3.2 Standard Wiring for Speed Control Mode

3.2 Functions of Terminals

1） Configuration of Terminal

Fig. 3.3 is a configuration chart for interface terminals of the servo drive unit. TB is the plate of terminals; CN1 is for connector of DB44 with male socket and female plug; CN2 is also for connector of DB28 with female socket and male plug.
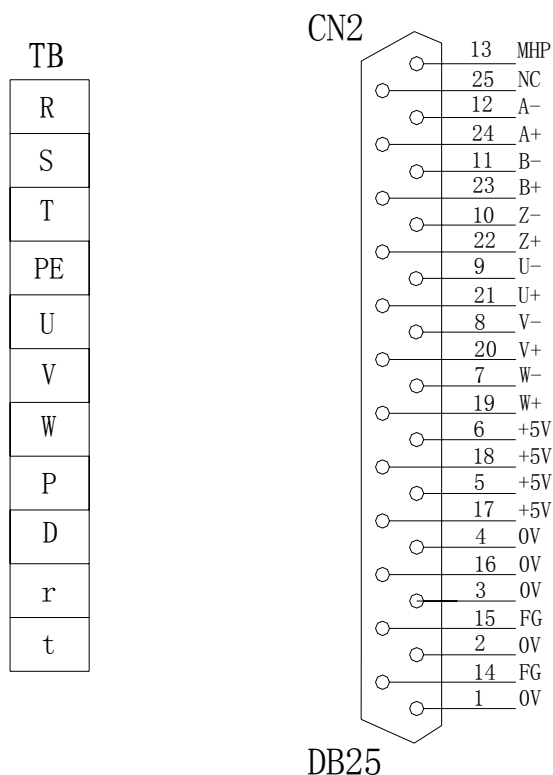
No.	Signal	Description
16	AGND	Analog Ground
1	SG	Analog command Ground
31	PE	Protection Earthling
17	VCMD	Simulation Velocity Command
2	AGND	Analog Ground
20	SRDY	Servo Ready for Output
5	ALM	Alarm Output
35	COIN	Positioning/Speed Completed
6	HOLD−	Hold Output−
36	Z−	Z Signal Output−
7	HOLD+	Hold Output+
37	Z+	Z Signal Output+
23	SON	Servo On
8	ALRS	Alarm Stopping
38	COM+	Control Signal Power Input (24VDC)
24	FSTP	CCW Drive Stopping
9	RSTP	Drive Stopping
39	COM+	Control Signal Power Input (24VDC)
25	FTL	CCW Torque Limiting
10	RTL	CW Torque Limiting
40	CLE/SC1	Speed Choice 1/Erro Clearance
26	ZSL	Zero Speed Clamping
41	INH/SC2	Speed Choice 2/Command Pulse Inhibiting
27	PAOUT+	Pulse Feedback A
12	PAOUT−	Pulse Feedback Z+
42	PZOUT+	Pulse Feedback B
28	PBOUT+	Pulse Feedback Z−
13	PBOUT−	Direction Signal Input
43	PZOUT−	Internal Data Ground
29	SIGN+	Pulse Command Signal Input
14	SIGN−	
44	GND	
30	PULS+	
15	PULS−	

CN2

13	MHP
25	NC
12	A−
24	A+
11	B−
23	B+
10	Z−
22	Z+
9	U−
21	U+
8	V−
20	V+
7	W−
19	W+
6	+5V
18	+5V
5	+5V
17	+5V
4	0V
16	0V
3	0V
15	FG
2	0V
14	FG
1	0V

DB25

TB

R
S
T
PE
U
V
W
P
D
r
t

Fig. 3.3 Configuration Chart for Interface Terminals of Servo Drive unit

2）　**Power Terminal TB**

Table 3.1 Power Terminal TB

Terminal No.	Terminal Mark	Terminal Name	Functions
TB-1	R	Major Loop Power Single-phase or Three-phase	Input terminal of major return circuit power ～220V　50Hz Notes: Do not connect with motor output terminals of U, V and W.
TB-2	S		
TB-3	T		
TB-4	PE	Product Earthling	Grounding terminals Grounding resistance is less than 100Ω; Servo motor output and power input have ground contact at the common point.
TB-5	U	Servo Motor Output	Servo motor output terminal; shall be connected with motor terminals of U, V and W in the way of one-to-one correspondence
TB-6	V		
TB-7	W		
TB-8	P	Back up	
TB-9	D	Back up	
TB-10	r	Control Power Single-Phase	Input terminal for control circuit power ～220V　50Hz
TB-11	T		

3）　**Control Terminal CN1**

Simplified form of Control Modes:

　　　　P stands for position control mode

　　　　S stands for speed control mode

Table 3.2   Control Signal Input/Output Terminal CN1

Terminal No.	Terminal Name	Mark	I/O	Mode	Functions
CN1-38 CN1-39	Power Anode of Input Terminal	COM+	Type I		Power anode of input terminal Used to drive photoelectrical coupler in the input terminal DC12~24V, current ≥100mA
CN1-23	Servo On	SON	Type1		Servo on input terminal SON ON: allow driving operation SON OFF: the driver is closed and stops work; the motor is under free state Note 1 before switching SON OFF to SON ON, the motor must be in stillness; Note 2: after SON ON is switched on, wait at least 50ms before inputting commands.
CN1-8	Alarm Stopping	ALRS	Type1		Input terminal for alarm stopping ALRS ON: stop system alarm ALRS OFF: maintain system alarm Note1: Alarm for failure code larger than 8 can not be stopped with this method; it needs to cut off the power for examination and repair, and then switch on power.
CN1-24	CCW Drive Stopping	FSTP	Type1		Input terminal for CCW(counter clockwise) drive stopping FSTP ON: allow CCW driving operation FSTP OFF: stop CCW driving operation Note 1: If limit of the machine is surpassed, the CCW torque will remain zero when switching on OFF. Note 2: The function of FSTP OFF can be screened off or the function of "ON" can permanently surface by setting No.20 parameter.
CN1-9	CW Drive Stopping	RSTP	Type1		Input terminal for CW(clockwise direction) drive stopping RSTP ON: allow CW driving operation RSTP OFF: stop CW driving operation Note 1: If limit of the machine is surpassed, the CW torque will remain zero when switching on OFF. Note 2: The function of FSTP OFF can be screened off or the function of "ON" can permanently surface by setting No.20 parameter.
CN1-40	Error Meter Clearance	CLE	Type1	P	Input terminal for clearing position error meter CLE ON: Position control ; the position error meter will be cleared
	Speed Choice 1	SC1	Type1	S	Input terminal for speed choice 1 Under the speed control mode, the combination of SC1 and SC2 can be used to select different internal speeds SC1 OFF,SC2 OFF: internal speed 1 SC1 ON,SC2 OFF: internal speed 2 SC1 OFF,SC2 ON: internal speed 3 SC1 ON,SC2 ON: internal speed 4 Note: the values of internal speed 1 to 4 can be changed with parameters.

CN1-41	Command Pulse Inhibiting	INH	Type1	P	Input terminal for command pulse inhibiting INH ON: command pulse input is inhibited INH OFF: command pulse input is valid
CN1-41	Command Pulse Inhibiting	INH	Type1	P	Input terminal for position command pulse inhibiting INH ON: command pulse input is inhibited INH OFF: command pulse input is valid
	Speed Choice 2	SC2	Type1	S	Input terminal for speed choice 2 Under the speed control mode, the combination of SCA and SC2 can be used to select different internal speeds. SC1 OFF,SC2 OFF: internal speed 1 SC1 ON:SC2 OFF: internal speed 2 SC1 OFF,SC2 ON: internal speed 3 SC1 ON,SC2 ON: internal speed 4
CN1-25	CCW Torque Limiting	FIL	Type1		Input terminal for CCW(counter-clockwise direction) torque limiting FIL ON:CCW torque is limited within the scope of parameter No.36 FIL OFF: CW torque is not limited by parameter No.36 Note 1: No matter FIL is on or off, CCW torque will still be limited by parameter No.34. Generally, parameter No.34 > parameter No.36
CN1-10	CW Torque Limiting	RIL	Type1		Input terminal for CW(clockwise direction) torque limiting RIL ON: CW torque is limited within the scope of parameter No.37. RIL OFF: CW torque is not limited by parameter No.37 Note 1: No matter FIL is on or off, CCW torque will still be limited by parameter No.35. Generally, parameter No.351 > parameter No.371
CN1-20	Servo Ready for Output	SRDY	Type2		Terminal of Servo Ready for Output SRDY ON: Control power supply and main power supply are normal, the driver alarm does not occur, and the servo gets Ready for Output ON. SRDY OFF: the main power supply is not cut off or the driver alarm occurs, and the servo gets Ready for outputting OFF.
CN1-5	Servo Alarm Output	ALM	Type2		Output terminal for servo alarm ALM ON: servo driver alarm dose not occur, and the servo is Ready for outputting ON. ALM OFF: servo driver alarm occurs and the servo is Ready for outputting OFF.
CN1-35	Output for Positioning Completing	COIN	Type2	P	Output terminal for positioning completing COIN ON: when the value of position error meter is within the set scope of positioning, ON will be output for positioning completing.
	Output for Speed Completing	SCMP	Type2	S	Output terminal for speed completing SCMP ON: when the speed reaches or surpasses the set speed, On will be output for speed completing.

CN1-32 CN1-33	Common edge of Output terminal	DG	Common edge		Earthling common edge of control signal output terminal (excluding CZ)
CN1-37	Z-Phase output of Encoder	CZ	Type2		Output terminal for Z-phase of encoder Output Z-phase pulse of servo motor's photoelectric code CZ ON: Z-phase signal appears
CN1-26	Zero Speed Clamping	ZSL	Type1		ZSL ON: Servo driver is not under the control of analog voltage, and zero speed is output. ZSL OFF: servo driver is under the control of analog voltage
CN1-36		CZCOM			Common edge of encoder's Z-phase output terminal
CN1-30	Command Pulse Input	PULS+	Type3	P	Input terminal for external command pulse Note 1: the pulse input modes are set by PA14. Mode of command pulse+ symbol; Mode of CCW/CW command pulse
CN1-15		PULS-	Type3	P	
CN1-29	Command Pulse Input	SIGN+	Type3	P	
CN1-14		SIGN-	Type3	P	
CN1-31	Shielding Ground Wire	FG			Earthling shielding terminal
CN1-2 CN1-16	Analog Ground	AGND		S	Analog ground
CN1-17	Input Simulation Command	VCMD	Type4	S	Input analog command+-10V Input resistance of 20K
CN1-1	Input Analog command Ground	SG		S	
CN1-7	Positive Terminal of Hold Output	HOLD+	Type2	S/P	Open-loop output of drain electrode, the photoelectric coupler is open under normal operation. ON is output The power is off and the drive stops. When alarm stops, the photoelectric coupler is closed. OFF is output
CN1-6	Negative Terminal of Hold Output	HOLD-		S/P	
CN1-27	Code disc Pulse A+	PAOUT+	Type5	S	Feedback output signal of encoder. The standard is 2500/line Output linear speed can be adjusted through electronic gears of output PA 41 and PA42, e.g. if the encoder has 2500 pulses per round, setting PA41/42=4/5, then the A and B-phase signals output from drive unit will be 2500 X PA41/PA42=2000 pluses/round.
CN1-12	Code disc Pulse A-	PAOUT-		S	
CN1-28	Code disc Pulse B+	PBOUT+			

| CN1-13	Code disc Pulse B-	PBOUT-			
CN1-42	Code disc Pulse Z+	PZOUT+			One pulse will be output from one round of the motor.
CN1-43	Code disc Pulse Z-	PZOUT-			

Feedback Signal Terminal CN2

<p align="center">Table 3.3   Encoder Signal Input/Output Terminal CN2</p>

Terminal No.	Terminal Name	Terminal Mark			Color	Functions
		Mark	I/O	Mode		
CN2-5 CN2-6 CN2-17 CN2-18	Power Output+	+5V				Photoelectric encoder of the servo motor employs ＋5V power supply; When the cable is relatively long, it should use multiple component wires that are connected in parallel.
CN2-1 CN2-2 CN2-3 CN2-4 CN2-16	Power Output-	OV				
CN2-24	Encoder A＋Input	A+	Type4			Connected with A+ phase of the servo motor's photoelectric encoder
CN2-12	Encoder A－Input	A-				Connected with A- phase of the servo motor's photoelectric encoder
CN2-23	Encoder B＋Input	B+	Type4			Connected with B+ phase of the servo motor's photoelectric encoder
CN2-11	Encoder B－Input	B-				Connected with B- phase of the servo motor's photoelectric encoder
CN2-22	Encoder Z＋Input	Z+	Type4			Connected with Z+ phase of the servo motor's photoelectric encoder
CN2-10	Encoder Z－Input	Z-				Connected with Z- phase of the servo motor's photoelectric encoder
CN2-21	Encoder U＋Input	U+	Type4			Connected with U+ phase of the servo motor's photoelectric encoder
CN2-9	Encoder U－Input	U-				Connected with U- phase of the servo motor's photoelectric encoder
CN2-20	Encoder V＋Input	V+	Type4			Connected with V+ phase of the servo motor's photoelectric encoder
CN2-8	Encoder V－Input	V-				Connected with V+ phase of the servo motor's photoelectric encoder

3.3 I/O Interface Principle
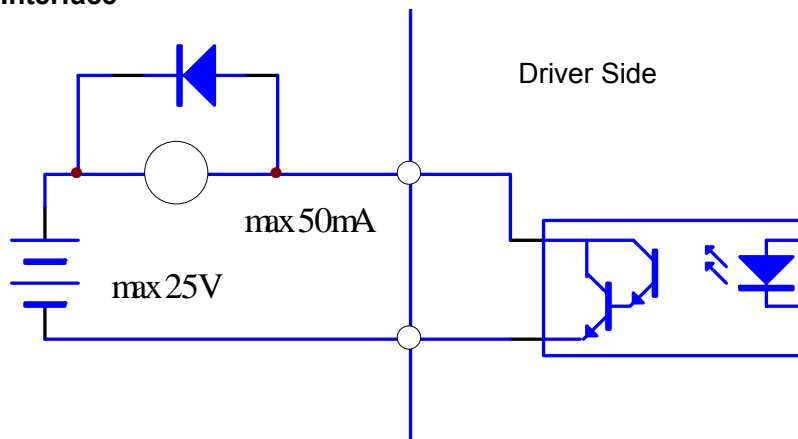
1) Switch Value Input Interface
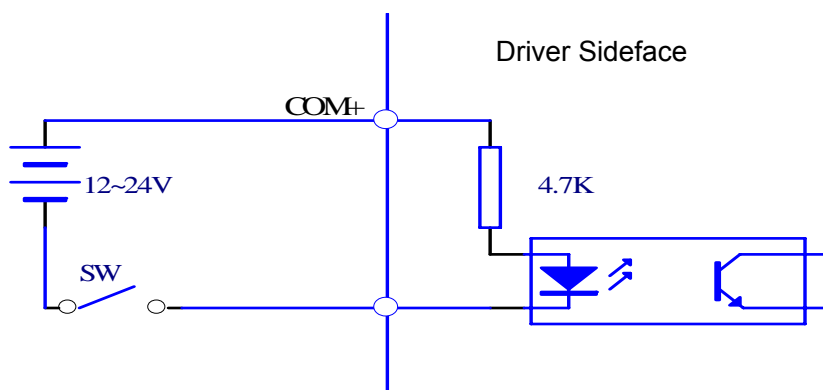
Fig. 3.4   Type1 Switch Value Input Interface

(1)   Power supply is provided by the user, DC12～24V, current≥100mA;

(2)   Note: if the electrodes are reversely connected, the servo driver will not work.

2) Switch Value Output Interface

Fig. 3.5   Type2 Switch Value Ouput Interface

(1)   The external power supply is provided by the user, but attention must be given to the case that if electrodes of the power supply are reversely connected, the servo drive unit may be damaged.

(2)   The output is an open-circuit form of collector, with a maximal current of 50mA and a maximal external power voltage of 25V. Therefore, the load of switch value output signal must satisfy this limited requirement. If the limited requirement is surpassed or the output terminal is directly connected with the power supply, the servo drive unit will be damaged;

(3)   If the loads are inductive ones like relay, two sides of the load must be reversely connected in parallel with the continuous current diode. If the continuous current diode is reversely connected, the servo drive unit will be damaged.

3) Analog Input Interface
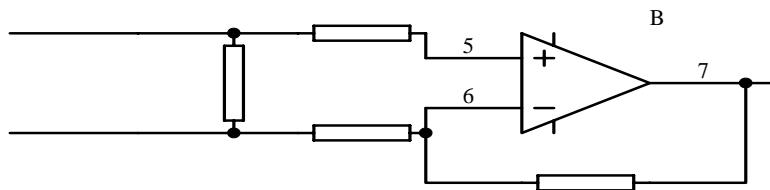
Fig. 3.6   Type4   Analog Command Input Interface

1.   Input signal is connected with twisted-pair cable lines.
2.   The circuit adopts the enlarged different-mode form, with an input resistance of 20K.

4) Pulse Output Interface
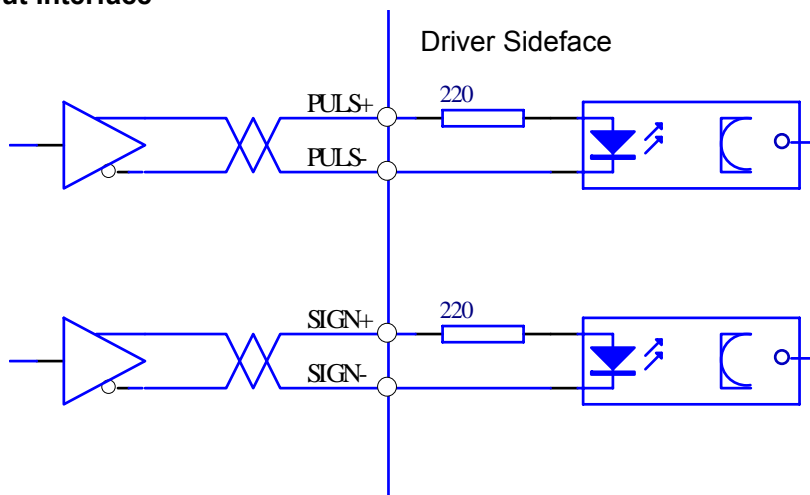
Fig. 3.7 Type3 Differential Drive Mode of Pulse Input Interface
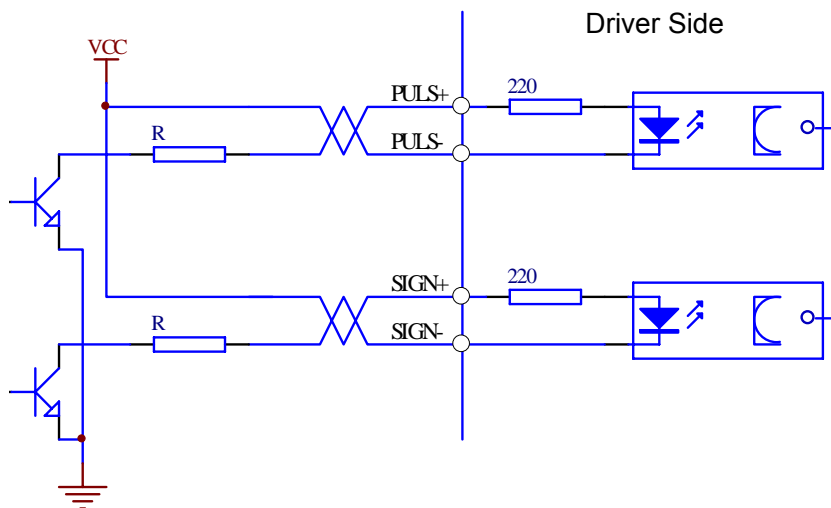
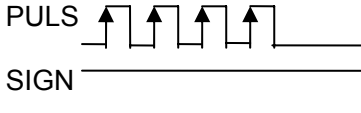**Fig. 3.8 Type4 Uni-polar Drive Mode of Pulse Input Interface**

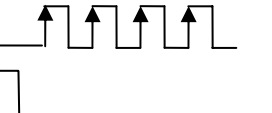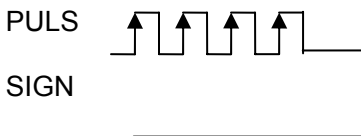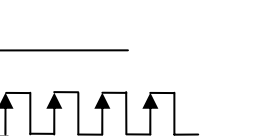（1）   For correctly transmitting pulse data, it is recommended to adopt the differential drive mode;

（2）   Under differential drive mode, AM26LS31 and MC3487 or similar cable driver of RS422;

（3）   The uni-polar drive mode will reduce the motion frequency. According to the requirements on the pulse amount input circuit: driving current $10\sim15$mA and limited maximal external power voltage of 25V, empirical data are as follows: VCC=24V,R=1.3$\sim$2k;VCC=12V,R=510$\sim$

820Ω;VCC=5V,R=82～120Ω.

（4） When adopting uni-polar drive mode, the external power supply will be provided by the user, but attention must be given to the case that if the power electrodes are reversely connected, the servo drive unit may be damaged.

（5） Refer to Table 3.4 for details about the pulse input forms, in which the arrow means counting trend. Table 3.5 shows the time sequence and parameters for pulse input.

Table 3.4 Pulse Input Forms

Forms of Pulse Command	CCW	CW	Set Parameter Values
Symbol for Pulse Train			0 Command Pulse＋Symbol
CCW Pulse Train CW Pulse Train			1 CCW Pulse/CCW Pulse

Table 3.5 Time sequence Parameters for Pulse Input

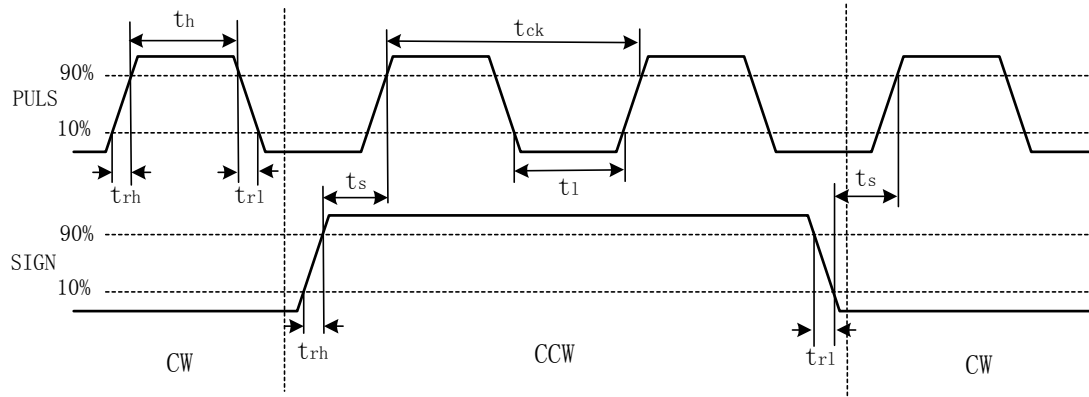| Parameter	Differential Drive Input	Uni-polar Drive Input
t_{ck}	>2μS	>5μS
t_h	>1μS	>2.5μS
t_l	>1μS	>2.5μS
t_{rh}	<0.2μS	<0.3μS
t_{rl}	<0.2μS	<0.3μS
t_s	>1μS	>2.5μS
t_{qck}	>8μS	>10μS
t_{qh}	>4μS	>5μS
t_{ql}	>4μS	>5μS
t_{qrh}	<0.2μS	<0.3μS
t_{qrl}	<0.2μS	<0.3μS
t_{qs}	>1μS	>2.5μS

Fig. 3.9　Time sequence Diagram for Pulse＋Symbol Input Interface (Maximal Pulse Frequency:500kHz)
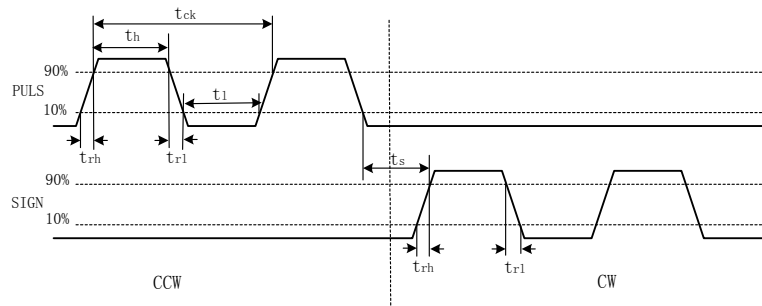

Fig. 3.10　Time sequence for CCW Pulse/CW Pulse Input Interface(Maximal Pulse Frequency:500kHz)

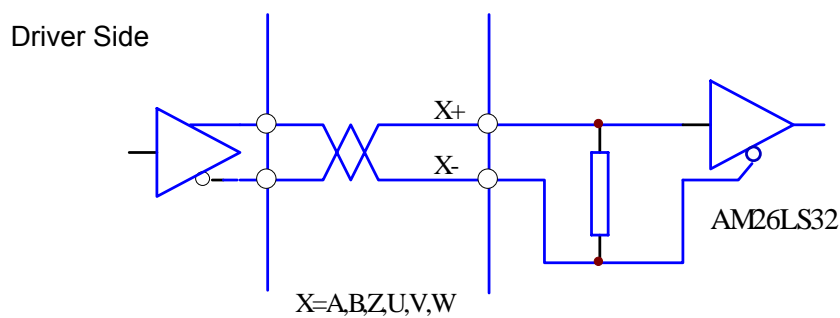**4)　Driver Speed Signal Output Interface**

Fig. 3.11　Type5　Driver Speed Signal Output Interface

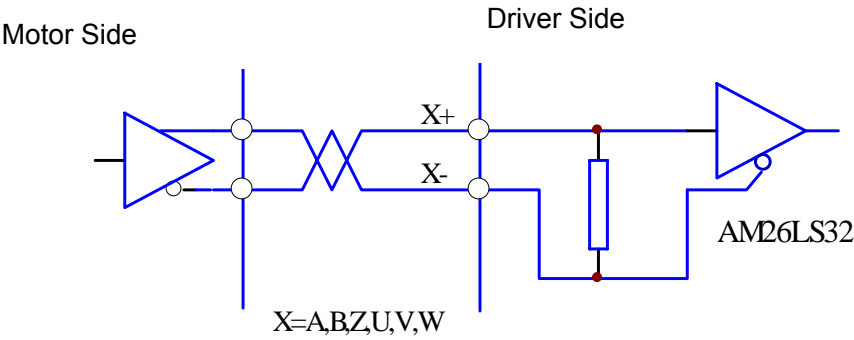**5)　Input Interface for Servo Driver's Photoelectric Encoder**

Motor Side

Driver Side

X+

X-

X=A,B,Z,U,V,W

AM26LS32

Fig. 3.12   Input Interface for Servo Driver's Photoelectric Encoder

Chapter Four Parameters

<table>
<tr><td colspan="2">⚠ Attention</td></tr>
<tr><td>●</td><td>Personnel involved in parameter adjusting must know parameter meanings for wrong setting may damage the equipment or hurt the personnel.</td></tr>
<tr><td>●</td><td>It is recommended that the parameters should be adjusted when the motor has no load.</td></tr>
<tr><td>●</td><td>The default motor parameters are adaptable to GSK SJT and Huazhong ST series of servo motors. If other servo motors are used, the parameters shall be adjusted accordingly; otherwise, the motor may not work normally.</td></tr>
</table>

4.1 Checklist of Parameters

● The following factory parameters listed are used to match the drive unit of GSK 10SJT-M020E digital control machine tool (2N.m,3000r/min) as an example. Related parameters of different motors are not the same.

● Software version is V804

Table 4.1   Checklist of Parameters

No.	Name	Mode	Parameter range	Factory Values	Unit
0	Password	P,S	0~9999	315	
1	Model Code	P,S	0~569	30*	
2	Software Version (Read only)	P,S	*	*	
3	Initial Display State	P,S	0~20	0	
4	Choice of Control Mode	P,S	0~5	0	
5	Speed Proportion Gain	P,S	5~2000	100*	Hz
6	Speed Integral Time Constant	P,S	1~1000	20*	ms
7	Torque Command Filter	P,S	1~500	100	%
8	Low pass Filter for Speed Inspection	P,S	1~500	100	%
9	Position Proportion Gain	P	1~1000	40	1/S
10	Position Feed Forward Gain	P	0~100	0	%
11	Low Pass Filter Cut-off Frequency for Position Feed-forward	P	1~1200	300	Hz
12	Position Command Pulse Frequency Division Numerator	P	1~32767	1	
13	Position Command Pulse Frequency Division Denominator	P	1~32767	1	
14	Position Command Pulse Input Mode	P	0~1	0	
15	Position Command Pulse Direction Reversing	P	0~1	0	
16	Range for Positioning Completing	P	0~30000	20	Pulse
17	Inspection Range for Position Excess	P	0~30000	400	×100 Pulse
18	Invalid Position Excess Error	P	0~1	0	
19	Position Command Smoothing Filter	P	0~30000	0	0.1ms
20	Invalid Drive Stopping Input	P,S	0~1	0	
21	JOG Operation Speed	S	-3000~3000	120	r/min
22	Reservation				
23	Maximal Speed Limit	P,S	0~4000	3600	r/min
24	Internal Speed 1	S	-3000~3000	0	r/min
25	Internal Speed 2	S	-3000~3000	100	r/min

26	Internal Speed 3	S	-3000~3000	300	r/min
27	Internal Speed 4	S	-3000~3000	-100	r/min
28	Speed Completing	S	0~3000	500	r/min
29	Reservation				
30	Linear Velocity Conversion Numerator	P,S	1~32767	10	
31	Linear Velocity Conversion Denominator	P,S	1~32767	1	
32	Decimal Position of Linear Velocity	P,S	0~5	3	
33	Zero Speed Scope for Analog Command	S	0~1000	3	
34	Internal CCW Torque Limiting	P,S	0~300	300*	%
35	Internal CW Torque Limiting	P,S	-300~0	-300*	%
36	External CCW Torque Limiting	P,S	0~300	100	%
37	Internal CW Torque Limiting	P,S	-300~0	-100	%
38	Torque Limiting for Speed Trial Operation and JOG Operation	S	0~300	100	%
39	Acceleration Time Constant	S	1~10000	0	ms
40	Deceleration Time Constant	S	1~10000	0	ms
41	Numerator of Output Electronic Gear Ratio	S	1~255	1	
42	Denominator of Output Electronic Gear Ratio	S	1~255	1	
43	Choice of Speed Command	S	0~1	1	
44	High Speed AD Zero Point	S	412~1600	1024	
45	Low Speed AD Zero Point	S	412~1600	1024	
46	Motor Rotation Direction Control	S	0~3	0	
47	Analog Command Gain	S	20~3000	100	
48	Anti-jamming Scope for Analog Command	S	0~1000		
49	Choice of Zero Adjustment Channels for Analog Speed	S	0~1	0	
52	Analog Command Transition Mode	S	0~1	0	
53	Zero-point Slope	S	0~1023	0	

4.2 Functions of Parameters

Table 4.2   Functions of Parameters

No	Name	Functions	Parameter range
0	Password	Prevent the parameters from being wrongly changed. Generally, when needing to set parameters, first set the parameter as the correct password, then set the parameters. After commissioning, reset the parameter back to 0 to ensure that the parameter will not be wrongly changed in the future. Passwords have different classes respectively for user parameters, system parameters and whole parameters. When changing model code parameter (PA1), the model code password must be used. Other passwords can not be used for changing this parameter. User password is 315. Model code password is 385.	0~9999
1	Model Code	Correspond to the same series of drive units and motors with different frequency classes. Different model codes correspond to different default parameter values. And when restoring the function of default parameter values, the parameter concerned must be correct. When EEPROM alarm (No.20) occurs, the parameter must be reset after the repair, then restore the default parameter value. Otherwise, the driver many not work normally or be damaged. When changing the parameter, first set the password PA0 as 385, then the parameter concerned can be changed. Please refer to this chapter for detained meanings about parameters.	0~69
2	Software Version	The software version No. can be checked, but cannot be changed.	*
3	Initial Display State	Select display states of the driver screen after being electrified. 0: Display motor rotation rate; 1: Display that current position is lower by 5 (pulses); 2: Display that current position is higher by 5; 3: Display that current position command (means accumulated pulse value)is lower by 5; 4: Display that current position command (means accumulated pulse value)is higher by 5; 5:Display that position error is lower by 5; 6: Display that position error is higher by 5; 7:Display motor torque; 8:Display motor current; 9:Display linear velocity; 10:Display control mode; 11:Display position command pulse frequency; 12:Display speed command; 13:Display torque command; 14:Display absolute position of rotor during one round; 15:Display input terminal state; 16: Display output terminal state; 17:Display encoder input signal; 18:Display operation state; 19:Display alarm code; 20: Reservation.	0~20

4	Choice of Control Mode	①Control mode of the driver can be selected by setting this parameter: 0:Position control mode; 1:Speed control mode; 2:Tiral operation control mode; 3:JOG control mode; 4: Encoder's zero adjusting mode. 5: Opern-loop operation mode (used for testing motor and encoder). ② Position control mode: position command is input through the pulse input port Speed control mode: speed command is input through the pulse input port or analog input, which can be determined by the parameter (internal and external speed command choice) PA42. When internal speed is employed, the combination of SC1 and SC2 can be used to select different internal speeds. SC1 OFF,SC2 OFF : Internal speed 1 SC1 ON,SC2 OFF : Internal speed 2 SC1 OFF,SC2 ON : Internal speed 3 SC1 ON,SC2 ON : Internal speed 4 Trial operation control mode: the speed command is input through the keyboard, used to test driver and motor. JOG control mode, i.e. itching mode: after the JOG operation is entered, press down ⇑ and hold on, the motor will run at JOG speed; leave the key, the motor will stop and keep zero speed; press down ⇓ and hold on, the motor will reversely run at JOG speed; leave the key, the motor will stop and keep zero speed. Encoder's zero adjusting mode: used to adjust zero point of the encoder disc when leaving factory	0~5
5	Speed Proportion Gain	Set proportion gain of the speed regulator. The higher the value is set, the gain will be larger and rigidity greater. Parameter value shall be determined by specific models and loads of the servo drive unit. Generally, the greater the load inertia is, the higher the value will be set. Under the condition that the system will not produce vibration, the value can be set as high as possible.	5 Hz ~ 2000Hz
6	Speed Integral Time Constant	Set integral time constant of the speed regulator The lower the value is set, the faster the integral speed will be and the greater the rigidity. Parameter value shall be determined by specific models and loads of the servo drive unit. Generally, the greater the load inertia is, the higher will the value be set. Under the condition that the system will not produce vibration, the value can be set as low as possible.	1 ms ~ 1000ms
7	Torque Command Filter	Set features of the torque command filter to inhibit resonance (sharp vibration noise produced by motor) produced by the torque; If the motor produces sharp vibration noise, please reduce the parameter value; The lower the value is, the smaller the cut-off frequency will be and the less the motor noise. If the load inertia is very great, the set value can be properly reduced. If the value is too low, the response will become slow and may cause instability. The higher the value is, the greater the cut-off frequency will be and the faster the response. If relatively high machinery rigidity is needed, the value can be increased properly.	1%~500%

8	Low Pass Filter for Speed Inspection	Set features of low pass filter for speed inspection. The lower the value is, the smaller will be the cut-off frequency will be and the less the motor noise. If the load inertia is very great, the set value can be properly reduced. If the value is too low, the response will become slow and may cause vibration. The higher the value, the greater the cut-off frequency will be and the faster the response. If relatively fast response is needed, the set value can be properly increased.	1%~500%
9	Position Proportion Gain	Set proportion gain of the position regulator. The higher the value is, the greater the gain will be and the less the position lagging amount will be under the condition of command pulse with the same frequency. But if the value is too high, it may cause vibration or over-adjustment. The parameter is determined by specific models of the servo drive unit and concrete loads.	1~1000 /S
10	Position Feed-forward Gain	Set feed-forward gain of the position loop. When the value is set at 100%, it means that the position lagging value will be always 0 under command pulse with any frequency. If the position feed-forward gain is increased, the high-speed response feature of the control system will be enhanced, but the position loop of the system will be instable and easy to cause vibration. If not specially requiring very fast response, the feed-forward gain of the position loop is generally set as 0.	0%~100%
11	Low Pass Filter Cut-off Frequency for Position Feed-forward	Set low pass filter cut-off frequency of the position feed-forward. The function of this filter is to enhance stability of the composite position control.	1 Hz ~ 1200Hz
12	Position Command Pulse Frequency Division Numerator	Set frequency division of the command pulse (electronic gear). Under position control mode, it can be conveniently matched with various pulse sources by setting PA12 and PA13 parameters, thus reaching the ideal control resolving power (i.e. angle/pulse) required by the user. $P \times G = N \times C \times 4$ P: Pulse number of the input command; G: Electronic gear ratio; $G = \dfrac{\text{Frequency Division Numerator}}{\text{Frequency Division Denominator}}$ N: Motor rotation rounds; C: Coil round number of the photoelectric encoder. In this system C＝2500. 〖Example〗 if the input command pulse is 6000, the servo motor rotates one round: $G = \dfrac{N \times C \times 4}{P} = \dfrac{1 \times 2500 \times 4}{6000} = \dfrac{5}{3}$ then the parameter PA12 is set as 5 and PA13 as 3. ⑤ Recommended range of electronic gear ratio: $\dfrac{1}{50} \leq G \leq 50$	1~32767
13	Position Command Pulse Frequency Division Denominator	①Refer to parameter PA12.	1~32767

14	Position Command Pulse Input Mode	Set input mode of the position command pulse. Three input modes can be set through parameters: 0: Pulse＋symbol; 1:CCW pulse/CW pulse; CCW is counter-clockwise rotation observed from the servo motor shaft direction, defined as positive direction. CW is clockwise rotation of observed from the servo motor shaft direction, defined as negative direction.	0~1
15	Position Command Pulse Direction Reversing	Set as 0:Normal; 1: opposite to position command pulse direction.	0~1
16	Range for Positioning Completing	Set pulse range for positioning completing under position control mode. The parameter provides a basis for judging whether drive unit has completed the positioning under position control mode. When the remaining pulse number in the position error meter is less than or the same with this parameter value, the driver is deemed to complete the positioning with the positioning completing signal of COIN ON. Otherwise it will be COIN OFF. SCMP.Under position control mode, the positioning completing signal of COIN is output; under other control modes, the speed completing signal will be output.	0 ~30000 pulses
17	Inspection Range for Position Excess	Set inspection range for position excess alarm. Under the position control mode, position excess alarm will occur in the servo drive unit when the number on the position error meter exceeds this parameter value.	0 ~30000 ×100 pulses
18	Invalid Position Excess Error	①Set as 0: Valid inspection for position excess alarm; 1: Invalid inspection for position excess alarm, stop inspecting position excess error.	0~1
19	Position Command Smoothing Filter	Smoothing filter of the command pulse, acceleration and deceleration with exponential form, and the value means time constant. The filter will not lose input pulse but it may cause delayed command; The filter is used in: Upper controller without deceleration function; Electronic gear with relatively high frequency division (>10); Relatively low command frequency; Motor with leaping-forward and instable steps during operation. When the position points to 0, the filter will not work.	0ms ~ 30000×0.1 ms
20	Invalid Drive Stopping Input	①Set as 0: Valid CCW and CW drive stopping. When CCW drive stopping switch (FSTP) is ON, CCW drive is allowed; when CCW drive stopping switch (FSTP) is OFF, CCW torque keeps 0. Likewise, if CCW and CW drive stopping switches are both OFF, the alarm for drive stopping input error will occur. 1: Cancel CCW and CW input stopping. No matter what state CCW and CW drive stopping switches are in, CCW and CW drive will be allowed. Meanwhile, if CCW and CW drive stopping switches are both OFF, the alarm for drive stopping input error will not occur.	0~1

21	JOG Operation Speed	Set JOG operation speed.	-3000 r/min ~3000r/min
22	Reservation		
23	Maximal Speed Limit	Set maximal speed limit of the servo motor. Unrelated with the rotation direction. If the set value surpasses the rated rotation rate, the actual highest speed limit will be the rated rotation rate.	0 r/min ~3000 r/min
24	Internal Speed1	Set internal speed 1 Under the speed control mode, the combination of SC1 OFF and SC2 OFF will be used to select internal speed 1 as the speed command.	-3000 r/min ~3000 r/min
25	Internal Speed 2	Set internal speed 1 Under the speed control mode, the combination of SC1 ON and SC2 OFF will be used to select internal speed 2 as the speed command.	-3000 r/min ~3000 r/min
26	Internal Speed 3	Set internal speed 3 Under the speed control mode, the combination of SC1 Off and SC2 ON will be used to select internal speed 3 as the speed command.	-3000 r/min ~3000 r/min
27	Internal Speed 4	Set internal speed 4 Under the speed control mode, the combination of SC1 On and SC2 ON will be used to select internal speed 4 as the speed command.	-3000 r/min ~3000 r/min
28	Speed Completing	Set speed completing. Under non-position control modes, if the motor speed surpasses this set value, the signal of SCMP ON will be output. Otherwise, the signal of SCMP OFF will be output. Under the position control mode, this parameter will not be used. Unrelated to rotation direction. Compared with other apparatus, it has slow-moving feature.	0 r/min ~3000 r/min
30	Linear Velocity Conversion Numerator	Used to display linear operation speed of the system $$\text{Linear Velocity} = \text{Motor Velocity} \ (r/\min) \times \frac{\text{Linear Velocity Conversion Numerator}}{\text{Linear Velocity Conversion Denominator}}$$ Decimal position of the linear velocity is determined by parameter PA32. 0 means no decimal, 1 means the decimal position is at the tens, 2 means the decimal point is are the hundreds… the process goes on by analogy. 〖Example〗 If the servo motor drives a 10mm ball lead screw, the linear velocity conversion numerator is set at10, the denominator at 1, and decimal point at 3, then the linear velocity can be displayed on the screen (counted in m/min). When the motor velocity is 500r/min, the linear velocity will be displayed as 5000m/min.	1~32767
31	Linear Velocity Conversion Denominator	①Refer to parameter PA30.	1~32767

32	Decimal Position of Linear Velocity	① Refer to Parameter PA30.	0~5
33	Zero Speed Scope for Analog Command	Since there is jamming in the process of transmitting analog command, the command received is not necessarily 0 when the upper machine gives the analog zero speed command, under which circumstances the motor can not stop steadily and cause shake. The shake caused by jamming can be inhibited by increasing this parameter, but the response speed will be reduced and the processing error be increased at that same time.	0~1000
34	Internal CCW Torque Limiting	Set internal CCW torque limiting for the servo motor. The value set is the percentage of rated torque, e.g., if the value needs to be set is two times as much as the rated torque, set the value at 200. At any time, this limit will be valid. If the value set surpasses the maximal over-loading capacity of the system, the actual torque limiting will be the maximal over-loading capacity permitted by the system.	0%~300%
35	Internal CW Torque Limiting	Set internal CW torque limiting for the servo motor. The value set is the percentage of rated torque, e.g., if the value needs to be set is two times as much as the rated torque, set the value at -200. At any time, this limit will be valid. If the value set surpasses the maximal over-loading capacity of the system, the actual torque limiting will be the maximal over-loading capacity permitted by the system.	-300%~0%
36	External CCW Torque Limiting	Set external CCW torque limiting for the servo motor. The value set is the percentage of rated torque, e.g., if the value needs to be set is as much as the rated torque, set the value at 100. This limiting will be valid only when the input terminal (FIL) for CCW torque limiting is ON. When the limiting is valid, the actual torque limiting will be the minimal one among the three values of maximal over-loading capacity, internal CCW torque limiting and external CCW torque limiting permitted by the system.	0%~300%
37	Internal CW Torque Limiting	Set external CW torque limiting for the servo motor. The value set is the percentage of rated torque, e.g., if the value needs to be set is as much as the rated torque, set the value at -100. This limiting will be valid only when the input terminal (FIL) for CCW torque limiting is ON. When the limiting is valid, the actual torque limiting will be the minimal one among the three values of maximal over-loading capacity, internal CW torque limiting and external CW torque limiting permitted by the system.	-300%~0%
38	Torque Limiting for Speed Trial Operation and JOG Operation	Set torque limiting under the modes of speed trial operation and JOG operation. Unrelated to rotation direction, valid for both directions. The value set is the percentage of rated torque, e.g., if the value needs to be set is as much as the rated torque, set the value at -100. Both internal and external torque limiting will still be valid.	0%~300%

39	Acceleration Time Constant	The set value means the acceleration time of motor ranging from 0r/min to 1000r/min The acceleration and deceleration have a linear feature. Only valid for speed control mode, invalid for position control mode. If the drive unit is used together with external position loop, this parameter shall be set as 0.	1ms ~10000ms
40	Deceleration Time Constant	The set value means the deceleration time of motor ranging from 0r/min to 1000r/min The acceleration and deceleration have a linear feature. Only valid for speed control mode, invalid for position control mode. If the drive unit is used together with external position loop, this parameter shall be set as 0.	1ms ~10000ms
41	Numerator of Output Electronic Gear Ratio	Feedback pulse from each coil of the encoder will be output through the gear within the drive unit. E.g., there are 2500 pulses in each coil of the encoder, setting PA41/42=4/5, then the A and B-phase signals output from the drive unit will be 2500 X PA41/PA42=2000 pulses/coil.	0～255
42	Denominator of Output Electronic Gear Ratio	This parameter must be more than or the same with parameter No.41.	0～255

43	Choice of Speed Command	Whether the operation speed is from internal speed or analog command:
		    0 Internal speed
		    1 Analog command
			0~1

44	High Speed AD Zero Point	When restoring default value, this parameter will not be recovered.	412~1600
45	Low Speed AD Zero Point	When restoring default value, this parameter will not be recovered.	412~1600
46	Motor Rotation Direction Control	0 Normal 1 Opposite to the analog speed command 2 Opposite to the output pulse rotation direction 3 Opposite to both.	0～3
47	Analog Command Gain	Analog command is transited to speed gain.	20～3000
48	Anti-jamming Scope for Analog Command	The function is the same with parameter No.33, but the function range includes all speeds rather than zero speed only. It is recommended that this parameter not be used simultaneously together with parameter No.33.	0～1000
49	Choice of Zero Adjustment Channels for Analog Speed	0 Low speed AD for low speed and high speed AD for high speed. 1 High speed AD for both high and low speed This parameter is used only for AD zero adjusting: to improve the resolving power of analog command, AD switch with different multiplying factors are employed for high and low speed. First set this parameter as 1 to adjust zero point for high speed AD, then set the parameter as 0 to adjust zero point for low speed AD.	0～1
52	Analog Command Transition Mode	0 Speed AD is transited to speed command with curve of second order 1 Speed AD is transited to speed command with straight line.	0～1

53	Zero-point Slope	When analog command AD is transited to speed command with curve of second order, the zero-point slope for the curve is 1024 times.	0～1023

4.3 List for comparison of Modle Codes & Parameters and Motor

Table 4.3   List for Comparison of Parameter No.1 and ST Series of Servo Motors

№1 Parameter	Models and Technical Parameters of Servo Motors	Remarks
30	110ST-M02030H,0.6kw, 300V, 3000r/min 4A, 0.33×10^{-3}kg.m^2	
35	110ST-M04030H,1.2kw, 300V, 3000 r/min, 5A, 0.65×10^{-3}kg.m^2	
36	110ST-M05030H,1.5kw, 300V, 3000 r/min, 6A, 0.82×10^{-3}kg.m^2	
37	110ST-M06020H,1.2kw, 300V, 2000 r/min, 6A, 1.00×10^{-3}kg.m^2	
38	110ST-M06030H,1.6kw, 300V, 3000 r/min, 8A, 1.00×10^{-3}kg.m^2	※
39	130ST-M04025H,1.0kw, 300V, 2500 r/min, 4A, 0.85×10^{-3}kg.m^2	
45	130ST-M05025H,1.3kw, 300V, 2500 r/min, 5A, 1.06×10^{-3}kg.m^2	
46	130ST-M06025H,1.5kw, 300V, 2500 r/min, 6A, 1.26×10^{-3}kg.m^2	
47	130ST-M07720H,1.6kw, 300V, 2000 r/min, 6A, 1.58×10^{-3}kg.m^2	
49	130ST-M10015H,1.5kw, 300V, 1500 r/min, 6A, 2.14×10^{-3}kg.m^2	
50	130ST-M10025H,2.6kw, 300V, 2500 r/min, 10A, 2.14×10^{-3}kg.m^2	※
51	130ST-M15015H,2.3kw, 300V, 1500 r/min, 9.5A, 3.24×10^{-3}kg.m^2	※

Table 4.4 List for Comparison of Parameter No.1 and SJT Series of Servo Motors

№1 Parameter	Models and Technical Parameters of Servo Motors	Remarks
60	110SJT-M020E,0.6kw, 300V, 3000 r/min, 3A, 0.34×10^{-3}kg.m^2	
61	110SJT-M040D,1.0kw, 300V, 2500 r/min, 4.5A, 0.68×10^{-3}kg.m^2	
62	110SJT-M060D,1.5kw, 300V, 2500 r/min, 7A, 0.95×10^{-3}kg.m^2	※
63	130SJT-M040D,1.0kw, 300V, 2500 r/min, 4A, 1.19×10^{-3}kg.m^2	
64	130SJT-M050D,1.3kw, 300V, 2500 r/min, 5A, 1.19×10^{-3}kg.m^2	
65	130SJT-M060D,1.5kw, 300V, 2500 r/min , 6A, 1.95×10^{-3}kg.m^2	
66	130SJT-M075D,1.88kw, 300V, 2500 r/min, 7.5A, 1.95×10^{-3}kg.m^2	※
67	130SJT-M100B,1.5kw, 300V, 1500 r/min, 6A, 2.42×10^{-3}kg.m^2	
68	130SJT-M100D,2.5kw, 300V, 2500 r/min, 10A, 2.42×10^{-3}kg.m^2	※
69	130SJT-M150B,2.3kw, 300V, 1500 r/min, 8.5A, 3.1×10^{-3}kg.m^2	※

Note: The driver matched with motors marked with "※" in the above tables shall adopt thicker heat radiator.

Chapter Five Alarming and Handling

Attention
● Personnel involved in examination and repair must possess corresponding professional knowledge and abilities.
● Do not touch driver and motor at least 5 minutes after the power has been cut off for fear of electric shock and heat injury.
● After alarm for the failure of drive unit occurs, the unit can only put into operation after the trouble is shot according to the alarm code.
● Do confirm that the SON (servo ready) signal is invalid before resetting the alarm for fear that the sudden staring of motor may cause accidents.

5.1 List of Alarms

Table 5.1 List of Alarms

Alarm Codes	Alarm name	Contents
0	Normal	
1	Excessive Speed	Speed of the servo motor exceeds the set value
2	Over-voltage in Main Circuit	Voltage of the main circuit power is excessive
3	Voltage Shortage in Main Circuit	Voltage of the main circuit power is too low
4	Position Excess	Value in the position error meter surpasses the set value.
5	Motor Overheating	Excessively high motor temperature
6	Saturation Failure of Speed Regulator	Long-time saturation of the speed regulator
7	Abnormal Drive Stopping	Both CCW and CW drive stopping are OFF.
8	Overflow of Position Error Meter	Absolute Value of the number in the position error meter exceeds 2^{30}
9	Encoder Failure	Encoder signal error
10	Voltage Shortage in Control Power	The control power of ±15V is on the low side
11	IPM Module Failure	IPM intelligent module breaks down
12	Excessive Current	Excessive motor current
13	Overload	Overload in servo driver and motor (instantaneous overheating)
14	Braking Failure	Failure in braking circuit
15	Counting Error of Encoder	Abnormal counting in Encoder
20	EEPROM Error	EEPROM Error
30	Z Pulse Losing in Encoder	Wrong Z pulse in encoder
31	UVW Signal Error in Encoder	Encoder's UVW signal is wrong or not matchable with encoder
32	Code Violation of Encoder's UVW Signal	or all-low level exists in UVW signal

5.2 Methods for Handling Alarms

Table 5.2 Methods for Handling Alarms

Alarm Code	Alarm Name	Operation State	Reasons	Handling Methods
1	Excessive Speed	Occur when switching on the control power	①Failure in control power board ②Encoder failure	①Replace servo driver. ②Replace servo motor.
		Occur during motor operation	Excessively high input command pulse frequency.	Correctly set the input command pulse.
			Excessively small acceleration/ deceleration time constant results in overshoot.	Increase acceleration/deceleration time constant.
			The input electronic gear ratio is excessively high.	Correctly set the ratio.
			Encoder failure.	Replace servo motor.
			Bad encoder cable.	Replace encoder cable.
			Instable servo system causes overshoot.	①Reset related gains. ②If the gains cannot be set at a proper value, reduce inertia rate for load rotation
		Occur immediately after the motor is started	Excessively large load inertia.	①Reduce load inertia. ②Replace it with driver and motor of greater frequency.
			Zero-point error in encoder.	①Replace servo motor ②Contact the manufacturer for readjusting the zero point.
			①Wrong connection of motor leads of U, V and W. ②Wrong connection of encoder cable leads	Correct wiring.
2	Over-voltage in Main Circuit	Occur when switching on control power	Failure in circuit board.	Replace servo drive unit.
		Occur when switching on main power supply	①Excessively high power voltage. ②Abnormal wave pattern of power voltage.	Examine the power supply source.
		Occur during motor operation	Disconnection of braking resistance.	Rewiring.
			①Braking transistor is damaged. ②Internal braking resistance is damaged.	Replace servo drive unit.
			Insufficient capacity in the braking return circuit.	①Reduce start/stop frequency . ②Increase acceleration/deceleration time constant. ③Reduce torque limiting value. ④Reduce load inertia. ⑤Replace it with driver and motor of greater frequency.

3	Voltage Shortage in Main Circuit	Occur when switching on main power supply	①Failure in circuit board. ②Power fuse is damaged. ③Failure in soft start circuit. ④Damaged rectifier.	Replace servo drive unit.
			①Excessively low power voltage. ②Temporary power failure for more than 20mS.	Examine the power supply.
3	Voltage Shortage in Main Circuit	Occur during motor operation	①Insufficient power capacity . ②instantaneous power failure.	Examine the power supply.
			Heat radiator overheating.	Examine load.
4	Position Excess	Occur when switching on control power	Failure in circuit board.	Replace servo driver.
		After switching on main power supply and control wire, the motor does not work when inputting command pulse	①Wrong connection of motor leads of U, V and W. ②Wrong connection of encoder cable leads.	Correct wiring.
			Encoder failure.	Replace servo motor.
			Set inspection range for position excess.	Extend inspection range for position excess.
			Position proportion gain is too small.	Increase the gain.
			Insufficient torque.	①Examine torque limiting value. ②Reduce loading capacity. ③Replace it with drive unit and motor of greater frequency.
			Excessively high command pulse frequency.	Reduce the frequency.
5	Motor overheating	Occur when switching on control power	Failure in circuit board.	Replace servo drive unit.
			①Cable disconnection . ②Internal temperature relay of motor is damaged.	①Examine cable. ②Examine motor.
		Occur during motor operation	Motor overload.	①Reduce load. ②Reduce start/stop frequency. ③Reduce torque limiting value. ④ Reduce related gain. ⑤Replace drive unit and motor of greater frequency.
			Internal failure in motor.	① Replace servo motor.
6	Saturation Failure of Speed Regulator	Occur during motor operation	Motor gets stuck by the machinery.	Examine machinery part of the load.
			Overload.	①Reduce load. ②Replace it with drive unit and motor of greater frequency.
7	Abnormal Drive Stopping		Disconnection of CCW and CW drive stopping input terminal.	Examine the wire connection and power of the input terminal.

8	Overflow of Position Error Meter		①The motor get stuck by the machinery. ②Abnormal input command pulse.	①Examine the machinery part of the load. ②Examine command pulse. ③.Examine whether the motor works after receiving command pulse
9	Encoder failure		Wrong connection of encoder.	Examine wire connection.
			Damaged encoder.	Replace motor.
			Bad encoder cable.	Replace cable.
9	Encoder Failure		Excessively long encoder cable results in low power voltage of encoder.	①Shorten cable. ②Supply power with multiple core wires connected in parallel.
10	Voltage Shortage in Control Power		Low input control power.	Examine control power.
			①Internal connectors of driver have bad performance. ②Abnormal switch power. ③Damaged chip.	①Replace drive unit. ②Examine connector. ③Examine switch power.
11	Encoder Failure	Occur when switching on control power	Failure in circuit board.	Replace servo drive unit.
		Occur during motor operation	①Excessively low power voltage. ②Overheating.	①Examine drive unit. ②Re-electrify. ③Replace drive unit.
			Short circuit between motor leads of U, V and W.	Examine wire connection.
			Bad ground contact.	Correct ground contact.
			Damaged motor insulation.	Replace motor.
			Be jammed.	①Add circuit filter. ②Keep away from jamming source
12	Excessive Current		Short circuit between motor leads of U, V and W.	Examine wire connection.
			Bad ground contact.	Correct ground contact.
			Damaged motor insulation.	Replace motor.
			Damaged driver.	Replace drive unit.
13	Overload	Occur when switching on control power	Failure in circuit board.	Replace servo drive unit.
		Occur during motor operation	Operation by exceeding rated torque.	①Examine load. ②Reduce start/stop frequency. Reduce torque limiting value. Replace it with drive unit and motor of greater frequency
			Hold brake cannot be opened.	Examine the hold brake.
			Instable motor with vibration.	①Increase gain. ②Increase acceleration/deceleration time. ③reduce load inertia.

			①One phase of U, V and W is disconnected. ②Wrong connection of encoder.	Examine wire connection.
14	Braking failure	Occur when switching on control power	Failure in circuit board.	Replace servo drive unit.
		Occur during motor operation	Disconnection of brake resistance.	Re-wiring.
			①Damaged brake transistor. ②Internal brake resistance is damaged.	Replace servo drive unit.
14	Braking failure	Occur during motor operation	Insufficient capacity in the brake loop.	①Reduce stop/start frequency. ②Reduce acceleration/deceleration time. ③Reduce torque limiting value. ④Reduce load inertia. ⑤Replace drive unit and motor of greater frequency.
			Excessively high main circuit power voltage.	Examine main circuit.
15	Counting Error of Encoder		Damaged encoder.	Replace motor.
			Wrong connection of encoder.	Examine wire connection.
			Bad ground contact.	Correct ground contact.
20	EEPROM Error		Damaged chip or circuit board.	Replace servo drive unit. .After repair, first reset driver model (parameter No.1), then restore default parameter value.
30	Z Pulse Losing in Encoder		Z pulse does not exist; damaged encoder Bad cable Bad cable shielding Bad connection between shielded wire and shielding layer Failure in encoder's interface circuit	Replace encoder Examine encoder's interface circuit
31	UVW Signal Error in Encoder		Damaged UVW signal of encoder Damaged Z signal of encoder Bad cable Bad cable shielding Bad connection between shielded wire and shielding layer Failure in encoder's interface circuit	Replace encoder Examine encoder interface circuit
32	Code Violation of Encoder's UVW Signal		Damaged UVW signal of encoder Bad cable Bad cable shielding Bad connection between shielded wire and shielding layer Failure in encoder's interface circuit	Replace encoder Examine encoder interface circuit

Chapter Six Display and Operation

6.1 Keyboard Operation

● The panel of drive unit is composed of six-phase LED nixie tube display and four keys of ▲ ▼ ◄ ←, which are used to display states of drive units and set parameters. The specific functions of the keys are as follows :

   ▲: Increase serial number and value or forward operation.

   ▼ : Decrease serial number and value or backward operation.

   ◄: Return to the preceding layer of men or cancel the operation.

   ←: Enter the next layer of menu or confirm the input.

   Note: Press down ▲ or ▼ and hold on, the operation will be repeated. The longer the key is kept being pressed down, the faster the repetition frequency will be.   .

● The six-phase LED nixie tube display can show various states and data about the system. If decimal point of all the nixie tubes or the nixie tube on the fastest right side keeps flashing, it means alarm.

● Operation is conducted according to multi-layer menu, in which the first layer is the main menu, including eight operation modes; the second layer is functional menu to the operation mode under first layer. Fig. 6.1 is a block chart for operations in the main menu, as shown in the following:
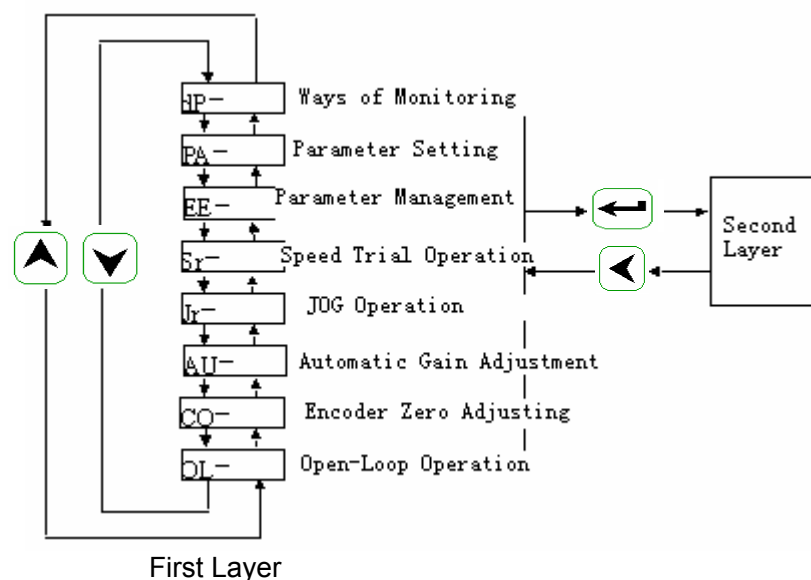
First Layer
Fig. 6.1 Block Chart for Operation Mode Selection

6.2 Ways of Monitoring

Select "dP-" In the first layer and press down⏎, then you will enter the ways of monitoring, in which there are 21 display states. Use ▲ and ▼ to select the display mode, then press down ⏎ to enter the specific display state.

Display	Description		Display	Description
DP-SPd	Motor Speed(r/min)		r 1000	Motor Speed 1000r/min
DP-PoS	Lower by 5 (pulses) at Current Position		P45806	
DP-PoS.	Higher by 5 (×100,000 Pulses) at Current Position		P. 12	Current Position at 1245806 Pulses
DP-CPo	Position Command is Lower then 5 (Pulses)		C45810	
DP-CPo.	Position Command is Higher then 5 (Pulses)		C. 12	Position Command of 1245810 Pulses
DP-EPo	Position Error is Lower by 5 (Pulses)		E 4	
DP-EPo.	Position Error is Higher by 5 (×100,000 Pulses)		E. 0	Position Error by 4 Pulses
DP-trq	Motor Torque		t 70	Motor Torque 70%
DP-I	Motor Current		I 2.3	Motor Current 2.3A
DP-LSP	Linear Velocity		L 5.000	Linear Velocity 5000m/min
DP-Cnt	Current Control Mode		Cnt 0	Control Mode 10
DP-Frq	Position Command Pulse Frequency		F 12.6	Position Command Pulse Frequency 12.6kHZ
DP-CS	Speed Command		r. -35	Speed Command -35r/min
DP-Ct	Torque Command		t. -20	Torque Command -20%
DP-APo	Absolute Position of Rotor During One Round		A 3265	Absolute position of Rotor
DP-In	Input Terminal State		In‖‖‖‖‖	Input Terminal
DP-oUt	Encoder Input Signal		oUt ‖‖‖	Output Terminal
DP-Cod	Operation State		Cod ‖‖‖‖	Encoder Signal
DP-rn	Alarm Code		rn on	Operation State: Under Operation
DP-Err	Reservation		Err 9	No.9 Alarm
DP-rES			U 0	

Fig. 6.2 Operation Chart for Ways of Monitoring

Note 1： Position and command pulse are both values multiplied by input electronic gear.

Note 2： Pulse unit is the internal pulse unit of the system, where it means 100,000 pulses/round. The pulse is expressed by value higher by 5 plus value lower by 5. The calculation method is: Pulse=(value higher by 5)×100,000 + value lower

by 5.

Note 3：Control mode: 0---position control; 2---speed control;3---speed trial operation; 3---JOG operation;4---encoder zero adjusting;5---open-loop operation.

Note 4：If the displayed number reach 6 digits (like 123456), the hint characters will not be shown.

Note 5：Position command pulse frequency is the actual pulse frequency before being multiplied by the input electronic gear, with a minimal unit of 0.1kHz. Forward-direction display stands for positive number and reverse-position display for negative number.

Note 6：The calculation method for motor current I is : $I = \sqrt{\dfrac{2}{3}(I_U^2 + I_V^2 + I_W^2)}$

Note 7：Absolute position of rotor during one round stands for the position of rotor in relative to stator during the round. One round is taken as a cycle, ranging from 0 to 9999.

Note 8：Input terminal is shown in Fig. 6.3; the output terminal is shown in Fig. 6.4; and encoder signal is shown in Fig. 6.5
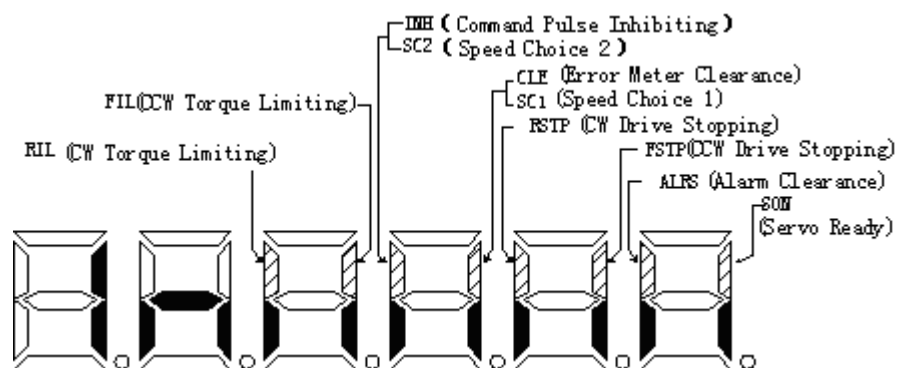
Fig. 6.3   Input Terminal Display (dot shining means ON and stop shining means OFF)
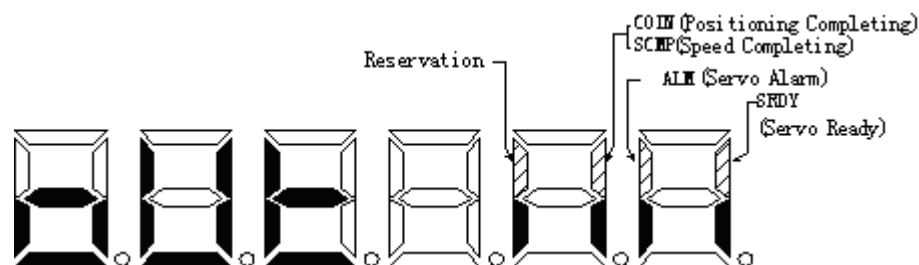
Fig. 6.4 Output Terminal Display (dot shining means ON and stop shining means OFF)
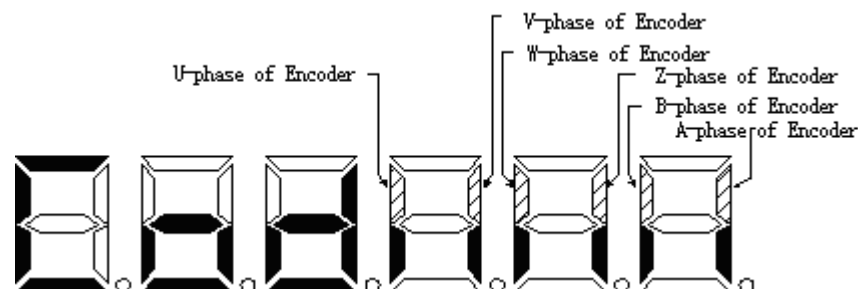
Fig. 6.5 Encoder Signal Display (dot shining means ON and stop shining means OFF)

Note 1：Operation states are expressed as:

"cn- oFF" : The main circuit is not discharged and the servo system does not work;

"cn- CH" : The main circuit is charged but the servo system does not work (the servo is not on or alarm occurs);

"cn- on" : The main circuit is charged and the servo system is under operation,

Note 2： Linear velocity only displays 4 digits.

6.3 Parameter Setting

⚠️ **Attention**

● Only after No.0 parameter is set as the corresponding value can other parameters be changed.
● Except No.1 parameter, the parameter will take effect immediately after it is set. Wrong parameter setting may cause wrong operation of the equipment, which will result in accidents.

Select "PA-" in the first layer, then press down ↵ to enter the parameter setting mode. Use ▲ and ▼ to select serial number of the parameter and enter ↵ to display the value, which can be changed by using ▲ and ▼. Click ▲ or ▼ for one time, the parameter value will be increased or decreased by 1; press down ▲ or ▼ and hold on, the parameter value will be increased or decreased continuously. When the parameter is changed, the decimal point on LED nixie tube at the furthest right side will shine, then press down ↵ to confirm the validity of the parameter changed and the decimal point will stop shining. The changed parameter value will be immediately reflected in the control operation. Use ▲ or ▼ to go on with parameter changing, after which click down ◀ to return to the parameter selecting mode. If you are not satisfied with the changed parameter value, do not press down ↵ for confirmation but use ◀ to cancel the parameter changing operation, restore the original value and return to the parameter selecting mode.
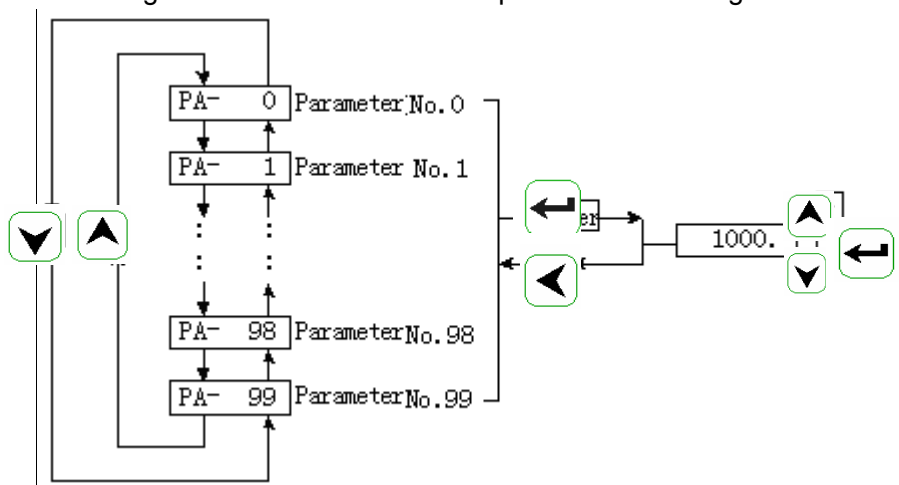
Fig. 6.6 Operation Chart for Parameter Setting

6.4 Parameter Management

⚠️ **Attention** If the writing-in operation fails to be implemented to the changed parameter, the value will not be stored and the change will go invalid after power off.

Parameter management mainly involves operations between memory and EEPROM. Select "EE-" in the first layer and press down ⏎ to enter the parameter management mode. First select an operation mode in the five modes with ▲ and ▼. Take "parameter writing-in"operation for example, first select "EE-Set", then press down ⏎ and hold on for at least 3 seconds. If the operation is successful, "FInISH" will be shown on the display; if it fails, "Error" will appear on the display. Re-press down ◄ to return to the operation mode selecting state.

● **EE－SEt** Write in parameter, i.e., write the parameter in the memory into the parameter area of EEPROM. When the user changes the parameter, it is only the parameter in the memory that is changed, and the parameter value will be restored after the power is switched on the next time. If you want to permanently change the parameter value, you have to implement the writing in operation, by which means you can write the parameter in the memory into the parameter area of EEPROM and you can use the changed parameter after power is switched on the next time.

● **EE－rd** Read parameter, i.e. the parameter will be red into the memory from the parameter area of EEPROM. This process will be automatically implemented after the power is switched on. In the beginning, the parameter value in the memory is the same with that in the parameter area of EEPROM. But after the user changes the parameter, the value in the memory will be changed; when the user is not satisfied with the changed parameter or the parameter is adjusted in a disorderly way, the parameter reading operation can be implemented for reading the data in the parameter area of EEPROM back into the memory and restoring the parameter value at the power-on time.

● **EE－bA** Back up parameter, i.e., write the parameter in the memory into the backup area of EEPROM. The whole EEPROM is divided into parameter area and backup area. System electrifying, parameter writing in and parameter reading operations all use parameter area of EEPROM, while parameter and recovery backup use the backup area of EEPROM. In the process of parameter setting, if the user is relatively satisfied with a set of parameters but want to make further changes, he or she can first implement the recovery backup operation, by which means the parameters in the memory will be stored in the backup area of EEPROM, then change the parameters. If the effect is not so good, the user can implement the recovery backup operation, in which way the parameters stored in the backup area of EEPROM will be red back into the memory. Then the user can continue with the revision or choose to stop. In addition, after the parameter is set, the user can implement the two operations of parameter writing in and parameter backup to render data in the parameter area and backup area identical with each other; so in case that the parameter is inadvertently changed, the recovery backup operation can be conducted to read the data in the backup area of EEPROM into the memory and then the parameter reading operation can be carried out to write the parameter in the memory into the parameter area of EEPROM.

- **EE－rS** Recovery backup, i.e., read data in the recovery area of EEPROM into the memory. What needs to be noted is that the parameter writing in operation is not implemented in this operation, so it is still the data in the parameter area of EEPROM that is red into the memory. If the user wants to permanently use the parameter in the backup area of EEPROM, he or she can conduct the parameter writing in operation.

- **EE－dEF** Restore default value, i.e., all the default parameter values (factory values) will first be red into the memory and then written into the parameter area of EEPROM, thus the default parameter value will be used after the power is switched on the next time. When the user adjusts the parameter in a disorderly way and the system cannot work, he or she can implement this operation to restore all the parameters back to the factory leaving conditions. Since different driver models correspond to different default parameter values, the driver models must be ensured to be correct when restoring the default parameters.
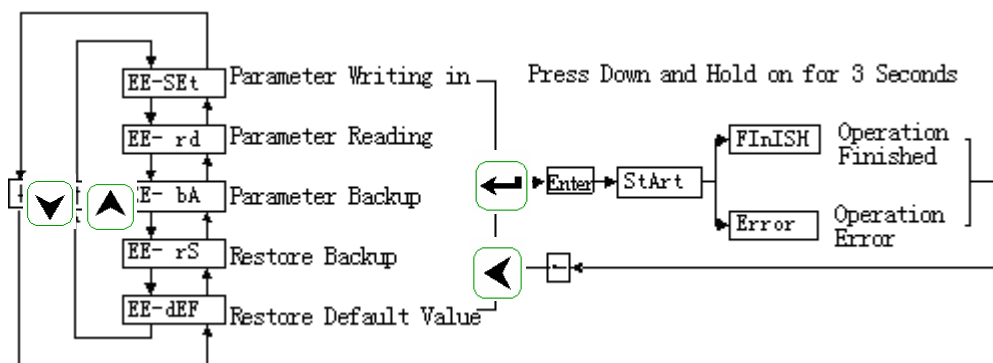
Fig. 6.7 Operation Chart for Parameter Management
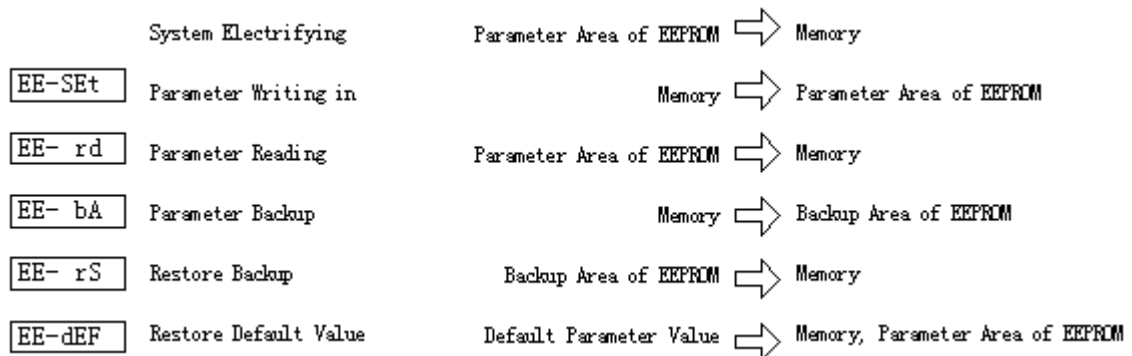
Fig. 6.8 Operation Meaning for Parameter Management

Attention

⚠

● It is recommended that speed trial operation and JOG operation should be conducted when the motor does not have load for preventing equipment accidents.
● During the trial operation, the driver SON should be valid while CCW and CW drive stopping should be invalid.

6.5 Speed Trial Operation

Select "Sr-" in the first layer and click to enter the trial operation mode. The hint character

for speed trail operation is "S" and the value unit is r/min. When the system is under speed control mode, the speed command will be provided by the keys. The speed command can be changed by ▲ or ▼ and the motor will run at the given speed. ▲is used to increase the speed in positive direction and ▼ to decrease the speed in positive direction (increase in the negative direction). When the speed is a positive value, the motor will rotate in positive direction; when the speed is a negative value, the motor will rotate in negative direction.

$$\boxed{\text{S} \quad 800} \quad \boxed{\begin{array}{c} \uparrow \\ \downarrow \end{array}}$$
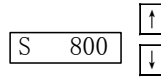
Fig.6.9 Speed Trial Operation Chart

6.6 JOG Operation

Select "Jr-" in the first layer and click ⏎ to enter the JOG operation mode, i.e. itching mode. The hint character for JOG operation is "J" and the value unit is r/min. When the system is under speed control mode, the speed command will be provides by keys. After entering the JOG operation, press down ▲ and hold on, then the motor will run at the JOG speed; release the key, the motor will stop and keep zero speed. Press down ▼ and hold on, the motor will run in the reserve direction; release the key, the motor will stop and keep zero speed. JOG speed is set through No.21 parameter.
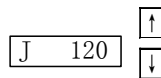
$$\boxed{\text{J} \quad 120} \quad \boxed{\begin{array}{c} \uparrow \\ \downarrow \end{array}}$$

Fig. 6.10 JOG Operation Chart

6.7 Others

The function of automatic gain adjustment is under development and cannot be provided temporarily.

The function of encoder zero adjusting is used by the motor manufacturer, so the user shall not use it.

Open-loop operation mode is used by the motor manufacturer, so the user shall not use it.

Chapter Seven Operation by Switching on Power

<table>
<tr><td align="center">⚠️**Attention**</td></tr>
<tr><td>

● The drive unit and motor must have reliable ground contact; PE terminal must be safely connected with the grounding terminal of equipment.
● It is recommended that the power should be supplied through isolating transformer and power filter for the purpose of ensuring safety and anti-jamming abilities.
● Only after examining and confirming that the wire is connected correctly can the power be switched on.
● An emergency stop circuit must be coupled in to ensure that the power can be immediately cut off in case of failure (see Fig. 7.1).
● After the alarm for failure in drivin unit occurs, confirm that the trouble has been shot and that the SON signal is invalid before restarting the system.
● Do not touch the drive unit and motor at least 5 minutes after the power is off for fear of electric shock.
● After some time of operation, the drive unit and motor may have a relatively high temperature. Be careful not be burned.
</td></tr>
</table>

7.1 Power Supply Connecting

Refer to Fig. 7.1 for power supply connecting and connect the power supply according to the following order:

1) Connect the power supply with input terminal of main circuit power (the three phases are connected with R, S and T; and the single phase is connected with R and S) through electromagnetic contactor.

2) Power supply r and t in the control circuit shall be connected at the same time with or prior to main circuit power. If only the control power is connected, the servo ready signal (SRDY) will be OFF.

3) After the main circuit power is connected, the servo ready signal (SDRY) will be ON with a time delay of 1.5 seconds, then the servo on signal (SON) can be received. After detecting validity of the servo on signal, the driver output will be valid, and the motor will be activated and under the operation state; when detecting invalidity of the servo on signal or alarm, the base electrode circuit will be closed and the motor will be under free state.

4) When servo on is connected with the power supply, the base electrode circuit will be connected after 1.5 seconds or so.

5) A frequent connection of the cut-off circuit may damage the soft start circuit and consume energy of the brake circuit. The connection frequency shall be best limited to less than 5 times per hours and 30 times per day. After the trouble for overheating in the drive unit or motor has been shot, the power can only be switched on after 30 minutes of cooling down.
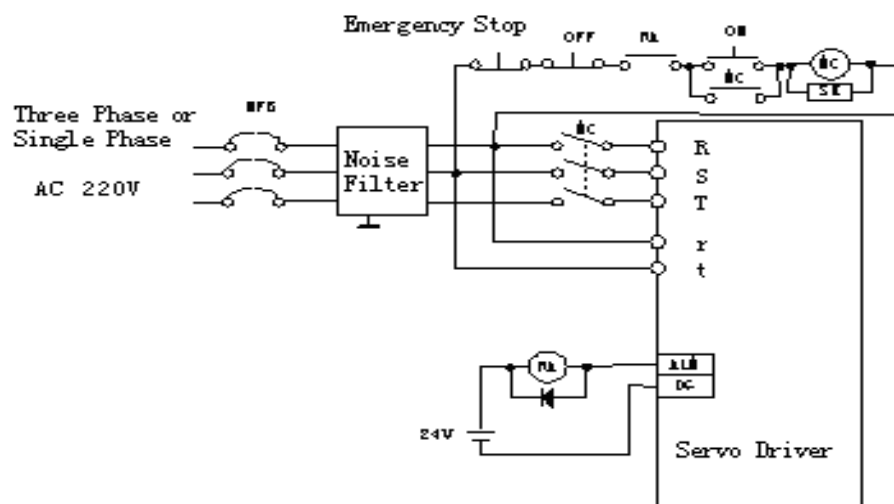
Fig. 7.1 Power Supply Connecting
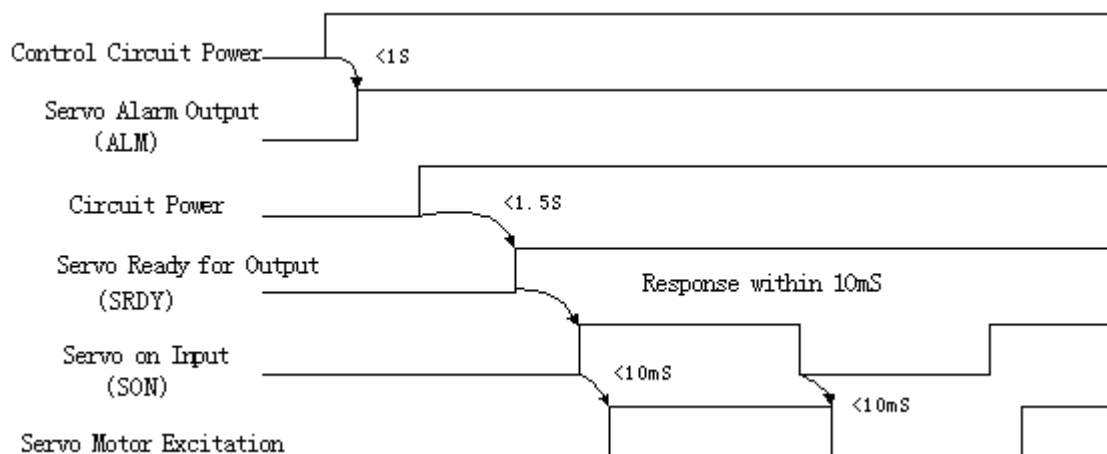
Time sequence for Power Supply Connecting and Alarming:

Fig. 7.2 Time sequence for Power Supply Connecting
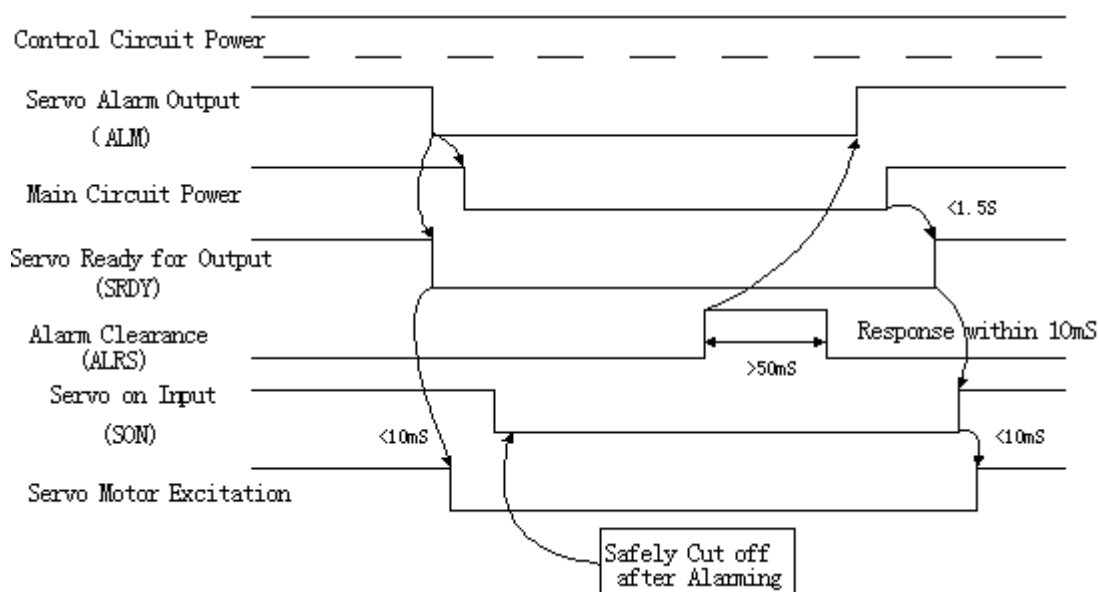

Fig. 7.3 Time sequence for Alarming

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7.2 Trial Operation

1） **Pre-operation Examination**

After installment and wiring have been completed, the following items shall be examined before switching on the power:

● Whether the wiring and reliable input voltage are correct in the power supply terminal TB.

● Whether the power supply wire and motor wire have short circuit or ground contact.

● Whether the encoder cable has correction wiring.

● Whether the wiring, power supply electrode and voltage are correction in the control signal terminal.

● Whether the drive unit and motor have been firmly installed.

● Whether the motor shaft is connected with load.

2） **Trail Operation by Switching on Power**

(1) Trail Operation

①Connect CN1 and set the input control signals as: servo on (SON) OFF, CCW drive stopping (FSTP) ON, CW drive stopping (RSTP) ON.

② Switch on control circuit power (temporarily not switching on the main circuit power) and the point on the display of the drive unit will shine. If alarm occurs, examine the wiring.

③Set the control mode (parameter No.4) as speed trail operation mode (set as 2).

④Switch on the main circuit power.

④ Render servo on (SON) ON after confirming that there is no alarm or any other abnormal condition, then the motor will be activated and under the state of zero speed.

⑥Enter the speed trial operation mode through key operation. The hint character for speed trial operation is "S" and the value unit is r/min. When the system is under the speed control mode, the speed command will be provided by the keys. The speed command can be changed by ▲ or ▼ and the motor will run at the given speed.

(2) JOG (Itching) Operation

① Connect CN1 and set the input control signals as: servo on (SON) OFF, CCW drive stopping (FSTP) ON, CW drive stopping (RSTP) ON.

② Switch on control circuit power (temporarily not switching on the main circuit power) and the point on the display of the drive unit will shine. If alarm occurs, examine the wiring.

③ Set the control mode (parameter No.4) as JOG operation mode (set as 3).

④ switch on the main circuit power..

⑤Render servo on (SON) ON after confirming that there is no alarm or any other abnormal condition, then the motor will be activated and under the state of zero speed.

⑥ Enter the speed trial operation mode through key operation. The hint character for speed trial operation is "J" and the value unit is r/min. When the system is under the speed control mode, the speed value and direction will be determined by the keys. With ▲, the motor will run at the speed and direction determined by parameter No.21; with ▼, the motor will run in the reserve direction at the given speed.

(3) Operation under Position Control Mode

① Connect CN1 and set the input control signals as: servo on (SON) OFF, CCW drive stopping (FSTP) ON, CW drive stopping (RSTP) ON.

② Switch on control circuit power (temporarily not switching on the main circuit power) and

the point on the display of the drive unit will shine. If alarm occurs, examine the wiring.

③Set the control mode (parameter No.4) as position operation mode (set as 0). According to the way of inputting signals by controller, the user shall set parameter No.14 and proper electronic gear ratio (No.12 and No.13).

④ Switch on the main circuit power.

⑤ Render servo on (SON) ON after confirming that there is no alarm or any other abnormal condition, then the motor will be activated and under the state of zero speed.

⑥ The output signal of operation position controller is transmitted to the driving foot of CN1-6, 18, 7 and 19, and the motor will run according to the command.

(4) Operation under Speed Control Mode

The speed operation mode can be divided into external speed control by analog voltage and internal speed control.

External Speed Control by Analog Voltage

① Connect CN1 and set the input control signals as: servo on (SON) OFF, CCW drive stopping (FSTP) ON, CW drive stopping (RSTP) ON.

② Switch on control circuit power (temporarily not switching on the main circuit power) and the point on the display of the drive unit will shine. If alarm occurs, examine the wiring.

③ Set the control mode (parameter No.4) as speed operation mode (set as 1), and set the PA43 parameter as 1.

④ Switch on the main circuit power.

⑤ Render servo on (SON) ON after confirming that there is no alarm or any other abnormal condition, then the motor will be activated and under the operation state of external control speed by analog voltage.

Analog speed zero adjusting:

    1) Set PA49 parameter as 1;

    2) Switch display to "DP-SPD";

    3) Observe current rotation rate: if it rotates in the positive direction, regulate PA44 value toward the higher side; if the it rotates in the reverse direction, regulate the PA44 value towards the lower side until the rotation rate reads "R-0";

    4) Set PA49 parameter value as 0;

    5) Switch display to "DP-POS";

    6) Observe current position: if it increases, regulate PA35 value towards the higher side; if it decreases, regulate PA45 value towards the lower side unit the position value stands still.

⑥ The motor rotation rate can be changed by adjusting external analog voltage and the motor rotation direction can be changed by adjusting direction of the analogy voltage.

Note: Under speed control mode, even when it, as the analog command voltage, gives 0V command, the motor will rotate at a minute speed. Then the zero point of the amplifier shall be adjusted.

Internal Speed Control:

(1) Connect CN1 and set the input control signals as: servo on (SON), speed choice 1 (SC1) and speed Choice2 (SC2) OFF, CCW drive stopping (FSTP) ON, CW drive stopping (RSTP) ON.

(2) Switch on control circuit power (temporarily not switching on the main circuit power) and the point on the display of the drive unit will shine. If alarm occurs, examine the wiring.

(3) Set the control mode (parameter No.4) as speed operation mode (set as 2) and set PA43 parameter as 0. Set parameter No.24～27 according to needs.

(4) Switch on the main circuit power.

(5) Render servo on (SON) ON after confirming that there is no alarm or any other abnormal condition, then the motor will be activated and under the operation state of internal speed 1.

(6) Change the states of input signal SC1 and SC2 to make the motor rotate at the given speed.

7.3 Adjustment

⚠ **Attention**
● Wrong parameter setting may cause equipment failure or accidents. Confirm validity of parameter setting before starting the system.   ● It is recommended to no-load commissioning should be conducted before commissioning with load.

1） Adjustment in Basic Gains

(1) Speed Control

① The value speed proportion gain (parameter No.5) should be set as large as possible under the precondition that no vibration will be caused. Generally, the greater the load inertia is, the larger the value of speed proportion gain shall be set.

② The value of speed integral time constant (parameter No.6) shall be set as low as possible according to the given conditions. If the value of speed integral time constant is set too low, the response speed will be improved but it is also easy to cause vibration. So under the precondition that no vibration will be caused, the value shall be set as low as possible. For if the value is too high, the speed will have a great change when the load is changed.

(2) Position Control

① Set proper speed proportion gain and speed integral time constant according to the above-motioned methods.

② Set position feed-forward gain (parameter NO.10) as 0%.

③ Within the range of stability, the value of position proportion gain (parameter No.9) shall be set as large as possible. If the value of position proportion gain is set too high, the position command will be easily traced and have small lag error, but it is prone to cause vibration when it stops positioning.

④ If an extremely high performance in position tracing is required, the value of position feed-forward gain can be increased. But if the value is set too high, it may cause over-adjustment.

Note: When the value of position proportion gain is relatively low, the system will be stable, but the position tracing performance will be impaired and the lag error increased.

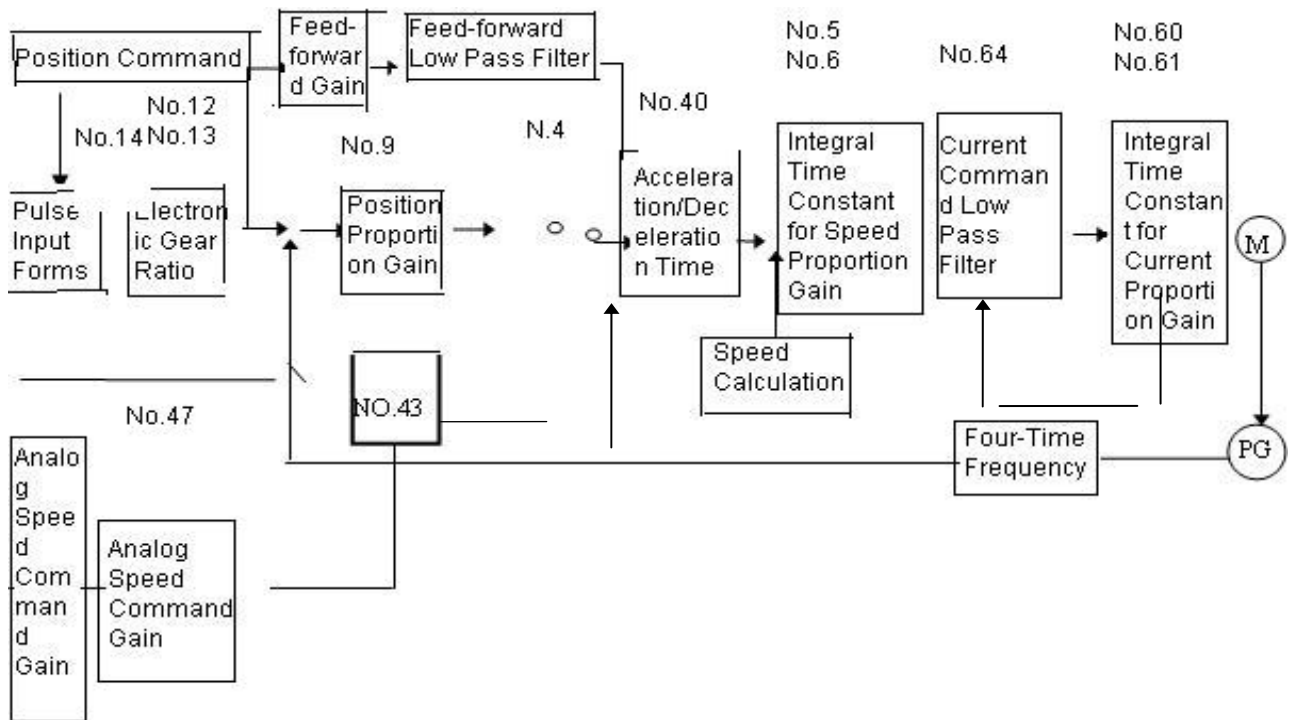**2） Chart for Adjustment in Basic Parameters**

Fig. 7.4 Chart for Adjustment in Basic Parameters

3) Position Resolution and Electronic Gear Position

Position resolution (one pulse itinerary△l) is determined by itinerary per round of servo motor △S and feedback pulse per round of encoder Pt, as expressed in the following calculation formula:

$$\triangle l = \frac{\Delta S}{Pt}$$

In which,

△l: one pulse itinerary (mm);

△S: one pulse itinerary (mm/round);

Pt: feedback pulse per round of encoder (pulses/round).

Since there is a four-time frequency circuit in the system, Pt=4×C, in which C is the line number per round of encoder. In this system, C=2500 lines/round, so Pt=10000 pulses/round.

Command pulse can be converted into position control pulse after being multiplied by electronic gear ratio G, so one command pulse itinerary △l ＊ is expressed as:

$$\triangle l^* = \frac{\Delta S}{Pt} \times G$$

In which, G= $\dfrac{\text{Command pulse frequency division numerator}}{\text{Command pulse frequency division denominator}}$

Chapter Eight Product Specifications

⚠ **Attention**
● Servo drive unit must be selected to match the servo motor. This manual describes matched specifications on GKS SJT series and ST series of products. ● Servo motor description. The user shall make a clear indication in the order if he or she needs to select servo motor of other manufacturers.

8.1 Driver Specifications

Table 8.1   Servo Driver Specifications

Output Power(kW)		0.4～0.8	1.0～1.5	1.7～2.3
Rated Torque of Motor (Nm)		2～4	4～10	6～15
Input Voltage		Three Phases or Single Phase AC220V -15%～+10%　50 Hz /60Hz	Three-phase AC220V -15%～+10%　50 Hz /60Hz	
Operation Environment	Temperature	Operaton:0℃～55℃　Storage:-20℃～80℃		
	Humidity	Less than 90%(no dew condensation)		
	Vibration	Less than 0.5G(4.9m/S2),10～60 Hz(non-continuous operation)		
Control Mode		①Position Control ②Speed Control ③Speed Trial Operation ④JOG Operation ⑤Open-loop Operation		
Regenerative Brake		Built in		
Control Features	Speed Frequency Response:200Hz or more			
	Speed Wave Frequency:＜±0.03(load 0～100%):＜±0.02(power supply-15%～+10%)(the value shall correspond to rated velocity)			
	Speed Ratio:1:5000			
	Pulse Frequency:≤500kHz			
Control Input		①Servo on; ②Alarm Clearance ;③CCW Drive Stopping; ④CW Drive Stopping;⑤Error Meter Clearance/Speed Choice1;⑥Command Pulse Inhibiting/Speed Choice2;⑦CCW Torque Limiting;⑧CW Torque Limiting.		
Control Output		①Servo Ready for Output;②Servo Alarm Output;③Positioning Completing Output/Speed Completing Output.④ Hold Output		
Position Control	Input Forms	①Pulse+Symbol;②CCW Pulse/CW Pulse;		
	Electronic Gear Ratio	1～32767/1～32767		

	Feedback Pulse	10000 Pulses/Round
Speed Control	1) Analog Speed Control Mode: +-10V Voltage; Input Impedance 20K 2) Electronic Gear Ratio: 1-1/255	
	Four Types of Internal Speeds	
Acceleration/ Deceleration Function	Parameter setting for acceleration/deceleration time 1 ms ～ 10000ms(0r/min←→1000r/min)	
Monitoring Function	Rotation rate, current position, command pulse accumulation, position error, motor torque, motor current, linear velocity, absolute position of rotor, command pulse frequency, operation state, input/output terminal signal and etc.	
Protection Function	Excessive speed, voltage shortage in main power supply, over-current, overload, abnormal brake, abnormal encoder, abnormal control power, position excess and etc.	
Display and Operation	6-phase LED nixie tube, 4 keys	
Applicable load inertia	Less than 5 times of motor inertia	
Dimension	240 mm×177.5 mm×90mm(see figuration drawing)	

8.2 Servo Motor Specifications

1）**Product Introduction**

GSK SJT series of three-phase AC permanent-magnet synchronous servo motors has the following technical features:

◆ Adopt new rare-earth materials, with great output power.

◆ Good low-speed performance, with speed ratio>1**:**10000.

◆ High dielectric strength and insulation resistance for safe operation.

◆ Powerful overlaod capacity: torque can reach 8 times of rated torque in an instant.

2）**Terminal Explanation**

（1）**SJT Series of Motor Winding**

U,V,W,PE terminal.The three winding phases of U, V and W of motor and the rack earth are led out through a 4-core connector. The corresponding relationships are shown in Table 8.2. U, V, W and rack earth are respectively connected with terminal U, V, W and PE of the main return circuit.
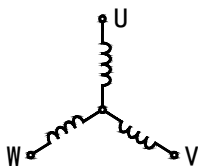
Table 8.2　Motor Wiring

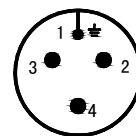| Motor Lead Wire	U	V	W	Rack (Earth)
Socket No.	2	3	4	1

Diagram for Plugs
(wire welding area)

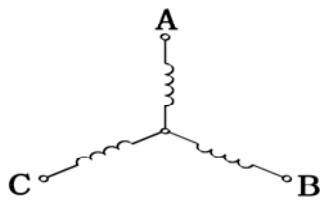The lead wires of photoelectric encoder are led out through a 15-core connector. The

corresponding relationships are shown in Table 8.2. The lead wires shall be connected with plugs of the driver feedback signals CN2 according to driver requirements.

Table 8.3 Encoder Wiring

Lead Wires of Encoder	Rack (Earth)	V_{CC}	GND	A	$\overline{A}$	B	$\overline{B}$	Z
Socket No.	1	2	3 $\overline{U}$	4	7 $\overline{V}$	5	8 $\overline{W}$	6
Lead Wires of Encoder	Z	U		V		W		
Plug No.	9	10	13	11	14	12	15	

(2)ST Series of Motor Winding

Schematic diagram for motor winding is shown as follows:

A, B and C are lead-out terminals of winding.

Lead-out way: 4-core socket.

Table 8.4 Motor Wiring

Socket No.	2	3	4
Motor Winding	A	B	C
Remark	One foot has ground contact (rack)		

Lead-out way of photoelectric encoder:15-core socket.

Table 8.5 Encoder Wiring

Marks	2	3	4	7	5	8	6	9	10	13	11	14	12	15
Lead-out foot	V_{CC}	GND	A	$\overline{A}$	B	$\overline{B}$	Z	$\overline{Z}$	U	$\overline{U}$	V	$\overline{V}$	W	$\overline{W}$
Remark	GND is one foot (rack) of the encoder power Vcc that has ground contact													

(3) Specifications

Table 8.8   Specifications on SJT Series of Some Motors

Models	Power(kw)	Paris of Electrodes	Rated Torque(N.m)	Rated Rotation	Rated Current	Rotor Inertia	Acceleration Time	Operating Voltage
110SJT-M020E	0.6	4	2	3000	3.0	3.4×10^{-4}	52	220(300)
110SJT-M040D	1.0	4	4	2500	4.5	6.8×10^{-4}	45	220(300)
110SJT-M060D	1.5	4	6	2500	7.0	9.5×10^{-4}	42	220(300)
130SJT-M040D	1.0	4	4	2500	4.0	1.19×10^{-3}	80	220(300)
130SJT-M050D	1.3	4	5	2500	5.0	1.19×10^{-3}	64	220(300)
130SJT-M060D	1.5	4	6	2500	6.0	1.95×10^{-3}	82	220(300)
130SJT-M075D	1.88	4	7.5	2500	7.5	1.95×10^{-3}	66	220(300)
130SJT-M100B	1.5	4	10	1500	6.0	2.42×10^{-3}	38	220(300)
130SJT-M100D	2.5	4	10	2500	10.0	2.42×10^{-3}	63	220(300)

130SJT-M150B	2.3	4	15	1500	8.5	$3.1×10^{-3}$	33	220(300)
130SJT-M150D	3.9	4	15	2500	14.5	$3.6×10^{-3}$	63	220(300)

Note: The user shall make a special indication if he or she wants to order motor with electricity-losing brake.

**Table 8.9 Specifications on ST Series of Some Motors**

Models	Power (kw)	Zero Speed	Rated Rotation	Rated Current	Rotor Inertia	Machinery Time	Operating Voltage	Weight (kg)
110ST-M02030H	0.6	2	3000	4.0	$0.33×10^{-3}$	3.64	220(300)	4.2
110ST-M04030H	1.2	4	3000	7.5(5.0)	$0.65×10^{-3}$	2.32	220(300)	5.2
110ST-M05030H	1.5	5	3000	9.5(6.0)	$0.82×10^{-3}$	2.03	220(300)	5.8
110ST-M06020H	1.2	6	2000	8.0(6.0)	$1.00×10^{-3}$	1.82	220(300)	6.4
110ST-M06030H	1.8	6	3000	11.0(8.0)	$1.00×10^{-3}$	1.82	220(300)	6.4
130ST-M04025H	1.0	4	2500	6.5(4.0)	$0.85×10^{-3}$	3.75	220(300)	7.4
130ST-M05025H	1.3	5	2500	6.5(5.0)	$1.06×10^{-3}$	3.07	220(300)	7.9
130ST-M06025H	1.5	6	2500	8.0(6.0)	$1.26×10^{-3}$	2.83	220(300)	8.6
130ST-M07720H	1.6	7.7	2000	9.0(6.0)	$1.58×10^{-3}$	2.44	220(300)	9.5
130ST-M10015H	1.5	10	1500	9.0(6.0)	$2.14×10^{-3}$	2.11	220(300)	11.1
130ST-M10025H	2.6	10	2500	14.5(10.0)	$2.14×10^{-3}$	2.11	220(300)	11.1
130ST-M15015H	2.3	15	1500	13.5(9.5)	$3.24×10^{-3}$	1.88	220(300)	14.3

Note 1: The value within the bracket in the column of rated current is the rated current under high voltage

Note 2: The user shall make a special indication if he or she wants to order motor with electricity-losing brake
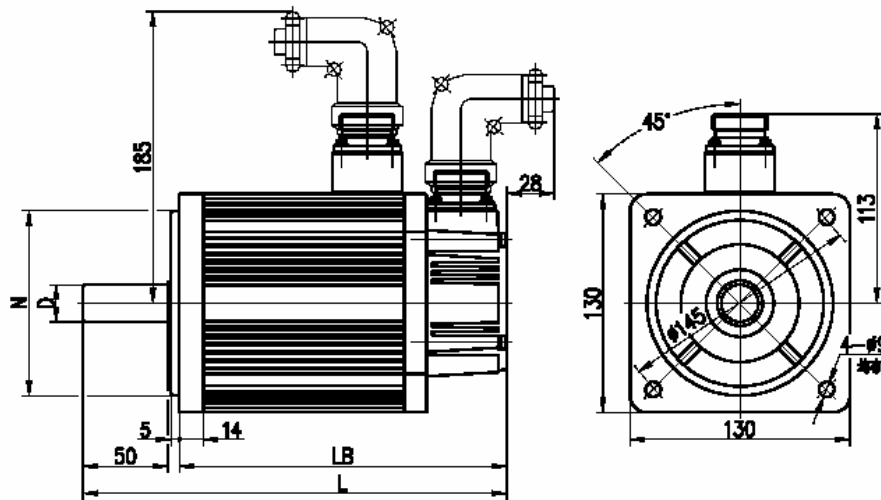
3) Figuration Dimension
  (1) Figuration and installment dimension for SJT series of 110-stand model AC servo motors
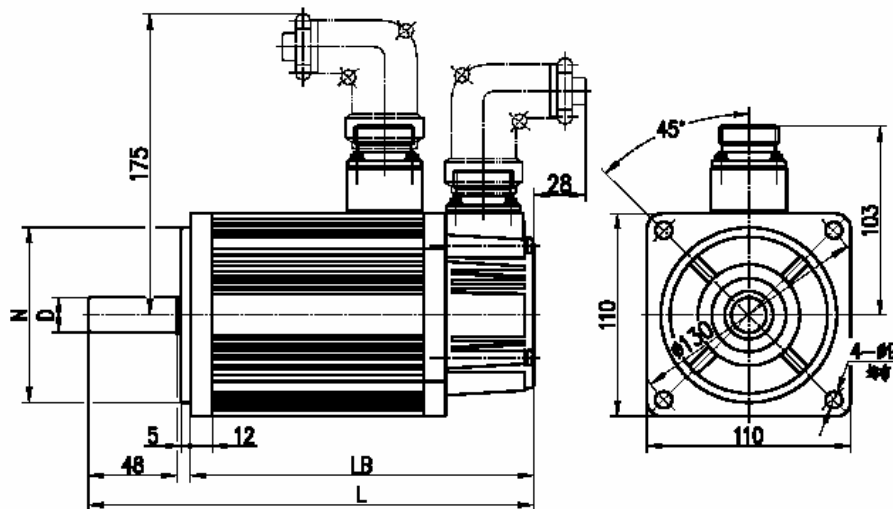
Specifications	D(mm)	N(mm)	LB(mm)	L(mm)
110SJT—M020E	$\phi 19^{0}_{-0.013}$	$\phi 95^{0}_{-0.035}$	156(207)	211(262)
110SJT—M040D	$\phi 19^{0}_{-0.013}$	$\phi 95^{0}_{-0.035}$	186(237)	241(292)
110SJT—M060D	$\phi 19^{0}_{-0.013}$	$\phi 95^{0}_{-0.035}$	212(263)	267(318)

Note: The LB and L value in the bracket is the length of motor with electricity-losing brake of the corresponding specifications.

(2) Figuration and installment dimension for SJT series of 130-stand model AC servo motors

Specifications	D(mm)	N(mm)	LB(mm)	L(mm)
130SJT—M040D	$\phi 22^{0}_{-0.013}$	$\phi 110^{0}_{-0.035}$	168(227)	225(284)
130SJT—M050D	$\phi 22^{0}_{-0.013}$	$\phi 110^{0}_{-0.035}$	168(227)	225(284)
130SJT—M060D	$\phi 22^{0}_{-0.013}$	$\phi 110^{0}_{-0.035}$	190(249)	247(306)
130SJT—M075D	$\phi 22^{0}_{-0.013}$	$\phi 110^{0}_{-0.035}$	190(249)	247(306)
130SJT—M100B	$\phi 22^{0}_{-0.013}$	$\phi 110^{0}_{-0.035}$	208(267)	265(324)
130SJT—M100D	$\phi 22^{0}_{-0.013}$	$\phi 110^{0}_{-0.035}$	208(267)	265(324)
130SJT—M150B	$\phi 22^{0}_{-0.013}$	$\phi 110^{0}_{-0.035}$	238(297)	295(354)
130SJT—M150D	$\phi 22^{0}_{-0.013}$	$\phi 110^{0}_{-0.035}$	248(307)	305(364)

Note: The LB and L value in the bracket is the length of motor with electricity-losing brake of the corresponding specifications.
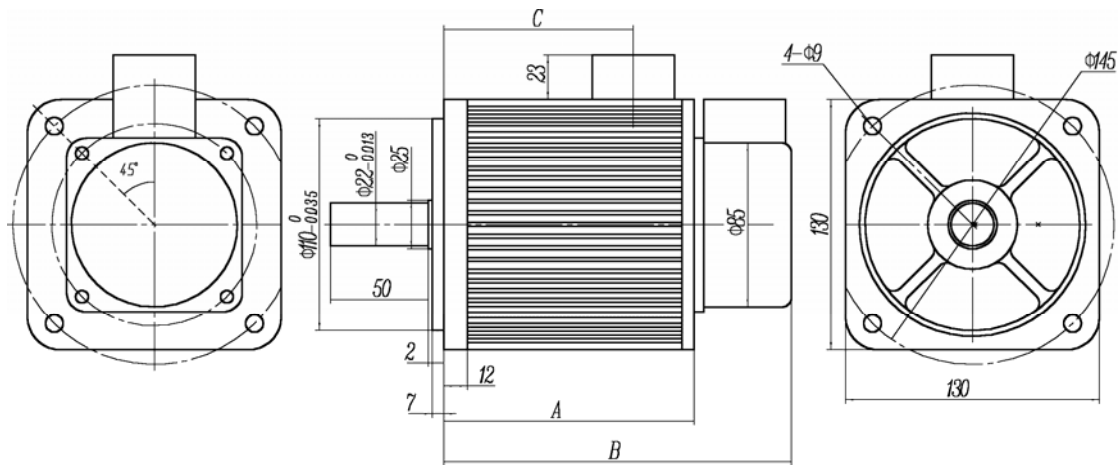
(3) Figuration Drawing for DST series of 110-stand model AC servo motors
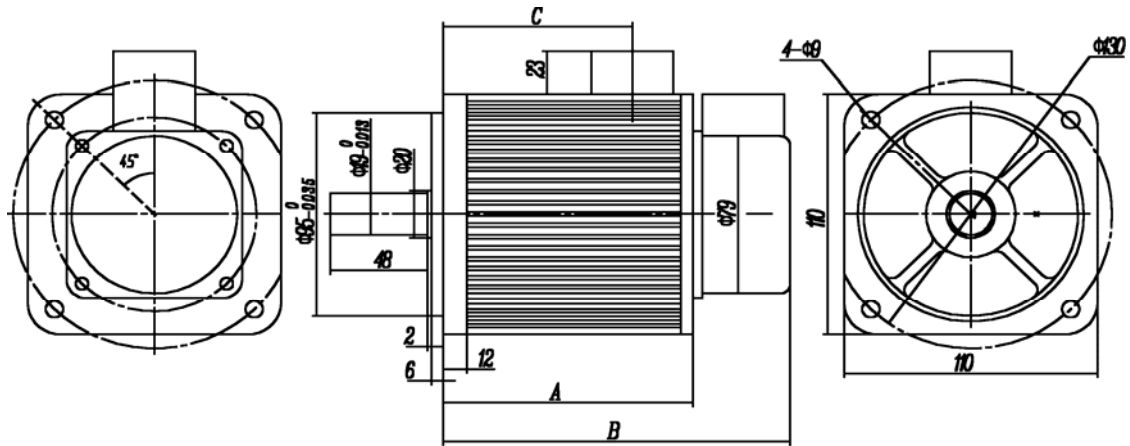
Zero-speed Torque (Nm)	2	4	5	6
A(mm)	106	132	148	164
B(mm)	158(205)	184(231)	200(247)	216(263)
C(mm)	76	102	118	134

Note: The B value in the bracket is the length of motor with electricity-losing brake.

(4) Figuration Drawing for DST series of 130-stand model AC servo motors

Zero-speed Torque (Nm)	4	5	6	7.7	10	15
A(mm)	110	119	128	142	166	214
B(mm)	162(209)	171(218)	180(227)	194(241)	218(265)	266(313)
C(mm)	80	89	98	112	136	184

Note: The B value in the bracket is the length of motor with the electricity-losing brake.

8.3 Isolating Transformer

| **⚠Attention** |
|---|
| ● It is recommended that the power of drive unit is supplied by isolating transformer for reducing the possibility of electric shock and jamming by power supply and electromagnetic field. |
| ● Drive units of 0.8kW and below can adopt single-phase power supply while drive units of more than 0.8kW can adopt three-phase power supply. |

We provide the following several models of transformers for the user to select. The user can make a choice by referring to the power and actual load of servo motor.

Table 8.5 Specifications on Some Isolating Transformers

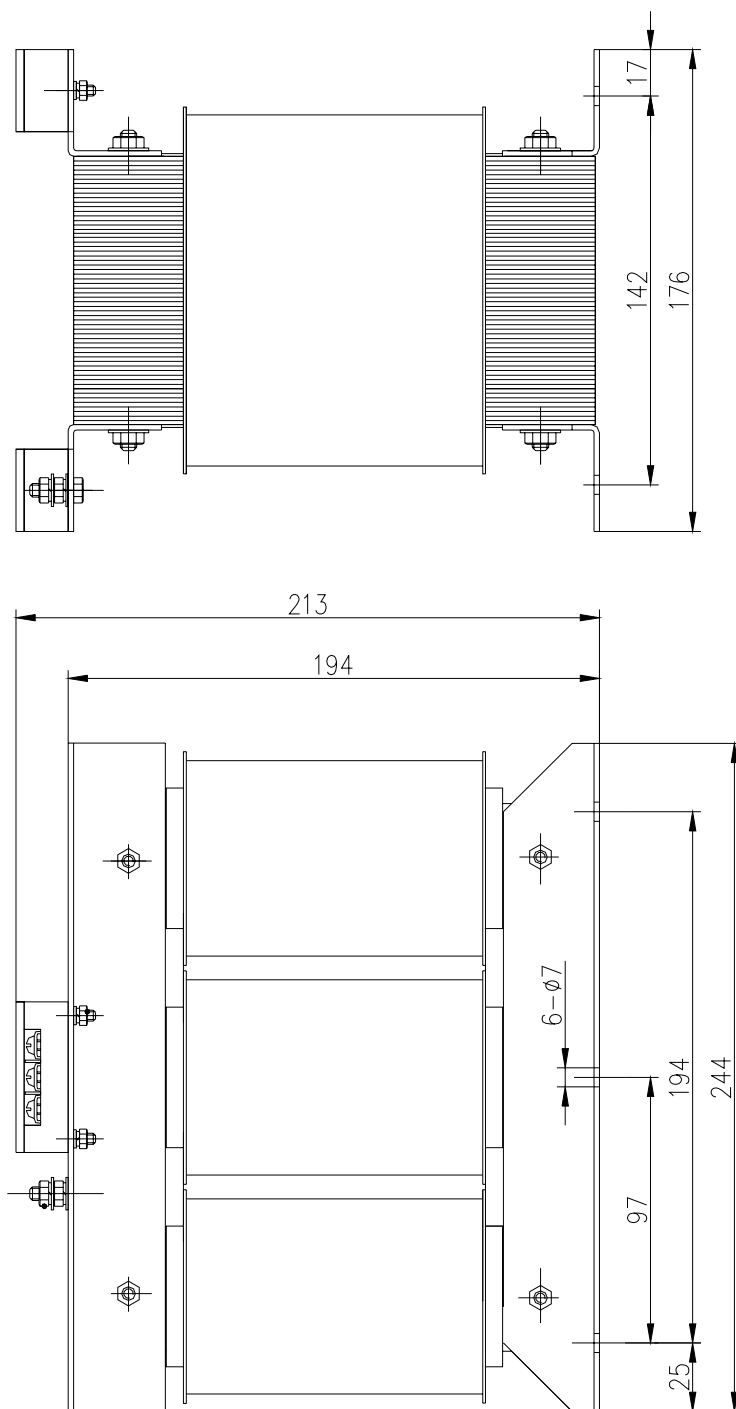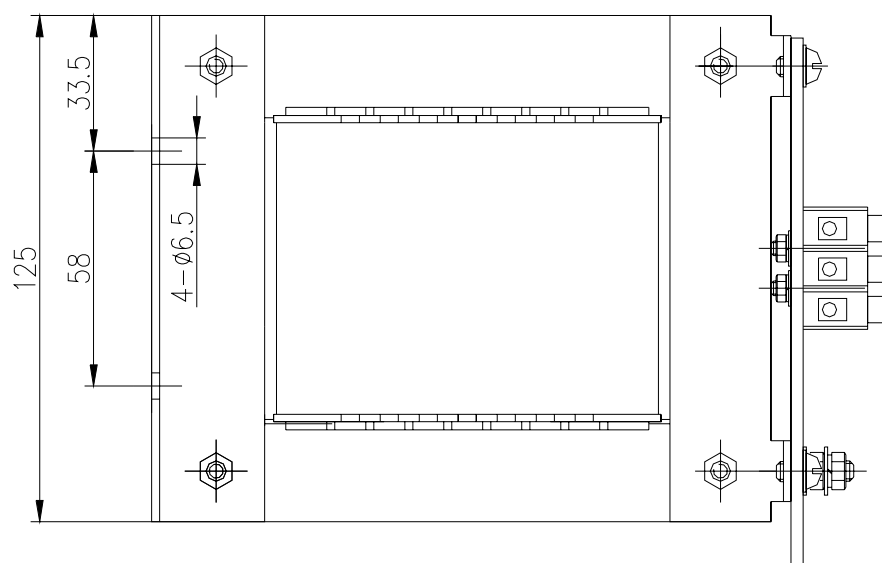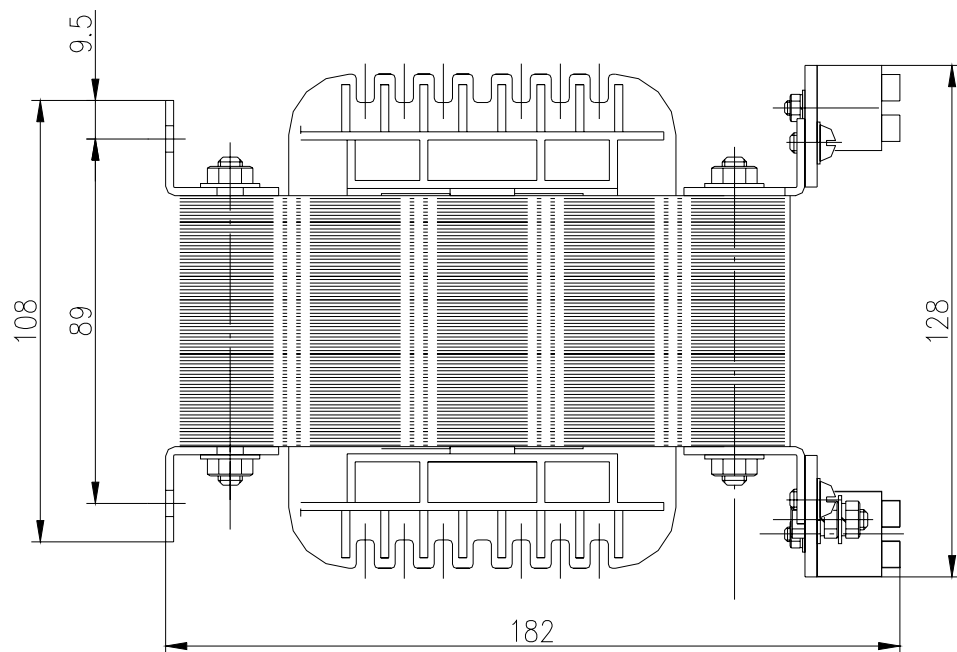| Models	Capacity (kVA)	Phase Number	Input Voltage (V)	Output Voltage (V)
BS—120	1.2	Three	380	220
BS—200	2.0			
BS—300	3.0			
BD—80	0.8	Single		
BD—120	1.2			
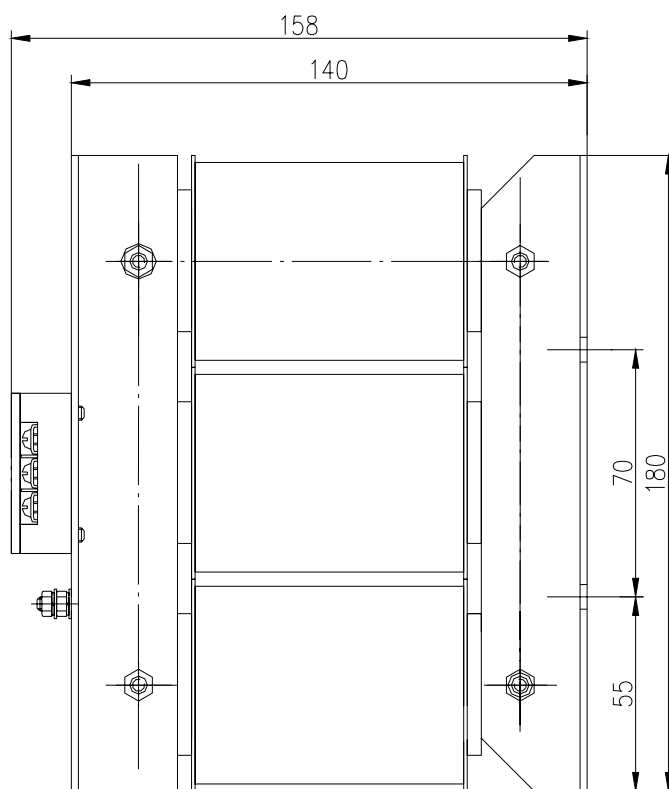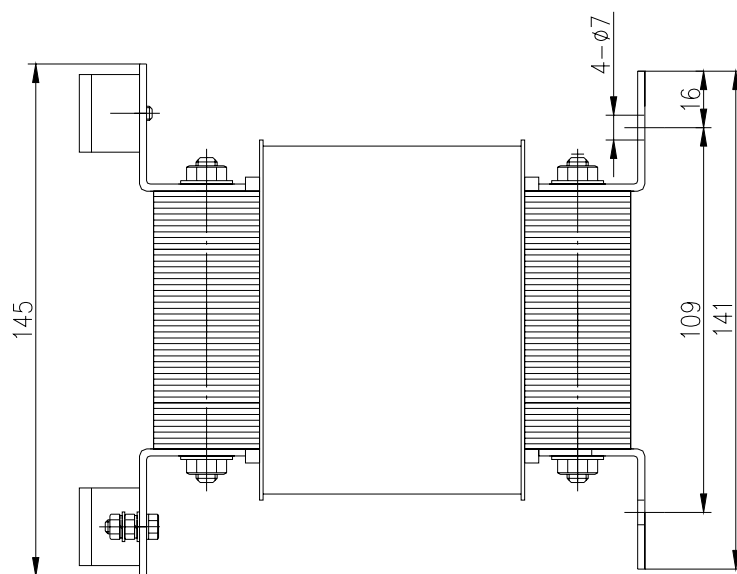
Installation Dimension Drawing for BS—120 Model
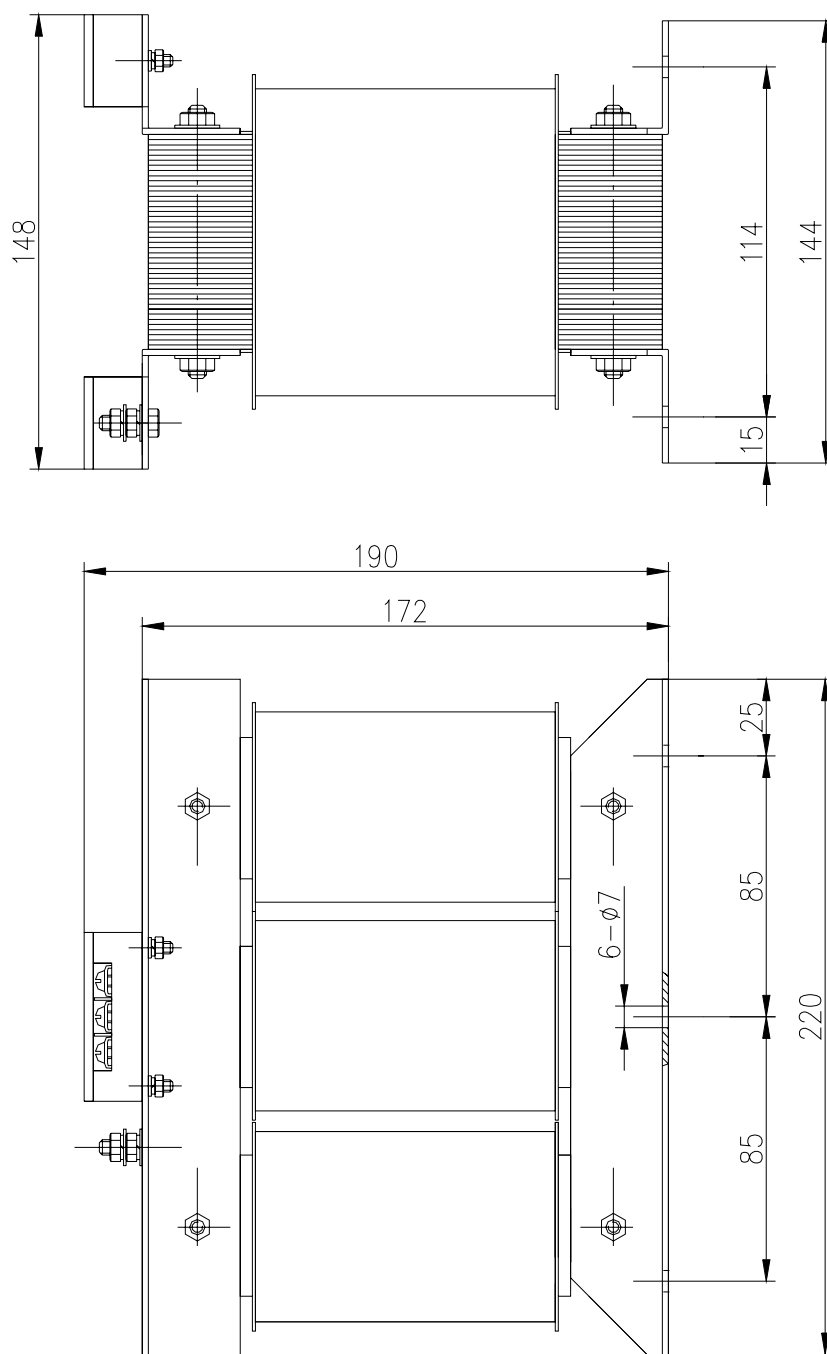
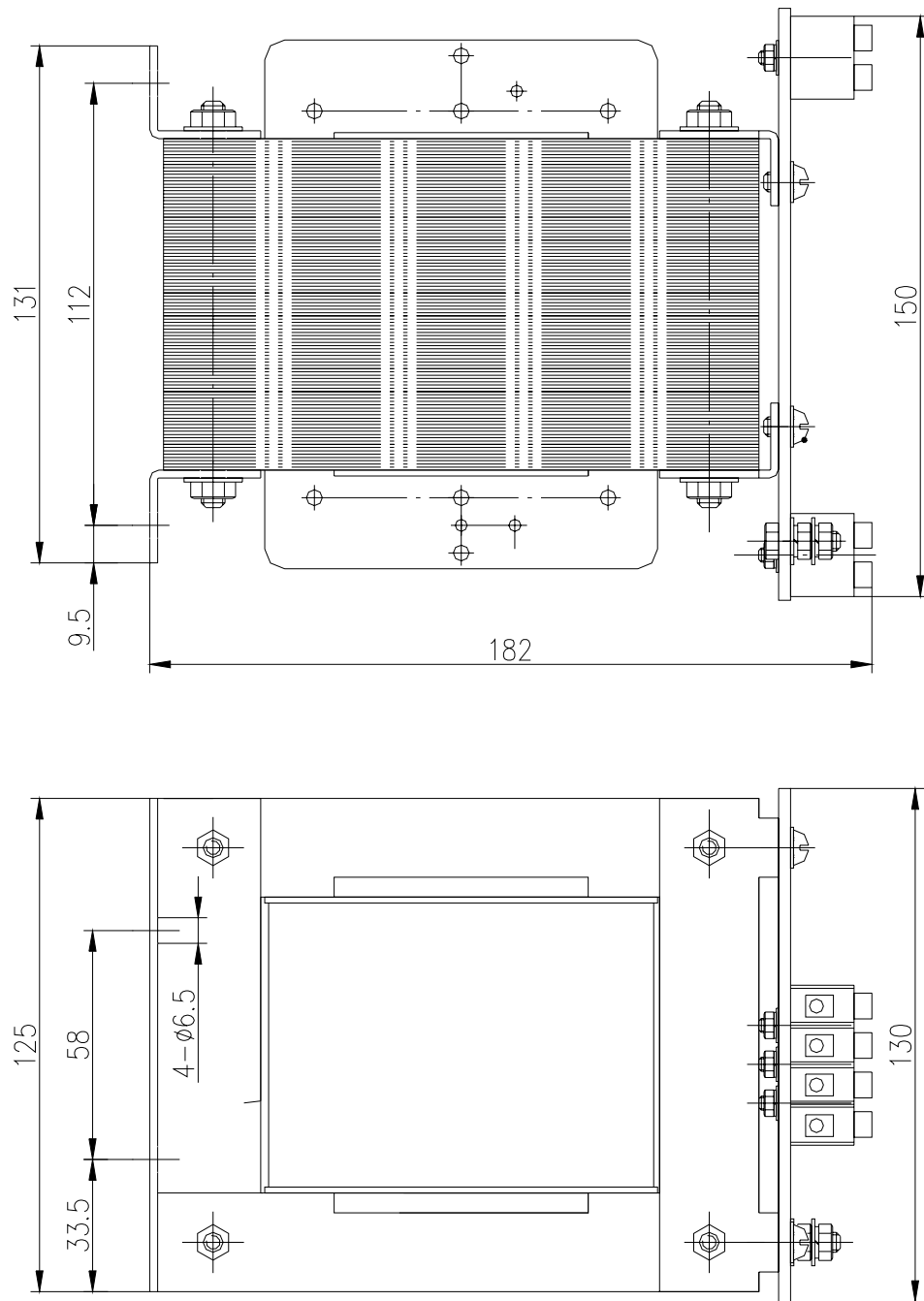**Installment Dimension Drawing for BS—200 Model**

Installment Dimension Drawing for BS—300 Model

Installment Dimension Drawing for BD—80 Model

Installment Dimension Drawing for BD—120 Model

Chapter Nine Order Instructions

9.1 Capacity Selecting

The determination of capacity of the servo system must comprehensively consider factors like load inertia, load torque, required positioning precision and maximal speed. The following steps are recommended for the considerations:

1）**Calculating Load Inertia and Torque**

By referring to related data, make a calculation on load inertia, load torque, acceleration/deceleration torque and effective torque, which will serve as the basis for choice at the next step.

2）**Initial Determination of Machinery Gear Ratio**

According to the required maximal speed and rotation rate of motor, make a calculation on the maximal machinery deceleration ration. This ratio and the minimal gyration unit of motor will be used to calculate whether the requirement for minimal position unit is satisfied. If a relatively high position precision is required, increase the machinery deceleration ratio (the actual maximal speed is decreased) or choose motor with higher rotation rate.

3）**Calculating Inertia and Torque**

The load inertia and torque can be converted to the motor shaft with machinery deceleration ratio. The converted inertial shall be no more than 5 times of the inertia of the motor rotor and the converted load torque and effective torque shall be not higher than the rated torque of motor. If these requirements cannot be satisfied, increase machinery ratio (the actual maximal speed is decreased) or choose motor with greater capacity.

9.2 Electronic Gear Ratio

Refer to Chapter Four (Table 4.2 Functions of Parameters), Chapter Six (Parameter Setting) and Chapter Seven (7.3 Adjustment) for the meaning and adjustment of electronic gear ratio G.

Under position control mode, the actual speed of load is:

command pulse speed×G×machinery deceleration ratio.

Under position control model, the actual minimal displacement of load is:

minimal command pulse itinerary×G×machinery deceleration ratio.

Note: When the electronic gear ratio G is not 1, the dividing operation of G may have a

remainder, which means that position errors exist. The maximal error is the minimal rotation value (minimal resolution) of the motor.

9.3 Stop Features

Under position control mode, there will be a difference between the command pulse and feedback pulse when using pulse train to control the servo motor. This difference will be accumulated in the position error meter and form the following relationships with the command pulse frequency, electronic gear ratio and position proportion gain:

$$\varepsilon = \frac{f^* \times G}{K_p}$$

in which,

  ε: Lag Pulse (Puls);

  f: Command Pulse Frequency (Hz);

  Kp: Position Proportion Gain (1/S);

  G: Electronic Gear Ratio.

Note: the above relationship is reached under the condition that position feed-forward gain is 0%. If the position feed-forward gain is >0%, the lag pulse will be less than that in the above calculation formula.

9.4 Calculation Method for Selecting Models of Servo System and Position Controller

1) Command displacement and actual displacement：

$$S = \frac{I}{\delta} \cdot \frac{CR}{CD} \cdot \frac{DR}{DD} \cdot \frac{1}{ST} \cdot \frac{ZD}{ZM} \cdot L$$

in which,

S: actual displacement mm;

I: command displacement mm;

δ: minimal unit of CNC mm;

CR: command frequency multiplication coefficient;

CD: command frequency division coefficient

DR: servo frequency multiplication coefficient;

DD: servo frequency division coefficient;

ST: grade division value per round of motor;

ZD: gear number of side gear of motor;

ZM: gear number of side gear of lead screw;

L: pitch of lead screw mm

Generally, S=I, which means command value equals actual value.

 2) Maximal Command Speed of CNC:

$$\frac{F}{60 \times \delta} \cdot \frac{CR}{CD} \le f_{max}$$

In which,   F: command speed mm/min;

　　　　f_{max}: maximal output frequency of CNC Hz(GSK980 为 128000)**.**

3) Maximal Speed of Servo System:

$$V_{max} = n_{max} \times \frac{DR}{DD} \times L$$

In which, V_{max}: maximal velocity of work bench permitted by the servo system mm/min;

　　　　n_{max}: maximal rotation rate permitted by the servo motor r/min;

Actual maximal speed of machine tools is restricted by maximal speed of CNC and the servo system.

$$\alpha = INT \left[INT \left(N \cdot \frac{CR}{CD} \right) \cdot \frac{DR}{DD} \right]_{min} \cdot \frac{1}{ST} \cdot \frac{ZD}{ZM} \cdot \frac{L}{\delta}$$

in which, α: minimal displacement of machine tools mm;

　　　　N : natural number;

　　　　INT( ): integral number;

　　　　INT [$]_{min}$: minimal integral num

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