Dear user,

We are really grateful for your patronage and purchase of this product

The manual describes the performance as well as the instructions for installation, wiring, commissioning, operation and maintenance of the GE series bus-oriented AC servo Drive Unit.

The operations involve the contents of two software versions: 1) The Version V1.xx focuses on the configuration of servomotors with an incremental encoder; 2) The Version V3.xx applies to the configuration of servomotor with a Tamagawa 17-bit absolute encoder and adapts with Danaher 17-bit absolute encoder servomotor (the user manual mainly describes the Version V1.03) .

- The contents herein are subject to change as a result of product modification without further notice.
- We assume no reliability for any consequence of user's modification of the product. In this case, the product warranty will become void.

To ensure the safety as well as the normal and efficient operation of the product, it is important to thoroughly read this manual prior to the installation and operation of it.

Special attention shall be given to the following warnings and precautions while reading this manual in order to prevent injury of operator and other persons as well as damage of the mechanical equipment.

Warning	**Incorrect operation may lead to severe injury or even death.**
Caution	**Incorrect operation may cause moderate or slight injury and property losses.**
Attention	**Negligence of the suggestion may result in an undesired consequence and condition.**

Danger

Tighten all connecting terminals of the main circuit with an appropriate torque.	Make sure to install the drive unit on an incombustible carrier and keep it away from inflammable substances.
 Negligence of the instruction may lead to loose conductor connection, electric spark and even fire.	 Negligence of the instruction may lead to fire.

Make sure the input power supply is disconnected prior to wiring.	Always ground the protective grounding terminal PE on the servo unit.
 Negligence of the instruction may lead to electric shock.	 Negligence of the instruction may lead to electric shock.

Have the wiring performed and inspected by a qualified electrician.	Make sure to disconnect the unit from power supply and wait for at least five minutes before moving, wiring, examining or maintaining it.
 Negligence of the instruction may lead to electric shock or fire.	 Negligence of the instruction may lead to electric shock.

Strictly abide by the procedures herein in wiring.	Make sure to tighten the power supply terminals and motor output terminals.
 Negligence of the instruction may lead to equipment damage and electric shock.	 Negligence of the instruction may lead to fire.

Do not operate the switches with a wet hand.	Do not reach your hands into the servo unit.
 Negligence of the instruction may lead to electric shock.	 Negligence of the instruction may lead to electric shock.

Do not open the cover of the terminal block while the unit is energized or is operating.	Do not directly touch the connecting terminals on the main circuit of the drive unit.
 Negligence of the instruction may lead to electric shock.	 Negligence of the instruction may lead to electric shock.

Attention

After the power supply is restored, do not immediately perform any work on the coupling of the servomotor as the drive unit may start suddenly.		Do not stop heat elimination or place any foreign matter into the fan or radiator.	
	Negligence of the instruction may cause personal injury.		Negligence of the instruction may lead to equipment damages or a fire.

Do not place the power cord on a sharp edge or under load or stress.		Do not operate the energized servo drive unit when the cover of the terminal block is removed.	
	Negligence of the instruction may lead to electric shock, fault or damage.		Negligence of the instruction may lead to electric shock.

Caution

The electric motor must be equipped with a suitable servo unit.		The voltage applied on all terminals must be consistent with the ratings specified on the manual.	
	Negligence of the instruction may lead to equipment damage.		Negligence of the instruction may lead to equipment damage.

Loaded operation is only permitted after successful no-load operation.		In case of alarm, make sure to eliminate the trouble before operation.	
	Negligence of the instruction may lead to equipment damage.		Negligence of the instruction may lead to equipment damage.

Do not grasp the power cord or motor shaft during the transport of the motor.		In case of a missing or defective component of the spindle drive unit, do not operate the motor but immediately contact your dealer.	
	Negligence of the instruction may lead to equipment damage.		Negligence of the instruction may lead to equipment damage.

Caution

Do not connect the power input wires R, S and T to the output terminals U, V and W of the motor.		Do not turn on/off the input power supply.	
	Negligence of the instruction may lead to equipment damage.		Negligence of the instruction may lead to equipment damage.

Do not touch the heat sink for the motor and servo unit during operation as they may become very hot.		Do not perform any limit adjustment or change of parameters.	
	Negligence of the instruction may lead to burn.		Negligence of the instruction may lead to equipment damage.

Do not attempt to modify, remove or repair the drive unit without permission from your dealer.		The electronic components inside a discarded drive unit shall be disposed as industrial waste without reuse.	
	Negligence of the instruction may lead to equipment damage.		Negligence of the instruction may cause accidents.

Safety Precaution

■Transportation and delivery

- Do not put over six packing boxes in piles
- Never climb the packing box, neither stand on it, nor place heavy items on it
- Do not use cable connected with the product to drag or move the product
- Forbid crash, scratch the panel and display screen
- Protect the system from humidity, sunlight and raindrops

■Check

- Ensure the ordered products after opening the packing box
- Ensure the products are perfect
- Ensure all elements are complete and perfect
- Contact with us if you have questions about the product type, accessories or products damaged during transportation

■Wiring

- Only qualified persons can connect the system or check the connection
- The product must earthed, grounding resistance should not be more than 0.1Ω and earth wire cannot be replaced with neutral line(null line)
- Wiring must be correct and fixed to avoid failure or unexpected result
- Surge absorber diode connected with the product must be connected in provided direction, otherwise, the product is damaged
- Turn off the power before pulling out the plug or opening the chassis

Safety Responsibilities

Safety Responsibilities of Manufacturer

—— The manufacturer shall be responsible for the risks eliminated and/or controlled in the design and structure of the supplied servo unit and accompanying accessories.

——The manufacturer shall ensure the safety of the supplied servo unit and accompanying accessories.

——The manufacturer shall be held responsible for the information and advices on usage given to the user.

Safety Responsibilities of User

——A user shall study and be trained for the safe operation of the servo unit and understand and master the knowledge regarding safe operation.

——The user shall take responsibility for the risks arising from his/her addition, change or modification of the original servo unit and accessories.

——The user shall be held responsible for the risks caused by the operations, adjustments, installation and transport of the product without following the requirements of the manual.

This manual is retained by the end user.

CNCmakers Limited
Address: No.168, Xiadu Road, Haizhu District, Guangzhou, China 510300
Email: info@CNCmakers.com Website: www.CNCmakers.com Tel: +86-138-24444158 Fax: +86-20-84185336

Contents

Chapter 1 Summary

1.1 Product Overview

The AC servo technology has been proved since the early 1990s. With ever-improving performance, it is widely applied to NC machine tools, printing and packaging machines, textile machines, automated production lines and other areas of automation.

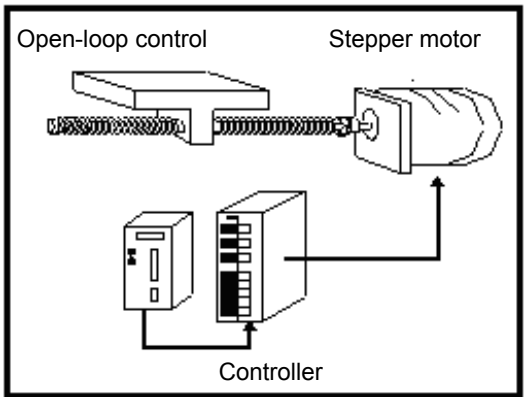
GE series AC servo Drive Unit (also known as bus-oriented AC servo Drive Unit) is a new generation of products with an up-to-date industrial Ethernet bus communication interface developed by us.

The external control device for the series of Unit can communicate with several GSK-LINK bus-oriented AC Servo Drive Unit through only one network cable. They feature simple interfaces, easy installation and high compatibility. Through a high-speed and reliable GSK-LINK field bus and protocol, a NC system may receive/send diversified data including position, speed command, motor encoder data, controlling parameters for current loop, speed loop and position loop, state parameters of drive unit and other messages from/to a servo Drive Unit. By supporting diversified data, the system may exert control over the operation of a motor and better realize the real-time monitoring of the control and drive Unit through configuration of position, speed command and adaptive parameters of the system, thereby further improving the processing efficiency and accuracy of the NC system. With a built-in advanced and dedicated chip for control over the motor, a FPGA (Field-Programmable Gate Array) and a new IPM intelligent power module, the servo drive unit is characterized by high integrity, compactness, complete protection and high reliability.

GE AC servo unit has the following advantages over step drive Unit:

- **No out-of-step**

  The servomotor is provided with an encoder that feeds back position signal to the servo drive unit and exerts semi-closed loop control with an open-loop control device.



- **Wide speed ratio and constant torque**

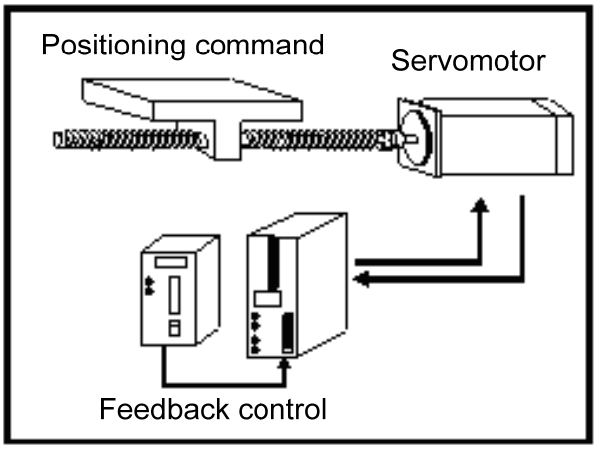
  Speed regulation ratio of 1: 5000 and constant torque characteristics at low to high speed; incremental encoders or 17-bit absolute encoders are available upon customer's request.

- **High speed and accuracy**

  Maximum rotating speed of servomotor: 6000r/min; rotary positioning accuracy: 1/10,000r

  Note: The maximum rotating speed of servomotor varies with its model.

- **Simple and flexible control**



It is possible to properly set the operating mode and characteristics of the servo system through the system interface in order to meet different requirements.

Characteristics of GE series AC servo unit:

- The data transfer speed is up to 100MBit/s by using an industrial Ethernet bus for communication transmission.
- High anti-interference capacity, bit error rate: 10^{-12}.
- The servo includes acceleration/deceleration's backlash offset function.
- It is easy to operate and adjust servo parameters and possible to adjust servo parameters and monitor servo through the system interface.
- Servo parameter optimization function is added to improve debugging efficiency and machine rigidity when it is matched with bus system.
- Add the 2nd gain function to meet different types of machining requirements with bus system.

1.2 Fundamentals

1. Operating Principle of AC Servo Drive Unit

The AC servo drive unit consists of an AC servo unit and an AC servomotor (3-phase permanent-magnet synchronous motor, hereinafter called "servomotor"). The servo unit rectifies 3-phase alternating current into direct current (namely AC to DC) and produces approximately simple harmonic alternating current (namely DC to AC) with 120° phase difference in the 3-phase stator winding of the servomotor by controlling the switching of the power switching tube. The current creates a rotating field in the servomotor. The rotor of the servomotor is made of high anti-demagnetizing rare-earth permanent magnetic material. The rotor of the servomotor is driven by the electromagnet torque as a result of the interaction of the magnetic field of the rotor for the servomotor and its rotating magnetic field. The higher the frequency of the current through the servomotor winding is, the faster the servomotor rotates. The output torque (torque = force x length of moment arm) of the servomotor increases with the amplitude of the current through the servomotor

winding.

Figure 1-1 is the block diagram of the main circuit in which PG indicates an encoder.

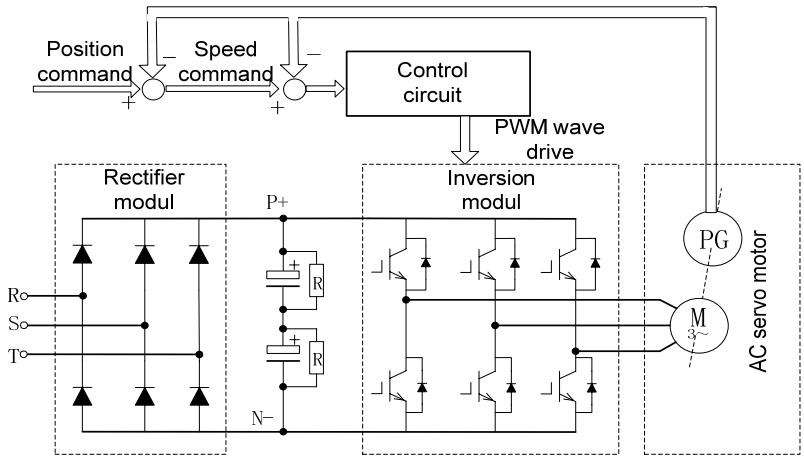


Figure 1-1 Block diagram of the main circuit of AC servo drive unit

2. Basic Structure of AC Servo Drive Unit

The servo unit receives speed commands from a control unit (also known as host computer) such as CNC system to control the amplitude and frequency of the current through the winding of the servomotor so that the rotating speed (or angle of rotation) of the rotor for the servomotor is close to the value of the speed (or position) commands, and knows the deviation of the real rotating speed (or angle of rotation) of the servomotor rotor from the command value through the feedback signal of the encoder. The servo unit keeps the deviation of the real rotating speed (or angle of rotation) of the servomotor rotor from the command value within the required range by continuous regulating the amplitude and frequency of the current through the winding of the servomotor. The basic structure of the servo system is shown in Figure 1-2.

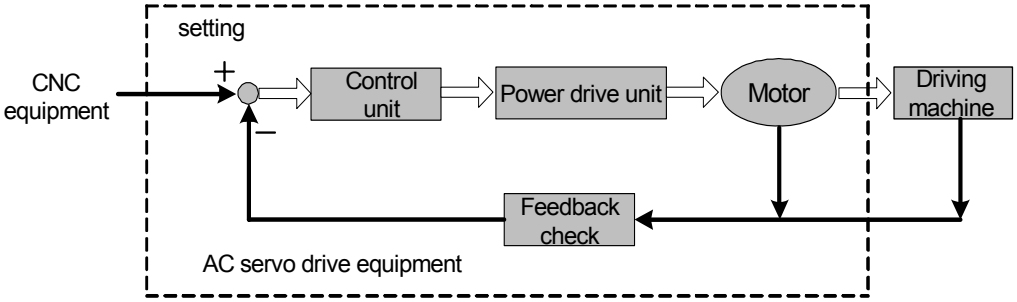


Figure 1-2 Basic structure of AC servo drive unit

3. General Glossaries regarding Control

- **Control:** Control refers to the procedure allowing the characteristics (e.g. rotating speed) of the object (e.g. servomotor) to reach or become close to the expected value. The foregoing object is

called “controlled object”, its characteristics “controlled variable”, the device that realizes the control “control unit (controller)”, the expected value (command value) of the controlled variable received by the control unit “setting”, the process that the controlled variable is affected as the input of the controller “feedback” and the unit that is used to detect the controlled variable “feedback unit”. Feedback is divided into positive feedback (in the same direction) and negative feedback (in opposite direction). The controller that realizes the controlled variable, the controlled object and feedback unit compose a “control system”. A drive is under closed-loop control or open-loop control depending on the presence of a feedback unit and the position where the feedback unit is located in the drive. The closed-loop control described in the manual is of negative feedback.

Among the AC servo Drive Unit described herein, the servo unit serves as a controller, the servomotor controlled object, rotating speed (or angle of rotation of rotor) of motor controlled variable and the encoder of the servomotor feedback unit. The encoder detects the actual rotating speed of the motor for speed control so as to achieve speed feedback. Therefore the AC servo drive unit is a closed-loop control system.

- **Open-loop control**: The actual value of the controlled variable does not affect the output of the controller if the control system is not provided with a feedback device. For a stepper motor drive, for example, the rotor of a stepper motor shall rotate with the change in the phase sequence of its output current. Since normally a stepper motor is not fitted with a speed or position feedback device, excessive load or acceleration/deceleration may prevent the motor rotor from accurately rotation with the change in the phase sequence of current, thereby causing the so-called “out-of-step”.

Open-loop control is as shown in Figure 1-3.

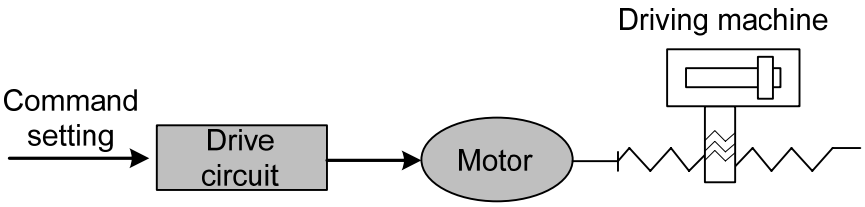


Figure 1-3 Open-loop control

- **Closed-loop control:** The controlled variable of the control system is detected and transferred to the controller by the feedback device to affect the output of the controller and thereby to change the controlled variable. Closed-loop control is classified as **full-closed loop control** and **semi-closed loop control** by the detection points. The feedback device’s direct detection of the controlled variable and use of it for feedback is called full-closed loop control (e.g. Figure 1-4) and the position of the gear is the controlled variable. The full-closed loop control over the position of the gearing is achieved by using the grating mounted on the gearing as a position feedback device and the encoder for the servomotor as a speed feedback. In the absence of the grating, the encoder for the servomotor is used as a position and speed feedback (see Figure 1-5). In this case, this is the semi-closed control over a mechanical position.

Gearing

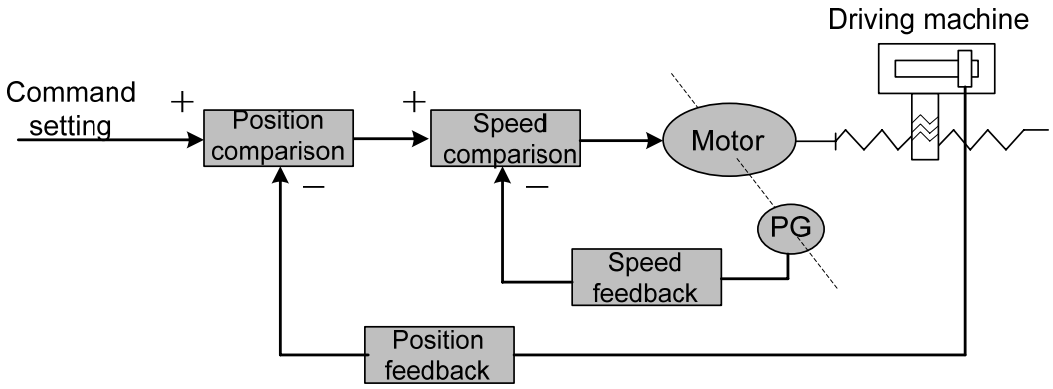


Figure 1-4 Full-closed loop control

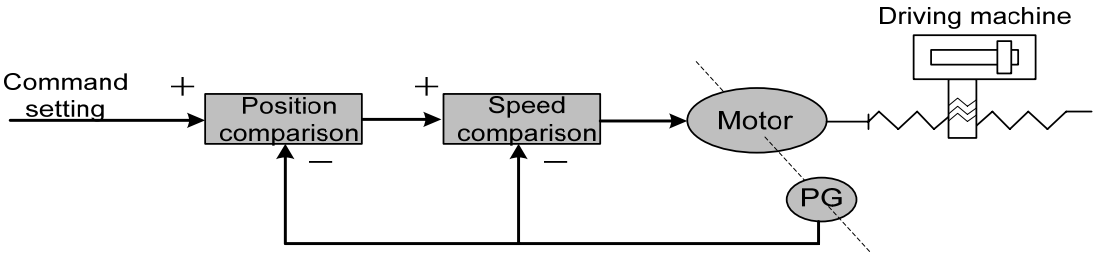


Figure 1-5 Semi-closed loop control

- **PID Control:** Also called PID regulation, it is the common algorithm used by the controller for mathematical treatment of the input data (setting and feedback). “P” is the abbreviation of “proportional” and refers to the linear proportional relationship between the input and output of a controller. The bigger a proportional control factor is, the more sensitively the system will respond and the smaller (cannot be completely eliminated) the steady state error will become. Excessive proportional control factor leads to the disturbance and instability of the system. “I” stands for “integral” and means the influence of controller input time integral upon output (input gradually affects output). The bigger an integral time constant is, the more smoothly the system runs without steady state error and the slower the system responds. “D” is the initial of “Differential”, indicating the influence of input differential (the slope of input change). Differential control can forecast, produces advanced correction, reduces following error and improves dynamic performance. Excessive differential coefficient may cause system disturbance and instability. Proportional, integral and differential controls influence each other. In a specific control system it is required achieve the balance of the response speed, control accuracy and stability by adjusting the PID control parameters. As differential control tends to produce impact and unsteadiness, the servo system described herein employs PI control, i.e. only proportional and integral control.

4. Glossaries with regard to Servo Control

The servo system is provided with three basic control modes: position control, speed control and torque control. The block diagram of the system is as shown in Figure 1-6.

- **Position control:** The direction and angle of rotation of the motor are set by means of digital pulse or data communication. The servo unit controls the motor rotor so that it rotates by a proper angle in the given direction. Both the angle (position) and speed of rotation are controllable.
- **Speed control:** The direction and angle of rotation of the motor are set by means of analog voltage or data communication. The servo unit controls the motor rotor so that it rotates in the given direction at the given speed.
- **Torque control:** The amplitude and direction of the output torque of the motor are set by means of analog voltage or data communication. The servo unit controls the direction of rotation and output torque of the motor rotor.

The servo unit described herein currently does not receive any torque setting signal or provide torque controlling mode.

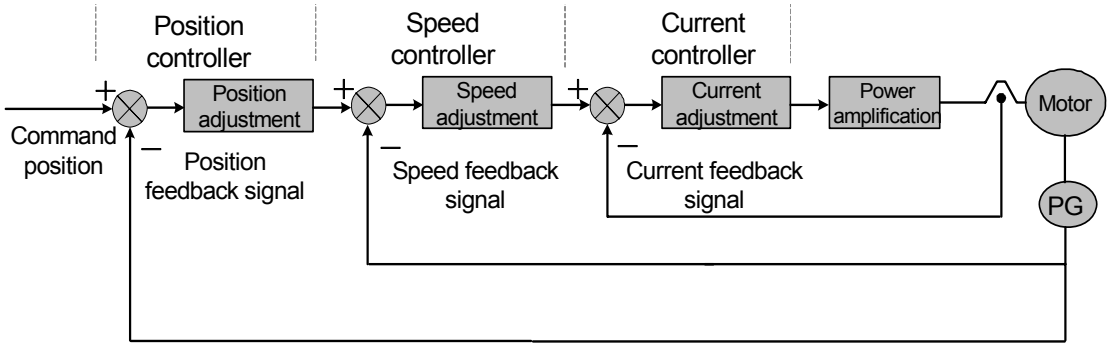


Figure 1-6 Block diagram of three-loop control

5. Indexes of Servo Performance

Characteristics of servo dynamic response: the response speed, dynamic control error and steady-state control error. Figure 1-7 is the response characteristic diagram of the given step signal from the servo signal (The solid line indicates given signal and dotted line the output signal from the servo system in the following text.):

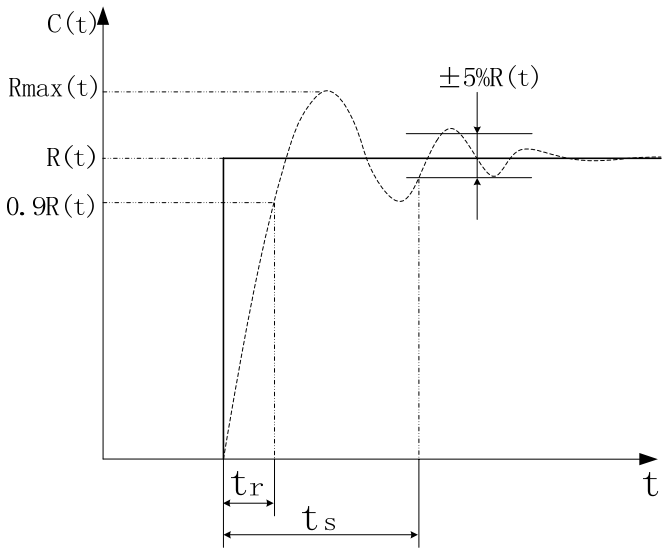


Figure 1-7 Servo dynamic response curve

Rise time t_r: It refers to the time elapsed when the rotating speed output rises from zero to 90% of steady state value R (t). It indicates the rapidity of dynamic response.

Adjustment time t_s: The range within ±5% of the steady-state value taken near the steady-state value of the step response curve is considered a permissible error band. The minimum time required for the response curve to reach but not go beyond the error band is the adjustment time which is used to measure the rapidity of the complete adjustment process of the unit.

Overshoot σ: It refers to the ratio of the maximum rotating speed difference (Rmax(t)-R (t)) between rotating speed output and steady-state value to steady-state value R (t). It reflects the relative stability of a servo unit and is as follows when indicated by percentage:

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

Steady-state error: The difference between the expected steady-state value and actual output of the system after rotating speed becomes steady during system response.

Servo static performance: The most important for a servo control system is its stability. The key static performance index of servo is positioning accuracy, which refers to the degree of deviation of the actual state from expectation at the end of the system transition. The steady-state accuracy of servo is subject to the error of position measuring appliance and system error and is related to the structure and parameters of the system. Figure 1-8 is a position servo static curve graph.

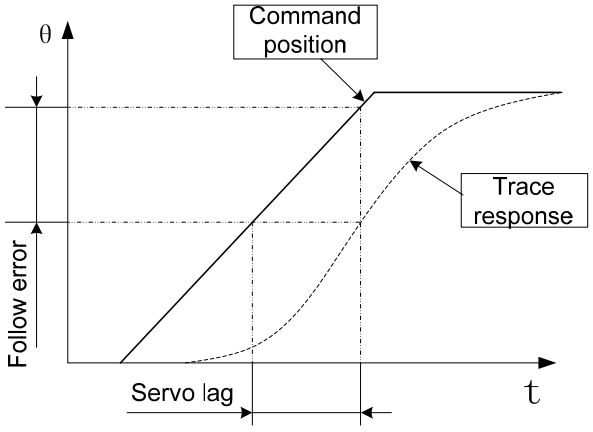


Figure 1-8 Position servo static curve

Following error: It refers to the difference between the displacement of workbench required by command signal (command position) and its actual displacement. That is to say, Following error = (Command position value) – (Actual position value).

Servo gain: It refers to the capability of a servo system's resistance against the position deviation resulting from load interference.

1.3 Receiving Inspection

1. When the goods is received, make sure to inspect the following items:

（1）Check that the packing case is integrate and no cargo is damaged in transport;

（2）Check that the received goods are those ordered against the nameplates on the servo drive unit and servomotor;

（3）Check that the accessories are complete against the packing list.

Attentions
● Do not install a defective or incomplete servo unit; ● The servo drive unit shall be used in combination with a servomotor with matching performance; ● Please contact your dealer or us for any question when the goods are received.

2. Description of Model Number

GE 2 050 T-L A 1
① ② ③ ④ ⑤ ⑥ ⑦

	Code explanation
①	"GE" series servo unit
②	Voltage classes are represented with 1- digit, 2：220V；3：380V；
③	Nominal current of power component is represented with 3-digit： 030, 048, 050,

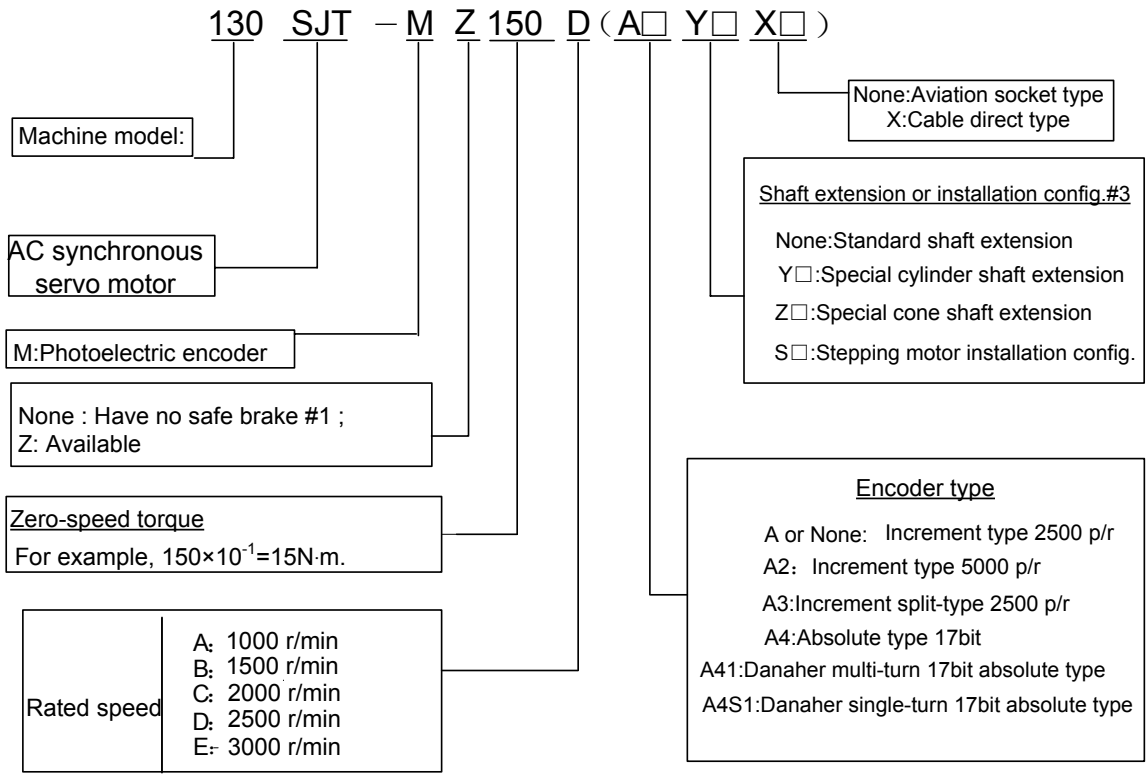
	075, 100, 150（unit A）
④	Adaptive motor type is represented with 1-letter, T：adaptive to synchronous servo motor; Y：adaptive asynchronous servo motor（reserved）; L：adaptive to linear motor （reserved）
⑤	Communication bus code is represented with 1-letter, N： pulse interface （reserved）; L：GSK-Link bus；U：NCUC_BUS （reserved）; F：optical fiber bus （reserved）;
⑥	Feedback（encoder）interface code is represented with 1-letter, P：adaptive to incremental encoder；A：adaptive to multi-turn absolute without backup battery; B：adaptive to absolute encoder with backup battery(memorize number of turn of absolute encoder when power-off) .

Feedback(encoder) interface type, configuration code

⑥	⑦	Feedback(encoder) interface type, configuration
P	1	Having a motor feedback input interface without the 2nd feedback input interface, and be adaptive to an incremental encoder
	2	Having two feedback input interfaces and be adaptive to an incremental encoder (reserved)
A （B）	1	Having a motor feedback input interface without the 2nd feedback input interface and be adaptive to absolute encoder (be compatible with communication protocol Biss, Tamagawa, and automatically identifying them)
	2	Having two motor feedback input interfaces and be adaptive to absolute encoder (be compatible with communication protocol Biss, Tamagawa, and automatically identifying them) (reserved)

3. Model Number of Servomotor

The GE series AC servo drive unit may be used in conjunction with many foreign and domestic servomotors that can be selected by user in ordering. The Chapter 8 of this manual offers the information on the SJT series of GSK. The information on other types of servomotors is supplied with them.



Note 1: The working power supply for the dead electromagnet brake is DC (0.9～1.1) ×24V and its connector a 3-pin socket whose Pin 1 and 2 are power inputs (not polarity specific) and Pin 3 is a ground terminal. When Pin 1 and 2 are connected to power supply, the dead electromagnet brake does not function. When they are disconnected from power supply, it operates for a duration less than or equal to 0.1s.

Note 2: "150" indicates that its value consists of three digits 150×10^{-1}=15 in N·m.

Note 3: '□' is a numeral code. See the installation diagram of the motor for the specific special shaft extension indicated by a figure.

4. Accessories

Standard accessories for GE servo drive unit

① User Manual (this manual)	1	
② Mounting bracket	2	
③ M4×8 countersunk head screws	4	
④ Industrial BUS (GT17)	1 set	(Note 1)
⑤ CN3 plug (MDR26 interface)	1 set	(Note 2)

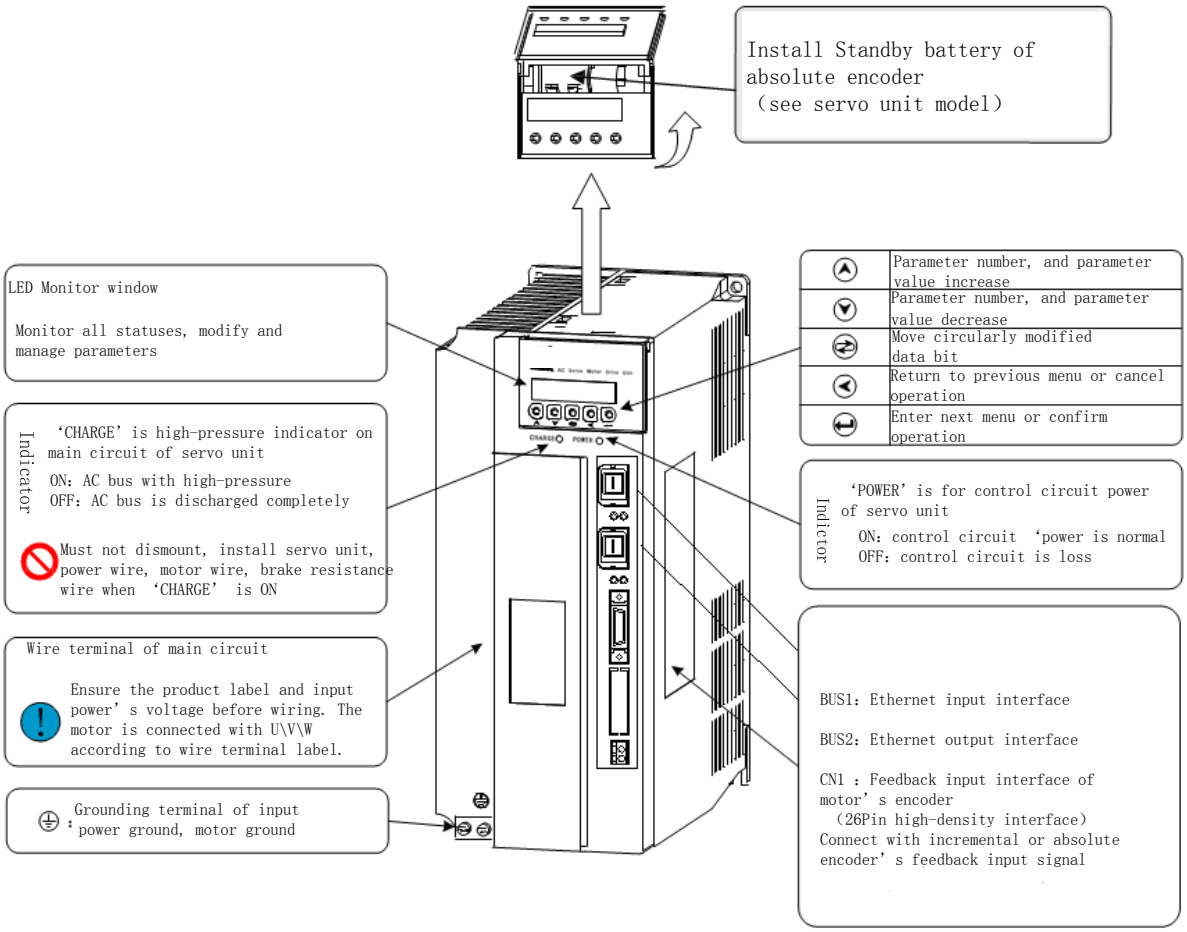
⑥ The standard accessories of a servo motor will be supplied to its operation manual.

Note 1: Our Ethernet bus communication position control device is supplied with a CAT-5e UTP signal cable (standard length: 3m); the industrial Ethernet bus type: IE-5CC4*2*AWG26/7-PUR（manufacture: Weidmuller）.

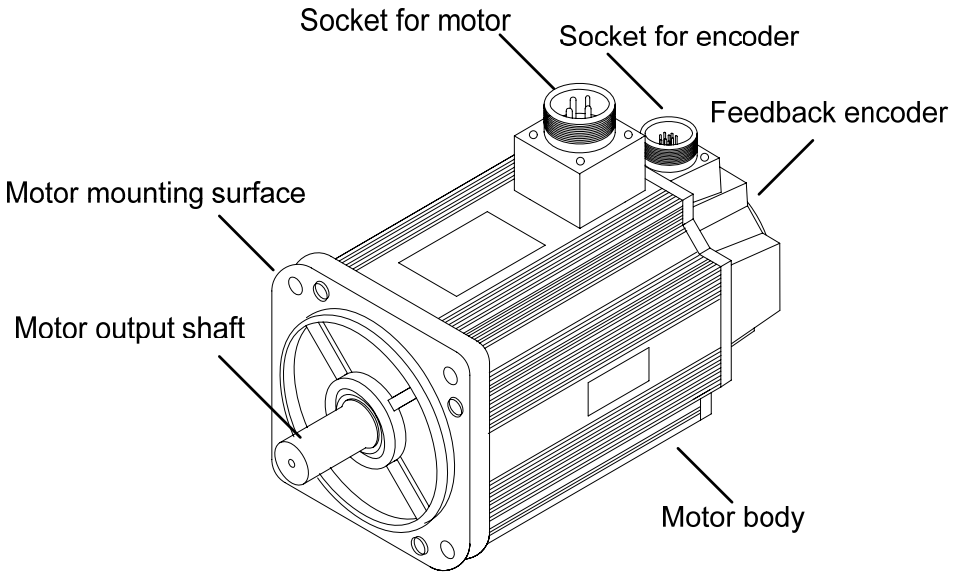
Note 2: A feedback cable (standard length: 3m) is available with our servomotor upon user's request.

1.4 Product Appearance

1） Appearance of Servo Drive Unit



2） Appearance of Servomotor



Chapter 2 Installation

Attention

- The product shall be stored and installed in an environment meeting the requirements of the specification.
- Do not stack up too many products as they are subject to damage under pressure and falling down.
- The original package must be used for the storage and transport of the product.
- A damaged or incomplete product must not be installed and used.
- Always use fire-proof material for the installation of the product. Do not install it on or near combustible materials to prevent fire.
- The servo drive unit must be installed in an electric cabinet in order to prevent dust, corrosive gas, conductive substances and combustible matters from entering.
- The servo drive unit and servomotor shall be protected from vibration and impact.
- Never pull the motor cable, shaft and encoder.

2.1 Ambient Conditions

Item	GE series of servo drive Unit	GSK SJT series of servomotors
Operating temp/humidity	0℃～40℃ (nonfreezing) RH<90% (noncondensing)	-10℃～40℃ (nonfreezing) RH<90% (noncondensing)
Storage and transport temp/humidity	-20℃～70℃ 90%RH (noncondensing)	-40℃～70℃ RH<85% (noncondensing)
Atmospheric environment	In a control cabinet without corrosive or combustible gas, oil mist, dust, etc.	Indoors (without direct sunlight) without corrosive or combustible gas, oil mist, dust, etc.
Elevation	Altitude below 2000m	Altitude below 2500m
Vibration	< 0.5G（4.9m/s^2）10 H_Z～60H_Z (discontinuous operation)	
Level of protection	IP20	IP54

2.2 Installation of Servo Drive Unit

Attention

- The servo drive unit must be installed in an electric cabinet properly protected (≥IP43).
- The servo drive unit must be installed in the direction with spacing as specified and provided with good heat eliminating condition.
- It must not be installed on or near combustible materials to prevent fire.

1. Installation Environment

It must be installed in an electric cabinet (≥IP43) properly protected and protected from exposure to corrosive and combustible gas and entry of conductive matters, metallic dust, oil dust and liquid.

2. Temperature/humidity

Ambient temperature: 0℃～50℃. For extended safe operation, the unit shall be installed in an environment at altitude less than 2000m and temperature below 40℃ and protected with good ventilation conditions.

3. Vibration and Impact

The drive unit shall be protected from vibration. Measures shall be taken to control vibration under 0.5(4.9m/s^2) as the drive unit cannot bear any high pressure or impact.

4. Installation Procedure

1) Installation Means

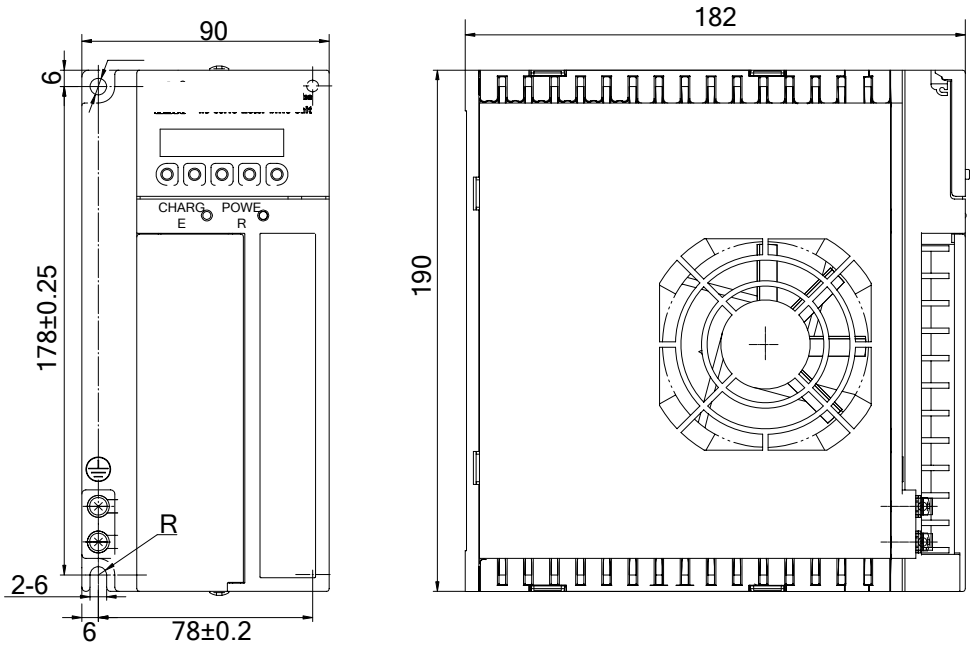


Figure 2-1 Appearance dimensions of GE2030T （unit: mm）

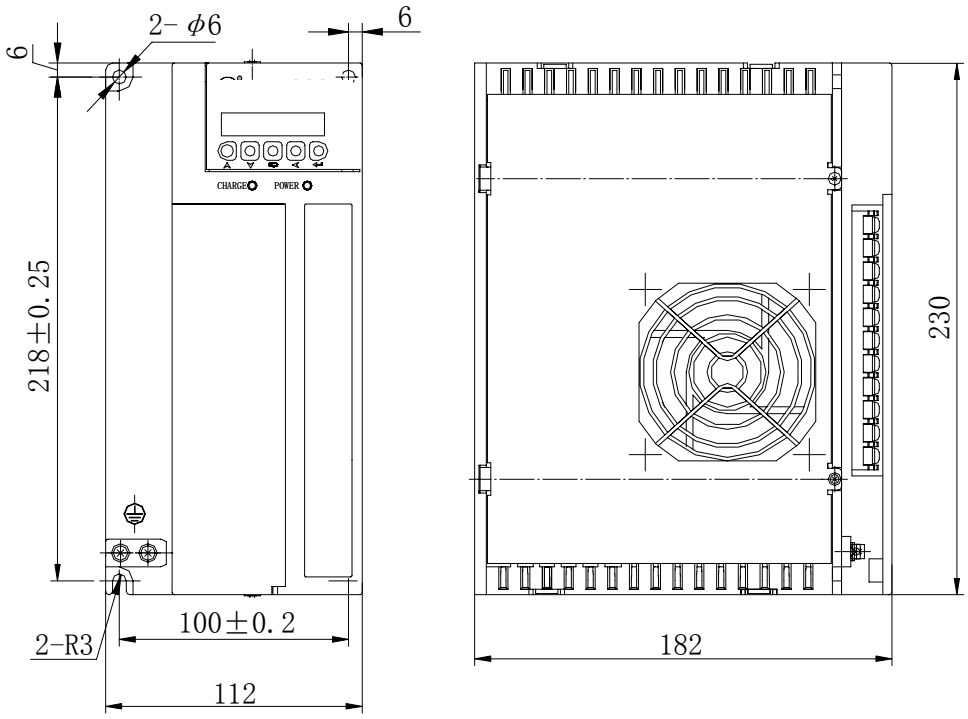


Figure 2-2 Appearance dimensions of GE2050T/GE3048T (unit: mm)

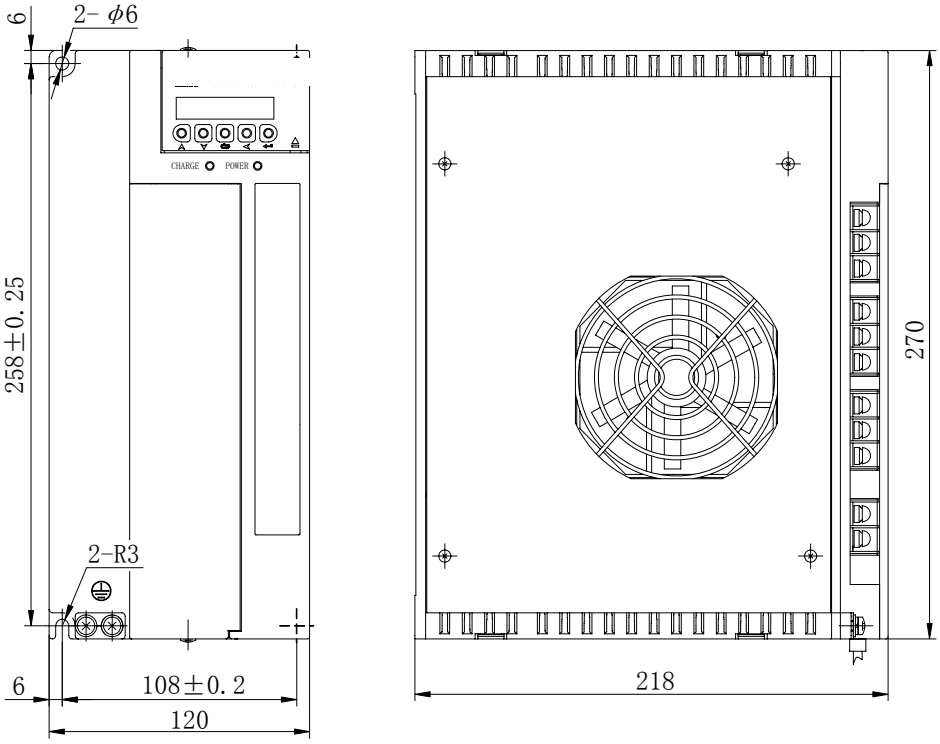


Figure 2-3 Appearance dimensions of GE2075T/GE3050T (unit: mm)

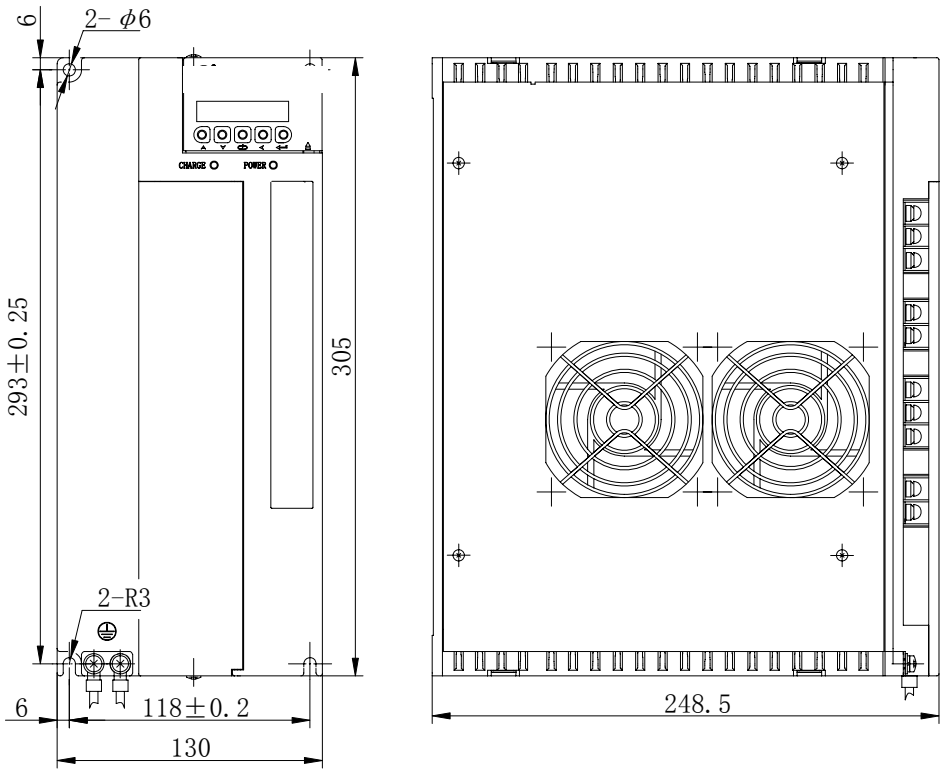
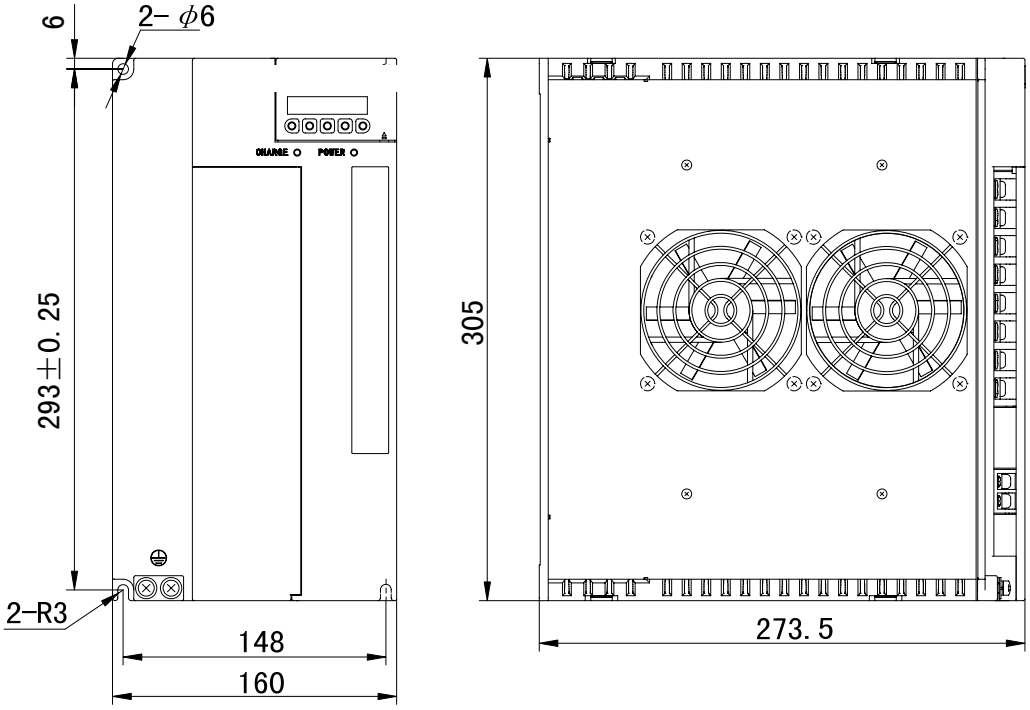
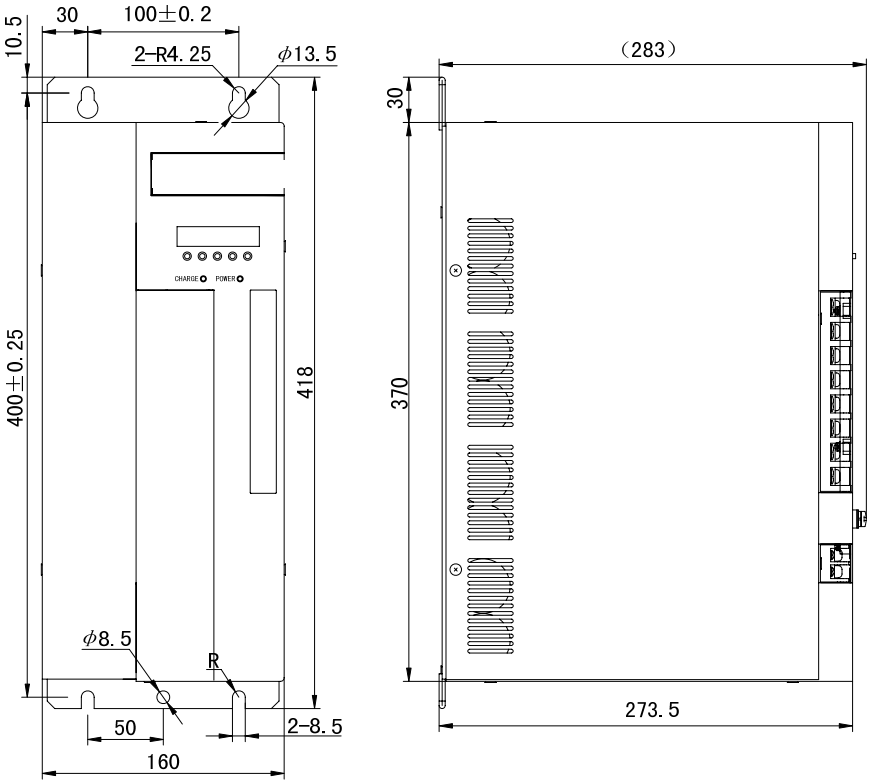


Figure 2-4 Appearance dimensions of GE2100T/GE3075T (unit: mm)



Appearance dimensions of GE3100T（unit：mm）



Appearance dimensions of GE3150T（unit：mm）

(2) Installation Space

GE series servo drive unit uses baseboard installation method, the installation direction is vertical with the installation surface upright, the front of servo drive unit is ahead and its top is upwards, which is conducive to heat dissipation, and a space as big as possible shall be kept

To prevent the surrounding temperature of servo drive unit from constantly rising, a radiator should be installed in the cabinet to blow the servo drive unit.

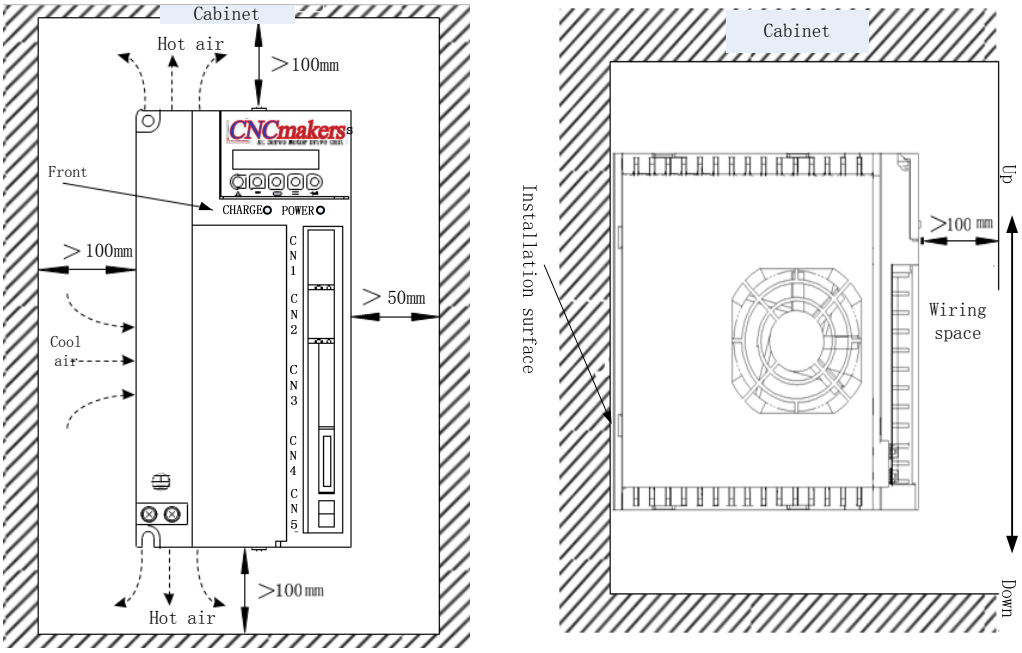


Figure 2-5 Installation spacing for GE2030T servo drive unit

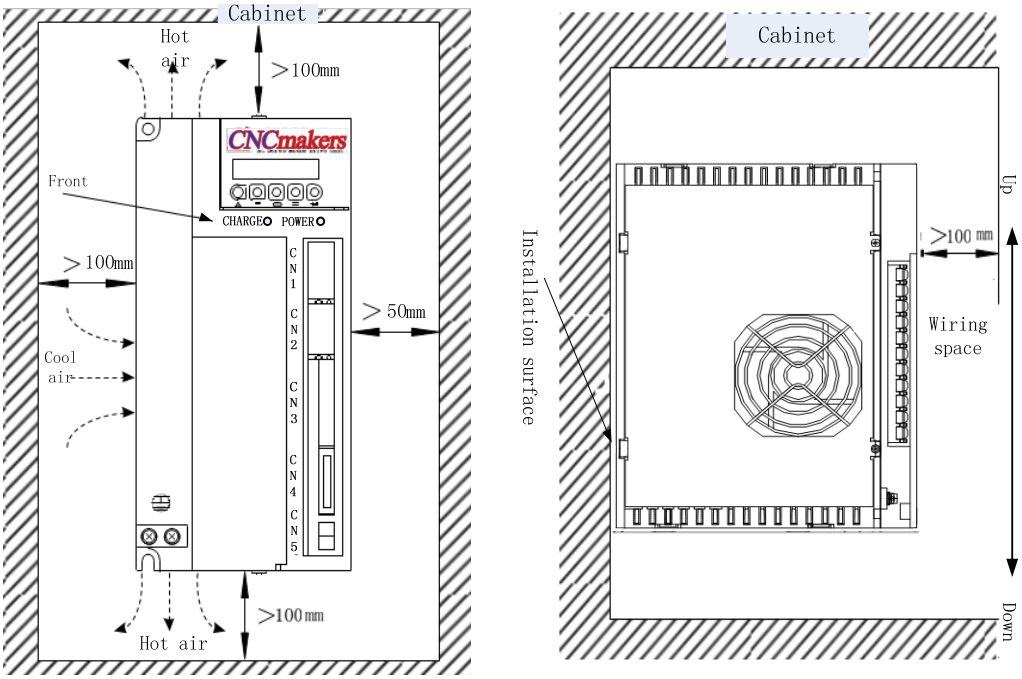


Figure 2-6 Installation spacing for GE2050T/GE3048T servo drive unit

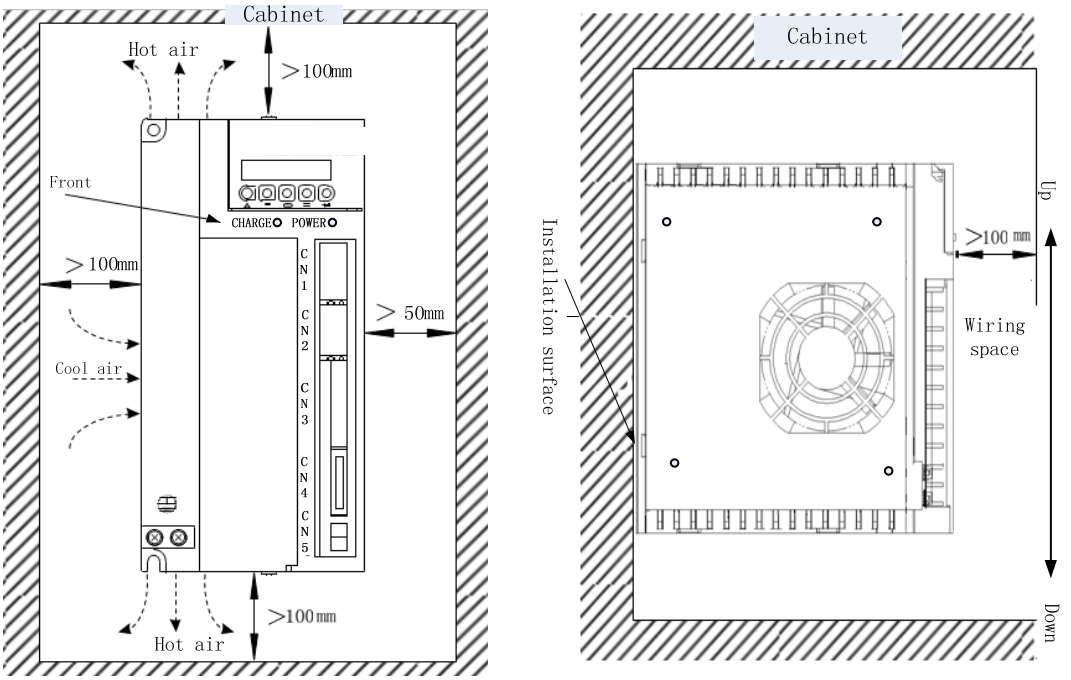


Figure 2-7 Installation spacing for GE2075T /GE3050T servo drive unit

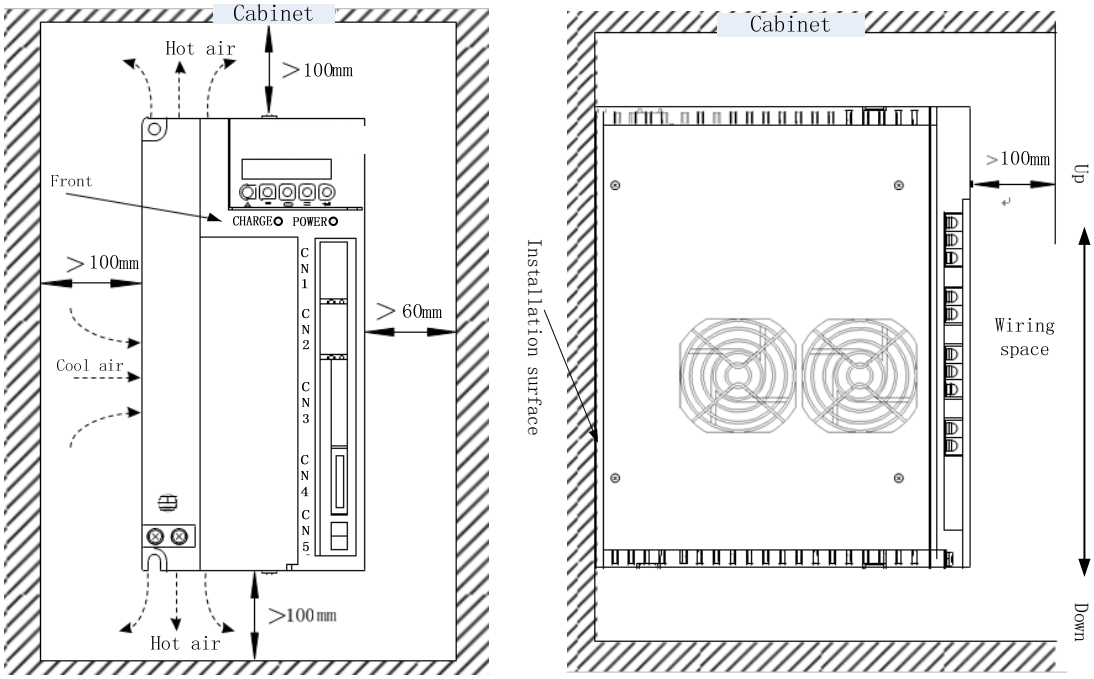


Figure 2-8 Installation spacing for GE2100T /GE3075T servo drive unit

Installation interval among servo drive units should be as possible as big to get excellent heat dissipation condition.

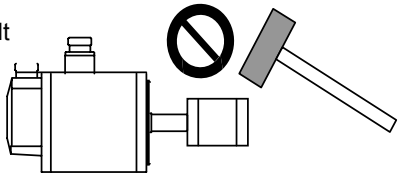
2.3 Installation of Servomotor

Installation and transportation environment of servo motor

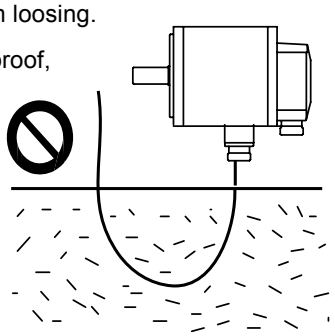
Item	Index
Working temperature	0℃～40℃
Storage and transportation temperature	-40℃～70℃
Working humidity	30%～95%（no condensation）
Storage and transportation humidity	≤95%（40℃）
Atmospheric environment	Without corrosive gas, inflammable gas, oil mist or dust and so on in cabinet
Altitude	Below 1000m

Note:

1. Must not hit motor or motor shaft when installing belt pulley to prevent damaging internal encoder. Must use screw-type press tool to dismount.



2. The servo motor cannot bear axial/radial load. A flexible coupling joint should be connected to load.
3. A washer is used to fix the motor to prevent the motor from loosing.
4. The motor is installed at the position where there is waterproof, and grease proofing because the cable in water or oil may bring water or oil to the motor.

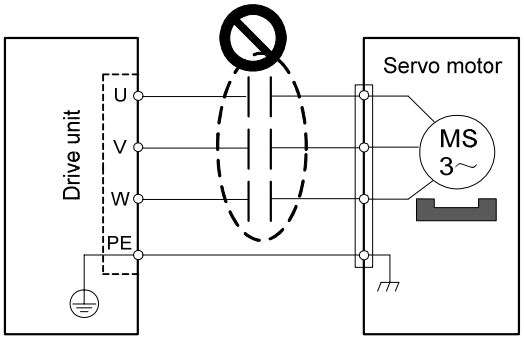


Chapter 3 Wiring

Carefully read and strictly abide by the following precautions which ensure your operating safety and reliability.

Attention

- The wiring shall be properly carried out by a well-trained and qualified technician by following the associated instruction.
- Any wiring or repair work on the servo unit can be performed only when you make sure the voltage-to-ground on all the terminals of the main circuit are safe five minutes after it is disconnected from the servo unit. Otherwise it may cause an electric shock.
- Make sure the servo unit and servomotor are correctly grounded.
- For wiring, do not damage the cable with a sharp object or forcibly pull it as it may lead to electric shock or poor line contact.
- Never extend connecting cables for the main circuit and signal cables through the same conduct or bind them together. In wiring, the connecting cables for the main circuit and signal cables shall be routed separately or crosswise with spacing over 30cm in order to prevent heavy-current lines from interfering the signal cables and causing the malfunction of the servo unit.
- Do not frequently turn on/off the power supply as the built-in high-capacity capacitors in the servo unit generates high charging current during powering on and frequent switching of the power supply may deteriorate the performance the components in the servo unit. A switching interval of 3min or longer is advised.
- Do not fit any additional power capacitor, surge arrester, wireless noise filter and other devices between the servo unit output side and servomotor.



- The wiring of the main circuit and signal cables shall be kept away from heat sink and electric motor in order to prevent their insulating property from deterioration by heating.
- After the wiring of the main circuit, attach the terminal cover to avoid electric shock.

3.1 Main Circuit Connection

3.1.1 Servo drive unit's main circuit connection

1. Main circuit wiring of GE series servo drive unit

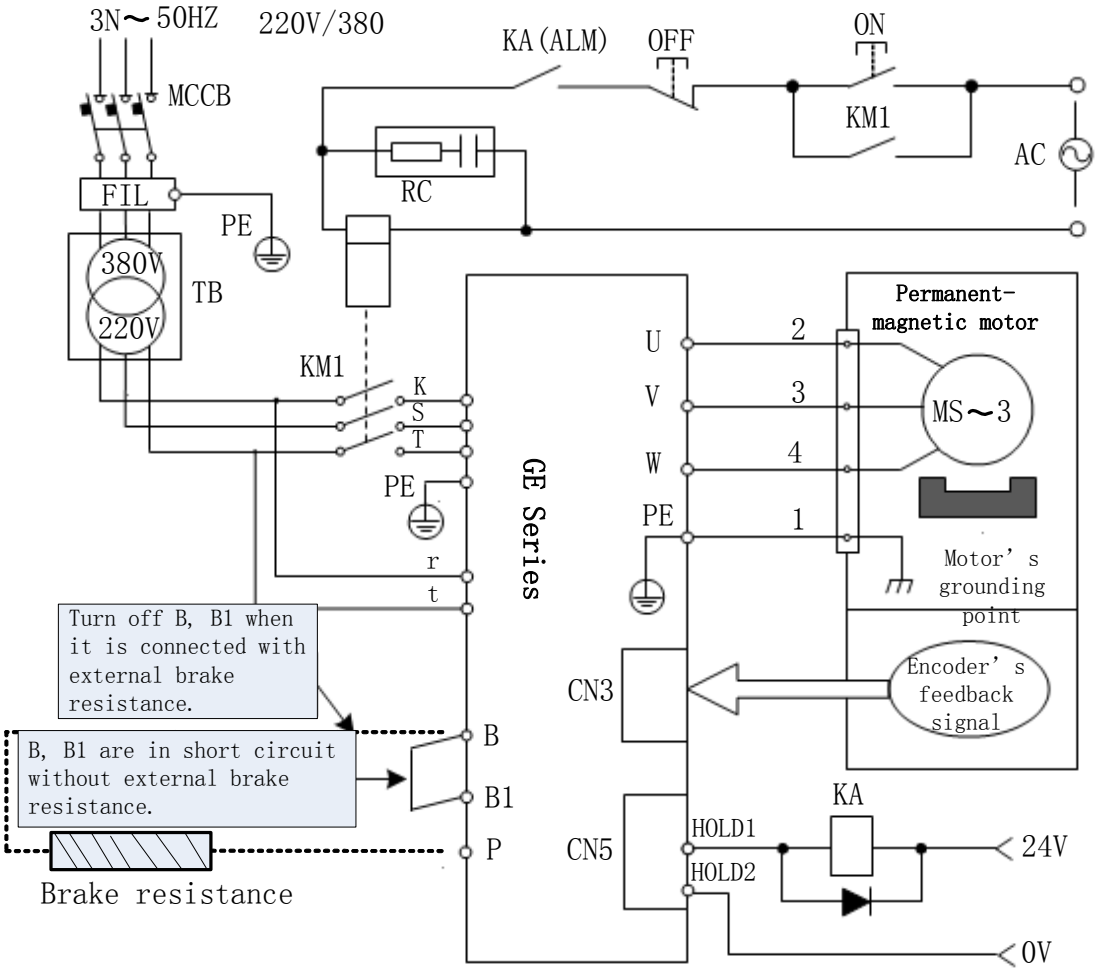


Fig.3-1 Main circuit wiring of GE series servo drive unit

Note

- B1 and B terminals are in short circuit without external brake resistance; turn off B1 and B with external brake resistance.
- GSK's motor power wire is labeled with U, V, W, PE matched with U, V, W, PE on the servo motor, otherwise, the motor cannot run normally. The grounding resistance should not be more than 0.1Ω.

1） Main circuit's wiring

Pin label	Name	Explanation

R, S, T	AC power supply input terminal	3-phase AC power supply input.
U, V, W	3-phase AC output terminal	Connected with motor's 3-phase wind U, V, W.
PE ⏚	Protective grounding terminal	Connected with power supply's ground wire and motor's ground wire. The protective ground resistance should be less than 1Ω.
P, B1, B	Brake resistance terminal	The brake resistance is used to energy consumption brake and the servo drive unit must be connected with an external brake to get normal work.

2） Cables and terminals of main circuit:

Type	Adapted motor's rated current I(A)	R，S，T，U，V，W		r，t		P，B1，B		PE	
		Terminal bolt φmm	Cable diameter mm^2	Terminal bolt φmm	Cable diameter mm^2	Terminal bolt φmm	Cable diameter mm^2	Terminal bolt φmm	Cable diameter mm^2
GE2030T	4.5＜I≤6	3.5	1.5	3.5	1.0	3.	1.5	3.	1.5
GE2050T	7.5＜I≤10	3.5	2.5	3.5	1.0	3.	2.5	4	2.5
GE2075T	10＜I≤15	4	2.5	4	1.0	4	2.5	5	2.5
GE2100T	15＜I≤25	6	4	4	1.0	6	4	5	4
GE2100T	25＜I≤29	6	6	4	1.0	6	6	5	6

3.1.2 Drive unit's bus and mask's connection

Bus communication signals CN1, CN2, feedback signal CN3, hold signal CN5, CN4 are the 2nd feedback signals, but they are not used at present.

- Control signal wire uses non-shielded engineering wire;
- Feedback signal wire diameter: shielding cable(twisted shielding cable) , line diameter ≥ 0.12mm2(AWG24-26)，shielding lays must be connected with FG terminal;
- Wire length: the cable length should be short as possible, cable length of the feedback signal CN3 should be less than 20m;
- Wiring: it should be far away from motive power and is prevented from other interferences;
- Suring absorb elements (coils) are installed to relevant wires: DC coil reverse being parallel with free wheeling diode, AC coil being parallel with resistance - capacitance absorb circuit.

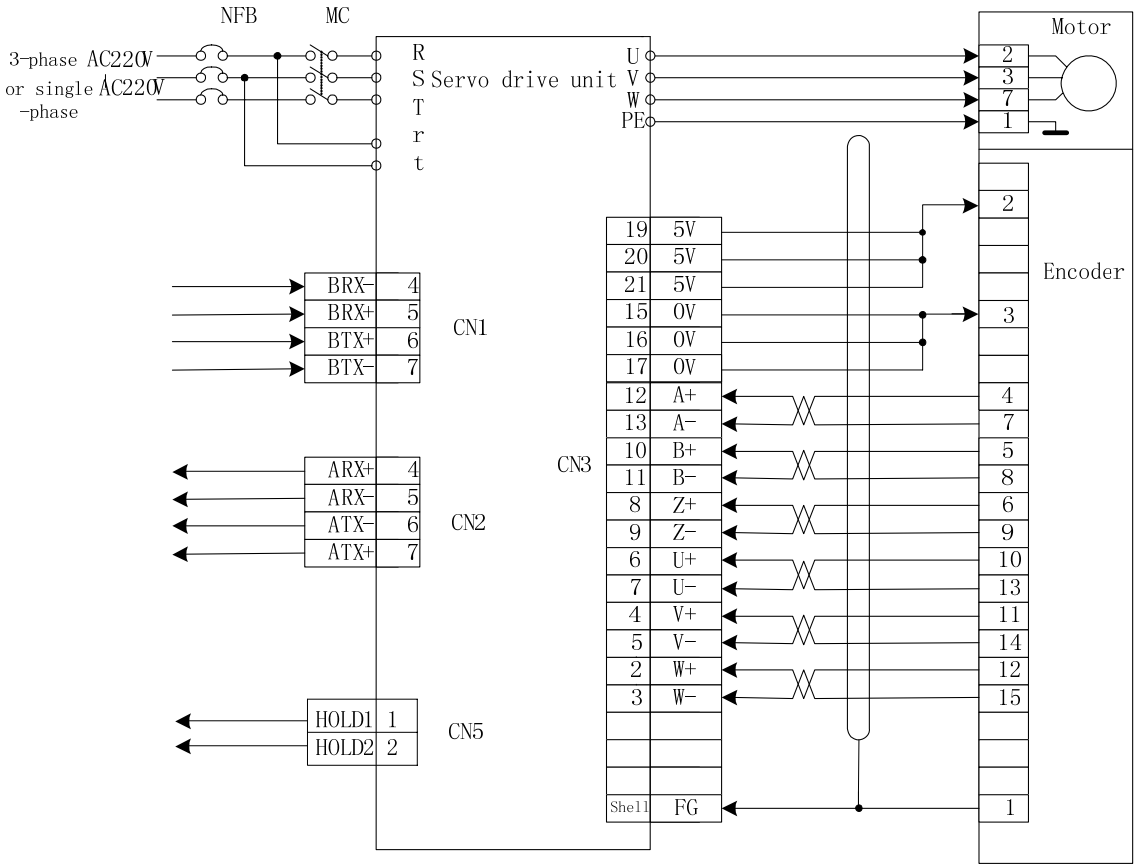


Figure 3-2 Standard wiring for position and speed control modes with an incremental encoder provided

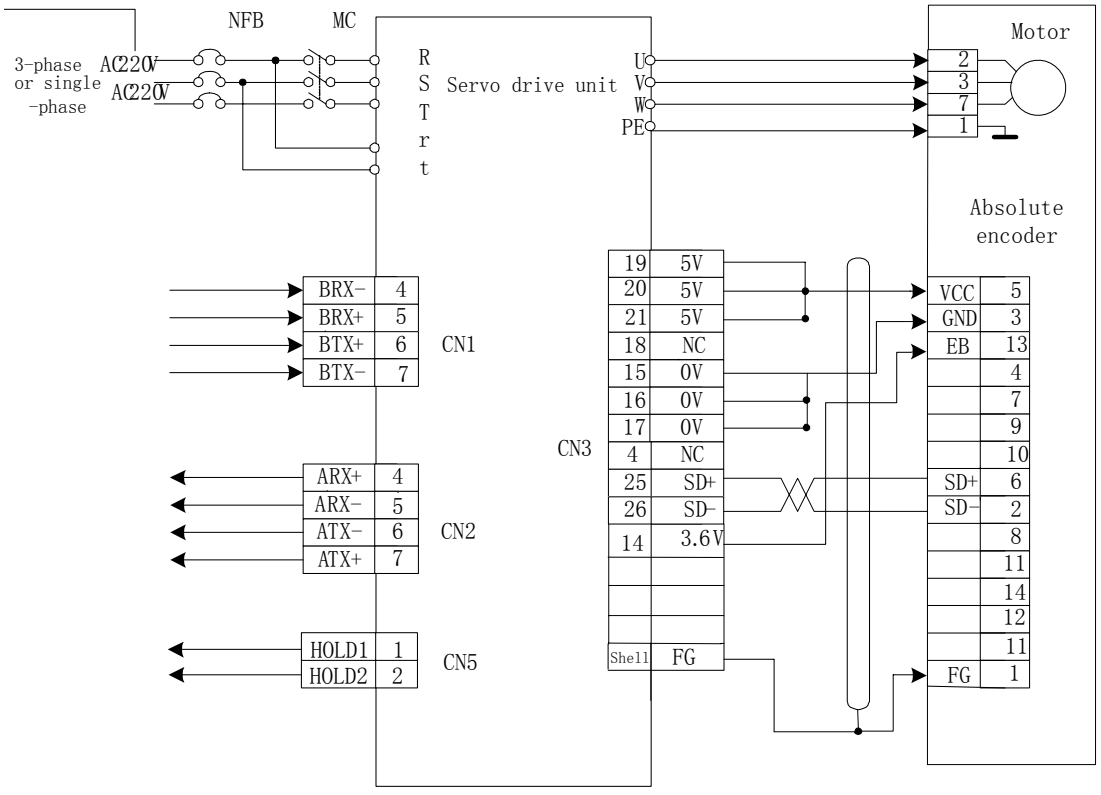


Figure 3-3 Standard wiring for position and speed control modes with a Tamagawa absolute encoder

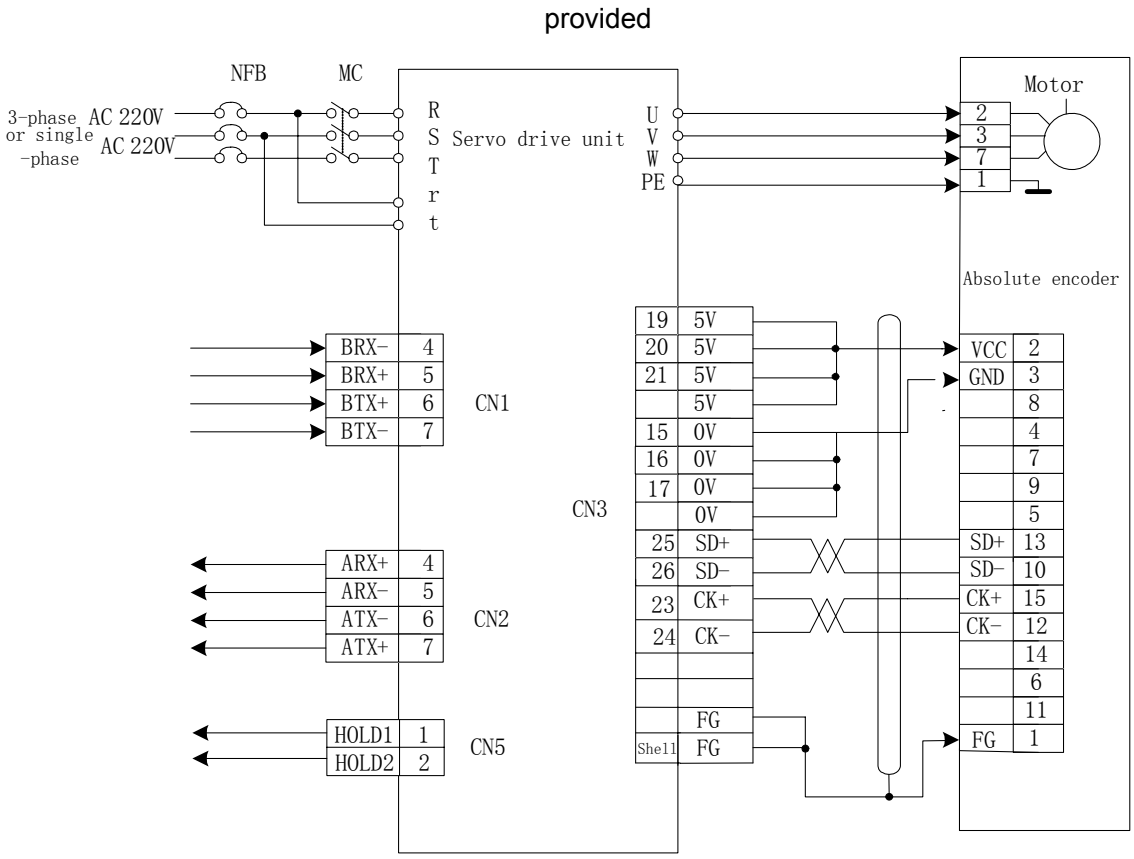


Figure 3-4 Standard wiring for position and speed control modes with a Danaher absolute encoder is provided

3.2 Functions of Terminals

1. Terminal Configuration

Configuring the terminals on the drive unit and incremental encoder motor is shown in the following Fig.3-5:

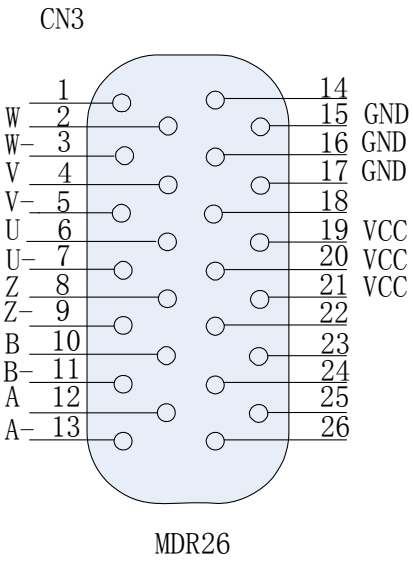


Figure 3-5 Diagram of configuring the terminals on the drive unit and incremental encoder motor

Configuration between servo drive unit and interface terminal of motor with absolute encoder is shown in Fig. 3-6 and Fig.3-7:

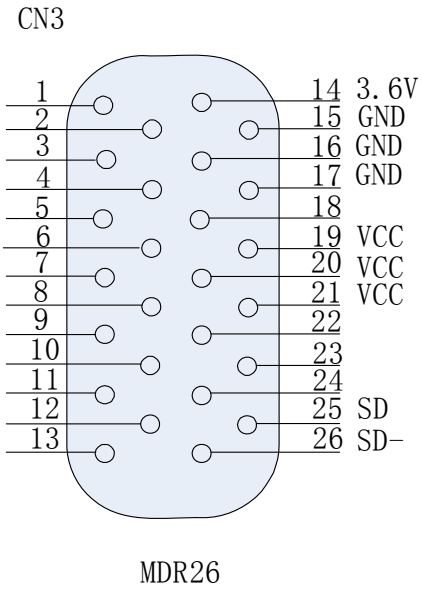


Fig. 3-6 Configuration between servo drive unit and interface terminal of Tamagawa absolute encoder

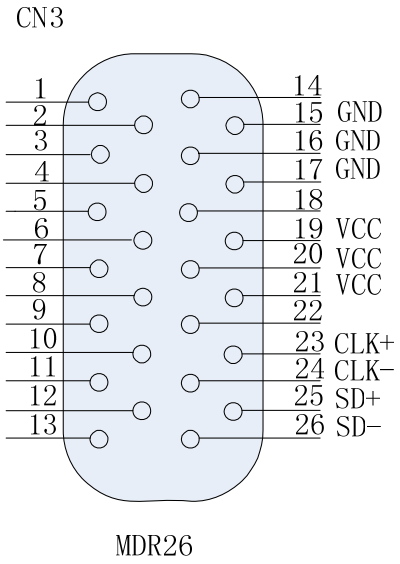


Fig. 3-7 Configuration between servo drive unit and interface terminal of Danaher absolute encoder

GSK-Link communication line *-00-770**

GT17VS-8DS-HU(line)			Wire	GT17VS-8DS-HU(line)		
No.	Signal name	Network cable color		No.	Signal name	Network cable color
1	RX− (BI_DA−)	Orange and white		1	RX− (BI_DA−)	Green and white
2	RX+ (BI_DA+)	Orange		2	RX+ (BI_DA+)	Green
3	TX− (BI_DB−)	Green and white		3	TX− (BI_DB−)	Orange and white
4	TX+ (BI_DB+)	Green		4	TX+ (BI_DB+)	Orange
5	Reserved (BI_DC−)	Blue and white		5	Reserved (BI_DC−)	Brown and white
6	Reserved (BI_DC+)	Blue		6	Reserved (BI_DC+)	Brown
7	Reserved (BI_DD−)	Brown and white		7	Reserved (BI_DD−)	Blue and white
8	Reserved (BI_DD+)	Brown		8	Reserved (BI_DD+)	Blue
PG	Shielding network			PG	Shielding network	

Note:1. The bracket is 1000M signal definition;
2. The industry ethernet type:: IE-5CC4*2*AWG26/7-PUR (Weidmüller)

Fig. 3-8 Communication terminal configuration

2. Communication terminal CN1

Table 3-2 control signal input/output terminal CN1

Terminal No.	Signal name	Sign	Mode	Function
CN1-4		BRX-		Bus differential data receiving
CN1-5		BRX+		Bus differential data receiving
CN1-6		BTX+		Bus differential data sending
CN1-7		BTX-		Bus differential data sending

3. Communication terminal CN2

Table 3-3 control signal input/output terminal CN2

Terminal No.	Signal name	Sign	Mode	Function
CN2-4		ARX+		Bus differential data receiving
CN2-5		ARX-		Bus differential data receiving
CN2-6		ATX-		Bus differential data sending
CN2-7		ATX+		Bus differential data sending

Brief Description of Bus Communication:

Control terminals CN1 and CN2 are the connection network created by the control device and servo in order to compose a closed loop of Ethernet transfer. The data transferred through Ethernet includes periodic and non-periodic data. Periodic data is transferred once per Interpolation period and non-periodic data in idle time.

a) Periodic data: It refers to Master Data Telegram (“MDT”). A CNC sends system control commands and position/speed/torque data to a servo while the latter transfers the current position information and the current key state of the servo to the CNC through a bus.

The format of the data sent by CNC --- 12 bytes:

Length of periodic data (10 bytes)		
16bits	16bits	8 bytes
Control word	Position/speed/torque data	Reserved

The format of the MDT control words send by CNC:

Format of control words sent by the system(16bits)		
Control bit	Meaning	Remarks
Bit0	To enable a servo	“1” is valid.
Bit1	To clear an alarm	“1” is valid.
Bit2	To disable CCW	“1” is valid.
Bit3	To disable CW	“1” is valid.
Bit4	To zero position deviation	“1” is valid.
Bit5	To disable command pulse	“1” is valid.

Bit6-Bit7	Reserved	
Bit8	To enable zeroing	“1” is valid.
Bit9-Bit10	Reserved	.
Bit11	Servo data acquisition	“1” is valid
Bit12	CNC device running mode	0/1
Bit13-Bit15	Reserved	

The format of the MDT data send by the incremental servo unit—12 bytes:

Length of periodic data (12 bytes)			
16bits	32bits	32bits	16bits
Control word	Current incremental position information	Z pulse position in zero return	Reserved

The format of the MDT control words send by the absolute servo unit-12 bytes:

Length of periodic data (12 bytes)			
16bits	32bits	32bits	16bits
Control word	Current incremental position information	One-turn absolute position	multi-turn absolute position

The format of the MDT control words send by the servo unit:

The format of the control words send by the servo (16bits)		
Control bit	Meaning	Remarks
Bit0	Servo ready.	“1” is valid.
Bit1	alarm output	“1” is valid.
Bit2	Positioning complete/speed arrival	“1” is valid.
Bit3	Z pulse signal	“1” is valid.
Bit4-bit10	Servo alarm number	7 bits: Max. alarm No. 32 indicates (000 0001 1111 0000 B) (the first bit being 1 means an alarm occurs)
Bit11-Bit12	Reserved	
Bit13	Run stop symbol in position mode	“1” is valid
Bit14--15	Reserved	

b) Non-periodic data: It refers to a general data telegram (“GDT”) that comprises control words and data. The functions of a non-periodic data in final version include: setting of

Ethernet communication parameters, setting and change of servo parameters, allowing a servo to save the current change in parameters, reception of servo parameters, reception of servo diagnostic messages, etc;

c) Determination of the axes X, Y and Z of a servo drive unit:

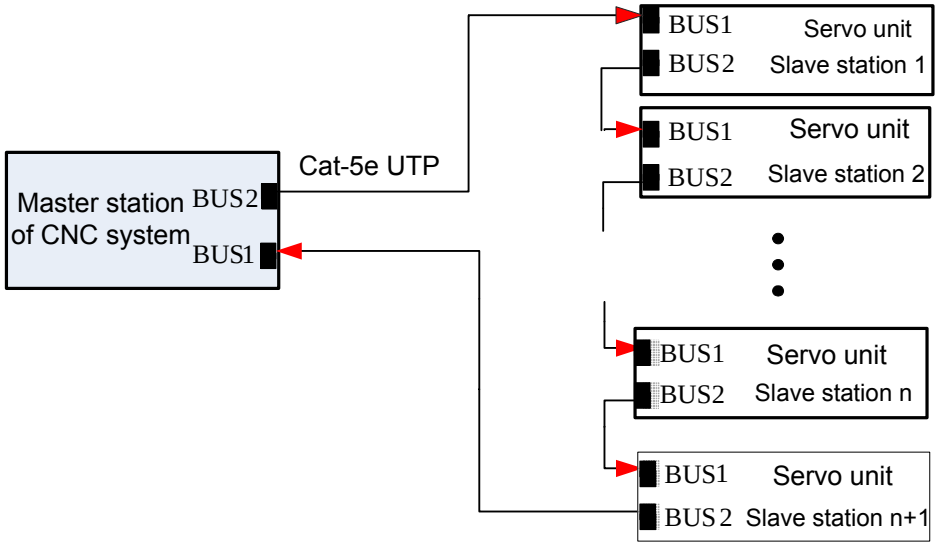


Figure 3-9 Diagram of connecting a CNC to servo Unit

The servo connecting the bus interface 2 of the CNC (i.e. CN2 of CNC) to the servo CN1 (GT 17 interfaces) is the first axis (Axis X). The servo connecting CN2 (GT17 interface) back to the bus interface 1 of the system (i.e. CN1 of CNC) is the last axis.

4. Feedback signal terminal CN1------Feedback signal from an incremental encoder

Table 3-4 Signal input/output terminal CN3 of encoder

Terminal No.	Signal designation	Terminal marking		Color	Functions
		Marking	Mode		
CN3-19 CN3-20 CN3-21 CN3-21	Power output +	+5V			The photoelectric encoder for the servomotor uses +5V power supply. For a long cable, connect several core wires in parallel.
CN3-15 CN3-16 CN3-17	Power output -	GND			
CN3-12	Encoder A＋input	A+			Connecting the A+ of the photoelectric encoder for the servomotor
CN3-13	Encoder A－input	A-			Connecting the A- of the photoelectric encoder for the servomotor

CN3-10	Encoder B＋input	B+			Connecting the B+ of the photoelectric encoder for the servomotor
CN3-11	Encoder B－input	B-			Connecting the B- of the photoelectric encoder for the servomotor
CN3-8	Encoder Z＋input	Z+			Connecting the Z+ of the photoelectric encoder for the servomotor
CN3-9	Encoder Z－input	Z-			Connecting the Z- of the photoelectric encoder for the servomotor
CN3-6	Encoder U+input	U+			Connecting the U+ of the photoelectric encoder for the servomotor
CN3-7	Encoder U-input	U-			Connecting the U- of the photoelectric encoder for the servomotor
CN3-4	Encoder V+input	V+			Connecting the V+ of the photoelectric encoder for the servomotor
CN3-5	Encoder V-input	V-			Connecting the V- of the photoelectric encoder for the servomotor
CN3-2	Encoder W+input	W+			Connecting the W+ of the photoelectric encoder for the servomotor
CN3-3	Encoder W-input	W-			Connecting the W- of the photoelectric encoder for the servomotor

5. CN1 feedback signal terminal –Feedback signal from Tamagawa 17-bit absolute encoder

Table 3-5 CN3 Signal Input/output Terminals of Tamagawa 17-bit Absolute Encoder

Terminal No.	Signal designation	Terminal marking		Color	Functions
		Marking	Mode		
CN3-19 CN3-20 CN3-21	Power output +	+5V			The absolute encoder for the servomotor uses +5V power supply. For a long cable, connect several core wires parallel.
CN3-15 CN3-16 CN3-17	Power output -	GND			

CN3-25	Encoder SD+1nput	SD+			Connecting the A+ of the photoelectric encoder for the servomotor
CN3-26	Encoder SD- input	SD-			Connecting the A- of the photoelectric encoder for the servomotor
CN3-14	Battery input ＋	+3.6V			The absolute encoder for the servomotor uses +3.6V power supply to maintain the data of several loops. For a long cable, connect several core wires in parallel. If the servo unit is not powered on for an extended period of time, the data of several loops is subject to loss due to low battery voltage.

Table 3-6 CN3 Signal Input/output Terminals of Danaher 17-bit Absolute Encoder

Terminal No.	Signal designation	Terminal marking		Color	Functions
		Marking	Mode		
CN3-19 CN3-20 CN3-21	Power output+	+5V			The absolute encoder for the servomotor uses +5V power supply. For a long cable, connect several core wires in parallel.
CN3-16 CN3-17 CN3-18	Power output -	GND			
CN3-24	Encoder CK – input	CK –			Connecting the CK- of the photoelectric encoder for the servomotor
CN3-23	Encoder CK + input	CK +			Connecting the CK+ of the photoelectric encoder for the servomotor
CN3-26	Encoder SD – input	SD –			Connecting the SD+ of the photoelectric encoder for the servomotor
CN3-25	Encoder SD + input	SD +			Connecting the SD- of the photoelectric encoder for the servomotor
Shell	Shield earth wire	EARTH			Connecting the B- of the photoelectric encoder for the servomotor

6. HOLD signal terminal CN5

Terminal number	Signal name	Explanation
CN5-1	HOLD output terminal 1	HOLD output signal is performed without concerning the sign+/-
CN5-2	HOLD output terminal 2	HOLD output signal is performed without concerning the sign+/-

3.3 I/O Interface

1. Input Interface of Incremental Photoelectric Encoder for Servomotor

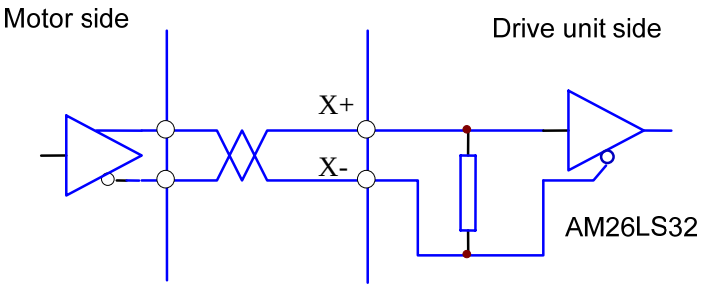


Figure 3-10 Input Interface of Incremental Photoelectric Encoder for Servomotor

2. Input Interface of Absolute Photoelectric Encoder for Servomotor

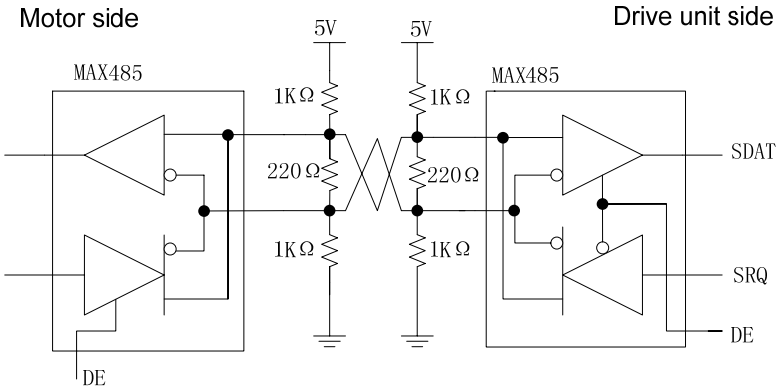


Figure 3-11 Input Interface of Absolute Encoder for Servomotor

Chapter 4 Parameters

Attention
● Each personnel involved in parameter adjustment shall understand the meaning of parameters as incorrect setting may cause equipment damage and personal injury. ● It is recommended to adjust the parameters when the servomotor is idling. ● The motor parameters are adaptive to GSK SJT and Huazhong ST series of servomotors. To use other servomotors, it is required to adjust the relevant parameters. Otherwise the motor will not operate normally.

4.1 Summary of Parameters

- The delivery settings in the following table are adaptive to the drive unit of GSK 110SJT-M040D (4N.m, 2500rpm) motor as an example. The relevant parameters vary with motors.
- The current software version is V1.0.3 – for servomotors with incremental encoder.

Table 4-1 Summary of Parameters

S/N	Name	Applicable mode	Range of parameter	Delivery setting	Unit
0	Password	P, S	0~9999	315	
1	Model code	P, S	0~78	60	
2	Software version (read-only)	P, S	*	*	
3	Initial display status	P, S	0~24	0	
4	Selection of control mode	P, S	0~5	0	
5	Proportional gain of speed	P, S	5~2000	240*	Hz
6	Integral time constant of speed	P, S	1~1000	25*	ms
7	Torque command filter	P, S	1~500	100	%
8	Low pass filter for speed detection	P, S	1~500	120	%
9	Proportional gain of position	P	1~1000	40	1/S
10	Feedforward gain of position	P	0~100	0	%
11	Cut-off frequency of positional feedforward low-pass filter	P	1~1200	300	Hz
12	Numerator of position command	P	1~32767	1	

	countdown				
13	Denominator of position command countdown	P	1~32767	1	
14	Reserved	P, S	200~30000	1000	us
15	Reversal of position command countdown	P	0~1	0	
16	Positioning range	P	0~30000	20	Pulse
17	Range of position out-of-tolerance detection	P	0~30000	200	×100 pulse
18	Erroneous and invalid position out-of-tolerance	P	0~1	0	
19	Position command smoothing filter	P	0~30000	0	0.1ms
20	Invalid drive disabling input	P, S	0~1	0	
21	Speed of JOG operation	S	-3000~3000	120	rpm
22	Selection of internal and external commands	S	0~4	0	
23	Limitation of maximum speed	P, S	0~4000	3000	rpm
24	Internal speed 1	S	-3000~3000	0	rpm
25	Internal speed 2	S	-3000~3000	100	rpm
26	Internal speed 3	S	-3000~3000	300	rpm
27	Internal speed 4	S	-3000~3000	-100	rpm
28	Arriving speed	S	0~3000	500	rpm
29	Contracting brake release signal delay	P, S	0~1000	50	ms
30	Numerator of linear speed conversion	P, S	1~32767	10	
31	Denominator of linear speed conversion	P, S	1~32767	1	
32	Position of decimal point in linear speed	P, S	0~5	3	
33	Stoppage delay time of contracting brake	P, S	0~1000	10	ms
34	Limitation of internal CCW torque	P, S	0~300	300*	%
35	Limitation of internal CW torque	P, S	-300~0	-300*	%
36	Limitation of external CCW torque	P, S	0~300	100	%
37	Limitation of external CW torque	P, S	-300~0	-100	%
38	Torque limitation of speed trial operation and JOG operation	S	0~300	100	%
39	Reserved;				

	Writing-in of drive unit type	P, S	0~100	0	
40	Acceleration time constant	S	1~10000	0	ms
41	Deceleration time constant	S	1~10000	0	ms
42	Reserved				
43	Backlash compensation amount	P	0~100	0	um
44	Acceleration/deceleration time of backlash	P	5~100	5	200us
45	Acceleration/deceleration compensation enabling of backlash	P	0~1	0	
46	Enabling for servo parameter optimization	P，S	0~1	0	
47	Rigid level parameter	P，S	0~10	0	
48	Servo optimization coefficient 1	P，S	-32767~32767	0	
49	Servo optimization coefficient 2	P，S	-32767~32767	0	
50	Servo data collection selection	P，S	0~3	0	
53	Stop vibration suppression function selection	P，S	0～2	0	
54	Stop judging pulse	P，S	0～32767	0	
55	The 2nd position gain	P	1～1000	102	1/S
56	The 2nd speed gain	P，S	5~2000	200	Hz
57	The 2nd speed integral time constant	P，S	1~1000	20	ms

Note: Current servo software version matched with the absolute encoder is V3.03.

4.2 Functions of Parameters

Table 4-2 Functions of Parameters

S/N	Name	Function	Range of parameter
0	Password	①The parameter is used to prevent the parameters from accidental alteration. To change a parameter, normally change the password to the required password and then set the parameter. After adjustment, finally set this parameter to 0 in order to prevent the parameters from accidental alteration. ②Different password levels correspond to user, system and all parameters. ③The change of the Model code parameter (PA1) requires the	0~9999

		use of a Model code password. Other passwords cannot be used change the parameter. ④User password: 315. ⑤Model code password: 385.	
1	Model code	①Different model codes correspond to the Drive Unit and motors at different power levels in the same series. ②Different model codes correspond to different default parameter settings. Always ensure the correctness of this parameter while using the default parameter recovery function. ③In the event of EEPROM alarm (No. Alarm 20), make sure to set this parameter again and then recover the default parameter. Otherwise the drive unit may operate abnormally or become damaged. ④To change the parameter, first set the password PA0 to 385 and then modify this parameter. ⑤ Refer to Section 4.3 of this chapter for the check list of motor models and codes.	0~78
2	Software version (read-only)	① The version number of the software may be reviewed but not changed. ② Meaning of the parameter: b1.01—incremental type V1.01; C3.01—absolute type V3.01;	*
3	Initial display status	① To select the display status of the display when the drive unit is powered on 0: To display the rotating speed of the motor; 1: To display the lower 5 digits of current position; 2: To display the upper 5 digits of current position; 3: To display the lower 5 digits of position command (command pulse accumulation); 4: To display the upper 5 digits of position command (command pulse accumulation); 5: To display the lower 5 digits of position deviation; 6: To display the upper 5 digits of position deviation; 7: To display the torque of the motor; 8: To display the current of the motor; 9: To display a linear speed; 10: To display control modes;	0~24

		11: To display the frequency of position command pulse; 12: To display a speed command; 13: To display a torque command; 14: To display the absolute position of the rotor in a revolution; 15: To display the state of input terminal; 16: To display the state of the output terminal; 17: To display the input signal of the encoder; 18: To display the operating state; 19: To display alarm codes; 20: To display radiator's temperature 22: To display the last upgrading data of DSP software; 23: To display FPGA version; 24; Reserved.	
4	Selection of control mode	① It is possible to set the control mode of the drive unit through this parameter: 0: Position control mode; 1: Speed control mode; 2: Trial operation control mode; 3: JOG control mode; 4: Encoder zeroing mode; 5: Open-loop operating mode (for test of motor and encoder); ② Position control mode: Position command data is input through a bus; Speed control mode: Speed command is selected through PA22 parameter (see PA22 for details); ③ Trial operation control mode; Speed commands are input through a keyboard to test the drive unit and motor. JOG control mode is known as inching mode. After entering JOG operation, the motor runs at JOG speed when the ↑ key is pressed and held, and stops and maintains at zero speed when the key is released. The motor runs inversely at JOG speed when the ↓ key is pressed and held, and stops and maintains at zero speed when the key is released. ④Encoder zeroing mode: It is used to set the encoder to zero before shipping the motor.	0~5
5	Proportional	①The parameter is used to set the proportional gain of the speed	5 Hz

	gain of the 1st speed	ring adjuster. ②The bigger the setting is, the higher the gain and rigidity and the smaller the speed overshooting during acceleration and deceleration will be. The setting of the parameter depends on the specific model number and load of the drive system. As a general rule, the setting declines with the increase of load inertia. ③ It shall be set as big as possible provided that the system does not produce any disturbance.	~2000Hz
6	Integral time constant of the 1st speed	①The parameter is used to set the integral time constant of the speed ring adjuster. ② The smaller the setting is, the higher the integral speed and rigidity will be. The setting of the parameter depends on the specific model number and load of the servo drive system. As a general rule, the setting rises with the increase of load inertia. ③It shall be set as small as possible provided that the system does not produce any disturbance.	ms~1000ms
7	Torque command filter	①It is used to limit the current command frequency band and suppress the resonance caused by torque (the motor produces sharp vibration noise) so that current response becomes smooth. ② Reduce the parameter if the motor makes sharp vibration noise; ③The smaller the setting is, the lower the cut-off frequency, the better the filtering effect and the lower the noise produced by the motor will be. In case of high load inertia, it is possible to appropriately reduce the setting. Excessively small setting may slow down response and cause instability. ④The bigger the setting is, the higher the cut-off frequency and the faster the response will be. It is possible to appropriately to increase the setting if relatively high mechanical rigidity is required.	1%~500%
8	Low pass filter for speed detection	①The parameter is used to set the characteristics of the low-pass filter for speed detection. ②The smaller the setting is, the lower the cut-off frequency, the better the filtering effect and the lower the noise produced by	1%~500%

		the motor will be. In case of high load inertia, it is possible to appropriately reduce the setting. Excessively small setting may slow down response, increase speed fluctuation and cause disturbance. ③The bigger the setting is, the higher the cut-off frequency and the faster the response will be. It is possible to appropriately to increase the setting if relatively high mechanical rigidity is required.	
9	Proportional gain of the 1st position	①The parameter is used to set the proportional gain of the position ring adjuster. ②The gain and rigidity increase with the setting. Under the same frequency command pulse condition, the position lag becomes less but excessive setting may cause disturbance or overshooting. ③The setting of the parameter depends on the version and load of the servo drive system.	1~1000 /s
10	Feedforward gain of position	①The parameter is used to set the feedforward gain of the position ring. ②When it is set to 100%, it indicates that the position lag is always 0 under the command pulse at any frequency. ③When the feedforward gain of the position ring rises, the high-speed response of the control system is improved but this may lead to the instability of position ring of the system and tend to cause disturbance. ④The feedforward gain of the position ring is generally 0 unless very high response characteristics are required.	0~100％
11	Cut-off frequency of positional feedforward low-pass filter	①This parameter is used to set the cut-off frequency of the low-pass filter for the position feedforward quantity. ②This filter is intended to improve the compound position control.	1 Hz ~1200Hz
12	Numerator of position command countdown	①This parameter is used to set the frequency division and multiplication of command pulse (electronic gear). ②In position control mode, it is very easy to be adaptive to all pulse sources by setting the PA12,PA13 parameter in order to	1~32767

		achieve the optimal control resolution (i.e. angle/pulse) of user. ③ $P \times G = N \times C \times 4$ ---incremental $P \times G = N \times C$ ---absolute P: Pulse number of input command; G: Electronic gear ratio: $G = \frac{\text{Numerator of frequency division}}{\text{Denominator of frequency division}}$ N: Number of rotations of motor; C: Number of lines of photoelectric encoder/rotation, V1.02 incremental C＝2500; V3.01 and V3.01 with Tamagawa 17-bit absolute encoder C＝2^{17}＝131072 ④ 〖Example〗 Calculation of the gear ratio for V1.01: When the input command pulse is 6000, the servomotor rotates by one turn $G = \frac{N \times C \times 4}{P} = \frac{1 \times 2500 \times 4}{6000} = \frac{5}{3}$ Then Parameter PA12 is set to 5 and PA13 to 3. ⑤ Calculation of the gear ratio for V3.01: When the input command pulse is 6000, the servomotor rotates by one turn $G = \frac{N \times C \times 4}{P} = \frac{1 \times 131072}{6000} = \frac{8192}{375}$	
13	Denominator of position command countdown	① See Parameter PA12.	1~32767
14	Bus communication period	① Bus communication period of CNC device and servo drive unit	200~30000
15	Reversal of position command countdown	① It is set to 0: Normal; or 1: Reverse pulse direction of position command	0~1
16	Positioning range	①This parameter is used to set the range of positioning pulse under position control. ②This parameter provides the basis for the drive unit to judge whether positioning is completed in position control mode.	0~30,000 pulses

		When the remaining pulse number in the position deviation counter is less than or equal to the setting of the parameter, the drive unit onsiders that the positioning has been completed. The positioning completion signal is COIN ON. Otherwise it is COIN OFF. ③The output positioning completion signal is COIN in the position control mode and the output speed reaching signal SCMP.	
17	Range of position out-of-tolerance detection	①This parameter is used to set the range of position out-of-tolerance alarm detection ②In the position control mode, the servo drive unit gives a position out-of-tolerance alarm when the count value of the position deviation counter goes beyond the setting of this parameter.	0~30000 ×100 pulses
18	Erroneous and invalid position out-of-tolerance	① 0: The position out-of-tolerance alarm detection is enabled. 1: The position out-of-tolerance alarm detection is disabled.	0~1
19	Position command smoothing filter	①Command pulses are smoothed. The acceleration and deceleration are in exponential form. The numerical value indicates a time constant. ②The filter is not subject to loss of input pulse but command delay. ③The filter is used when ● A host controller has no acceleration and deceleration functions; ● The frequency division and multiplication of the electronic gear are high (>10); ● The command frequency is low; ● The motor is subject to step leaping and instability during operation; ④ When it is set to 0, the filter does not work.	0~30000×0.1 （ms）
20	Invalid drive disabling input	① 0: CCW and CW input disabling is active. When the CCW drive disabling switch (FSTP) is turned ON, CCW drive is allowed. When the CCW drive disabling switch (FSTP) is turned OFF, the torque in CCW direction is 0. The same goes for CW.	0~1

		If both CCW and CW drive disabling switches are turned off, a drive disabling input error alarm will be given. 1: CCW and CW input disabling is deactivated. CCW and CW drives are allowed irrespective of the state of CCW and CW drive disabling switches. At the same time, a drive disabling input error alarm will not be given if both CCW and CW drive disabling switches are turned off.	
21	Speed of JOG operation	①This parameter is used to set the running speed of JOB operation.	-3000 rpm ~3000rpm
22	Selection of internal and external commands	① When it is set to 0, the speed command is bus entry; ② When it is set to 1, the speed command is Internal speed 1; ③ When it is set to 2, the speed command is Internal speed 2; ④ When it is set to 3, the speed command is Internal speed 3; ⑤ When it is set to 4, the speed command is Internal speed 4;	0~4
23	Limitation of maximum speed	①It is used to set the upper speed limit of the servomotor. ②It is independent of direction of rotation. ③If the setting goes beyond the rated rotating speed, the actual maximum speed limit the rated rotating speed.	0 rpm ~ 4000 rpm
24	Internal speed 1	① This parameter is used to set Internal speed 1 ② See PA22.	-3000 rpm ~3000 rpm
25	Internal speed 2	① This parameter is used to set Internal speed 2 ② See PA22.	-3000 rpm ~3000 rpm
26	Internal speed 3	① This parameter is used to set Internal speed 3 ② See PA22.	-3000 rpm ~3000 rpm
27	Internal speed 4	① This parameter is used to set Internal speed 4 ② See PA22.	-3000 rpm ~3000 rpm
28	Arriving speed	①It is used to set the arriving speed. ②In a non-position control mode, it is set to SCMP ON if the motor speed exceeds the setting. Otherwise it is set to SCMP OFF. ③This parameter is not used in position control mode. ④It is independent of direction of rotation. ⑤The comparator has lagging characteristics.	0 ms ~ 3000rpm
29	Contracting brake	① When the drive unit is enabled (SON is ON), the contracting brake release signal will delay the output by following the	0 ms ~1000ms

	release signal delay	delay time set by the parameter in order to ensure that the contracting brake motor will release the contracting brake unit only after it is energized and excited and that the workbench will not drop. ② The parameter setting must not be too long; otherwise the motor cannot operate by following the command and even cause a position out-of-tolerance alarm due to the delayed release of the motor contracting brake when SON is set to ON. Therefore the parameter shall be set to a small setting as far as possible provided that the workbench does not drop.	
30	Numerator of linear speed conversion	① This parameter is used to indicate the linear running speed of the system. ② $\text{Linear speed} = \text{Motor speed (rpm)} \times \frac{\text{Numerator of linear speed conversion}}{\text{Denominator of linear speed conversion}}$ ③The decimal point of linear speed depends on the setting of Parameter PA32. “0” means that there is no decimal point, “1” it is in tens place, “2” in hundred's place and so on. ④〖Example〗If the servo motor drives a 10mm ball screw, the numerator of linear speed conversion is set to 10, denominator of linear speed conversion to 1 and the decimal point of linear speed is 3. The linear speed may be displayed on the monitor in m/min. When the speed of the motor is 500rpm, its linear speed is indicated by 5.000m/min.	1~32767
31	Denominator of linear speed conversion	① See Parameter PA30.	1~32767
32	Position of decimal point in linear speed	① See Parameter PA30.	0~5
33	Stoppage delay time of contracting brake	①For the motor with a contracting brake unit, when the system cancels the enabling signal, the drive unit continues to excite the motor for some time to ensure that the motor contracting brake fully arrests the motor rotor before stopping the excitation	0-2000 （ms）

		of the motor. ②Delay time=Setting value*1ms.	
34	Limitation of internal CCW torque	①This parameter is used to set the internal torque limit in the CCW direction of the servomotor. ②The setting is a percentage of the rated torque. For example, if it is set to twice the rated torque, the setting is 200. ③The limitation is active at any time. ④If the setting is over the maximum overloading capacity of the system, the actual torque limit is the permissible maximum overloading capacity of the system.	0-300%
35	Limitation of internal CW torque	①This parameter is used to set the internal torque limit in the CW direction of the servomotor. ②The setting is a percentage of the rated torque. For example, if it is set to twice the rated torque, the setting is -200. ③The limitation is active at any time. ④If the setting is over the maximum overloading capacity of the system, the actual torque limit is the permissible maximum overloading capacity of the system.	-300%~0
36	Limitation of external CCW torque	①This parameter is used to set the external torque limit in the CCW direction of the servomotor. ②The setting is a percentage of the rated torque. For example, if it is set to one time the rated torque, the setting is 100. ③The limitation is active only when the CCW torque limit input terminal (FIL) is ON. ④When the limitation is active, the actual torque limit is the smallest of the maximum overloading capacity of the system, internal CCW torque limit and external CCW torque limit.	0~300%
37	Limitation of external CW torque	①This parameter is used to set the external torque limit in the CW direction of the servomotor. ②The setting is a percentage of the rated torque. For example, if it is set to one time the rated torque, the setting is -100. ③The limitation is active only when the CW torque limit input terminal (RIL) is ON. ④When the limitation is active, the actual torque limit is the smallest of the absolute values of the maximum overloading capacity of the system, internal CW torque limit and external	-300%~0

		CW torque limit.	
38	Torque limitation of speed trial operation and JOG operation	①This parameter is used to set the torque limit in the speed trial operation and JOG operating modes. ②It is active in both directions and independent of direction of rotation. ③The setting is a percentage of the rated torque. For example, if it is set to one time the rated torque, the setting is 100. ④The limitation on the internal and external torques is still active.	0~300%
39	Reserved		
40	Acceleration time constant	①The setting is the time elapsed when the motor accelerates from 0 to 1,000rpm. ②The acceleration and deceleration characteristics are linear. ③It is only applicable to speed control mode and invalid for position control mode. ④This parameter must be set to 0 when the drive unit is used in combination with an external position ring.	1 ms ~10000ms
41	Deceleration time constant	①The setting is the time elapsed when the motor decelerates from 1,000rpm to 0. ②The acceleration and deceleration characteristics are linear. ③It is only applicable to speed control mode and invalid for position control mode. ④This parameter must be set to 0 when the drive unit is used in combination with an external position ring.	1 ms~ 10000ms
42	Return to reference point	Store the previous run direction of the machine used to the backlash of absolute servo's initial power-on, generally cannot be set by manual operation	-32767～ 32767
43	Backlash compensation value	Backlash value when the machine runs reversely.	um
44	Acceleration/ deceleration time of backlash compensation	The faster backlash is, the shorter the compensation time is, the least setting value is 1ms;	*200us

45	Backlash compensation enabling	0: not use backlash compensation function; 1: do	
46	Enabling for servo parameter optimization	0：invalid；1: valid； The parameter is set by the parameter and cannot be modified by user.	0～1
47	Rigid level parameter	It is used to improve the parameter's debugging speed, is used by the system with matched bus, and cannot be set on the servo.	0～9
48	Servo optimization parameter 1	It is used to improve the servo's respond speed, is used by the system with matched bus, and cannot be set on the servo.	-32767~32767
49	Servo optimization parameter 2	It is used to improve the servo's respond speed, is used by the system with matched bus, and cannot be set on the servo.	-32767~32767
50	Servo data collection selection	It is set to resolve actual machining problems and is used by the system with matched bus.	0～3
53~54	Stop vibration suppression function	The function reserves parameters. Currently, it is only used to stop vibration suppression of absolute servo on the machine with small static friction.	
55	The 2nd position proportional gain	Its function is the same that of item 6, and is used to drill and rapidly position.	1～1000
56	The 2nd speed proportional gain	Its function is the same that of item 5, and is used to drill and rapidly position.	5～2000
57	The 2nd speed integral time constant	Its function is the same that of item 6, and is used to drill and rapidly position.	1～1000

4.3 Checklist of Model Numbers and Specification of Motor

Table 4-3 Checklist of No.1 Parameter and SJT Series 2500-Line Incremental Servo Motors

№1 Parameter	Model numbers and Specification of Servomotors
40	130SJTG-M040GH，1.7kW, 380V, 4000 r/min, 4.8A, 1.0×10-3kg. m^2
41	130SJTG-M050GH，2.1kW, 380V, 4000 r/min, 6.0A, 1.2×10-3kg. m^2
42	130SJTG-M060GH，2.5kW, 380V, 4000 r/min, 7.2A, 1.5×10-3kg. m^2
43	130SJTG-M075GH，3.1kW, 380V, 4000 r/min, 7.5A, 1.9×10-3kg. m^2
44	130SJTG-M100GH，4.2kW, 380V, 4000 r/min, 10.0A, 2.5×10-3kg. m^2
45	175SJTG-M120EH，3.8kW, 380V, 3000 r/min, 10.5A, 4.1×10-3kg. m^2
46	175SJTG-M150EH，4.7kW, 380V, 3000 r/min, 12.5A, 4.9×10-3kg. m^2
47	175SJTG-M180EH，5.7kW, 380V, 3000 r/min, 15.5A, 6.1×10-3kg. m^2
48	175SJTG-M220EH，6.9kW, 380V, 3000 r/min, 18.5A, 7.2×10-3kg. m^2
49	175SJTG-M300EH，9.4kW, 380V, 3000 r/min, 25.0A, 9.5×10-3kg. m^2
50	175SJTG-M380EH，11.9kW, 380V, 3000 r/min, 32A, 12.1×10-3kg. m^2
51	175SJT-M380BH，6.0kW, 380V, 1500 r/min, 15A, 14.8×10-3kg. m^2
52	175SJT-M380DH，7.9kW, 380V, 2500 r/min, 26A, 14.8×10-3kg. m^2
53	175SJT-M500BH，7.8kW, 380V, 1500 r/min, 20A, 14.8×10-3kg. m^2
54	175SJT-M500DH，10.5kW, 380V, 2500 r/min, 33A, 14.8×10-3kg. m^2
55	80SJT-M024C，0.5kW, 220V, 2000 r/min, 3A, 0.83×10^{-4}kg.m^2
56	80SJT-M024E，0.75kW, 220V, 3000 r/min, 4.8A, 0.83×10-4kg.m^2
57	80SJT-M032C，0.66kW, 220V, 2000 r/min, 5A, 1.23×10-4kg.m^2
58	80SJT-M032E，1.0kW, 220V, 3000 r/min, 6.2A, 1.23×10-4kg.m^2
59	110SJT-M040D，1.0kW, 220V, 2500 r/min, 4.5A, 0.68×10-3kg.m^2
60	110SJT-M040E，1.2kW, 220V, 3000 r/min, 5A, 0.68×10-3kg. m^2
61	110SJT-M060D，1.5kW, 220V, 2500 r/min, 7A, 0.95×10-3kg. m^2
62	110SJT-M060E，1.8kW, 220V, 3000 r/min, 8A, 0.95×10-3kg. m^2
63	130SJT-M040D，1.0kW, 220V, 2500 r/min, 4A, 1.19×10-3kg. m^2
64	130SJT-M050D，1.3kW, 220V, 2500 r/min, 5A, 1.19×10-3kg. m^2
65	130SJT-M060D，1.5kW, 220V, 2500 r/min , 6A, 1.95×10-3kg. m^2
66	130SJT-M075D，1.88kW, 220V, 2500 r/min, 7.5A, 1.95×10-3kg. m^2
67	130SJT-M100B，1.5kW, 220V, 1500 r/min, 6A, 2.42×10-3kg. m^2
68	130SJT-M100D，2.5kW, 220V, 2500 r/min, 10A, 2.42×10-3kg. m^2
69	130SJT-M150B，2.3kW, 220V, 1500 r/min, 8.5A, 3.1×10-3kg. m^2
70	130SJT-M150D，2.3kW, 220V, 2500 r/min, 8.5A, 3.1×10-3kg. m^2
71	175SJT-M150D，3.1 kW, 220V, 2500 r/min, 14 A, 5.1×10-3kg. m^2
72	175SJT-M180B，2.8 kW, 220V, 1500 r/min, 15 A, 6.5×10-3kg. m^2
73	175SJT-M180D，3.8 kW, 220V, 2500 r/min, 16.5 A, 6.5×10-3kg. m^2
74	175SJT-M220B，3.5 kW, 220V, 1500 r/min, 17.5 A, 9.0×10-3kg. m^2
75	175SJT-M220D，4.5kW, 220V, 2500 r/min, 19 A, 9.0×10-3kg. m^2
76	175SJT-M300B，4.7 kW, 220V, 1500 r/min, 24A, 11.2×10-3kg. m^2

77	175SJT-M300D，6kW, 220V, 2500 r/min, 27.5 A, 11.2×10-3kg. m^2
78	175SJT-M380B，6 kW, 220V, 1500 r/min, 29 A, 14.8×10-3kg. m^2

Table 4-4 Checklist of No.1 Parameter and SJT Series 5000-Line Incremental Servo Motor

№1 Parameter	Model numbers and Specification of Servomotors
39	130SJTG-M040GH(A2)，1.7kW, 380V, 4000 r/min, 4.8A, 1.0×10-3kg. m^2
01	130SJTG-M050GH(A2)，2.1kW, 380V, 4000 r/min, 6.0A, 1.2×10-3kg. m^2
02	130SJTG-M060GH(A2)，2.5kW, 380V, 4000 r/min, 7.2A, 1.5×10-3kg. m^2
03	130SJTG-M075GH(A2)，3.1kW, 380V, 4000 r/min, 7.5A, 1.9×10-3kg. m^2
04	130SJTG-M100GH(A2)，4.2kW, 380V, 4000 r/min, 10.0A, 2.5×10-3kg. m^2
05	175SJTG-M120EH(A2)，3.8kW, 380V, 3000 r/min, 10.5A, 4.1×10-3kg. m^2
06	175SJTG-M150EH(A2)，4.7kW, 380V, 3000 r/min, 12.5A, 4.9×10-3kg. m^2
07	175SJTG-M180EH(A2)，5.7kW, 380V, 3000 r/min, 15.5A, 6.1×10-3kg. m^2
08	175SJTG-M220EH(A2)，6.9kW, 380V, 3000 r/min, 18.5A, 7.2×10-3kg. m^2
09	175SJTG-M300EH(A2)，9.4kW, 380V, 3000 r/min, 25.0A, 9.5×10-3kg. m^2
10	175SJTG-M380EH(A2)，11.9kW, 380V, 3000 r/min, 32A, 12.1×10-3kg. m^2
11	175SJT-M380BH (A2)，6.0kW, 380V, 1500 r/min, 15A, 14.8×10-3kg. m^2
12	175SJT-M380DH (A2)，7.9kW, 380V, 2500 r/min, 26A, 14.8×10-3kg. m^2
13	175SJT-M500BH (A2)，7.8kW, 380V, 1500 r/min, 20A, 14.8×10-3kg. m^2
14	175SJT-M500DH (A2)，10.5kW, 380V, 2500 r/min, 33A, 14.8×10-3kg. m^2
15	80SJT-M024C(A2)，0.5kW, 220V, 2000 r/min, 3A, 0.83×10-4kg. m^2
16	80SJT-M024E(A2)，0.75kW, 220V, 3000 r/min, 4.8A, 0.83×10-4kg. m^2
17	80SJT-M032C(A2)，0.66kW, 220V, 2000 r/min, 5A, 1.23×10-4kg. m^2
18	80SJT-M032E(A2)，1.0kW, 220V, 3000 r/min, 6.2A, 1.23×10-4kg. m^2
19	110SJT-M040D(A2)，1.0kW, 220V, 2500 r/min, 4.5A, 0.68×10-3kg. m^2
20	110SJT-M040E(A2)，1.2kW, 220V, 3000 r/min, 5A, 0.68×10-3kg. m^2
21	110SJT-M060D(A2)，1.5kW, 220V, 2500 r/min, 7A, 0.95×10-3kg. m^2
22	110SJT-M060E(A2)，1.8kW, 220V, 3000 r/min, 8A, 0.95×10-3kg. m^2
23	130SJT-M040D(A2)，1.0kW, 220V, 2500 r/min, 4A, 1.19×10-3kg. m^2
24	130SJT-M050D(A2)，1.3kW, 220V, 2500 r/min, 5A, 1.19×10-3kg. m^2
25	130SJT-M060D(A2)，1.5kW, 220V, 2500 r/min , 6A, 1.95×10-3kg. m^2
26	130SJT-M075D(A2)，1.88kW, 220V, 2500 r/min, 7.5A, 1.95×10-3kg. m^2
27	130SJT-M100B(A2)，1.5kW, 220V, 1500 r/min, 6A, 2.42×10-3kg. m^2
28	130SJT-M100D(A2)，2.5kW, 220V, 2500 r/min, 10A, 2.42×10-3kg. m^2
29	130SJT-M150B(A2)，2.3kW, 220V, 1500 r/min, 8.5A, 3.1×10-3kg. m^2

30	130SJT-M150D(A2)，2.3kW, 220V, 2500 r/min, 8.5A, 3.1×10-3kg. m^2
31	175SJT-M150D(A2)，3.1 kW, 220V, 2500 r/min, 14 A, 5.1×10-3kg. m^2
32	175SJT-M180B(A2)，2.8 kW, 220V, 1500 r/min, 15 A, 6.5×10-3kg. m^2
33	175SJT-M180D(A2)，3.8 kW, 220V, 2500 r/min, 16.5 A, 6.5×10-3kg. m^2
34	175SJT-M220B(A2)，3.5 kW, 220V, 1500 r/min, 17.5 A, 9.0×10-3kg. m^2
35	175SJT-M220D(A2)，4.5kW, 220V, 2500 r/min, 19 A, 9.0×10-3kg. m^2
36	175SJT-M300B(A2)，4.7 kW, 220V, 1500 r/min, 24A, 11.2×10-3kg. m^2
37	175SJT-M300D(A2)，6kW, 220V, 2500 r/min, 27.5 A, 11.2×10-3kg. m^2
38	175SJT-M380B(A2)，6 kW, 220V, 1500 r/min, 29 A, 14.8×10-3kg. m^2

Table 4-5 Checklist of No.1 Parameter and SJT Series Absolute Servo Motor

№1 Parameter	Model numbers and Specification of Servomotors
01	60SJTR-MZ003E(A4)，0.10kW, 220V, 3000 r/min, 1.1A, 0.05×10-4kg. m^2
02	60SJTR-MZ005E(A4)，0.16kW, 220V, 3000 r/min, 1.45A, 0.07×10-4kg. m^2
03	80SJTR-MZ006E(A4)，0.20kW, 220V, 3000 r/min, 2.8A, 2.71×10-5kg. m^2
04	80SJTR-MZ010E(A4)，0.30kW, 220V, 3000 r/min, 3.1A, 2.36×10-5kg. m^2
05	80SJTR-MZ016E(A4)，0.40kW, 220V, 3000 r/min, 3.3A, 3.88×10-5kg. m^2
07	150SJTR-MZ040C(A4)，0.84kW, 220V, 2000 r/min, 4.5A, 1.3×10-3kg. m^2
08	150SJTR-MZ060C(A4)，1.26kW, 220V, 2000 r/min, 6.0A, 1.9×10-3kg. m^2
09	150SJTR-MZ080C(A4)，1.68kW, 220V, 2000 r/min, 8.5A, 2.9×10-3kg. m^2
10	150SJTR-MZ100C(A4)，2.10kW, 220V, 2000 r/min, 10.5A, 3.4×10-3kg. m^2
11	150SJTR-MZ120C(A4)，2.50kW, 220V, 2000 r/min, 12.5A, 3.9×10-3kg. m^2
35	130SJT-M050E(A4/A4I)，1.57kW, 220V, 3000 r/min, 7.2A, 1.10×10-3kg. m^2
36	130SJT-M060E(A4/A4I)，1.88kW, 220V, 3000 r/min, 7.8A, 1.33×10-3kg. m^2
37	130SJT-M075E(A4/A4I)，2.36kW, 220V, 3000 r/min, 9.9A, 1.85×10-3kg. m^2
38	175SJT-M120E(A4/A4I)，3.30kW, 220V, 3000 r/min, 13.0A, 5.1×10-3kg. m^2
39	175SJT-M150B(A4/A4I)，2.40kW, 220V, 1500 r/min, 11.0A, 5.1×10-3kg. m^2
40	130SJTG-M040GH(A4/A4I)，1.7kW, 380V, 4000 r/min, 4.8A, 1.0×10-3kg. m^2
41	130SJTG-M050GH(A4/A4I)，2.1kW, 380V, 4000 r/min, 6.0A, 1.2×10-3kg. m^2
42	130SJTG-M060GH(A4/A4I)，2.5kW, 380V, 4000 r/min, 7.2A, 1.5×10-3kg. m^2
43	130SJTG-M075GH(A4/A4I)，3.1kW, 380V, 4000 r/min, 7.5A, 1.9×10-3kg. m^2
44	130SJTG-M100GH(A4/A4I)，4.2kW, 380V, 4000 r/min, 10.0A, 2.5×10-3kg. m^2
45	175SJTG-M120EH(A4/A4I)，3.8kW, 380V, 3000 r/min, 10.5A, 4.1×10-3kg. m^2
46	175SJTG-M150EH(A4/A4I)，4.7kW, 380V, 3000 r/min, 12.5A, 4.9×10-3kg. m^2
47	175SJTG-M180EH(A4/A4I)，5.7kW, 380V, 3000 r/min, 15.5A, 6.1×10-3kg. m^2
48	175SJTG-M220EH(A4/A4I)，6.9kW, 380V, 3000 r/min, 18.5A, 7.2×10-3kg. m^2
49	175SJTG-M300EH(A4/A4I)，9.4kW, 380V, 3000 r/min, 25.0A, 9.5×10-3kg. m^2

50	175SJTG-M380EH(A4/A4I)，11.9kW, 380V, 3000 r/min, 32A, 12.1×10-3kg. m^2
51	175SJT-M380BH (A4/A4I)，6.0kW, 380V, 1500 r/min, 15A, 14.8×10-3kg. m^2
52	175SJT-M380DH (A4/A4I)，7.9kW, 380V, 2500 r/min, 26A, 14.8×10-3kg. m^2
53	175SJT-M500BH (A4/A4I)，7.8kW, 380V, 1500 r/min, 20A, 14.8×10-3kg. m^2
54	175SJT-M500DH (A4/A4I)，10.5kW, 380V, 2500 r/min, 33A, 14.8×10-3kg. m^2
55	80SJT-M024C(A4/A4I)，0.5kW, 220V, 2000 r/min, 3A, 0.83×10-4kg. m^2
56	80SJT-M024E(A4/A4I)，0.75kW, 220V, 3000 r/min, 4.8A, 0.83×10-4kg. m^2
57	80SJT-M032C(A4/A4I)，0.66kW, 220V, 2000 r/min, 5A, 1.23×10-4kg. m^2
58	80SJT-M032E(A4/A4I)，1.0kW, 220V, 3000 r/min, 6.2A, 1.23×10-4kg. m^2
59	110SJT-M040D(A4/A4I)，1.0kW, 220V, 2500 r/min, 4.5A, 0.68×10-3kg. m^2
60	110SJT-M040E(A4/A4I)，1.2kW, 220V, 3000 r/min, 5A, 0.68×10-3kg. m^2
61	110SJT-M060D(A4/A4I)，1.5kW, 220V, 2500 r/min, 7A, 0.95×10-3kg. m^2
62	110SJT-M060E(A4/A4I)，1.8kW, 220V, 3000 r/min, 8A, 0.95×10-3kg. m^2
63	130SJT-M040D(A4/A4I)，1.0kW, 220V, 2500 r/min, 4A, 1.19×10-3kg. m^2
64	130SJT-M050D(A4/A4I)，1.3kW, 220V, 2500 r/min, 5A, 1.19×10-3kg. m^2
65	130SJT-M060D(A4/A4I)，1.5kW, 220V, 2500 r/min , 6A, 1.95×10-3kg. m^2
66	130SJT-M075D(A4/A4I)，1.88kW, 220V, 2500 r/min, 7.5A, 1.95×10-3kg. m^2
67	130SJT-M100B(A4/A4I)，1.5kW, 220V, 1500 r/min, 6A, 2.42×10-3kg. m^2
68	130SJT-M100D(A4/A4I)，2.5kW, 220V, 2500 r/min, 10A, 2.42×10-3kg. m^2
69	130SJT-M150B(A4/A4I)，2.3kW, 220V, 1500 r/min, 8.5A, 3.1×10-3kg. m^2
70	130SJT-M150D(A4/A4I)，2.3kW, 220V, 2500 r/min, 8.5A, 3.1×10-3kg. m^2
71	175SJT-M150D(A4/A4I)，3.1 kW, 220V, 2500 r/min, 14 A, 5.1×10-3kg. m^2
72	175SJT-M180B(A4/A4I)，2.8 kW, 220V, 1500 r/min, 15 A, 6.5×10-3kg. m^2
73	175SJT-M180D(A4/A4I)，3.8 kW, 220V, 2500 r/min, 16.5 A, 6.5×10-3kg. m^2
74	175SJT-M220B(A4/A4I)，3.5 kW, 220V, 1500 r/min, 17.5 A, 9.0×10-3kg. m^2
75	175SJT-M220D(A4/A4I)，4.5kW, 220V, 2500 r/min, 19 A, 9.0×10-3kg. m^2
76	175SJT-M300B(A4/A4I)，4.7 kW, 220V, 1500 r/min, 24A, 11.2×10-3kg. m^2
77	175SJT-M300D(A4/A4I)，6.0kW, 220V, 2500 r/min, 27.5 A, 11.2×10-3kg. m^2
78	175SJT-M380B(A4/A4I)，6.0 kW, 220V, 1500 r/min, 29 A, 14.8×10-3kg. m^2

Chapter 5 Alarms and Remedies

Attention
● Any personnel involved in the check and repair work must be well trained and qualified. ● Do not touch the drive unit and motor until 5min after they are disconnected from power supply as it may lead to electric shock and burn. ● When the drive unit gives a fault alarm, do not bring it into use unless the fault is eliminated by its alarm code. ● Before resetting the alarm, make sure SON (servo is active) signal is active in order to prevent the motor from accidental start.

5.1 Abnormalities Arising from Improper Usage

Table 5-1 Abnormalities in Ethernet Bus Control Mode and Remedies

Abnormality	Possible Causes	Examinations and Solutions
The motor fails to operate when pulse commands are given in the position mode.	1. Incorrect selection of operating mode	Check the setting of PA4.
	2. Failure to give an enabling signal	Check that SON is correct and judge that the CNC of the system can give enabling signal by examine dP- In or internally force enabling by setting PA98=1.
Excessive vibration during the operation of the motor.	Improper setting of proportional gain of speed ring and integral time constant (PA5, PA6); Improper setting of proportional gain of position ring (PA9)	Recover the default parameters of the motor or manually adjust PA5, PA6 and PA9.
Inaccurate position control	1. Incorrect setting of electronic gear ratio;	Refer to the method for calculation of electronic gear ratio and correctly set it.
	2. Inaccurate pulse reception caused by external interference	When the command pulse number is less than the indication of dP-CPo, it is under external interference. A. Use a differential circuit as far as possible; B. Correctly connect the shielded wires; C. Keep away from the interference

		source.
	3. Fault of mechanical connection	When the command pulse number is equal to the indication of dP-CPo and, after the conversion of electronic gear ratio, the indication of dP-Pos, carefully check that the mechanical joint becomes loose or is deformed.
Excessive fluctuation of the load during start or stop	Big load inertia and excessively low setting of acceleration and deceleration time of the commands from the corresponding host computer	Increase the acceleration and deceleration time of the commands from the corresponding host computer so that the motor starts or stops smoothly or reduce the proportional gain of the position ring.

5.2 Summary of Alarms

Table 5-2 Summary of Alarms

Alarm code	Alarm name	Contents
1	Overspeed	The speed of the servomotor is higher than the setting.
2	Overvoltage of main circuit	Excessively high supply voltage of main circuit
3	Undervoltage of main circuit	Excessively low supply voltage of main circuit
4	Position out-of-tolerance	The indication of the position deviation counter goes beyond the setting.
6	Saturation fault of speed amplifier	The speed adjuster is saturated for a long time.
7	Abnormality of drive unit disabling	Both CCW and CW drive disabling inputs are OFF.
8	Overflow of position deviation counter	The absolute value of the position deviation counter is above 230.
9	Fault of encoder	Signal error of encoder
10	Undervoltage of control power supply	The voltage of the control power supply ±15V is too low.
11	Fault of IPM module	Fault of IPM intelligent module
13	Overload	Overload of the servo drive unit and motor (transient overtemperature)

15	Counting error of encoder	Counting abnormality of encoder
16	Motor'heat overload	Alarm for motor's long time running beyond rated load
17	Brake time too long	Input power supply's voltage time is tool long or brake is fault
18	DC bus voltage is too high but there is no brake feedback	Brake circuit is fault
19	There is a brake feedback when DC bus voltage has not reached the brake valve value	Brake circuit is fault
20	EEPROM error	EEPROM error
21	Power supply lacking of phase	3-phase input power supply lacking of phase
22	AC voltage is too high	3-phase AC input voltage is tool high
23	Error of A/D chip	Error of A/D chip or current sensor
24	Multi-turn data is mistaken	The absolute encoder reading multi-turn data is mistaken
25	The encoder's battery error	External battery of the absolute encoder is less than 2.5V
26	The encoder's battery alarms	The absolute encoder's external battery is less than 3.1V
27	The motor type is not matched	The servo saving motor type is not matched with the current absolute motor type
28	Encoder CRC check is mistaken	The absolute encoder reading data CRC check is mistaken
29	The encoder data is abnormal	Reading the absolute encoder data is abnormal
30	Missing pulse of Encoder Z	Pulse error of Encoder Z
31	Erroneous UVW signal of encoder	Erroneous UVW signal of encoder or mismatching encoder
32	Illegal coding of encoder UVW signal	Full-high or full-low level of UVW signal
33	Abnormal bus communication	Interruption of bus communication
34	Alarm for radiator's high temperature	Current temperature of radiator is more than its setting value
35	Alarm for radiator low-temperature	Current temperature of radiator is lower than its setting value
36	Main power supply's power down	AC input power supply is turned off
37	Reading absolute encoder EEPROM data is overtime	Reading motor model and single-turn offset amount and other data stored in EEPROM is overtime

5.3 Solutions for Alarms

Table 5-4 Solutions for Alarms

Alarm code	Alarm name	Causes	Solutions
1	Overspeed	①Fault of control circuit board ②Fault of encoder	①Change the servo drive unit. ②Change the servomotor.
		①The input command pulse frequency is too high.	①Correctly set the input command pulse.
		①Small acceleration/ deceleration time constant causes excessive speed overshooting.	①Increase the acceleration/ deceleration time constant.
		①The electronic gear ratio entered is too high.	①Correctly set the ratio.
		① Fault of encoder.	①Change the servomotor.
		① Defective power cable of encoder.	① Change the power cable of encoder.
		① The servo system is not stable, causing overshooting.	①Reconfigure the relevant gain. ②If the gain cannot be set to an appropriate value, the load rotary inertia ratio shall be decreased.
		①Excessive load inertia	①Reduce the load inertia. ②Replace it with a drive unit and motor with higher power.
		①Zero error of encoder	①Change the servomotor. ② Have the zero of the encoder reconfigured by manufacturer.
		①The leads U, V and W are connected incorrectly. ②The leads of the power cable for the encoder are connected incorrectly.	①Connect them correctly.

2	Overvoltage of main circuit	① Fault of circuit board.	①Change the servo Drive Unit.
		① High supply voltage ②Abnormal waveform of supply voltage.	①Check the power supply.
		① The wires connecting the brake resistor are disconnected.	①Connect the wires again.
		① The brake transistor is damaged. ② The internal brake resistor is damaged.	①Change the servo drive unit.
		① The capacity of the brake circuit is insufficient.	①Reduce start and stop frequency. ②Increase the acceleration/ deceleration time constant. ③Reduce the torque limit. ④Reduce the load inertia. ⑤Replace it with a drive unit and motor with higher power.
3	Undervoltage of the main circuit	①Fault of circuit board. ②Damaged power supply fuse. ③Fault of soft start circuit. ④Damaged rectifier.	①Change the servo drive unit.
		①Lover supply voltage ②Temporary power failure for 20mS or longer.	①Check the power supply.
		①Insufficient capacity of power supply. ② Transient power failure.	①Check the power supply.
		①Overtemperature of radiator.	①Check the load.
4	Position out-of-tolerance	① Fault of circuit board.	①Change the servo Drive Unit.
		① The leads U, V and W of the motor are connected incorrectly. ② The leads of the power cable for the encoder are connected incorrectly.	①Connect them correctly.
		① Fault of encoder.	①Change the servomotor.

		①The set detection range of position out-of-tolerance is too small.	①Increase the detection range of position out-of-tolerance.
		①Excessively low proportional gain of position.	①Increase the gain.
		① Insufficient torque.	①Check the torque limit. ②Reduce the load capacity. ③Replace it with a drive unit and motor with higher power.
		① High command pulse frequency.	①Reduce the frequency.
5	Motor overheat	① The circuit board is fault.	①Change the servo drive unit.
		① The cable is broken. ② The temperature relay in the motor is damaged.	①Check the cable. ②Check the motor.
		① The motor is overload.	①Reduce the load. ②Reduce the start-stop frequency. ③Reduce the torque limit value. ④Reduce the relevant gain. ⑤Change a drive unit and a motor with bigger power.
		① The motor's interior is fault.	① Change the servo motor.
6	Saturation fault of speed amplifier	① The motor is mechanically blocked.	①Check the mechanical portion of the load.
		① Excessive load.	①Reduce the load. ②Replace it with a drive unit and motor with higher power.
7	Drive disabling failure	① Both CCW and CW drive disabling input terminals are open.	①Check the wiring and the power supply for the input terminals.

8	Overflow of the position deviation counter	①The motor is mechanically blocked. ②Abnormal input command pulse.	①Check the mechanical portion of the load. ②Check the command pulse. ③Check that the motor rotates to the command pulse.
9	Fault of encoder	①Error in encoder wiring.	①Check the wiring.
		①Damaged encoder.	①Change the motor.
		①Defective power cable for the encoder.	①Change the power cable.
		①Excessively low supply voltage on the encoder caused by long power cable for the encoder.	①Keep the cable as short as possible. ②Connect several core wires in parallel for supplying power.
		① Absolute encoder communication fault.	① Turn on the drive unit.
10	Undervoltage of control power supply	① Low input control power supply.	①Check the control power supply.
		①Defective built-in connectors in the Drive Unit. ②Abnormal switching power supply. ③Damaged chip.	①Change the Drive Unit. ②Check the connectors. ③Check the switching power supply.
11	Fault of IPM module	① Fault of circuit board.	①Change the servo drive unit.
		① Low supply voltage ② Overheating.	①Check the Drive Unit. ②Restart it. ③Replace the Drive Unit.
		① Short circuit between terminals U, V and W of the Drive Unit.	①Check the wiring.
		①Improper grounding	①Correctly ground it.
		①Damaged insulation of the motor.	①Change the motor.
		①Interference	①Add a line filter. ②Keep away interference sources.

12	Overcurrent	①Short circuit between terminals U, V and W of the Drive Unit.	①Check the wiring.
		① Improper grounding.	①Correctly ground it.
		①Damaged insulation of the motor.	①Change the motor.
		① Damaged the drive unit.	①Replace the drive unit.
13	Overload	① Fault of circuit board	①Change the servo drive unit.
		① The motor operates at torque above the rating.	①Check the load. ②Reduce the start and stop frequency. ③Reduce the torque limit. ④Change a drive unit and motor with higher power.
		①The holding brake is not released.	①Check the holding brake.
		① Unsteady operation of the motor with vibration.	①Adjust the gain. ②Increase the acceleration/deceleration time. ③Reduce the load inertia.
		① Open circuit of one of the wires U, V and W. ② Error in encoder wiring	①Check the wiring.
		①The capacity of the brake circuit is insufficient.	①Reduce start and stop frequency. ②Increase the acceleration/ deceleration time constant. ③Reduce the torque limit. ④Reduce the load inertia. ⑤Change it with a drive unit and motor with higher power.
		① High supply voltage on the main circuit.	①Check the main power supply.
15	Counting error of encoder	① Damaged encoder.	①Change the motor.
		① Error in encoder wiring.	①Check the wiring.
		① Improper grounding.	①Correctly ground it.

16	Motor's heat overload	① Damaged circuit boar. ② Mistaken parameter setting. ③ Long-time run exceeds the rated torque. ④ Defective mechanical drive	①Change the circuit board ②Check the load ③Correctly set parameters ④Reduce start-stop frequency. ⑤Increase torque limit value. ⑥Change a drive unit and motor with more power. ⑦Check mechanical part.
17	Brake time too long	① Input power supply, voltage time is too long.	①Power supply meeting the servo unit is connected.
		②There is no brake resistance or brake resistance is too big, energy cannot release in time during the brake, which causes the internal DC voltage to rise	Connect with a correct brake resistance.
18	DC bus voltage is too high but there is no brake feedback	The brake circuit is fault.	Change the servo unit.
19	DC bus voltage has not reached the brake valve value, but there is a brake feedback	The brake circuit is fault.	Change the servo unit.
20	EEROM error	Damaged chip or circuit board.	① Change the servo Drive Unit. ② After the remedy, make sure to set the model number (No.1 parameter) again and then restore the default parameters.
21	Alarm for power supply default phase	3-phase input power supply defaults phase.	Check input power supply.
22	AC voltage too high	3-phase input AC power supply, voltage are too high.	①Reduce input AC power supply, voltage. ②Change a servo unit.
23	A/D conversion error	① Defective amplifier or 431. ② Damaged current sensor.	①Change the servo drive unit.

24	Multi-circle data error	① it is caused by the abnormally absolute encoder data when the main power supply is turned on.	①Start the servo and initialize the absolute encoder to make alarm reset.
25	External battery error	① The external battery is lower than 2.5V. ② The absolute encoder creates mistaken operations.	①Change the external battery. ②Change the servo motor. ③Set again the machine zero.
26	External battery alarm	The external battery is lower than 3.1V.	Change the external battery.
27	Motor type unmatched	The drive unit saving type is not matched with the currently used motor type.	Reset corresponding motor type, recover the default value, and restart after power-off.
28	Mask data CRC check error	① The encoder's internal storage is abnormal.	①Restart and initialize again the encoder. ②Write-in the motor type again to the encoder. ③Change the servo motor when the error creates frequently.
		① Communication chip or circuit board is damaged.	①Change the servo drive unit.
29	Alarm for abnormal absolute position data	① Interference influencing communication cause data transmission error.	①Check and regulate assembly around the encoder.
		① The encoder is fault.	①Change the servo motor when the error creates frequently.
30	Missing Z pulse of encoder	① Absence of Z pulse and damaged encoder. ② Defective power cable. ③ Poor cable shielding. ④ Improper connection of shield earth wire. ⑤ Fault of the encoder interface circuit.	① Change the encoder. ② Check the encoder interface circuit.
31	UVW signal error of encoder	① Damage of UVW signal of encoder. ② Damage of Z signal of encoder.	① Change the encoder. ② Check the encoder

		③ Defective power cable. ④ Poor cable shielding ⑤ Improper connection of shield earth wire ⑥ Fault of the encoder interface circuit.	interface circuit.
32	Illegal encoding of UVW signal of encoder	① Damage of UVW signal of encoder. ② Defective power cable. ③ Poor cable shielding. ④ Improper connection of shield earth wire. ⑤ Fault of the encoder interface circuit.	① Change the encoder. ② Check the encoder interface circuit.
33	Abnormality of bus communication	① Loose network cable and poor contact. ② Damaged communication chip in the control board.	① Check that the network cable is correctly connected. Otherwise change the control network cable. ② Change the servo Drive Unit.
34	Alarm for radiator's high temperature	①The motor's too long run with load.	Reduce load
		② Tool high ambient temperature.	Improve ambient temperature
		③ Damaged servo unit.	Change a servo unit
35	Alarm for radiator's low temperature	① Too low ambient temperature ② Damaged drive unit.	① Improve ambient temperature. ② Change a servo unit.
36	3-phase main power supply power-down	① Power-down or transient fall-out 3-phase main power supply.	Check main power supply and ensure a correct 3-phase voltage input
		② Detection circuit of 3-phase main power supply is failure.	Change a servo unit
37	Overtime of reading absolute encoder EEPROM	① Bad encoder's cable.	Change a cable
		② Damaged communication chip or circuit board	Change a servo control panel

Chapter 6 Display and Operations

6.1 Keyboard Operations

1. The panel of the drive unit consists of 6 LED nixie-tube displays and four keys ↑, ↓, ← and Enter, which are used to indicate the states of the system and to set parameters.

The functions of the keys are described below:

↑ : S/N, to increase a value or move forward in options

↓ : S/N, to decrease a value or move backward in options

← : to return to the upper layer of functional menu or cancel an operation

Enter : To enter the next layer of functional menu or confirm entry

Note: When ↑ and ↓ are pressed and held, an operation is repeated. The repeating rate increases with the holding time.

2. The 6-digit LED nixie tubes indicate all states and data. The flashing of all the nixie tubes or the decimal point on the right nixie tube indicates an alarm.

3. The operating menus are arranged in layers. The first layer is the main menu that includes eight operating modes. The second layer consists of the functional menus in all operating modes. Figure 6-1 shows the block diagram of operating the main menu.

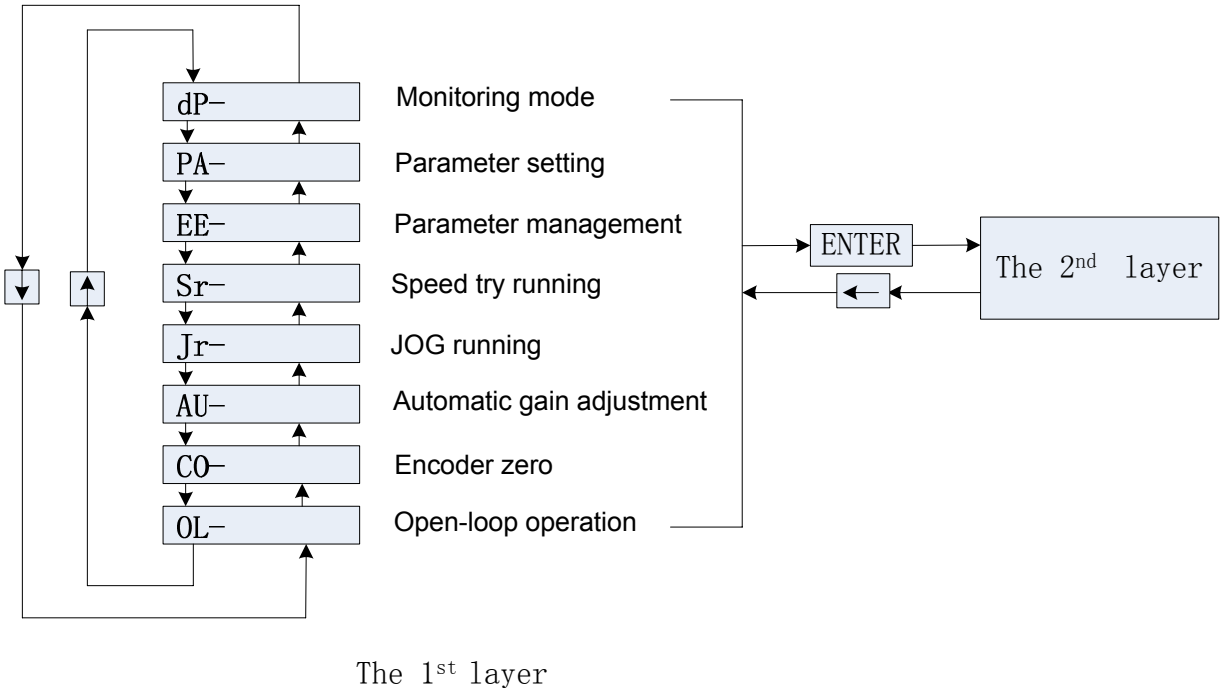


Figure 6-1 Block diagram of Mode Selection

6.2 Monitoring Mode

To enter the monitoring mode, choose “dP-” in the first layer and press the Enter key. There are 21 display modes. A user may select the required display mode using the ↑ and ↓ keys and then press the Enter key to enter the specific display mode.

Note: The main monitoring information of GE may be displayed on the servo monitoring interface of the system.

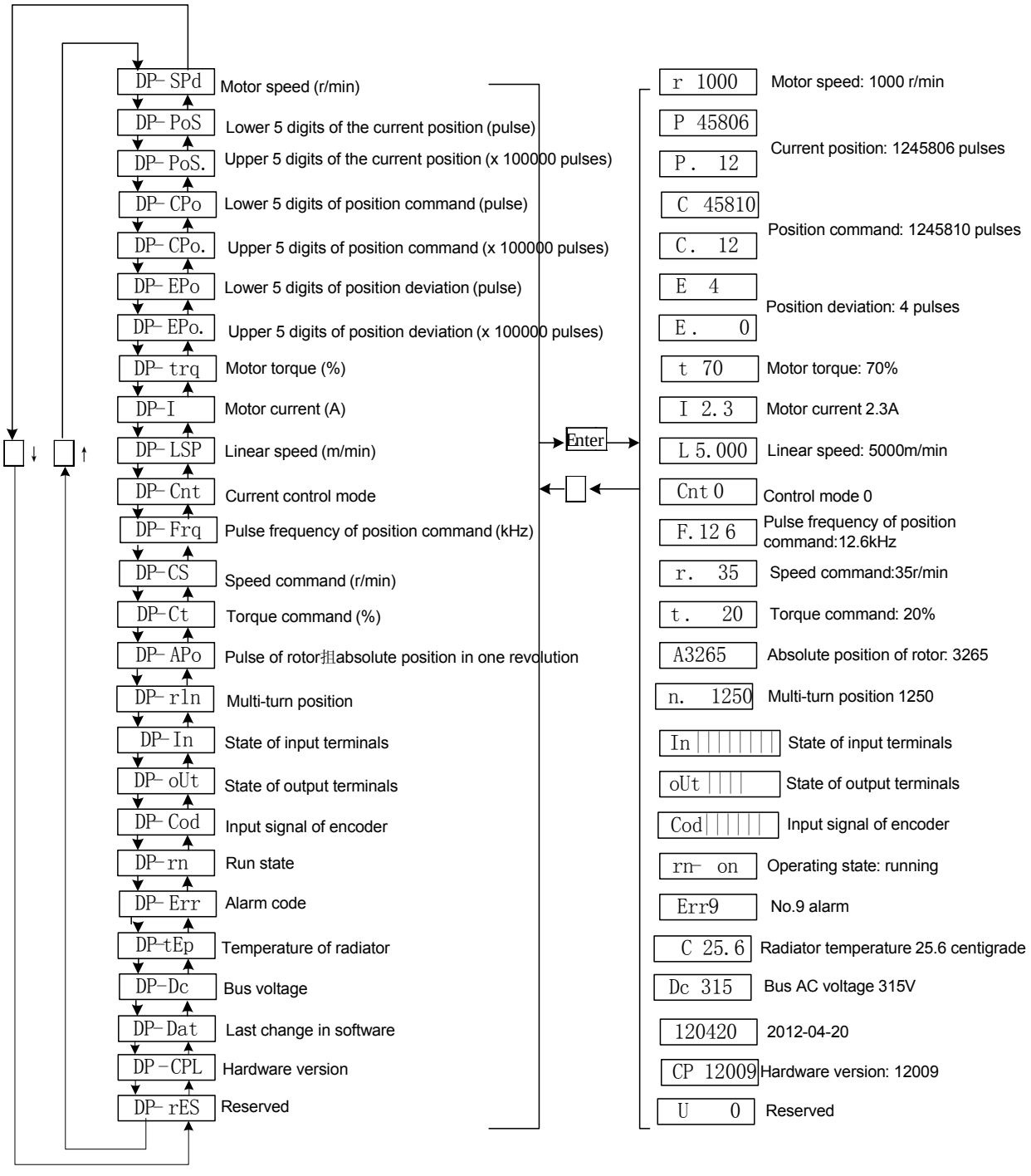


Figure 6-2 Block diagram of operations in monitoring mode

Note 1: Both the speed pulse and command pulse are the values amplified by the input electronic gear.

Note 2: The unit of the pulse number is the pulse unit in V1.01. The number is indicated in 10000 pulses/revolution (Note: 131,072 pulses/revolution for V3.01). A pulse is indicated by upper 5 digits plus lower 5 digits. It is calculated is as follows:

Pulse number =Upper 5-digit value x 100000 + Lower 5-digit value

Note 3: Control mode: 0-Position control; 1-Speed control: 2-Speed trial operation, 3-JOG operation; 4-Zeroing of encoder; 5-Open-loop operation

Note 4: If 6 or more digits are indicated (For example, it indicates -12345), then prompt characters are not indicated.

Note 5: The position command pulse frequency is the actual pulse frequency before amplification of input electronic gear to the nearest 0.1kHz. It is positive for forward direction and negative for reverse direction.

Note 6: The motor current I is calculated as follows:

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

Note 7: The rotor's absolute position in one revolution is its position in one revolution relative to the stator. A revaluation is regarded one cycle and its range is 0～9999 (The range of one-turn absolute date indication is 0～131072).

Note 8: The input terminals are indicated as shown in Figure 6-3, output terminal in Figure 6-4 and encoder signal in Figure 6-5 (No encoder signal display terminal is provided by V3.0).

Note 9: The multi-turn data display DP-rln for the absolute encoder is added in V3.03.

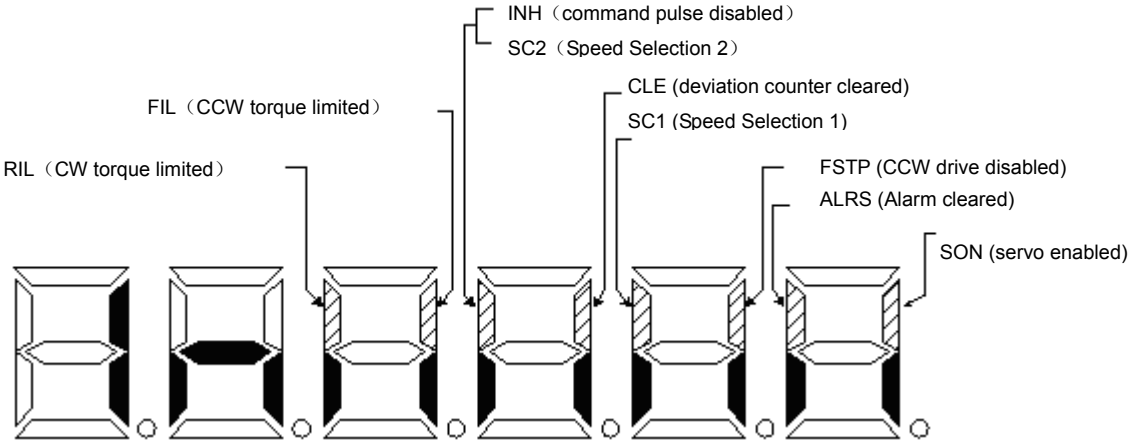


Figure 6-3 Indications of input terminals (The strokes are lit: ON. The strokes go out: OFF.)

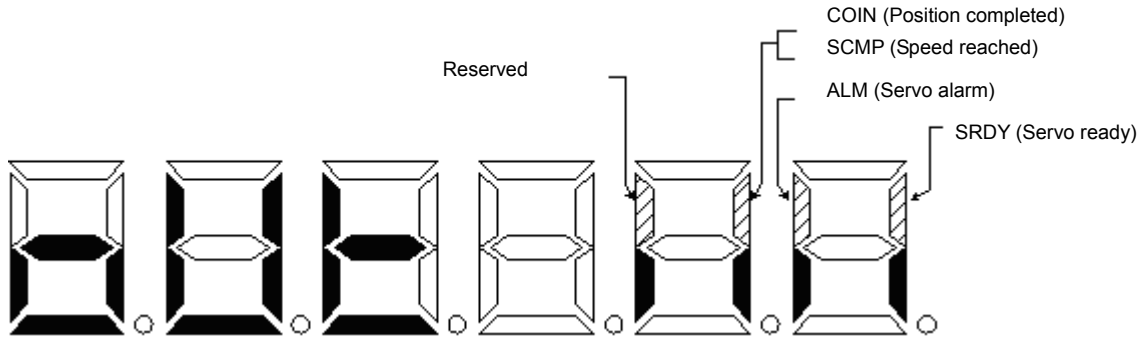


Figure 6-4 Indications of output terminals (The strokes are lit: ON. The strokes go out: OFF.)

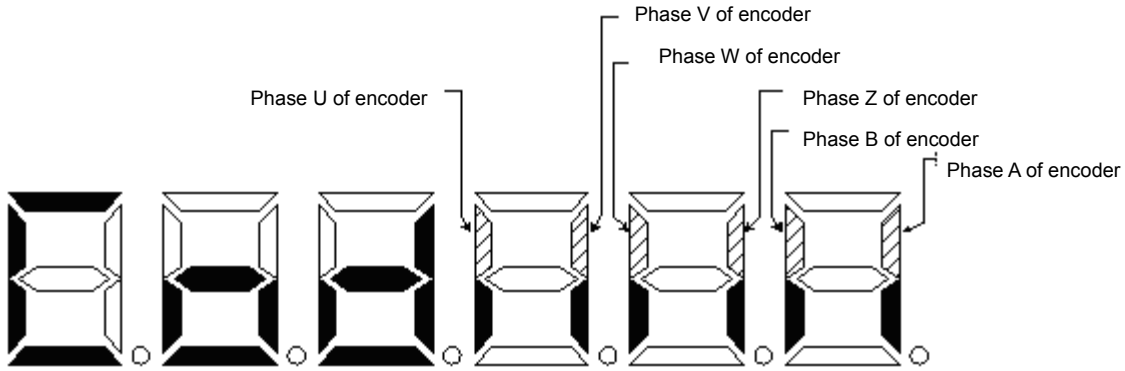


Figure 6-5 Signal indications of encoder (The strokes are lit: ON. The strokes go out: OFF.)

Note 1: The operating state is indicated by:

"rn- oFF": The main circuit is not electrified and the servo system is not operating.

"rn- CH": The main circuit is electrified and the servo system is not operating. (The servo is not enabled or an alarm other than No.33 is given);

"rn- on": The main circuit is electrified and the servo system is operating.

Note 2: It indicates "err" in case of alarm. "--" means that the system operates normally without alarm.

6.3 Parameter Setting

Attention
● Other parameters cannot be changed unless No.0 parameter is set to the corresponding value. ● To set parameters, first make sure the model number of the motor in No.1 parameter conforms to that of the motor. ● The parameter setting becomes effective immediately and improper setting may cause incorrect equipment operation and thereby accidents. ● The parameters of the GE series servo Unit may be set through the interface of CNC.

1. **Parameter Setting on Servo Drive Unit**

Select “PA-” in the first layer and press the Enter key to enter the parameter setting mode. Choose a parameter number using the ↑and ↓keys and press the Enter key to indicate the setting of the parameter. The parameter setting may be modified using the ↑and ↓keys. The parameter setting increases or decreases by one each press of the ↑ or ↓key. The parameter setting increases or decreases continuous when the ↑ or ↓key is pressed and held. Once the parameter setting is changed, the decimal point on the right LED nixie tube is lit. The change in the setting becomes effective when the Enter key is pressed. Now the decimal point on the right LED nixie tube goes out and the changed value is immediately reflected in control. Thereafter it is possible to continue to modify the parameter setting with the ↑ or ↓key and then return to the parameter selecting state by pressing the ← key. If you are not satisfied with the setting being changed, press the ← key other than the Enter key to cancel the setting, restore it to the original value and return to the parameter setting state.

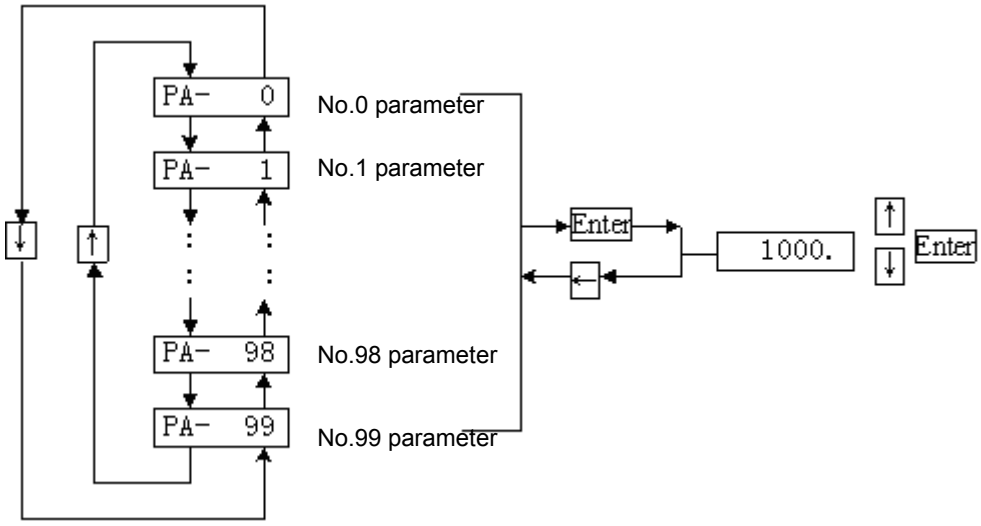


Figure 6-6 Block diagram of parameter setting

2. **Setting of Parameters on the System**

After start, first check the drive unit parameters saved in CNC system and servo are consistent (The system gives the relevant alarm in case of inconsistency) and then set the relevant parameter to download the servo parameters saved in the system to the Drive Unit.

Enter the password for system modification on the system to activate the parameter switch and thereafter access the system servo parameter management interface to modify the relevant parameters. Before modifying the parameters, set No.0 password privilege parameter the corresponding value. Only in this way other parameters can be modified. The system can automatically save the changed parameters by operating the system interface. The servo parameters will become active in the next start.

3. Description of Parameter Setting

The rigidity of the motors corresponding to the default parameters in the current servo software version is relatively low. Make sure to set No.5, 6, 7, 8 and 9 parameters on a machine tool as required and adjust it to appropriate rigidity so as to achieve the optimal machining effect.

When it is matched with the CNC system featuring GSK_LINK Ethernet bus communication function, it can execute the servo rigid class debugging and parameter optimization operation, which improves debugging efficiency and machine rigid.

6.4 Parameter Management

> **Attention**
>
> If parameter writing-in operation is not performed for the changed parameters, they are not saved after power-off and the change is not active.

Parameter management is mainly intended for the operation between the memory and EEPROM. Select “EE-” in the first layer and enter the Enter key to start parameter management. First select one of the five operating modes with the ↑and ↓keys. To take “Write-in of Parameters” as an example, select “EE-Set” and then press and hold the Enter key for more than 3s. “Start” appears on the display, indicating the parameter is being written in the EEPROM. Wait for about 1-2 seconds. The display shows “Finish” if the write-in is successful and “Error” if it is failed. It is possible to return to the operating mode selecting state by pressing the ←key.

- EE-SEt: to write parameters: It means that the parameters in the memory are written in the parameter area of EEPROM. When the parameter is modified, a user can only change its setting in the memory and it will be restored to the original value in the next power-on. For permanent modification of the parameter setting, it is required to perform parameter writing-in operation. The changed setting will be used in the next power-on if the parameters in the memory are written in the parameter area of the EEPROM.
- EE-rd: to read parameters: It means that the data in the parameter area of EEPROM is read into the memory. This process is automatically whenever the system is powered on. The parameter settings in the memory are identical with those in the parameter area of EEPROM. The user’s modification of a parameter changes its setting in the memory. If the user is not satisfied with the changed parameter or when the parameter is improperly adjusted, the data in the parameter area of the EEPROM may be read into the memory again to restore the parameters prior to power-on by performing the parameter reading operation.
- EE-bA: to back up parameters: It means that the parameters in the memory are written in the backup area of EEPROM. The complete EEPROM is divided into parameter area and backup area for storage of two sets of parameters. The parameter area of EEPROM is used in system power-on, parameter writing and parameter reading operations. The backup area of

EEPROM is used for parameter backup and recovery backup. If a user is satisfied with one parameter group but wants to continue the modification during parameter configuration, it is possible to first perform a parameter backup operation and save the parameters in the memory in the backup area of EEPROM and then change the parameters. In case of poor effect, read the parameters saved in the backup area of EEPROM by recover backup and then modify or end up the configuration. In addition, when a user has properly set the parameters, he may keep the data in the parameter of EEPROM identical with that in the backup area by means of parameter writing and backup in order to prevent the parameters from accidental modification. It is also possible to read the data in the backup area of EEPROM by recovery backup and to write the memory parameters in the parameter area of EEPROM by parameter writing.

- EE-rS: to recover backup: It means that the data in the backup area of the EEPROM is saved in memory. Note that parameters are not written in this operation and the data in the parameter area of EEPROM will be read in the memory in the next power-on. If a user wants to use the parameters in the backup area of EEPROM permanently, the parameter writing operation must be performed again.
- EE-dEF: to recover default settings: It means that all the defaults (factory settings) of all the parameters are read to the memory and written in the parameter area of EEPROM. The parameter defaults will be used in the next power-on. In case of failure to operate normally as a result of improper parameter setting, all the parameters may be reset to factory defaults by this operation. The accuracy of the model number (No.1 parameter) of the drive unit must be ensured while using the default recovery parameter as the parameter defaults vary with drive unit types.

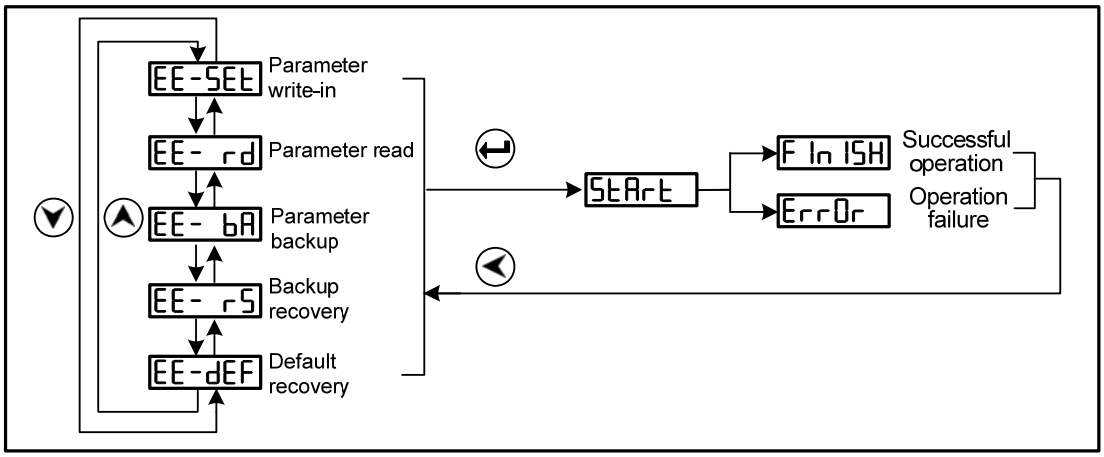


Figure 6-7 Block diagram of parameter management

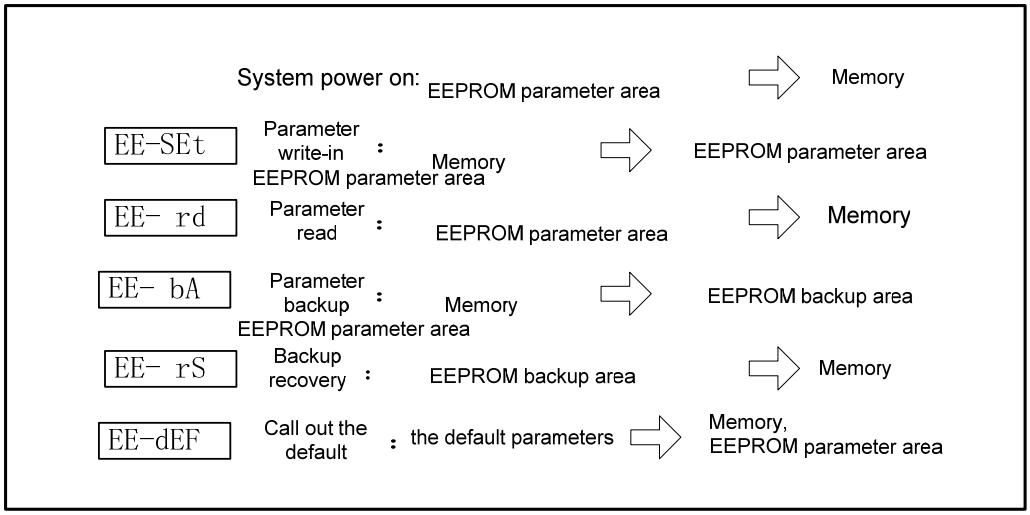


Figure 6-8 Operations for Parameter management

Attention

- It is recommended to perform speed trial operation and JOG operation when the motor is unloaded in order to prevent the equipment from accident.
- The drive unit SON (servo enabled) shall be active and the CCW and CW drives enabling inactive during trial operation.

6.5 Speed Trial operation

First set No.4 parameter “Operation control mode” to “2 – Trial operating mode”, then select “Sr-” in the first layer and press the Enter key to start the trial operating mode. The prompt for speed trial operation is “S” and figures are expressed in rpm. When the system is speed control mode, the speed command is given by keys. Speed commands may be changed using ↑ and ↓ keys so that the motor operates at given speed. Speed is increased in forward direction when ↑ is pressed and decreased in reverse direction (increased in reverse direction) when ↓ is pressed. The motor rotates forward when the indicated speed is positive and reversely when it is negative.

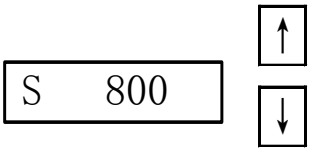


Figure 6-9 Block diagram of speed trial operation

6.6 JOG operation

First set No.4 parameter “Operation control mode” to “3 – JOG operating mode”, then select “Jr-” in the first layer and press the Enter key to start the JOG operation, i.e. JOG mode. The prompt for speed trial operation is “J” and figures are expressed in rpm. When the system is speed control mode, the speed command is given by keys. After JOG operation is started, the motor operates at JOG speed when the ↑ key is pressed and held and stops and keeps zero speed when it is released. The motor operates reversely at JOG speed when the ↓ key is depressed and stops and keeps zero speed when it is released. JOG speed is set through No.21 parameter.

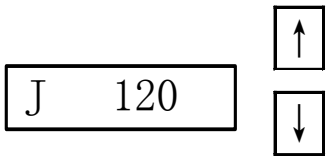


Figure 6-10 Block diagram of JOG operation

6.7 Other

The zeroing function of the encoder is used by manufacturer. It shall not be used by user.

The open-loop operating mode is used by manufacturer. It shall not be used by user.

Chapter 7 Power-on and Operation

Attention
● The drive unit and motor must be securely grounded and the PE terminal properly connected to the earth terminal of the equipment (≤0.1Ω) ● It is recommended to supply power to the drive unit through an insulating transformer and power filter in order to ensure safety and anti-jamming capacity. ● Do not switch on the power supply until you make sure the wiring is correct. ● Make sure to connect the equipment to an emergency stop circuit so that the power supply can be immediately disconnected in the event of fault. (See Fig.7.1) ● After the drive unit gives a fault alarm, make sure the fault is eliminated and SON signal is inactive before restart. ● Do not touch the drive unit and the motor within five minutes after power-off to avoid electric shock by residual voltage. ● The drive unit and motor are subject high temperature rise after operating for some time. Be careful to prevent burn.

7.1 Connection to Power Supply

See Figure 7-1 for connection to power supply and switch on the equipment in the following sequence:

1) Connect the power supply to the input power terminals of the main circuit (to R, S and T for 3-phase and to R and S for single-phase) through an electromagnetic contactor.
2) The power supplies r and t to the control circuit and the power supply to the main circuit are switched on simultaneously or the former before the latter. The Servo Ready (SRDY) is OFF if only the power supplies to the control circuit are switched on.
3) The Servo Ready (SRDY) is ON after delay for about 1.5s when the power supply to the main circuit is switched on. Now it is possible to receive Servo Enabled (SON) signal. The motor is excited and is in operating state when active Servo Enabled signal and servo drive output are detected. The base circuit opens and the motor is free state when inactive Servo Enabled signal and alarm are detected
4) When Servo Enabled and power supply are switched on concurrently, the base circuit is closed after about 1.5s.
5) Frequently switching on/off the power supply may cause damage to the soft starting circuit and dynamic braking circuit. It is advisable to limit the switching on/off frequency to 5

times/hour and 30 times/day. In case of fault as a result of overheating of the drive unit or motor, do not restart them until cooling for 30min after the removal of the fault.

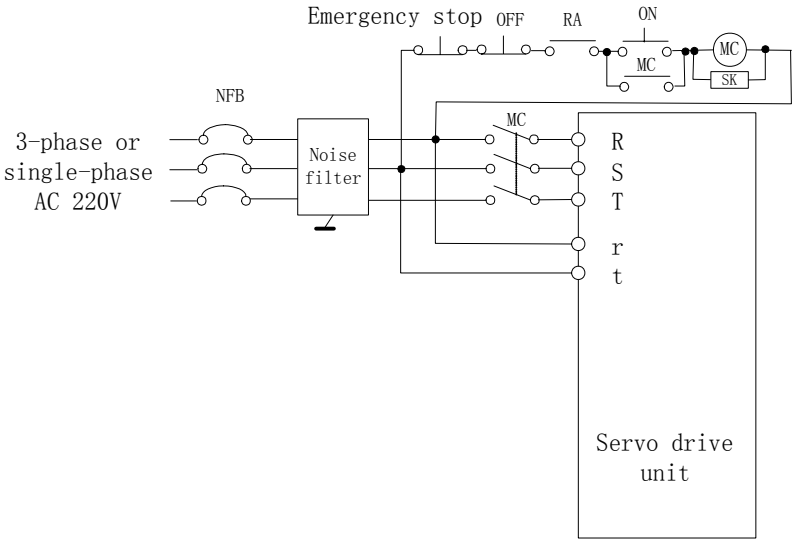


Figure 7-1 Power supply wiring diagram

Time sequence of power-on and alarm:

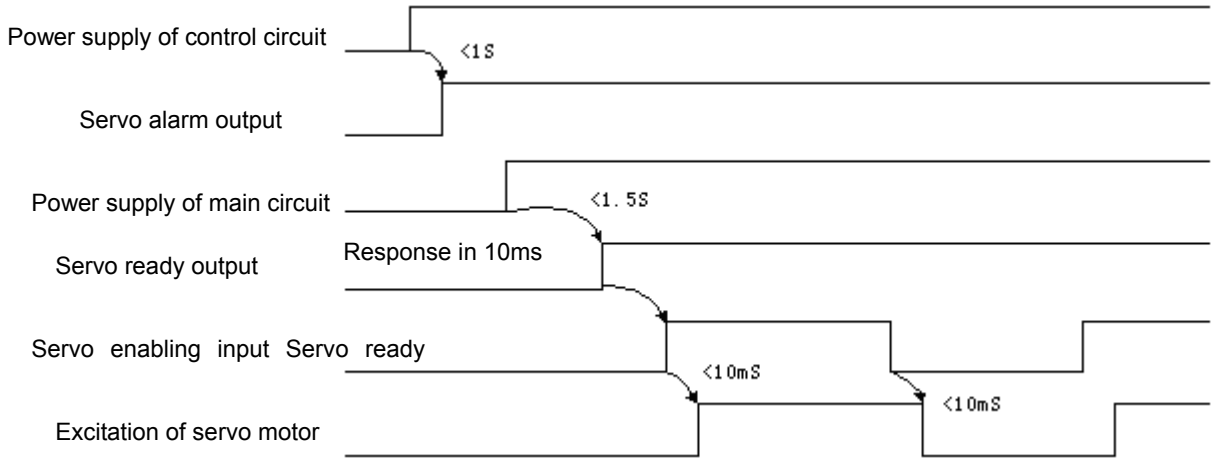


Figure 7-2 Diagram of power-on time sequence

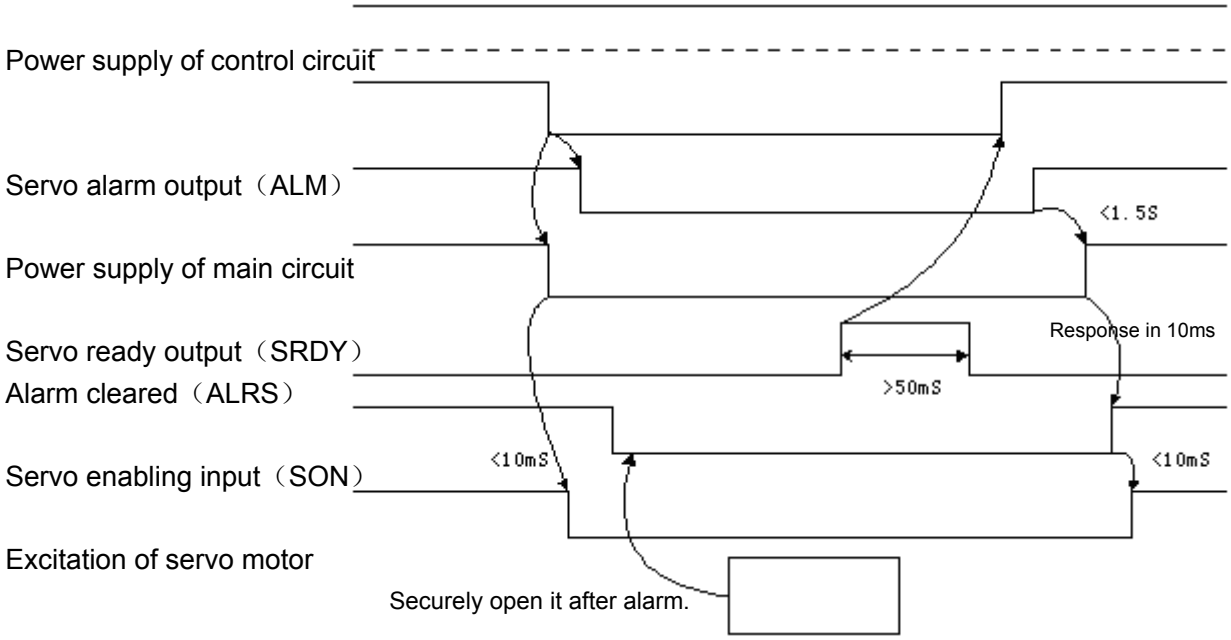


Figure 7-3 Diagram of alarm time sequence

7.2 Trial Operation

1) Examinations before operation:

Following installation and wiring, always check the following items before powering on the drive unit and motor:

- Are the TB power supply terminals connected properly and securely and is the input voltage correct?
- Are the power cables and motor wires shorted or grounded?
- Is the encoder cable connected correctly?
- Are the control terminals connected accurately? Are the polarity and ratings of the power supply correct?
- Are the drive unit and motor fixed securely?
- Is the motor shaft connected to a load?

2) Power-on and Trial operation

A: Trial operating mode

（1）Connect network cables BUS1 and BUS2 so that the input control signal Servo Enabled (SON) is OFF.

（2）Turn on the control circuit (the main circuit is not switched on for the time being). The display of the drive unit is on. If an alarm is given, check the wiring.

（3）Set the control mode (No.4 Parameter) to speed trial operating mode (set to 2).

（4）Turn on the main circuit.

（5）Make sure there is no alarm and any other abnormality, connect BUS1 and BUS2 to the system and reset Servo Enabled (SON) to ON. Now the motor is excited and operates at zero speed.

（6）Enter the speed trial operation operating mode through key operations. The prompt for speed Trial operation is “S” and figures are expressed in rpm. When the system is speed control mode, the speed command is given by keys. Speed commands may be changed using ⇑ and ⇓ keys so that the motor operates at given speed.

B: JOG (Inching) Operation

（1） Connect network cables BUS1 and BUS2 so that the input control signal Servo Enabled (SON) is OFF.

（2） Turn on the control circuit (the main circuit is not switched on for the time being). The display of the drive unit is on. If an alarm is given, check the wiring.

（3） Set the control mode (No.4 Parameter) to JOG operating mode (set to 3).

（4） Turn on the main circuit.

（5） Make sure there is no alarm and any other abnormality, connect BUS1 and BUS2 to the system and reset Servo Enabled (SON) to ON. Now the motor is excited and operates at zero speed.

（6） Start JOG operation through key operations. The prompt for speed Trial operation is “J” and figures are expressed in rpm.. When the system is speed control mode, the speed and direction are dependent on No.21 parameter. The motor operates at the speed in the direction as specified in No.21 parameter when ↑ is pressed and runs reversely at the given speed when the ↓ key is pressed.

C: Position Operating Mode

（1） Connect BUS1 and BUS2 so that the input control signal Servo Enabled (SON) is OFF.

（2） Turn on the control circuit (the main circuit is not switched on for the time being). The display of the drive unit is on. If an alarm is given, check the wiring in order to ensure that Ethernet can be initialized successfully.

（3） Set the “Selection of control mode” (No.4 Parameter) to position operating mode (set to 0). Set No.14 parameter depending on the controller output signal mode and set an appropriate electronic gear ratio (No.12 and No.13).

（4） Turn on the main circuit.

（5） Make sure there is no alarm, set Servo Enabled (SON) to ON. Now the motor is excited and operates at zero speed.

（6） Send Ethernet position controller output signal to the drive so that the motor runs by following the commands.

D: Speed Operating Mode

（1） Turn on the control circuit (the main circuit is not switched on for the time being). The display of the drive unit is on. If an alarm is given, check the wiring in order to ensure that Ethernet can be initialized successfully.

（2） Set the control mode (No.4 Parameter) to position operating mode (set to 1). Set speed parameters No.24～27 as required.

（3） Turn on the main circuit.

（4） Make sure there is no alarm, set Servo Enabled (SON) to ON. Now the motor is excited and operates in Internal Speed 1 mode.

（5） Change the speed selection parameter (No.22) so that the motor runs at the set speed.

7.3 Adjustments

Attention
● Make sure the parameters are set correctly as incorrect parameter configuration may cause equipment fault and accidents. ● It is advised to make no-load adjustments before the equipment is loaded.

1) Basic Gain Adjustment

- **Speed Control**

（1）[Proportional gain of speed] (No.5 parameter) shall be set as big as possible provided that no vibration occurs. Generally the setting of [Proportional gain of speed] shall increase with load inertia.

（2）[Integral time constant of speed] (No.6 parameter) shall be set as small as possible depending on the given conditions. If the setting of [Integral time constant of speed] is too small, the response speed will be increased but it tends to cause vibration. Therefore it shall be set as small as possible provided that no vibration occurs. If the setting of [Integral time constant of speed] is too big, the speed will change abruptly when the load changes. Generally the setting of [Integral time constant of speed] shall increase with load inertia.

- **Position Control**

（1） First appropriately set [Proportional gain of speed] and [Integral time constant of speed].

（2） [Proportional gain of position] (No.9 parameter) shall be set as big as possible provided that the equipment operates stably. For high setting of [Proportional gain of position], the tracing characteristics of position commands are good with little lagging error but it tends to cause vibration at the point of positioning stop.

（3） [Feedforward gain of position]

PA10 adjusts the speed ring using the speed information of position commands. The following error is reduced with the increase of the setting. However, the motor is liable to produce overshooting and vibration in the event of excessive setting. PA11 substantially intends to smooth the feedforward control of position commands. The bigger the setting is, the faster the response to the step speed command will be and the better the position overshoot and vibration are suppressed. The smaller the setting is, the less clear the effect of feedforward and the bigger the vibration caused by feedforward control will be in case of sudden change in speed.

As a general rule, it is possible not to use PA10 (Feedforward gain of position) and PA11 (Cut-off frequency of positional feedforward low-pass filter).

Note 1: When the setting of [Proportional gain of position] is small, the system is in stable state but the position tracing characteristics become poor with more lagging error. To use relatively high [Proportional gain of position], it is possible to increase the setting of [Acceleration/deceleration time constant] (No.40 and 21 parameters) to avoid overshoot.

Note 2: Refer to the following table for the configuration of [Proportional gain of position] （incremental）

Rigidity	[Proportional gain of position]
Low rigidity	20/s～40/s
Middle rigidity	40/s～70/s
High rigidity	70/s～150/s

Note 3: Refer to the following table for the configuration of [Proportional gain of position] （absolute）.

Rigidity	[Proportional gain of position]
Low rigidity	70/s～100/s
Middle rigidity	100/s～150/s
High rigidity	150/s～250/s

2) Diagram of Basic Parameter Adjustments

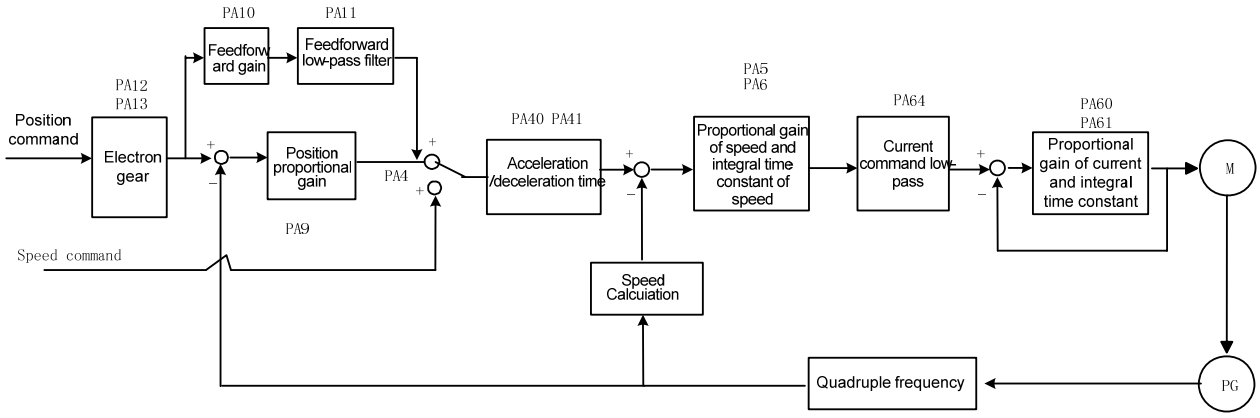


Figure 7-4 Diagram of basic parameter adjustment

3) Setting of Position Resolution and Electronic Gear

The position resolution (a pulse stroke △l) depends on the stroke △S of the servo motor in each revolution and the feedback pulse P_t of encoder in each revolution. It may be expressed with the following formulae:

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

Where,

△l: a pulse stroke (mm);

△S: stroke △S of the servo motor in each revolution (mm/revolution);

P_t: Number of feedback pulses of encoder in each revolution (pulses/revolution)

As the system is provided with a quadruple-frequency circuit, P_t is equal to 4×C (C is the number of lines of the encoder in each revolution). P_t is equal to 10,000 pulses/revolution since C is 2,500 lines/revolution in the system.

A command pulse can be converted to a position control pulse only when it is multiplied by the electronic gear ratio G. Therefore a command pulse stroke △l * is expressed as

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

Where, $G = \dfrac{\text{Denominator of command pulse frequency division}}{\text{Numerator of command pulse frequency division}}$

Chapter 8 Product Specification

Attention

- The servo drive unit must be ordered with a servomotor. This manual applies to GSK SJT series.
- To use a servomotor made by another manufacturer, always specify in ordering.

8.1 Specification of Drive Unit

Table 8-1 Specification of Servo Drive Unit

Output power (kW)	3-phase AC220V（85%～110%） 50/60Hz	
Rated power of matched servo motor	0.1kW -- 11.9kW	
Communication interface	GSK-Link bus I	Minimum communication cycle: 200μs
		Length of communication data: 0～256 Byte
		Bit error rate: 10^{-12}
Control modes	① Position control ② Speed control ③ Speed trial operation ④ Speed JOG operation	
Control characteristics	Speed frequency response: ≥200Hz	
	Speed ratio: 5000:1	
	Speed fluctuation ratio ＜±0.03 (load 0～100%); ＜±0.02 [(Supply voltage 0.90%～+1.1%) (a value relative to the rated speed)	
	Period of least position command: ≥200us	
Control input	Servo Enabled; Alarm cleared; Deviation Counter Zeroed signal; Command pulse prohibit; Setting servo parameters; Position command; Speed command; CW/CCW Torque Limit; Internal speed selection; Zero return function input, ect.	
Control output	Servo ready signal; Servo alarm output symbol; Positioning completion output; Speed Arrival output; HOLD signal; Zero-speed output; Mask code feedback signal; Zero return completion, ect.	
Position control	Input means	Periodic data input by bus
	Electronic gear ratio	Numerator of gear ratio: 1～32767 Denominator of gear ratio: 1～32767
	Position command pulse frequency	Incremental servo motor：≤ 500kHz
		Absolute servo motor ：≤ 6554kHz

	Feedback pulse	Incremental servo motor：10000 pulse/rev
		17bit absolute servo motor：131072 pulse/rev
Speed control	Control command mode: ①external speed command ②internal speed command	
	Speed command range: ± 6000r/min	
Acceleration/deceleration function	Acceleration/deceleration setting time in speed control mode: 1ms～10000ms (0～1000r/min)	
Monitoring functions	Monitor speed, current position, command pulse accumulation, position deviation, motor torque, motor current, linear speed, absolute position of rotor, command pulse frequency, operating state, current control mode, rotor's absolute position, encoder input signal by the CNC side and drive side.	
Alarm functions	Overspeed, overvoltage and undervoltage of main power supply, overcurrent, overload, position out-of-tolerance, speed amplifier saturation, drive prohibit abnormality, position deviation counter overflow, encoder malfunction, undervoltage of control power supply, IPM module failure, overcurrent, motor's overload, EEPROM error, Z pulse loss, bus communication fault, etc	
Display function	Data is displayed on the drive unit or CNC	
	Parameter setting mode, parameter management mode, status monitor mode, speed trial-run mod, JOG run mode, encoder zeroing mode and so on	
Parameter management	The parameters may be set, saved, backed up and recovered through the drive unit or CNC.	
Bus functions	1. Use the encoder with high resolution to get stable run and smooth machine run 2. Upload/download servo parameters online, feedback servo diagnosis messages and monitor servo alarms in bus communication mode 3. High-efficient acceleration/deceleration compensation of drive unit's backlash 4. Power-down memory function of workpiece coordinate system and zero return function without stroke limit switch in bus communication mode 5. Debug rigid grade of the drive parameters and optimize parameters in bus communication mode to improve the whole response of matched machine tool 6. The communication period can be adjusted to apply to the bus CNC device with different interpolation period 7. Add the 2nd gain to meet different machining requirements.	

8.2 Specification of Servomotor

1. Product Overview

GSK SJT series of 3-phase AC permanent magnet synchronous servo motor has the following technical advantages:

- Made of new rare earth materials, high output power;
- Superior low-speed characteristics of motor, speed ratio >1:10000。
- High dielectric strength, insulating resistance and operating safety
- High overloading capacity, transient torque up to 8 times the rated torque

2. Description of Terminals

（1） ST Motor Winding

The schematic diagram of the motor winding is as shown below: A, B and C are the outlet terminals of the winding. Outlet means: 4-pin socket.

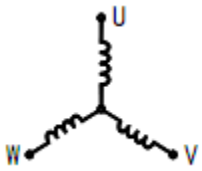


Table 8-2-1 Wiring of motor

Socket No.	2	3	4
Motor winding	U	V	W
Remarks	Pin 1 is grounded (enclosure)		

Outlet means of the photoelectric encoder: 15-pin socket

Table 8-3 Wiring of incremental encoder

Pin	2	3	4	7	5	8	6	9	10	13	11	14	12	15
Marking	V_{cc}	GND	A	$\overline{A}$	B	$\overline{B}$	Z	$\overline{Z}$	U	$\overline{U}$	V	$\overline{V}$	W	$\overline{W}$
GND is the earth wire of encoder power supply Vcc. Pin 1 is grounded (enclosure)														

Table 8-4 Wiring of Tamagawa absolute encoder

Socket No.	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
Pin	Shell grounding	$\overline{SD}$	GND		VCC	SD							VB		

3. Specification

Table 8-5 Specification of SJT Series Motors

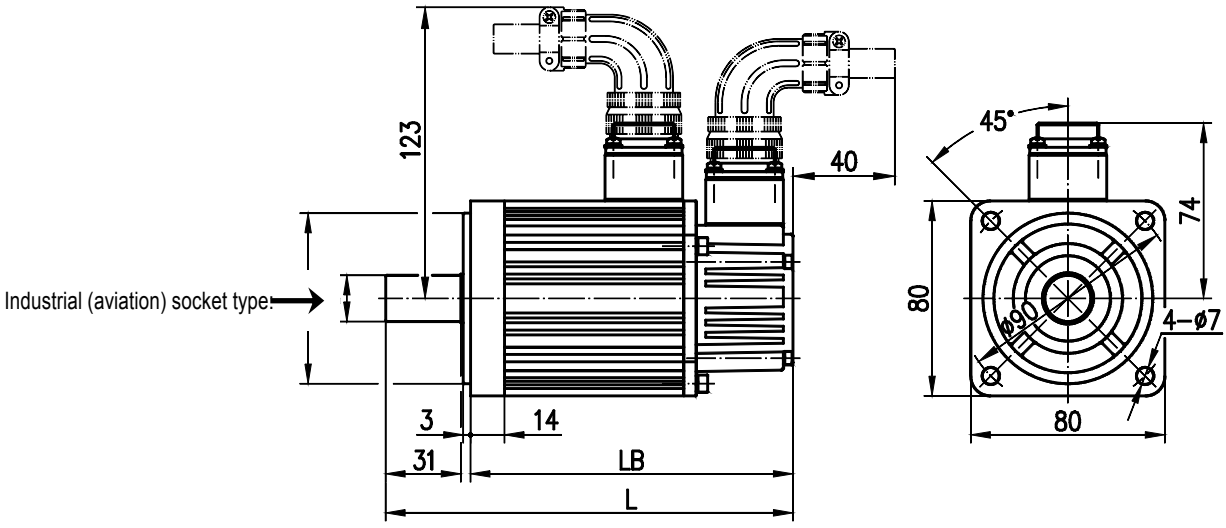
Model number	Power (kW)	Pole pairs	Rated torque (N.m)	Rated speed (r/min)	Rated current (A)	Rotor inertia (kgm2)	Acceleration time constant (ms)	Operating voltage V(DC)
110SJT-M020E	0.6	4	2	3000	3.0	3.4×10^{-4}	52	220(300)

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: Specify the specification while ordering a motor with dead electromagnet brake.

4. External Dimensions

(1) External view and installation dimensions of 80SJT series of motors



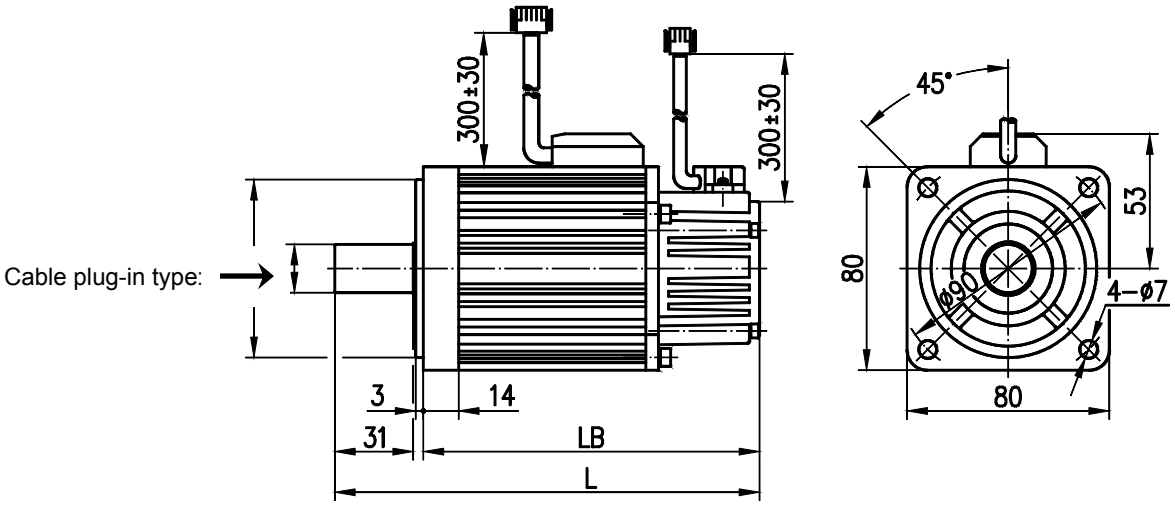


Fig. 8-2 External view and installation dimensions of SJT series of AC servomotors with 80# base

Table 8-6

Model No.	D(mm)	N(mm)	LB(mm)	L(mm)
80SJT—M024C (A□)	$\varphi 19^{0}_{-0.013}$	$\varphi 70^{0}_{-0.03}$	171	206
80SJT—M024E(A□)	$\varphi 19^{0}_{-0.013}$	$\varphi 70^{0}_{-0.03}$	171	206
80SJT—M032C(A□)	$\varphi 19^{0}_{-0.013}$	$\varphi 70^{0}_{-0.03}$	189	224
80SJT—M032E(A□)	$\varphi 19^{0}_{-0.013}$	$\varphi 70^{0}_{-0.03}$	189	224

(2) External view and installation dimensions of SJT series of AC servomotors with 110# base

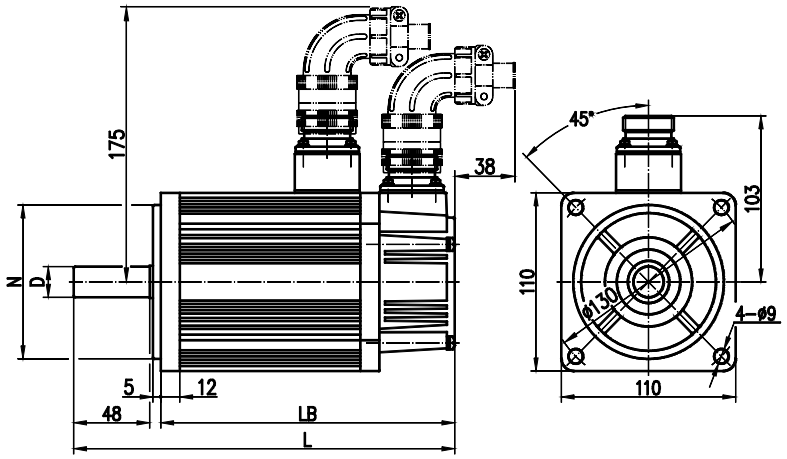


Fig. 8-3 External view and installation dimensions of SJT series of AC servomotors with 110# base

Table 8-7

Model No.	D(mm)	N(mm)	LB(mm)	L(mm)
110SJT—M040D(A□)	$\varphi 19^{0}_{-0.013}$	$\varphi 95^{0}_{-0.035}$	186 (237)	241 (292)

110SJT—M040E(A□)	$\varphi 19^{0}_{-0.013}$	$\varphi 95^{0}_{-0.035}$	186 (237)	241 (292)
110SJT—M060D(A□)	$\varphi 19^{0}_{-0.013}$	$\varphi 95^{0}_{-0.035}$	212 (263)	267 (318)
110SJT—M060E(A□)	$\varphi 19^{0}_{-0.013}$	$\varphi 95^{0}_{-0.035}$	212 (263)	267 (318)
Note: The LB and L figures in the brackets are the lengths of the motors with dead electromagnet brake of the corresponding specification.				

(3) External view and installation dimensions of SJT series of AC servomotors with 130# base

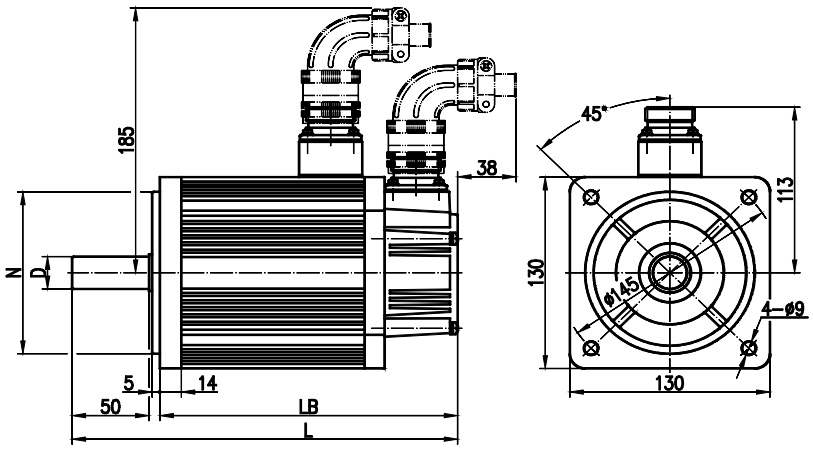


Fig. 8-3 External view and installation dimensions of SJT series of AC servomotors with 130# base

Table 8-8

Model No.	D(mm)	N(mm)	LB(mm)	L(mm)
130SJT—M040D(A□)	$\varphi 22^{0}_{-0.013}$	$\varphi 110^{0}_{-0.035}$	168 (227)	225 (284)
130SJT—M050D(A□)	$\varphi 22^{0}_{-0.013}$	$\varphi 110^{0}_{-0.035}$	168 (227)	225 (284)
130SJT—M060D(A□)	$\varphi 22^{0}_{-0.013}$	$\varphi 110^{0}_{-0.035}$	176 (235)	233 (292)
130SJT—M075D(A□)	$\varphi 22^{0}_{-0.013}$	$\varphi 110^{0}_{-0.035}$	188 (247)	245 (304)
130SJT—M100B(A□)	$\varphi 22^{0}_{-0.013}$	$\varphi 110^{0}_{-0.035}$	208 (267)	265 (324)
130SJT—M100D(A□)	$\varphi 22^{0}_{-0.013}$	$\varphi 110^{0}_{-0.035}$	208 (267)	265 (324)
130SJT—M150B(A□)	$\varphi 22^{0}_{-0.013}$	$\varphi 110^{0}_{-0.035}$	238 (297)	295 (354)
130SJT—M150D(A□)	$\varphi 22^{0}_{-0.013}$	$\varphi 110^{0}_{-0.035}$	248 (307)	305 (364)
Note: The LB and L figures in the brackets are the lengths of the motors with dead electromagnet brake of the corresponding specification.				

(4) External view and installation dimensions of 175SJT series of motors

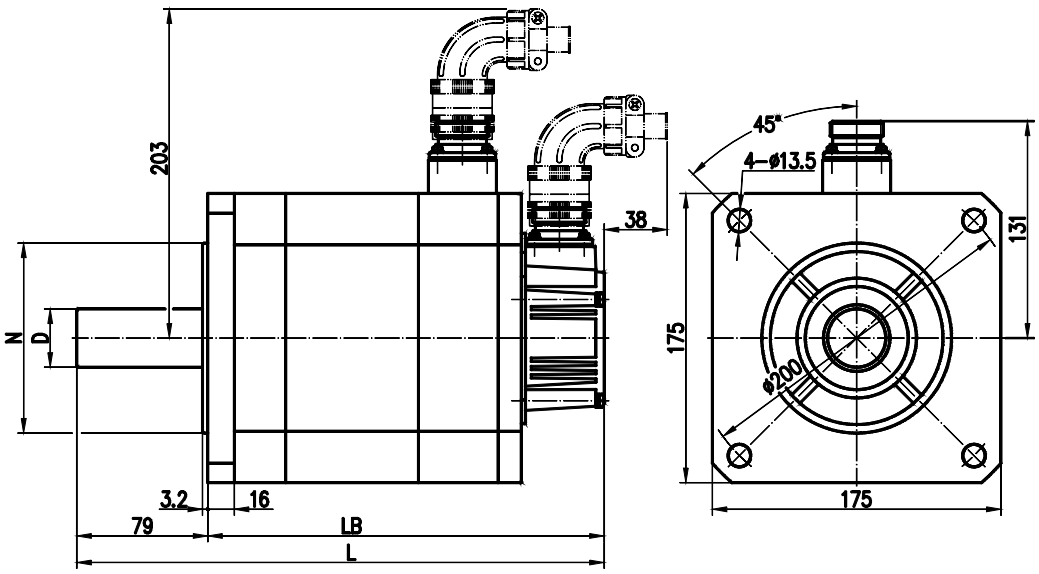


Figure 8-5 External view and installation dimensions of SJT series of AC servomotors with 175# base

Table 8-9

Model No.	D(mm)	N(mm)	LB(mm)	L(mm)
175SJT—M150D(A□)	$\varphi 35_0^{+0.01}$	$\varphi 114.3^0_{-0.025}$	224 (291)	303 (370)
175SJT—M180B(A□)	$\varphi 35_0^{+0.01}$	$\varphi 114.3^0_{-0.025}$	244 (311)	323 (390)
175SJT—M180D(A□)	$\varphi 35_0^{+0.01}$	$\varphi 114.3^0_{-0.025}$	244 (311)	323 (390)
175SJT—M220B(A□)	$\varphi 35_0^{+0.01}$	$\varphi 114.3^0_{-0.025}$	279 (346)	358 (425)
175SJT—M220D(A□)	$\varphi 35_0^{+0.01}$	$\varphi 114.3^0_{-0.025}$	279 (346)	358 (425)
175SJT—M300B(A□)	$\varphi 35_0^{+0.01}$	$\varphi 114.3^0_{-0.025}$	309 (382)	388 (461)
175SJT—M300D(A□)	$\varphi 35_0^{+0.01}$	$\varphi 114.3^0_{-0.025}$	309 (382)	388 (461)
175SJT—M380B(A□)	$\varphi 35_0^{+0.01}$	$\varphi 114.3^0_{-0.025}$	359 (432)	438 (561)

Note: The LB and L figures in the brackets are the lengths of the motors with dead electromagnet brake of the corresponding specification.

8.3 Isolation Transformer

Supply of power to the servo unit through an isolation transformer may minimize the potential interference with the servo unit by power sources and electromagnetic field. The selection of an isolation transformer depends on the rated capacity, load rate and loading constant rate of the drive unit.

① A 3-phase isolation transformer shall be used for supplying of power when the power of the servo is greater than or equal to 1kW.

For single axis, the capacity of the isolation transformer shall not be less than 80% of the power of the servo motor. A user may select a transformer with capacity between 70% and 100% of the power of the servo motor.

② For two or more axes, the capacity of the isolation transformer shall not be less than 70% of the total power of the servo motor. A user may select a transformer with capacity between 60% and 80% of the power of the servo motor.

Table 8-10 Specification of Isolation Transformer

Model No	Capacity (kVA)	Phases	Input voltage (V)	Output voltage (V)
BS--120	1.2	3 phases	380	220
BS--200	2.0			
BS--300	3.0			
BD--80	0.8	Single phase		
BD--120	1.2			

The diagrams shows the dimensions in mm of the isolation transformer.

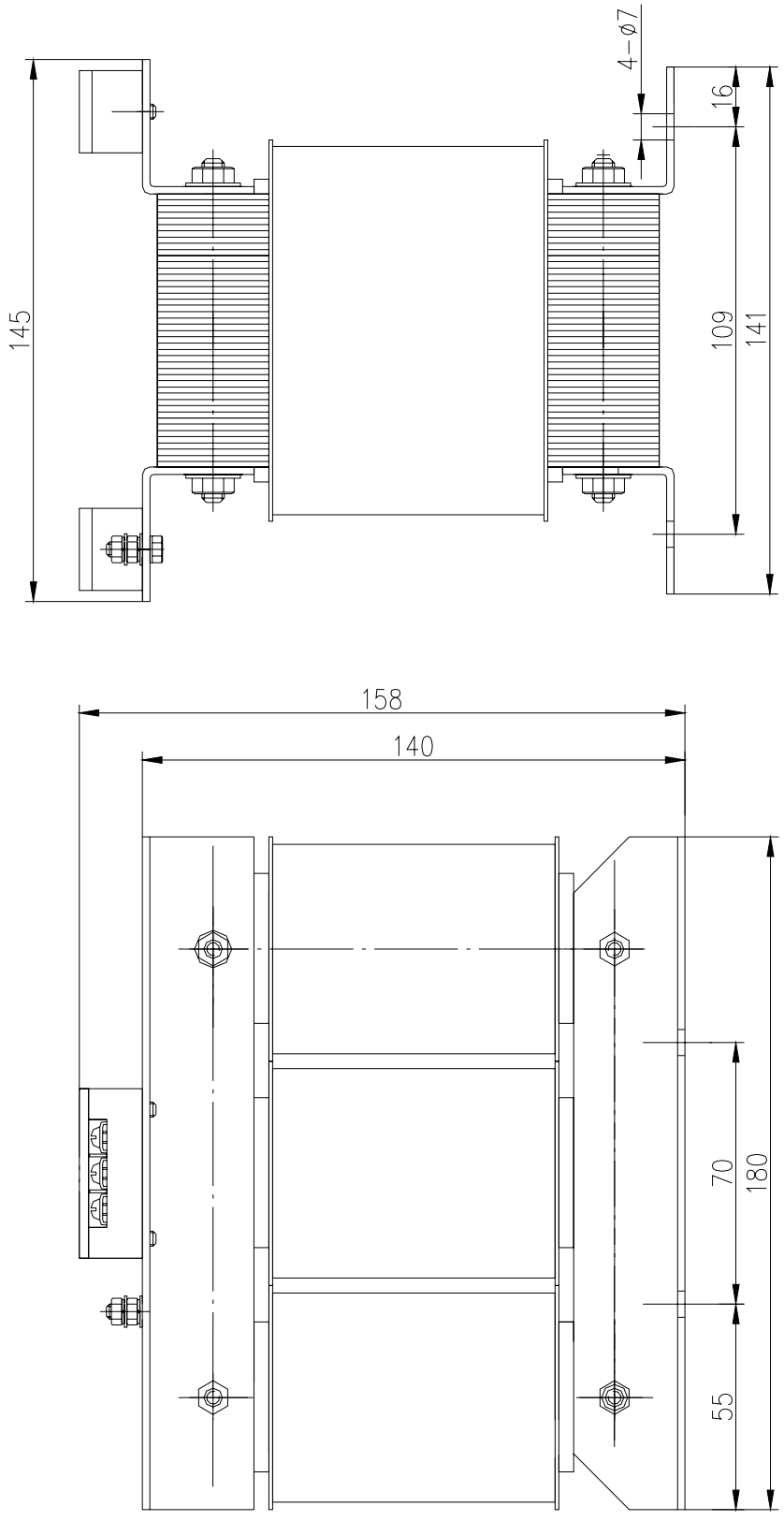


Figure 8-6 External view and installation dimensions of BS-120

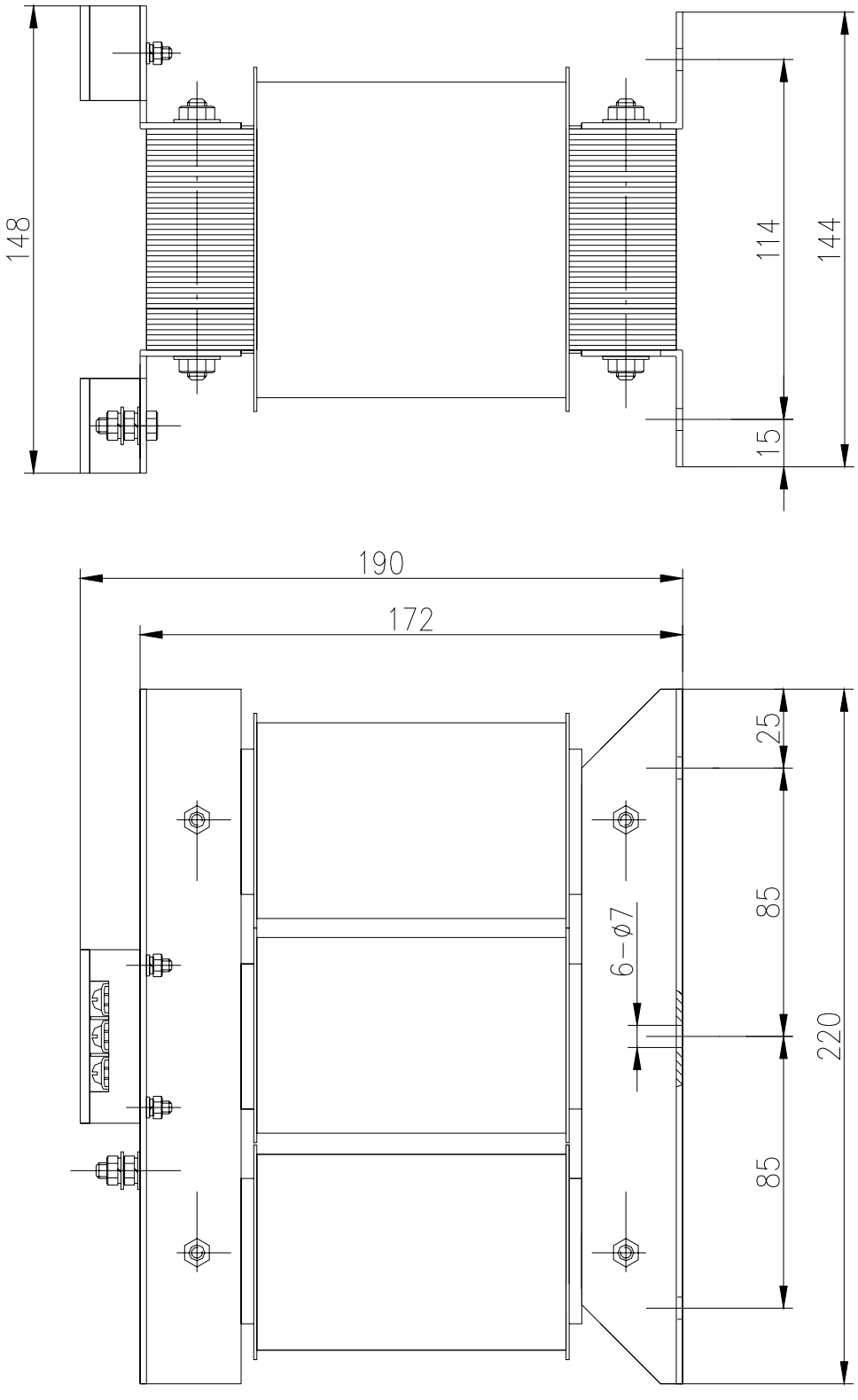


Figure 8-7 External view and installation dimensions of BS-200

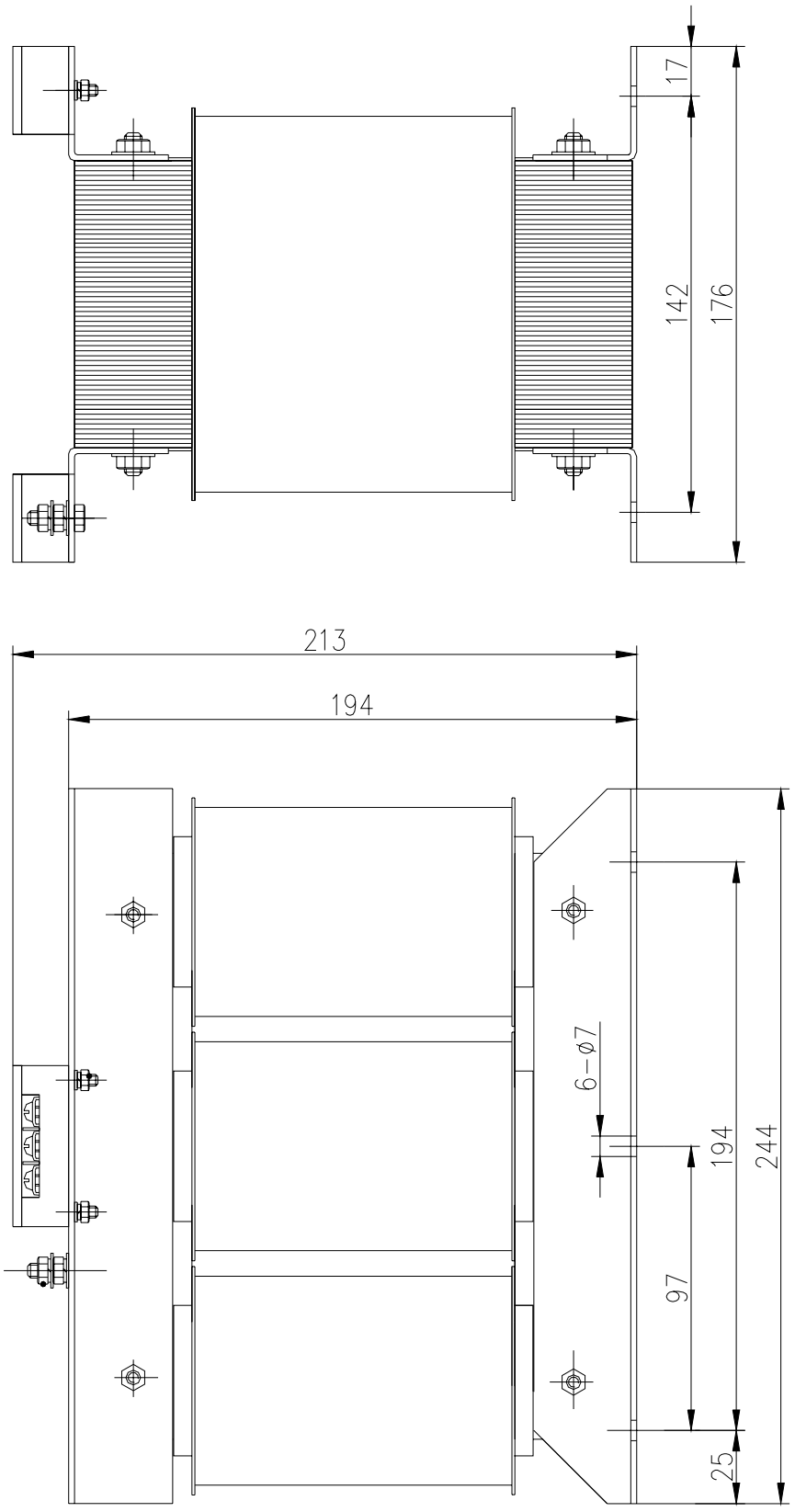


Figure 8-8 External view and installation dimensions of BS-300

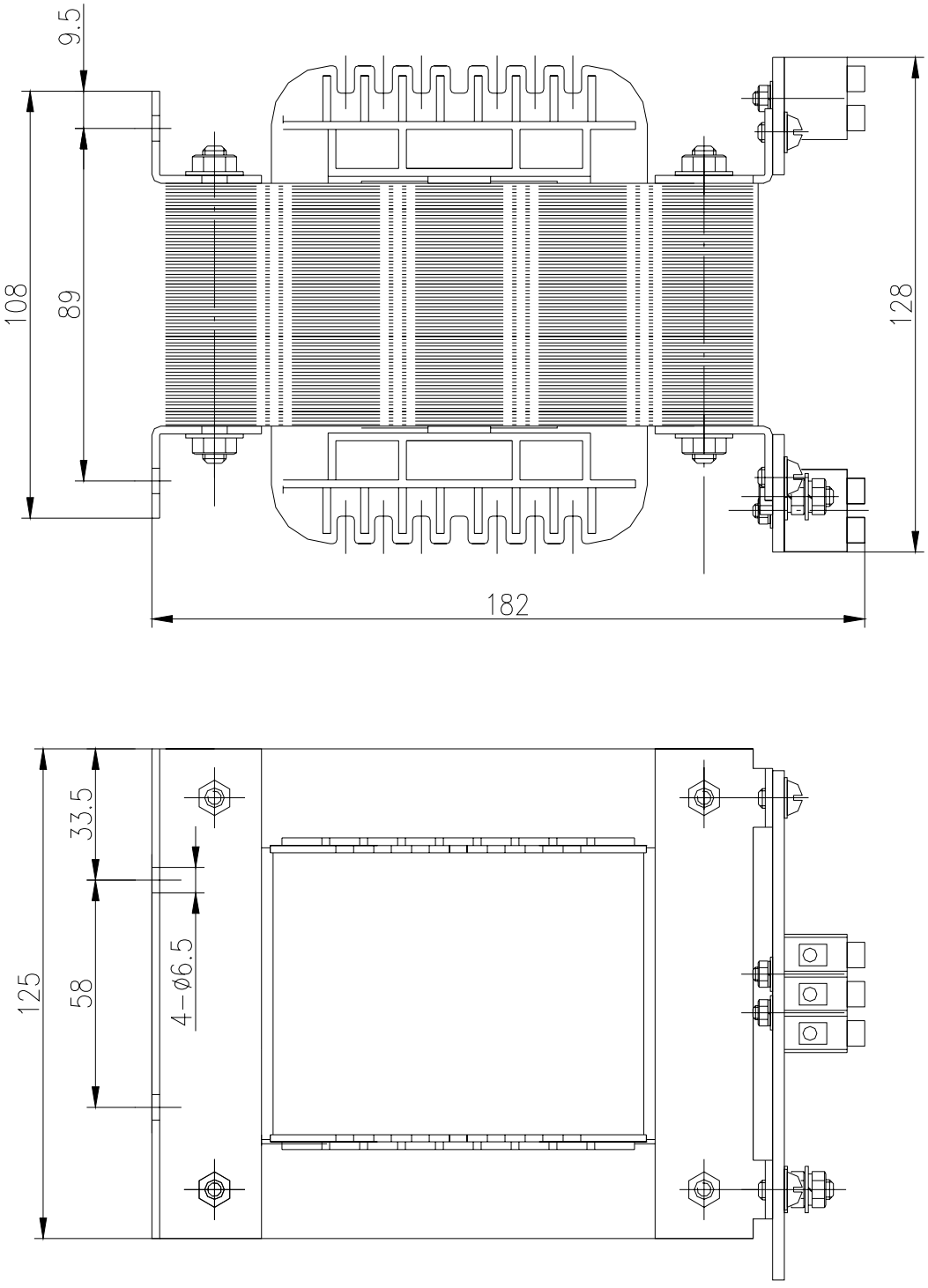


Figure 8-9 External view and installation dimensions of BD-80

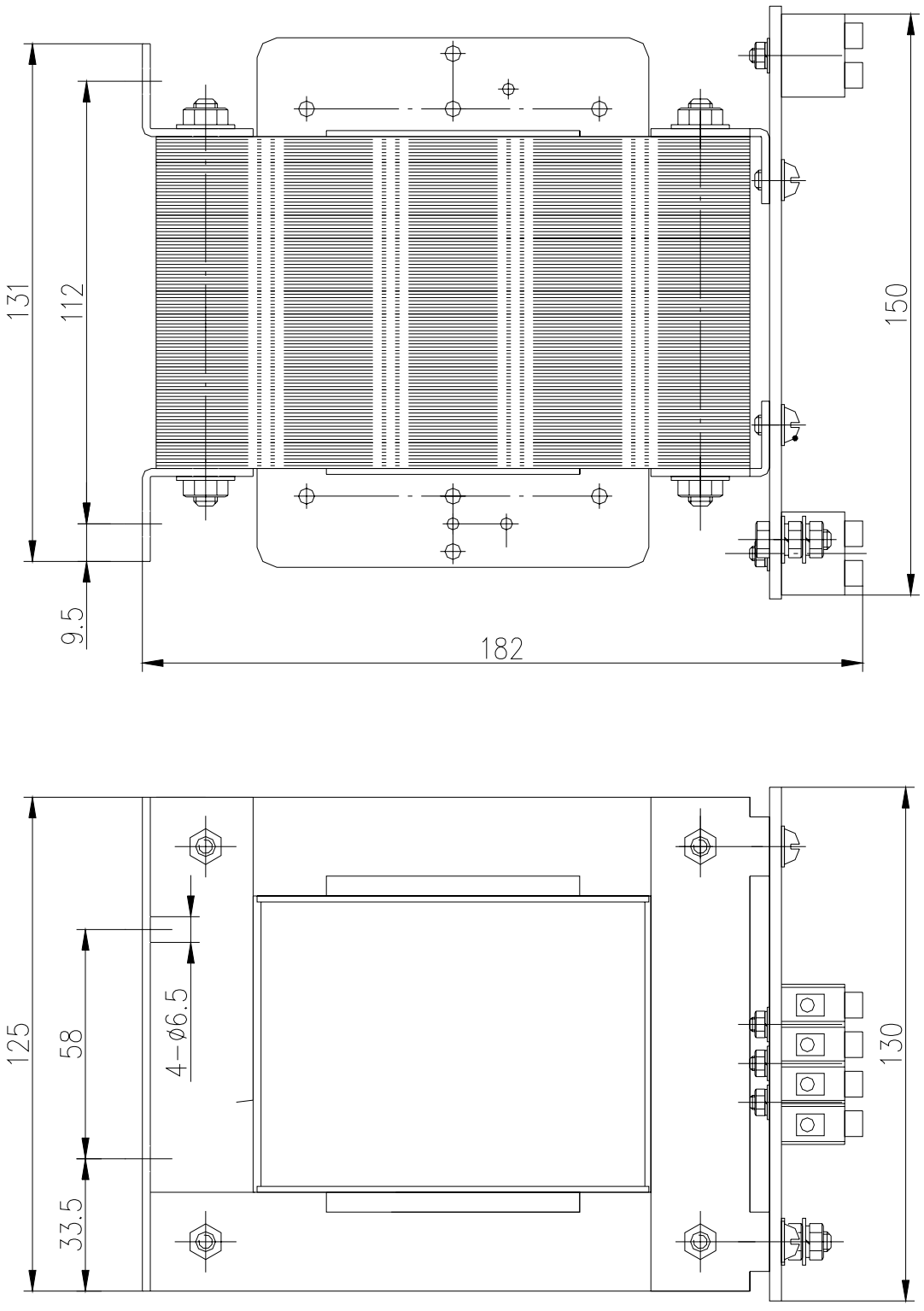
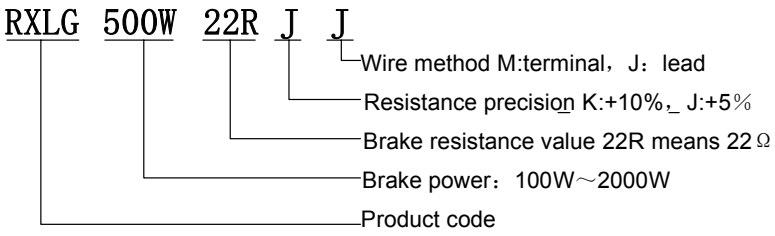


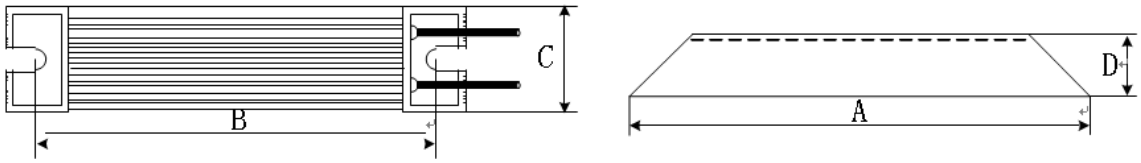
Figure 8-10 External view and installation dimensions of BD-120

8.4 External Brake Resistance

1. Brake resistance model

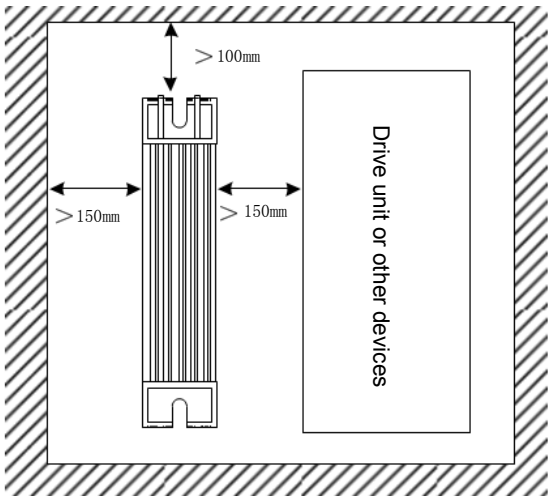


2. Brake resistance size



Servo unit	Brake resistance specification （W/Ω）	Size（mm）				Wiring （mm^2）	Lead length （m）	Terminal
		A	B	C	D			
GE2030T	300/30(option)	215	205	60	30	2.5	1	M5
GE2050T	500/22(option)	335	325	60	30	2.5	1	M5
GE2075-T	800/15	420	410	61	59	2.5	1	M5
GE2100-T	1200/10	485	473	50	107	2.5	1	M5
GE3050T	(1200W/30)	450	438	50	107	2.5	1	M5
GE3075T	(1500W/30)	485	473	50	107	2.5	1	M5
GE3100T	(1200W/30)//2	450	438	50	107	2.5	1	M5
GE3150T	(1500W/22)//2	485	473	50	107	2.5	1	M5

3. Brake resistance installation interval



Danger 1. Don’ t touch the brake resistance surface because of high-temperature and high pressure when the servo drive unit is turned on or runs!

2. Please install isolation cover!
3. Ensure temperature of the brake resistance surface is dropped down room temperature to touch it after the servo drive unit has been OFF for 10 min when it is checked, maintained!
4. Surface temperature of the brake resistance with SHE drops slowly after the servo unit is turned off!

Chapter 9 Ordering Guide

9.1 Capacity Selection

To determine the capacity of a servo device, give comprehensive consideration of its load inertia, load torque, required positioning accuracy and required maximum speed in the following steps:

1）Calculate its load inertia and torque

Calculate its load inertia, load torque, acceleration/deceleration torque, load torque and active torque as the basis for further selection by consulting the related data.

2）Preliminarily determine the mechanical gear ratio

Calculate the maximum mechanical gear reduction ratio using the required maximum speed and maximum rotating speed of the motor and check that reduction ratio and the minimum unit of revolution can satisfy the requirements of minimum unit of position. For high requirement for position accuracy, increase the mechanical reduction ratio (the actual maximum speed is reduced) or use a motor with higher rotating speed.

3）Check the inertia and torque

Convert the load inertia and load torque to the motor axis with the mechanical reduction ratio. The converted inertia and active torque shall not exceed five times the inertia of the motor inertia and the rated torque of the motor respectively. If the above requirements cannot be fulfilled, increase the mechanical reduction ratio (the actual maximum speed is reduced) or use a motor with higher rotating speed.

9.2 Electronic Gear Ratio

Refer to Chapter 4 (Table 4-2 Functions of Parameters), Chapter 6 (6.3 Parameter Setting) and Chapter 7 (7.3 Adjustment) for the meaning and adjusting methods of the electronic gear ratio G.

The actual speed of the load in position control mode is:

Command pulse speed ×G× Mechanical reduction ratio

The actual minimum displacement of the load in the position control mode is:

Minimum command pulse stroke x G x Mechanical reduction ratio

Note: when the electronic gear ratio G is not 1, there may be a remainder in the division operation of the gear ratio. Now there is a position deviation and the maximum deviation is the minimum movement (minimum resolution).

9.3 Stop Characteristics

When a train of impulses is used to control the servomotor in the position control mode, the difference between command pulse and feedback pulse is called lagging pulse. The figure is accumulated in the position deviation counter. It forms the following relationship with command pulse frequency, electronic gear ratio and proportional gain of position:

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

Where,

ε: Lagging pulse (Puls);

f: Command pulse frequency (Hz);

K_p: Proportional gain of position (1/S);

G: Electronic gear ratio

Note: The above relationship is obtained under the condition that [Feedforward gain of position] is 0%. If [Feedforward gain of position] is above 0%, the lagging pulse will be less than the result of the above formulae.

9.4 Calculation for Type Selection of Servo and Position Controller

Command position and actual displacement:

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

Where, S: actual displacement, mm; I: command displacement, mm;

δ: minimum unit of CNCk, mm; CR: command multiplier factor;

CD: command frequency division factor DR: servo multiplier factor;

DD: servo frequency division factor ST: number of divisions each revolution of servo motor

ZD: number of teeth on the side gear of motor; ZM: number of teeth on the side gear of screw

L: screw lead, mm

Generally S is equal to I and the command value to the actual value.

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

1. Maximum Command Speed of CNC

Where F: command speed, mm/min;

f_{max}: maximum output frequency of CNC, Hz (128000 for GSK980)

2. Maximum Speed of Servo System

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

Where, V_{max}: maximum speed of workbench permitted by servo system, mm/min;

n_{max}: permissible maximum rotating speed of servomotor, rpm;

Actual maximum speed of machine tool Maximum speed limit of CNC and servo system

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

3. Minimum Displacement of Machine Tool

Where, α: minimum displacement of machine tool, mm;

N: natural number;

INT ( ): round-off number;

INT[ ]$_{min}$: minimum integer;

9.5 Examples of Model Numbers Available for Ordering

Table 9—5-1 Example of types of SJT series of 2500-line incremental servomotor available for ordering

Drive unit	Main specification of motor						
Model No.	PA1	Motor Model No.	Rated power	Rated current	Rated torque	Rated speed	Encoder
GE2030T-LP1	55	80SJT-M024C	0.5kW	3A	2.4N·m	2000r/min	2500-line incremental type
	56	80SJT-M024E	0.75kW	4.8A	2.4N·m	3000r/min	2500-line incremental type
	57	80SJT-M032C	0.66kW	5A	3.2N·m	2000r/min	2500-line incremental type
GE2030T-LP1	58	80SJT-M032E	1.0kW	6.2A	3.2N·m	3000r/min	2500-line

							incremental type
GE2030T-LP1	59	110SJT-M040D(A)	1.0kW	4.5A	4N·m	2500r/min	2500-line incremental type
	60	110SJT-M040E(A)	1.2kW	5A	4N·m	3000r/min	2500-line incremental type
GE2050T-LP1	61	110SJT-M060D(A)	1.5kW	7A	6N·m	2500r/min	2500-line incremental type
	62	110SJT-M060E(A)	1.8kW	8A	6N·m	3000r/min	2500-line incremental type
GE2030T-LP1	63	130SJT-M040D(A)	1.0kW	4A	4N·m	2500r/min	2500-line incremental type
	64	130SJT-M050D(A)	1.3kW	5A	5N·m	2500r/min	2500-line incremental type
GE2050T-LP1	65	130SJT-M060D(A)	1.5kW	6A	6N·m	2500r/min	2500-line incremental type
	66	130SJT-M075D(A)	1.88kW	7.5A	7.5N·m	2500r/min	2500-line incremental type
	67	130SJT-M100B(A)	1.5kW	6A	10N·m	1500r/min	2500-line incremental type
	68	130SJT-M100D(A)	2.5kW	10A	10N·m	2500r/min	2500-line incremental type
	69	130SJT-M150B(A)	2.3kW	8.5A	15N·m	1500r/min	2500-line incremental type
GE2075T-LP1	70	130SJT-M150D(A)	3.9kW	14.5A	15N·m	2500r/min	2500-line incremental type

	71	175SJT-M150D(A)	3.1kW	14A	12N·m	2500r/min	2500-line incremental type
	72	175SJT-M180B	2.8kW	15A	18N·m	1500r/min	2500-line incremental type
GE2100T-LP1	73	175SJT-M180D	3.8kW	16.5A	14.5N·m	2500r/min	2500-line incremental type
	74	175SJT-M220B	3.5kW	17.5A	22N·m	1500r/min	2500-line incremental type
	75	175SJT-M220D	4.5kW	19A	17.6N·m	2500r/min	2500-line incremental type
	76	175SJT-M300B	4.7kW	24A	30N·m	1500r/min	2500-line incremental type
	77	175SJT-M300D	6.0kW	27.5A	24N·m	2500r/min	2500-line incremental type
	78	175SJT-M380B	6.0kW	29A	38N·m	1500r/min	2500-line incremental type

Table 9-5-2 Example of types of SJT series of 5000-line incremental servomotor available for ordering

Drive unit	Main specification of motor						
Model No.	PA1	Motor Model No.	Rated power	Rated current	Rated torque	Rated speed	Encoder
GE2030T-LP1	15	80SJT-M024C(A2)	0.5kW	3A	2.4N·m	2000r/min	5000-line incremental type
	16	80SJT-M024E(A2)	0.75kW	4.8A	2.4N·m	3000r/min	5000-line incremental type

	17	80SJT-M032C(A2)	0.66kW	5A	3.2N·m	2000r/min	5000-line incremental type
GE2030T-LP1	18	80SJT-M032E(A2)	1.0kW	6.2A	3.2N·m	3000r/min	5000-line incremental type
	19	110SJT-M040D(A2)	1.0kW	4.5A	4N·m	2500r/min	5000-line incremental type
	20	110SJT-M040E(A2)	1.2kW	5A	4N·m	3000r/min	5000-line incremental type
GE2050T-LP1	21	110SJT-M060D(A2)	1.5kW	7A	6N·m	2500r/min	5000-line incremental type
	22	110SJT-M060E(A2)	1.8kW	8A	6N·m	3000r/min	5000-line incremental type
GE2030T-LP1	23	130SJT-M040D(A2)	1.0kW	4A	4N·m	2500r/min	5000-line incremental type
	24	130SJT-M050D(A2)	1.3kW	5A	5N·m	2500r/min	5000-line incremental type
GE2050T-LP1	25	130SJT-M060D(A2)	1.5kW	6A	6N·m	2500r/min	5000-line incremental type
	26	130SJT-M075D(A2)	1.88kW	7.5A	7.5N·m	2500r/min	5000-line incremental type
	27	130SJT-M100B(A2)	1.5kW	6A	10N·m	1500r/min	5000-line incremental type
	28	130SJT-M100D(A2)	2.5kW	10A	10N·m	2500r/min	5000-line incremental type

	29	130SJT-M150B(A2)	2.3kW	8.5A	15N·m	1500r/min	5000-line incremental type
GE2075T-LP1	30	130SJT-M150D(A2)	3.9kW	14.5A	15N·m	2500r/min	5000-line incremental type
	31	175SJT-M150D(A2)	3.1kW	14A	12N·m	2500r/min	5000-line incremental type
	32	175SJT-M180B(A2)	2.8kW	15A	18N·m	1500r/min	5000-line incremental type
GE2100T-LP1	33	175SJT-M180D(A2)	3.8kW	16.5A	14.5N·m	2500r/min	5000-line incremental type
	34	175SJT-M220B(A2)	3.5kW	17.5A	22N·m	1500r/min	5000-line incremental type
	35	175SJT-M220D(A2)	4.5kW	19A	17.6N·m	2500r/min	5000-line incremental type
	36	175SJT-M300B(A2)	4.7kW	24A	30N·m	1500r/min	5000-line incremental type
	37	175SJT-M300D(A2)	6.0kW	27.5A	24N·m	2500r/min	5000-line incremental type
	38	175SJT-M380B(A2)	6.0kW	29A	38N·m	1500r/min	5000-line incremental type

Table 9-5-3 Example of types of SJT series of Tamagawa 17-bit absolute servomotor available for ordering

Drive unit		Main specification of motor					
Model No.	PA1	Motor Model No.	Rated power	Rated current	Rated torque	Rated speed	Encoder
GE2030T-LB1	55	80SJT-M024C(A4)	0.5kW	3A	2.4N·m	2000r/min	131072-line absolute type
	56	80SJT-M024E(A4)	0.75kW	4.8A	2.4N·m	3000r/min	131072-line absolute type
	57	80SJT-M032C(A4)	0.66kW	5A	3.2N·m	2000r/min	131072-line absolute type
GE2030T-LB1	58	80SJT-M032E(A4)	1.0kW	6.2A	3.2N·m	3000r/min	131072-line absolute type
	59	110SJT-M040D(A4)	1.0kW	4.5A	4N·m	2500r/min	131072-line absolute type
	60	110SJT-M040E(A4)	1.2kW	5A	4N·m	3000r/min	131072-line absolute type
GE2050T-LB1	61	110SJT-M060D(A4)	1.5kW	7A	6N·m	2500r/min	131072-line absolute type
	62	110SJT-M060E(A4)	1.8kW	8A	6N·m	3000r/min	131072-line absolute type
GE2030T-LB1	63	130SJT-M040D(A4)	1.0kW	4A	4N·m	2500r/min	131072-line absolute type
	64	130SJT-M050D(A4)	1.3kW	5A	5N·m	2500r/min	131072-line absolute type
GE2050T-LB1	65	130SJT-M060D(A4)	1.5kW	6A	6N·m	2500r/min	131072-line absolute type
	66	130SJT-M075D(A4)	1.88kW	7.5A	7.5N·m	2500r/min	131072-line absolute type
	67	130SJT-M100B(A4)	1.5kW	6A	10N·m	1500r/min	131072-line absolute type
	68	130SJT-M100D(A4)	2.5kW	10A	10N·m	2500r/min	131072-line absolute type
	69	130SJT-M150B(A4)	2.3kW	8.5A	15N·m	1500r/min	131072-line absolute type
GE2075T-LB1	70	130SJT-M150D(A4)	3.9kW	14.5A	15N·m	2500r/min	131072-line absolute type
	71	175SJT-M150D(A4)	3.1kW	14A	12N·m	2500r/min	131072-line absolute type

	72	175SJT-M180B(A4)	2.8kW	15A	18N·m	1500r/min	131072-line absolute type
GE2100T-LB1	73	175SJT-M180D(A4)	3.8kW	16.5A	14.5N·m	2500r/min	131072-line absolute type
	74	175SJT-M220B(A4)	3.5kW	17.5A	22N·m	1500r/min	131072-line absolute type
	75	175SJT-M220D(A4)	4.5kW	19A	17.6N·m	2500r/min	131072-line absolute type
	76	175SJT-M300B(A4)	4.7kW	24A	30N·m	1500r/min	131072-line absolute type
	77	175SJT-M300D(A4)	6.0kW	27.5A	24N·m	2500r/min	131072-line absolute type
	78	175SJT-M380B(A4)	6.0kW	29A	38N·m	1500r/min	131072-line absolute type

Table 9-5-4 Example of types of SJT series of Danaher 17-bit absolute servomotor available for ordering

Drive unit		Main specification of motor					
Model No.	PA1	Motor Model No.	Rated power	Rated current	Rated torque	Rated speed	Encoder
GE2030T-LA1	55	80SJT-M024C(A4I)	0.5kW	3A	2.4N·m	2000r/min	131072-line absolute type
	56	80SJT-M024E(A4I)	0.75kW	4.8A	2.4N·m	3000r/min	131072-line absolute type
	57	80SJT-M032C(A4I)	0.66kW	5A	3.2N·m	2000r/min	131072-line absolute type
	58	80SJT-M032E(A4I)	1.0kW	6.2A	3.2N·m	3000r/min	131072-line absolute type
	59	110SJT-M040D(A4I)	1.0kW	4.5A	4N·m	2500r/min	131072-line absolute type
	60	110SJT-M040E(A4I)	1.2kW	5A	4N·m	3000r/min	131072-line absolute type
GE2050T-LA1	61	110SJT-M060D(A4I)	1.5kW	7A	6N·m	2500r/min	131072-line absolute type
	62	110SJT-M060E(A4I)	1.8kW	8A	6N·m	3000r/min	131072-line absolute type

GE2030T-LA1	63	130SJT-M040D(A4I)	1.0kW	4A	4N·m	2500r/min	131072-line absolute type
	64	130SJT-M050D(A4I)	1.3kW	5A	5N·m	2500r/min	131072-line absolute type
GE2050T-LA1	65	130SJT-M060D(A4I)	1.5kW	6A	6N·m	2500r/min	131072-line absolute type
	66	130SJT-M075D(A4I)	1.88kW	7.5A	7.5N·m	2500r/min	131072-line absolute type
	67	130SJT-M100B(A4I)	1.5kW	6A	10N·m	1500r/min	131072-line absolute type
	68	130SJT-M100D(A4I)	2.5kW	10A	10N·m	2500r/min	131072-line absolute type
	69	130SJT-M150B(A4I)	2.3kW	8.5A	15N·m	1500r/min	131072-line absolute type
GE2075T-LA1	70	130SJT-M150D(A4I)	3.9kW	14.5A	15N·m	2500r/min	131072-line absolute type
	71	175SJT-M150D(A4I)	3.1kW	14A	12N·m	2500r/min	131072-line absolute type
	72	175SJT-M180B(A4I)	2.8kW	15A	18N·m	1500r/min	131072-line absolute type
GE2100T-LA1	73	175SJT-M180D(A4I)	3.8kW	16.5A	14.5N·m	2500r/min	131072-line absolute type
	74	175SJT-M220B(A4I)	3.5kW	17.5A	22N·m	1500r/min	131072-line absolute type
	75	175SJT-M220D(A4I)	4.5kW	19A	17.6N·m	2500r/min	131072-line absolute type
	76	175SJT-M300B(A4I)	4.7kW	24A	30N·m	1500r/min	131072-line absolute type
	77	175SJT-M300D(A4I)	6kW	27.5A	24N·m	2500r/min	131072-line absolute type
	78	175SJT-M380B(A4I)	6.0kW	29A	38N·m	1500r/min	131072-line absolute type

CNCmakers Limited
Address: No.168, Xiadu Road, Haizhu District, Guangzhou, China 510300
Email: info@CNCmakers.com Website: www.CNCmakers.com Tel: +86-138-24444158 Fax: +86-20-84185336