This user manual describes all proceedings concerning the operations of GR-L Series Bus AC Servo Drive Unit in detail as much as possible. However, it is impractical to give particular descriptions for all unnecessary or unallowable system operations due to the manual text limit, product specific applications and other causes. And therefore, the proceedings not indicated herein should be considered impractical or unallowable.

PREFACE

Your Excellency,

It's our pleasure for your patronage and purchase the product made by GSK CNC Equipment Co., Ltd.

This manual is detailed the capacity, installation, connection, debugging, use and maintenance etc. of GR-L series bus AC servo drive unit.

In order to guarantee the safety of the produce, and its effective working, it is better to carefully read this manual before installing or using this product.

In order to prevent the operator and other personnel from hurting, as well the damage in the mechanical equipment, especially note the following warn marks when reading this manual.


Danger Incorrect operation may result in death or severe injury.


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

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


It reminds the vital requirement and important indication for the user


It means Forbiddance (Absolutely can not be done).


It means Compulsion (Must be done).

⚠ Danger

Tighten each wiring terminal of the main circuit by appropriate strength

If the approved instruction is not observed, it may cause fire due to the loose wiring, and easily bring fire hazard.

Install the servo unit on the incombustible object and far from the flammable matters.

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

Confirm the input power is on the OFF state before wiring.

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

The earthing terminal PE of the servo unit should be grounded.

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

The wiring and inspection should be performed by the qualified professional personnel.

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

The movement, wiring, inspection or maintenance can be performed after its power is turned off for 5min.

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

Strictly connect based upon the wiring method in the user manual.

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

It is very important to tighten up the power and motor output terminals.

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

Never attempt to operate the switch by your wet hand.

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

Do not stretch your hand into the servo unit.

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

Do not open the cover plate of the terminal when the power is turned on or operated.

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

Do not directly touch the wiring terminal of the servo motor main circuit.

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

Danger

Do not immediately operate the servo motor shaft connection equipment because the servo unit may suddenly start after the power is turned on again.

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

Do not stop the thermal-diffusion or put the foreign material into the fan and cooling fan.

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

Do not place the cable at the edge of the sharp material; do not overload or extremely extent the cable

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

Do not operate the servo drive equipment with the power-on when disassembling the cover plate on the terminal block.

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

Caution

Motor should be matched with the appropriate servo motor

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

The voltage level loaded on each terminal should be consistent with the one specified in the user manual.

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

The motor can be performed loading operation, only when its dry run is completed.

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

It can not be operated before the fault is not eliminated after the alarm occurs.

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

Do not hold the cable and motor shaft during the motor transportation.

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

Do not operated it if the components of the servo unit are absent or damaged, immediately contact the seller.

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

Caution

Do not connect the power input cables R, S, T to the terminals U , V and W of the motor’ s output cable

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

Do not frequently open/close the input power

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

Do not touch the thermal-radiator equipment of the motor and servo motor during operating, because the high temperature may occur.

If the approved instruction is not observed, it may cause scald

Do not extremely debug and alter the parameter.

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

Do not modify, disassemble or repair the drive unit freely .

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

The wasted servo unit and the internal electric components only treated as industry trash instead of using repeatedly.

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

SECURITY RESPONSIBILITY

Security responsibility of the manufacturer

——Manufacturer should take responsibility for the design and structure danger of the motor and the accessories which have been eliminated and/or controlled.

——Manufacturer should take responsibility for the security of the motor and accessories.

——Manufacturer should take responsibility for the offered information and suggestions for the user.

Security responsibility of the users

——User should know and understand about the contents of security operations by learning and training the security operations of the motor.

——User should take responsibility for the security and danger because of increasing, changing or modifying the original motor or accessory by themselves.

——User should take responsibility for the danger without following the operations, maintenances, installations and storages described in the manual.

This manual is reserved by final user.

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

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

CONTENTS

CHAPTER ONE PRODUCT INTRODUCTION

The GR-L Series Bus AC Servo Drive Unit (It is abbreviated as Servo Drive Unit) made by GSK CNC Equipment CO., LTD. which is matched with GSK988□ (□: TA or TB or MDs or MD) CNC system and supports the servo drive unit product with GSK-Link bus agreement.

The series servo drive unit owns the following basis characteristics comparing with others servo drive units:

- Integrated permanent-magnet synchronous servo motor and asynchronous spindle servo motor are performed the control algorithm together, which can be adapted by setting the motor parameter;
- Using the GSK-Link spot bus and CNC high speed real-time communication can be simplified the connection to avoid the transmission distortion of analogy and pulse signals, as well support the real-time monitoring, parameter management and servo parameter tuning;
- Support the control methods, such as position, speed and position/speed, etc;
- It owns two-position feedback input interfaces, supports the encoder communication agreement and incremental encoder of the BISS, Endat2.2 and TAMAGAWA etc. The overall closed-loop control can be carried out by connecting the absolute and increment optical grating.
- Strong overloading drive ability, wide brake pipe capacity, support the external brake resistance and fast start and brake speed.
- It owns 220V, 380V and 440V levels to suit different electric networks.

1.1 Product Type Confirmation

It is necessary to inspect the following items after receiving; if you have any questions, contact the supplier or our company.

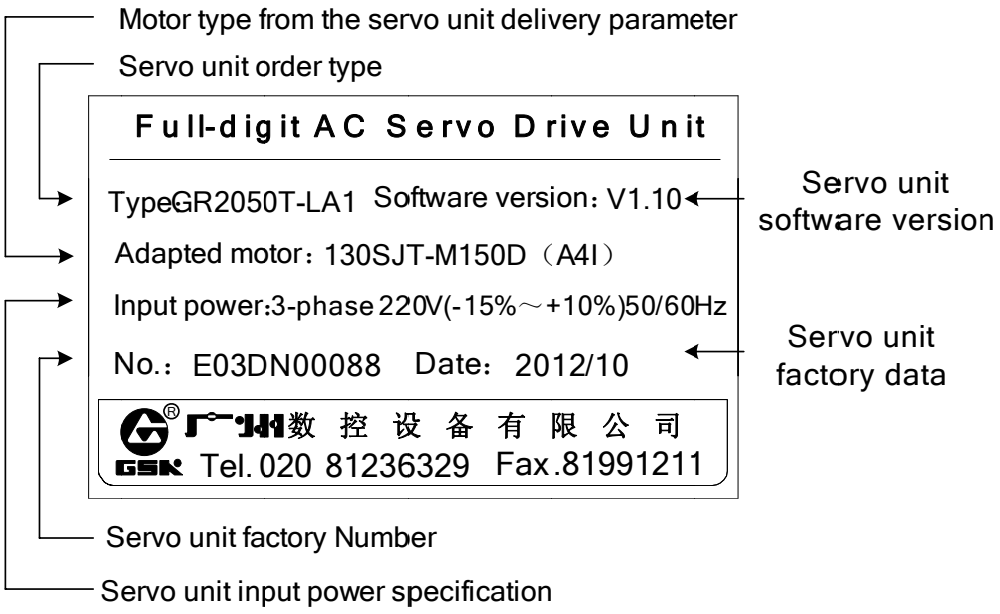
Inspection Item	Remark
Check the servo drive unit and servo motor and confirm whether it is the ordered products.	Confirm it by the nameplate of the servo drive unit and servo motor

Check whether the components are complete	Check the component content of the packing list; it is better to contact the supplier if it does not match.
Check whether the cargo is damaged due to the transportation.	Check the integrative appearance of the product that it should be integrated and without damage.
Check whether the screw is tightened.	Check whether it is loosened by screwdriver.

Notice	1. The AC servo drive unit with damaging or absenting in components can not be installed; 2. The servo unit operation should be matched with the adapted power servo motor; 3. It is necessary to confirm each parameter of the GR-L series product and motor are consistent with its requirement based upon the Section 1.3 Order Guiding.

1.1.1 Servo Drive Unit Type Explanation

- **Nameplate example of servo drive unit**



- **Type example of servo drive unit**

①	“GR” series general-purpose servo drive unit, GR: Product code
②	Voltage grave code, 2: 220V; 3: 380V; 4: 440V
③	Power component nominal current, 3-digit number means: 025, 030, 045, 048, 050, 075, 100, 148, 150 (Unit: A), and the leading zero can not be ignored.
④	Adapted motor type, T; Adapted synchronous servo motor; Y: Adapted asynchronous servo motor

⑤	Communication bus code, N: Without bus; L: GSKLink bus
⑥	Feedback (Encoder) interface type code, P: Adapted incremental encoder; A: Adapted absolute encoder, without spare/standby battery. B: Adapted absolute encoder, equipped battery (It is used for memorizing the coil numbers of absolute encoder after the power is turned off). B: Adapted absolute or incremental encoder, equip with the spare/standby battery.
⑦	Feedback (Encoder) interface configuration code; it expresses with 1-digit, "1" means motor feedback (the 1st position feedback) Input interface (CN2), "2" means the motor feedback input (CN2) and the 2nd position feedback input interface (CN3)
⑧	Encoder agreement, without: BISS + TAMAGAWA (Nominal standard configuration); A: BISS+EnDat

1.1.2 Servo Drive Unit Appearance

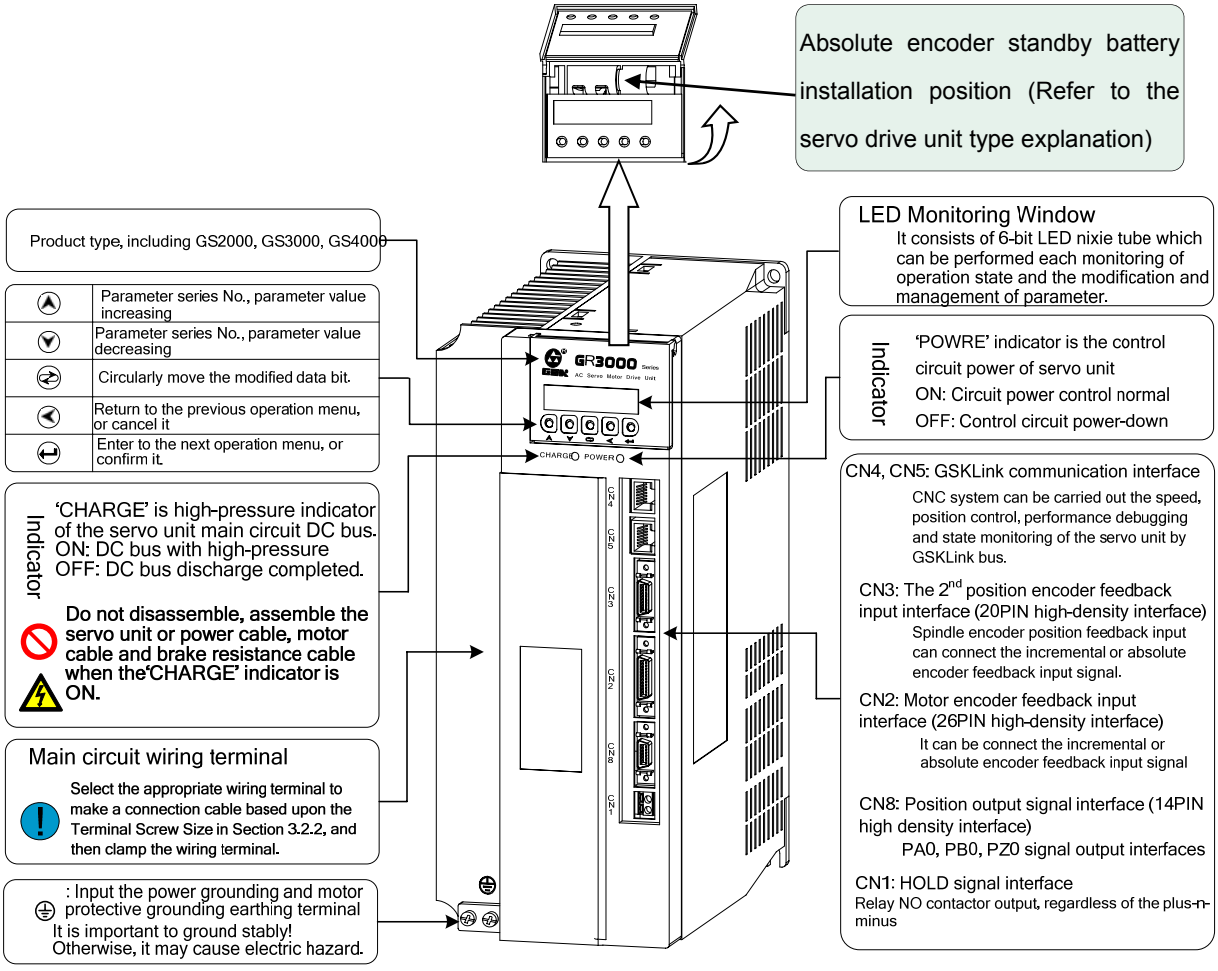


Fig. 1-10 GR2000T-C product appearance

- Motor encoder should be equipped with the battery on the servo drive unit when adapts with 'A4Ⅱ' 17-bit absolute encoder. Our company provides the ABLE company ER14250 battery, its specification is 3.6V, 1.2Ah, 1/2AA
- GR2025T-L, GR2030T-L and GR2045T-L servo drive units are not supported to the CN8 interface function.

1.2 GR-L Servo Drive Unit Technical Specification

Servo drive type	GR2019T-L	GR2030T-L	GR2045T-L	GR2050T-L	GR2075T-L	GR2100T-L
Consecutive output currengt (A)	6	10	15	16.8	25.5	34
Wight（kg）	2.325			3.365	5.275	7.265
Standard configuration servo motor rated current I (A)	I≤4	4＜I≤6	6＜I≤7.5	7.5＜I≤10	10＜I≤15	15＜I≤29
Power input	3-phase AC220V（85%～110%）50/60Hz±1Hz					
Brake resistance	Built-in brake resistance. (External brake resistance can be matched)				External brake resistance (without built-in brake resistance)	

Servo drive type	GR2050Y-L	GR2075Y-L	GR2100Y-L
Consecutive output currengt (A)	17	25.5	34
Weight（kg）	3.365	5.275	7.265
Standard configuration motor rated power (kW)	1.5，2.2	3.7	5.5，7.5
Standard configuration motor rated current I (A)	I≤10	10＜I≤15.5	15.5＜I≤29
Power input	3 phase AC220V（85%～110%）50/60Hz±1Hz		
Brake resistance	Either select the built-in or external brake resistance	External brake resistance (without built-in brake resistance)	

Servo drive type	GR3048T-L	GR3050T-L	GR3075T-L	GR3100T-L	GR3148T-L	GR3150T-L	GR3198T-L
Consecutive output currengt (A)	13.5	17	25.5	34	41	48	56
Weight（kg）	3.42	5.38	7.6	9.755	9.850	13.34	13.4
Standard configuration motor rated current I (A)	I≤8	8＜I≤10	10＜I≤15	15＜I≤20	20＜I≤27	27＜I≤34	34＜I≤45

Power input	3-phase AC380V（85%～110%）50/60Hz±1Hz						
Brake resistance	External brake resistance (without built-in brake resistance)						
Servo drive type	**GR3048Y-L GR4048Y-L**	**GR3050Y-L GR4050Y-L**	**GR3075Y-L GR4075Y-L**	**GR3100Y-L GR4100Y-L**	**GR3148Y-L GR4148Y-L**	**GR3150Y-L GR4150Y-L**	**GR3198Y-L GR4198Y-L**
Standard configuration motor's rated power (kw)	1.5, 2.2	3.7, 5.5	5.5, 7.5	7.5, 11	11	15, 18.5	22
Consecutive output currengt (A)	13.5	17	25.5	34	41	48	56
Weight（kg）	3.42	5.38	7.6	9.755	9.850	13.34	13.4
Standard configuration motor rated current I (A)	I≤8	8＜I≤15.5	15.5＜I≤20	20＜I≤27	27＜I≤34	34＜I≤49	49＜I≤60
Power input	GR3000Y series power input: 3-phase AC380V (85%～110%) 50/60Hz±1Hz GR4000Y series power input：3-phase AC440V (85%～110%) 50/60Hz±1Hz						

Servo drive type	**GR-L series product**
Communication bus	GSK-Link bus interface, accept the position, speed, torque and control command, feedback the actual position/speed/torque and state data, support the servo state real-time monitoring, servo parameter loading/unloading and servo dynamic characteristic debugging.
Working method	Manual, JOG, Internal speed, Speed, Position, Torque, Speed/position, Speed/torque, Position/torque
Position control	Command range: -2^{31}~2^{31} -1 Command unit: Position feedback pulse input equivalent Position command electric gear ratio: (1～32767) / (1～32767)
Speed control	Command range: -2^{31}~2^{31} -1 Command unit: 0.01rpm Speed command electric gear ratio: (1～32767) / (1～32767） Speed-regulation range: 1~5000rpm (Feed servo); 1~12000rpm (Spindle servo) Orientation function: Any angle
Torque control	Command range: -2^{31}~2^{31} -1 Command unit: 0.0001Nm
Motor feedback input	A/B/Z 3-pair differential signal input, adapt with 1024~8192p/r incremental encoder; RS485 semi-duplex series communication interface, support BISS, TAMAGAWA encoder communication agreement, adapt the DANAHER, TAMAGAWA absolute encoder. It can be adapted with HEIDENHAIN encoder of EnDat2.2 communication agreement. Feed servo matches the multi-coil absolute encoder with single-coil 17-bit accuracy; spindle servo matches with the 1024p/r incremental encoder.
The 2nd feedback input	Feed servo optional adapt interface, spindle servo standard interface A/B/Z 3-pair differential signal input, adapt with the incremental encoder and grating bar; RS485 semi-duplex series communication interface, support BISS, TAMAGAWA encoder communication agreement, adapt the DANAHER, TAMAGAWA absolute encoder. It can be adapted with HEIDENHAIN encoder grating bar of EnDat2.2 communication agreement.
Position feedback output	Output the A/B/Z differential signal based upon the 1st or the 2nd position feedback signal input; When the reference position feedback input is the incremental encoder, support the position feedback output gear ratio, and the resolution range of the gear ratio numerator/denominator: 1~256, the numerator should be less than the denominator; When the reference position feedback input is absolute encoder, the feedback pulse number output

	of the motor per each revolution is set (0~30000) by parameter; the motor/r output feedback pulse number should be less than the counter value/r of the reference position feedback input.
I/O signal	Fixed output signal (Brake releasing)

1.3 Order Guiding

1.3.1 GR-L Series Servo Drive Unit Type-Selecting Step

S/N	Type-selecting step	Type-selecting content	
1	**Motor selection Voltage level**	Optional: GR2000, GR3000 and GR4000 series	
		AC permanent-magnetic synchronous servo motor	**AC asynchronous spindle servo motor**
2	**Motor selection Power, torque**	Optional power range (0.5 ～ 10.5)kW Optional torque range (2.4 ～ 50)N·m	Optional power: 1.5, 2.2, 3.7, 5.5, 7.5, 11, 15, 18.5 and 22 (Unit: kW) etc.
3	**Motor revolving speed selection**	A: Motor rated speed 1000r/min B: Motor rated spee1500r/min C: Motor rated spee2000r/min D: Motor rated spee2500r/min E: Motor rated spee3000r/min	1. Spindle motor rated speed：750r/min，Max. speed 4500r/min 2. Spindle motor rated speed：1000r/min, Max. speed 7000r/min 3. Spindle motor rated speed：1500r/min, Max. speed 7000r/min or 10000r/min
4	**Confirm the motor and spindle encoder by machining accuracy**	2500 cable incremental encoder, resolution ±0.036º 5000 cable incremental encoder, resolution ±0.018º 17-bit absolute encoder, resolution ±0.0027º	1024 cable incremental encoder, resolution ±0.088 º 2500 cable incremental encoder, resolution ±0.022 º 17-bit absolute encoder (A4I), resolution ±0.0027º 19-bit absolute encoder (A8), resolution ±0.0007º IGS512 gear magnetic resistance encoder, resolution ±0.0055º, HEIDENHAIN 1024 magnetic grid encoder, resolution ＜±0.00005 º
I	**Confirm the motor type**	Confirm the motor type according to the GSK servo motor type-table	
6	**Confirm the servo drive unit type**	Confirm the servo unit type based upon the type-selecting table 1.3.3, 1.3.4, 1.3.5 and 1.3.6	

The resolution does not equal to the eventual positioning accuracy due to the mechanical and assemble precision of machine tool.

1.3.2 Order Type Example

1. GR-L series servo equipment (including the SJT series AC servo motor) integrated order type

GR-L Servo drive unit type — SJT AC servo motor type

For example: GR2030T-LA1—110SJT-M040D (A4I)

Explanation: Order the GR2030T-LA1 AC servo drive unit and matched with the 110SJT-M040D (A4I) AC servo motor; the accessory is standard configuration (Refer to 1.3.5)

GR servo drive unit type —（Servo motor type）

For example: GR2030T-LA1—(110SJT-M040D(A4I)) or GR3075Y-LP2—(ZJY208-7.5BM-B5LY1)

Explanation: Only order servo drive unit; the factory parameter is configured based upon the servo motor inside the bracket; the accessory is the optional one (Refer to 1.3.5).

1.3.3 Option-Type Table of SJT Series Servo Motor Matching with GR2000T-LA1 Series Product

Servo Drive Type	Servo Motor Parameter					
	Motor Type	Rated Power	Rated Current	Rated Torque	Rated Speed	Encoder
GR2019T-LA1	80SJTA-M024C(A4I)	0.5kW	3A	2.4N·m	2000r/min	Absolute 17bit
GR2019T-LA1	80SJTA-M024E(A4I)	0.75kW	4.8A	2.4N·m	3000r/min	Absolute 17bit
GR2019T-LA1	80SJTA-M032C(A4I)	0.66kW	5A	3.2N·m	2000r/min	Absolute 17bit
GR2030T-LA1	80SJTA-M032E(A4I)	1.0kW	6.2A	3.2N·m	3000r/min	Absolute 17bit
GR2030T-LA1	110SJT-M040D(A4I)	1.0kW	4.5A	4N·m	2500r/min	Absolute 17bit
GR2030T-LA1	110SJT-M040E(A4I)	1.2 kW	5A	4N·m	3000r/min	Absolute 17bit
GR2045T-LA1	110SJT-M060D(A4I)	1.5kW	7A	6N·m	2500r/min	Absolute 17bit
GR2045T-LA1	110SJT-M060E(A4I)	1.8kW	8A	6N·m	3000r/min	Absolute 17bit
GR2025T-LA1	130SJT-M040D(A4I)	1.0kW	4A	4N·m	2500r/min	Absolute 17bit
GR2030T-LA1	130SJT-M050D(A4I)	1.3kW	5A	5N·m	2500r/min	Absolute 17bit
GR2045T-LA1	130SJT-M050E(A4I)	1.57 kW	7.2A	5N·m	3000r/min	Absolute 17bit
GR2030T-LA1	130SJT-M060D(A4I)	1.5kW	6A	6N·m	2500r/min	Absolute 17bit
GR2045T-LA1	130SJT-M060E(A4I)	1.88 kW	7.8A	6N·m	3000r/min	Absolute 17bit
GR2045T-LA1	130SJT-M075D(A4I)	1.88kW	7.5A	7.5N·m	2500r/min	Absolute 17bit
GR2050T-LA1	130SJT-M075E(A4I)	2.36 kW	9.9A	7.5N·m	3000r/min	Absolute 17bit
GR2030T-LA1	130SJT-M100B(A4I)	1.5kW	6A	10N·m	1500r/min	Absolute 17bit
GR2050T-LA1	130SJT-M100D(A4I)	2.5kW	10A	10N·m	2500r/min	Absolute 17bit
GR2050T-LA1	130SJT-M150B(A4I)	2.3kW	8.5A	15N·m	1500r/min	Absolute 17bit
GR2075T-LA1	130SJTE-M150D(A4I)	3.9kW	14.5A	15N·m	2500r/min	Absolute 17bit
GR2075T-LA1	175SJT-M120E(A4I)	3kW	13A	9.6N·m	3000r/min	Absolute 17bit

Servo Drive Type	Servo Motor Parameter					
	Motor Type	Rated Power	Rated Current	Rated Torque	Rated Speed	Encoder
GR2075T-LA1	175SJT-M150B(A4I)	2.4kW	11A	15N·m	1500r/min	Absolute 17bit
GR2075T-LA1	175SJT-M150D(A4I)	3.1kW	14A	12N·m	2500r/min	Absolute 17bit
GR2075T-LA1	175SJT-M180B(A4I)	2.8kW	15A	18N·m	1500r/min	Absolute 17bit
GR2100T-LA1	175SJT-M180D(A4I)	3.8kW	16.5A	14.5N·m	2500r/min	Absolute 17bit
GR2100T- LA1	175SJT-M220B(A4I)	3.5kW	17.5A	22N·m	1500r/min	Absolute 17bit
GR2100T- LA1	175SJT-M220D(A4I)	4.5kW	19A	17.6N·m	2500r/min	Absolute 17bit
GR2100T-LA1	175SJT-M300B(A4I)	4.7kW	24A	30N·m	1500r/min	Absolute 17bit
GR2100T-LA1	175SJT-M300D(A4I)	6kW	27.5A	24N·m	2500r/min	Absolute 17bit
GR2100T-LA1	175SJT-M380B(A4I)	6 kW	29 A	38 N·m	1500 r/min	Absolute 17bit

The motor optional configuration with the power-down brake is consistent with the one without power-down, for example: the standard type of the 175SJT-M Z 180D (A4I) is consistent with the 175SJT-M180D (A4I); it is suitable for the following standard type.

1.3.4 Option-type Table of SJT Series Servo Motor Matching with GR3000T-LA1 Series Product

Servo Drive Type	Servo Motor Parameter					
	Motor Type	Rated Power	Rated Current	Rated Torque	Rated Speed	Encoder
GR3075T-LA1	175SJT-M380BH(A4I)	6kW	15A	38N·m	1500r/min	Absolute 17bit
GR3148T-LA1	175SJT-M380DH(A4I)	7.9kW	26A	30N·m	2500r/min	Absolute 17bit
GR3100T-LA1	175SJT-M500BH(A4I)	7.8kW	20A	50N·m	1500r/min	Absolute 17bit
GR3150T-LA1	175SJT-M500DH(A4I)	10.5kW	33A	40N·m	2500r/min	Absolute 17bit

1.3.5 Option-type Table of ZJY Series Spindle Servo Motor Matching with GR3000Y-LP2, GR4000Y-LP2 Series Product

Servo Drive Type	Adapted Motor Type	Main Parameter of Spindle Motor					
		Rated Power	Rated Torque	Rated Speed	Max. Speed	Rated Current	Standard-configuration Encoder
GR3048Y-LP2 GR4048Y-LP2	ZJY182-1.5BH	1.5kW	9.5 N·m	1500 rpm	10000rpm	7.3 A	1024 resolution incremental
	ZJY182-2.2BH	2.2kW	14 N·m	1500 rpm	10000rpm	7.5 A	1024 resolution incremental
	ZJY182-2.2CF	2.2kW	10.5 N·m	2000 rpm	12000 rpm	9A	1024 resolution incremental
	ZJY208A-2.2AM	2.2kW	21 N·m	1000rpm	7000rpm	6.7A	1024 resolution incremental

Servo Drive Type	Adapted Motor Type	Main Parameter of Spindle Motor					
		Rated Power	Rated Torque	Rated Speed	Max. Speed	Rated Current	Standard-configuration Encoder
	ZJY208A-2.2BH (ZJY208-2.2BM)	2.2kW	14.5 N·m	1500rpm	10000rpm	8.9A	1024 resolution incremental
GR3050Y-LP2 GR4050Y-LP2	ZJY182-3.7BL	3.7kW	24 N·m	1500rpm	4500rpm	10.4A	1024 resolution incremental
	ZJY182-3.7BH	3.7kW	24 N·m	1500 rpm	10000rpm	15.5 A	1024 resolution incremental
	ZJY182-3.7DF	3.7kW	14 N·m	2500 rpm	12000rpm	13A	1024 resolution incremental
	ZJY208A-3.7WL	3.7kW	47N·m	750rpm	4500rpm	11.3A	1024 resolution incremental
	ZJY208A-3.7AM	3.7kW	35 N·m	1000rpm	7000rpm	10.2A	1024 resolution incremental
	ZJY208A-3.7BM (ZJY208-3.7BH)	3.7kW	24 N·m	1500rpm	7000rpm	8.9A	1024 resolution incremental
	ZJY208A-3.7BH	3.7kW	24 N·m	1500rpm	10000rpm	12.6A	1024 resolution incremental
	ZJY208A-5.5BM (ZJY208-5.5BH)	5.5kW	35 N·m	1500rpm	7000rpm	13.7A	1024 resolution incremental
GR3075Y-LP2 GR4075Y-LP2	ZJY182-5.5CF	5.5kW	26.2 N·m	2000 rpm	12000 rpm	19A	1024 resolution incremental
	ZJY182-5.5EH	5.5kW	17.5 N·m	3000rpm	10000rpm	17A	1024 resolution incremental
	ZJY208A-5.5BH	5.5kW	35 N·m	1500rpm	10000rpm	18.4A	1024 resolution incremental
	ZJY208A-5.5AM	5.5kW	53 N·m	1000rpm	7000rpm	16.3A	1024 resolution incremental
	ZJY208A-7.5BM (ZJY208-7.5BH)	7.5kW	48 N·m	1500rpm	7000rpm	18.4A	1024 resolution incremental
	ZJY265A-5.5WL	5.5kW	70 N·m	750rpm	4500rpm	16.3A	1024 resolution incremental
	ZJY265A-7.5BM	7.5kW	49 N·m	1500rpm	7000rpm	18A	1024 resolution incremental
GR3100Y-LP2 GR4100Y-LP2	ZJY208A-7.5BH	7.5kW	48 N·m	1500rpm	10000rpm	22.4A	1024 resolution incremental
	ZJY265A-7.5WL	7.5kW	95.5 N·m	750rpm	4500rpm	21.4A	1024 resolution incremental
	ZJY182-7.5EH	7.5kW	24 N·m	3000rpm	10000rpm	21A	1024 resolution incremental
	ZJY265A-7.5AM	7.5kW	72 N·m	1000rpm	7000rpm	21A	1024 resolution incremental
	ZJY265A-7.5BH	7.5kW	48 N·m	1500rpm	10000rpm	22.4A	1024 resolution incremental
	ZJY265A-11BM	11kW	72 N·m	1500rpm	7000rpm	26A	1024 resolution incremental
GR3148Y-LP2 GR4148Y-LP2	ZJY265A-11AM	11kW	105 N·m	1000rpm	7000rpm	31A	1024 resolution incremental
	ZJY265A-11WL	11kW	140 N·m	750 rpm	4500 rpm	30A	1024 resolution incremental
	ZJY265A-11BH	11kW	70 N·m	1500rpm	10000rpm	30A	1024 resolution incremental
GR3150Y-LP2 GR4150Y-LP2	ZJY265A-15AM	15kW	143 N·m	1000rpm	7000rpm	48.3A	1024 resolution incremental
	ZJY265A-15BM	15kW	98 N·m	1500rpm	7000rpm	35A	1024 resolution incremental

Servo Drive Type	Adapted Motor Type	Main Parameter of Spindle Motor					
		Rated Power	Rated Torque	Rated Speed	Max. Speed	Rated Current	Standard-configuration Encoder
	ZJY265A-15BH	15kW	95 N·m	1500rpm	10000rpm	40.7	1024 resolution incremental
	ZJY265A-18.5BM	18.5kW	118 N·m	1500rpm	7000rpm	48.7A	1024 resolution incremental
GR3198Y-LP2 GR4198Y-LP2	ZJY265A-22BM	22kW	140 N·m	1500rpm	7000rpm	58A	1024 resolution incremental

1.3.6 Option-type Table of ZJY Spindle Servo Motor Matching with GR2000Y-LP2 Series Product

Servo Drive Type	Adapted Motor Type	Main Parameter of Spindle Motor					
		Rated Power	Rated Power	Rated Power	Rated Power	Rated Power	Rated Power
GR2050Y-LP2	ZJY182-2.2BH-L	2.2kW	14 N·m	1500 rpm	10000rpm	13 A	1024 resolution incremental
GR2075Y-LP2	ZJY208A-3.7BH-L	3.7kW	24 N·m	1500 rpm	10000rpm	22 A	1024 resolution incremental
	ZJY208A-3.7AM-L	3.7kW	35 N·m	1000rpm	7000rpm	17.5A	1024 resolution incremental
GR2100Y-LP2	ZJY182-3.7BH-L	3.7kW	24 N·m	1500 rpm	10000rpm	26A	1024 resolution incremental
	ZJY208A-5.5AM-L	5.5kW	53 N·m	1000 rpm	7000rpm	28.2 A	1024 resolution incremental
	ZJY208A-5.5BH-L	5.5kW	35 N·m	1500 rpm	10000rpm	31.8A	1024 resolution incremental
	ZJY208A-7.5BM-L	7.5kW	48 N·m	1500rpm	7000rpm	29.4A	1024 resolution incremental

1.3.7 Product Factory Equipped Accessory

- **GR2000T-L, GR3000T-L series product standard accessory list**

Accessory Name	Specification Type	Q'ty	Accessory Explanation	Remark
Motor encoder	-00-761B	1 pc	Standard length 3m, CN2 interface connects to 110/130/175 flange motor (Aviation socket outlet, encoder suffix A4I).	Select 1pc corresponding cable based upon the ordered motor
	-00-761E	1 pc	Standard length 3m, CN2 interface connects to 80 flange motor (Cable direct outlet, encoder suffix A4I).	
	-00-761K	1 pc	Standard length 3m, CN2 interface connects to 80 flange motor (Aviation socket outlet, encoder suffix A4I).	
Motor power cable	00-765* (Note 1)	1 pc	Standard length:3m	It adapts based upon the rated current of ordered motor.
Product user manual	*GR-L Series AC Servo Drive Unit User Manual*	1 copy	Following with the technical document	

4-bit plug	BCF 3.81/04/180F	1 pc	CN7 interface plug	
Aluminum encloser brake resistance	Aluminum brake resistance		1m cable	Refer to the *Appendix C* for the specification, quantity and terminal
GSKLink communication cable provides (Note 2) with CNC product.				

Note 1: "*" is undetermined suffix letter which is corresponding to the motor power cable specification.

Note 2: At present, the CNC system that supports to the GSK-Link spot bus includes GSK988☐ (☐: TA, TB, MDs, MD etc.), which can be adapted with GR2000T-L, GR2000Y-L, GR3000T-L and GR3000Y-L, GR4000Y-L series servo drive unit.

- **GR2000T-L, GR3000T-L series product optional accessory list**

Accessory name	Specification type	Q'ty	Accessory explanation	Remark
Aluminum enclosure brake resistance	RXLG300W30RJJ	1 pc	300W /30Ω, GR2025/GR2030 optionally matched with the external resistance, 0.5m connection cable included.	It can be optionally matched when the rapid start or loading inertia is more than the one of the 5-time motor rotor.
Aluminum enclosure brake resistance	RXLG500W22RJJ	1pc	500W /22Ω, GR2045/GR2050 optionally matched the external brake resistance, 0.5m connection cable included.	

- **GR2000Y-L, GR3000Y-L, GR4000Y-L series product standard accessory list**

Accessory name	Specification type	Q'ty	Accessory explanation	Remark
Motor encoder cable	-00-761C	1 pc	Standard length 3m, matching with 208/265 motor (26pin high-density head-15 female aviation plug)	Select 1 piece cable based upon the order motor
	-00-761G	1 pc	Standard length 3m, matching with 208/265 motor (26pin high-density head-1- female round plug)	
	-00-761F	1 pc	Standard length 3m, matching with ZJY182 motor (26pin high-density head-12 pin connector)	
Motor power cable	00-765*	1 pc	Standard length: 3m	Matching with the rated current of the order motor
Product user manual	*GR-L Series AC Servo Drive Unit User Manual*	1 copy	Following with the technical document	
4-bit plug	BCF 3.81/04/180F	1 pc	CN7 interface plug	
Aluminum enclose brake resistance	Aluminum enclose brake resistance		1m cable	Refer to the *Appendix C* for specification, quantity and terminal

20-bit high density plug	MDR-20	1 set	CN3 interface plug	This plug is provided with cable instead of offering alone, simultaneously, the user selects the spindle encoder.
Fan cable	-00-768A		Standard length 3m, for 208/265 flange size spindle servo motor fan	Optional one according to the ordered motor
	-00-768E		Standard length 3m, for 182 flange size spindle servo motor fan	
GSK-Link communication cable provides with the CNC product.				

- **GR2000Y-L , GR3000Y-L, GR4000Y-L series product optional accessory list**

Accessory name	Specification type	Q'ty	Accessory explanation	Remark
Spindle encoder cable	-00-762B	1 pc	Standard 3m long, REP incremental spindle encoder	The DR-20 plug of the CN3 interface does not provide any more after the optional cable is selected.
Spindle encoder cable	-00-762F	1 pc	Standard 3m long, TAMAGAWA magnetic-resistance encoder (TAMAGAWA agreement)	
Spindle encoder cable	-00-762G	1 pc	Standard 3m long, HEIDENHAIN magnetic grid encoder matching with ERM2410 reading head (EnDat2.2)	
Spindle encoder cable	-00-762E	1 pc	Standard 3m long, User self-equipped encoder	

Notice	① It is very essential to write the type and quantity of the order product (servo drive unit, servo motor, insulation transformer and CNC), and also, it is very important to note the special version supply or optional matching function requirement ② It is very essential to write the type, specification and quantity of the non-standard accessory (for example: special cable or cable length, cable manufacture technique, etc.) ; Otherwise, it will provide according to the standard accessory. ③ It is very essential to write the codes, such as the shaft extension, structure type and outlet method of the servo motor. Special requirement should be indicated on order.

CHAPTER TWO INSTALLATION

2.1 Installation Environment Requirement

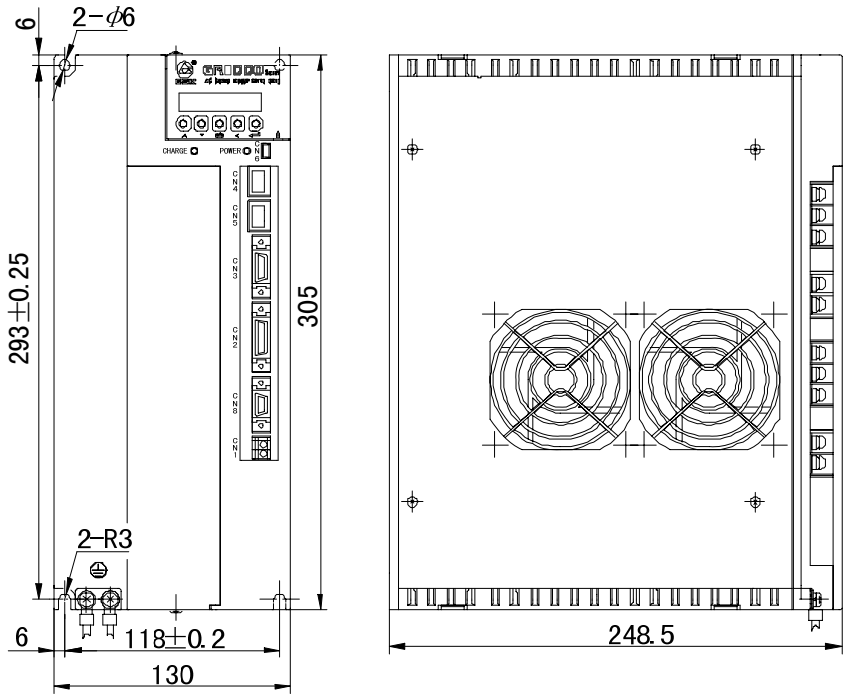
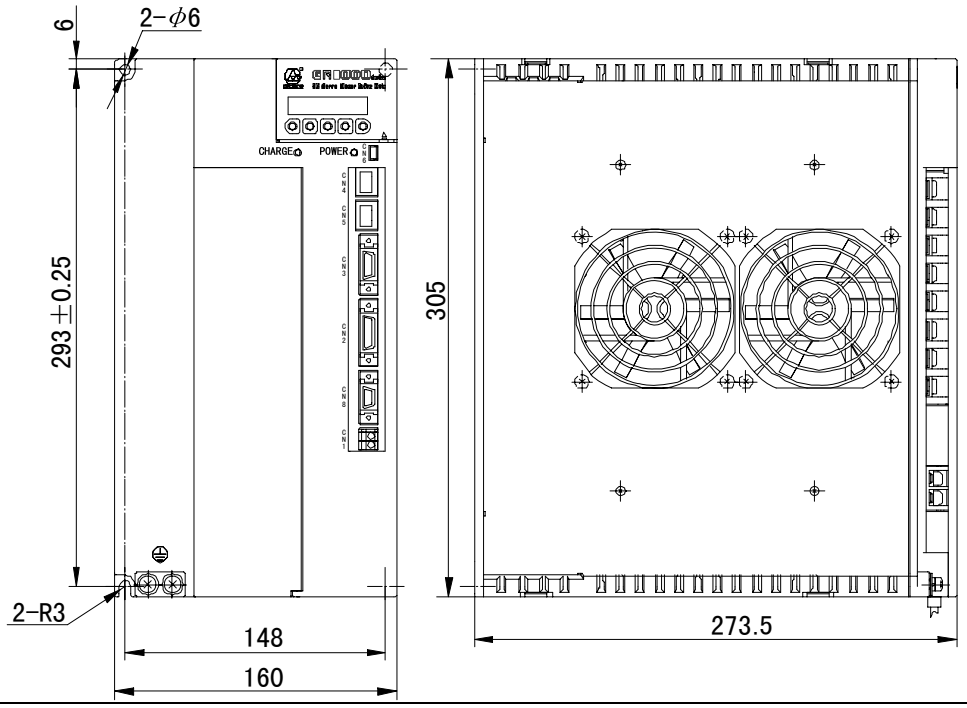
The installation environment condition of the GR-L series bus servo drive unit makes directly effective to the normal usage of the function and its life-span; it is very necessary to install based upon the following steps.

Notice	■ **It is necessary to install at the place where without the water-drop, steam, dust and oil.** ■ **Pay attention to the ventilation, damp-proof and dust in the installation place.** ■ **Do not install it on the flammable surface or neighbor, avoid the accident fire hazard.** ■ **The installation situation should be convenient for maintaining and inspecting.**

Item	Index
Usage temperature	0℃～40℃
Storage & transportation temperature	-40℃～70℃
Usage humidity	30%～95% (No condensation)
Storage & transportation humidity	≤95%（40℃）
Atmosphere environment	There is no corrosive gas, flammable gas, oil mist or dust etc. in the controllable cabinet.
Altitude height	Altitude under 2000m
Vibration	≤0.6G(5.9m/s^2)
Atmosphere pressure	86kPa～106kPa

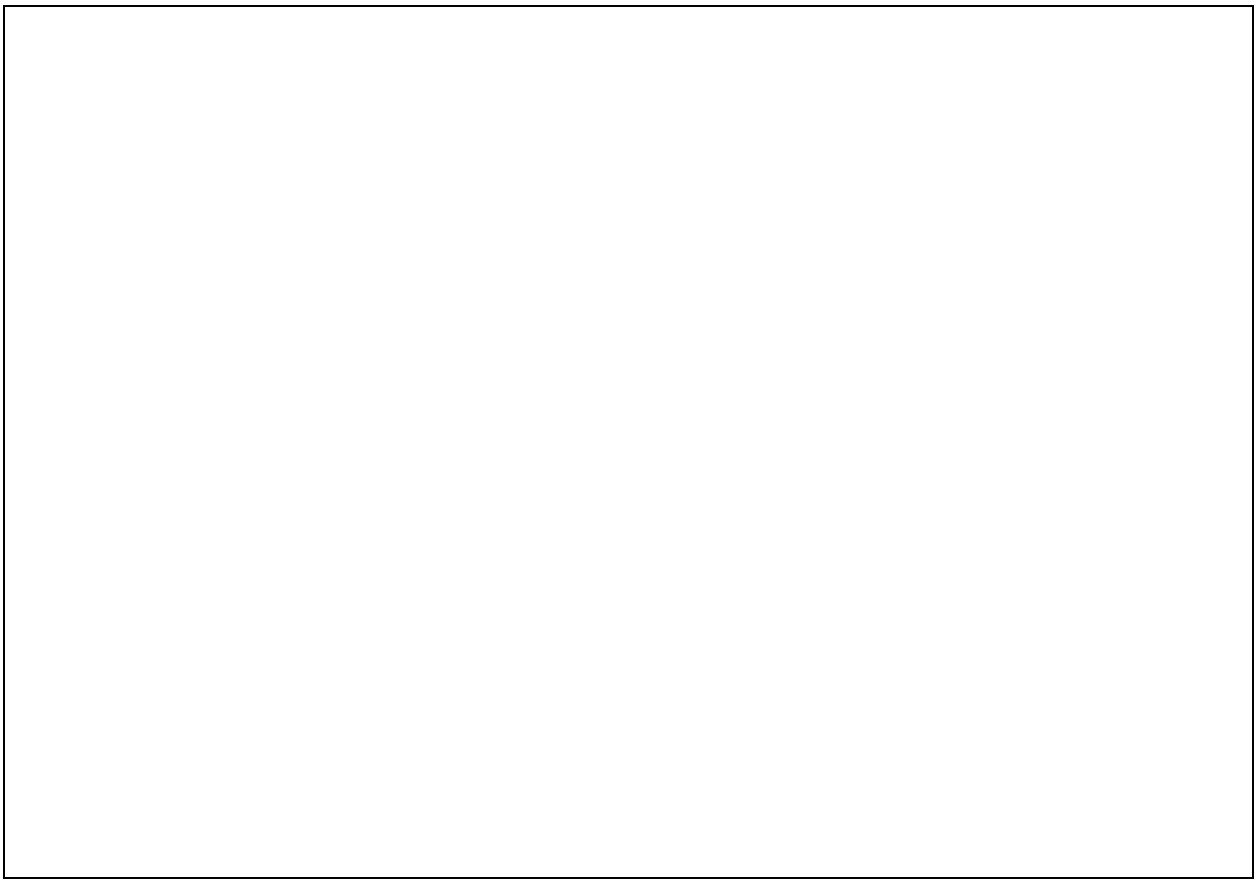
2.2 Installation Dimension

The suitable product for the right figure: GR2025T-L; GR2030T-L; GR2045T-L. (Unit: mm)	
The suitable product for the right figure: GR2050T-L; GR2050Y-L GR3048T-L; GR3048Y-L; GR4048Y-L. (Unit: mm)	
The suitable product for the right figure: GR2075T-L; GR2075T-L; GR3050T-L; GR3050Y-L; GR4050Y-L. (Unit: mm)	

The suitable product for the right figure: GR2100T-L; GR2100Y-L; GR3075T-L; GR3075Y-L; GR4075Y-L. (Unit: mm)	
The suitable product for the right figure: GR3100T-L; GR3100Y-L; GR4100Y-L; GR3148T-L; GR3148Y-L; GR4148Y-L. (Unit: mm)	

The suitable product for the right figure: GR3150T-L; GR3150Y-L; GR4150Y-L; GR3198T-L; GR3198Y-L and GR4198Y-L.

(Unit: mm)



2.3 Installation Interval

GR-L series servo drive units are adapted the baseplate mounting method, and its installation direction is vertical to the surface. The front of the servo drive unit should be put forward and the top should be upward when mounting. Note that it is necessary to keep adequate intervals around it.

Reserve the bigger intervals for the multi-servo unit installation interval as much as possible during the actual installation; guarantee the well heat-radiating condition.

To guarantee against the consecutive heating-up around the servo drive unit; keep the convection air for the electric cabinet.

The following figures are suggested the installation interval distance of the servo drive unit.

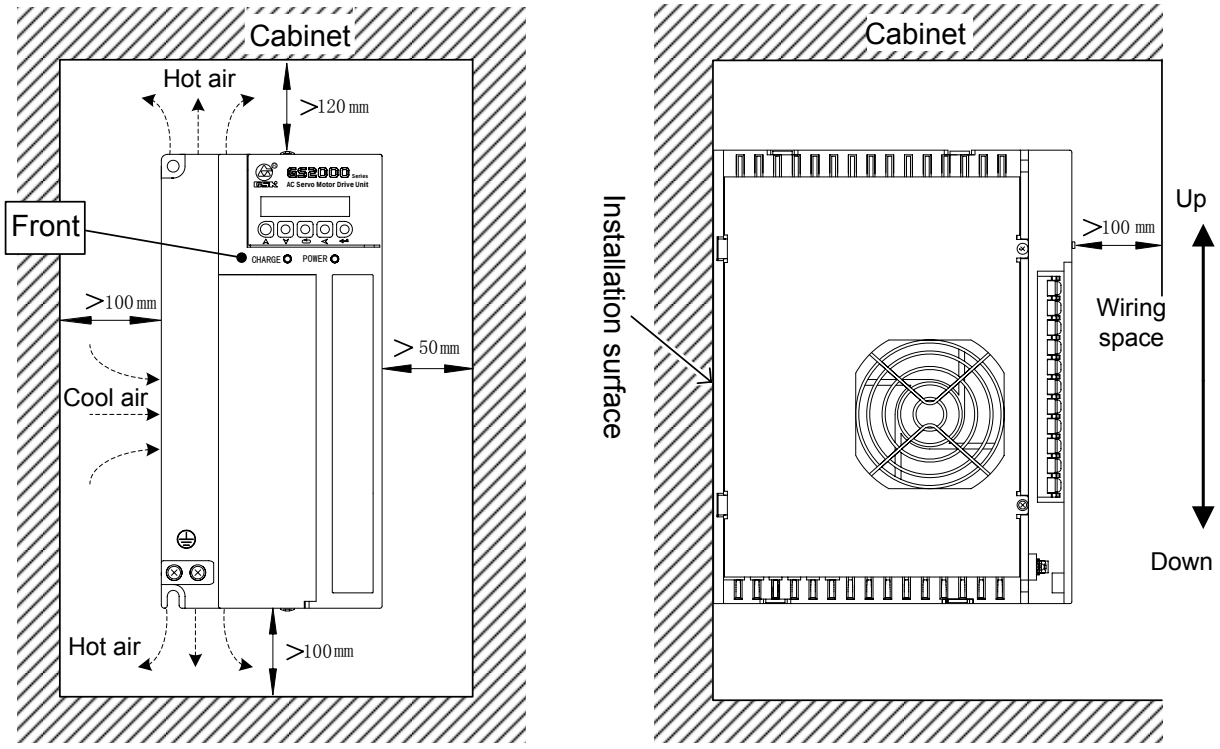


Fig. 2-1 The installation interval for 1 servo drive unit

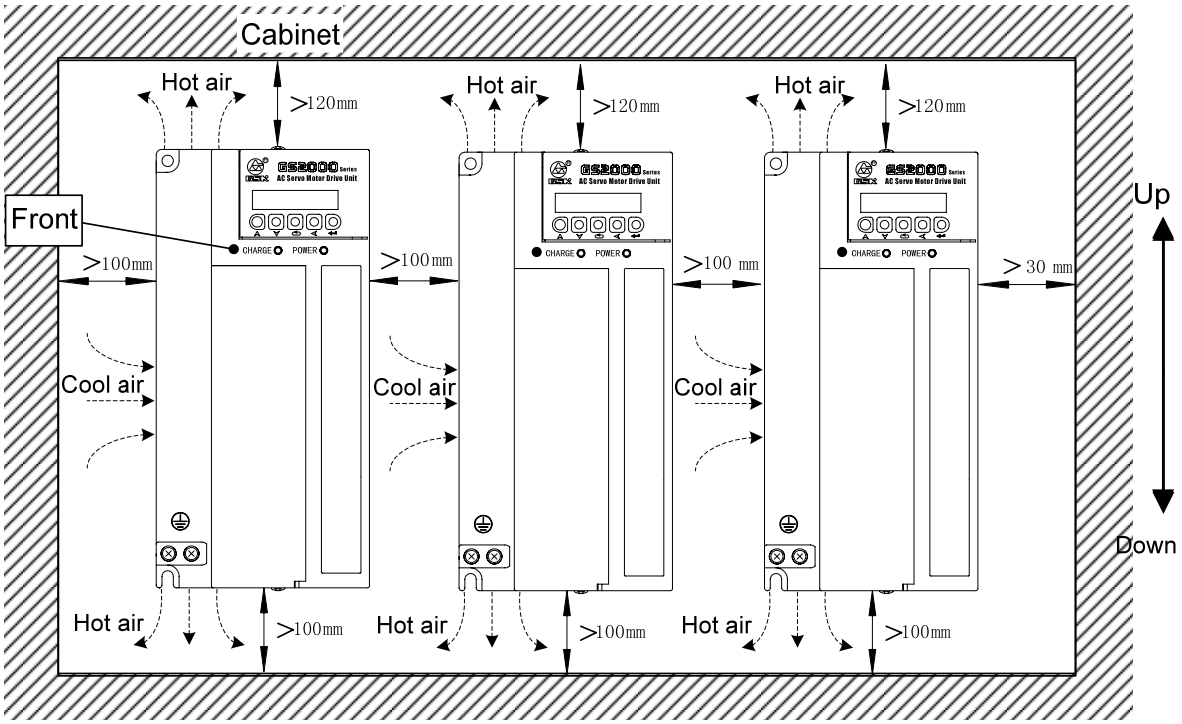


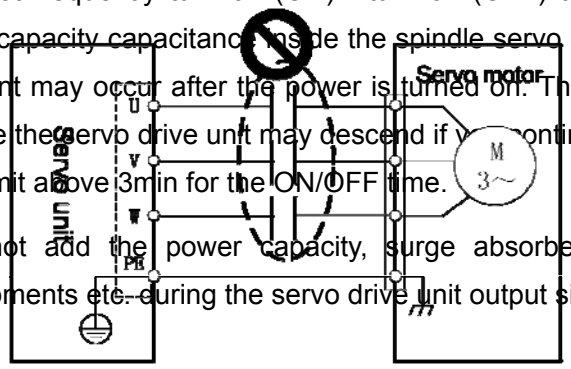
Fig. 2-2 The installation interval for multiple servo drive units

CHAPTER THREE CONNECTION

User should carefully read the following cautions and execute it according to its requirements; it will ensure that the operation is safe and successful.

Notice

- The wiring should be performed by the qualified professional personnel and correctly connected it based upon its related explanations.
- The wiring or inspection operation only can be performed after the servo drive unit is turned off for 5min by confirming that each main circuit terminal is safe voltage for the grounding by multimeter; otherwise, the electric shock may occur.
- Confirm that the servo drive unit and servo motor are correctly grounded.
- Depart from the sharpened material and do not drag the cable by force during wiring; otherwise, the electric shock or fault circuit may issue.
- Do not cross the main circuit wiring and signal cable over the same pipeline and bind them together. The former should be separated from the latter or cross each other; its interval distance should be more than 30cm to prevent the strong circuit from interfering for the signal cable, so that the servo unit will not be normally operated.
- Do not frequently turn on (ON) / turn off (OFF) the power, because there is high-capacity capacitance inside the spindle servo drive unit; the strong charge current may occur after the power is turned on. The component's performance inside the servo drive unit may descend if you continually ON/OFF; it is better to intermit above 3min for the ON/OFF time.



- Do not add the power capacity, surge absorber and wireless noisy filter equipments etc. during the servo drive unit output side and servo motor.

- The main circuit wiring and signal cable can not close to the heat-radiating

	equipment and motor, so that it will be reduce its insulation performance due to the heating. ■ The terminal protective cover should be closed to avoid electric shock after the main circuit connection is performed.

3.1 Peripheral Equipment Connection

The usage of the servo unit needs to equip some peripheral equipment, selecting the correct peripheral equipment can be confirmed the stable operation for the servo unit and servo motor, as well the life span of the servo unit can be prolonged.

It is necessary to note the peripheral equipment in the following figure:

- The equipment in the virtual frame is refined by user, and the equipment in the actual frame can be purchased from GSK.
- Refer to the selection of the breaker, AC filter, insulation transformer, AC reactor and AC contactor (Appendix B).
- The peripheral equipment marks with “Essential Install” in the figure, which can be not only guaranteed the user’s safety and reliability for servo equipment, but also greately reduced the loss in the user equipment fault.
- The peripheral equipment mars with “Optional Install” in the figure, which can be guaranteed the stability for the servo unit when the user power ambient is poor.

Prevent the electric shock hazard! Notice the high temperature! Avoid the remains voltage; it can be disassembled after the power is cut off for 5min.

The sensitive leakage current of the servo unit is bigger, because it is the high frequency equipment; it is necessary to reliably and protectively grounding, and the grounding resistance should be less than 4Ω.

3.1.1 Peripheral Equipment Connection of GR2000T-L Servo Drive Unit

- **The single peripheral equipment connection figure for the GR2025T-L, GR2030T-L, GR2045T-L series**

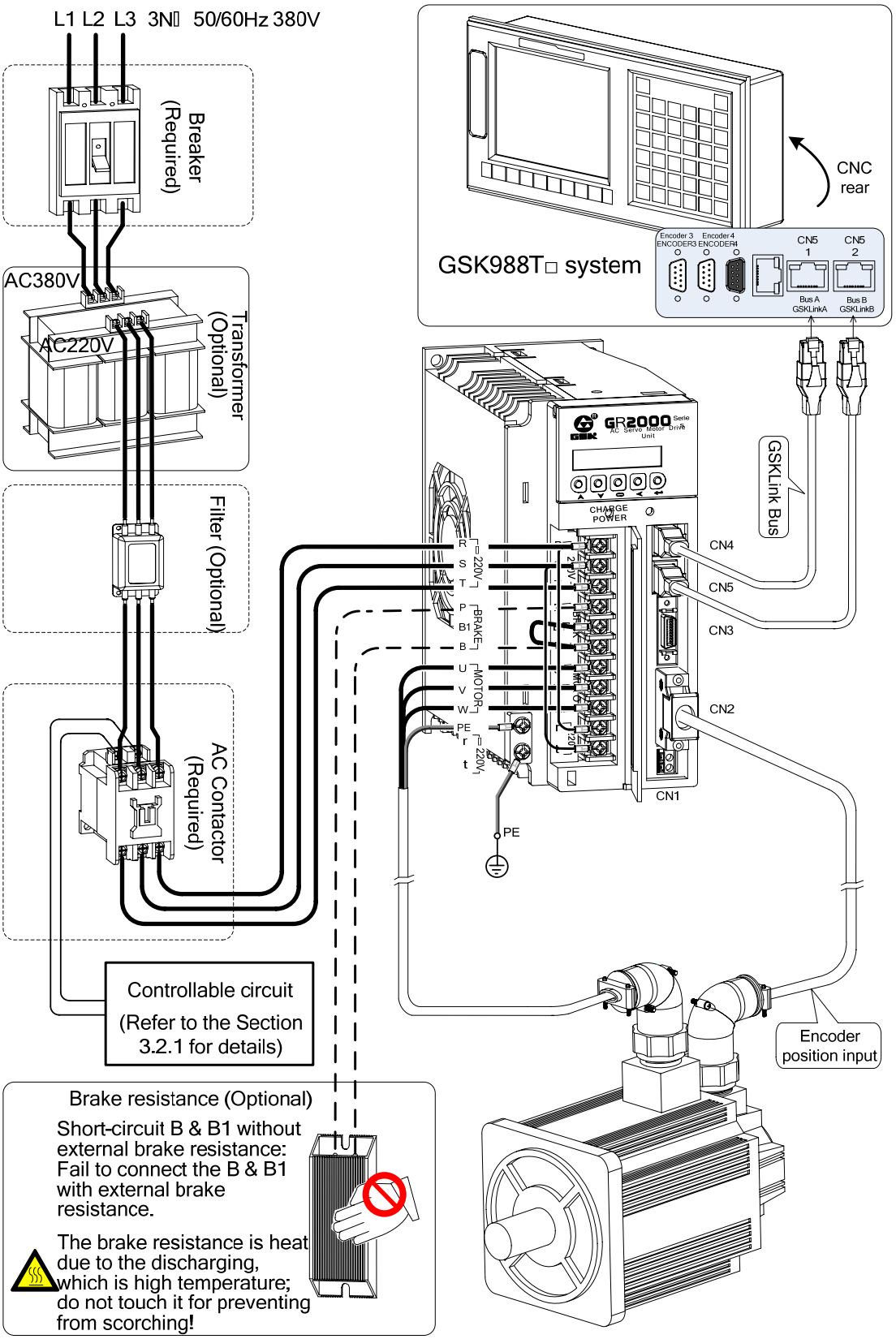


Fig. 3-1 (a) Single peripheral equipment connection of GR2000T-L

- **The single peripheral equipment connection figure for the GR2050T-L, GR2075T-L, GR2100T-L series**

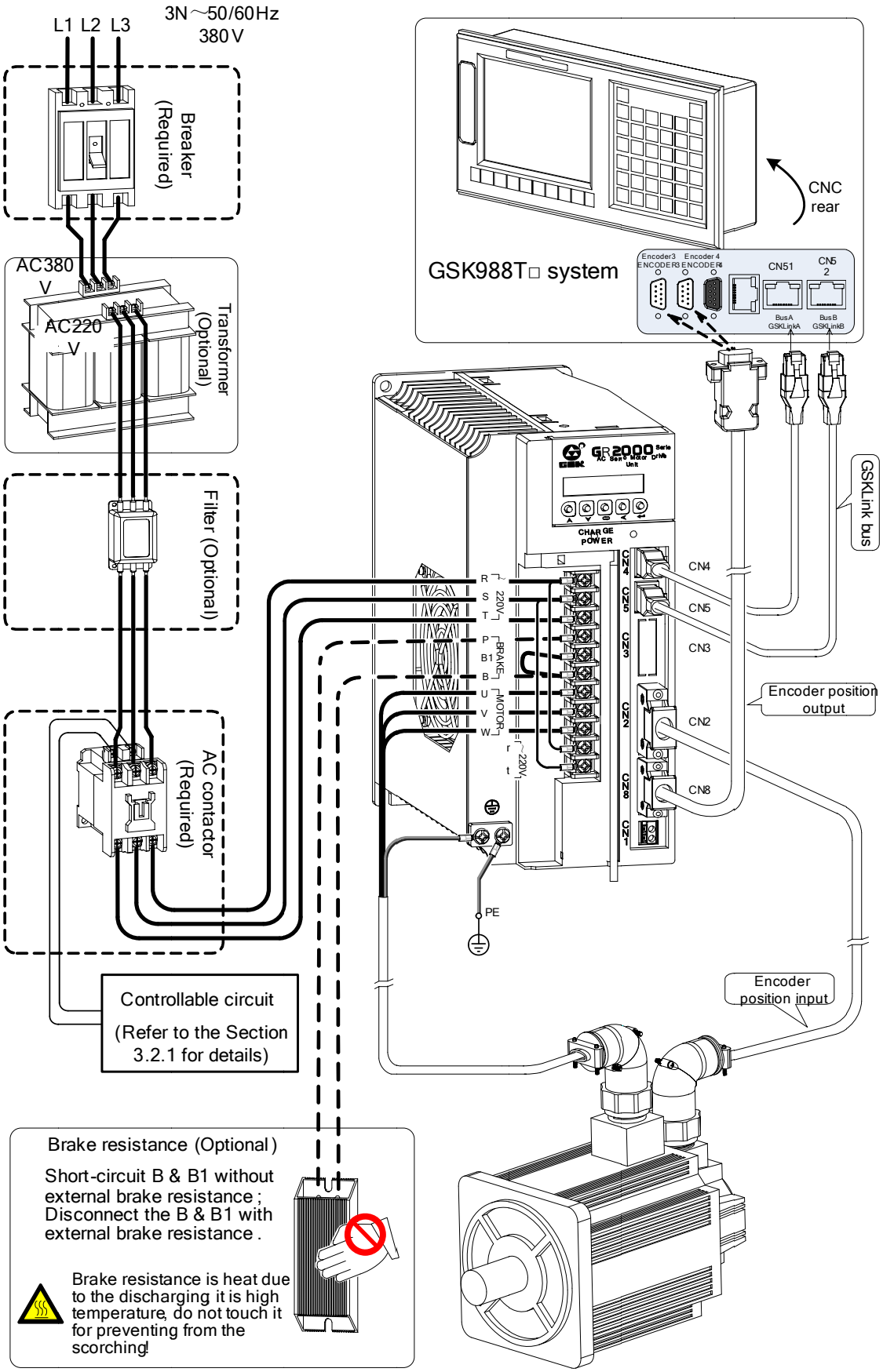


Fig. 3-1 (b) Single peripheral equipment connection of GR2000T-L

3.1.2 Peripheral Equipment Connection of GR3000T-L Servo Drive Unit

- **Single peripheral equipment connection figure of GR3000T-L series**

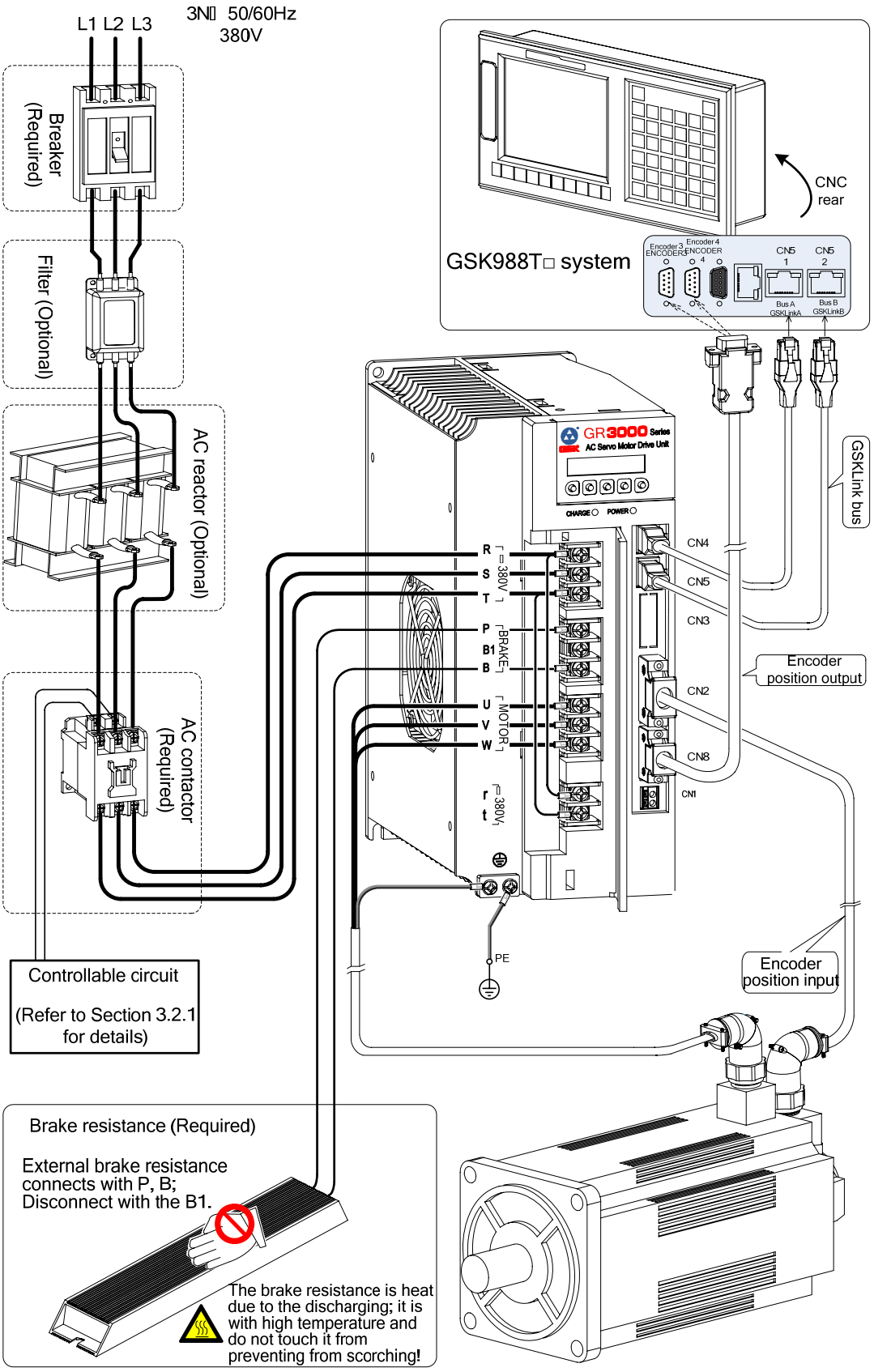


Fig. 3-2 Single peripheral equipment connection of GR3000T-L

3.1.3 Peripheral Equipment Connection of GR-L Spindle Servo Drive Unit

- **Single peripheral equipment connection figure of GR3000Y-L series**

  The peripheral equipment connection figure of the GR2000Y-L and GR4000Y-L are shown below; it is only need to change the power level input.

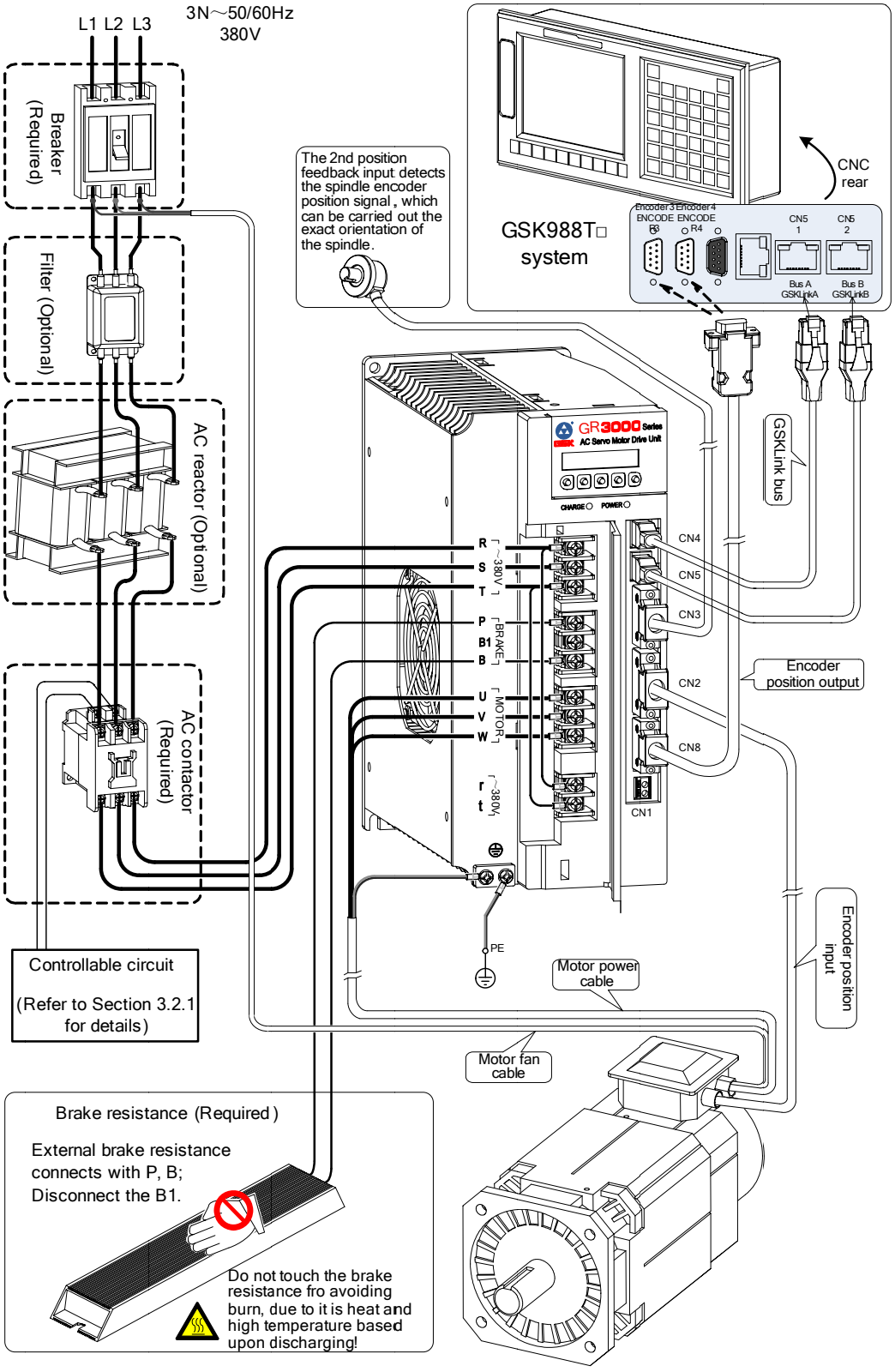


Fig. 3-3 Single spindle servo drive unit peripheral equipment connection of GR3000Y-L

3.1.4 Product Connection for Multi-GSK-Link Spot Bus

- **The multi-GSKLink bus connection of GR-L type (Only describe the bus connection and regardless of the other connections.)**

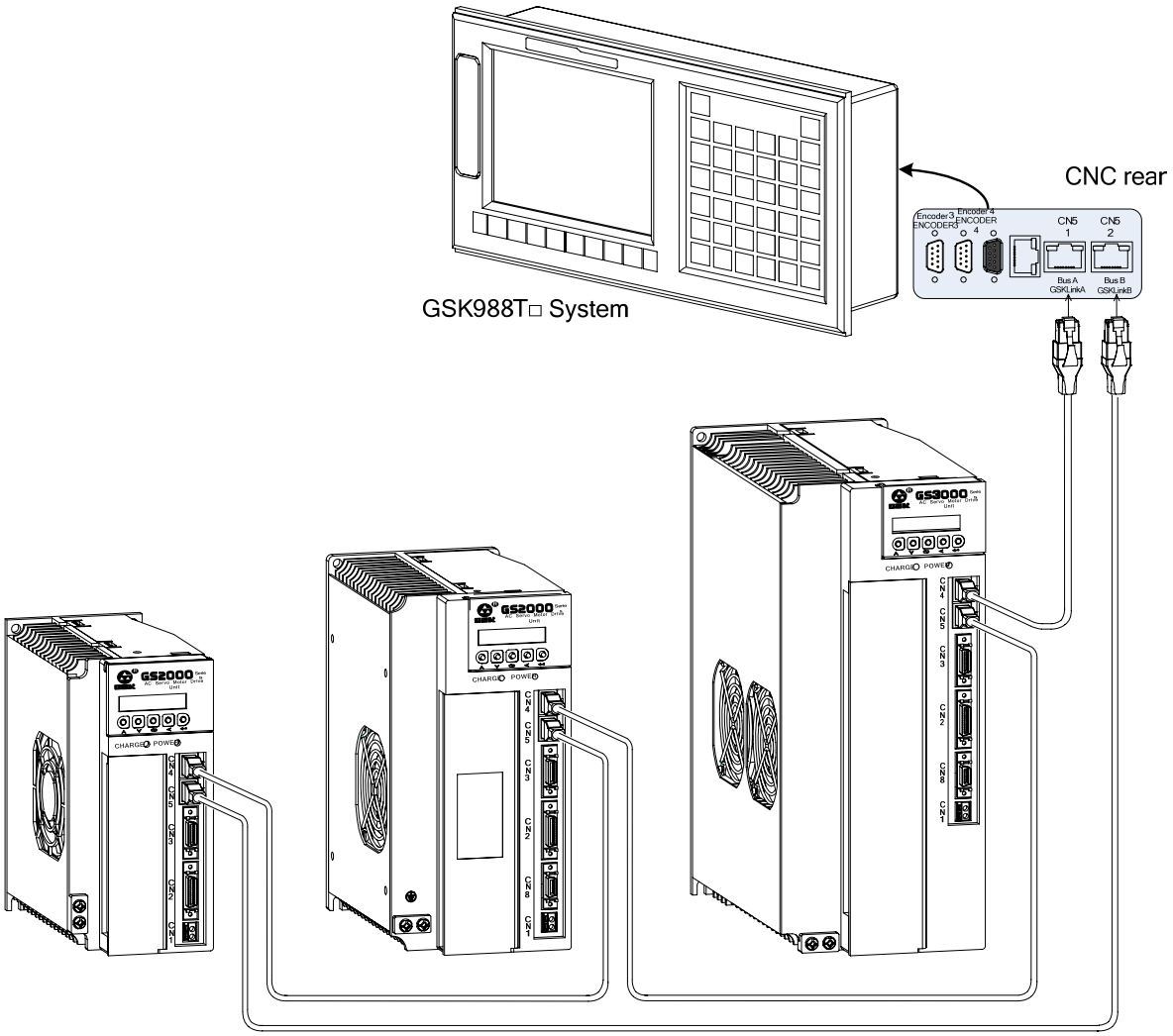


Fig. 3-4 GSKLink bus connection figure for multi servo drive units

3.2 Main Circuit Wiring

3.2.1 Function and Wiring of Main Circuit Connection Terminal

Terminal Mark	Name	Description	
R, S, T	AC power input terminal	GR2000	3-pahse AC220V（85%～110%） 50/60Hz
		GR3000	3-pahse AC380V（85%～110%） 50/60Hz
		GR4000	3-pahse AC440V（85%～110%） 50/60Hz
r, t	Controllable power	GR2000	Single-phase AC220V（85%～110%） 50/60Hz

		GR3000	Single-phase AC380V（85%～110%） 50/60Hz
		GR4000	Single-phase AC440V（85%～110%） 50/60Hz
U, V, W	3-phase AC output terminal	AC permanent magnetism synchronous motor	Be sure to correctly connect the U, V and W; otherwise, the motor may not normally operate.
		AC asynchronous motor	Be sure to correctly connect the U, V and W; otherwise, the motor may not normally operate. **Notice:** When configuring the spindle motor out of GSK, the motor may generate Err-27 alarm even correct connection, in this case, any 2-phase of U, V and W can be exchanged freely.
PE ⏚	Protective grounding terminal	It is connected with the power and motor grounding cables, and the protection grounding resistance should be less than 4Ω.	
P, B1, B	Brake resistance terminal Brake resistance for the dynamic brake	GR2025T GR2030T GR2045T GR2050T	The B1 and B2 should be performed by short-circuit when the internal brake resistance is connected. When the brake capacity is inadequate, the external brake resistance can be connected both P and B terminals; **simultaneously, cut off the connection between B1 and B.**
		Other types	Connect the external brake resistance both P and B terminals.

Main circuit terminal wiring of GR2000T-L

Product type	Adapted motor rated current I(A)	R, S, T, U, V, W		r, t		P, B1, B		PE	
		Terminal screw size φmm	Cable diameter mm^2	Terminal screw size φmm	Cable diameter mm^2	Terminal screw size φmm	Cable diameter mm^2	Terminal screw size φmm	Cable diameter mm^2
GR2025T-L	I≤4.5	3.5	1.0	3.5	1	3.5	1.5	3.5	1.0
GR2030T-L	4.5＜I≤6	3.5	1.0	3.5	1	3.5	1.5	3.5	1.0
GR2045T-L	6＜I≤7.5	3.5	1.5	3.5	1	3.5	2	3.5	1.5
GR2050T-L	7.5＜I≤10	3.5	1.5	3.5	1	3.5	2.5	4	1.5
GR2075T-L	10＜I≤15	4	2.5	4	1	4	2.5	5	2.5
GR2100T-L	15＜I≤20	6	2.5	4	1	6	4	5	2.5
GR2100T-L	20＜I≤29	6	4	4	1	6	4	5	4

Main circuit terminal wiring of GR3000T-L

Product type	Adapted motor rated current I(A)	R, S, T, U, V, W		r, t		P, B		PE	
		Terminal screw size φmm	Cable diameter mm^2	Terminal screw size φmm	Cable diameter mm^2	Terminal screw size φmm	Cable diameter mm^2	Terminal screw size φmm	Cable diameter mm^2
GR3048T	I≤7.5	3.5	1.0	3.5	1	3.5	2.5	4	1.0

GR3050T	7.5＜I≤10	4	1.5	4	1	4	2.5	5	1.5
GR3075T	10＜I≤15	6	2.5	4	1	6	2.5	5	2.5
GR3100T	15＜I≤20	6	2.5	4	1	6	4	6	2.5
GR3148T	20＜I≤27	6	4	4	1	6	4	6	4
GR3150T	27＜I≤34	6	6	4	1	6	4	6	6
GR3198T	34＜I≤45	6	6	4	1	6	4	6	6

Main circuit terminal wiring of GR2000Y-L

Product type	Adapted motor rated current I(A)	R, S, T, U, V, W		r, t		P, B		PE	
		Terminal screw size φmm	Cable diameter mm^2	Terminal screw size φmm	Cable diameter mm^2	Terminal screw size φmm	Cable diameter mm^2	Terminal screw size φmm	Cable diameter mm^2
GR2050Y	I≤10	3.5	1.5	3.5	1	3.5	2.5	4	1.5
GR2075Y	10＜I≤15	4	2.5	4	1	4	2.5	5	2.5
GR2100Y	15＜I≤29	6	4	4	1	6	2.5	5	4

Main circuit terminal wiring of GR3000Y-L and GR4000Y-L

Product type	Adapted motor rated current I(A)	R, S, T, U, V, W		r, t		P, B		PE	
		Terminal screw size φmm	Cable diameter mm^2	Terminal screw size φmm	Cable diameter mm^2	Terminal screw size φmm	Cable diameter mm^2	Terminal screw size φmm	Cable diameter mm^2
GR3048 GR4048	I≤8	3.5	1.0	3.5	1	3.5	2.5	4	1.0
GR3050 GR4050	8＜I≤15.5	4	1.5	4	1	4	2.5	5	1.5
GR3075 GR4075	15.5＜I≤20	6	2.5	4	1	6	2.5	5	2.5
GR3100 GR4100	20＜I≤27	6	4	4	1	6	4	6	4
GR3148 GR4148	27＜I≤34	6	6	4	1	6	4	6	6
GR3150 GR4150	34＜I≤40	6	8	4	1	6	4	6	8
GR3150 GR4150	40＜I≤49	6	10	4	1	6	4	6	10
GR3198 GR4198	49＜I≤60	6	10	4	1	6	4	6	10

3.2.2 Typical Wiring Example of Main Circuit

- **Main circuit wiring example of GR2000T-L series**

Fig. 3-5 Main circuit wiring of GR2000T-L series

Notice	● It is necessary to select the suitable breaker MCCB based upon the description in *Appendix B* if user refer to the abovementioned wiring. ● If two or more servo drive units are shared with one transformer, it is better to mount a breaker of each servo drive unit at the secondary transformer. ● The B1 and B terminals should be short-circuited when do not connect the external brake resistance; however, it must be cut off when connects. ● The external brake resistance surface temperature may extremely high when the servo drive unit is operated, so it is better to install a protective enclosure. ● The equipped motor power in our company has been marked U, V, W and PE wiring terminals, which should be connected with the one of the servo drive unit one by one; otherwise, the motor may not normally operate. ● Correctly connect the protective grounding terminal, and its grounding resistance should be less than or equals to 4Ω.

- **Main circuit wiring example of GR3000T-L series**

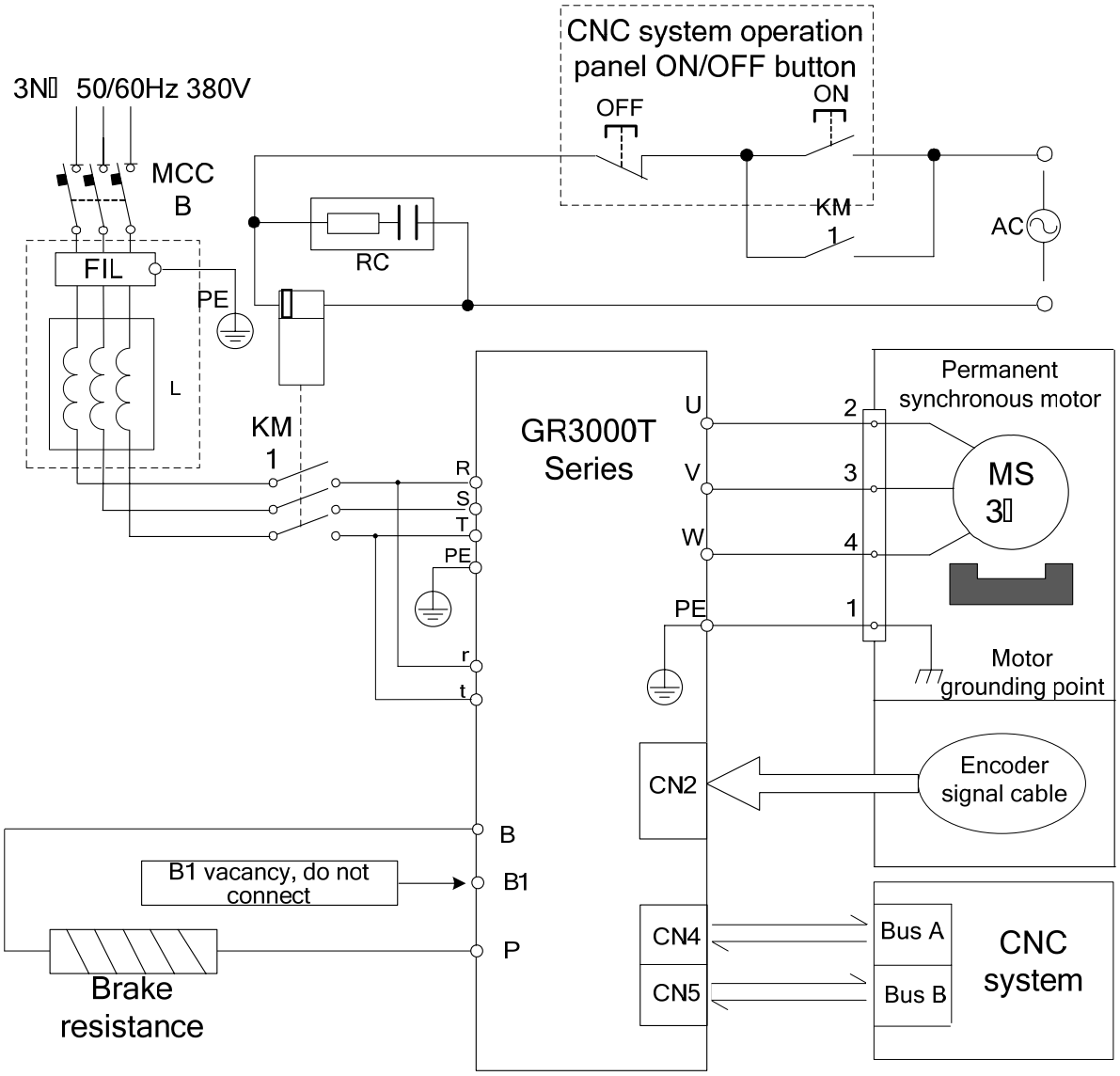


Fig. 3-6 Main circuit wiring of GR3000T-L series

Notice	● It is necessary to select the suitable breaker MCCB based upon the description in *Appendix B* if user refer to the abovementioned wiring. ● The brake resistance surface temperature may extremely high when the servo drive unit is operated, so it is better to install a protective enclosure. ● The equipped motor power in our company has been marked U, V, W and PE wiring terminals, which should be connected with the one of the servo drive unit one by one; otherwise, the motor may not normally operate. ● Correctly connect the protective grounding terminal, and its grounding resistance should be less than or equals to 4Ω.

- **Main circuit wiring example of GR2000Y-L series**

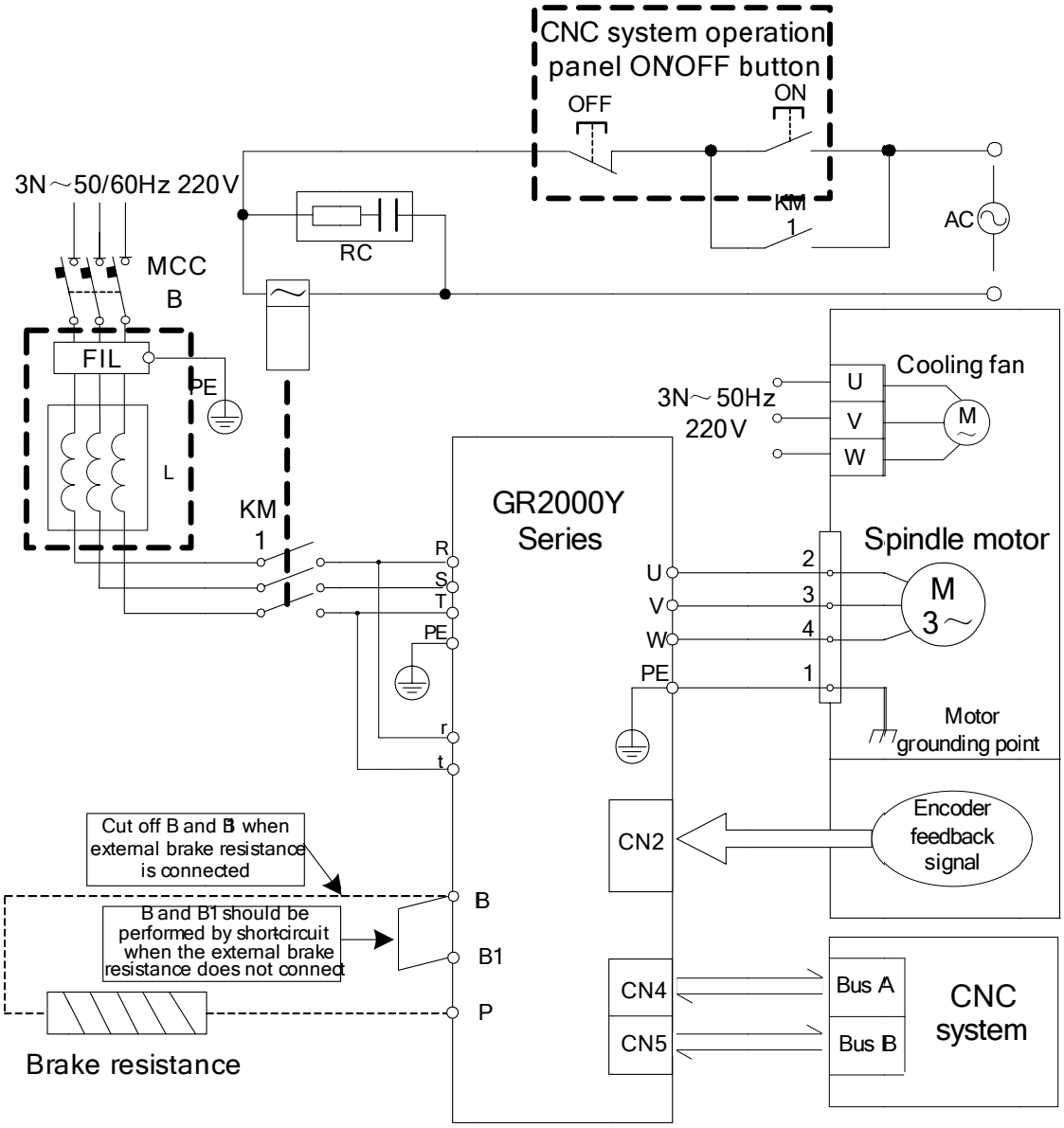


Fig. 3-7 Main circuit wiring of GR2000Y-L series

Notice	● It is necessary to select the suitable breaker MCCB based upon the description in *Appendix B* if user refer to the abovementioned wiring. ● GR2050Y is mounted an internal brake resistance, and it can be select an external one; however, do not use the internal one and external one together! GR2075Y and GR2100Y are without internal brake resistance. ● The brake resistance surface temperature may extremely high when the servo drive unit is operated, so it is better to install a protective enclosure! ● Not all of the motor connection U, V and W are corresponding to the one of the servo drive unit; if the motor generates Err-27 at the 1st operation time, the cable phase-frequency of user is then prompted the error which means not the servo drive unit is out-of-order; any two phases of the U, V and W can be exchanged after the power is turned off for 5min. ● Correctly connect the protective grounding terminal, and its grounding resistance should be less than or equals to 4Ω.

- **Main circuit wiring example of GR3000Y-L series**

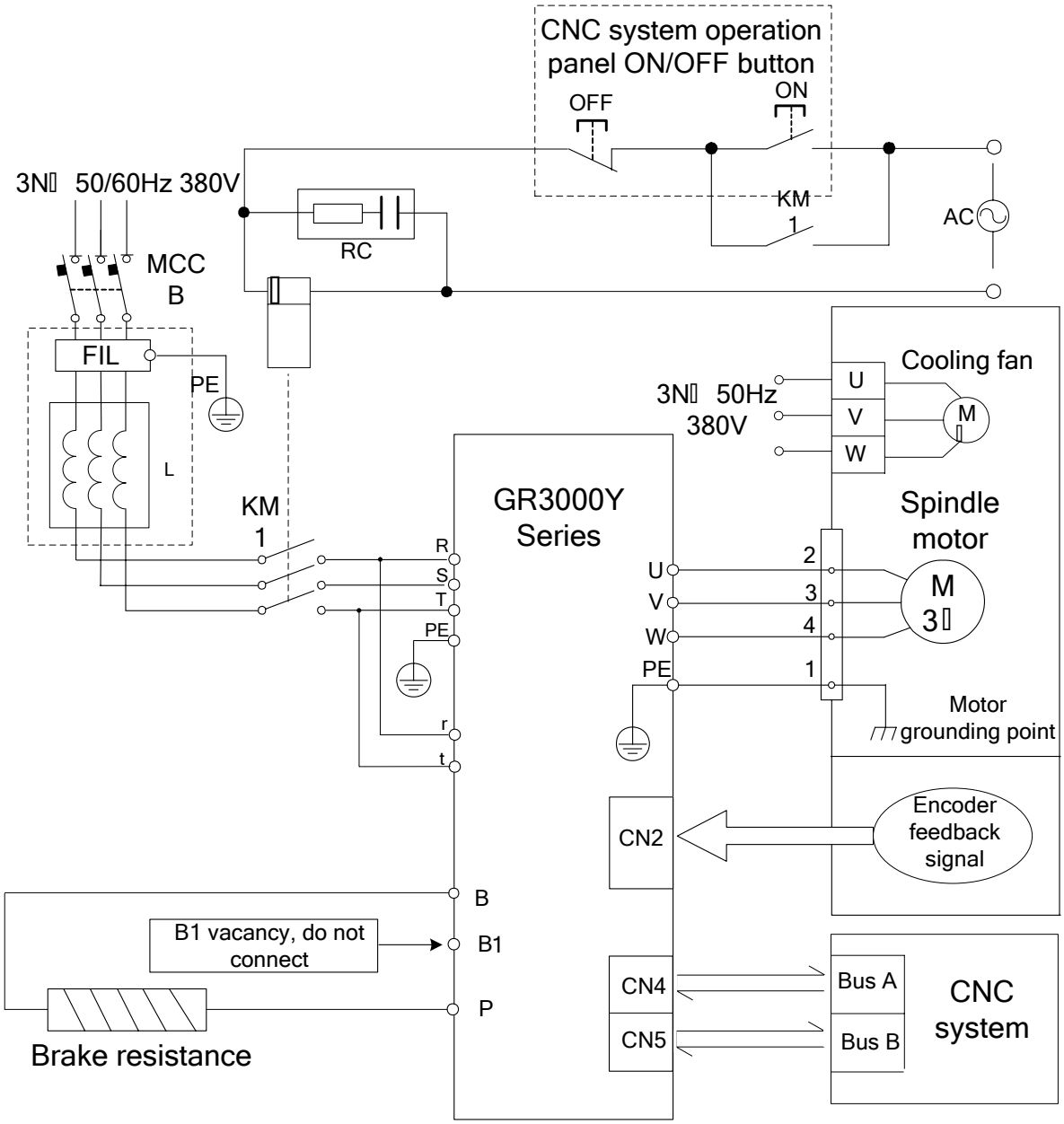


Fig. 3-8 main circuit wiring of GR3000Y-L series

Notice	● It is necessary to select the suitable breaker MCCB based upon the description in *Appendix B* if user refer to the abovementioned wiring. ● The brake resistance surface temperature may extremely high when the servo drive unit is operated, so it is better to install a protective enclosure! ● Not all of the motor connection U, V and W are corresponding to the one of the servo drive unit; if the motor generates Err-27 at the 1st operation time, the cable phase-frequency of user is then prompted the error which means not the servo drive unit is out-of-order; any two phases of the U, V and W can be exchanged after the power is turned off for 5min. ● Correctly connect the protective grounding terminal, and its grounding resistance should be less than or equals to 4Ω.

- **Main circuit wiring example of GR4000Y-L**

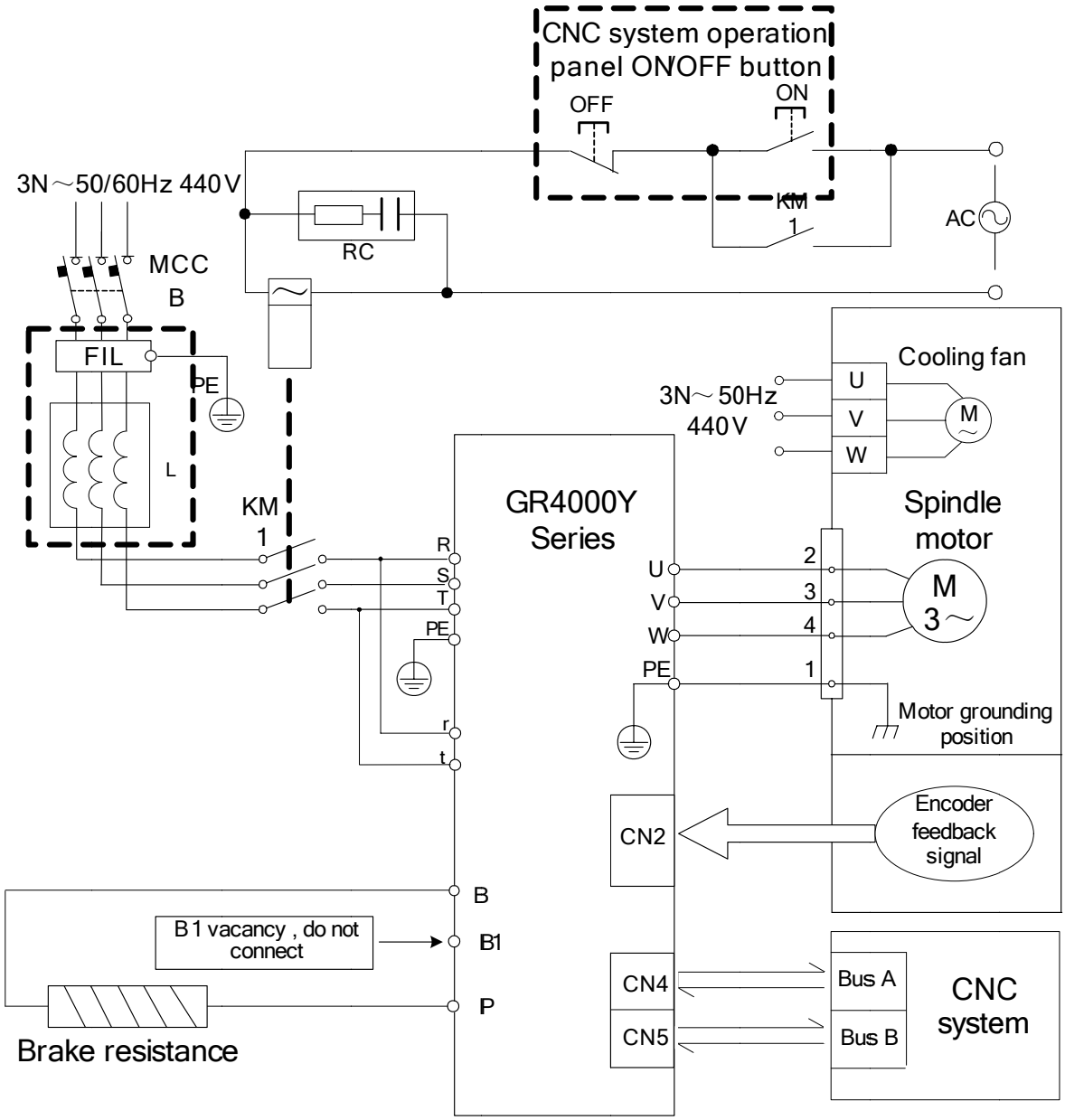


Fig. 3-9 Main circuit wiring of GR4000Y-L

Notice	● It is necessary to select the suitable breaker MCCB based upon the description in *Appendix B* if user refer to the abovementioned wiring. ● The brake resistance surface temperature may extremely high when the servo drive unit is operated, so it is better to install a protective enclosure! ● Not all of the motor connection U, V and W are corresponding to the one of the servo drive unit; if the motor generates Err-27 at the 1st operation time, the cable phase-frequency of user is then prompted the error which means not the servo drive unit is out-of-order; any two phases of the U, V and W can be exchanged after the power is turned off for 5min. ● Correctly connect the protective grounding terminal, and its grounding resistance should be less than or equals to 4Ω.

3.3 Connection of Controllable Signal

3.3.1 CN2 Motor Encoder Feedback Interface & Wiring

CN2 is the 26-core high density socket which matches with 26-core high density plug (Type: MDR10126-3000-PE, for 3M Company) of its encoder wiring; refer to the following pin figure.

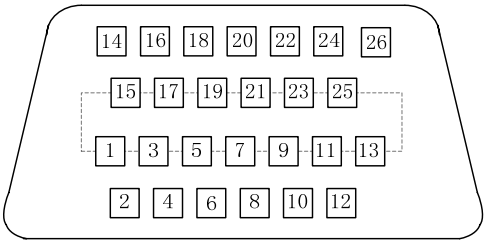
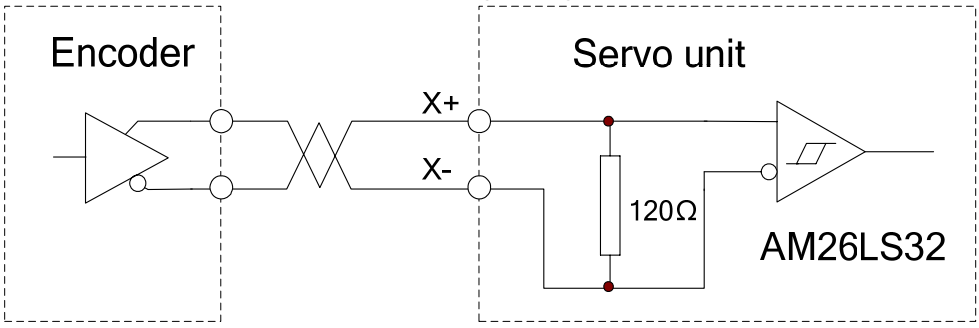


Fig. 3-10 CN2 wiring plug pin (Welding cable side)

Pin No.	Name	Meaning	Pin No.	Name	Meaning
1	OH	Motor temperature inspection	14	BAT3V6	Connect to the 3.6V battery (+)
2	W+	Connect the incremental encoder feedback signal	15	0V	
3	W−		16	0V	Encoder power (-)
4	V+		17	0V	
5	V−		18	NC	
6	U+		19	5V	Encoder power (+)
7	U−		20	5V	
8	Z+		21	5V	
9	Z−		22	NC	
10	B+		23	MA+	Absolute encoder feedback signal
11	B−		24	MA−	
12	A+		25	SL+	
13	A−		26	SL−	

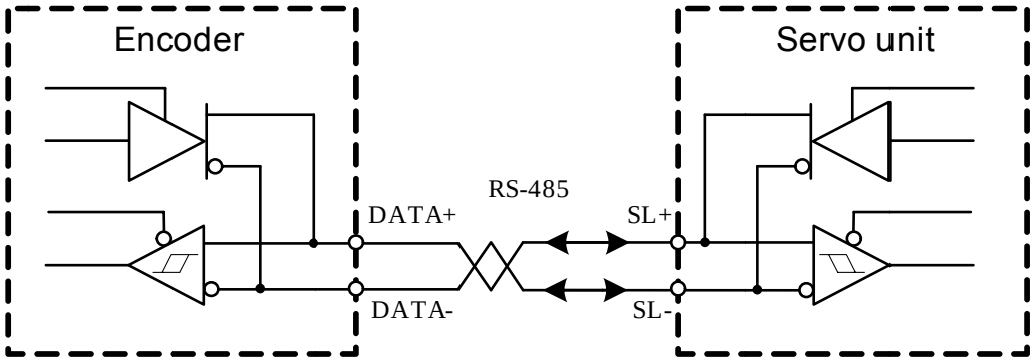
1. Pin 2 to Pin 13 in CN2 are incremental encoder interface; the signal cable is differential drive connection method; refer to the following wiring circuit.



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

2. OH (CN2-1) is used for connecting the overheating inspection components inside the servo motor, so that the servo drive unit owns motor overheating protective function. The servo motor made in GSK is without overheating protective component so disconnect this signal.

3. Pin 14 and Pins 23～26 in CN2 are absolute encoder feedback signal which its input circuit is quadruple differential bus transceiver that it is consistent with ANSI standard EIA/TIA-422-B and RS-485. The wiring schematic is shown below:



1. The standard wiring of CN2 matches with SJT series permanent synchronous motor absolute encoder.

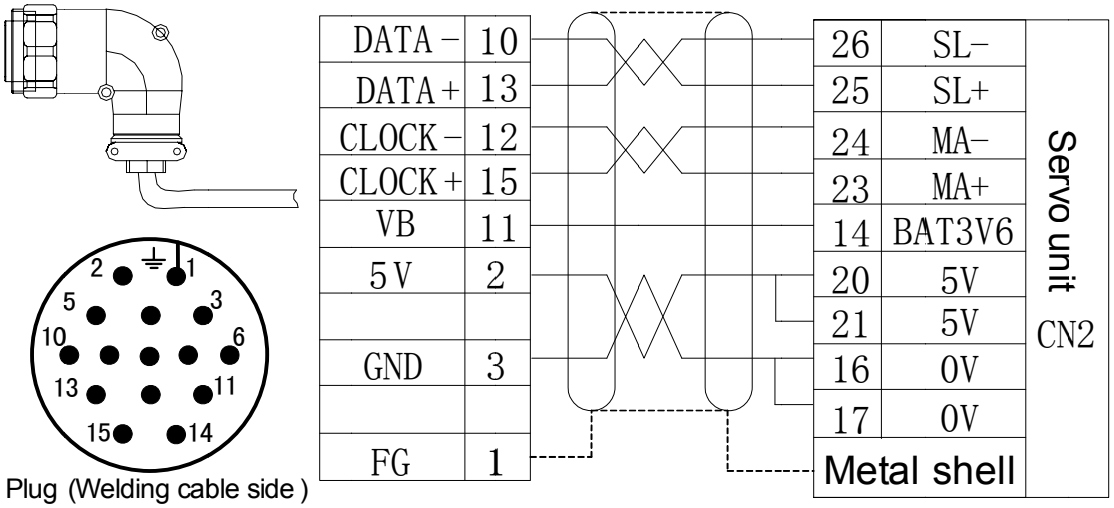


Fig. 3-11 Wiring of CN2 matches with SJT series permanent synchronous motor absolute encoder

1. The abovementioned figure is simultaneously suitable for both the absolute encoder A4 I (DANAHER BISS Agreement) and A4 II (TAMAGAWA Agreement).
2. Do not install 3.6V battery when servo drive unit matches with A4 I encoder.
3. It is important to install the 3.6V battery when servo drive unit is matched with A4 II encoder.

2. The standard wiring of CN2 matches with SJT series permanent synchronous motor incremental encoder.

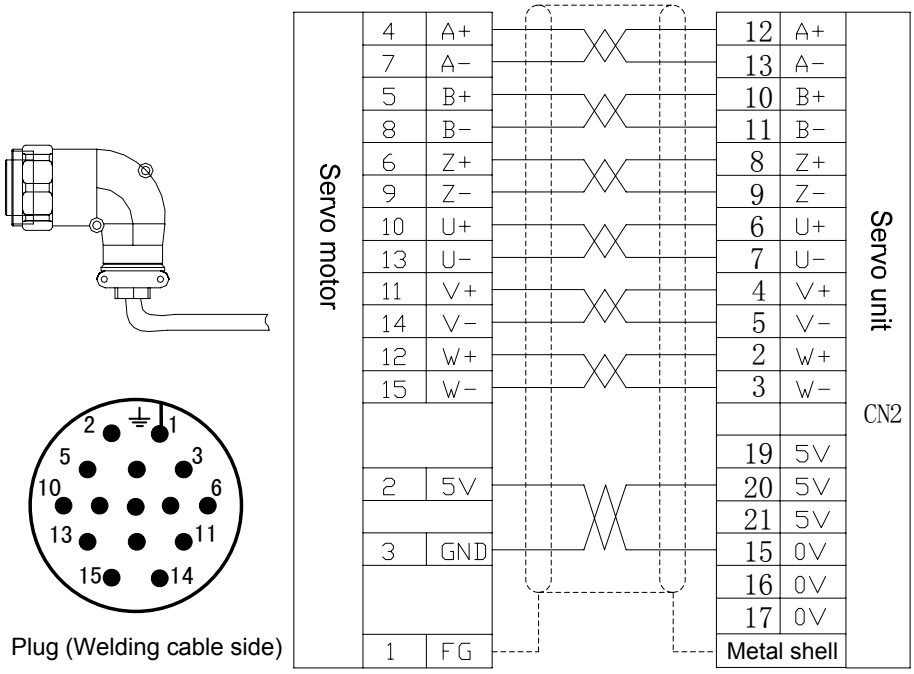


Fig. 3-12 Wiring of CN2 matches with SJT series permanent synchronous motor incremental encoder

Notice	● The length between motor power cable and motor encoder feedback signal cable should be within 20 and separated more than 30cm. Two cables can not be shared with a same pipeline or bound with together. ● The signal cable should be used the twisted shielding cable, and its sectional is 0.15mm^2～0.20mm^2, and the shielding layer must be connected with PE terminal.

3. The standard wiring of CN2 matches with the ZJY208A and ZJY265A series spindle asynchronous motor incremental encoder

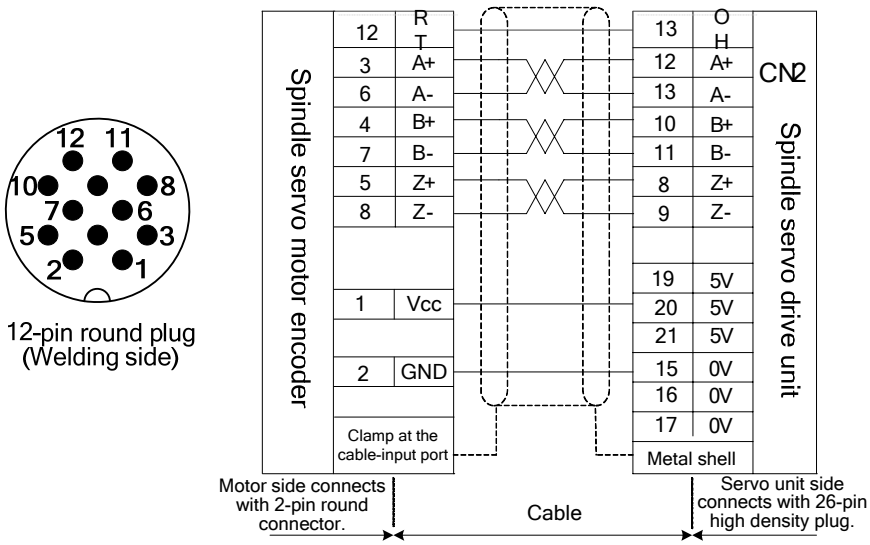


Fig. 3-13 CN2 matches with ZJY series spindle motor encoder/12-female industry plug wiring

4. The standard wiring of CN2 matches with the ZJY182 series spindle asynchronous motor incremental encode

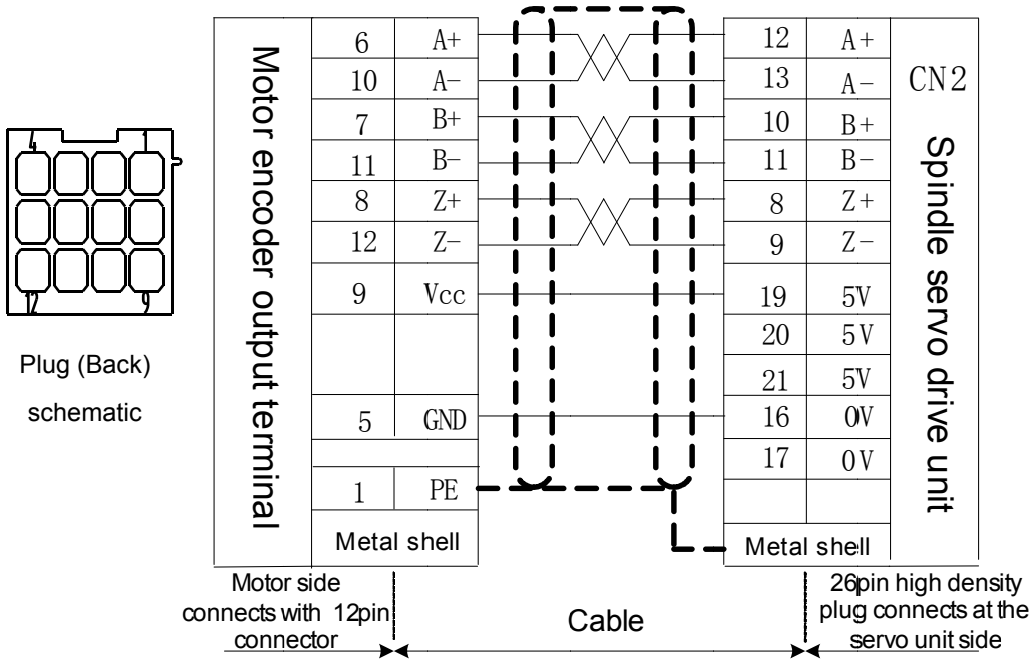


Fig. 3-14 CN2 matching with ZJY182 series spindle motor encoder/12PIN plug wiring

5. The standard wiring of CN2 matches with the ZJY208A and ZJY265A series spindle asynchronous motor absolute encoder

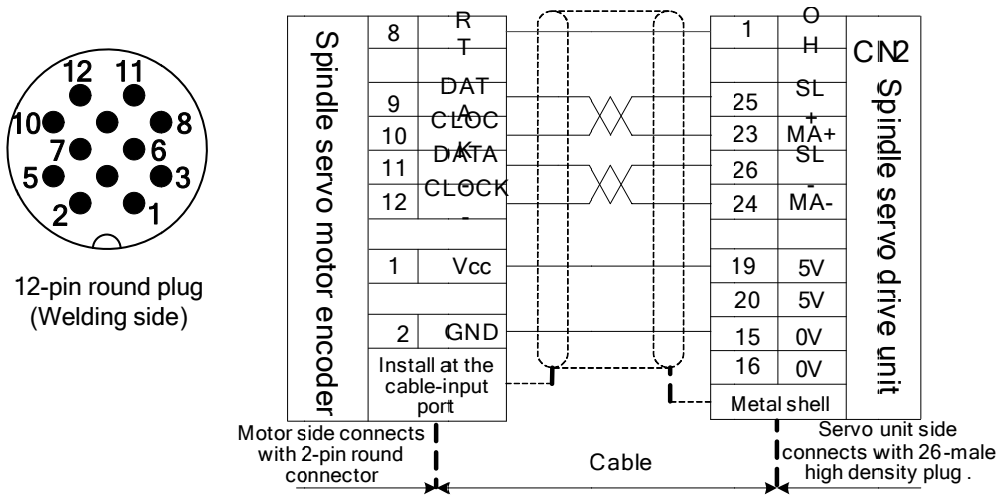


Fig. 3-15 CN2 matches with ZJY series spindle motor encoder/12-female industry plug wiring

6. The standard wiring of CN2 matches with the ZJY208 and ZJY265 series spindle asynchronous motor incremental encoder

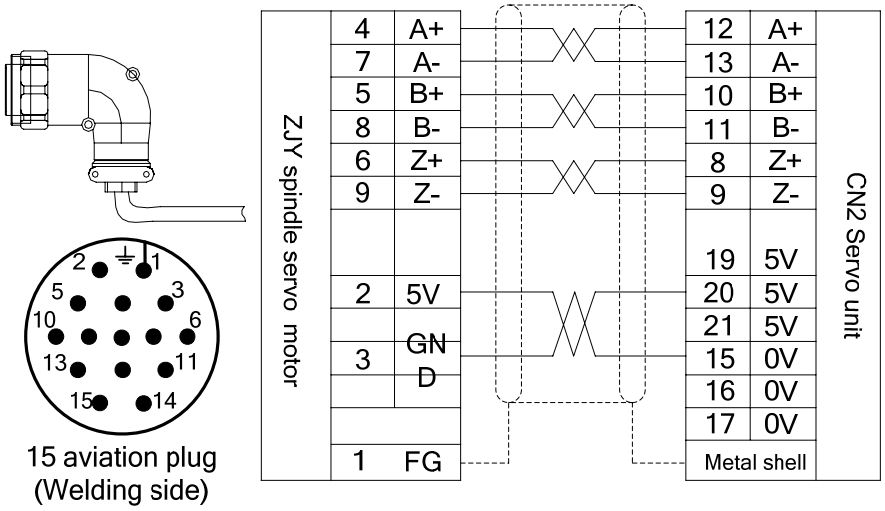


Fig. 3-16 CN2 matches with ZJY series spindle motor encoder/15-female industry plug wiring

3.3.2 The 2nd Position Encoder Feedback Interface and Wiring of CN3

User can select the 2nd position encoder feedback signal input interface CN3 (spindle encoder feedback input) according to requirements; it can be composed of the 2nd position closed-loop with the servo drive unit by connecting the 2nd position encoder.

CN3 is the 20-core high density socket which matches with 20-core high density plug (Type: MDR10120-3000-PE, for 3M Company) of its encoder wiring; refer to the following pin figure.

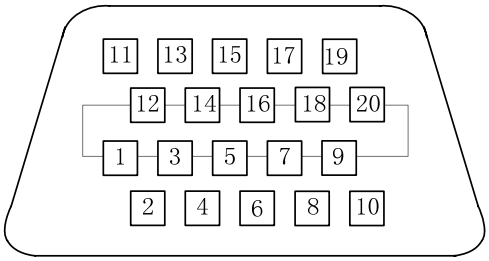


Fig. 3-17 CN3 wiring plug pin figure (Welding cable side)

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

The 2nd position encoder feedback signal interface of the GR-L series servo drive unit can be connected with the incremental or absolute encoder.

1. The wiring between CN3 and the 2nd position incremental encoder

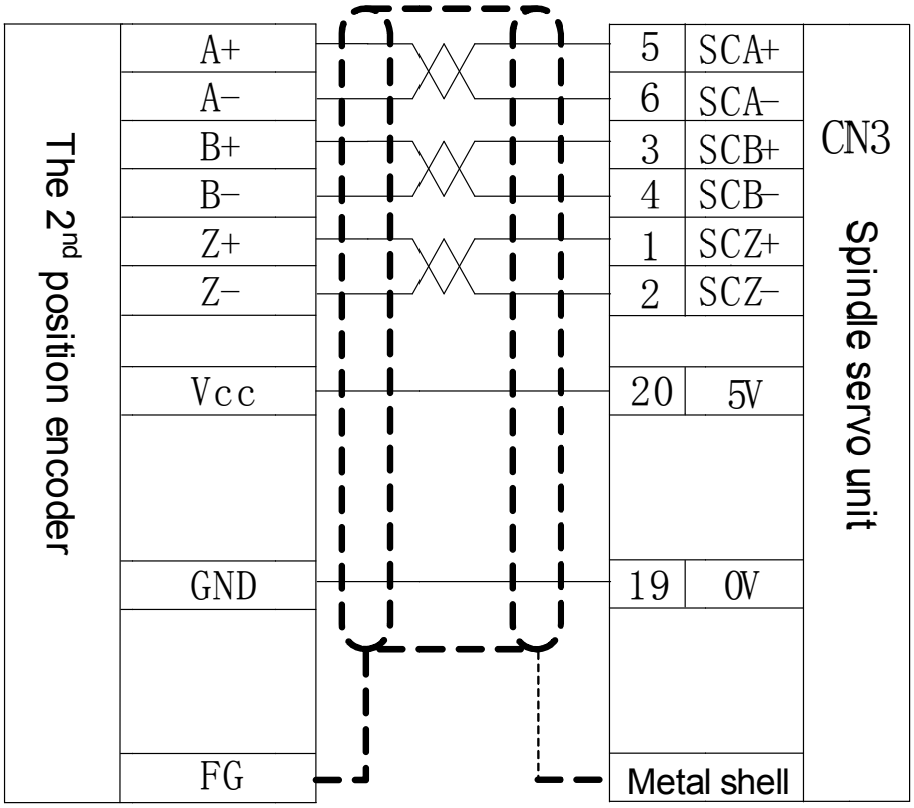


Fig. 3-18 The wiring between CN3 and the incremental encoder

2. The wiring between CN3 and the 2nd position absolute encoder

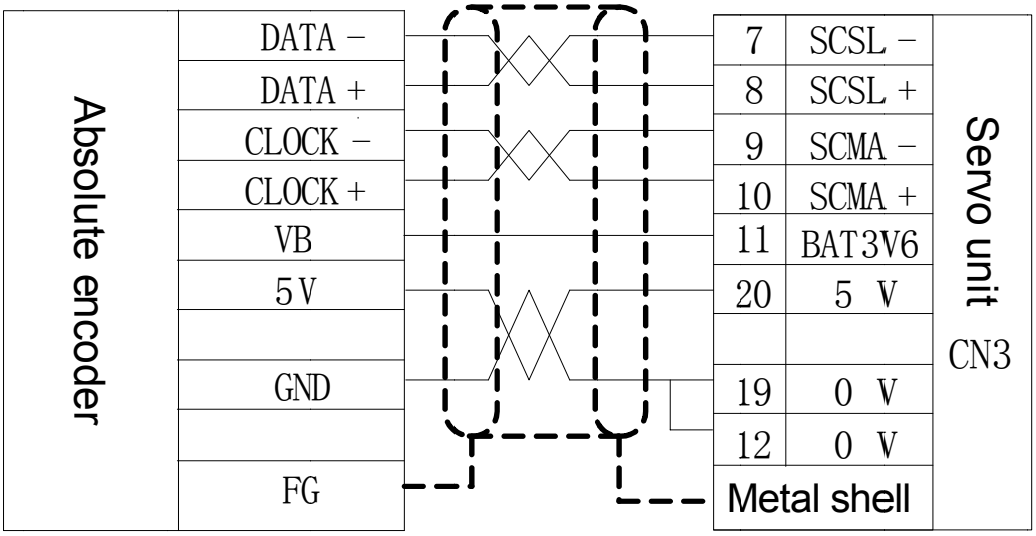
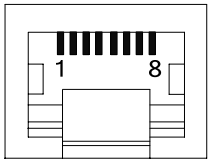


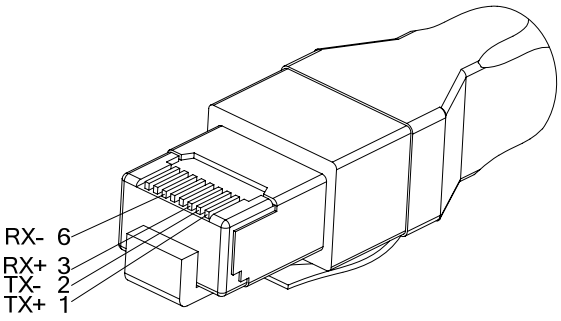
Fig. 3-19 The wiring between CN3 and absolute encoder of GR-L series

3.3.3 CN4, CN5 Ethernet Spot Bus GSKLink Interface and Wiring

CN4 & CN5 are used the RJ45 socket from HARTING Company, refer to the RJ45 plug illustration for its pin definition.

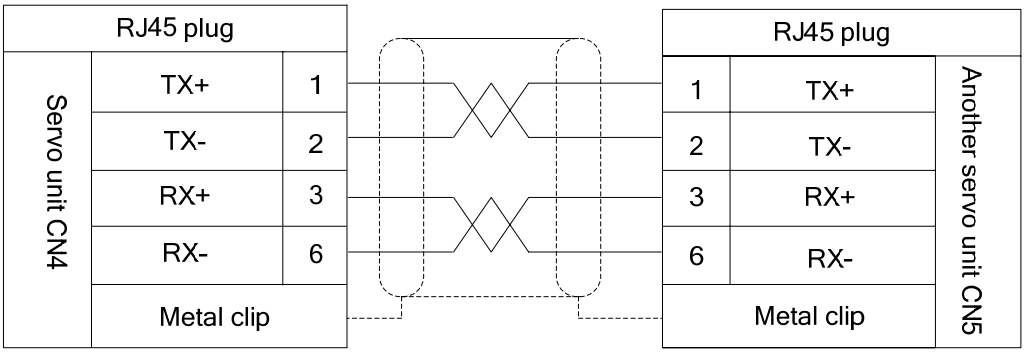


GSKLink socket



Pin No.	Name	Meaning
1	TX＋	Data delivery
2	TX－	
3	RX＋	Data acceptance
6	RX－	

The communication cable connection diagram among GR-L series servos, alternatively, between the CNC system and servo unit.



The GSKLink interface of the CNC system is connected by the CN4 or CN5 interface, which carries out the real-time communication with the CNC system. The GR-L series servo unit can be performed by the control, monitoring, administration, debugging and tuning. (Refer to the Section 5.4 for details)

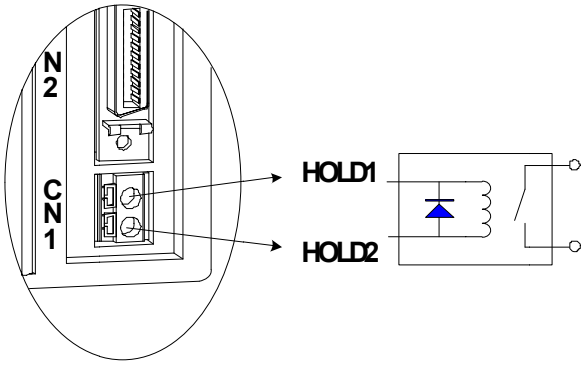
GR servo unit should be correctly set the following parameters, which can be established the Ethernet communication with the CNC.

Relevant para.	Description	Unit	Parameter range	Default	Application
PA4	Controllable method selection		9～25	21	P，S
	PA4=21: GSKLink Ethernet communication function				
PA156	Servo unit slave number		1～20	1	P，S

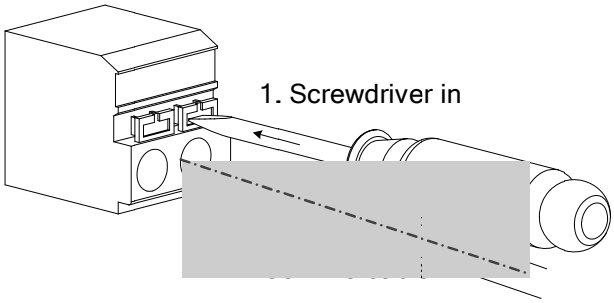
	The servo unit, establishes the bus communication with the CNC system, may be more than one; set the corresponding servo slave number with the CNC system, so that CNC can be controlled one servo unit. Therefore, the servo unit connected with a same CNC system can not be set the repeated slave number.

3.3.4 CN1 Brake Releasing Signal

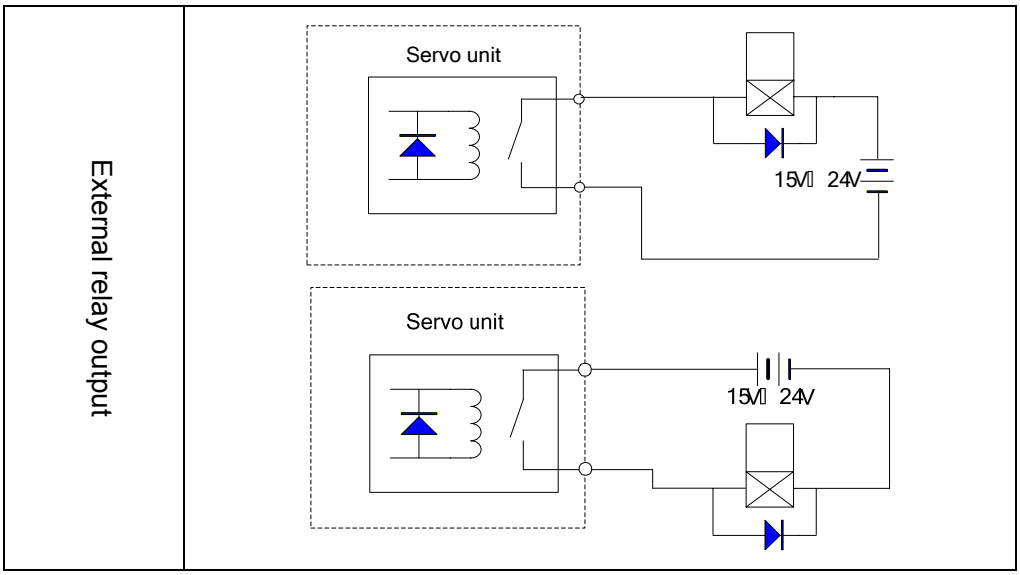
CN1 interface is releasing signal socket for the 2-pin motor brake; the relay NO contact is inside it.



Notice: CN1 peripheral loading selection should be less than or equal to the 1.0A/30VDC, 0.3A/60VDC and 0.5A/125VAC!



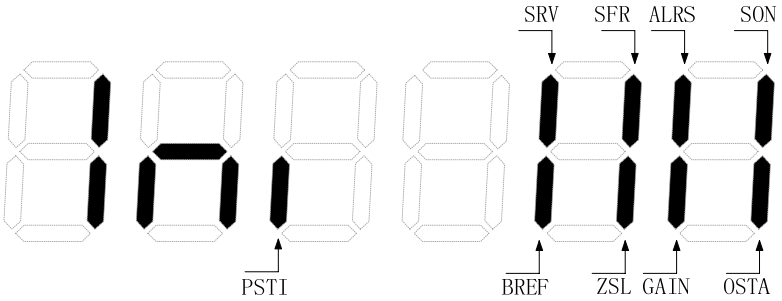
- **HOLD signal wiring example**



3.3.5 I/O Information by Bus Interaction

Unlike the GR-N and GR-C servo drive units, GR-L servo drive unit is interacted with the most I/O information by GSKLink bus and CNC system. Maintainer can judge whether the function in servo drive unit and CNC system communication are normal by monitoring the state of DL-IN and DL-OUT.

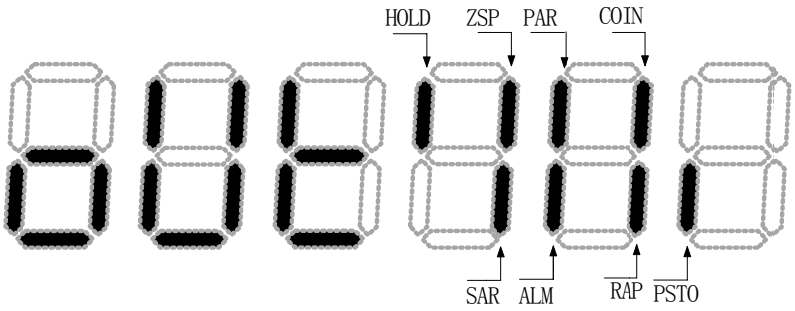
CNC system that sends to the input command DL-IN of the servo drive unit is as follows:



Explanation: If the nixie light of the abovementioned figure is ON, the command signal input is enabled; whereas, OFF is disabled.

Name	Function	Name	Function
SON	Enabling input	OSTA	Orientation start input
GAIN	Rigid tapping input	ALRS	Alarm clear input
SFR	Positive input	ZSL	Zero speed clamping input
SRV	Reverse input	BREF	Machinery locking input
PSTI	Speed position shift input		

CNC system that sends to the output command DL-OUT of the servo drive unit is as follows:



Explanation: If the nixie light of the abovementioned figure is ON, the command signal input is enabled; whereas, OFF is disabled.

Name	Function	Name	Function
PSTO	Speed position shift state	COIN	Orientation completion output
RAP	Rigid tapping output	PAR	Position arrival output
ALM	Alarm output	SAR	Speed arrival output
ZSP	Zero output	HOLD	Hold releasing output

3.3.6 CN8 Position Feedback Output Interface and Wiring

The position feedback output signal is treated the data inside the servo drive unit from the 1st or 2nd position encoder (PG), then output to the instruction control unit by CN8 based upon the set pulse numbers to content with the closed control function of the instruction control unit position etc.

CN8 is the 14-core high density socket, its adapted encoder wiring uses 14-core high density plug (Type MDR10214-52A2PL, 3M Company's product); refer to the following figure for the pin distribution:

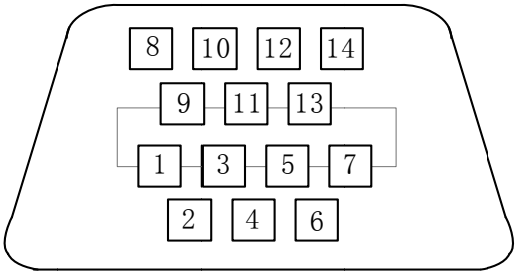
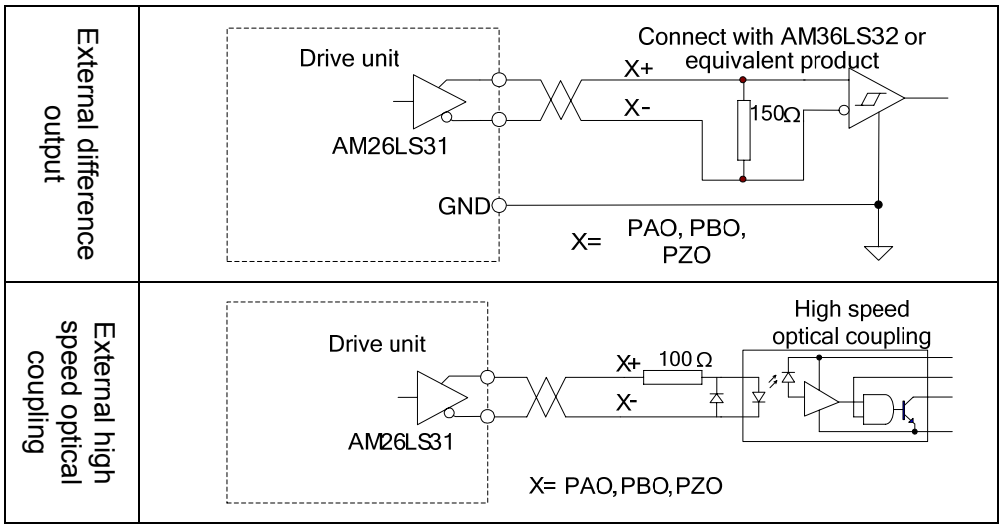


Fig. 3-21 CN8 wiring plug pin (Welding cable side)

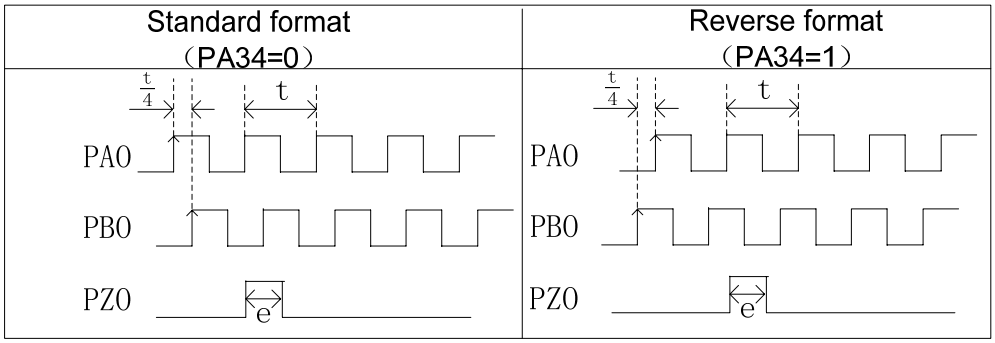
Pin No.	Name	Meaning	Pin No.	Name	Meaning
1	GND	0V	8	GND	0V
2	PZO—	Position feedback output signal	9	NC	
3	PZO+		10	NC	
4	PBO—		11	NC	

5	PBO＋		12	NC	
6	PAO－		13	NC	
7	PAO＋		14	NC	

The wiring circuit is:



There are two types for wave output: (Wherein, e= $\frac{t}{2}$)



Relevant para.	Description	Unit	Parameter range	Initialization	Application
PA34	Position output signal reverse		0～1	0	P, S
	PA34＝0, Maintain the original relationship of the CN8 position feedback output signal; PA34＝1, The phase position between the position feedback output signal PAO and PBO phases are reversed.				
PA37	Position feedback output pulse number Position feedback output pulse number	Pulse	1024～30000	10000	P,S

	When the motor (or spindle) encoder signal is absolute encoder signal, set the corresponding position feedback output pulse number after the motor rotates one circle. It is better to calculate it based upon the command unit of the machinery and instruction control unit. For example: As the above-mentioned figure, the numerical value of the PA37 means it counts based upon the edge signal of the A/B phase pulse; that is, count once while capturing 1 edge signal. And therefore, PA37=64 means the PAO (or PBO) pulse numbers from the servo drive unit output is 16 after the motor (or spindle) rotates one circle. And for another example: PA37=10000, the pulse numbers of the actual position output PAO or PBO is: PAO or PBO pulse numbers = $\frac{10000}{4}$ =2500 (pulse/circle)

The wiring illustration between CN8 and 988T□ system is shown below:

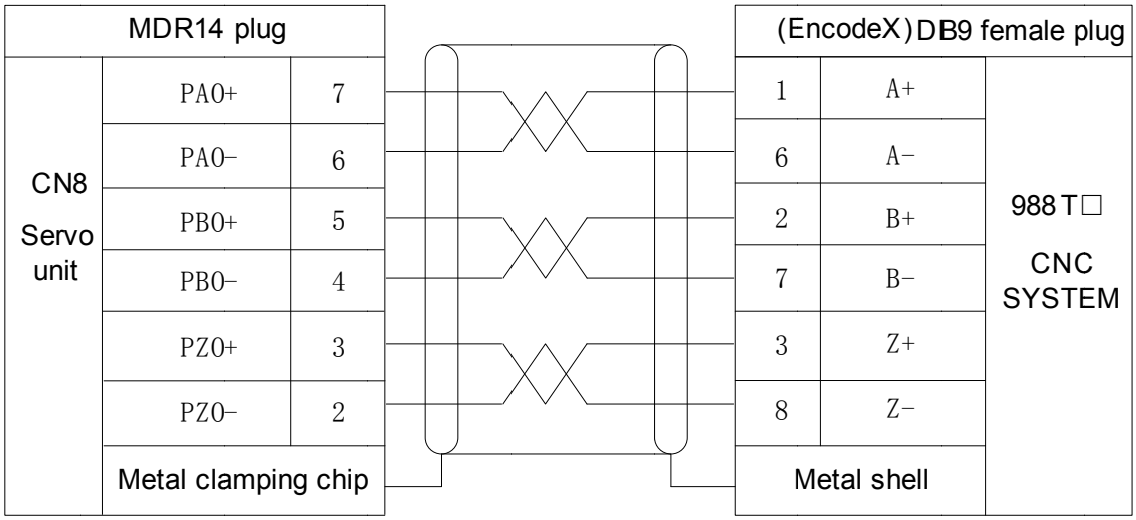


Fig. 3-22 CN8 wiring plug pin (Welding cable side)

CHAPTER FOUR DISPLAY & OPERATION

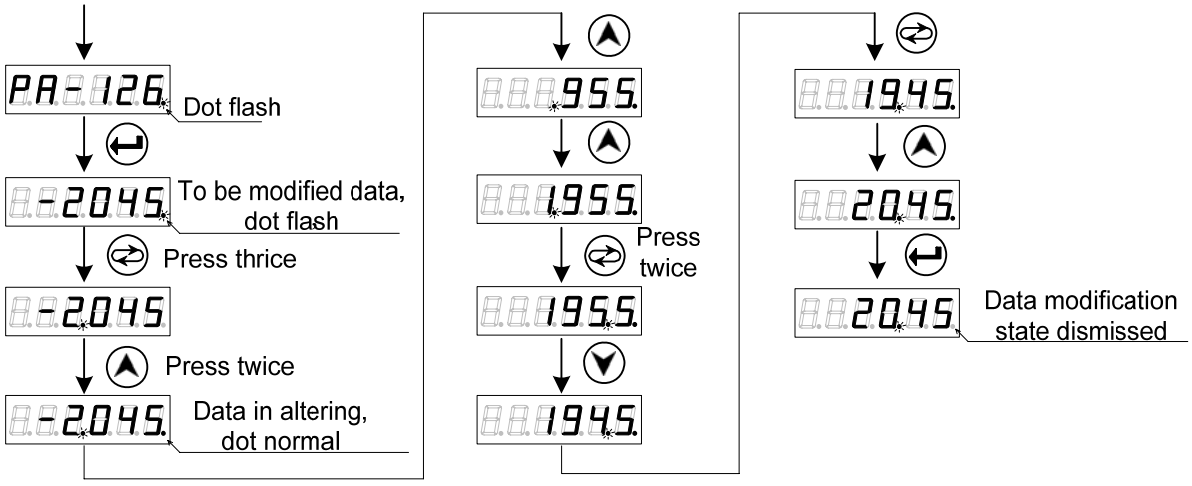
4.1 Operation Panel

➢ Refer to the Section 1.1.3 in Chapter One for the function brief of each component on the AC servo drive unit panel.

➢ The button function details as follows:

Button	Name	Explanation
▲	'Addition' button	1. Parameter series number, parameter value addition 2. Next menu page up 3. Add the motor run velocity in Manual mode 4. Motor CCW starts in JOG mode.
▼	'Decrease' button	1. Parameter series number, parameter value decreasing 2. Next menu page down 3. Decrease the motor run velocity in Manual mode. 4. Motor CW starts in JOG mode.
⇄	'Shift' button	1. Select the modification bit of the parameter series number 2. Select the modification bit of the parameter value
◀	'Return' button	Return to the previous menu or cancel the operation
↵	'Enter button	Enter the next menu or confirm the data setting

The shift function of '⇄' is introduced in the parameter setting, the value of the PA126 is changed into 2045 from -2045; refer to the following steps:



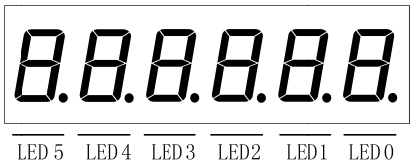
1. In the above example, directly increase in the LED2 bit by the shifting key, -45 does not change to the 1045 instead of -45+1000＝955; It is the calculation result of the servo drive unit.

2. When the parameter value is modified, the decimal point indicator at the lower right corner of the 6-segment nixie display tube is always turned on; this indicator is turned off

after pressing , it means that the numerical value is disabled. If the decimal point indicator does not OFF, press to retract, the parameter setting is then disabled.

4.2 Display Menu

6-segment nixie tube composes of the monitoring window of the GS-L series product; administer its content by menu's form. When the LED5, LED4 in the right figure is the flash state, it means that the servo drive unit is on the alarm state.



Nixie tube display contains of 3 levels menus:

The 1st level is the function type which includes the State monitoring, Parameter setting, Parameter administration, Manual operation and JOG operation etc.

The 2nd menu is meaning which includes the functions such as the Displayed content, Parameter function and Register operation etc.

The 3rd menu is content which includes the value of the monitoring and the parameter etc.

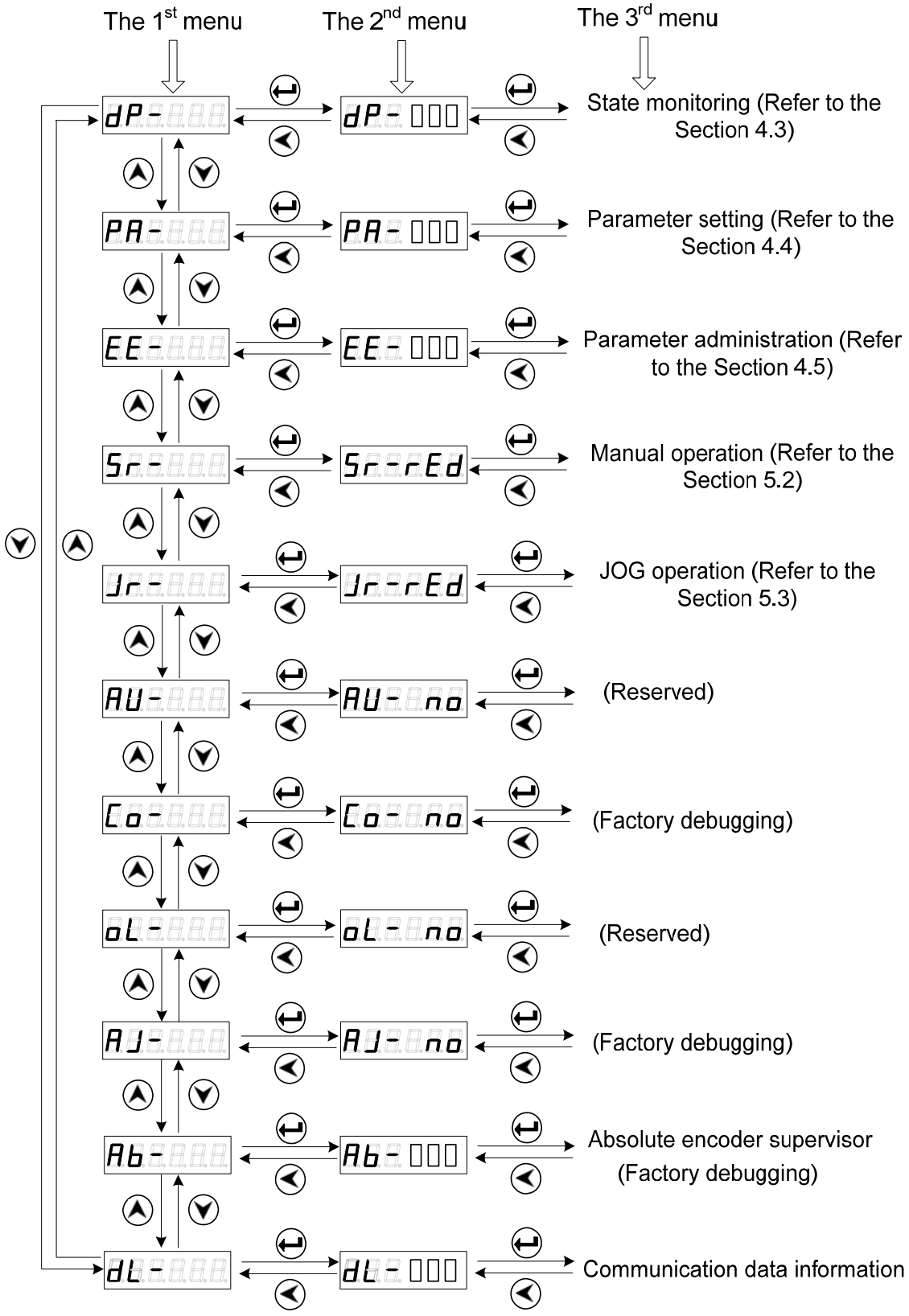


Fig. 4.1 The operation of the display menu

4.3 State Monitoring

is the state monitoring, user can not only select different monitoring states in this menu, but also set the value of the parameter PA03, and the initial monitoring state when servo drive unit is ON.

Parameter value	Initial Power-on monitoring	Operation	Monitoring data	Explanation
PA3=0				Current motor speed100r/min 【1】
PA3=1				Current motor position LOW (Pulse) 【2】
PA3=2				Current motor position HIGH (×10000 pulse)
PA3=3				Position command LOW (Pulse) 【2】
PA3=4				Position command HIGH (×10000)
PA3=5				Position error LOW (Pulse) 【2】
PA3=6				Position error HIGH (×10000 Pulse)
PA3=7				Motor current is 2.3A
PA3=8			*(Reserved)*	
PA3=9				Velocity command is 210r/min
PA3=10			*(Reserved)*	
PA3=11			*(Reserved)*	
PA3=12			*(Reserved)*	
PA3=13				Radiator temperature is 32° c.
PA3=14			*(Reserved)*	
PA3=15				DC bus voltage is 320V
PA3=16				Alarm display No.9
PA3=17				Being operated 【3】
PA3=18			*(Reserved)*	
PA3=19			*(Reserved)*	
PA3=20				Output point state monitoring 【4】
PA3=21			*(Reserved)*	
PA3=22				Hardware version number
PA3=23				Software version number
PA3=24				The 2nd position encoder Z pulse absolute position LOW is 3256.

PA3=25	dP-SPo.		E. 6	The 2nd position encoder Z pulse absolute position HIGH is 6.
PA3=26	dP-APo		A 3256	Motor encoder Z pulse absolute position LOW is 3256.
PA3=27	dP-APo.		A. 6	Motor encoder Z pulse absolute position HIGH is 6.
PA3=28	dP-SAS		S 5836	The 2nd position encoder single-core absolute position LOW.
PA3=29	dP-SAS.		S. 0	The 2nd position encoder single-core absolute position HIGH.
PA3=30	dP-HAS		H 38	The 2nd position encoder relative position LOW.
PA3=31	dP-HAS.	↵ / ←	H. 12	The 2nd position encoder relative position HIGH
PA3=32	dP-Ab5		b 15038	The 1st position encoder single-core position LOW.
PA3=33	dP-Ab5.		b. 0	The 1st position encoder single-core position HIGH.
PA3=34	dP-Hb5		H 38	The 1st position multi-coil encoder numbers LOW.
PA3=35	dP-Hb5.		H. 12	The 1st position multi-coil encoder numbers HIGH.
PA3=36	dP-Ub5		U 6735	The 1st position encoder relative LOW.
PA3=37	dP-Ub5.		U. 0	The 1st position encoder relative LOW.

[1] "r" is regarded as the motor's speed code in r 100.0, 100.0 means the motor speed is the reverse direction 100r/min. The negative speed - 100.0 displays if it operates CW; its unit is r/min.

Explanation: When the servo drive unit drives the spindle motor, its speed displays r 0, it only can be accurate to 1r/min.

[2] The position value of the motor encoder feedback consists of POS. (Higher 5-bit) + POS (Lower 5-bit).

For example: P. 18 × 100000 + P45806 =1845806 pulses.

Similar, the position command pulse value is also composes of CPO. (Higher 5-bit) + CPO (Lower 5-bit)

For example: C. 18 × 100000 + C45810 =1845810 pulses

The relationship between CPO and POS is: (When the motor stillness)

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

The calculation format when the electric gear ratio of the position error (EPO) is 1:1:

C. 18 − P. 18 = E. 0

C45810 − P45806 = E 4

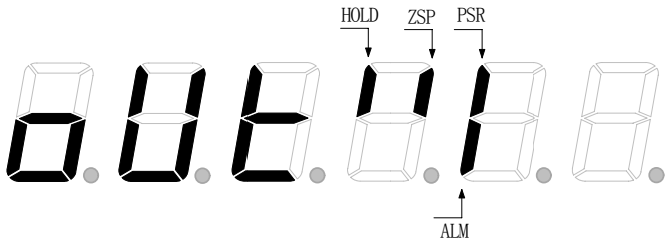
Explanation: When PA97=1, dP-PoS shows the current position increment of the motor encoder; when PA97=0, it displays the one of the 2nd position encoder.

Relative parameter	PA97=1, Selecting the motor encoder signal regards as the position feedback input signal;
	PA97=0, Selecting the 2nd position input signal treats as the position feedback input signal.

[3] Operation state display

rn-on	Servo unit main circuit is already charged and enabled.
rn-oFF	Servo unit main circuit uncharged
rn-CH	Servo unit main circuit is already charged instead of disabling.

[4] Output point state monitoring:

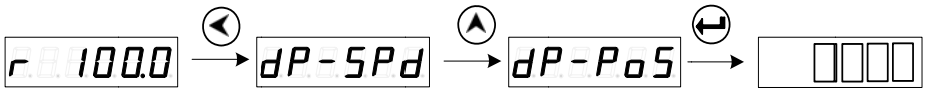


Explanation: dP-oUt monitors the brake releasing signal state via CN7.

The operation method of the setting state monitoring

For example: There are two methods to call the state monitoring related with the current position lower 5-bit , is as follows:

Method 1: Directly select the state monitoring



Method 2: Select the state monitoring by parameter

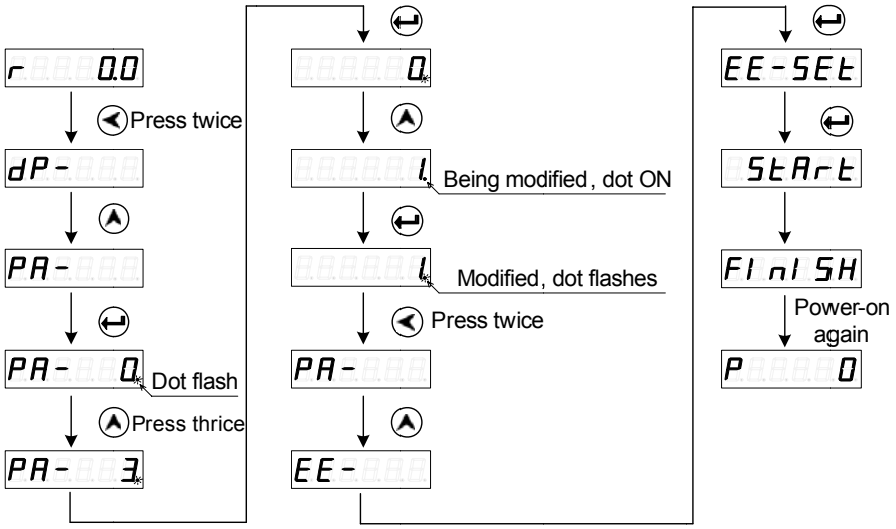


Fig. 4-2 The monitoring operation of the parameter selection state

4.4 Parameter Setting

➢ **Recover the operation of the motor default parameter**

The parameter value after performing the initialization is regarded as the **initialization value**; the one after performing the motor default parameter operation is called **default value**.

1. Input the specified password for modifying the motor, that is PA0=385.
2. Search current motor correspondence with the motor type code based upon the *Appendix A* Motor Type Code Table
3. Input the motor type code PA1, then enter the parameter administration menu by ↵, perform the EE-dEF operation, and then complete the operation of the motor default parameter recovery.

Related parameter	Description	Unit	Parameter range	Initialization value	Application
PA0	Parameter modifies password		0～9999	315	P, S
	The user parameter can be altered when PA0＝315.				
PA1	Motor type code		0～1329	0	P, S

To recover the 130SJT-M100D (A) (motor type code is 4) motor default parameter is taken an example; refer to the following operation:

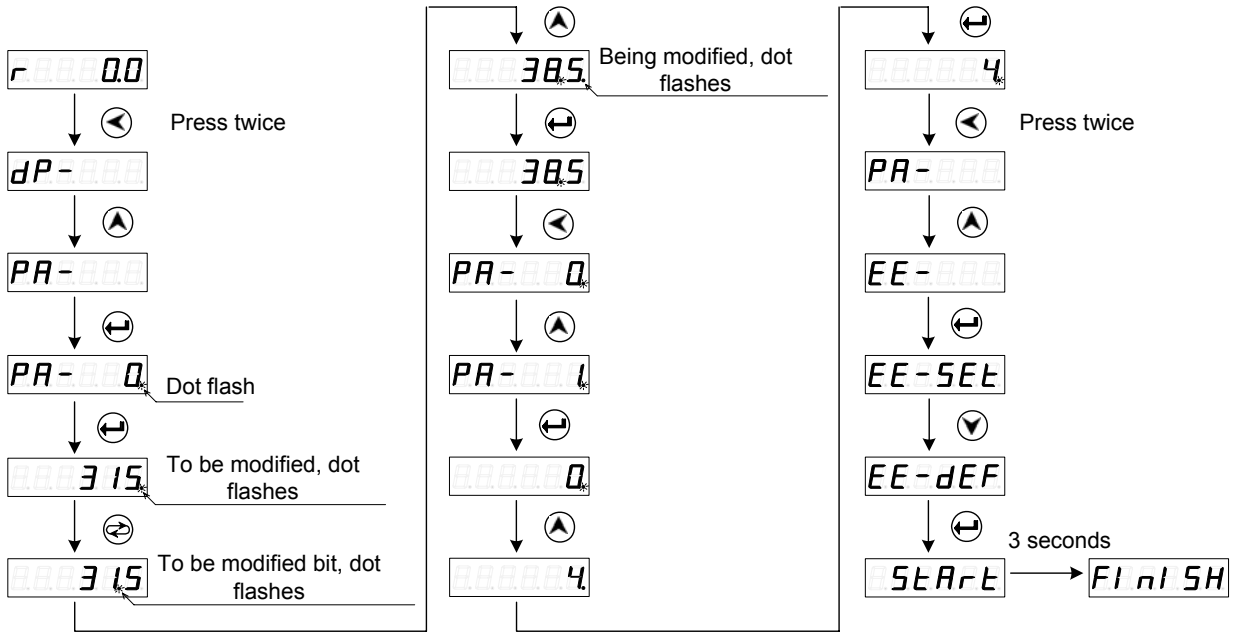
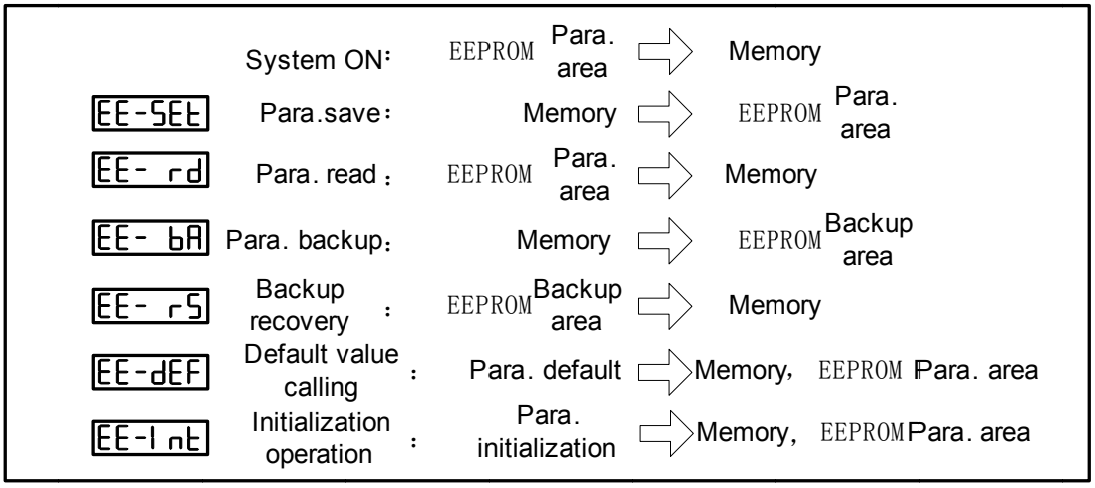


Fig. 4-3 Recover the motor's default parameter

1. After the parameter is altered on servo drive unit panel, it only can be enabled by . In this case, the altered parameter is immediately reacted to the control. If you unsatisfy the being modified parameter value, press the for retracting instead of , and then the parameter value is recoverd into the one before altering. If you want that of the modified parameter can be eanbled after the power is turned off, it is better perform the parameter save operation .
2. The parameter related with the motor is written into the default value by setting the motor's default parameter. User, also, can judge whether the default parameter of the servo drive unit is suitable for the driving motor, based upon the value (refer to the Appendix A) of the PA1 parameter. If the PA1 parameter value does not corresponding to the motor type code, the motor may not normally operate.

4.5 Parameter Administration

The parameter write, read, backup, recovery backup and default value calling are described in servo unit for the parameter administration section. The data memory relationship in the parameter administration; refer to the following table.



- **EE—SEt Parameter Saving**

It means that the parameter in the memory is written to the EEPROM parameter area. The value in the memory can be only changed when user modifies the parameter, however, it will be recovered to the original numerical value when the power is turned on again. If you want to change the parameter value permanently, it is necessary to perform the parameter saving operation, and the parameter value in the memory should be written to the EEPROM parameter area; and then the modified parameter value will be used after the power is turned on next time;

- **EE—rd Parameter Read**

It means that the data in the EEPROM parameter area is read to the memory. This procedure may automatically perform once when the power is turned on. At the beginning, the memory parameter value is identical with the parameter area of the EEPROM. The parameter value in the memory will be changed if user alters the parameter. When user does not satisfy the modified

parameter or debugged parameter, perform the parameter read operation; then the data in the EEPROM parameter area can be read to the memory again, and then recover to the parameter just when the power-on;

- **EE－bA Parameter Backup**

Write the parameter in the memory to the EEPROM backup area. This is for preventing that user modifies the parameter incorrectly and can return to the original parameter. User should be backup the parameter firstly after debugging the motor's capacity.

- **EE－rs Backup Recovery**

Read the parameter in the EEPROM backup area to the memory. This parameter value should be written to operation; otherwise, it will still the original parameter value after the power is turned on again.

- **EE－dEF Call out the default value**

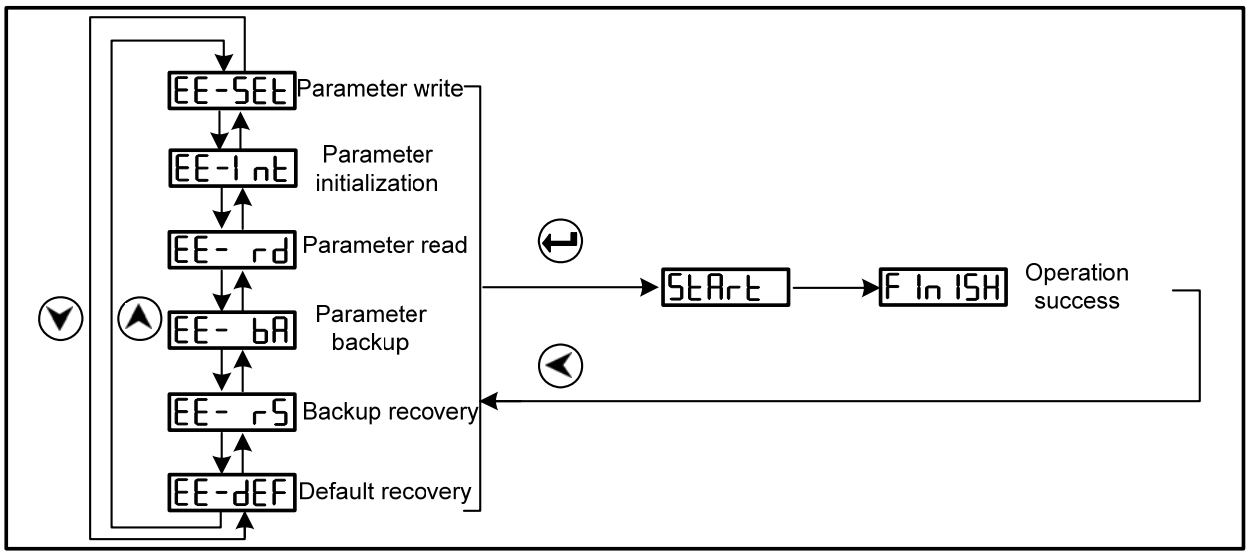
It means that the default value of one motor's relative parameter is read to the memory, and the write to the EEPROM parameter area; the default parameter will be used next time when the power is turned on again. (Refer to the Section 4.4 Parameter Setting)

- **EE－Int Initialization Operation**

The overall parameters of the servo drive unit are recovered to the factory initialization state.

Notice! The operation is protected by special password, user can not operate freely!

➢ Parameter administration operation



➢ Parameter saving operation illustration

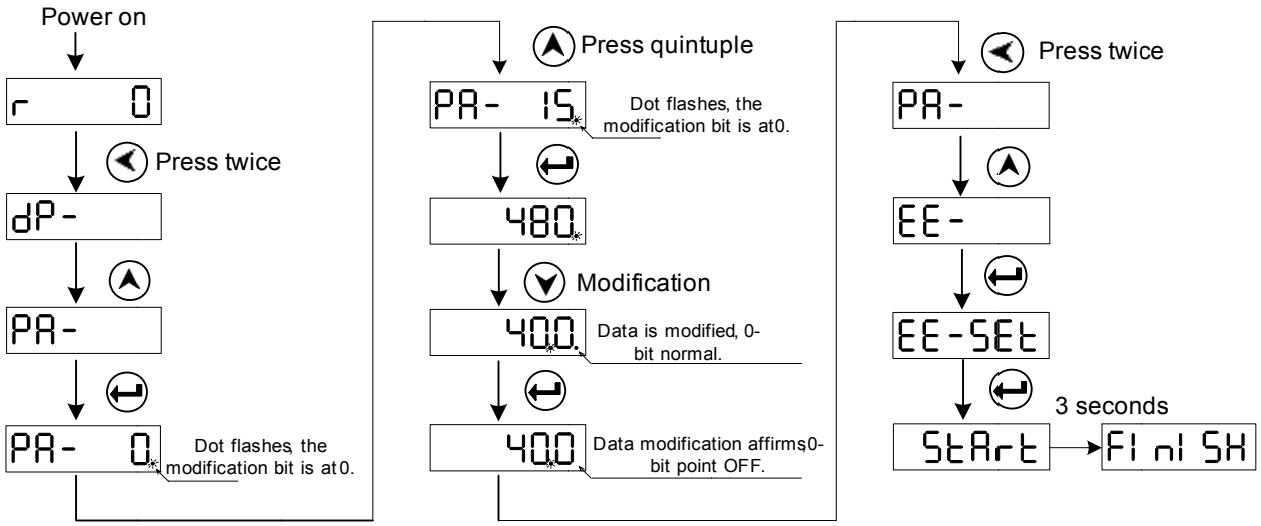


Fig. 4-4 The operation steps for saving the parameter

CHAPTER FIVE OPERATION

This chapter will introduce the debugging operation of the servo drive unit based upon the working method set by the PA4 parameter.

Relative parameter	Description	Unit	Parameter range	Initialization value	Application
PA4	Working method selection		9～25	21	P, S
	● PA4=9: Manual method To operate in the Sr- menu, perform the acceleration or deceleration by '▲' or '▼', separately. ● PA4=10: JOG method To operate in the Jr- menu, set the JOG velocity value of the PA124, and then perform the CCW or CW operation by '▲' or '▼', separately. ● PA4=21: GSKLink bus control method The drive unit is carried out the real-time transmission of the command control and feedback data to simplify the connection by GSKLink bus and CNC, avoid the transmission distortion when using the analog and pulse signals; Also, it supports the real-time monitoring, parameter administration and process command treatment of the servo drive unit for the CNC.				

Usually, there are four steps for operating a new servo drive unit as follows:

Correct wiring ⟹ Parameter setting ⟹ Basis debugging operation ⟹ Function debugging

Mainly, the previous three steps are described in this chapter, so that user can operate the servo drive equipment faster.

When function debugging is performed based upon the user's different requirements, refer to the *Function Debugging* in the **Chapter Six**.

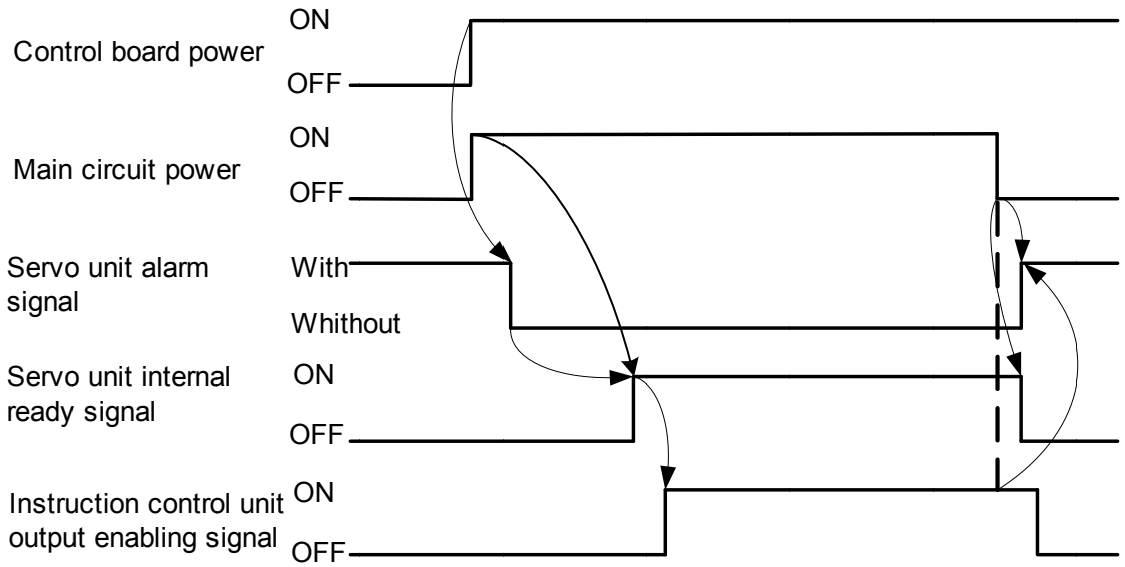
5.1 Ensure Correct Wiring

- It is suggest that user firstly perform the Manual or JOG operation without connecting the loading when using the servo drive unit at the first time. Ensure that the servo drive unit and motor can be normally operated after transporting, vibrating or installing.
- Connect the CNC system after confirming the drive equipment can be normally operated based upon disconnecting the loading; user can execut the debugging and operation of the velocity or position method according to their actual requirements.
- The loading operation can be connected and performed after the dubugging, such as the signal connection, parameter setting and motor operation, are normally performed.

Firstly, correctly connect the servo drive unit and motor based upon the “Section 3.2.2 Main Circuit Typical Wiring Example”; ensure that the motor is disconnected with the loading. After the connection is correctly connected, the power-on inspection is then performed as follows:

Inspection item	Inspection method
Inspect whether the specification of the servo drive unit and motor is matched.	Check the nameplate of the servo drive unit and motor according to the User Manual
Inspect whether connect the correct breaker, contactor and insulation transformer	Refer to the Appendix B Peripheral Equipment Selection
Inspect whether the R, S, T, P, B1 and B- are correctly connected with the U, V, W and PE.	Confirm the on-site power circuit; measure it by multimeter if it is necessary.
Inspect whether the feedback signal cable of the motor encoder is correctly connected.	Refer to the Section 3.3.1 in this User Manual
Inspect whether the screw of the main circuit terminal is fixed.	Check whether it is loosen by screwdriver.

Secondly, switch on the power after the connection is normal. The power-on time sequence is as follows:



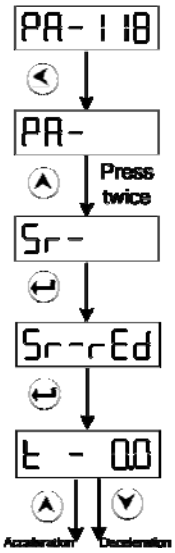
Notice	When the user operates the servo drive unit at the first time, call out the monitoring window of the motor’s current after the power is turned on firstly. The dimension of the motor’s current from the real-time monitoring is performed after the motor is enabled; if it exceeds the rated current of the motor, it will be immediately disabled. Check the parameter setting both the wiring and servo drive unit; otherwise, the motor may be damaged.

5.2 Manual Operation

After the servo drive unit is power on, normally, it will display r 0. If the servo drive unit fault occurs, the alarm code Err-□□ may display. Refer to the *Chapter Eight Abnormality and Troubleshooting* to solve it after an alarm code occurs.

Necessary parameter	Description	Unit	Parameter range	Initialization value	Application
PA4	Working method selection		9～25	21	P，S
PA118	Internal enabling		0～1	0	P，S

The operation steps of the Manual operation (PA4=9) are shown below:



1. r 0 displays after the servo drive unit is power ON, which is the motor operation speed monitoring window.

2. Check whether the PA1 is the correspondence with the motor (Refer to the Appendix A); it may skip this step if PA1 is correct; otherwise, call out the default parameter (Refer to the Section 4.4 for details) corresponding to the servo motor in the servo drive unit.

3. Set PA4=9, select the Manual operation method

4. Set PA118＝1, Internal enabling (Confirm that the motor axis rotation is without hazard before enabling.)
(If you want to cancel the internal enabling, set PA118＝0)

5. Enter the Manual operation menu according to the left figure (Regardless of the previous parameter settings).

6. Hold ▲, motor accelerates; release it, the velocity invariable.
Hold ▲, motor decelerates till to zero, and then accelerates reversely.
The motor may immediately stop by ▲ and ▼ simultaneously.

During Manual operation, Sr-rEd displays on the monitoring window, then no-Enb shows by OK button, which means the servo drive unit is without enabling signal, set the PA118 as 1; if the Sr-rEd appears on the monitoring window, then displays no-PA4 by OK button, which means the working method setting of the servo drive unit is incorrect, then set the PA4 as 9.

If the abnormal case, such as vibration or noisy generates on motor in the Manual operation mode; it is necessary to debug the velocity loop parameters PA15, PA16 and PA18 etc. Refer to the Section 6.1 for the debugging method.

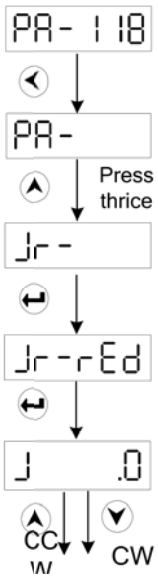
5.3 JOG Operation

After the servo drive unit is power on, normally, it will display . If the servo drive unit fault occurs, the alarm code may display. Refer to the *Chapter Eight (Abnormality and Troubleshooting)* to solve it after an alarm code occurs.

Necessary parameter	Meaning	Unit	Parameter range	Initialization value	Application
PA4	Working method selection		9～25	21	P, S
PA124	JOG operation speed	r/min	0～12000	300	S
PA118	Internal enabling		0～1	0	P, S

Similar as the Manual operation, the JOG is also performed by the operational panel.

The steps of the JOG operation (AP4=10) are as follows:



1. The appears as soon as the servo drive unit is turned on, which is the motor operation velocity monitoring window.

2. Check whether the PA1 is the correspondence with the motor (Refer to the Appendix A); it may skip this step if PA1 is correct; otherwise, call out the default parameter (Refer to the Section 4.4 for details) corresponding to the servo motor in the servo drive unit.

3. Set PA4=10, select the JOG operation method
   Set PA124＝500, set the JOG velocity is 500 r/min.

4. Set PA118＝1, Internal enabling (Confirm that the motor axis rotation is without hazard before enabling.)
   (Set PA118＝0, the internal enabling cancels)

5. Enter the JOG operation menu according to the left figure (Regardless of the previous parameter settings).

6. Hold , motor operates based upon the velocity 500r/min set by PA124.
   Hold the , the motor operates reversely based on the set velocity by PA124.
   Motor stops after releasing the button till to hold at the zero velocity.

During JOG operation, Jr-rEd displays on the monitoring window, then no-Enb shows by OK button, which means the servo drive unit is without enabling signal, set the PA118 as 1; if the Jr-rEd appears on the monitoring window, then displays no-PA4 by OK button, which means the working method setting of the servo drive unit is incorrect, then set the PA4 as 10.

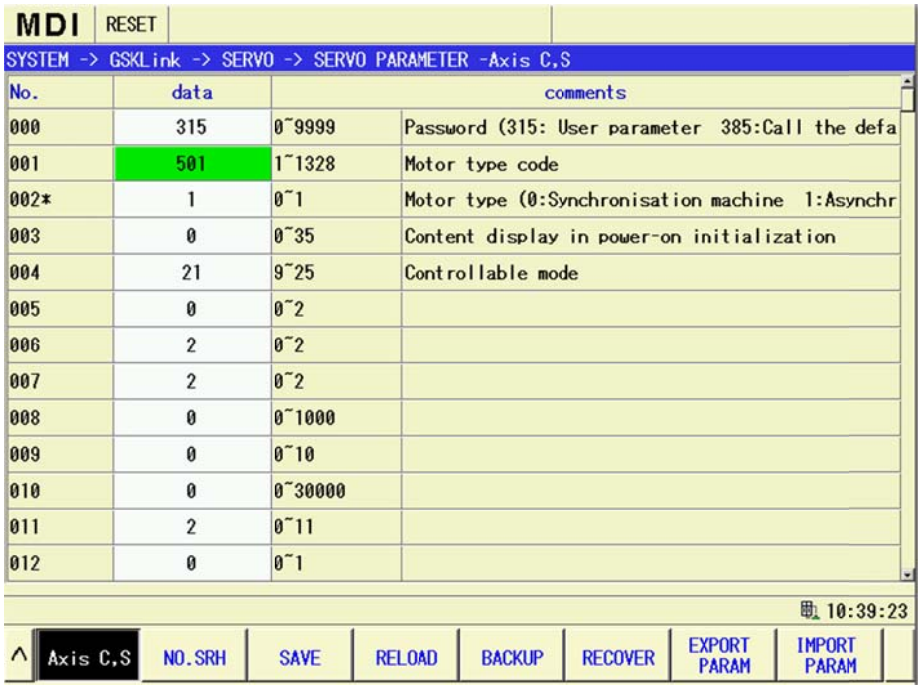
If the abnormal case, such as vibration or noisy generates on motor in the JOG operation mode; it is necessary to debug the velocity loop parameters PA15, PA16 and PA18 etc. Refer to the Section 6.1 for the debugging method.

5.4 GSK-Link Bus Control Operation

GR-L series servo drive unit is connected the CN4 and CN5 interfaces with the GSKLink of GSK988T□ (□: A, B, Ds and D) series, which carries out the high-speed real-time communication with the CNC system. The CNC system then can be realized by GSK-Link bus as follows:

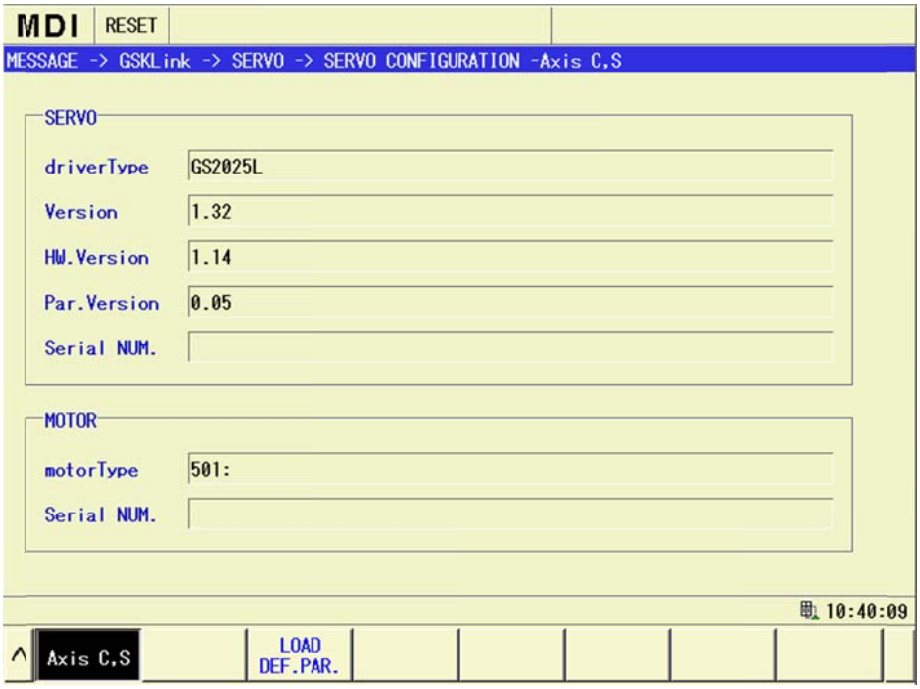
- **Parameter administration**

In the GSK988 T□/GSK980TDi series interface, perform the “System＞GSKLink＞Servo＞Servo parameter＞Optional any axis” in turn; And then the operations such as parameter modification, parameter saving, parameter backup, parameter backup recovery and parameter search, etc. can be performed.



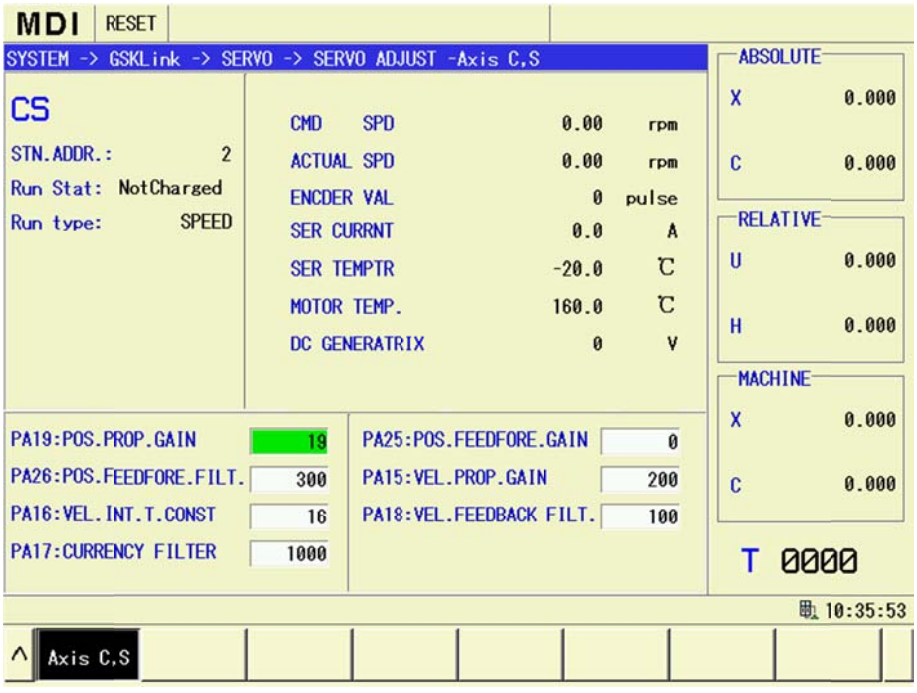
In the above-mentioned interface, enter the “System＞GSKLink＞Servo＞Servo configuration - some one axis” to recover the motor’s default parameter operation after the value of the PA1 is

altered.



- **State monitoring and servo rigidity adjustment**

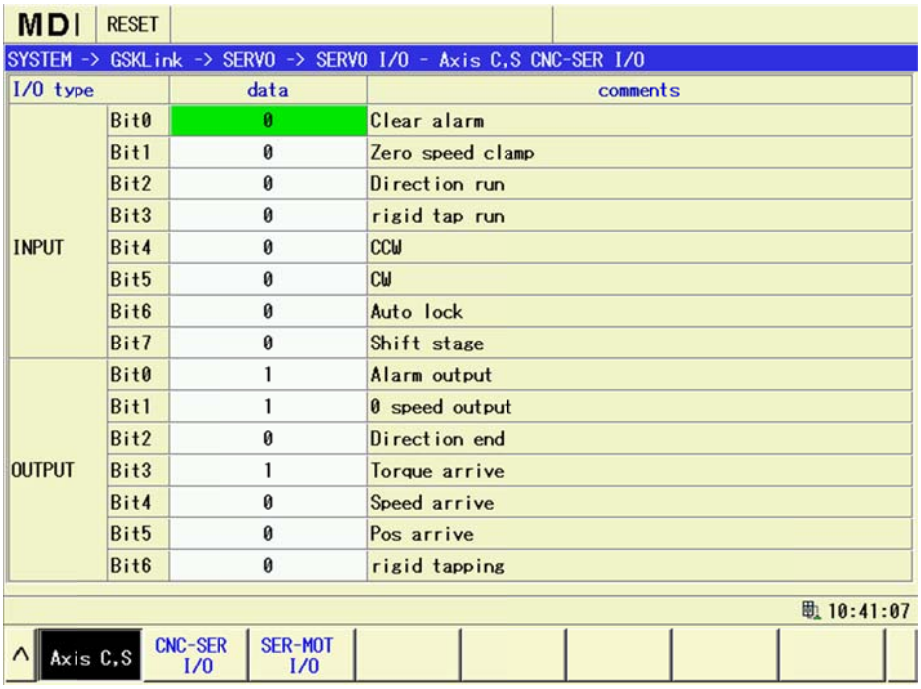
In the GSK988 TA series interface, perform the “System＞GSKLink＞Servo＞Servo adjustment - some one axis” in turn; And then the states such as the real-time monitoring command velocity, motor velocity, encoder value (dP-APo), servo current, servo temperature, servo DC bus voltage etc. can be performed. Simultaneously, each gain parameter of the 1st servo position loop, the 1st velocity loop can be debugged to realize the optimum operation state for the motor.



- **I/O information exchange and state monitoring**

In the GSK988TA interface, perform the “System＞GSKLink＞Servo＞Servo I/O” in turn; the

state of the real-time monitoring hardware IO and bus IO can be performed accordingly.



I/O type		data	comments
INPUT	Bit0	0	Clear alarm
	Bit1	0	Zero speed clamp
	Bit2	0	Direction run
	Bit3	0	rigid tap run
	Bit4	0	CCW
	Bit5	0	CW
	Bit6	0	Auto lock
	Bit7	0	Shift stage
OUTPUT	Bit0	1	Alarm output
	Bit1	1	0 speed output
	Bit2	0	Direction end
	Bit3	1	Torque arrive
	Bit4	0	Speed arrive
	Bit5	0	Pos arrive
	Bit6	0	rigid tapping

- **Real-time control**

In the GSK988TA system, the motion control of the feed axis is regarded as position control; the motion control of the spindle (it is also called the rotation axis) is retreated as speed control; the motion control of the Cs axis is that the spindle speed control shifts to the position control, that is, Cs axis can be performed an interpolation control to any feed axis. The motion commands of each axis are transmitted with high speed by GSKLink bus.

The CNC system and the I/O information of the servo drive unit are exchanged by bus, too; therefore, simplify the trouble of the complicate control cable connection. User does not care about these problems when they are operate the CNC system, and therefore each function command of CNC machine does not change.

GR servo drive unit should be correctly set the following parameters, which only can be set up the Ethernet communication with 988T□, as follows:

Relevant para.	Name	Unit	Para. range	Default value	Application
PA4	Control method selection		9～25	21	P, S
	PA4=21: GSKLink communication function				
PA156	Servo drive unit slave machine number		1～20	**1**	P, S

	Usually, more than one servo drive unit is set up the bus communication with the CNC system, set the corresponding servo salve machine number to CNC system; confirm that CNC is uniquely controlled to some one servo drive unit; and consequently, the servo drive unit connected with the same CNC system can not set the repeated servo slave number.

CHAPTER SIX FUNCTION DEBUGGING

6.1 Basis Performance Parameter Debugging Explanation

Notice	■ The following figure is the servo drive unit performance parameter debugging. User should appropriately debug the partial parameter based upon the following figure according to the different motor or loading to achieve the optimum working state of the motor. ■ Over-debugging may cause the servo motor unstable operation.

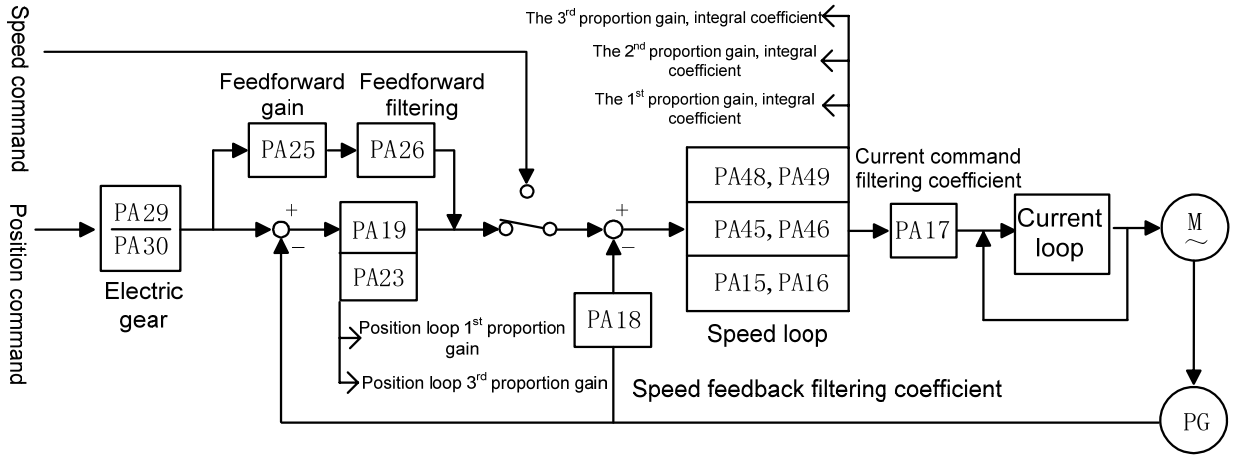


Fig. 6-1 Basis performance parameter debugging

- Generally, the above-mentioned parameter should be firstly adjusted the velocity loop, then the position loop. (The current loop parameter is already optimized before deliverying, so that the user needs not to adjust it again.)
- The parameter range of between the AC permanent synchronous motor and AC asychronous spindle motor is different, but the debugging method is similar.

6.1.1 Debugging Method of Adapted Permanent Synchronous Motor

Firstly, confirm that the value of the PA1 is consistent with the type code of the adapted motor while the user debugs the machine; otherwise, the default parameter should be called out based upon the corresponding motor type code in the Appendix A.

The characters and debugging methods of the parameter will be described as follows:

- PA15 (PA45 shares the same debugging method with the PA48) velocity loop proportional gain, the recommended debugging range is 50～600;

Increase the setting value

Advantage: Accelerate the overshoot, overrun and adjustment. The more the motor's overrun decreases, the more the rigid strengthens.

Shortage: It is easy to cause the vibration of motor itself and the resonance of the mechanical equipment, as well the noisy from the machine vibration.

Decrease the setting value

Advantage: Decrease the impacting of the mechanical equipment when the loading inertial is larger.

Shortage: The overrun velocity is increased when the resolution of the PA15 is smaller, which is easy to cause the shimmy of the mechanical equipment, and generate the low and deep noise, and it is also slow the excitation of the loading and adjustment.

Adjustment skill

In the default parameter, it can be altered 50 each time to confirm the approximate range, and then slightly debug it.

- PA16 (PA46 shares the same debugging method with the PA49) velocity loop integral coefficient, the recommended debugging range is 1～3000.

Increase the setting value

Advantage: Quicken the velocity command response, strengthen the motor rigidity;

Shortage: The setting value is excessive big, which causes the vibration of motor itself and the mechanical equipment resonance, as well the noisy from the mechanical vibration.

Decrease the setting value

Advantage: It is not easy to cause the resonance and wave of the motor and mechanical equipment when the loading inertial is bigger.

Shortage: Slow response for the velocity command, it is easy to cause the wave of the velocity when the loading changes, so that the smoothness on the machining workpiece surface is affected.

Adjustment skill

In the default parameter, it can be altered 100 each time to confirm the approximate range, and then slightly debug it.

- PA18 velocity feedback filtering coefficient; the recommended debugging range is 100～3000.

Increase the setting value

Advantage: Quicken the response of the velocity command; reduce the velocity overshoot of the motor;

Shortage: The setting value is excessive big, which causes the motor and the mechanical equipment resonance, as well the noisy from the mechanical vibration.

Decrease the setting value

Advantage: It is not easy to cause the resonance and wave of the motor and mechanical

equipment when the loading inertial is bigger.

Shortage: The setting value is ultra-small, the wave velocity is then enlarged, and even vibration issues.

Adjustment skill

In the default parameter, it can be altered 100 each time to confirm the approximate range, and then slightly debug it.

- PA19 position loop proportional gain (it is same to the PA23 debugging method), the recommended debugging range is 20～100.

Increase the setting value

Advantage: Strengthen the position loop rigidity, reduce the position following-error, and then decrease the position overshoot position.

Shortage: The setting value is ultra-big; it is easy to cause the resonance of the motor and mechanical equipment.

Decrease the setting value

Advantage: It is not easy to cause the vibration when starts or stops, as well less impacting to the mechanical equipment.

Shortage: The setting value is ultra-small; it is easy to cause the machine crawl, overcutting etc.

Adjustment skill

Increase 10 (or decrease 10) to roughly debug based upon the motor's default parameter, and then slightly debug till to the motor operates stably.

Summary: The proportional gain and integral coefficient of the velocity loop can be adjusted with the same proportion based upon the concrete servo motor and loading. Generally, the bigger the loading inertial is, the less the setting value is. The two parameters should be set bigger as much as possible on the condition that there is no vibration on the system.

6.1.2 Debugging Method of Adapted AC Asynchronous Spindle Motor

Notice: When the GR-L series product matches with the AC asynchronous spindle motor, the parameter range of the Section 6.1.1 is not suitable any more.

Firstly, confirm the value of the PA1 is consistent with the type code of the adapted motor while the user debugs the machine; otherwise, the default parameter should be called out based upon the corresponding motor type code in the Appendix A.

The characters and debugging methods of the parameter will be described as follows:

- PA15 (PA45 shares a same debugging method with the PA48) velocity loop proportional gain; the recommended debugging range is 500～2000.

Increase the setting value

Advantage: Accelerate the overshoot, overrun and adjustment. The more the motor's overrun decreases, the more the rigid strengthens.

Shortage: It is easy to cause the vibration of motor itself and the mechanical equipment resonance, as well the noisy from the mechanical vibration.

Decrease the setting value

Advantage: When the loading inertial is bigger which is reduced the impacting to the mechanical equipment.

Shortage: The overrun velocity is increased when the resolution of the PA15 is smaller, which is easy to cause the shimmy of the mechanical equipment, and generate the low and deep noise, and it is also slow the excitation of the loading and adjustment.

Adjustment skill

In the default parameter, it can be altered 100 each time to confirm the approximate range, and then slightly debug it.

- PA16 (PA46 shares the same debugging method with the PA49) velocity loop integral coefficient, the recommended debugging range is 1～1000.

Increase the setting value

Advantage: Quicken the velocity command response, strengthen the motor rigidity;

Shortage: The setting value is excessive big, which causes the vibration of motor itself and the mechanical equipment resonance, as well the noisy from the mechanical vibration.

Decrease the setting value

Advantage: It is not easy to cause the resonance and wave of the motor and mechanical equipment when the loading inertial is bigger.

Shortage: It is slow response to the velocity command, and it is easy to cause the velocity fluctuation when the loading changes; so the smoothness of the machining workpiece surface is then affected.

Adjustment skill

In the default parameter, it can be altered 20 each time to confirm the adequate range.

- PA18 velocity feedback filtering coefficient; the recommended debugging range is 100～1000.

Increase the setting value

Advantage: Quicken the response of the velocity command; reduce the velocity overshot of the motor;

Shortage: The setting value is excessive big, which causes the motor and the mechanical equipment resonance, as well the noisy from the mechanical vibration.

Decrease the setting value

Advantage: It is not easy to cause the resonance and wave of the motor and mechanical equipment when the loading inertial is bigger.

Shortage: The setting value is ultra-small, the wave velocity is then enlarged, and even vibration issues.

Adjustment skill

In the default parameter, it can be altered 50 each time to confirm the approximate range, and then slightly debug it.

- PA19 position loop proportional gain (It is same to the PA23 debugging method); the recommended debugging rage is 20～100.

Increase the setting value

Advantage: Strengthen the position loop rigidity, reduce the position following-error, and decrease the position overshoot;

Shortage: The setting value is excessive big, which causes the motor and the mechanical equipment resonance.

Decrease the setting value

Advantage: It is not easy to cause the vibration when starts or stops with the large loading inertial, as well less impacting to the mechanical equipment;

Shortage: It is easy to cause crawl and overcutting etc. for the machine tool when the setting value is ultra-small.

Adjustment skill

Increase 10 (or decrease 10) to roughly debug based upon the motor's default parameter, and then slightly debug till to the motor operates stably.

Summary: The proportional gain and integral coefficient of the velocity loop can be adjusted with the same proportion based upon the concrete servo motor and loading. Generally, the bigger the loading inertial is, the less the setting value is. The two parameters should be set bigger as much as possible on the condition that there is no vibration on the system.

6.1.3 Three-Gain Selection of Closed-Loop Control

Spindle servo drive unit allows debugging 3-kind different velocity loop, position loop rigidity in the different function applications, refer to the following table:

General application	The 1st proportional gain (PA15) of velocity loop and the 1st integral time coefficient (PA16) are enabled. The 1st proportional gain (PA19) of position loop is enabled.	It is applied to the most general-purpose velocity and position control.	Moderate velocity loop rigidity
CNC system executes M29	The 2nd proportional gain (PA45) of velocity loop and the 2nd integral time coefficient (PA46) are enabled. The 1st proportional gain (PA19) of position loop is enabled.	CNC controls spindle to perform the rigid tapping.	Stronger velocity loop rigidity

CNC system executes M51, before the completion of the motor orientation	The 3rd proportional gain (PA48) of velocity loop and the 3rd integral time coefficient (PA49) are enabled. The 3rd proportional gain (PA23) of position loop is enabled.	Instruction control unit controls the spindle servo motor to perform the orientation function	Weaker velocity loop rigidity
CNC system executes M14, before the completion of the motor orientation	The 3rd proportional gain (PA48) of velocity loop and the 3rd integral time coefficient (PA49) are enabled. The 3rd proportional gain (PA23) of position loop is enabled.	Instruction control unit controls the spindle servo motor to perform the velocity/position shifting	Moderate velocity loop rigidity

- **The orientation application of the velocity/position shifting**

The spindle should be firstly orientated when the Cs axis is performed the velocity/position shifting; in this case, the rigidity both the motor's and general-purpose velocity control are consistent. The spindle after orientation is easily caused the swing when the spindle inertial is bigger or its driving machinery is with bigger interval. In this moment, it is necessary to descend the rigidity of the motor and, especially, the integral adjustment of the velocity loop so that the motor can be fast and stably clamped at the reference position.

Perform the M14 when the application velocity/position is shifted, then start the parameter PA48, PA49 and PA23; the weaker servo motor rigidity then can be set.

- **The application of the rigid tapping**

In the machine tool machining, the rigid tapping belongs to the thread machining under at the position closed-loop; it should has the high rigidity with the servo motor, and with the fast response to the command, as well reduce the following-error as much as possible. And therefore, the higher proportional gain of the servo drive unit velocity loop should be set when the rigid tapping is performed. Generally, the motor velocity should be less than the 2000r/min in rigid tapping because it is easy cause vibration when the high rigidity motor is performed high speed. The common motor operation velocity should be higher instead of the rigidity of the servo motor for the general-purpose machining of the spindle. And therefore, the general-purpose spindle machining needs the lower velocity loop gain compared with the rigid tapping.

The M29 is performed when the system starts the rigid tapping, then uses the PA45 and PA46; the higher servo motor rigidity then can be set.

- **The application of the orientation function**

Similar as the velocity/position shifting, the rigidity of the motor and the one controlled by the general-purpose velocity are consistent when the spindle motor performs the orientation function. When the inertial of the spindle is bigger or the spindle driving device is with bigger interval, the spindle after orientating is easily swung. In this case, it is necessary to reduce the rigidity of the motor; especially, for the integral adjustment of the velocity loop to guarantee the motor clamps at the one position rapidly and stably.

The M51 is performed when the orientation function is applied, then uses the PA48, PA49 and PA23; the weaker servo motor rigidity then can be set.

6.2 Position Electric Gear Ratio

As for the mechanical variable gear, the "**Electric gear function**", is set the motor movement value equivalent to the input command as any value by adjusting the servo parameter during the control, regardless of the deceleration ratio of the machinery and resolution of the encoder.

Relevant para.	Description	Unit	Para. range	Initialization value	Application
PA29	Position pulse command multiple coefficient		1～32767	1	P
PA30	Position pulse command frequency-division coefficient		1～32767	1	P

The calculation of the position electric gear ratio is as follows:

$$S = \frac{I}{\delta} \cdot \frac{CR}{CD} \cdot \frac{PA29}{PA30} \cdot \frac{L}{4C} \cdot \frac{ZD}{ZM}$$

That is, $$G = \frac{PA29}{PA30} = \frac{4C}{L} \cdot \frac{ZM}{ZD} \cdot \frac{\delta}{I} \cdot \frac{CD}{CR} \cdot S$$

G: Electric gear ratio, it is recommended as $\frac{1}{50} \le G \le 50$

C: Motor encoder resolution; (Note: Incremental encoder numerator is 4C, the absolute one is C)

L: : Leading screw guide (mm);

ZM: The gear number at the end of the leading screw (It is suitable for the decelerator);

ZD: The gear number at the end of the motor;

δ: The least output command unit of the system (mm/pulse);

I: Command shifting (mm);

S: Actual shifting (mm)

CR: Instruction control unit command multiple coefficient;

CD: Instruction control unit command frequency-division coefficient.

[For example]: The system is GSK988T□ for the machine tool. The motor is directly connected with the X axis leading screw; its guiding is 6mm; the encoder of the motor is 17-bit absolute type; calculate the electric gear ratio of the servo drive unit regardless of the

command multiple frequency and frequency-division coefficient.

Solution: Motor directly connects with the X axis, then ZM : ZD＝1; Generally, S = I, the command shifting equals to the actual one; as well the least output command unit in the diameter programming $\delta=\frac{0.0001}{2}$ mm/pulse and when GSK988T□ system is selected the 0.1μ machining accuracy, it can be substituted into the following format:

$\delta=\frac{0.0001}{2}$ mm/pulse，substitute the formula:

$$G=\frac{PA29}{PA30}=\frac{C}{L}\cdot\frac{ZM}{ZD}\cdot\frac{\delta}{I}\cdot\frac{CD}{CR}\cdot S=\frac{C}{L}\cdot\delta=\frac{2^{17}}{6}\times 0.00005=\frac{2048}{1875}$$

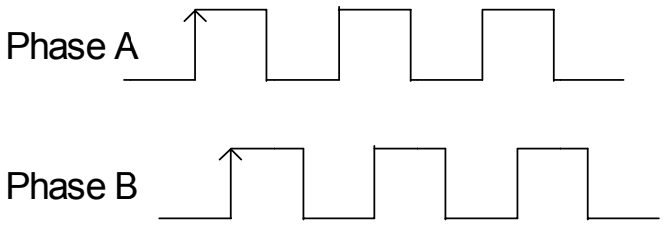
Then, the parameter PA29 is set to 2048, PA30 is set to 1875.

6.3 Shift of Motor Rotation Direction

■ **Standard setting**

1. When the overall parameters of the servo drive unit are set as Initialization values;

2. The phase relationships between the motor encoder input signal A and B are shown below:



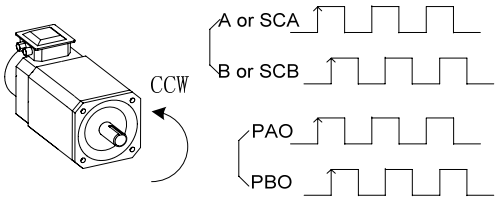
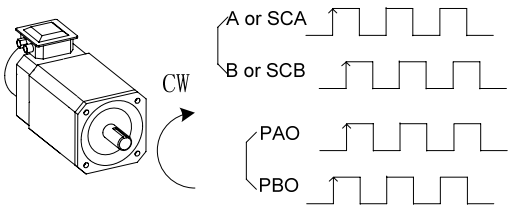
In that case, the relationships between the command and motor rotation direction are consistent with the “Standard setting” for the speed method or position method.

■ **Reverse mode**

Servo drive unit can be shown the reverse rotation “Reverse Mode” of the rotation direction of the servo motor on the condition that the servo motor wiring does not alter.

1. Position method

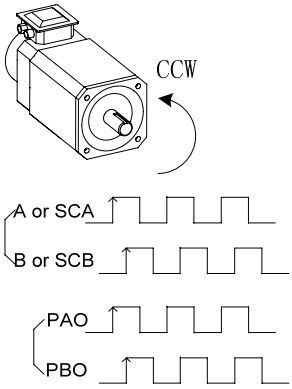
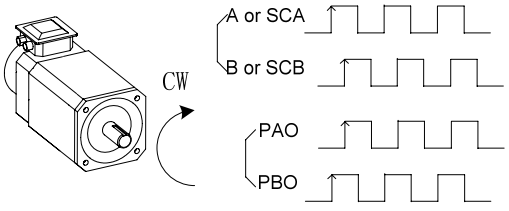
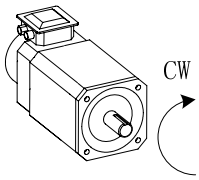
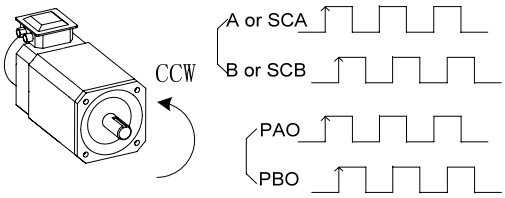
Relevant para.	Description	Unit	Parameter range	Initialization value	Application
PA28	Position command direction reverse		0～1	0	P
	PA28＝0: Maintain the origin command direction; PA28＝1: Inputted the pulse command reverse.				

Command	Standard setting (PA28=0)	Reverse mode (PA28=1)
CCW command	 LED displays that the motor speed is positive (PA34=0).	 LED displays that the motor speed is negative. (PA34=0).

Explanation: The output of the PAO and PBP are related with the PA34, and consequently, set the PA34=0, the above-mentioned relationship is indicated the function of the PA28 parameter.

2. Velocity method

Relevant para.	Description	Unit	Parameter range	Initialization value	Application
PA51	The motor rotation direction is reversed when velocity command is enabled.		0～1	0	S
	PA51＝0, velocity command is positive, motor CCW; velocity command is negative, motor CW. PA51＝1, velocity command is positive, motor CW; velocity command is negative, motor CCW.				

Command	Standard setting (PA51=0)	Reverse mode (PA51=1)
CCW command	 LED displays that the motor speed is positive (PA34=0).	 LED displays that the motor speed is negative (PA34=0).
CW command		 LED displays that the motor speed is positive (PA34=0).

	LED displays that the motor speed is negative (PA34=0).	

6.4 Servo Torque Limit

Set the overloading multiple of the servo drive unit based upon the rated current of the motor, and its setting range is 0～300%, which means up to 3 times overloading. If the setting is less than 100%, the output torque of the servo drive unit can be limited.

Relevant para.	Description	Unit	Parameter range	Initialization value	Application
PA133	Internal CCW torque limit	%	0～300	300	P,S
	Set the internal torque limit value of the servo motor along with the CCW direction, and the internal torque limit is enabled in the velocity and position method.				
PA134	Internal CW torque limit	%	-300～0	-300	P,S
	Set the internal torque limit value of the servo motor along with the CW direction, and the internal torque limit is enabled in the velocity and position method.				
PA125	Manual, JOG operation torque limit	%	0～300	300	S
	The torque output from motor is restricted by its parameter percentage when the simple operations such as the manual and JOG are performed. Set lower percentage torque to guarantee the safety of the equipments.				

6.5 Brake Release Signal Application

In order to lock the vertical or inclined worktable connected with the motor's shaft to prevent the worktable from dropping when the servo alarms or power absents. Generally, we use the servo motor with power-down brake; actually, it is brake motor. This servo drive unit provides brake releasing signal (HOLD) for effectively controlling the movement of the hold motor.

The power-down brake is only used in the Hold Worktable instead of using the Deceleration and Enforcement machine movement stop.

① First of all, correctly connect the wiring based upon the Fig. 6-2; it is very essential to note that the required input signal in the following table must be connected.

Pin No.	Signal input	Function
CN1	HOLD1	Brake releasing signal. (It is enabled when PA2=0)
	HOLD2	

The brake releasing signal, in the Fig. 6-2, controls the actual wiring principle of the brake motor. The 24V in the following figure is offered by user. The brake releasing signal (HOLD) is relay NO contact output. Its wiring is shown below:

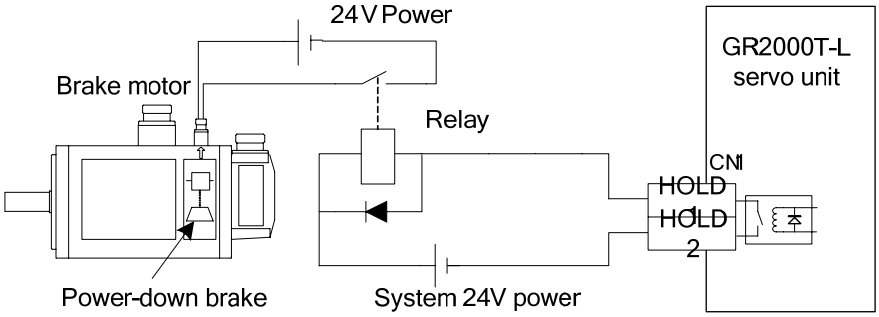


Fig. 6-2 The typical example of the HOLD± brake releasing signal

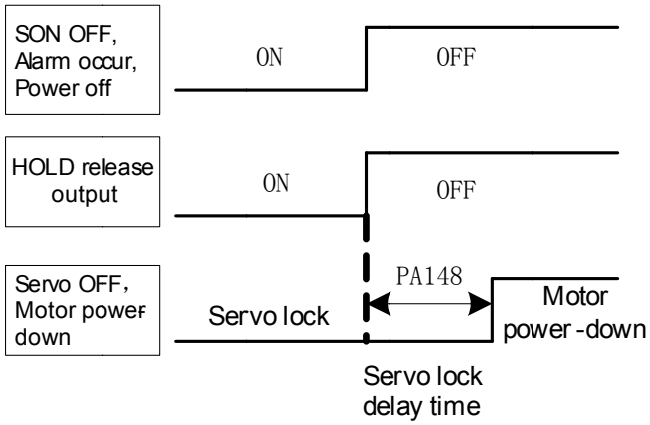
The motors with different power are matched with different power-down brake; refer to the following brake's technology parameter with different motors when user selects the 24V power.

Motor flange size	Rated torque	Power voltage	20℃ brake power	Releasing time (s)
80	3.2 N·m	DC(0.9～1.1)24V	15W	0.037
110	4 N·m	DC(0.9～1.1)24V	20W	0.037
130	12 N·m	DC(0.9～1.1)24V	30W	0.042
175 (motor rated torque 12～22 N·m)	23 N·m	DC(0.9～1.1)24V	40W	0.135
175 (motor rated torque 30～38 N·m)	46 N·m	DC(0.9～1.1)24V	50W	0.135

② Switch on the power after confirming the correct connection, then set the necessary parameter. Consider the time sequence relationship of the HOLD signal when the machinery or worktable slightly moves under the gravity. The time adjustment can be performed with the related parameter of the brake movement, as follows:

Relevant parameter	Description	Unit	Parameter range	Initialization value	Application
PA147	Allow the motor's Max. deceleration time before the power-down operation	ms	0～30000	30	P, S
PA148	Servo lock delay time	ms	0～30000	100	P, S
PA149	The motor speed in the power-down operation	r/min	5～300	30	P, S

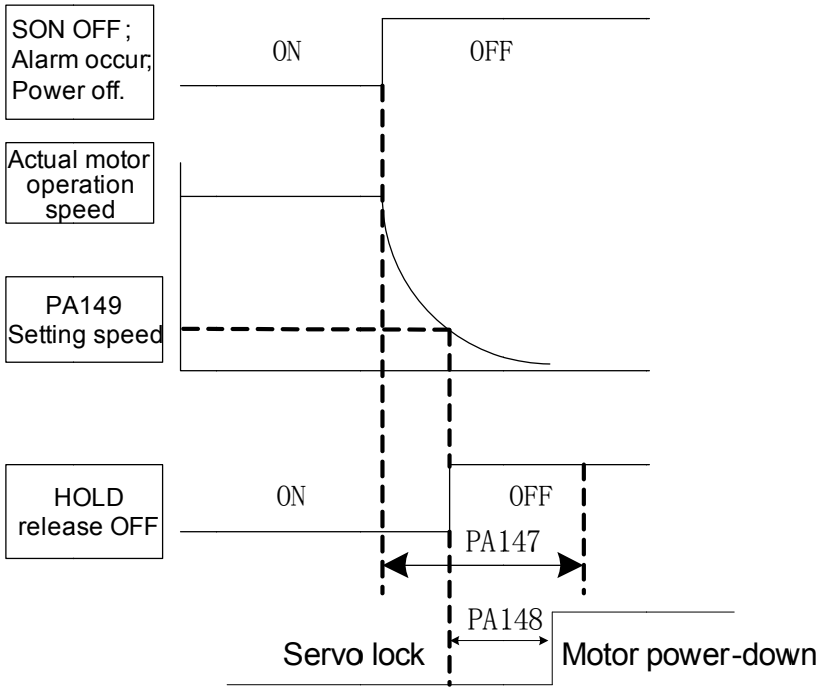
Case 1: The power of the servo drive unit is suddenly turned off in the static state of the motor.



Generally, if HOLD is cut off, simultaneously, the servo drive unit is turned off. When the machinery or worktable slightly moves under the gravity; adjust the PA148 to delay the servo drive unit OFF and then avoid the slight movement.

The energy may release in a short time by the dynamic-consumption brake due to the servo drive unit is turned off; and therefore, the actual servo locked delay time does not exceed the energy releasing time even when the PA148 is set to bigger value; and the energy releasing time is related with the loading inertia or the deceleration time of the motor.

Case 2: The power of the servo drive unit is suddenly turned off in the operation state of the motor.

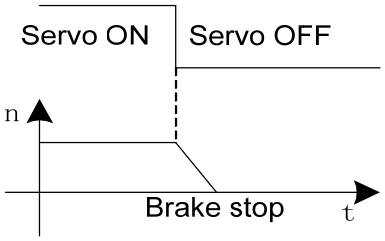


The servo drive unit can not be suddenly braked during moving with high velocity; otherwise, it may damage the brake; it is necessary to cut off the HOLD brake releasing signal at the appropriate time. The motor can be firstly decelerated and then braked by adjusting the PA147 and PA149. It is recommended that the PA149 is set to 30r/min. The setting value of the PA147 should be performed based upon the actual mechanical operation.

6.6 Motor Brake Method

- **Brake**

Generally, the brake is a stop method for the servo drive unit. The energy generated during the motor stop is run out by the brake resistance; on the other hand, the servo drive unit adds the reverse torque for the motor, so that the motor is rapidly stopped in a very short time. The brake time is determined by PA58.

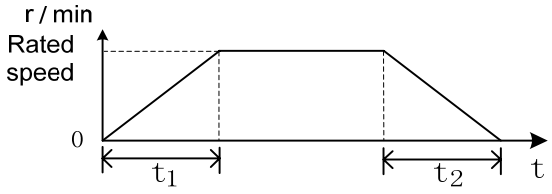


Relevant parameter	Description	Unit	Parameter range	Initialization value
★PA57	Straight-line acceleration time constant	0~10000	50	S
★PA58	Straight-line deceleration time constant	0~10000	100	S

The acceleration/deceleration time constant is only enabled in the velocity method.

PA57 sets the desired time that the motor accelerates to rated velocity from the zero speed; refer to the t1 in the following figure.

PA58 sets the desired time that the motor decelerates to rated velocity from the zero speed; refer to the t2 in the following figure.



The actual acceleration time of the motor = Command velocity/Rated speed×PA57;

The actual deceleration time of the motor = Command velocity/Rated speed×PA58;

Note: When the PA57 and PA58 are set as ultra-small, the actual acceleration/deceleration time is restricted by the servo drive unit top acceleration/deceleration capability. Failure to restriction may generate during the brake; on the contrary, the overall deceleration time may exceed the setting one.

6.7 Spindle Clamping Interlocking Signal

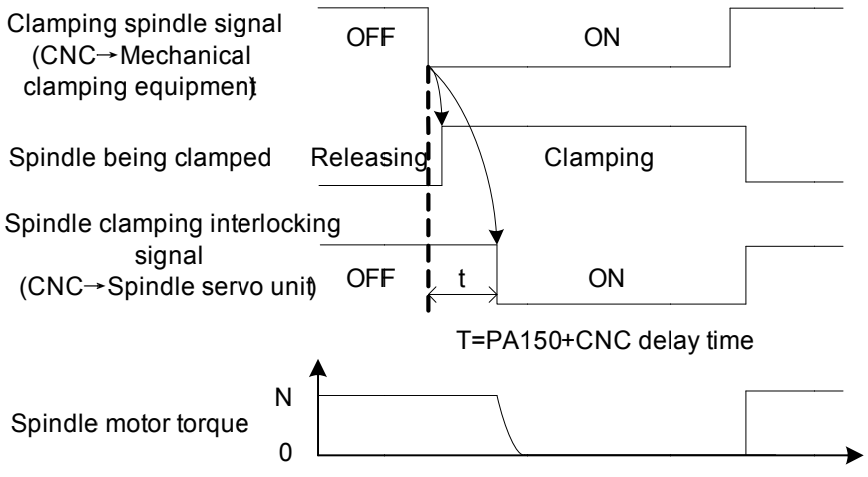
At present, partial turning machines are equipped with the mechanical clamping devices on the spindle for carrying out the drilling, tapping, etc. at the excircle of the workpiece. The spindle can be locked by machinery to ensure that of the accuracy and stability of the machining. In order to solve the conflicts between the clamping force of the mechanical clamping equipment and the torque of the spindle motor; when the CNC system control machinery clamping clamps the spindle, simultaneously, control the servo drive to reduce the torque of the motor. As for the GS series spindle servo drive unit, the function for decreasing the motor torque can be carried out by controlling the spindle clamping interlocking signal (BREF).

Explanation: The spindle clamping interlocking signal (BREF) is specified by communication agreement.

Relevant para.	Description	Unit	Parameter range	Initialization value	Application
PA150	Spindle clamping interlocking delay time	ms	0～32000	100	S, P
	After the spindle that is clamped by the mechanical clamping equipment is set at the side of the spindle, and then reduce the delay time of the motor's torque.				

Generally, PA150 is set to 100. This delay time is mainly confirmed that the spindle is already clamped absolutely by mechanical equipment, the motor's torque can be reduced accordingly; in this case, the spindle's position will not offset during clamping.

The time-sequency of the CNC controllable spindle clamping is shown below:



When the workpiece is already machined and spindle clamping equipment releases, the BREF signal is set to OFF. The spindle enters to the position method again and the spindle position is still at the clamping position. The spindle position will slightly offset if the clamping equipment is released; and the spindle position is then drawn back to its clamping position after the BREF turns into OFF.

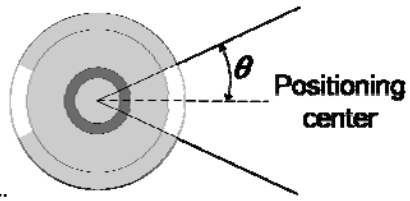
6.8 Spindle Orientation Function

Orientation function: In order to the change and measure the tool, rapidly and accurately position to reserve at the prestop position (the stop position of either the motor's shaft or the spindle) based upon the feedback signals of the motor encoder and the 2nd position encoder, which is called the orientation function.

Orientation accuracy: The orientation accuracy can be expressed by the Max. orientation angle θ when the orientation axis is executed; refer to the following formula.

Formula 1——

$$\theta = \frac{360^\circ}{4C} = \frac{90^\circ}{C}$$



Then, the orientation accuracy is ±θ.

C: The resolution of the position feedback encoder;

4C: The orientation encoder pulse after the 4-frequency.

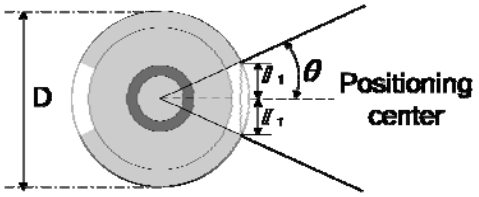
And therefore, when select the 1024 resolution incremental encoder, the orientation accuracy is ±0.088°.

> In the actual orientation, the orientation error is ±2θ due to the mechanical driving error.

In the orientation application, the orientation accuracy, also, can be expressed by the workpiece arc length or the string length of the arc. For example, turning machine, the orientation drilling is performed at the excircle of the round workpiece; milling machine, the machining center is performed the tool-setting with the spindle. In this case, the orientation accuracy is related with not only the motor (or spindle), but also the diameter of the orientation circle; refer to the following formulae:

Formula 2——

$$\delta_1 = \frac{D}{2}\sin\frac{90^\circ}{C}$$



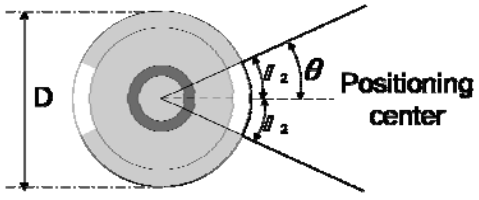
D: The diameter of the orientation circle

δ_1: The string length on the orientation circle is regarded as the orientation accuracy.

Also, it can be calculated by the following formula.

Formula 3——

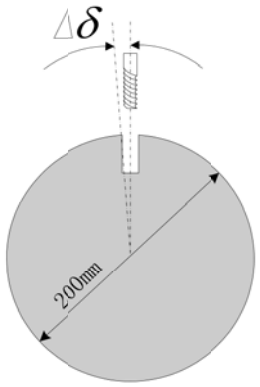
$$\delta_2 = \frac{\pi D}{4C}$$



The string length on the orientation circle is regarded as the orientation accuracy.

The orientation accuracy of spindle servo drive unit can be exactly set to the $\pm\delta_1$ or $\pm\delta_2$ based upon the formulae 2 and 3.

For example:



The drilling is performed at the excircle round workpiece with 200mm diameter, the orientation error of the drilling should be less than 50μm, calculate how many resolutions of the encoder can be required?

The arc length calculation can be performed according to our selection; the drive unit should guarantee $\Delta\delta$ ≤25μm to suitable for the requirement less than 50μm, which can be calculated by the formula 3:

$$\Delta\delta \geq \frac{\pi D}{4\,C}$$

Then: C ≥ 6280

And therefore, to guarantee the error of the drilling position is less than or equals to the 50μm, the selected encoder resolution should be more than or equals to 6280.

Also, the GR-L series servo drive unit orientation function can be divided into two operations based upon the different position feedback inputs:

1. The motor encoder (input by CN2) is regarded as the orientation position feedback input; the operation schedule for orientation is as follows:

① Call the monitoring menu dP-APo after the power is turned on, display the E □□□□ by ↵; the symbol "E" means that the motor shaft is on the undefined orientation position, and its value can not regarded as the orientation position reference value.

② The motor shaft revolves one circle at least; the servo drive unit displays the correct position after it detects the Z pulse signal of the motor encoder, then the value of the dP-APo becomes F □□□□, which means the current encoder position is correct.

The motor rotates one circle, which can be revolved the shaft not only by hand but also by a specified low velocity command when the motor is disabled.

③ Ensure the spindle servo drive unit enabling is cut off. The motor axis or the connected spindle are slowly adjusted to the preset orientation point, then record the position displayed by dP-APo, write it to the PA103; as well, record the position displayed by dP-APo., write it to the PA104, and then, save it, the two parameter values are the

orientation position 1.

④ CNC system performs M51 (Orientation start). System delivers the enabling (SON) to servo drive unit by GSKlink bus, and then the orientation starts (OSTA) the commands; firstly, the motor rotates based upon the orientation velocity set by PA99 till find the orientation point position, and then it immediately holds on the orientation position; simultaneously, the servo drive unit sends the orientation completion signal (COIN) to the CNC system.

⑤ The operation such as the tool-change can be carried out after the CNC system accepts the COIN; the orientation start signal (OSTA) during the tool-change should always ON. Other operations can be performed only when the signal should be cancelled after the operation is performed.

1. To guarantee the position accuracy of the orientation operation, the motor encoder is regarded as the feedback signal of the orientation position, it is only suitable for the 1:1 driving ratio occasion between the motor shaft and machine spindle;
2. When the machine is not performed the driving ration 1:1 between the motor shaft and machine spindle, then the 2nd position encoder of the driving ration 1:1 should be installed at the side of the machine spindle; so that the encoder feedback returns the unique Z pulse signal after the spindle rotates one circle.

2. The 2nd position input signal (inputted from CN3) is regarded as the operation schedule of the orientation position feedback input, which is similar with the above-mentioned operations; the rest of steps are identical other than the front of three. The front 3 steps are shown below:

① Call out the monitoring menu dP-SPo, then display the E □□□□ by ↵, after the power is turned on. The symbol “E” means that the spindle is at the undefined orientation position, and its value can not be regarded as the reference value of the orientation position.

② The servo drive unit may automatically search the correct position of the 2nd position encoder when the spindle rotates one circle at least. dP-SPo becomes F □□□□ after the correct position is searched, which means the current encoder position is correct.

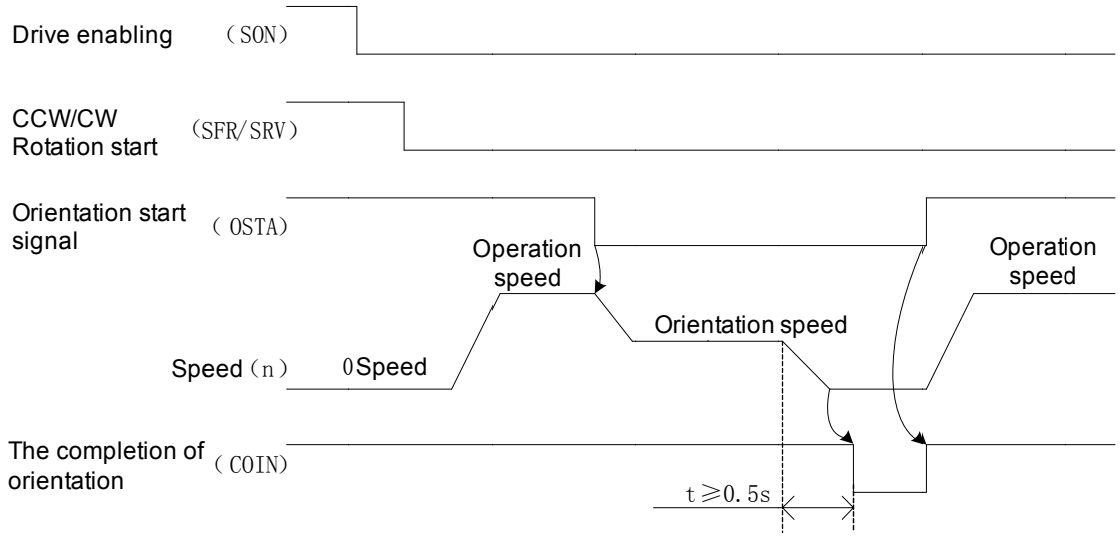
③ Ensure that the servo drive unit enabling is already cut off, the spindle is then slowly adjusted to the orientation point, and then record the position displayed from dP-SPo, lastly write to the PA103 to save it; in this case, this parameter value is treated as the orientation position 1.

④ The orientation can be completed by repeatedly performing the orientation operation steps 4~5 with the motor encoder.

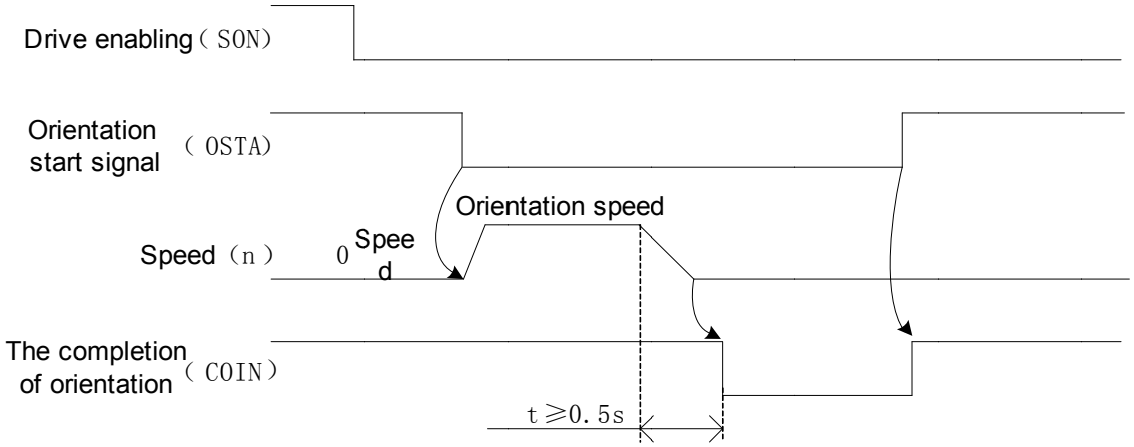
If the spindle is always rotates instead of inspecting the Z pulse when it orientates so that the orientation is unsuccessful. That is, the 2nd position encoder SCA and SCB pulses position are reversed. In this case, alter the value of the PA101 to save it, and then the orientation can be performed again after the power is turned on.

The time sequence of the whole orientation is as follows:

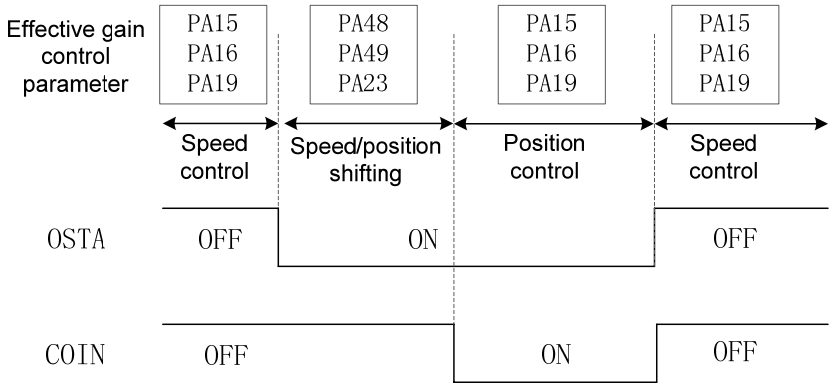
■ Spindle orientation time-sequence A (The motor is on the movement state.)



■ Spindle orientation time-sequence B (The motor is on the free or null velocity state.)



Relevant para.	Description	Unit	Parameter range	Initialization value	Application
PA23	The 3rd proportional gain of the position loop		10~1000	40	P
PA48	The 3rd proportional gain of the velocity loop	Hz	10~3000	200/400	S
PA49	The 3rd integral time constant of the velocity loop		1~3000	100	S
The 1st velocity-loop gain (PA15, PA16), the 1st position-loop gain (PA19), the 3rd velocity-loop gain (PA48, PA49) and the 3rd position-loop gain (PA23) are separately used during the orientation.					



Hence, the spindle swings during orientation, decrease the values of the PA48, PA49 PA23 according to the proportion to remove the swing.

※PA96	The type selection of the 2nd position encoder		0~30	0	P/S
	PA96＝0: TTL incremental encoder signal; PA96＝3: TAMAGAWA agreement, 17Bits single-coil absolute encoder signal; PA96 ＝ 4: TAMAGAWA agreement, 1617 multi-coil absolute encoder signal; PA96＝8: 21Bits magnetic-resistance encoder signal; PA96＝9: 22 Bits magnetic-resistance encoder signal; PA96＝10: 23 Bits magnetic-resistance encoder signal; PA96＝11: Null encoder in IGS, A384 gear; PA96＝12: Null encoder in IGS, A512 gear PA96＝13: BISS agreement，17 Bits single-coil absolute encoder signal; PA96＝14: BISS agreement，1217 multi-coil absolute encoder signal; PA96＝15: BISS agreement，19 Bits single-coil absolute encoder signal; PA96 ＝ 16: BISS agreement， 1219 multi-coil absolute encoder signal;; PA96＝21: ENDAT2.2 agreement，512 resolution magnetic grating encoder signal; PA96＝22: ENDAT2.2 agreement，1024 resolution magnetic grating encoder signal; PA96 ＝ 23: ENDAT2.2 agreement， 1200 resolution magnetic grating encoder signal;		PA96＝24: ENDAT2.2 agreement, 1400 linear magnetic grid encoder signal; PA96＝25: ENDAT2.2 agreement, 2046 linear magnetic grid encoder signal; PA96＝26: ENDAT2.2 agreement, 2600 linear magnetic grid encoder signal; PA96＝27: ENDAT2.2 agreement, 3600 linear magnetic grid encoder signal; PA96＝28: ENDAT2.2 agreement, 900 linear magnetic grid encoder signal; PA96＝29: ENDAT2.2 agreement, 600 linear magnetic grid encoder signal; PA96＝30: ENDAT2.2 agreement, 256 linear magnetic grid encoder signal; PA96＝37: 25Bit absolute single-core encoder.		
※PA97	Position feedback input signal selection		0~2	0/1	P/S
	PA97=1, the motor encoder signal is regarded as the position feedback input signal; PA97=0, the 2nd position input signal is treated as the position feedback input signal. In this case, the CN3 does not connect the 2nd position encoder feedback signal, the Er-24 fault on servo drive unit may occur.				
PA98	The 2nd position encoder resolution		10~30000	1024	P/S
	It is enabled when set the 2nd position encoder resolution and match with the incremental encoder.				

Relevant para.	Description	Unit	Parameter range	Initialization value	Application
PA99	Orientation velocity	r/min	10~1000	100	S
	When the spindle is orientated, firstly rotates based upon the orientation velocity, then the spindle motor rotates and dwells at the orientation position after the servo drive unit is captured the encoder pulse Z.				
PA100	The selection of the orientation direction		0~2	0	S
	PA100＝0, the orientation velocity of the motor is along with CCW when it is rotated to start in CCW; Similarly, the orientation velocity of the motor is along with CW when it is rotated to start in CW. PA100＝1, the motors are orientated along with the CCW orientation velocity no matter how the operation direction of the motor. PA100＝2, the motors are orientated along with the CW orientation velocity no matter how the operation direction of the motor.				
※PA101	The 2nd position feedback input signal reverse		0~1	0	P/S
	PA101＝0: Maintain the original phase relationships of the 2nd position input signal SCA, SCB pulses. PA101＝1: The phase relationships between SCA and SCB are reversed.				
PA102	The position window during orientation	Pulse	0~100	2	S
	The servo drive unit enters the position loop control; the motor shaft (or the spindle) searches and dwells at the reference point based upon the orientation velocity after the velocity/position shifting starts. The motor may slightly tremble at the distant of the stop because the position-loop is performed closed-loop adjustment for the offset angle of the motor shaft. And therefore, the orientation can be executed when the offset of the motor tremble is within the orientation window, and the PSIO shifting completion signal is enabled. If the setting value is smaller, PSIO shifting completion signal output may instable due to the tremble of the motor, even cause the failure of the orientation.				
PA103	Lower for the orientation position		0~9999	0	S
PA104	Higher for the orientation position	×10000	0~30000	0	S
	Set 4 orientation positions, if the numerical of the orientation position does not exceed the number of the lower orientation position, regardless of the higher orientation position. Wherein, the lower				

	orientation position based upon the orientation of the motor encoder signal is set by DP-APO, and the higher orientation position is set by the DP-APO. The lower orientation position based upon the orientation of the 2nd position encoder signal is set by DP-SPO, and the higher orientation position is set by the DP-SPO.

Explanation: After the parameter with "※" in front of the parameter number is modified, it can be enabled after saving when the power is turned on again.

6.9 Velocity/Position Shifting Function (CS Axis Function)

Cs axis function, is one certain axis of the CNC machine tool factory, can be controlled both the operation velocity (it owns the wide regulation speed range) and the position (it performs the interpolation operation with other feed axes). For example, the spindle of the turning machining center owns the above-mentioned function.

Velocity/position shifting function: The servo drive unit is the velocity control method. The servo equipment performs the orientation function after CNC system executes the M114. Servo motor orientates to the reference point, and then the system is performed the position control to the servo drive unit. The system performs M15, that is, the position method shifts to the velocity one.

The shifting process of the velocity/position is consistent with the orientation function, the same as the debugging method and relative parameter. The only different that the reference point between the orientation position of its function and the velocity/position shifting are set by different reference points, as well as the signal of the start velocity/position shifting is different.

Basis debugging operation:

Step 1	CNC system performs the M14 command It requires that the servo drive unit shifts to the position method from the velocity one.	The system delivers SON, PST1 input command to the servo drive unit by GSKlink bus of which this command can be monitored in dl-in. (Refer to the Section 3.3.4 for details)

Key points:

1. PA88 exactly stops at the reference point (PA90+PA91) after it set to velocity/position shifting by default. Set PA88=1, it immediately stops after shifting the velocity/position regardless of the reference point.
2. dl-in is the I/O information in the communication, debugger can verify the PLC signal of CNC based upon these information.

Relevant para.	Description	Unit	Parameter range	Initialization value	Application
PA88	Velocity position shifting method selection		0～1	0	P/S
	0: Exactly stop at the reference point position after shifting to the position method from the velocity method (PA90+PA91); 1: It immediately stops after shifting to the position method from the velocity method instead of searching the reference point.				
PA89	Position velocity shifting method selection		0～1	0	P/S
	0: Shift to the velocity method after performing the position command; 1: The system immediately shifts to the velocity method after retreat from the PSTI signal.				
PA90	Lower for the velocity/position method positioning		0~9999	0	P
PA91	Higher for the velocity/position method positioning		0~30000	0	P
	The position parameter of the reference point in velocity/position shifting. When the encoder resolution is less than or equals to 2500, PA90 sets the reference point position. When the encoder resolution is more than 2500, PA90 sets the lower 4-digit of the reference point position, and PA91 sets the higher 5-digit of the reference point position.				

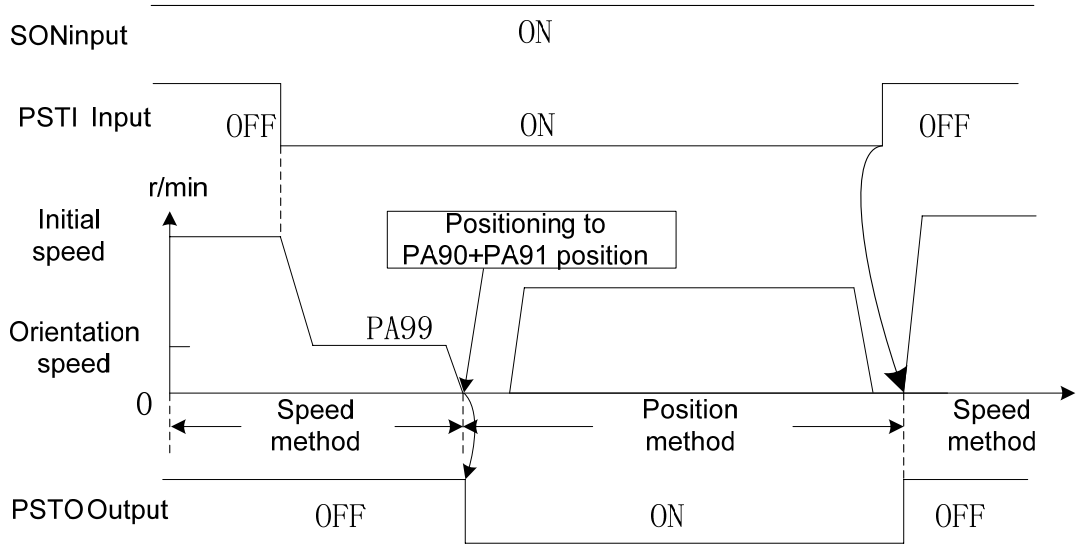
Step 2	Servo drive unit performs shifting as long as it receives the SON, PSTI input commands.	1. The spindle firstly rotates based upon the setting velocity of the PA99 in the velocity mode; 2. The servo drive unit will exactly stop based upon the reference point set by PA90+PA91 once it inspects the pulse Z. 3. Servo drive unit sends PSTO shifting completion signal by GSKlink bus after the motor exactly stops, the velocity/position shifting is then performed.

Key points:

1. PA99 is set to the absolute value. PA100 can be set if the direction of the motor's velocity should be changed.
2. If the motor can not search the pulse Z after rotating based upon the specified velocity by PA99, the drive unit then may alarm Err-25 orientation failure after 15 seconds.
3. Velocity/position shifting procedure, the desired pulse Z for the orientation is derived from CN2 or CN3 which is determined by PA97.
4. The 2nd position encoder is with the 1: 1 driving of the spindle should be installed when the driving ration between spindle and motor shaft is not 1:1.
5. As for the heavy inertia loading, the spindle swing may occur when velocity/position shifts. In this case, the parameter of the servo drive unit should be modified to reduce the motor's rigidity during shifting, and remove the swing in orientation.

Step 3	CNC system performs the M15 command The servo drive unit should be shifted to velocity mode from the position mode.	1. System performs M15, that is, it retracts the PSTI signal; the servo drive unit returns to the velocity method along with the disappearance of the PSTO signal. 2. If the system is only retracted the SON instead of retreating from the PSTI, the motor is on the free state. The servo motor still searches the reference point to orientate again when SON signal is enabled, and then enter the position method.

The following figure is the velocity/position shifting time-sequence. When the SON and PSTI are ON, the servo drive unit shifts to the orientation function (the reference point is the orientation position from the setting of the PA90+PA91). Refer to the concrete shifting process:



CHAPTER SEVEN PARAMETER

7.1 Parameter List

1. The parameter with "※" in front of the parameter number should be registered after the parameter numerical value is altered. It only can be enabled after the power is turned on again. The factory value of parameter followed with the "★" may differ depending on different adapted motors.
2. In the column of the adapted motor, "T" is suitable for synchronous servo motor; "Y" is appropriate for asynchronous one.
3. When PA2=0, "T" related parameter adjustment is enabled; when PA2=1, "Y" related parameter adjustment is enabled.
4. Never attempt to modify the PA4 when GSKLink communication connection is successful or PA118=1.

Para. No.	Meaning	Setting range	Initialization value (Synchronous/asynchronous)	Unit	Suitable motor	Reference
PA 0	Parameter password modification	0~9999	315		T, Y	
★PA 1	Motor type code	1~1329	1/501			Appendix A
PA 2	Motor type selection	0~1	0/1			/
※PA 3	Monitoring setting of initial power-on	0~35	0			4.3
PA 4	Working mode selection	9~25	21			Chapter Five
★PA15	The 1st proportion gain of the velocity loop	10~3000	200/400	Hz		6.1
★PA16	The 1st integral time constant of the velocity loop	1~3000	100			
★PA17	Current command filtering coefficient	10~5000	800/1000			
★PA18	Velocity feedback inspection filtering coefficient	10~5000	800/100			
★PA19	The 1st proportional gain of the position loop	10~1000	40			
PA25	Position feedback gain	0~100	0	%		
PA26	Position feedback low-pass filtering coefficient	10~5000	2000/300	Hz		
PA28	Position command direction reverse	0~1	0	0		Section 6.3
PA29	Position command electric gear ratio numerator	1~32767	1			Section 6.2
PA30	Position command electric gear ratio denominator	1~32767	1			

PA31	Position arrival range	0~30000	20	Pulse		
PA32	Position out-of-tolerance range	0~30000	400	×100 Pulse		
※PA34	Position feedback output reverse	0~1	0			3.3.6
PA37	Position feedback output resolution	1024~30000	20000	Pulse		3.3.6
★PA45	The 2nd proportional gain of the velocity loop	10~3000	200/400	Hz	T, Y	6.1
★PA46	The 2nd integral time constant of the velocity loop	1~3000	100			

Para. No.	Meaning	Setting range	Initialization value (Synchronous/asynchronous)	Unit	Suitable motor	Reference
★PA48	The 3rd proportional gain of the velocity loop	10~3000	200/400	Hz	T, Y	
★PA49	The 3rd integral time constant of the velocity loop	1~3000	100			
PA51	Motor rotation direction reverse in the valid velocity command	0~1	0		T, Y	6.3
★PA54	Velocity command top speed limit	1~30000	2500/6000	r/min		
★PA57	Linear acceleration time constant	0~10000	0/400	ms	T, Y	6.6
★PA58	Linear deceleration time constant	0~10000	0/600	ms		
PA61	Velocity arrival enabled range	0~100	5	%	T, Y	
PA62	Zero velocity output effective range	0~100	5	r/min	T, Y	
PA63	Analog command multiply coefficient	1~1024	1		T, Y	
PA64	Analog command frequency-division coefficient	1~1024	1		T, Y	
PA88	The mode selection shifting from velocity to position	0~1	0		T, Y	6.8
PA89	The mode selection shifting from position to velocity	0~1	0			
PA90	Reference point lower for velocity/position shifting	0~9999	0			
PA91	Reference point higher for velocity/position shifting	0~30000	0			
※PA96	The 2nd position encoder type selection	0~30	0			
※PA97	Position feedback input signal selection	0~2	1/0			
PA98	The 2nd position encoder resolution	10~30000	1024			
PA99	Orientation velocity	10~1000	100	r/min		
PA100	Orientation direction selection	0~2	0			
※PA101	The 2nd position feedback input signal reverse	0~1	0			
PA102	Position window in timer	0~100	2	Pulse		
PA103	Orientation position lower	0~30000	0	Pulse		

PA104	Orientation position higher	0~30000	0	Pulse		
PA118	Internal enforcement enabling	0~1	0		T, Y	5.2
PA124	JOG operation velocity setting	0~12000	120	r/min	T, Y	5.3
PA125	The torque limit of the Manual and JOG operation method	0~300	100	%	T, Y	
PA132	Spindle orientation alarm time	0~30000	0		T, Y	
PA133	Internal CCW torque limit	0~300	300	%	T, Y	6.4
PA134	Internal CW torque limit	-300~0	-300	%	T, Y	

Para. No.	Meaning	Setting range	Initialization value (Synchronous/asynchronous)	Unit	Suitable motor	Reference
PA137	Position out-of-tolerance disabled	0~1	1		T, Y	
PA139	open-phase alarm disabled	0~1	1		T, Y	
PA143	Brake time	10~32000	375/400	0.1ms	T, Y	
PA144	Overloading time	0~32000				
PA145	Module over-current time	0~32000	20/1000	1ms		
PA146	Long time saturation alarm time of velocity regulator	0~30000	1000/30000	5ms		
PA147	Allow the top deceleration time of the motor before the power-down brake operation	0~30000	5000/20000	ms	T	6.5
PA148	Servo locking delay time	0~30000	50	ms	T,Y	
PA149	The motor velocity in power-down brake operation	0~300	30	r/min	T	
PA150	Spindle clamping interlocking delay time	0~32000	0	ms	Y	6.7
※PA156	GSKLINK servo axis number	1~20	1			5.4

7.2 Parameter Meaning Details

P: Position control S: Velocity control

Para. No.	Meaning	Setting range	Initialization value (Synchronous/asynchronous)	Unit	Application method
PA0	Parameter modification password	0 ~ 9999	315		P, S
	When PA0＝315, the parameters can be modified other than PA1 and PA2. When PA0＝385, alter PA1, call the corresponding parameter for its motor type and motor type.				
★PA1	Motor type code	1～1329	1/501		P, S
	Generally, servo drive unit factory is already correctly set the adapted motor's parameters, and unexpected result may occur if incorrect modification executes so that user should carefully perform it!				

<table>
<tr><td></td><td colspan="6">Correctly set the PA1 corresponding with the motor type code based upon PA2's motor type.
Select the corresponding servo motor code based upon the selection (Appendix A), and the feed servo motor type code range is 1～183.
Set the corresponding spindle servo motor code based upon the Spindle Servo Motor Type Code Comparison Table (Appendix B), and the spindle servo motor type code range is 501～546.</td></tr>
<tr><td rowspan="2">PA2</td><td colspan="2">Motor type selection</td><td>0～1</td><td>0/1</td><td></td><td>P, S</td></tr>
<tr><td colspan="6">PA2=0: Synchronous motor, it usually corresponds to the feed servo motor.
PA2=1: Asynchronous motor, it usually corresponds to the spindle servo motor.</td></tr>
<tr><td rowspan="20">※PA3</td><td colspan="2">Monitoring setting of initial power-on</td><td>0~37</td><td>0</td><td></td><td>P, S</td></tr>
<tr><td>Para. Value</td><td>Initial power-on monitoring</td><td colspan="2">Explanation</td><td>Initial power-on monitoring</td><td>Explanation</td></tr>
<tr><td>PA3=0</td><td></td><td colspan="2">Motor velocity</td><td>PA3=19</td><td></td><td>Terminal input state</td></tr>
<tr><td>PA3=1</td><td></td><td colspan="2">Lower 5-bit of current motor position</td><td>PA3=20</td><td></td><td>Terminal output state</td></tr>
<tr><td>PA3=2</td><td></td><td colspan="2">Higher 5-bit of current motor position</td><td>PA3=21</td><td></td><td>(Reserved)</td></tr>
<tr><td>PA3=3</td><td></td><td colspan="2">Lower 5-bit of position command</td><td>PA3=22</td><td></td><td>Hardware version number</td></tr>
<tr><td>PA3=4</td><td></td><td colspan="2">Higher 5-bit of position command</td><td>PA3=23</td><td></td><td>Software version number</td></tr>
<tr><td>PA3=5</td><td></td><td colspan="2">Lower 5-bit of position offset</td><td>PA3=24</td><td></td><td>The 2nd position encoder Z signal absolute position low</td></tr>
<tr><td>PA3=6</td><td></td><td colspan="2">Higher 5-bit of position offset</td><td>PA3=25</td><td></td><td>The 2nd position encoder Z signal absolute position high</td></tr>
<tr><td>PA3=7</td><td></td><td colspan="2">Motor current</td><td>PA3=26</td><td></td><td>Motor encoder Z signal absolute position low</td></tr>
<tr><td>PA3=8</td><td></td><td colspan="2">The corresponding velocity of the analog command</td><td>PA3=27</td><td></td><td>Motor encoder Z signal absolute position high</td></tr>
<tr><td>PA3=9</td><td></td><td colspan="2">Velocity command</td><td>PA3=28</td><td></td><td>The 2nd position encoder single-coil absolute position low</td></tr>
<tr><td>PA3=10</td><td></td><td colspan="2">Position command pulse frequency</td><td>PA3=29</td><td></td><td>The 2nd position encoder single-coil absolute position high</td></tr>
<tr><td>PA3=11</td><td></td><td colspan="2">Torque command</td><td>PA3=30</td><td></td><td>The 2nd position encoder relative position low</td></tr>
<tr><td>PA3=12</td><td></td><td colspan="2">Motor torque</td><td>PA3=31</td><td></td><td>The 2nd position encoder relative position high</td></tr>
<tr><td>PA3=13</td><td></td><td colspan="2">Heat-radiator temperature</td><td>PA3=32</td><td></td><td>The 1st position encoder single-coil absolute position low</td></tr>
<tr><td>PA3=15</td><td></td><td colspan="2">DC bus voltage</td><td>PA3=33</td><td></td><td>The 1st position encoder single-coil absolute position high</td></tr>
<tr><td>PA3=16</td><td></td><td colspan="2">Alarm display</td><td>PA3=34</td><td></td><td>The 1st position multi-coil encoder number low</td></tr>
<tr><td>PA3=17</td><td></td><td colspan="2">Servo drive working state</td><td>PA3=35</td><td></td><td>The 1st position multi-coil encoder number high</td></tr>
<tr><td>PA3=18</td><td></td><td colspan="2">Encoder feedback signal</td><td>PA3=36</td><td></td><td>The 1st position encoder relative position low</td></tr>
<tr><td></td><td></td><td colspan="2"></td><td>PA3=37</td><td></td><td>The relative position higher for the 1st position absolute encoder</td></tr>
</table>

P: Position control S: Velocity control

Para. No.	Meaning	Setting range	Initialization value	Unit	Application method
PA4	Working method selection	9~25	21		P, S
	PA4=9: Manual operation Inspect the operation and state monitoring of the servo drive unit and motor. Internal enabling PA118=1, in Sr- menu, acceleration/deceleration can be operated by '▲, ▼'. PA4=10: JOG method; Inspect servo drive unit and motor operation. PA124 sets JOG velocity, PA118=1 internal enabling; in Jr- menu, the negative/reverse operation can be performed by '▲, ▼'. PA4=21 ： GSK—LINK **Notice** PA4 parameter can not be modified when the GSKLink communication connection is successful or in the case of the internal enabling PA118=1. This parameter is already adjusted before delivery, it is better not to alter it.				
★PA15	The 1st proportional gain of the velocity loop	10~3000	200/400		
	The bigger the velocity loop proportional gain is, the stronger the servo rigidity is; however, when it is set excessive big, the vibration (Abnormal noisy occurs in motor) issues when starting or stopping; the less the value is, the slow the response is.				
★PA16	The 1st integral time constant of the velocity loop	1~3000	100		
	The bigger the value of the velocity loop integral time constant is, the faster the system response is; however, the system may instable when the value is set to excessive big, even the vibration occurs. The less the value is, the slower the response, it is better to set bigger as much as possible when there is no vibration in system.				
★PA17	★ Current command filtering coefficient	10~5000	800	Hz	P, S
	It is used for restricting the current command frequency band to prevent the current from impacting and vibrating, so that the current can be steadily answered. Enlarge the setting value as much as possible when there is no vibration.				
★PA18	★ Velocity feedback inspection filtering coefficient	10~5000	800/100		P, S
	The bigger the velocity feedback filtering coefficient is, the faster the velocity feedback response is. When the setting value is excessive big, the bigger electromagnetism noisy of the motor may issue. The less the setting value is, the slower the velocity feedback response is; if the setting value is excessive small, the velocity wave is then increased; even the vibration occurs.				
★PA19	★ The 1st proportional gain of the position loop	10~1000	40		P, S
	The bigger the position loop proportional gain is, the faster the response of the position command is, the stronger the rigidity is. When this value is set to excessive big, the motor of the position overrun may be generated leading to the vibration when starting/stopping. The less the setting value is, the slower the response is, so that the following-error is then increased.				
PA25	Position feedforward gain	0~100	0		P, S
	The position loop feedforward gain is adjusted the velocity loop from the velocity information by the position command. The bigger the setting value is, the faster the response is, and the following-error is then decreased. When this setting value is set to excessive big, the instantaneous overshoot and vibration of the motor are easily generated. When PA25＝0, the position feedforward function is disabled.				
PA26	Position feedforward low-pass filtering coefficient	10~5000	2000/300		P
	The feedforward filtering coefficient is performed the smooth treatment for the position command feedforward control; the bigger the setting value is, the faster the response of the step velocity command is, which can be better restricted the position overrun and vibration caused from command velocity by suddenly changing.				
PA28	Position command direction reverse	0~1	0		P

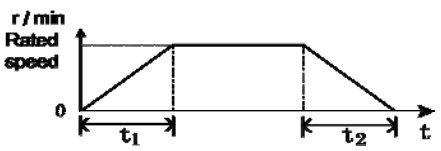
	PA28＝0: Maintain the original command direction; PA28＝1: The inputted pulse command direction reverse				
PA29	The position command pulse frequency-multiplication coefficient	1~32767	1		P
	(Refer to the Section 6.2 Electric gear ratio)				
PA30	The position command pulse frequency-division coefficient	1~32767	1		P
	(Refer to the Section 6.2 Electric gear ratio)				

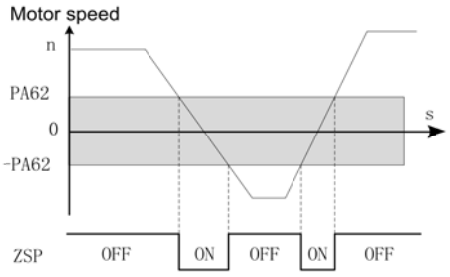
P: Position control S: Velocity control

Para. No.	Meaning	Setting range	Initialization value	Unit	Application
PA31	Position arrival range	0~30000	20	Pulse	P
	When the position following-error is less than or equals to the setting value of the PA31, servo drive unit is regarded as the position is reached; the position arrival signal PSR outputs ON; otherwise, PSR outputs OFF.				
PA32	Position out-of-tolerance range	0~30000	400	×100 pulse	P
	When the position following-error exceeds PA32 parameter value in the position mode operation, the servo drive unit alarm is then generated due to the out-of-tolerance. (Refer to the Section 8.1 for Er-4 fault elimination)				
※PA34	Position output signal reverse	0~1	0		P，S
	PA34＝0, maintain the original relationship of the CN1 position feedback output signal; PA34＝1, the phase relationship of the position feedback output signal PAO, PBO are reversed				
PA37	The pulse number of the position feedback output	1024~30000	10000	Pulse	P, S
	Set the corresponding position feedback output pulse numbers of the motor for each circle when the motor (or spindle) is absolute encoder signal. It is better to calculate it based upon the machinery and the instruction control unit. **For example:** The numerical value of the PA37 is counted based upon the edge signal of the A/B phase pulse, that is, gain 1 edge signal counts once. And therefore, PA37=64, the PAO (or PBO) pulse numbers of servo drive unit feedback output are 16 after the motor (or spindle) rotates one circle. Also: PA37=10000, the PAO or PBO phase numbers of the actual position output: PAO or PBO phase pulse numbers = $\frac{10000}{4}$ =2500 (pulse/rev.)				
★PA45	The 2nd proportional gain of the velocity loop	10~3000	200/400	Hz	S
	Similar as the PA15, it is enabled in rigid tapping. Generally, it is used in the rigid tapping of the machine tool.				

★PA46	The 2nd integral time constant of the velocity loop	1~3000	100		S
	Similar as the PA16, it is enabled in rigid tapping. Generally, it is used in the rigid tapping of the machine tool.				
★PA48	The 3rd proportional gain of the	10~3000	200/400	Hz	S
	Its function is similar as PA15 during the orientation or velocity position shifting. Generally, it is used for the spindle orientation control of the machine tool.				
★PA49	The 3rd integral time constant of the velocity loop	1~3000	100		S
	Its function is similar as PA16 during the orientation or velocity position shifting. Generally, it is used for the spindle orientation control of the machine tool.				

P: Position control S: Velocity control

Para. No.	Meaning	Setting range	Initialization value	Unit	Application method
PA51	Velocity command CCW/CW is reversed	0~1	0		S
	PA51＝0: Maintain the original command direction PA51＝1: Velocity command direction reverse				
★PA54	The velocity command top limit	1~30000	2500/6000	r/min	P，S
	The top velocity of the motor is restricted in PA54.				
★PA57	Linear acceleration time constant	0~10000	0/400	ms	S
	The acceleration/deceleration time constant is only enabled in the velocity mode. The acceleration time sets the desired one when the motor accelerates to the rated velocity from the zero speed; refer to the t1 in the following figure. The deceleration time sets the desired one when the motor decelerates to the zero speed from the rated velocity; refer to the t2 in the following figure. The actual acceleration time of the motor = Command velocity/rated speed x PA57; The actual deceleration time of the motor = Command velocity/rated speed x PA58;;  **Note: If the setting time is ultra-small, the actual acceleration/deceleration is restricted by the Max. acceleration/deceleration capacity of the servo drive unit; the actual time may more than the setting one.**				
★PA58	Linear deceleration time constant	0~10000	0/600	ms	S
PA61	Velocity arrival effective range	0～100	5	%	S
	In the velocity mode, when the actual velocity ＝ [Command velocity × (100－PA61) %～Command velocity × (100＋PA61) %], the velocity arrival (PSR) is enabled.				
PA62	Zero velocity outputs the effective	0~100	5	r/min	S

	When the actual speed is less than or equals to the zero speed output effective range, zero speed (ZSP) signal is then enabled. 				
PA63	Velocity command multiple coefficient (Refer to PA64)	1~1024	1		S
PA64	Velocity command frequency-division coefficient	1~1024	1		S
	When the driving ratio between the spindle and motor shaft is not 1:1, it is very convenient to match the speed between CNC with spindle by the setting of the parameter PA63 and PA64. **For example**, if the driving ratio between spindle and motor is 3:5, set the PA63 as 3, PA64 as 5; the motor speed is 500 when the CNC specifies S 300; the spindle speed is then regarded as 300.				
PA88	The mode selection shifting from the velocity to the position mode	0～1	0		P/S
	Velocity/position mode, select the transition mode shifting the velocity control to the position control. PA88=0: When PSTI is ON, the motor firstly searches the position based upon the orientation speed specified by PA99, and then dwells at the one of the reference point specified by PA90, PA91, lastly the servo drive unit shifts to the position control. PA88=1: When PSTI is ON, the motor is immediately shifted to the position control when the current velocity decelerates to the zero.				

P: Position control S: Velocity control

Para. No.	Meaning	Setting range	Initialization value	Unit	Application method
PA89	The mode selection shifting from the position to the velocity mode	0～1	0		P/S
	Velocity/position mode, select the transition mode shifting the position control to the velocity control. PA89＝0: When PSTI signal is OFF, shift to the velocity control after performing the position command of the control operation. PA89＝1: When PSTI signal is OFF, immediately shift to the velocity control, no matter whether the position command is performed.				
PA90	Velocity/position shifting reference point position Low-bit	0～9999	0		P/S
PA91	Velocity/position shifting reference point position High-bit	0～30000	0		P/S
	When the servo drive unit is shifted to the position control from the velocity control, which firstly searches the position based upon the orientation speed specified by PA99, and then dwells at the one of the reference point specified by PA90, PA91, lastly wait for the position control (Refer to the Section 6.9 Velocity/position shifting function for the overall orientation procedure).				
※PA96	The 2nd position encoder type selection	0～30	0		

	PA96＝0: TTL incremental encoder signal PA96＝3: TAMAGAWA agreement, 17Bits single-coil absolute encoder signal PA96＝4: TAMAGAWA agreement, 1617 multi-coil absolute encoder signal PA96＝8: 21Bits magnetic resistance encoder signal PA96＝9: 22 Bits magnetic resistance encoder signal PA96＝10: 23 Bits magnetic resistance encoder signal PA96＝11: hollow magnetic loop encoder, 1VPP signal, 384 gear; PA96＝12 hollow magnetic loop encoder, 1VPP signal, 512 gear; PA96＝13: BISS agreement, 17 Bits single-coil absolute encoder signal PA96＝14: BISS agreement, 1217 multi-coil absolute encoder signal PA96＝15: BISS agreement, 19 Bits single-coil absolute encoder signal PA96 ＝ 16: BISS agreement, 1219 multi-coil absolute encoder signal PA96＝21: ENDAT2.2 agreement, 512 resolution magnetic grid encoder signal PA96＝22: ENDAT2.2 agreement, 1024 resolution magnetic grid encoder signal PA96＝23: ENDAT2.2 agreement, 1200 resolution magnetic grid encoder signal PA96＝24: ENDAT2.2 agreement, 1400 resolution magnetic grid encoder signal		PA96＝24: ENDAT2.2 agreement, 1400 linear magnetic grid encoder; PA96＝25: ENDAT2.2 agreement, 2048 linear magnetic grid encoder; PA96＝26: ENDAT2.2 agreement, 2600 linear magnetic grid encoder; PA96＝27: ENDAT2.2 agreement, 3600 linear magnetic grid encoder; PA96＝28: ENDAT2.2 agreement, 900 linear magnetic grid encoder; PA96＝29: ENDAT2.2 agreement, 600 linear magnetic grid encoder; PA96＝30: ENDAT2.2 agreement, 256 linear magnetic grid encoder; PA96＝37: 25Bit absolute single-core encoder. **Explanation: PA96 set to 0 by default, which is the standard configuration; When it is set as other encoders, it should be explained as the special version.**		
※PA97	Position feedback input signal selection	0～2	1		P. S
	PA97=1, To select the motor encoder signal regards as the position feedback input signal. PA97=0, To select the 2nd position input signal is treated as the position feedback input signal. In this case, CN3 does not connect the 2nd position encoder feedback signal, the servo drive unit Er-24 fault may occur.				
PA98	The 2nd position encoder resolution	10~30000	1024		P. S
PA99	Orientation velocity	10～1000	100	r/min	S
	When the spindle orientates, it rotates along with the orientation velocity firstly, and then dwells at the orientation position when servo drive unit captures the encoder Z pulse.				
PA100	Orientation direction selection	0～2	0		S
	PA100＝0, the orientation velocity of the motor is CCW when it rotates to start along with CCW; Similarly, the orientation velocity of the motor is CW when it rotates to start along with CW. PA100＝1, motors are all orientated along with the CCW velocity no matter how the operation direction of the motor.				

	PA100＝2, motors are all orientated along with the CW velocity no matter how the operation direction of the motor.				
※PA101	The 2nd position feedback input signal reverse	0～1	0		P. S
	PA101＝0: Maintain the original phase relationships of the 2nd position input signal SCA, SCB pulse. PA101＝1: The phase relationship between the SCA and SCB is reversed.				

P: Position control S: Velocity control

Para. No.	Meaning	Setting range	Initialization value	Unit	Application method
PA102	The position window in orientation	0～100	2	Pluse	S
	Servo drive unit enters the position loop control, and the motor shaft (or spindle) dwells at the orientation position after the orientation function is started. There is a slightly tremble on the motor may occur when it stops at the moment, due to the closed-loop adjustment of the position loop. It is regarded as the completion of the orientation when the offset of the motor's tremble is within the orientation window, and then the servo drive unit feeds back the orientation completion signal to CNC. If the PA102 is set as a little bit small, the orientation completion signal of the CNC from the servo drive unit may instable due to the tremble of the motor, even the orientation may fail.				
PA103	Orientation position low	0~9999	0	Pulse	S
PA104	Orientation position high	0~30000	0	Pulse	S
	If the numerical value of the orientation position is within the range of the PA103, and then the PA104 does not need to be set. When the orientation is performed based upon the motor's encoder signal, the orientation position low can be set according to the 'DP-APO', and the high one is set according to 'DP-APO.'. When the orientation is performed based upon the 2nd position encoder signal, the orientation position low can be set according to 'DP-SPO', and the high one is set according to the 'DP-SPO.'.				
PA111	DSP software version	Do not modify			
	DSP software number mark				
PA118	Internal enabling	0～1	0		P，S
	Enable the motor by setting the parameter of the servo drive unit in the case of no external SON signal input. PA118=0: Enable the motor when the external input signal SON is ON. PA118=1: Enable the motor inside the servo drive unit instead of the external input signal SON.				
PA124	Set the JOG operation velocity	0～12000	120	r/min	S
	Set (Jr) the operation velocity in the JOG mode, and the operation mode is selected by PA4.				
PA125	The torque limit of the Manual and JOG operation mode	0～300	100	%	S
	The setting value is the rated torque percentage of the motor. The output torque of the motor is restricted by this parameter in the Manual/JOG operation mode.				
PA132	Spindle orientation alarm time	0~30000	0	1.6ms	
	The alarm time of the orientation failure after the spindle orientation function start is set.				
PA133	Internal CCW torque limit	0～300	300	%	P,S

PA134	Internal CW torque limit	-300～0	-300	%	P,S
	Set the internal torque restriction value of the servo motor along with the CCW/CW, its setting value is the percentage of the rated torque. Two torque restrictions are enabled in any working method. The setting value exceeds the allowed top overloading capacity by the module, and therefore, the actual torque restriction is Max. overloading multiple allowed by module.				
PA137	Position out-of-tolerance alarm inspection selection	0～1	1		P
	In the position method, when the following-error exceeds the setting range of the PA32, the servo drive unit output Er-4 position out-of-tolerance alarms. PA137＝0: Do not inspect the position out-of-tolerance alarm PA137＝1: Inspect the position out-of-tolerance alarm				
PA139	Open-phase alarm inspection selection	0～1	1		P,S
	When one of the three-phase input power is absent, and then the servo drive unit output Er-21 open-phase alarms PA139＝0: Do not inspect the open-phase alarm PA139＝1: Inspect the open-phase alarm				
PA143	Brake time	10~32000	375/400	0.1ms	P,S
	(Factory debugging parameter, user can not change it!)				

P: Position control S: Velocity control

Para. No.	Meaning	Setting range	Initialization value	Unit	Application method
PA144	Overloading time	0~32000			
	(Factory debugging parameter, user can not change it!)				
PA145	Module over-current time	0～32000	20/1000	1ms	P,S
	(Factory debugging parameter, user can not change it!)				
PA146	Velocity regulator saturation alarm time for long time	0～32000	1000/ 30000	ms	P,S
	Velocity regulator saturation alarm time for long time				
PA147	The Max. deceleration time of the motor before the operation of the allowed power-down brake	0～30000	5000/ 20000	ms	P,S
	When the being operated motor should be locked by the power-down brake, the motor should be firstly decelerated. Within the set deceleration time of the PA14, enforce the power-down brake to lock the motor's shaft if the motor's speed is still more than the one set by PA149. Refer to the 6.5.				
PA148	Servo locking delay time	0～30000	50	ms	P,S
	When the being operated motor should be locked by the power-down brake, the SON signal should be turned off after the motor stops (servo locking), and then lock the power-down. From the servo locking state to the power-down brake locking state, the motor's shaft position is invariable after the servo locking state should be delayed the PA148 so that guarantee the operation of the power-down brake.				
PA149	The motor velocity when the power-down brake is performed.	0～300	30	r/min	P,S
	Allow the top velocity when the power-down brake is operated.				

PA150	Spindle clamping interlocking delay time	0～32000	0	ms	
	After the spindle is clamped at the side of the mechanical clamping equipment of the spindle, and then reduce the delay time of the motor torque.				
※PA156	GSKLINK servo axis number	1～20	1		P,S
	It may be not only one servo drive unit for establishing the series communication with CNC system. Set the corresponding servo axis number to the CNC system for controlling one servo drive unit. And therefore, the servo drive unit connected with the same CNC system can not be set the repeated servo axis number, and this parameter should be enabled without power after altering.				

CHAPTER EIGHT ABNORMALITY & TROUBLESHOOTING

Caution

- If the servo drive unit or the motor should be disassembled because of the inspection or maintenance, it is better to operate it with the professional personnel or contact the technicians;
- When the servo drive unit abnormality occurs, the abnormalities can be inspected or treated after the power is cut off for more than 5min till the 'CHARGE' indicator is turned off, prevent the remaining voltage of the servo drive unit from hurting the person.

8.1 Meaning and Treatment of Alarm or Prompt Code

The motor may stop when the servo drive unit inspects the fault; simultaneously, the 2-LED at the right enters the flashing state, and then the alarm code Er - □□ displays on the operational panel. Also, enter the dP-Err menu, and then check the current alarm code. Refer to the related content based upon the alarm code, and comprehend the fault reasons and troubleshootings.

Alarm No.	Meaning	Main reason	Troubleshooting
Er-1	Motor velocity exceeds the setting value (Refer to the PA54 top velocity limit)	1. Encoder feedback signal abnormality	Inspect the motor encoder or its signal connection or PA1 setting error
		2. In the velocity mode, acceleration/deceleration time constant setting is excessive small, so that the velocity overshoot value is excessive big.	Enlarge the acceleration time PA57 and the deceleration time PA58
		3. PA54 (top velocity limit) setting value excessive small.	Correctly set the PA54 value based upon the motor's nameplate.
		4. Excessive big position command electric gear ratio	Correctly set the electric gear ratio
Er-2	Main circuit DC bus voltage excessive high	1. Disconnected or damaged of the brake resistance.	Detect the brake resistance and its connection.
		2. Do not match the brake resistance (Resistance value excessive big); **Note:** The less the brake resistance value is, the more the current flowing over the brake circuit is; it is easy to damage the brake tube in the brake circuit.	A. Change the resistance value and the brake resistance matched with the power; B. Decrease the ON-OFF frequency based upon the use conditions. C. Increase the acceleration/deceleration time based upon the use conditions, and adjust the PA57, PA58 by velocity mode.
		3. Instable power voltage;	Detect the power
		4. Internal brake circuit damaged.	Change the servo drive unit
Er-3	Main circuit DC bus voltage	1. Inadequate power capacity input causing the lower voltage;	Detect the power capacity and the controllable cabinet electric part

	excessive low	2. It occurs when the power is turned on; the servo drive unit does not connect with the normal voltage;	Detect the main circuit electric control
		3. Fail to start the start circuit of the servo drive unit	Change the servo drive unit
Er-4	Position offset counter exceeds the setting value (Refer to the setting range of the PA32) (PA137=0: Do not detect the position out-of-tolerance alarm; PA137=1: Detect the position out-of-tolerance alarm.	1. Set excessive big of the position command electric gear ratio;	Detect the setting of the electric gear ration PA29/PA30
		2. Loading inertia is bigger or inadequate torque.	A. Increase the servo drive unit and motor's power B. Decrease the loading
		3. Motor encoder fault or fail to set the encoder resolution;	Detect the motor encoder and its connection, as well the setting of the PA1
		4. The phase sequence U, V, W of the motor is incorrect, it may generate the Er-12 or Er-27 alarm; (It is available for the AC asynchronous spindle servo motor)	Exchange two phases freely

Continued:

Alarm No.	Meaning	Main reason	Troubleshooting
Er-4	The numerical value of the position offset counter exceeds the setting value (Refer to the position out-of-tolerance inspection range set by PA32)	5. Incorrect set the PA98 when using the 2nd position encoder so that the feedback signal is abnormal;	Detect the setting of the PA98
		6. Excessive small of position loop or velocity loop gain setting (Refer to the PA15, PA16, PA19)	Adjust the velocity loop or position loop gain
		7. Excessive small setting of position out-of-tolerance effective range	Correctly set the PA32
Er-5	Motor temperature abnormality	1. Motor's temperature is higher than 145℃ setting value; (This temperature is restricted by PA183; Motor's temperature restriction of different types may inconsistent).	A. Motor's heat dissipation condition is blocked, it is better to unblock the heat dissipation channel. B. Motor's current excessive big; it is better to reduce the motor's loading or inspect whether the motor or servo unit is normal.
		1. Fail to correctly connect the motor's temperature detection sensor	Correctly connect the motor's temperature detection signal cable based upon it User Manual.
		2. Motor's temperature detection sensor damaged;	Contact the after-sales of our company for maintenance.
Er-6	Velocity regulator saturation fault	1. Motor torque adequate, or overloading, so that the motor can not steadily operate following with the velocity for long time.	A. Check whether the PA1 is correct; call the motor default parameter again. B. Check the machinery equipment, and ensure that there is no block on it.
		2. U, V, W three-phase phase reverse;	Correctly connect the U, V and W wirings.

		3. Motor's default incorrect, or too soft of motor characteristic;	Verify the corresponding motor type code by PA1; correctly call out the motor's default parameter again.
		4. Motor or encoder abnormality	Change the servo motor
Er-8	Position offset counter overflow	Excessive big setting of the position command electric gear ratio.	Check the setting of the PA29, PA30.
Er-9	Motor code signal feedback abnormal	1. Poor motor encoder signal wiring or incorrect wiring;	Check the connector and signal cable welding
		2. Too long cable of the motor encoder signal feedback so that the signal voltage is lower;	Shorten the cable length (within 30m)
		3. Motor encoder damaged;	Change the motor or another encoder
		4. Servo drive unit control board fault	Change the servo drive unit
Er-11	IPM module fault inside the servo drive unit	1. It appears when the power is turned on and the servo drive unit is disabled, and it can not be eliminated. A. Servo drive unit control board fault; B. Brake resistance wiring terminal is short-circuit with the grounding.	Change the servo drive unit if it is the reason A. Check and correctly connect the brake resistance if it is the reason B.
		2. It appears when the power is turned on and the servo drive unit is disabled, and it can be eliminated after the power is turned on again.	Poor grounding or external interference. Inspect the grounding and search the interference resource and depart it or perform a shielding treatment.
		3. It appears when the power is turned on and the servo drive unit is enabled, and it can not be eliminated. A. Motor power cable is short-circuit among the U, V and W or between the U, V, W and PE. B. Servo drive unit IPM module damaged; C. Servo drive unit current sample circuit OFF.	Change the motor cable or motor if it is the reason A Change the servo drive unit if it is the reason B or C.

Continued:

Alarm No.	Meaning	Main reason	Troubleshooting
Er-11	IPM module failure inside the servo unit	4. It occurs when the motor starts or stops; the alarm of restart can be eliminated. A. Motor's default parameter error in the setting of the servo unit; B. Loading inertia is bigger; the command acceleration rate is excessive big when starts or stops.	If it is the reason A, recover the motor's default parameter operation. (Refer to the Section 4.4 for details) It it is the reason B, increase the acceleration or deceleration time of the command, and reduce the acceleration rate of the command. Alternatively, reduce the loading inertia.
Er-12	Loading alarm in the motor's operation	1. Motor overcurrent for long time;	Reduce the loading.
		2. Incorrect parameter setting, the motor may have vibration or abnormality noisy;	Ajust the capacity parameter related to the motor again (Refer to the PA15, PA16, PA18 and PA19 explanations)

		3. Incorrect PA1 setting causing the incorrect motor encoder linear number	Set the PA1 again based upon the motor type code.
		4. U, V, W wiring error. It is similar between power-on operation and Er-27 alarm.	Any two-phase of the AC asynchronous spindle motor can be exchanged. Permanent magnetic synchronous motor is correctly connected based upon the factory cable-standard; the brown, red and blue cables are separately corresponding to the U, V and W.
Er-16	overloading alarm in the motor's operation	1. Motor overloading operation for a long time, its time is longer than Er-12.	A. Reduce the loading B. Change the bigger power for drive equipment
		2. Incorrect setting of the motor's rated current parameter	Correctly set the drive parameter based upon the motor nameplate.
Er-17	Excessive long of the brake time	1. Excessive high power voltage input for a long time.	Connect the desired power for servo drive unit
		2. There is no brake resistance or bigger one; the energy can not be released immediately in the brake so that the internal DC voltage is raised.	Connect the correct brake resistance
Er-18	Excessive high of the DC bus voltage, without brake feedback	Brake circuit fault	Change the servo drive unit
Er-19	DC bus voltage does not arrive to the brake valve value, with brake feedback	Brake circuit fault	Change the servo drive unit
Er-20	EEPROM alarm inside the servo drive unit when the power is turned on.	1. Fail to read the data in EEPROM for servo drive unit when the power is turned on.	Recover the motor's default parameter again, refer to the Section 4.4 Default value operation recovery.
		2. EEPROM chip or circuit board fault	Change the servo drive unit
Er-21	Open-phase alarm of the input power R, S and T	1. One phase of the input power wiring is OFF or power opening-phase.	A. Check the power input wiring, connect it again. B. Inspect the inputted 3-phase power.
		2. Circuit input fault of the servo drive unit power	Change the servo drive unit
Er-22	Encoder null alarm	Failure to the encoder null	Change the encoder and then zero again.
Er-23	Excessive big current error	Current inspection circuit fault, or the current sensor damaged, the control power voltage fault.	Change the servo drive unit
Er-24	The 2nd position input signal abnormality of the CN3 interface	1. Fail to connect the 2nd position encoder feedback signal, but the parameter PA97 is set to 0;	Modify PA97=1
		2. Spindle encoder feedback signal abnormality. (It's reason is similar to the Er-9 alarm)	Inspect the wiring, welding and connector to the 2nd position encoder signal

Continued:

Alarm No.	Meaning	Main reason	Troubleshooting
Er-25	Fail to orientate the servo drive unit	1. Fail to inspect the Z pulse signal;	Inspect the feedback input signal wiring
		2. The corresponding parameter setting is improper or excessive big gain setting due to the loading inertial is bigger.	Inspect the motor type code PA1 or the relative gain parameter PA15, PA16, PA18 and PA19
		3. When orientation is performed by the 2nd position input signal, and the phase-sequence between the spindle encoder is inconsistent with the motor encoder signal A/B phase.	Modify PA101 parameter, and then alter its phase-sequence into same identical; refer to the parameter explanation of PA101.
Er-27	Incorrect wiring of U, V and W (Enabled in asynchronous motor)	Error in the servo drive unit main circuit output U, V, W corresponding to the motor's phase-sequence of U, V, W.	Any two-phase can be changed freely
Er-28	Incorrect software parameter upgrade	The parameter does not readjust and register after the software is copied or upgraded.	Call out the default parameter again, and the power is turned on after the parameter is registered.
Er-29	Incorrect power-on parameter inspection	The new version and the old one are conflicted when the software upgrades.	Perform the parameter write-in operation and turn the power-on again.
Er-30	Excessive high AC input voltage alarm	Excessive high AC power input voltage which exceeds 115% of the rated voltage.	Stable the power and adjust the network voltage or increase AC reactor, AC filter, etc.
Er-32	Illegal code for encoder UVW signal (Enabled in synchronous motor)	1. Defective interface contact or cable shielding	Inspect the encoder interface and shielding cable
		2. Encoder UVW signal damaged;	Change the encoder
		3. Encoder interface circuit fault.	Change the servo drive unit
Er-34	Excessive big pulse electric gear ratio	Irrational parameter setting of pulse electric gear ratio	Correctly set the PA29/PA30
Er-35	Brake tube failure alarm	GS2019,GS2025,GS2030,GS2045 servo units alarm are generated; interal brake circuit failure.	Change the servo unit
		The servo units other than the above-mentioned types are generated this alarm, it is the reason that the parameter setting is incorrect.	Set the PA225=0.
Er-36	3-phase main power OFF	1. 3-phase main power power-off or instantaneous drop-off	Check the main power to ensure the normal input of the 3-phase power
		2. 3-phase main power inspection circuit fault	Change the servo drive unit
Er-37	Radiator alarm when its	1. Temperature inspection sensor open-circuit;	Change the servo drive unit

	temperature is lower than -20℃.	2. Excessive low of the ambient temperature	Ensure the working ambient of the drive unit is more than -20℃
Er-38	Radiator alarm when its temperature is higher than 75℃.	1. Motor overloading operation for a long time;	Reduce the loading
		2. Excessive high of the ambient	Improve the ventilation condition
		3. Thermistor short-circuit.	Change the servo drive unit
Er-39	Data read error in the absolute encoder sensor mode	1. PAA1 parameter setting error;	Call out the correct motor's default value
		2. Encoder feedback CN2 OFF or defective contact;	Check CN2 wiring
		3. Absolute encoder damaged.	Change a new motor
Er-40	Data transmission error of absolute encoder	Encoder or encoder cable being interfered.	Check the servo drive unit and servo motor grounding
Er-41	Multi-core data error of the absolute encoder	Absolute encoder multi-coil data error.	1. Encoder damaged, change it. 2. Check the grounding

Continued:

Alarm No.	Meaning	Main reason	Troubleshooting
Er-42	Read the EEPROM error in absolute encoder	1. PAA1 parameter setting error;	Call out the correct motor's default value
		2. Encoder EEPROM read error of the servo drive unit of power-on;	Check CN2 wiring
		3. Motor encoder EEPROM damaged.	Change the motor
Er-43	Verification error when reading EEPROM in absolute encoder	1. PAA1 parameter setting error;	Call out the correct motor's default value
		2. Data verification error after the drive unit reads the encoder EEPROM when the power is turned on.	Perform the Ab-Set encoder write-in operation
Er-44	Incorrect configuration of the encoder single-/multi-core	1. PAA1 parameter setting error;	Call out the correct motor's default value
		2. Encoder feedback CN2 OFF or detective contact.	Check CN2 wiring
Er-45	Encoder data verification error	In the sensor mode, the data verification error when reading the current position of the encoder. The alarm occurs when the U/VW of the motor is leaked to PE.	1. Check whether the grounding in the shielding layer of the encoder cable is reliable. 2. Check whether the overall equipments of the machine tools are leaked to the grounding.
Er-46	A4Ⅱ encoder overspeed	1. The motor high-velocity is to be rotated during the power-off of the servo drive.	Switch on the servo and system power and then enter the system interface, and the power is turned on after GSKLink communication is normal, this alarm will be automatically removed.

		2. Servo unit power-on occurs when the external 3.6V battery is disconnected.	1. Install 3.6V battery 2. Switch on the servo and system power and then enter the system interface, and the power is turned on after GSKLink communication is normal, this alarm will be automatically removed.
Er-47	A4Ⅱ encoder single-coil resolution error	When the servo drive unit is ON, motor rotates more than the 100r/min.	1. Ajust the motor's velocity below the 100r/min 2. Switch on the servo and system power and then enter the system interface, and the power is turned on after GSKLink communication is normal, this alarm will be automatically removed.
Er-48	A4Ⅱ encoder single-coil counting error	1. Encoder to be interfered;	1. Execute the interference measure to the encoder wiring 2. Switch on the servo and system power and then enter the system interface, and the power is turned on after GSKLink communication is normal, this alarm will be automatically removed.
		2. Encoder fault	Change the servo motor
Er-49	A4Ⅱ encoder internal underpressure	1. Excessive low of the encoder battery voltage	Change the battery, switch on the servo and system power and then enter the system interface, and the power is turned off and then switch on again after GSKLink communication is normal, this alarm will be automatically removed.
		2. When the servo drive unit is OFF, cut off the over-encoder battery or connection cable;	Confirm the connection is normal, switch on the servo and system power and then enter the system interface, and the power is turned off and then switch on again after GSKLink communication is normal, this alarm will be automatically removed.
		3. Encoder cut off	Confirm the connection is normal, switch on the servo and system power and then enter the system interface, and the power is turned off and then switch on again after GSKLink communication is normal, this alarm will be automatically removed.
Er-50	TAMAGAWA magnetic resistance code CC data error alarm	Encoder or encoder wiring is to be interfered.	Check whether the grounding of the servo unit and motor are corrected, and magnetic resistance eoncder connectiion shielding cable is disconnected or poorly connected.
Er-51	Excessive high of position command frequency	Excessive high of the position command frequency or excessive big of the electric gear ratio.	Reduce the position command frequency, or correctly set the electric gear ratio

Continued:

Alarm No.	Meaning	Main reason	Troubleshooting
Er-53	Read error alarm in the 2nd position encoder sensor mode	1. PA96 parameter setting error	Reset the 2nd position encoder type.
		2. The 2nd position encoder input signal connecting to the CN3 is disconnected or poorly connected.	Check the wiring of the CN3.
		3. The 2nd postion encoder is damaged.	Change a new encoder.
Er-54	The 2nd encoder CRC verification alarm	1. The data verification error when reading the current position of the 2nd encoder in the sensor mode.	Check the shielding layer and the grounding of the 2nd encoder is fixed.
		2. When the U/V/W of the motor is leaked to the PE, this alarm is easily to generate.	Check the overall machine tool devices are leaked to the grounding.
Er-55	The data offset of the 2nd position encoder is excessive big.	Encoder or encoder cable is to be interfered.	1. Check wheterh the grounding of the servo unit and motor are normal; 2. Check whether the shielding layer of the encoder is disconnect or poorly connected; 3. Check whether the installation of the encoder is consistent with its installation requirements.
Er-56	The CC data error alarm of the 2nd position TAMAGAWA magnetic resistance encoder	Encoder or encoder cable is to be interfered.	1. Check wheterh the grounding of the servo unit and motor are normal; 2. Check whether the shielding layer of the encoder is disconnect or poorly connected;
Er-57	CRC verification alarm of HEIDENHAN magnetic grid encoder additional information 1	Encoder or encoder cable is to be interfered.	1. Check wheterh the grounding of the servo unit and motor are normal; 2. Check whether the shielding layer of the encoder is disconnect or poorly connected; 3. Check whether the installation of the encoder is consistent with its installation requirements.
Er-58	The 1st and 2nd position feedback data offset alarms due to excessive big.	1. Fail to set the 1st and 2nd encoder driving ratio;	A. Check the setting of the driving ratio PA41/PA42 in the feed working mode;
		2. Motor encoder failure or encoder parameter setting error;	A. Check the setting of the PA96 or PA98; B. Check the setting of the PA101 (It should be restarted after modifying).
		3. The feedback position offset between the 2nd encoder and motor is excessive big;	Data-free or loose structure of the 2nd encoder;
Er-60	Power-on detection backup EEPROM fault alarm	There is no backup for the parameter, or the parameter verification in the backup space is incorrect.	Backup the parameter again, perform the EE-bA operation
Er-61	The relative parameter of the motor is abnormal when verifying the register area and backup area.	When recovering the backup operation EE-rs, different types are inconsistent with the motor's encoder resolutions.	Save the parameter again, perform the EE-SEt operation
Er-62	The parameter version such as the software, backup and preservation are inconsistent when the power is turned on.	Inspect the software version in the backup area is inconsistent with the current one.	Backup the parameter again, perform the EE-bA operation

Er-63	Synchronous/asynchronous shifting alarm	It is being performed the hazard operation. Shift the control software of synchronous and asynchronous.	If this alarm occurs; it is better to contact the factory technologist.

Continued:

Alarm No.	Meaning	Main reason	Troubleshooting
Er-100	GSLINK communication mst absence alarm	Defective or broken GSKLINK communication contact	Inspect whether the communication cables at both servo and CNC sides are effectively connected.
Er-101	GSLINK communication mst absence alarm	Defective or broken GSKLINK communication contact	Inspect whether the communication cables at both servo and CNC sides are effectively connected.
Er-102	GSLINK communication mst absence alarm	Defective or broken GSKLINK communication contact	Inspect whether the communication cables at both servo and CNC sides are effectively connected.
Er-103	mdt data CRC verification error in communication	mdt data CRC verification error in GSKLINK communication	CNC and servo drive unit are turned on again, if the fault still occurs, and then change the servo drive unit.
Er-104	PFGA initialization error alarm in communication	PFGA initialization error in GSKLINK communication.	CNC and servo drive unit are turned on again, if the fault still occurs, and then change the servo drive unit.
Er-105	GSKLINK communication jump monitoring abnormality alarm	GSKLINK communication jump abnormality	CNC and servo unit should be restarted again, if the fault still occurs, change the servo unit.

Servo unit shows its alarm, which means that servo unit prompts user to pay attention to the relevant alarm contents; it is better to treat it immediately, prevent the fault from generating. The servo unit still can be normally operated before the alarm occurs.

Alarm No.	Meaning	Main reason	Troubleshooting
Ar-601	GS-LINK communication mdt CRC verification error prompt	Defective GSKLINK communication cable contact	Inspect whether the servo and CNC side communication cable is effectively connected.
Ar-602	GS-LINK communication gdt CRC verification error prompt		
Ar-603	Fail to connect the bus_read in	Fail to connect the GSKLINK communication	Connect the servo CN4 and CN5, this alarm is then automatically eliminates.

	the GSKLINK communication		
Ar-701	The external battery underpressure of the absolute encoder	Prompt for battery underpressure for the absolute encoder	It is necessary to change the battery when the servo drive unit is power on. This caution will be automatically eliminated after changing a battery.
Ar-702	Positioning place exceeds the positioning encoder counter range	Positioning place value is more than the positioning encoder single-core counter range	Check the PA90, PA91; PA68~PA75; PA103~PA110;
Ar-703	Motor initialization value disabled	The motor type code set by PA1 has no corresponding motor parameter in the software;	Modify PA1 setting.
Ar-704	Motor temperature prompts due to overheating	Setting value when motor temperature reaches to 130℃	A. Motor's radiator condition blocks, it is better to unchock the radiator fan channel. B. Motor current excessive big; it is better to reduce the motor's loading or check whether the motor or servo unit is normal.
Ar-705	Motor prompts due to the excessive low temperature	Setting value when motor temperature reaches to -30℃	Motor's ambient temperature is excessive low; it is better to rise its temperature.

8.2 Normal Troubleshooting

Common abnormality phenomenon	Probable reason	Inspection and troubleshooting
The bigger vibration of motor's operation, or whistle occurs.	1. Incorrect set of velocity loop gain	Recover the motor's default parameter or refer to the debugging method of the PA15, PA16 and PA18 in the Section 6.1.1 for debugging manually.
	2. Mechanical dynamic balance tolerance connecting with the motor shaft.	The vibration and noise are increased along with its velocity. Singly operate the motor with dry run regardless of the other connections of the motor's shaft; and then the vibration disappears so that the dynamic balance of the machinery should be readjusted.
The bigger sway occurs in the motor start/stop.	The acceleration/deceleration time setting of the corresponding instruction control unit command is excessive small due to the bigger loading inertia.	Decrease the velocity-loop integral time, or reduce the motor's speed.
★Er-27 alarm occurs when the power is turned on	Incorrect wiring phase-sequence between the servo drive unit and the U, V, W of the motor	Exchange any two phases freely. For example: The U port of the servo drive unit connects with the V port of the motor cable; the V of the servo drive unit connects with the U of the motor cable

★Er-2，Er-17 alarm occurs when the motor is operated.	Servo drive unit disconnects to the brake resistance or the excessive big brake resistance.	Correctly configure the brake resistance
★Motor can not brake to stop	There is no appropriate acceleration/deceleration velocity time due to the bigger load inertia	Set the value of the PA57, PA58, observe the effect for increasing 100 each time till the abnormality removes.
★Instable spindle motor operation, bigger velocity wave	A. Motor encoder fault B. Parameter setting error	A. Change the motor B. Reset the motor's default parameter. Especially, the setting of the motor's poles and the resolution of the encoder
★ Excessive big of the velocity overshoot when starts/stops. There is obvious swing in the motor.	The bigger load inertia	1. Check whether the acceleration/deceleration time of the motor's start/stop is short. 2. Check whether the velocity-loop and position-loop proportional integral parameter is excessive big. Refer to the parameter setting method in Section 6.1)
★ Spindle motor overheating	Fan damaged, or incorrect connection for the fan's power	1. Check the radiating/cooling fan
	Radiating duct is stuffed by foreign material.	2. Check the radiating duct
	Ambient temperature is ultra-high, increase or improve the radiating equipment	3. Check ambient temperature;
	Heavy load, relief it	4. Check the loading state, whether it is overloading operation.
	Motor default parameter error	5. Check the motor type code parameter
★ There is abnormal noisy in spindle motor.	Motor default parameter error	1. Check whether the velocity-loop and position-loop parameter are set appropriately.
	The input command encounters to the strong interference. It is better to depart from the interference resource and handle the shielding.	2. Check whether the analog command or the position command is with strong interference.
	The load is stopped operation by foreign material, or distorted	3. Disconnect the load, check whether the load is with retard
	A. Fix the screw of the motor B. Motor internal fault	4. Freely stop in the high velocity, check whether the motor is still noisy.

8.3 Inspection and Maintenance of Servo Drive Unit

Notice	■ Never attempt to perform the insulation inspecting for the servo drive unit by megohmmeter or similar tools; otherwise, it may cause the damage in servo drive unit. ■ User can not disable or repair the servo drive unit. ■ It is better to change the encoder backup battery each half year.

Inspection type	Inspection item	Inspection time	Daily maintenance
Electric cabinet ambient	Abnormal odour	Once a day	Immediately treat it if the abnormal odour occurs; immediately change it if the equipment aged and will be damaged.
	Dust, moisture and greasy dirt	Monthly at least	Clean it by dry fabric or the high-pressure gun after filtering
	Electric cable, connection terminal	Once a half year	Immediately change or treat it if there is the damage or ageing in the external insulation layer and the connection place of the insulation wrapping. Fasten the loose terminal by screwdriver.
Servo drive unit	Radiating/cooling fan	Once a week	Observe whether the blowing speed and value of the cooling fan is normal or abnormality heating, and it is necessary to change the cooling fan if the abnormality occurs.
	Dust in the cooling fin	Monthly at least	Clean it by dry fabric or the high-pressure gun after filtering
	Loose screw	Once a half year at least	Fasten the terminal block, connector and installation screw etc. by the screwdriver.
Motor	Noisy, vibration	Once a day	The noisy and vibration are obviously increased comparing with common; immediately inspect the connection of the mechanical equipment and repair the fault.
	Radiating/cooling fan	Once a week at least	Observe whether the blowing speed and value of the cooling fan is normal or abnormality heating, and it is necessary to change the cooling fan if the abnormality occurs.
	Dust, water-drop, greasy dirt	Monthly at least	Clean it by dry fabric or the high-pressure gun after filtering
	The measure for insulation resistance	Once a half year at least	It is better to measure it by 500V megameter; its resistance value should be more than 10MΩ. If it is less 10MΩ, contact our technologists.
	Motor's installation and loading connection	Once a half year at least	Check whether the mechanical equipment is wore by the specified machinery tools, the connection is loosed and it is chucked by foreign matters.

APPENDIX A MOTOR TYPE CODE TABLE

- **Adapted motor type code table of the GR2000T-L AC servo drive unit**

Motor type code (PA01 resolution)	Servo motor type	Motor type code (PA01 resolution)	Servo motor type
PA001=3	130SJT-M075D（A）	PA001=64	130SJT-M075E（A2）
PA001=4	130SJT-M100D（A）	PA001=65	80SJT-M024C
PA001=5	110SJT-M040D（A）	PA001=66	80SJT-M024E
PA001=6	110SJT-M060D（A）	PA001=67	80SJT-M032C
PA001=7	130SJT-M050D（A）	PA001=68	80SJT-M032E
PA001=8	130SJT-M100B（A）	PA001=70	80SJTA-M024C
PA001=9	130SJT-M150B（A）	PA001=71	80SJTA-M024E
PA001=11	110SJT-M040D	PA001=72	80SJTA-M032C
PA001=12	110SJT-M060D	PA001=73	80SJTA-M032E
PA001=13	130SJT-M040D	PA001=76	110SJT-M040E（A2）
PA001=14	130SJT-M050D	PA001=77	110SJT-M060E（A2）
PA001=15	130SJT-M060D	PA001=78	110SJT-M040D（A2）
PA001=16	130SJT-M075D	PA001=79	110SJT-M060D（A2）
PA001=17	130SJT-M100D	PA001=81	130SJT-M150D（A）
PA001=18	130SJT-M100B	PA001=82	130SJT-M040D（A）
PA001=19	130SJT-M150B	PA001=83	130SJT-M060D（A）
PA001=20	130SJT-M150D	PA001=84	130SJT-M100D（A）
PA001=22	175SJT-M180B	PA001=85	130SJT-M040D（A2）
PA001=23	175SJT-M180D	PA001=86	130SJT-M050D（A2）
PA001=24	175SJT-M220B	PA001=87	130SJT-M060D（A2）
PA001=25	175SJT-M220D	PA001=88	130SJT-M075D（A2）
PA001=26	175SJT-M300B	PA001=89	130SJT-M100D（A2）
PA001=27	175SJT-M300D	PA001=90	130SJT-M100B（A2）
PA001=28	175SJT-M380B	PA001=91	130SJT-M150B（A2）
PA001=29	175SJT-M150D	PA001=92	130SJT-M150D（A2）
PA001=30	175SJT-M120E	PA001=93	175SJT-M180B（A2）
PA001=31	175SJT-M120E（A2）	PA001=94	175SJT-M180D（A2）
PA001=32	130SJTE-M150D（A2）	PA001=95	175SJT-M220B（A2）
PA001=58	130SJTE-M150D	PA001=96	175SJT-M220D（A2）
PA001=59	130SJT-M050E（A）	PA001=97	175SJT-M300B（A2）
PA001=60	130SJT-M060E（A）	PA001=98	175SJT-M300D（A2）
PA001=61	130SJT-M075E（A）	PA001=99	175SJT-M380B（A2）
PA001=62	130SJT-M050E（A2）	PA001=100	175SJT-M150D（A2）
PA001=63	130SJT-M060E（A2）		

Motor type code (PA01 resolution)	Servo motor type		Motor type code (PA01 resolution)	Servo motor type
PA001=104	80SJT-M024C（A4Ⅰ）		PA001=154	130SJT-M150D（A4Ⅰ）
PA001=106	80SJT-M024E（A4Ⅰ）		PA001=156	130SJT-M050E（A4Ⅰ）
PA001=108	80SJT-M032C（A4Ⅰ）		PA001=158	130SJT-M060E（A4Ⅰ）
PA001=110	80SJT-M032E（A4Ⅰ）		PA001=160	130SJT-M075E（A4Ⅰ）
PA001=122	110SJT-M040D（A4Ⅰ）		PA001=162	130SJTE-M150D（A4Ⅰ）
PA001=124	110SJT-M040E（A4Ⅰ）		PA001=166	175SJT-M120E（A4Ⅰ）
PA001=126	110SJT-M060D（A4Ⅰ）		PA001=168	175SJT-M150D（A4Ⅰ）
PA001=128	110SJT-M060E（A4Ⅰ）		PA001=170	175SJT-M180B（A4Ⅰ）
PA001=140	130SJT-M040D（A4Ⅰ）		PA001=172	175SJT-M180D（A4Ⅰ）
PA001=142	130SJT-M050D（A4Ⅰ）		PA001=174	175SJT-M220B（A4Ⅰ）
PA001=144	130SJT-M060D（A4Ⅰ）		PA001=176	175SJT-M220D（A4Ⅰ）
PA001=146	130SJT-M075D（A4Ⅰ）		PA001=178	175SJT-M300B（A4Ⅰ）
PA001=148	130SJT-M100B（A4Ⅰ）		PA001=180	175SJT-M300D（A4Ⅰ）
PA001=150	130SJT-M100D（A4Ⅰ）		PA001=182	175SJT-M380B（A4Ⅰ）
PA001=152	130SJT-M150B（A4Ⅰ）			
PA001=204	80SJT-M024C（A4Ⅱ）		PA001=254	130SJT-M150D（A4Ⅱ）
PA001=206	80SJT-M024E（A4Ⅱ）		PA001=256	130SJT-M050E（A4Ⅱ）
PA001=208	80SJT-M032C（A4Ⅱ）		PA001=258	130SJT-M060E（A4Ⅱ）
PA001=210	80SJT-M032E（A4Ⅱ）		PA001=260	130SJT-M075E（A4Ⅱ）
PA001=222	110SJT-M040D（A4Ⅱ）		PA001=262	130SJTE-M150D（A4Ⅱ）
PA001=224	110SJT-M040E（A4Ⅱ）		PA001=266	175SJT-M120E（A4Ⅱ）
PA001=226	110SJT-M060D（A4Ⅱ）		PA001=268	175SJT-M150D（A4Ⅱ）
PA001=228	110SJT-M060E（A4Ⅱ）		PA001=270	175SJT-M180B（A4Ⅱ）
PA001=240	130SJT-M040D（A4Ⅱ）		PA001=272	175SJT-M180D（A4Ⅱ）
PA001=242	130SJT-M050D（A4Ⅱ）		PA001=274	175SJT-M220B（A4Ⅱ）
PA001=244	130SJT-M060D（A4Ⅱ）		PA001=276	175SJT-M220D（A4Ⅱ）
PA001=246	130SJT-M075D（A4Ⅱ）		PA001=278	175SJT-M300B（A4Ⅱ）
PA001=248	130SJT-M100B（A4Ⅱ）		PA001=280	175SJT-M300D（A4Ⅱ）
PA001=250	130SJT-M100D（A4Ⅱ）		PA001=282	175SJT-M380B（A4Ⅱ）
PA001=252	130SJT-M150B（A4Ⅱ）			

- **Adapted motor type code table of the GR3000T-L AC servo drive unit**

Motor type code (PA01 resolution)	Servo motor type		Motor type code (PA01 resolution)	Servo motor type
PA001=1112	175SJT-M380BH		PA001=1133	**175SJT-M500BH（A2）**
PA001=1113	175SJT-M380DH		PA001=1134	**175SJT-M500DH（A2）**
PA001=1114	175SJT-M500BH		PA001=1222	**175SJT-M380BH（A4Ⅰ）**
PA001=1115	175SJT-M500DH		PA001=1224	**175SJT-M380DH（A4Ⅰ）**
PA001=1131	175SJT-M380BH（A2）		PA001=1226	**175SJT-M500BH（A4Ⅰ）**
PA001=1132	**175SJT-M380DH（A2）**		**PA001=1228**	**175SJT-M500DH（A4Ⅰ）**

- **Adapted spindle servo motor type code table of the GR-L spindle servo drive unit**

PA1 para.	Spindle motor type	Rated current	Voltage level	Standard configuration servo drive unit
510	ZJY182-2.2BH-L	13A	220V	GR2050Y
509	ZJY182-3.7BH-L	26A	220V	GR2100Y
513	ZJY208A-3.7AM-L	17.5A	220V	GR2075Y
511	ZJY208A-3.7BH-L	22A	220V	GR2075Y
514	ZJY208A-5.5AM-L	28.2A	220V	GR2100Y
508	ZJY208A-5.5BH-L	31.8A	220V	GR2100Y
512	ZJY208A-7.5BM-L	29.4A	220V	GR2100Y
517	ZJY182-1.5BH	7.3A	380V	GR3048Y
518	ZJY182-2.2BH	7.5A	380V	GR3048Y
552	ZJY182-2.2CF	9A	380V	GR3048Y
551	ZJY182-3.7BL	10.4A	380V	GR3050Y
519	ZJY182-3.7BH	15.5A	380V	GR3050Y
554	ZJY182-3.7DF	13A	380V	GR3050Y
553	ZJY182-5.5CF	19A	380V	GR3075Y
541	ZJY182-5.5EH	17A	380V	GR3075Y
542	ZJY182-7.5EH	21A	380V	GR3100Y
543	ZJY208A-2.2AM	6.7A	380V	GR3048Y
520	ZJY208-2.2BH	6.3A	380V	GR3048Y
521	ZJY208A-2.2BH (ZJY208-2.2BM)	8.9A	380V	GR3048Y
540	ZJY208A-3.7WL	11.3A	380V	GR3050Y
544	ZJY208A-3.7AM	10.2A	380V	GR3050Y
522	ZJY208A-3.7BM (ZJY208-3.7BH)	8.6A	380V	GR3050Y
534	ZJY208A-3.7BH	12.6A	380V	GR3050Y
515	ZJY208A-5.5AM	16.3A	380V	GR3075Y
523	ZJY208A-5.5BM (ZJY208-5.5BH)	13.2A	380V	GR3050Y
535	ZJY208A-5.5BH	18.4A	380V	GR3075Y
524	ZJY208A-7.5BM (ZJY208-7.5BH)	17.3A	380V	GR3075Y
536	ZJY208A-7.5BH	22.4A	380V	GR3100Y
539	ZJY265A-5.5WL	16.3A	380V	GR3075Y
538	ZJY265A-7.5WL	21.4A	380V	GR3100Y
516	ZJY265A-7.5AM	21.5A	380V	GR3100Y
525	ZJY265A-7.5BM	18A	380V	GR3075Y
548	ZJY265A-7.5BH	21A	380V	GR3100Y
537	ZJY265A-11 WL	30A	380V	GR3148Y
546	ZJY265A-11AM	30.9A	380V	GR3148Y
526	ZJY265A-11BM	26A	380V	GR3100Y
549	ZJY265A-11BH	30A	380V	GR3148Y
528	ZJY265A-15AM	48.3A	380V	GR3150Y
527	ZJY265A-15BM	35A	380V	GR3150Y
550	ZJY265A-15BH	40.7A	380V	GR3150Y
530	ZJY265A-18.5BM	48.7A	380V	GR3150Y
529	ZJY265A-22BM	58A	380V	GR3198Y
531	ZJY265A-30BL	69A	380V	GR3300Y

APPENDIX B PERIPHERAL EQUIPMENT SELECTION

B.1 Breaker and Contactor (Necessary Equipment)

Breaker and AC contactor should be installed between the power input and spindle servo drive unit. The breaker and contactor are regarded as not only the power of the servo drive unit but also the protective function for the power.

Breaker is a kind of protection switch for automatically cutting off the fault circuit, which owns the functions such as the circuit overloading, short-circuit and underpressure protection. The servo drive owns the 150%, 30min overloading capacity for itself. It is recommended that user selects the contributing protective breaker for fully play the overloading capability of servo drive unit.

Installing the AC contactor can be rapidly cut off the power of the drive equipment in the system fault for controlling the power-on and off of drive equipment by the electric protection circuit.

User can freely configure it based upon the following technical data:

Servo drive unit	**GR2025T**	**GR2030T**	**GR2045T**	**GR2050T GR2050Y**	**GR2075T GR2075Y**	**GR2100T GR2100Y**	
Rated current I (A) of standard configuration servo motor	I≤4	4＜I≤6	6＜I≤7.5	7.5＜I≤10	10＜I≤15	15＜I≤22	22＜I≤29
（AC380V） Breaker rated current (A) (AC380V)	9	12	15	20	30	40	40
（AC220V） Contactor rated current (A) (AC220V)	20	20	20	20	25	32	40
Servo drive unit	**GR3048T**	**GR3050T**	**GR3075T**	**GR3100T**	**GR3148T**	**GR3150T**	**GR3198T**
Rated current I (A) of standard configuration servo motor	I≤7.5	7.5＜I≤10	10＜I≤15	15＜I≤20	20＜I≤27	27＜I≤34	34＜I≤45
（AC380V） Breaker rated current (A) (AC380V)	15	20	30	40	63	63	80
（AC380V） Contactor rated current (A) (AC380V)	20	20	25	32	40	60	70
Servo drive unit	**GR3048Y GR4048Y**	**GR3050Y GR4050Y**	**GR3075Y GR4075Y**	**GR3100Y GR4100Y**	**GR3148Y GR4148Y**	**GR3150Y GR4150Y**	**GR3198Y GR4198Y**
Rated current I (A) of standard configuration servo motor	I≤8	8＜I≤15.5	15.5＜I≤20	20＜I≤27	27＜I≤34	34＜I≤49	49＜I≤60
（AC380V） Breaker rated current (A) (AC380V)	15	20	30	40	63	63	80
（AC380V） Contactor rated current (A) (AC380V)	20	25	32	40	60	70	80

B.2 Three-phase AC Filter (Recommended Equipment)

Three-phase filter is a kind of passive low-pass filter, and its filtering frequency channel is 10kHz～30MHz for restraining the high-frequency noisy interference generated from the power port of the servo drive unit. Generally, do not install it only when the high frequency noisy generated from servo drive unit is interfered to the normal working of other devices during the use ambient.

User can freely configure it based upon the following technical data:

Servo drive unit adapted motor power (kW)	1.5	2.2	3.7	5.5	7.5	11	15	18.5	22
3-phase AC filter rated current (A)	10	10	20	20	30	40	50	50	60
3-phase AC filter rated voltage (V)	380/440	380/440	380/440	380/440	380/440	380/440	380/440	380/440	380/440
3-phase AC filter inductance (mH)	≈2.8	≈2.8	≈1.6	≈1.6	≈0.9	≈1.1	≈0.6	≈0.6	≈0.4
3-phase AC filter current-leakage (mA)	≤2	≤2	≤2	≤2	≤2	≤2	≤3	≤3	≤3

The installation cautions for the filter:

- The filter metal shell and the electric cabinet should be contacted finely and grounded stably;
- The filter input/output cable should be parted and can not be parallelled, to prevent the filter performance from reducing;
- The installation of the filter should be placed at the entrance of the equipment power, and shorten the input cable length inside the cabinet of the filter as much as possible for reducing the radiation interference.

B.3 AC Reactor (Recommended Equipment)

The power input port series-in AC reactor is used for restraining the higher-harmonic-wave input, which can be not only stopped the interference from electric net, but also reduce the eclectic net pollution of the harmonic-current generated from integrated unit. Generally, the use ambient can not be installed. It is recommended to install the AC reactor for the servo drive unit based upon the following working ambient:

1. The power of the configured motor is more than 15kW.
2. The imbalance degree of the three-phase voltage is more than 3%.
3. The same power supply system is installed the equipments such as the thyristor converter, non-linear loading, electric arc furnace load and the compensation capacitor equipment connected with the switch shifting adjustment power factor.

4. It is necessary to improve the power factor of the input side.

The selection of the AC reactor can be determined by pressure-drop based upon each-phase winding on the expected reactor. Generally, the pressure-drop is selected to the 2%～4% of the net side-phase voltage. The reactor pressure-drop of the series-in from the input port can not be ultra-big; otherwise, the motor's torque will be affected. It is recommended to use the 45 (8.8V) of the leading-in voltage.

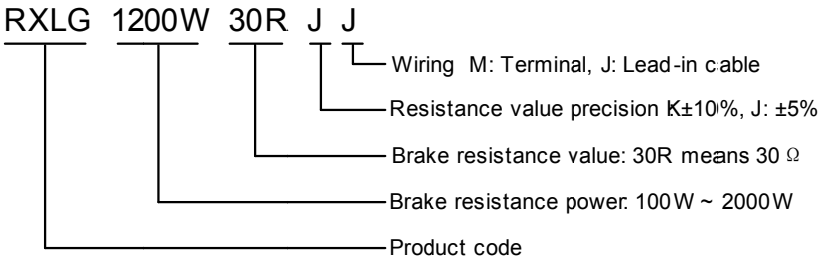
User can freely configure it based upon the following technical data.

Spindle servo drive unit output power	3-phase AC lead-in reactor		
	Rated operation voltage		Rated operation voltage
1.5 kW	3-phase AC 380V (or 440V) /50Hz	8A～10 A	1.0 mH～2.5 mH
2.2 kW	3-phase AC 380V (or 440V) /50Hz	8A～10 A	1.0 mH～2.5 mH
3.7 kW	3-phase AC 380V (or 440V) /50Hz	9A～10 A	1. mH ～2.5 mH
5.5 kW	3-phase AC 380V (or 440V) /50Hz	13A～15 A	1.0 mH～1.5 mH
7.5 kW	3-phase AC 380V (or 440V) /50Hz	18A～20 A	0.8 mH～1.2 mH
11 kW	3-phase AC 380V (or 440V) /50Hz	24A～30 A	0.5 mH～0.8 mH
15 kW	3-phase AC 380V (or 440V) /50Hz	34A～40 A	0.4 mH～0.6 mH
18.5 kW	3-phase AC 380V (or 440V) /50Hz	40A～50A	0.4 mH～0.5 mH
22 kW	3-phase AC 380V (or 440V) /50Hz	50A～60 A	0.35 mH～0.4mH

APPENDIX C SELECTION OF BRAKE RESISTANCE

Notice	■ Do not touch the brake resistance, because the high pressure and temperature may be generated on its surface when servo drive unit is turned on or operated! ■ It is necessary to install an insulation enclosure. ■ The surface temperature of the aluminum enclosure brake resistance falls slowly after the servo drive unit is turned off! You can touch it when inspecting and maintaining till the surface temperature of the brake resistance descends to room-temperature and after the servo drive unit is turned off for 10min.

① Brake resistance type explanation



② Brake resistance appearance

③ Brake resistance dimension

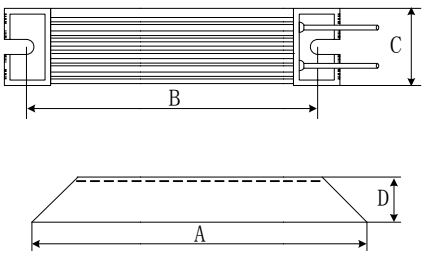


Fig.1-9-1 Installation aperture5.5mm

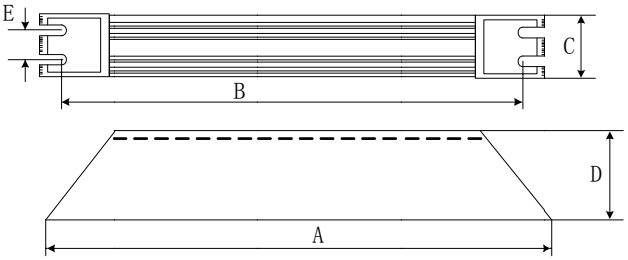
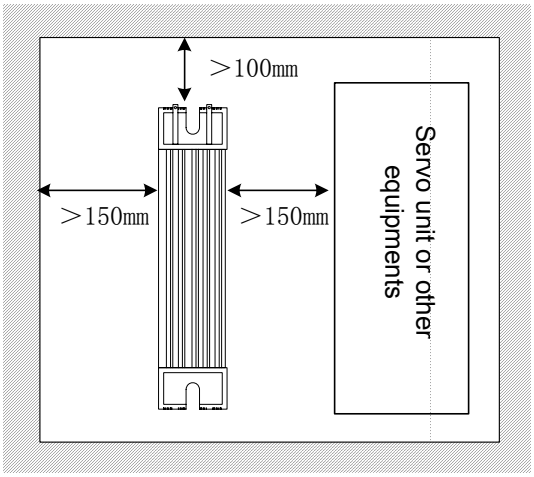


Fig.1-9-2 Installation aperture5.5mm

Product code	Brake resistance rate (W)	Appearance figure	Dimension (mm)					Wiring (mm^2)	Lead-in cable length (mm)	Terminal
			A	B	C	D	E			
RXLG	500	Fig. 1-9-1	335	323	60	30	/	2.5	1000	M5
RXLG	800		400	388	61	59	/	2.5	1000	M5

RXLG	1200	Fig. 1-9-2	450	438	50	107	30	2.5	1000	M5
RXLG	1500		485	473	50	107	30	2.5	1000	M5

④ Brake resistance installation interval



⑤ Brake resistance configuration table

Servo drive unit type	Large, medium inertial application (Turning machine)		Small inertial application (Milling machine)	
	Specification	Type	Specification	Type
GR2050Y	800W/15Ω	RXLG800W15RJJ-M4	500W/15Ω	RXLG500W15RJJ-M4
GR2075Y	1200W/10Ω	RXFG1200W10RJM-M4	800W/10Ω	RXFG800W10RJM-M4
GR2100Y	1500W/9Ω	RXFG1500W09RJM-M6	1200W/9Ω	RXFG1200W09RJM-M6
GR3048Y	800W/35Ω	RXLG800W35RJJ	500W/35Ω	RXLG500W35RJJ
GR4048Y	800W/35Ω	RXLG800W35RJJ	500W/35Ω	RXLG500W35RJJ
GR3050Y	1200W/30Ω	RXLG1200W30RJM	800W/30Ω	RXLG800W30RJJ
GR4050Y	1200W/35Ω	RXLG1200W35RJM	800W/35Ω	RXLG800W35RJJ
GR3075Y	1500W/30Ω	RXLG1500W30RJM	1200W/30Ω	RXLG1200W30RJM
GR4075Y	1500W/35Ω	RXLG1500W35RJM	1200W/35Ω	RXLG1200W35RJM
GR3100Y	(1200W/30Ω)//2	RXLG1200W30RJM	(800W/30Ω)//2	RXLG800W30RJJ
GR4100Y	(1200W/35Ω)//2	RXLG1200W35RJM	(800W/35Ω)//2	RXLG800W35RJJ
GR3148Y	(1500W/30Ω)//2	RXLG1200W30RJM	(1200W/30Ω)//2	RXLG1200W30RJM
GR4148Y	(1500W/35Ω)//2	RXLG1200W35RJM	(1200W/35Ω)//2	RXLG1200W35RJM
GR3150Y	(1500W/30Ω)//2	RXLG1500W30RJM	(1200W/30Ω)//2	RXLG1200W30RJM
GR4150Y	(1500W/35Ω)//2	RXLG1500W35RJM	(1200W/35Ω)//2	RXLG1200W35RJM
GR3198Y	(2000W/25Ω)//2	RXLG2000W25RJM	(1500W/25Ω)//2	RXLG1500W25RJM
GR4198Y	(2000W/25Ω)//2	RXLG2000W25RJM	(1500W/25Ω)//2	RXLG1500W25RJM

Servo drive unit type	Specification	Type	Servo drive unit type	Specification	Type
GR2025T	300W/22Ω (Optional configuration)	RXLG300W22RJJ	GR3048T	500W/35Ω	RXLG500W35RJJ
GR2030T			GR3050T	800W/30Ω	RXLG800W30RJJ
GR2045T			GR3075T	1200W/30Ω	RXLG1200W30RJJ

Appendix

Servo drive unit type	Specification	Type	Servo drive unit type	Specification	Type
GR2050T	500W/15Ω (Optional configuration)	RXLG500W15RJJ	GR3100T	(800W/30Ω)//2	RXLG800W30RJJ
GR2075T	800W/12Ω	RXLG800W12RJM	GR3148T	(1200W/30Ω)//2	RXLG1200W30RJJ
GR2100T	1200W/10Ω	RXLG1200W10RJJ	GR3150T	(1200W/30Ω)//2	RXLG1200W30RJJ
/	/	/	GR3198T	(1500W/25Ω)//2	RXLG1500W25RJJ

***: "//2" means that each servo drive unit should be performed the parallel connection with two same types brake resistances; and then the lead-in cable will be mounted to the drive unit after separately parallel to the pressure-welding.**