
 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.

 This user manual is the property of GSK CNC Equipment Co., Ltd. All rights are reserved. It is against the law for any organization or individual to publish or reprint this manual without the express written permission of GSK and the latter reserves the right to ascertain their legal liability.

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

| | |
|--|-------------|
| CONTENTS | VIII |
| CHAPTER ONE PRODUCT INTRODUCTION | 1 |
| 1.1 PRODUCT TYPE CONFIRMATION..... | 1 |
| 1.1.1 Servo Drive Unit Type Explanation | 2 |
| 1.1.2 Servo Drive Unit Appearance..... | 3 |
| 1.2 GR-L SERVO DRIVE UNIT TECHNICAL SPECIFICATION..... | 4 |
| 1.3 ORDER GUIDING..... | 6 |
| 1.3.1 GR-L Series Servo Drive Unit Type-Selecting Step..... | 6 |
| 1.3.2 Order Type Example | 7 |
| 1.3.3 Option-Type Table of SJT Series Servo Motor Matching with GR2000T-LA1 Series Product..... | 7 |
| 1.3.4 Option-type Table of SJT Series Servo Motor Matching with GR3000T-LA1 Series Product | 8 |
| 1.3.5 Option-type Table of ZJY Series Spindle Servo Motor Matching with GR3000Y-LP2, GR4000Y-LP2 Series Product..... | 8 |
| 1.3.6 Option-type Table of ZJY Spindle Servo Motor Matching with GR2000Y-LP2 Series Product..... | 10 |
| 1.3.7 Product Factory Equipped Accessory..... | 10 |
| CHAPTER TWO INSTALLATION | 13 |
| 2.1 INSTALLATION ENVIRONMENT REQUIREMENT | 13 |
| 2.2 INSTALLATION DIMENSION | 14 |
| 2.3 INSTALLATION INTERVAL..... | 16 |
| CHAPTER THREE CONNECTION | 19 |
| 3.1 PERIPHERAL EQUIPMENT CONNECTION | 20 |
| 3.1.1 Peripheral Equipment Connection of GR2000T-L Servo Drive Unit..... | 20 |
| 3.1.2 Peripheral Equipment Connection of GR3000T-L Servo Drive Unit..... | 23 |
| 3.1.3 Peripheral Equipment Connection of GR-L Spindle Servo Drive Unit..... | 24 |
| 3.1.4 Product Connection for Multi-GSK-Link Spot Bus..... | 25 |
| 3.2 MAIN CIRCUIT WIRING | 25 |
| 3.2.1 Function and Wiring of Main Circuit Connection Terminal..... | 25 |
| 3.2.2 Typical Wiring Example of Main Circuit | 28 |
| 3.3 CONNECTION OF CONTROLLABLE SIGNAL..... | 33 |
| 3.3.1 CN2 Motor Encoder Feedback Interface & Wiring..... | 33 |
| 3.3.2 The 2 nd Position Encoder Feedback Interface and Wiring of CN3..... | 37 |
| 3.3.3 CN4, CN5 Ethernet Spot Bus GSKLink Interface and Wiring..... | 39 |
| 3.3.4 CN1 Brake Releasing Signal..... | 40 |
| 3.3.5 I/O Information by Bus Interaction | 41 |
| 3.3.6 CN8 Position Feedback Output Interface and Wiring..... | 42 |
| CHAPTER FOUR DISPLAY & OPERATION | 45 |
| 4.1 OPERATION PANEL | 45 |
| 4.2 DISPLAY MENU..... | 46 |
| 4.3 STATE MONITORING..... | 48 |
| 4.4 PARAMETER SETTING..... | 51 |
| 4.5 PARAMETER ADMINISTRATION..... | 52 |
| CHAPTER FIVE OPERATION | 55 |
| 5.1 ENSURE CORRECT WIRING | 55 |
| 5.2 MANUAL OPERATION | 57 |
| 5.3 JOG OPERATION | 58 |

| | |
|---|------------|
| 5.4 GSK-LINK BUS CONTROL OPERATION | 59 |
| CHAPTER SIX FUNCTION DEBUGGING..... | 65 |
| 6.1 BASIS PERFORMANCE PARAMETER DEBUGGING EXPLANATION | 65 |
| 6.1.1 Debugging Method of Adapted Permanent Synchronous Motor | 65 |
| 6.1.2 Debugging Method of Adapted AC Asynchronous Spindle Motor | 67 |
| 6.1.3 Three-Gain Selection of Closed-Loop Control..... | 69 |
| 6.2 POSITION ELECTRIC GEAR RATIO | 71 |
| 6.3 SHIFT OF MOTOR ROTATION DIRECTION | 72 |
| 6.4 SERVO TORQUE LIMIT | 74 |
| 6.5 BRAKE RELEASE SIGNAL APPLICATION | 74 |
| 6.6 MOTOR BRAKE METHOD..... | 77 |
| 6.7 SPINDLE CLAMPING INTERLOCKING SIGNAL | 78 |
| 6.8 SPINDLE ORIENTATION FUNCTION | 79 |
| 6.9 VELOCITY/POSITION SHIFTING FUNCTION (CS AXIS FUNCTION) | 85 |
| CHAPTER SEVEN PARAMETER..... | 89 |
| 7.1 PARAMETER LIST | 89 |
| 7.2 PARAMETER MEANING DETAILS | 91 |
| 8.1 MEANING AND TREATMENT OF ALARM OR PROMPT CODE | 101 |
| 8.2 NORMAL TROUBLESHOOTING | 110 |
| 8.3 INSPECTION AND MAINTENANCE OF SERVO DRIVE UNIT | 111 |
| APPENDIX A MOTOR TYPE CODE TABLE | 113 |
| APPENDIX B PERIPHERAL EQUIPMENT SELECTION | 117 |
| B.1 BREAKER AND CONTACTOR (NECESSARY EQUIPMENT)..... | 117 |
| B.2 THREE-PHASE AC FILTER (RECOMMENDED EQUIPMENT) | 118 |
| B.3 AC REACTOR (RECOMMENDED EQUIPMENT) | 118 |
| APPENDIX C SELECTION OF BRAKE RESISTANCE | 121 |

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.

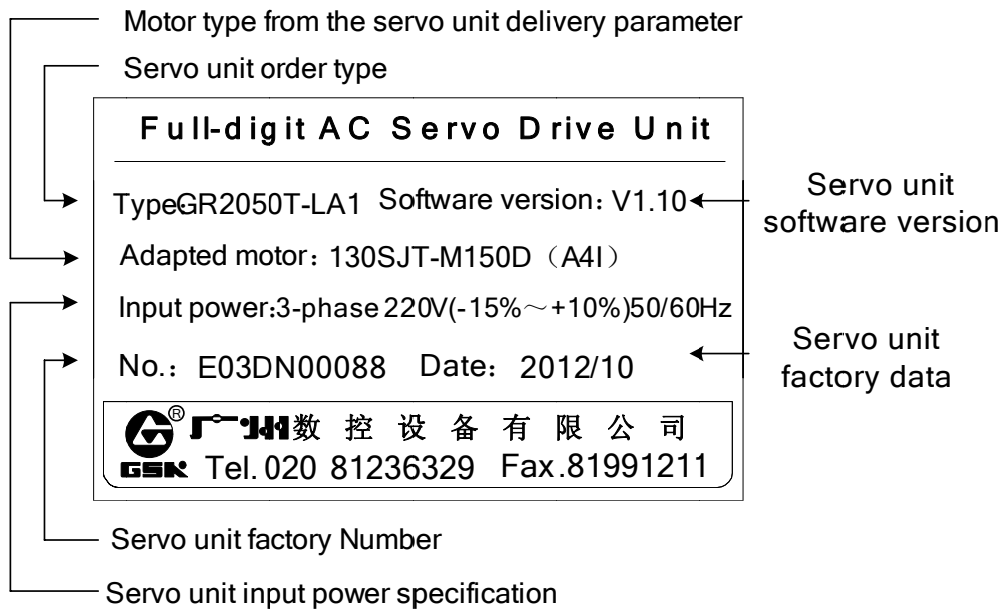
| Inspection Item | Remark |
|--|---|
| Check the servo drive unit and servo motor and confirm whether it is the ordered products. | Confirm it by the nameplate of the servo drive unit and servo motor |

| | |
|---|---|
| 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 | <p>1. The AC servo drive unit with damaging or absents in components can not be installed;</p> <p>2. The servo unit operation should be matched with the adapted power servo motor;</p> <p>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.</p> |
|---------------|--|

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 1 st position feedback) Input interface (CN2), "2" means the motor feedback input (CN2) and the 2 nd position feedback input interface (CN3) |
| ⑧ | Encoder agreement, without: BISS + TAMAGAWA (Nominal standard configuration); A: BISS+EnDat |

1.1.2 Servo Drive Unit Appearance

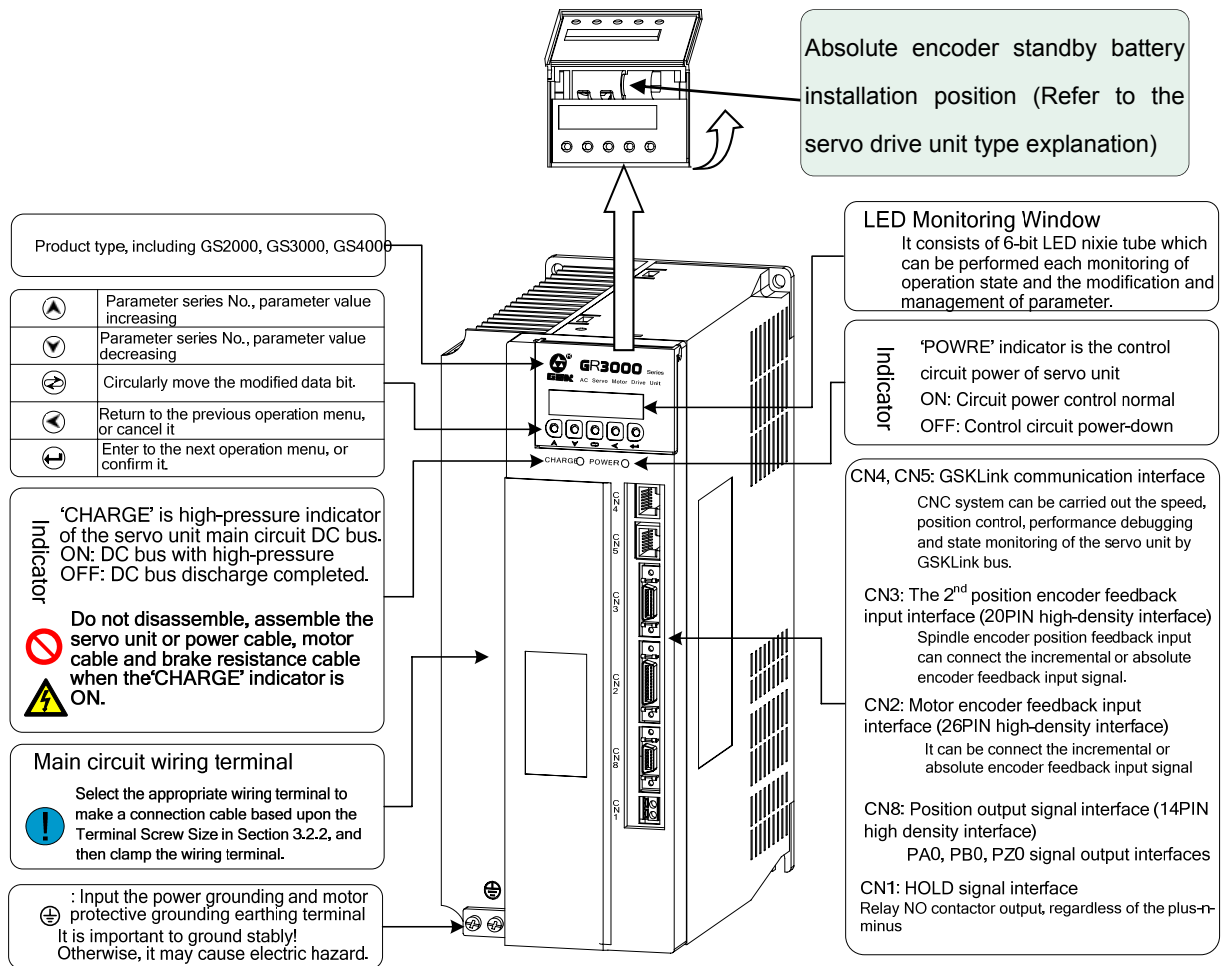


Fig. 1-10 GR2000T-C product appearance



- Motor encoder should be equipped with the battery on the servo drive unit when adapts with 'A4 II' 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 current (A) | 6 | 10 | 15 | 16.8 | 25.5 | 34 | |
| Weight (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 current (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 current (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 |

Chapter One Product Introduction

| | | | | | | | |
|---|--|------------------------|------------------------|------------------------|------------------------|------------------------|------------------------|
| 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 current (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: $-2^{31} \sim 2^{31} - 1$ Command unit: Position feedback pulse input equivalent Position command electric gear ratio: $(1 \sim 32767) / (1 \sim 32767)$ |
| Speed control | Command range: $-2^{31} \sim 2^{31} - 1$ Command unit: 0.01rpm Speed command electric gear ratio: $(1 \sim 32767) / (1 \sim 32767)$ Speed-regulation range: 1~5000rpm (Feed servo); 1~12000rpm (Spindle servo) Orientation function: Any angle |
| Torque control | Command range: $-2^{31} \sim 2^{31} - 1$ 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 1 st or the 2 nd 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 speed 1500r/min C: Motor rated speed 2000r/min D: Motor rated speed 2500r/min E: Motor rated speed 3000r/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 spindle encoder machining accuracy by | 2500 cable incremental encoder, resolution $\pm 0.036^\circ$ 5000 cable incremental encoder, resolution $\pm 0.018^\circ$ 17-bit absolute encoder, resolution $\pm 0.0027^\circ$ | 1024 cable incremental encoder, resolution $\pm 0.088^\circ$ 2500 cable incremental encoder, resolution $\pm 0.022^\circ$ 17-bit absolute encoder (A4I), resolution $\pm 0.0027^\circ$ 19-bit absolute encoder (A8), resolution $\pm 0.0007^\circ$ IGS512 gear magnetic resistance encoder, resolution $\pm 0.0055^\circ$, HEIDENHAIN 1024 magnetic grid encoder, resolution $< \pm 0.00005^\circ$ |
| 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 |

Chapter One Product Introduction

| 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 | |

Chapter One Product Introduction

| | | | | |
|--|---------------------------|------|--------------------|---|
| 4-bit plug | BCF 3.81/04/180F | 1 pc | CN7 interface plug | |
| Aluminum enclosure brake resistance | Aluminum brake resistance | | 1m cable | Refer to the <i>Appendix C</i> 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 | RXLG300W30RJ J | 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 | RXLG500W22RJ J | 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 | <i>GR-L Series AC Servo Drive Unit User Manual</i> | 1 copy | Following with the technical document | |
| 4-bit plug | BCF 3.81/04/180F | 1 pc | CN7 interface plug | |
| Aluminum enclosure brake resistance | Aluminum enclosure brake resistance | | 1m cable | Refer to the <i>Appendix C</i> 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 | <p>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</p> <p>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.</p> <p>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.</p> |
|---------------|--|

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.

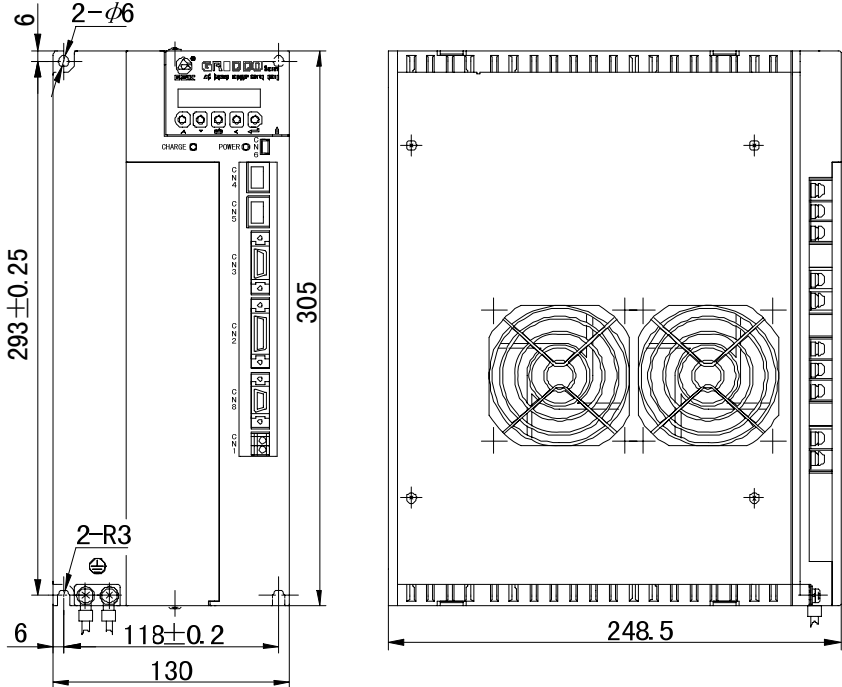
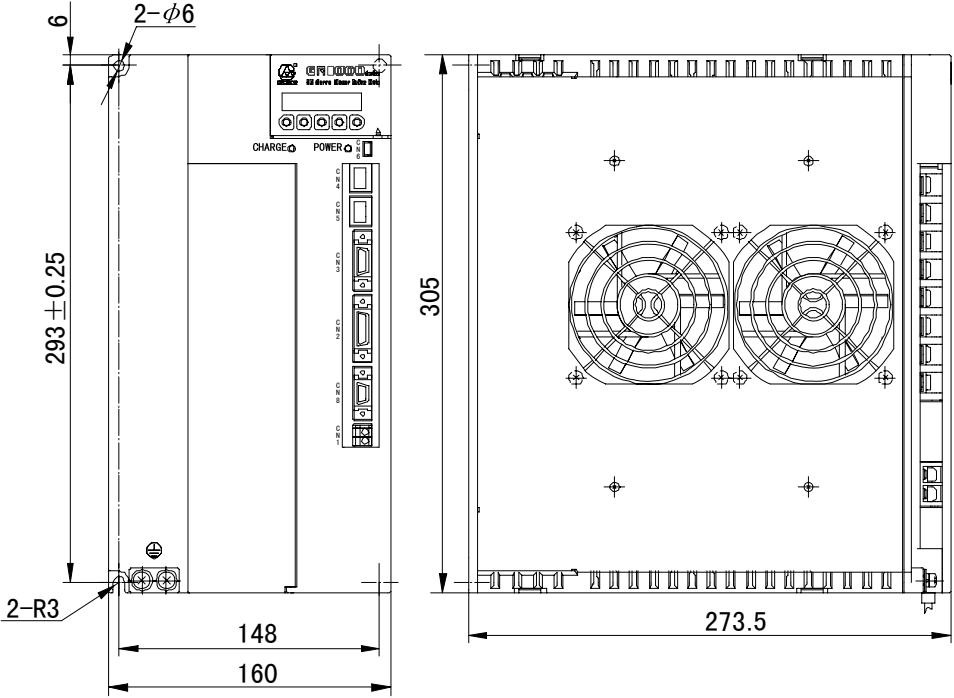
| | |
|---------------|--|
| Notice | <ul style="list-style-type: none"> ■ It is necessary to install at the place where without the water-drop, steam, dust and oil. ■ Pay attention to the ventilation, damp-proof and dust in the installation place. ■ Do not install it on the flammable surface or neighbor, avoid the accident fire hazard. ■ The installation situation should be convenient for maintaining and inspecting. |
|---------------|--|

| Item | Index |
|--------------------------------------|--|
| Usage temperature | 0°C~40°C |
| Storage & transportation temperature | -40°C~70°C |
| Usage humidity | 30%~95% (No condensation) |
| Storage & transportation humidity | ≤95% (40°C) |
| 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 |

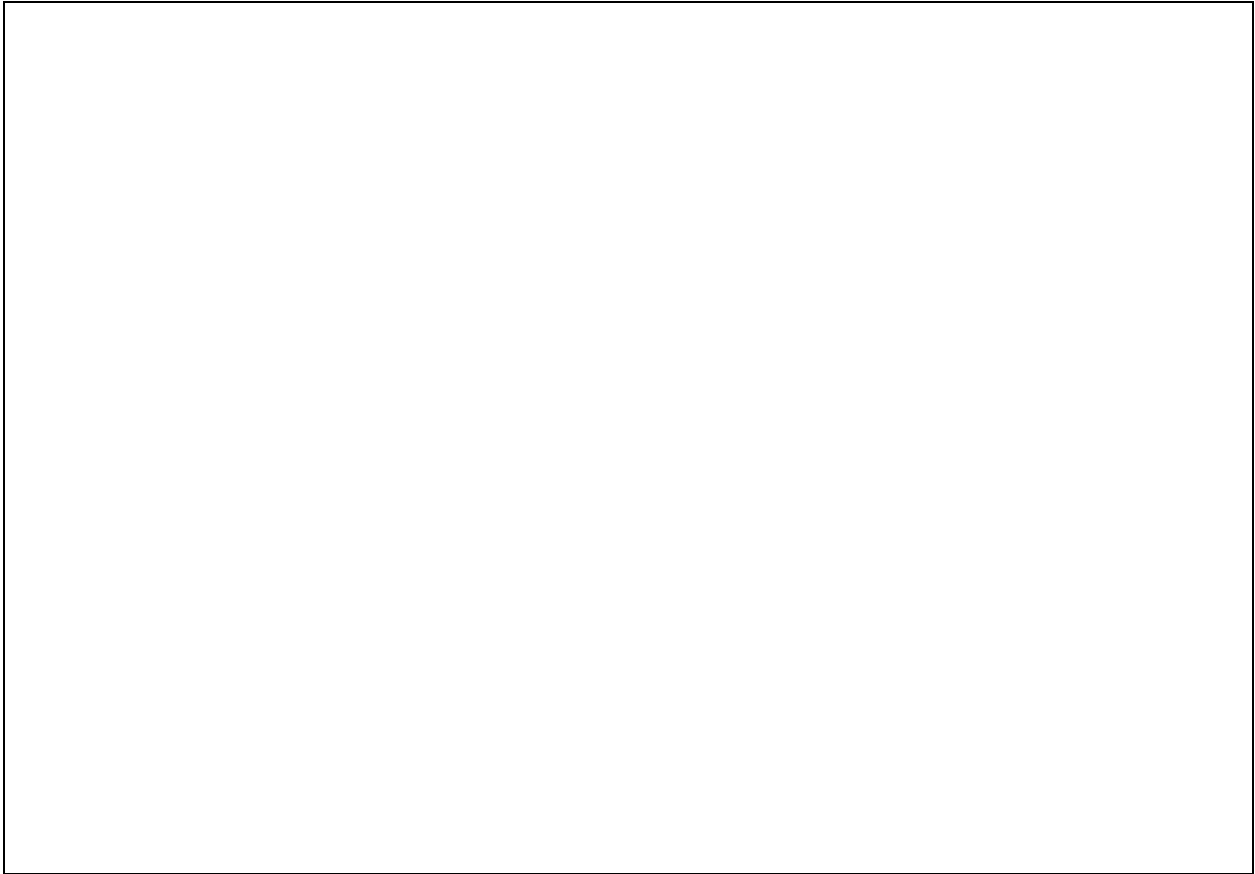
2.2 Installation Dimension

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

Chapter Two Installation

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

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.

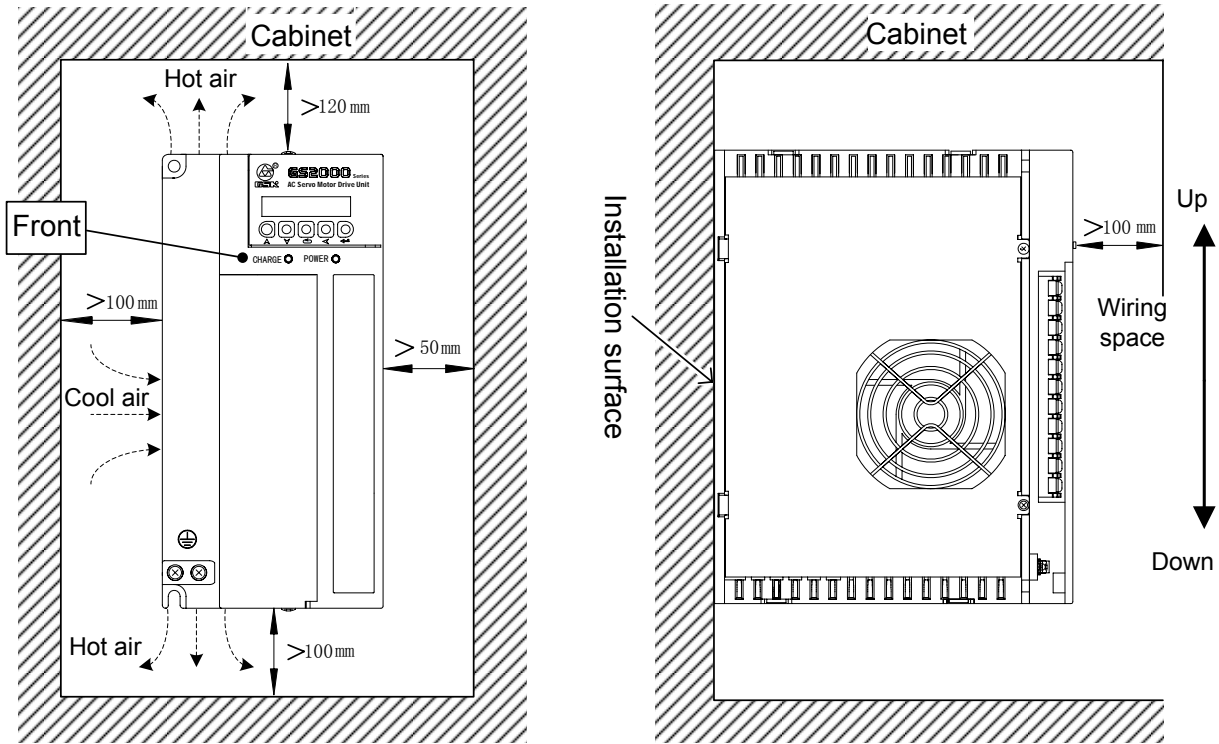


Fig. 2-1 The installation interval for 1 servo drive unit

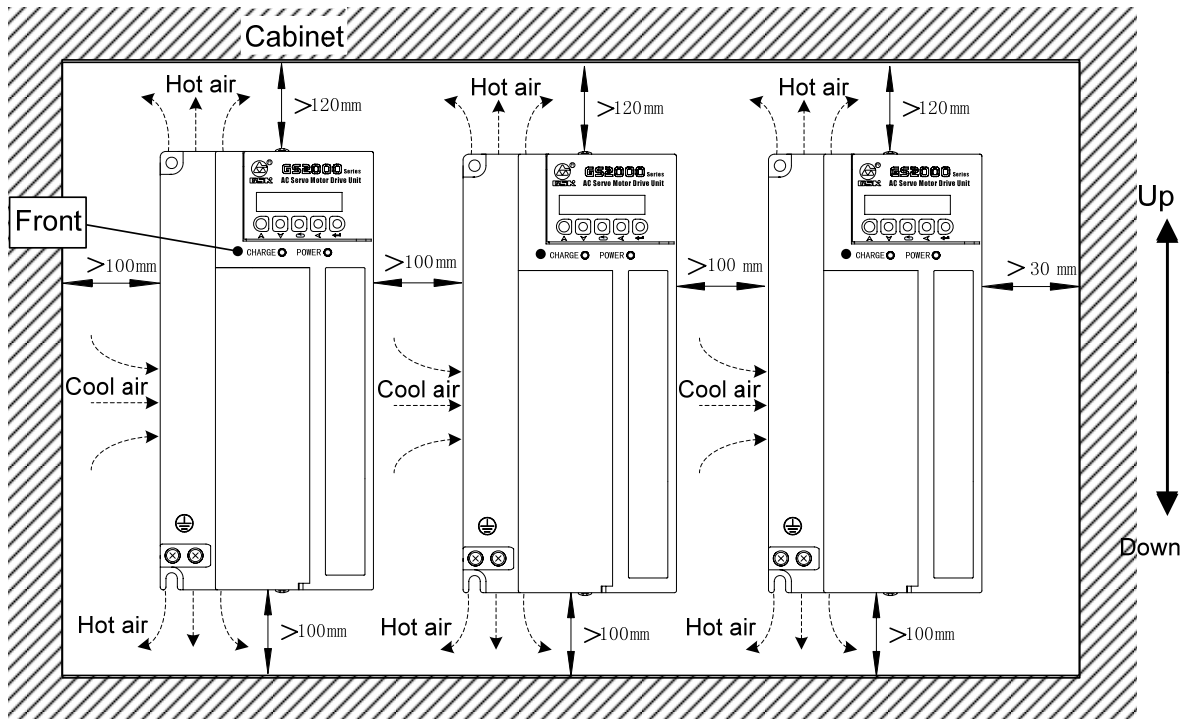


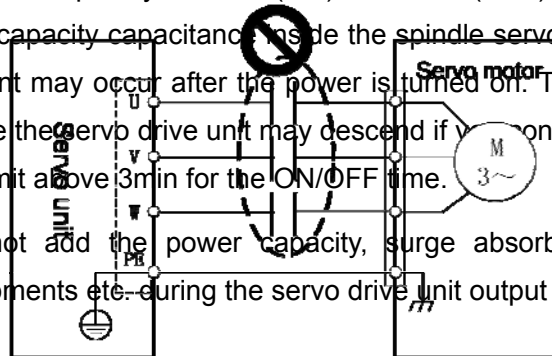
Fig. 2-2 The installation interval for multiple servo drive units

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


| | |
|--|---|
| | <p>equipment and motor, so that it will be reduce its insulation performance due to the heating.</p> <ul style="list-style-type: none"> ■ 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 greatly 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.

| | |
|---|--|
|  | <p>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.</p> <p>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.</p> |
|---|--|

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**

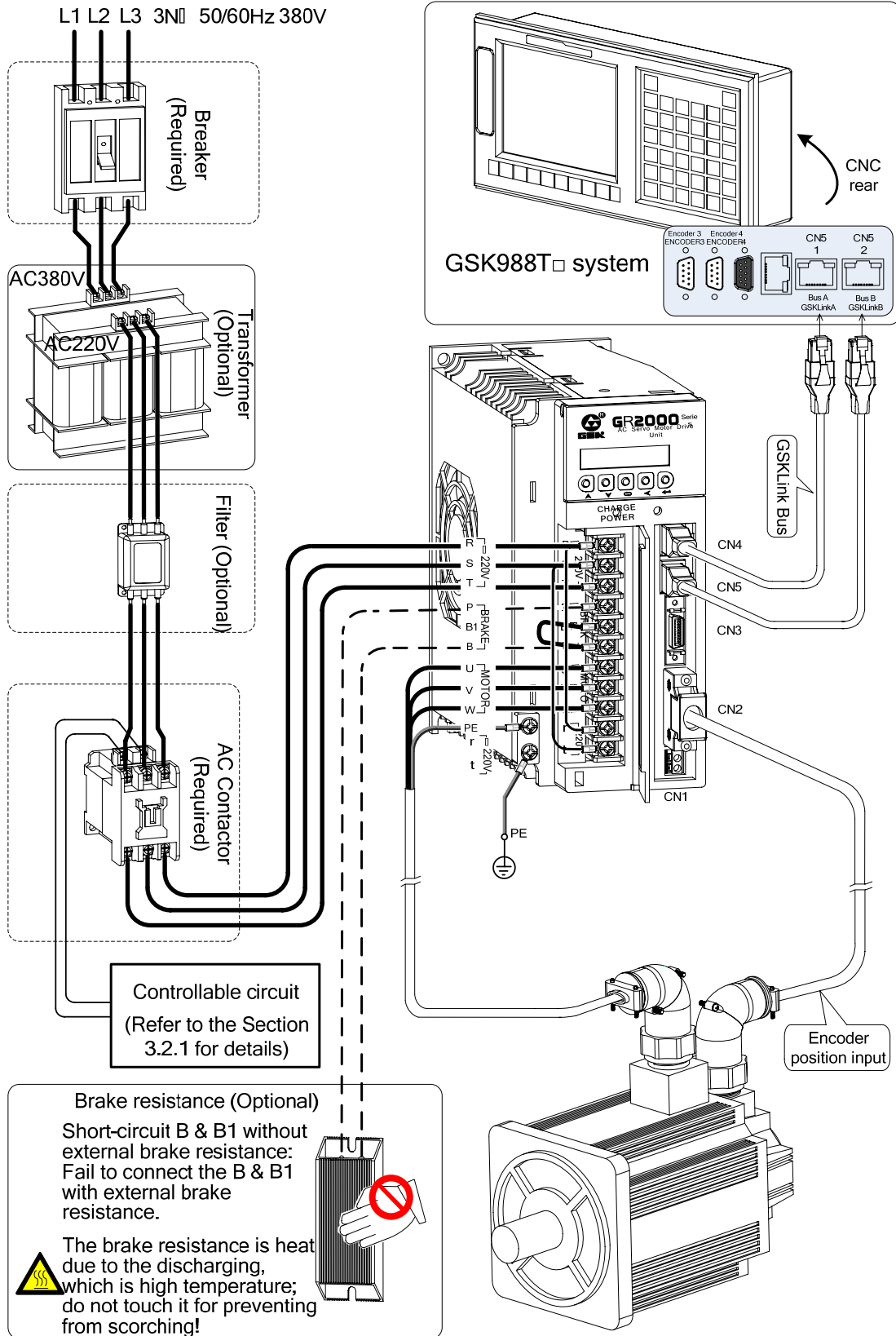


Fig. 3-1 (a) Single peripheral equipment connection of GR2000T-L

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

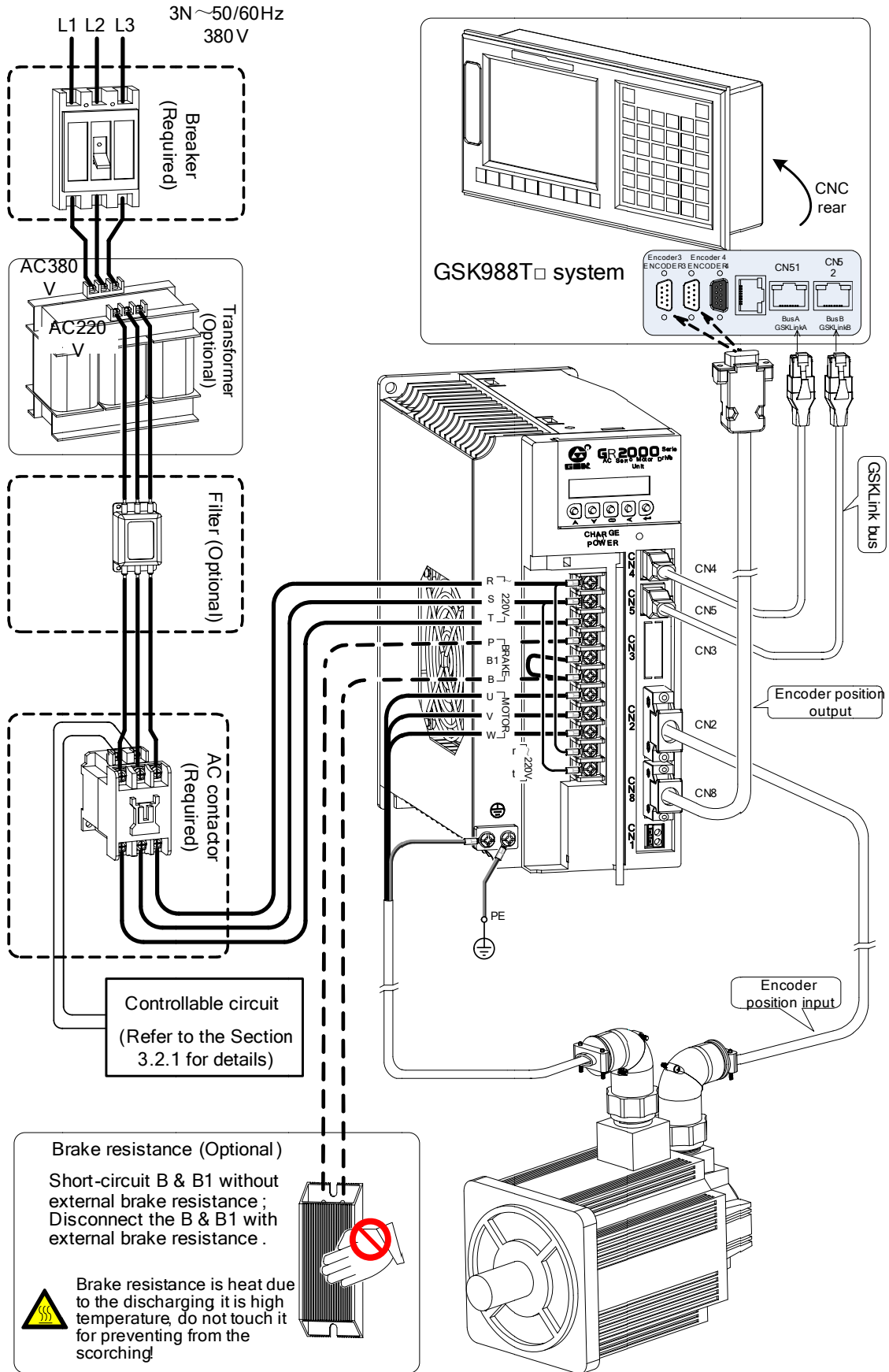


Fig. 3-1 (b) Single peripheral equipment connection of GR2000T-L

3.1.2 Peripheral Equipment Connection of GR3000T-L Servo Drive Unit

- Single peripheral equipment connection figure of GR3000T-L series

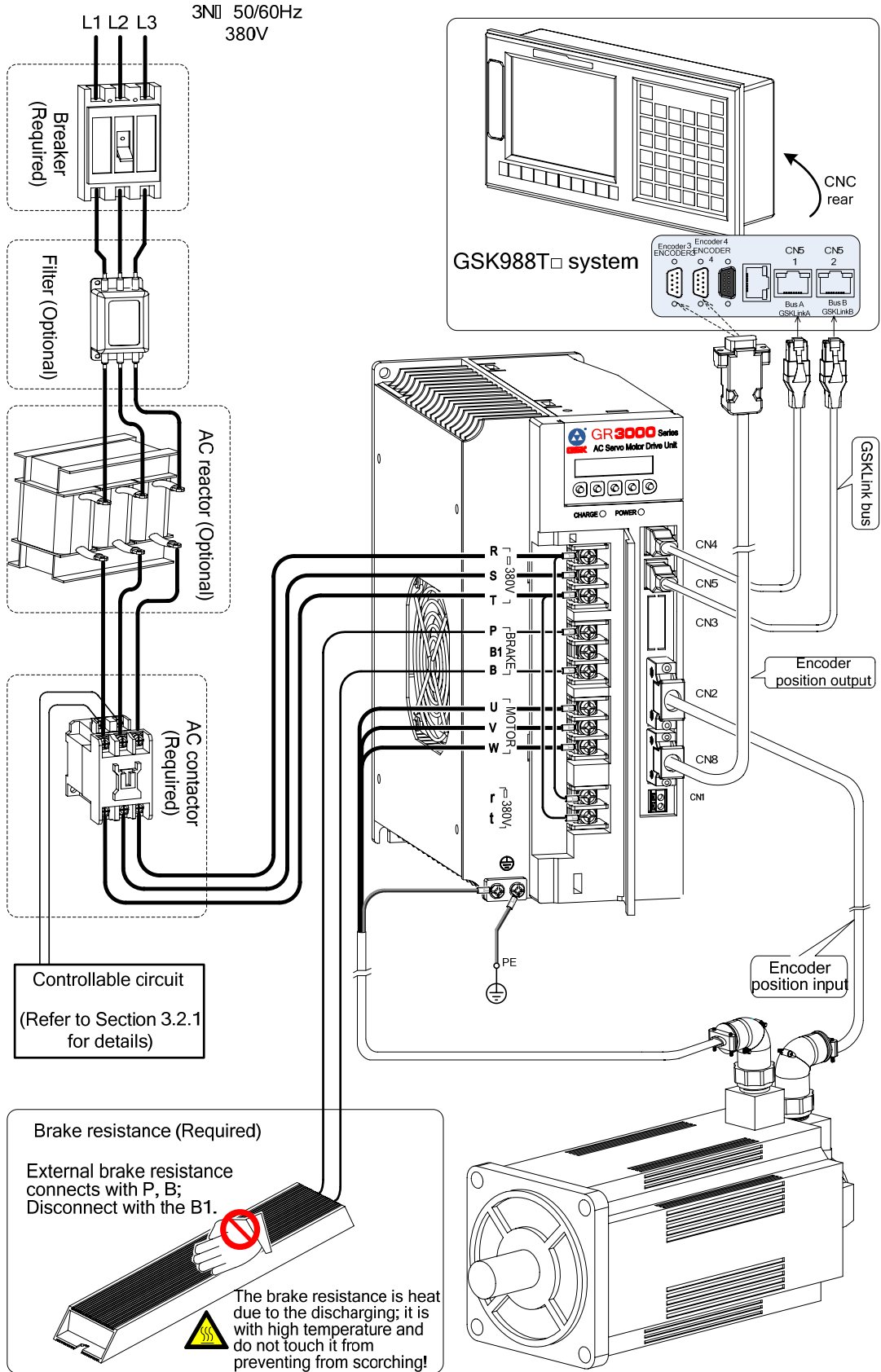


Fig. 3-2 Single peripheral equipment connection of GR3000T-L

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.

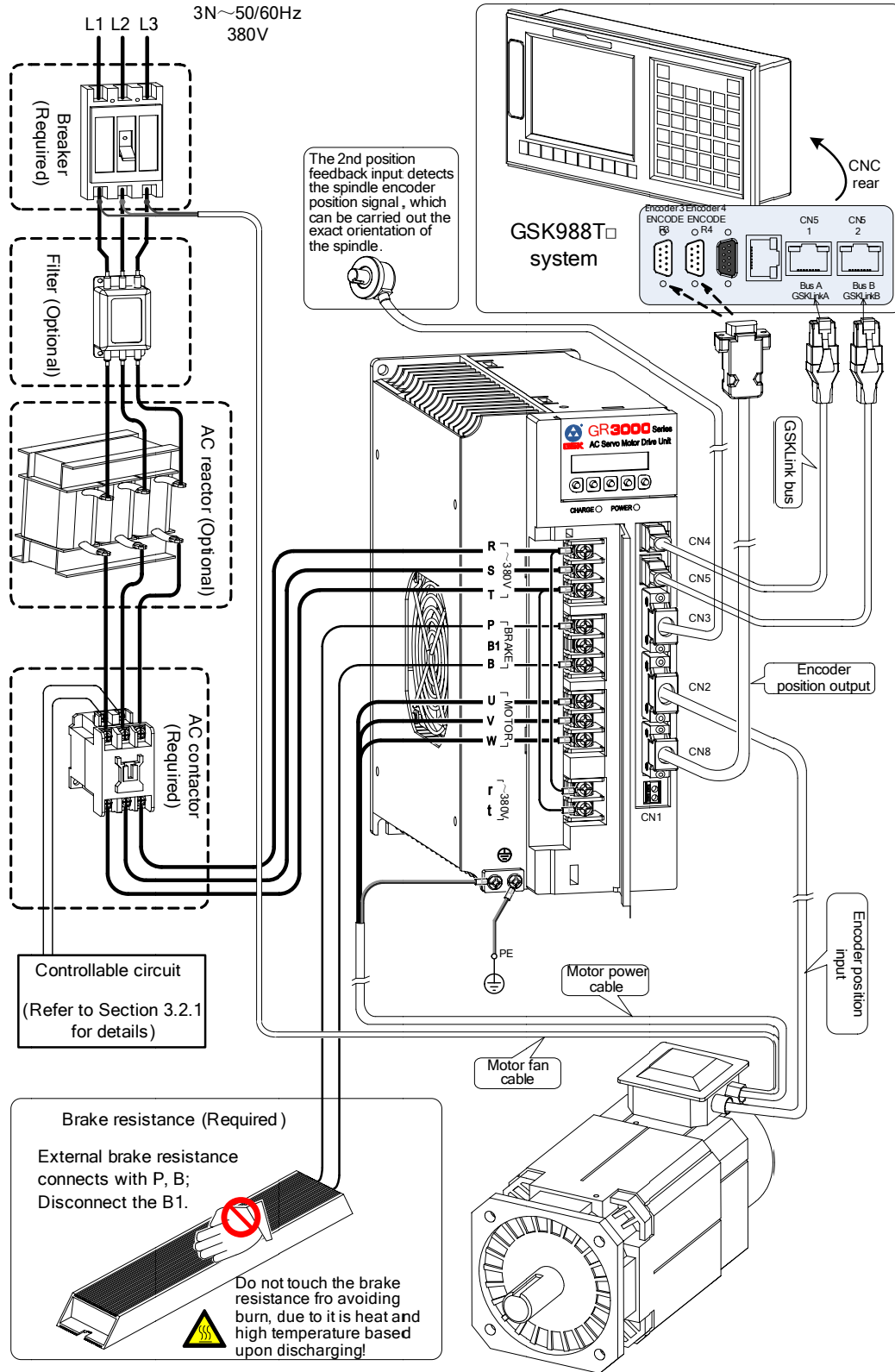


Fig. 3-3 Single spindle servo drive unit peripheral equipment connection of GR3000Y-L

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.)

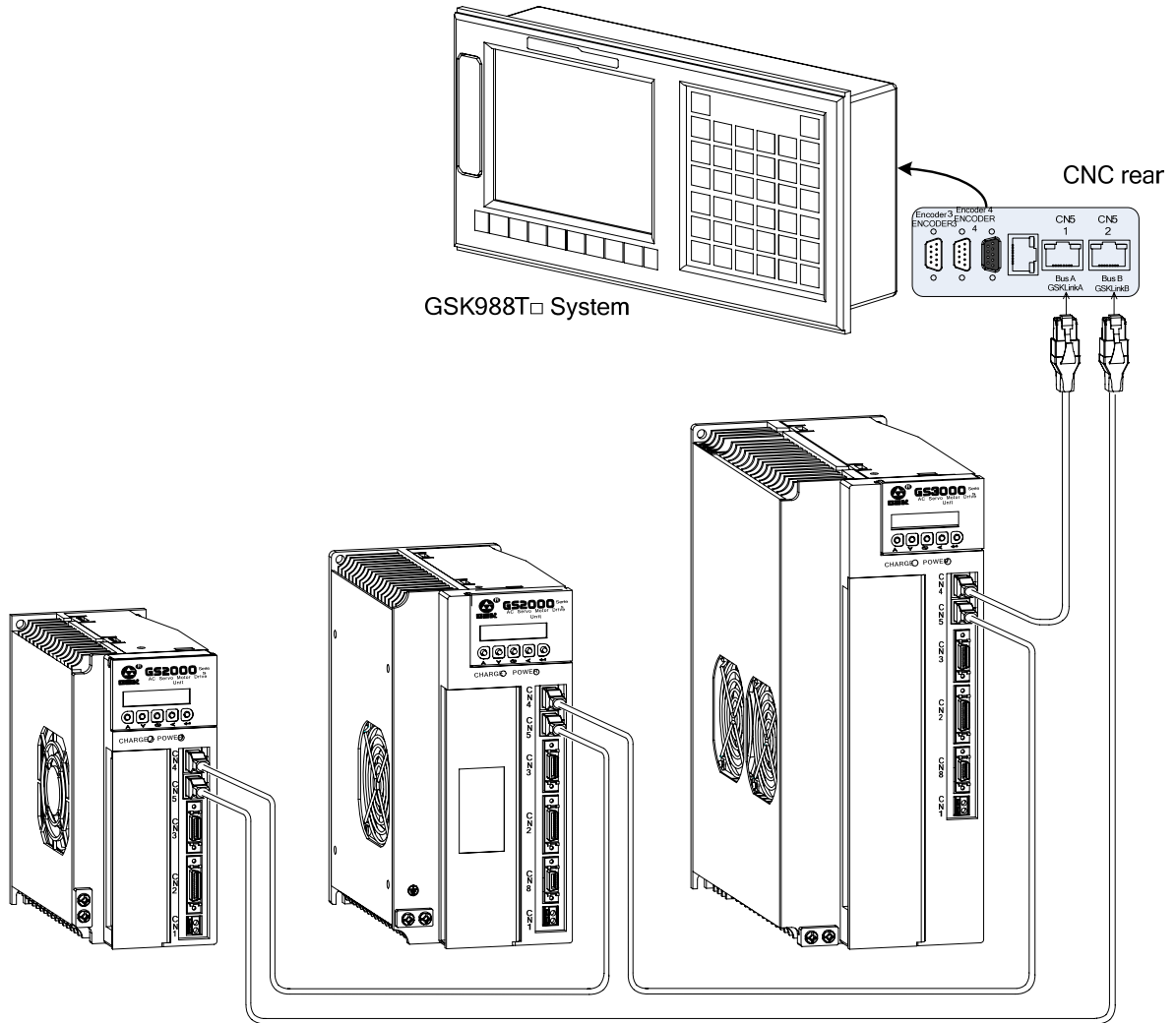



Fig. 3-4 GSKLink bus connection figure for multi servo drive units

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-phase AC220V (85%~110%) 50/60Hz |
| | | GR3000 | 3-phase AC380V (85%~110%) 50/60Hz |
| | | GR4000 | 3-phase 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 |

Chapter Three Connection

| | | | | | | | | | |
|---------|-------------------|---|-----|---|---|---|-----|---|-----|
| GR3050T | $7.5 < I \leq 10$ | 4 | 1.5 | 4 | 1 | 4 | 2.5 | 5 | 1.5 |
| GR3075T | $10 < I \leq 15$ | 6 | 2.5 | 4 | 1 | 6 | 2.5 | 5 | 2.5 |
| GR3100T | $15 < I \leq 20$ | 6 | 2.5 | 4 | 1 | 6 | 4 | 6 | 2.5 |
| GR3148T | $20 < I \leq 27$ | 6 | 4 | 4 | 1 | 6 | 4 | 6 | 4 |
| GR3150T | $27 < I \leq 34$ | 6 | 6 | 4 | 1 | 6 | 4 | 6 | 6 |
| GR3198T | $34 < I \leq 45$ | 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 ϕ mm | Cable diameter mm^2 | Terminal screw size ϕ mm | Cable diameter mm^2 | Terminal screw size ϕ mm | Cable diameter mm^2 | Terminal screw size ϕ mm | Cable diameter mm^2 |
| GR2050Y | $I \leq 10$ | 3.5 | 1.5 | 3.5 | 1 | 3.5 | 2.5 | 4 | 1.5 |
| GR2075Y | $10 < I \leq 15$ | 4 | 2.5 | 4 | 1 | 4 | 2.5 | 5 | 2.5 |
| GR2100Y | $15 < I \leq 29$ | 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 ϕ mm | Cable diameter mm^2 | Terminal screw size ϕ mm | Cable diameter mm^2 | Terminal screw size ϕ mm | Cable diameter mm^2 | Terminal screw size ϕ mm | Cable diameter mm^2 |
| GR3048 GR4048 | $I \leq 8$ | 3.5 | 1.0 | 3.5 | 1 | 3.5 | 2.5 | 4 | 1.0 |
| GR3050 GR4050 | $8 < I \leq 15.5$ | 4 | 1.5 | 4 | 1 | 4 | 2.5 | 5 | 1.5 |
| GR3075 GR4075 | $15.5 < I \leq 20$ | 6 | 2.5 | 4 | 1 | 6 | 2.5 | 5 | 2.5 |
| GR3100 GR4100 | $20 < I \leq 27$ | 6 | 4 | 4 | 1 | 6 | 4 | 6 | 4 |
| GR3148 GR4148 | $27 < I \leq 34$ | 6 | 6 | 4 | 1 | 6 | 4 | 6 | 6 |
| GR3150 GR4150 | $34 < I \leq 40$ | 6 | 8 | 4 | 1 | 6 | 4 | 6 | 8 |
| GR3150 GR4150 | $40 < I \leq 49$ | 6 | 10 | 4 | 1 | 6 | 4 | 6 | 10 |
| GR3198 GR4198 | $49 < I \leq 60$ | 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

| | |
|---|---|
| <div data-bbox="165 1778 306 1832" data-label="Section-Header"> <p>Notice</p> </div> | <ul style="list-style-type: none"> ● It is necessary to select the suitable breaker MCCB based upon the description in <i>Appendix B</i> 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

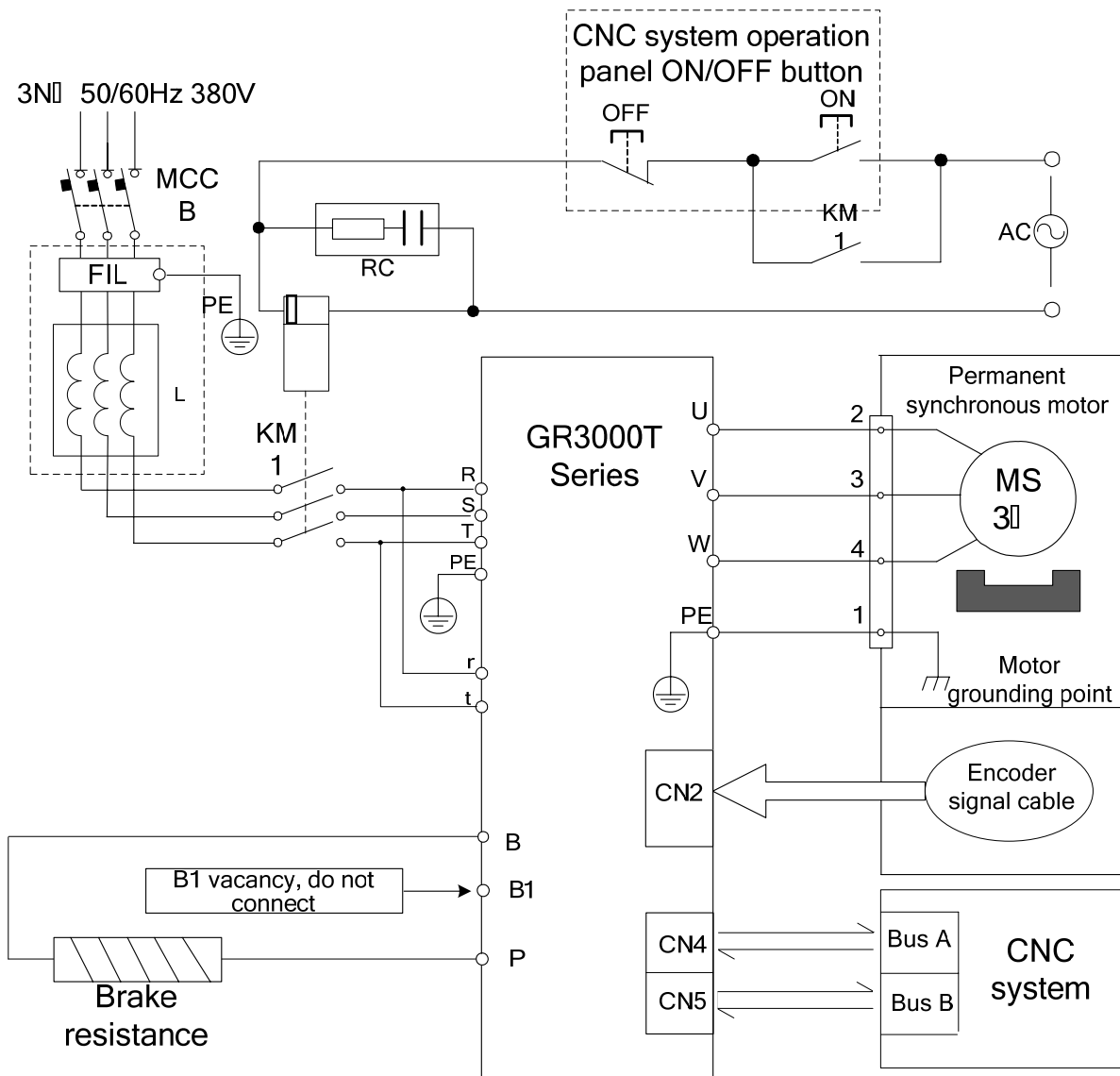


Fig. 3-6 Main circuit wiring of GR3000T-L series

| | |
|---------------|--|
| Notice | <ul style="list-style-type: none"> ● It is necessary to select the suitable breaker MCCB based upon the description in <i>Appendix B</i> 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

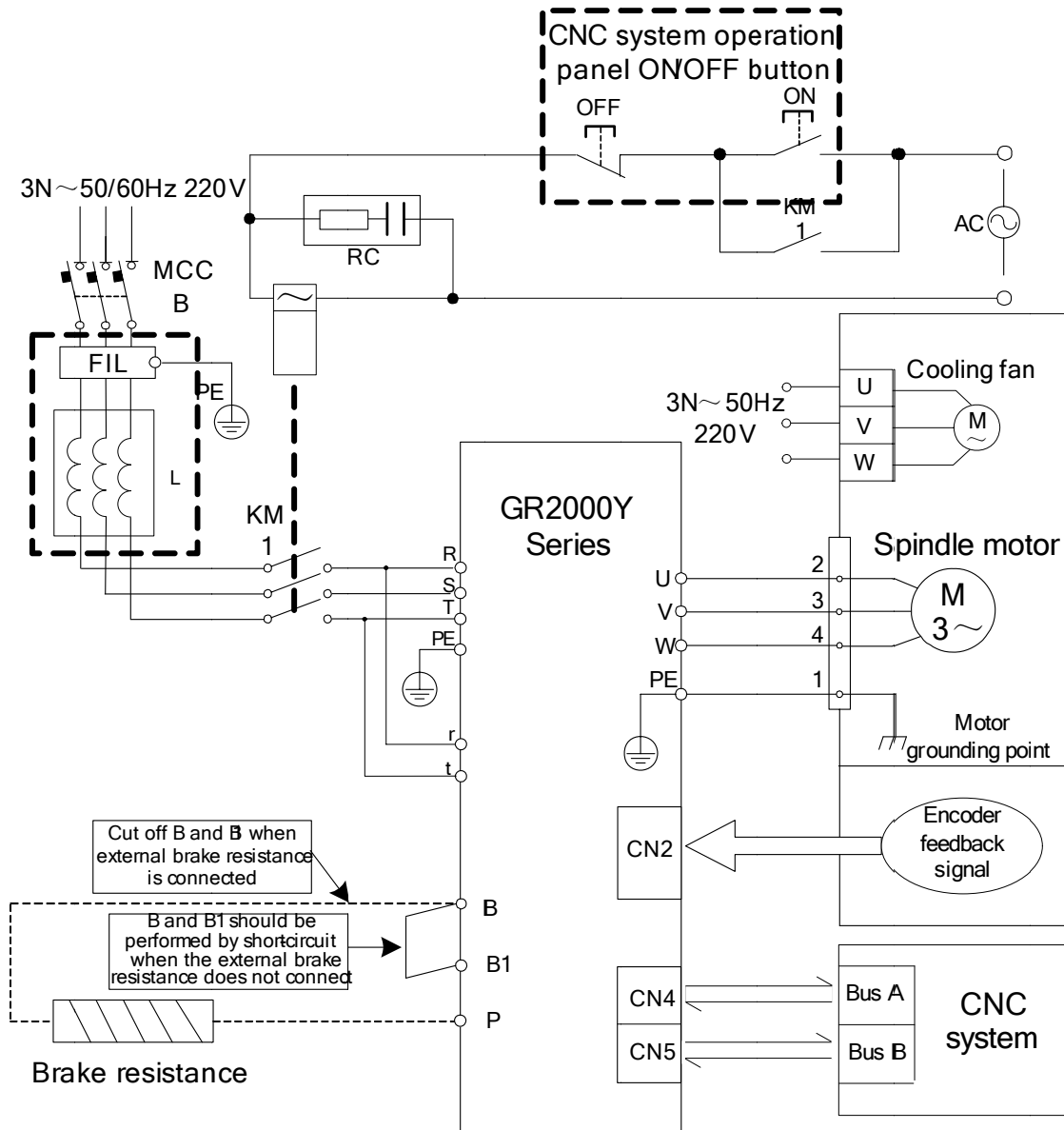


Fig. 3-7 Main circuit wiring of GR2000Y-L series

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

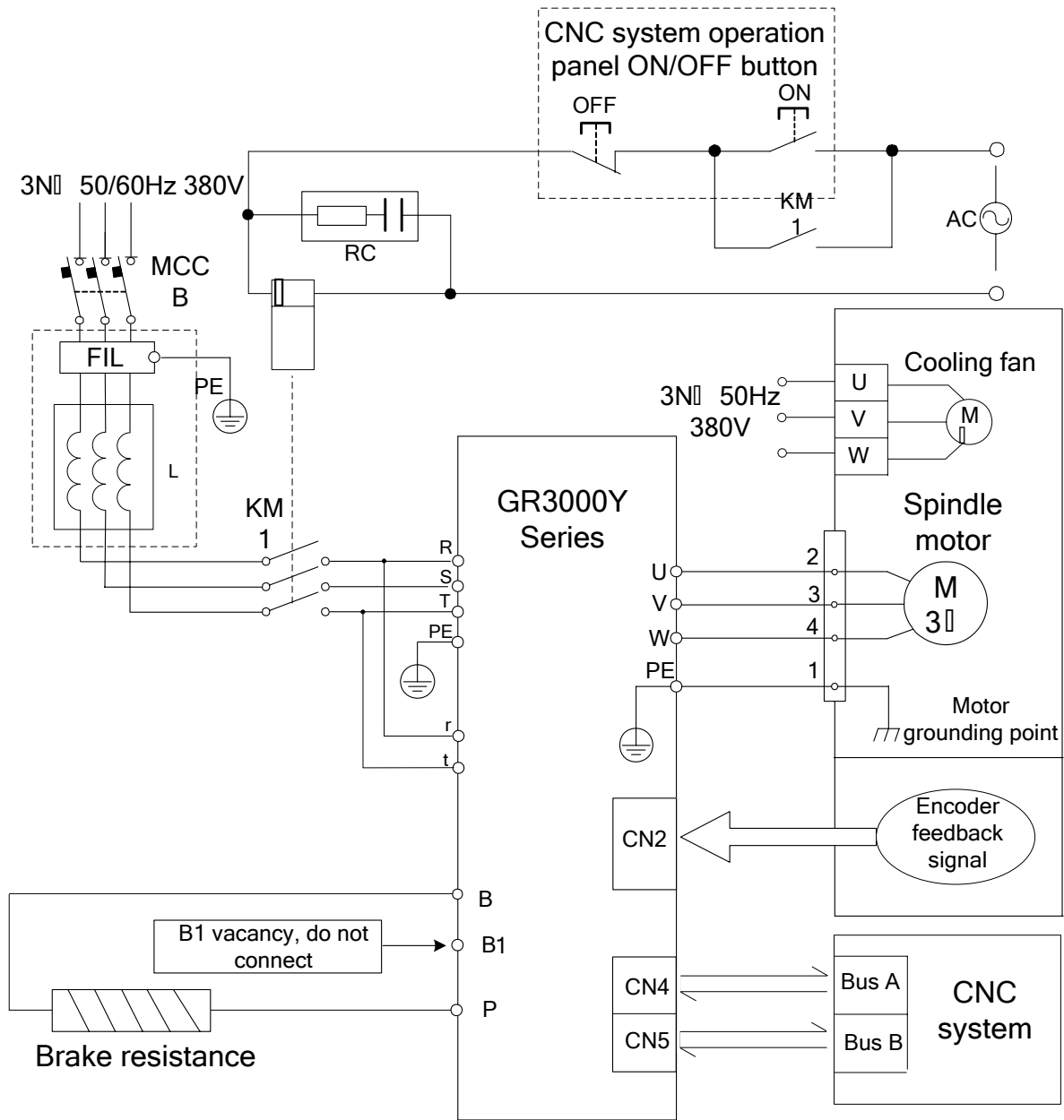


Fig. 3-8 main circuit wiring of GR3000Y-L series

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

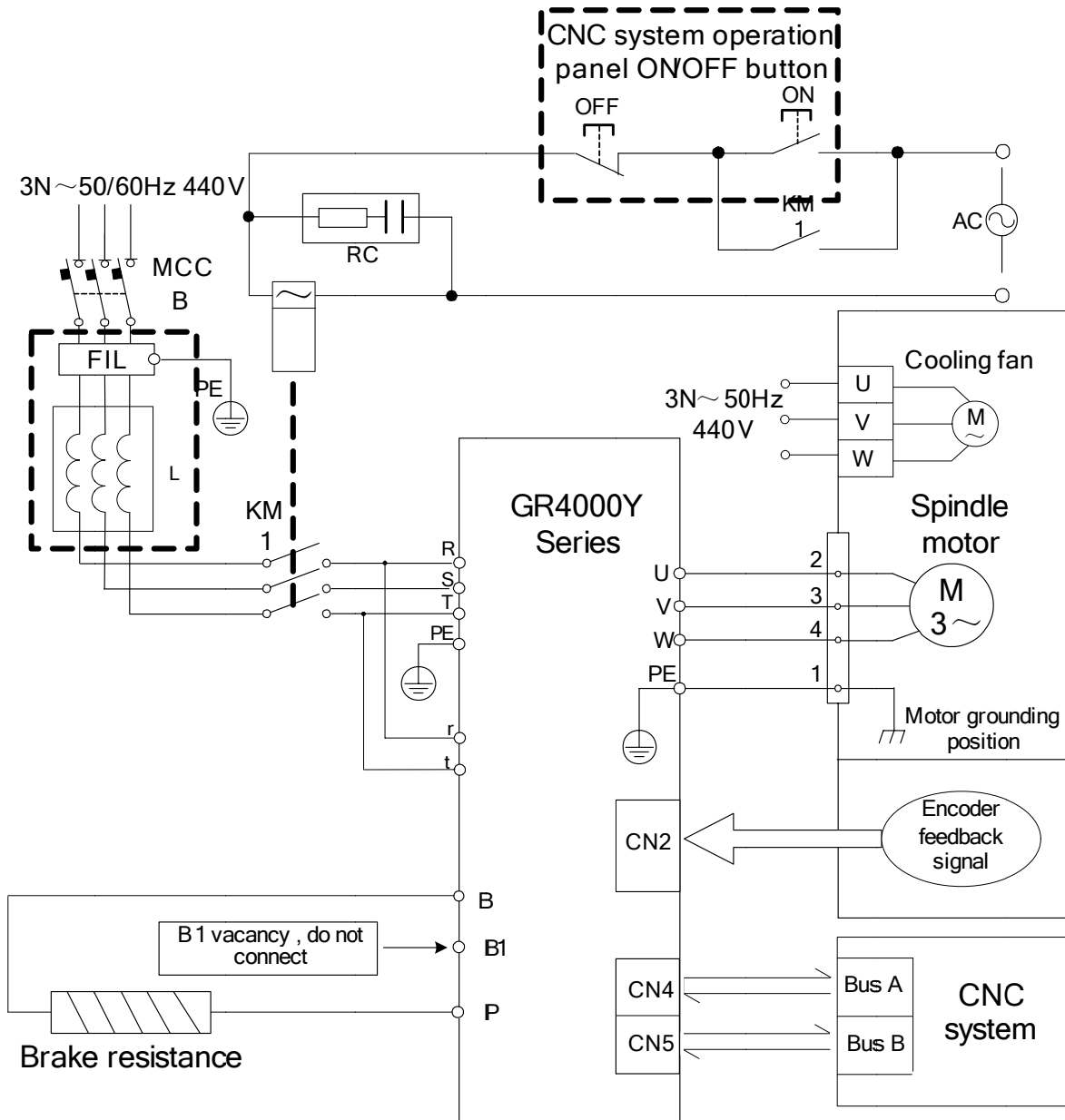


Fig. 3-9 Main circuit wiring of GR4000Y-L

| | |
|---------------|---|
| Notice | <ul style="list-style-type: none"> ● It is necessary to select the suitable breaker MCCB based upon the description in <i>Appendix B</i> 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.

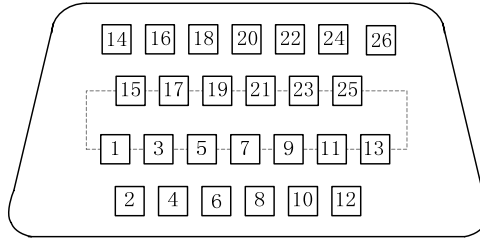
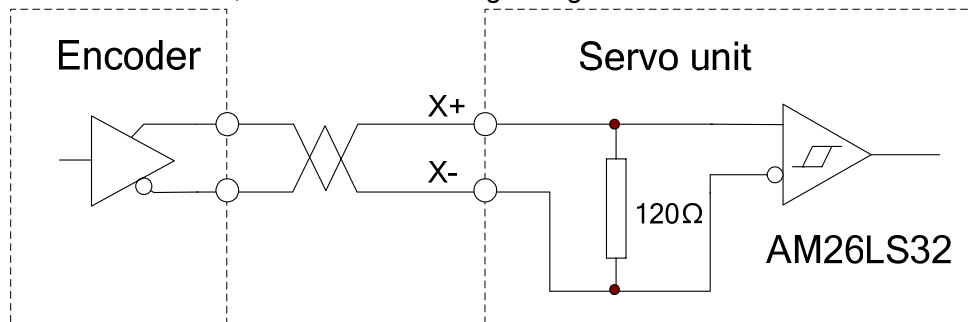


Fig. 3-10 CN2 wiring plug pin (Welding cable side)

| 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 | Encoder power (-) |
| 3 | W- | | 16 | 0V | |
| 4 | V+ | | 17 | 0V | |
| 5 | V- | | 18 | NC | Encoder power (+) |
| 6 | U+ | | 19 | 5V | |
| 7 | U- | | 20 | 5V | |
| 8 | Z+ | | 21 | 5V | Absolute encoder feedback signal |
| 9 | Z- | | 22 | NC | |
| 10 | B+ | | 23 | MA+ | |
| 11 | B- | | 24 | MA- | |
| 12 | A+ | 25 | SL+ | | |
| 13 | A- | 26 | SL- | | |

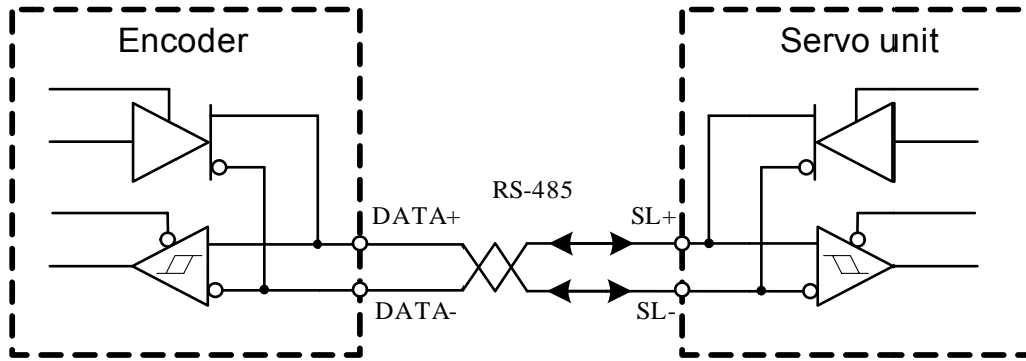
1. Pin 2 to Pin 13 in CN2 are incremental encoder interface; the signal cable is differential drive connection method; refer to the following wiring circuit.



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.

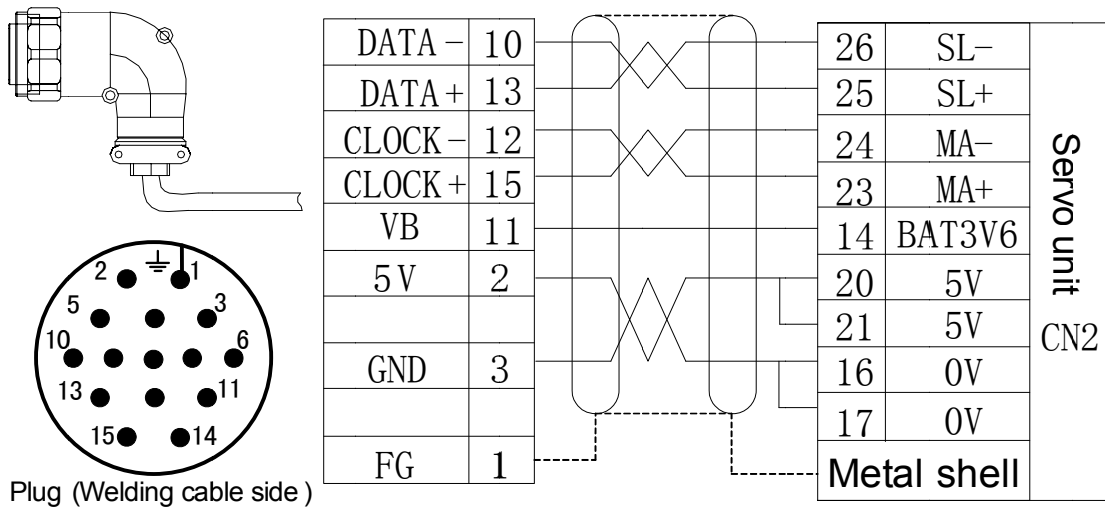


Fig. 3-11 Wiring of CN2 matches with SJT series permanent synchronous motor absolute encoder



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.

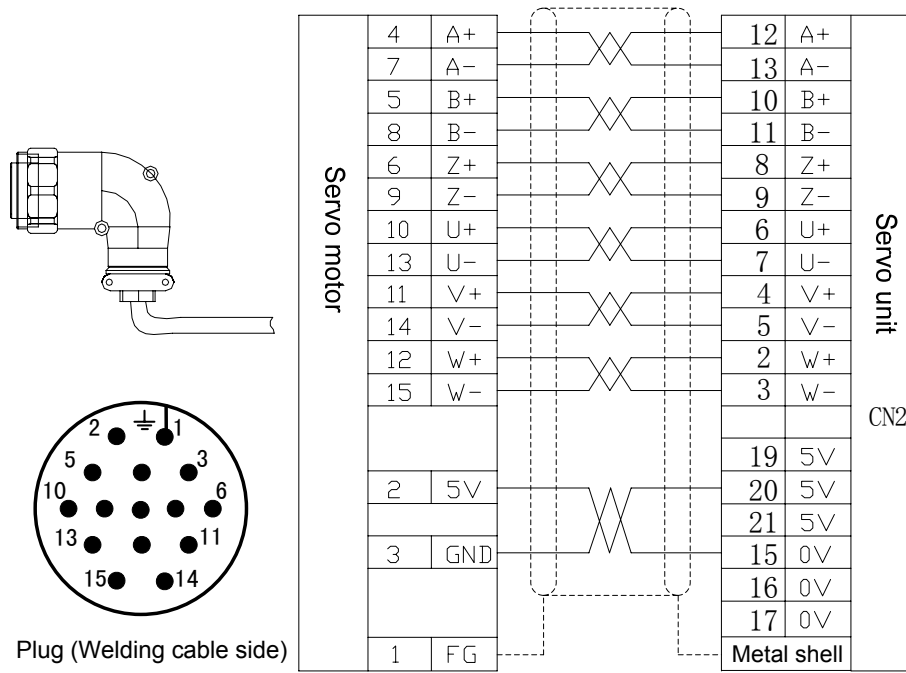


Fig. 3-12 Wiring of CN2 matches with SJT series permanent synchronous motor incremental encoder

| | |
|---------------|--|
| Notice | <ul style="list-style-type: none"> ● 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 $0.15\text{mm}^2 \sim 0.20\text{mm}^2$, 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

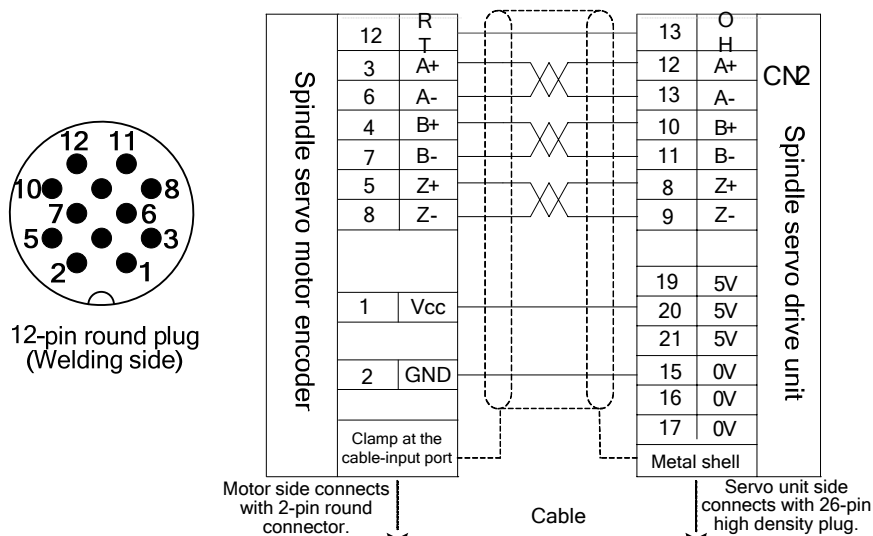


Fig. 3-13 CN2 matches with ZJY series spindle motor encoder/12-female industry plug wiring

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

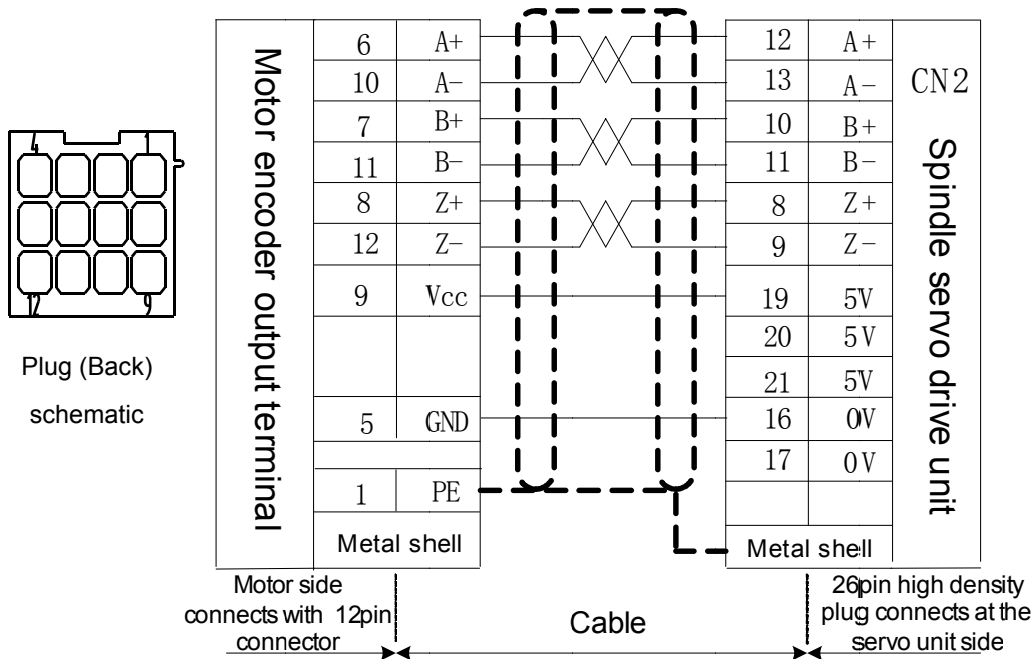


Fig. 3-14 CN2 matching with ZJY182 series spindle motor encoder/12PIN plug wiring

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

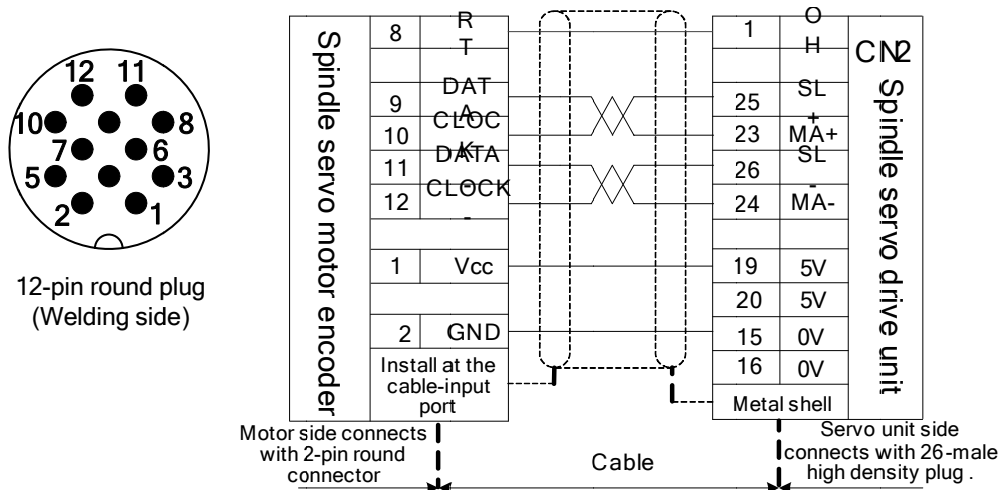


Fig. 3-15 CN2 matches with ZJY series spindle motor encoder/12-female industry plug wiring

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

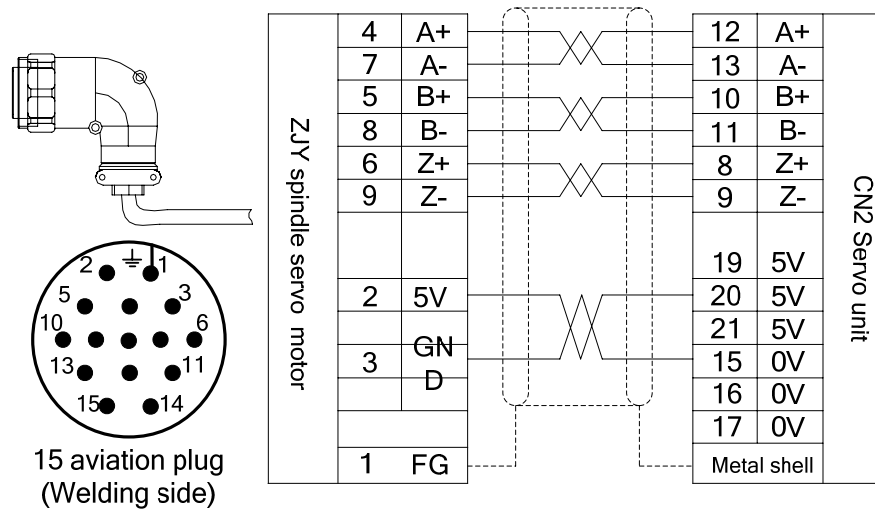


Fig. 3-16 CN2 matches with ZJY series spindle motor encoder/15-female industry plug wiring

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.

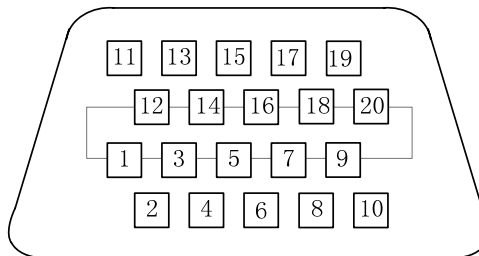


Fig. 3-17 CN3 wiring plug pin figure (Welding cable side)

| Pin No. | Name | Meaning | Pin No. | Name | Meaning |
|---------|-------|---|---------|--------|--------------------------------|
| 1 | SCZ+ | The 2 nd 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 2 nd 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

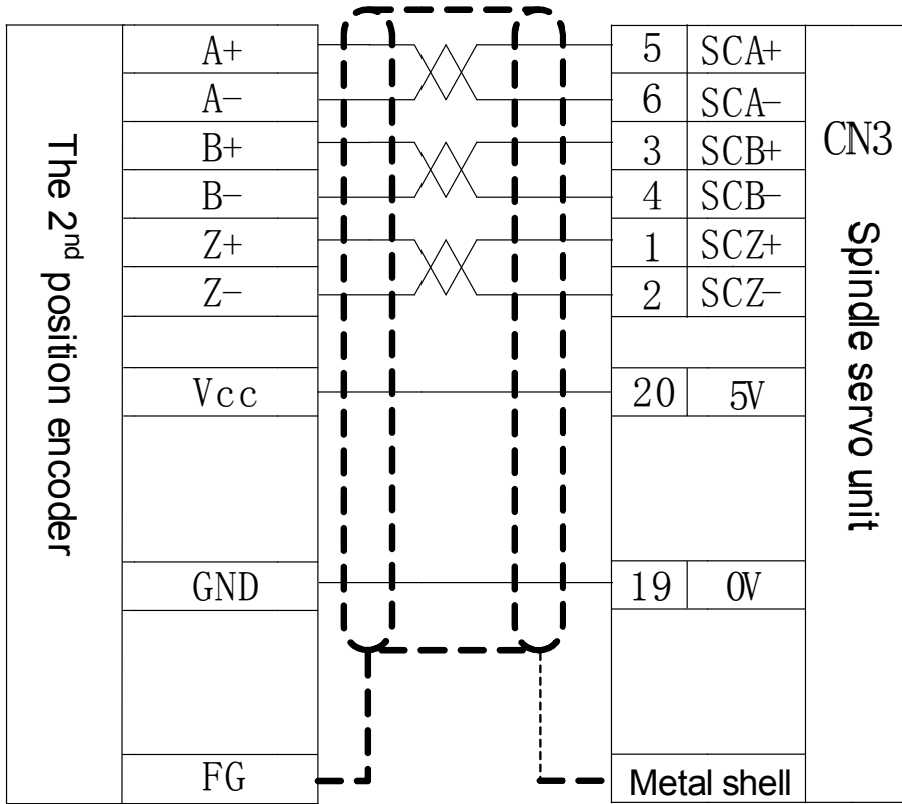


Fig. 3-18 The wiring between CN3 and the incremental encoder

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

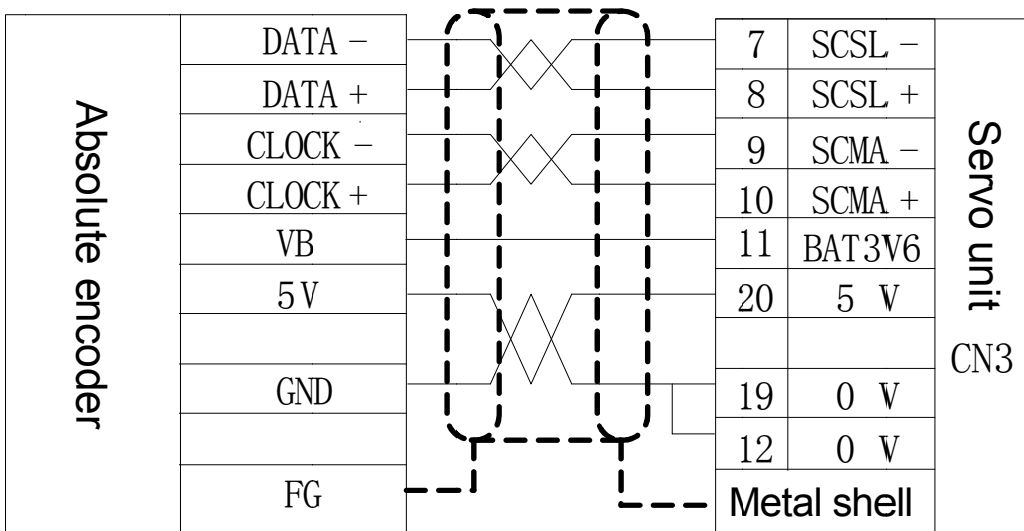
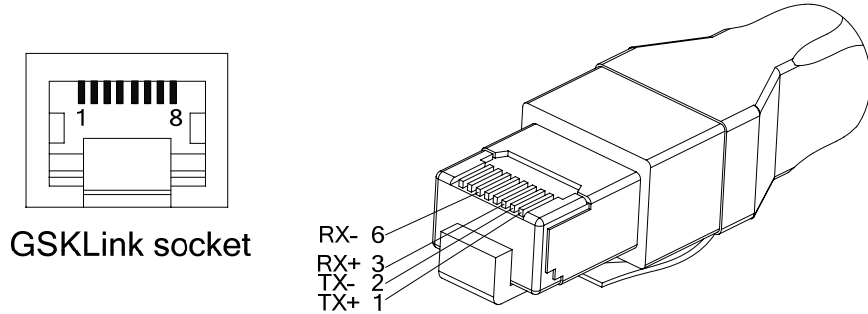


Fig. 3-19 The wiring between CN3 and absolute encoder of GR-L series

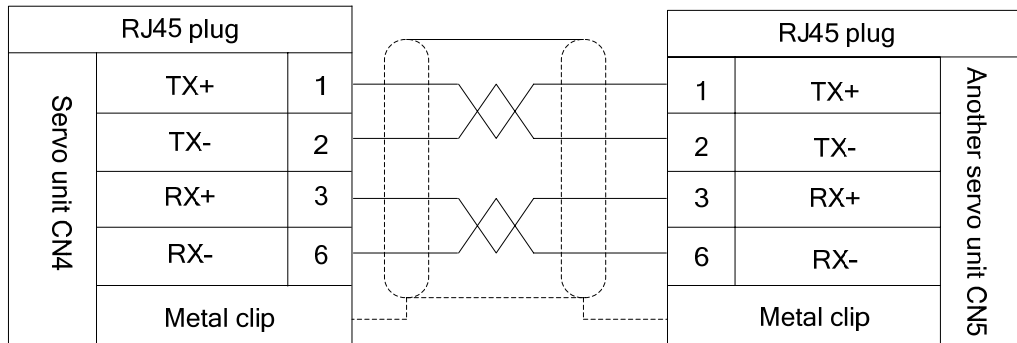
3.3.3 CN4, CN5 Ethernet Spot Bus GSKLink Interface and Wiring

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



| 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)

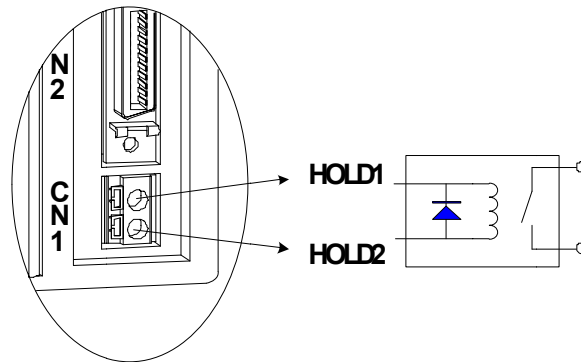
GR servo unit should be correctly set the following parameters, which can be established the Ethernet communication with the CNC.

| 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 |

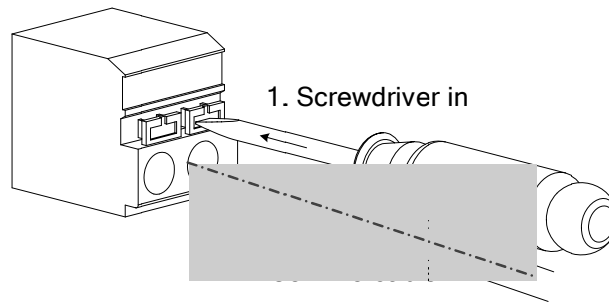
The servo unit, establishes the bus communication with the CNC system, may be more than one; set the corresponding servo slave number with the CNC system, so that CNC can be controlled one servo unit. Therefore, the servo unit connected with a same CNC system can not be set the repeated slave number.

3.3.4 CN1 Brake Releasing Signal

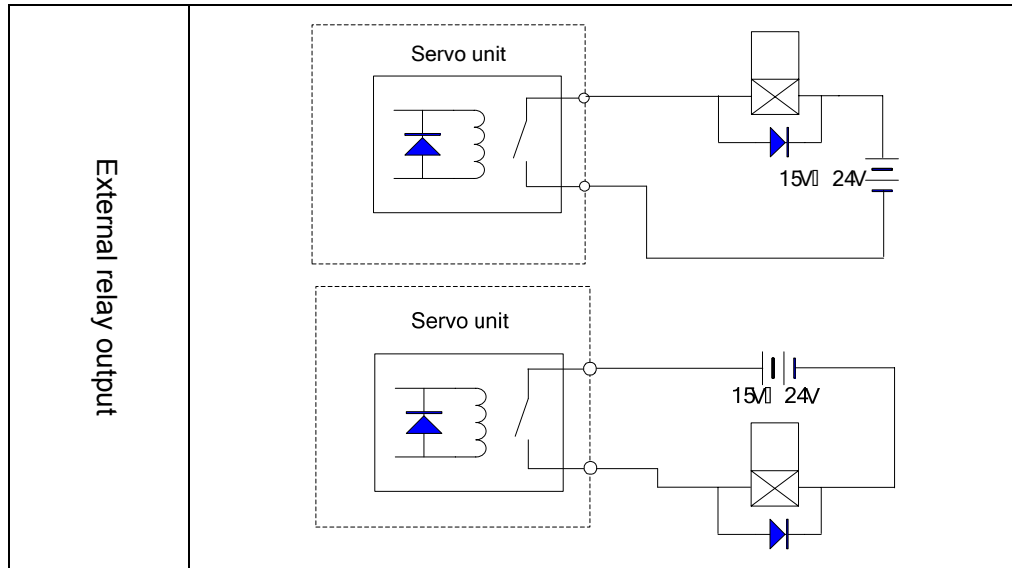
CN1 interface is releasing signal socket for the 2-pin motor brake; the relay NO contact is inside it.



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



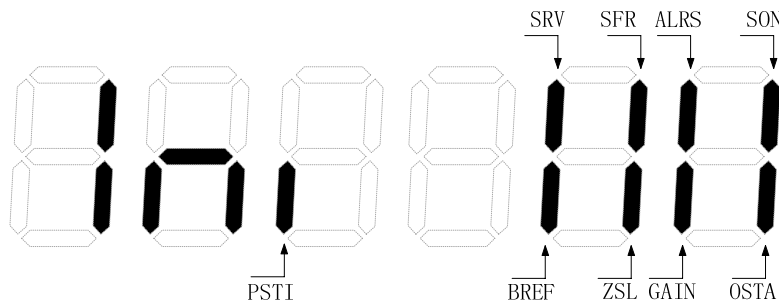
- HOLD signal wiring example



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.

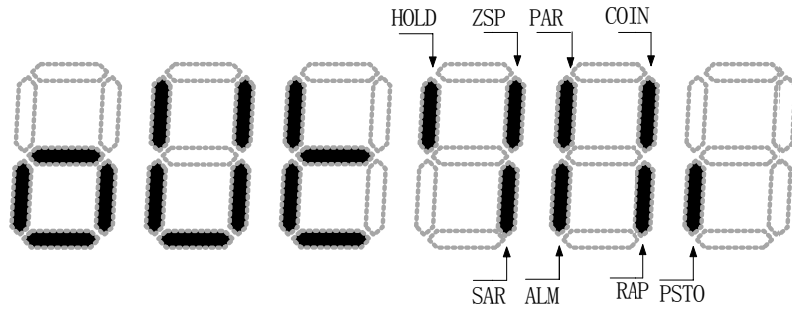
CNC system that sends to the input command DL-IN of the servo drive unit is as follows:



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:

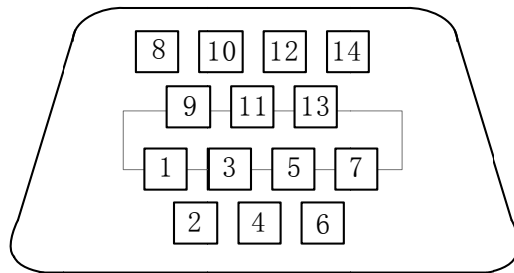
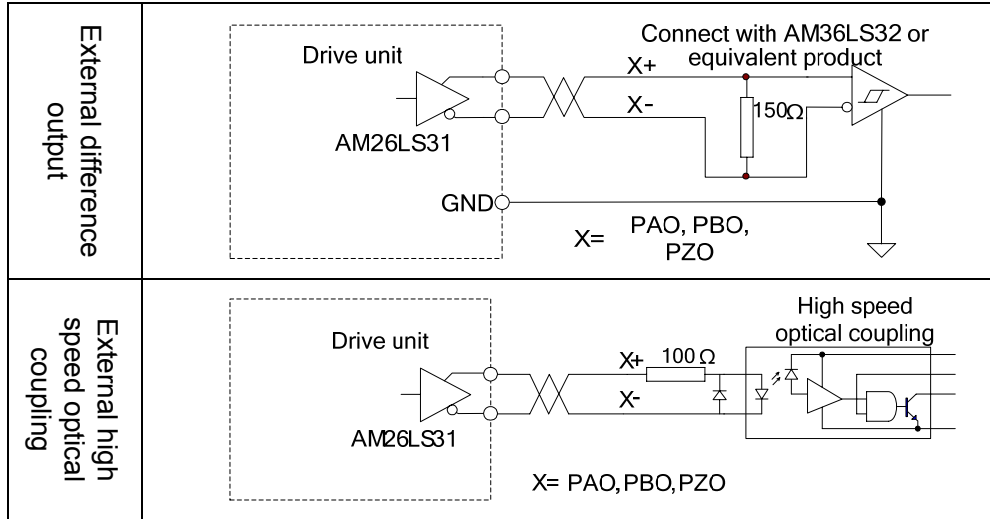


Fig. 3-21 CN8 wiring plug pin (Welding cable side)

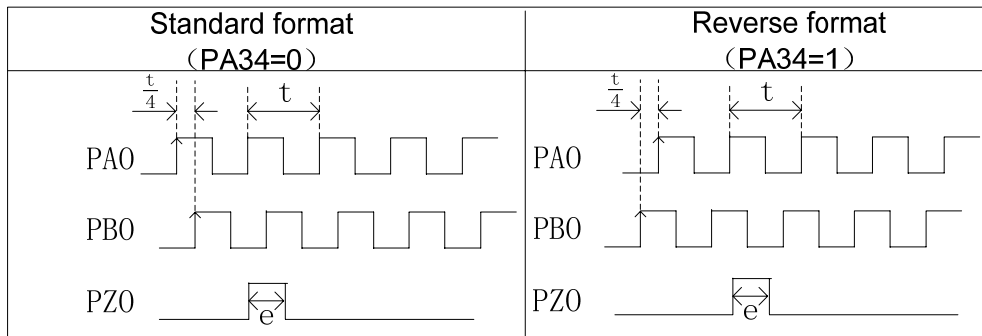
| Pin No. | Name | Meaning | Pin No. | Name | Meaning |
|---------|------|---------------------------------|---------|------|---------|
| 1 | GND | 0V | 8 | GND | 0V |
| 2 | PZO- | Position feedback output signal | 9 | NC | |
| 3 | PZO+ | | 10 | NC | |
| 4 | PBO- | | 11 | NC | |

| | | | | | |
|---|------|--|----|----|--|
| 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 | Initializati on | 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:

$$\text{PAO or PBO pulse numbers} = \frac{10000}{4} = 2500 \text{ (pulse/circle)}$$

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

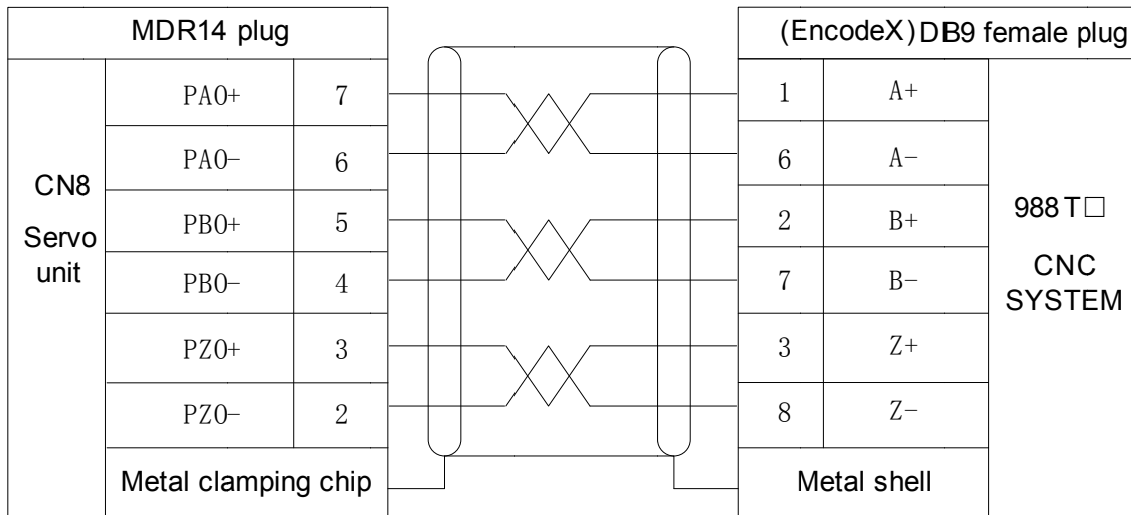







Fig. 3-22 CN8 wiring plug pin (Welding cable side)


CHAPTER FOUR DISPLAY & OPERATION

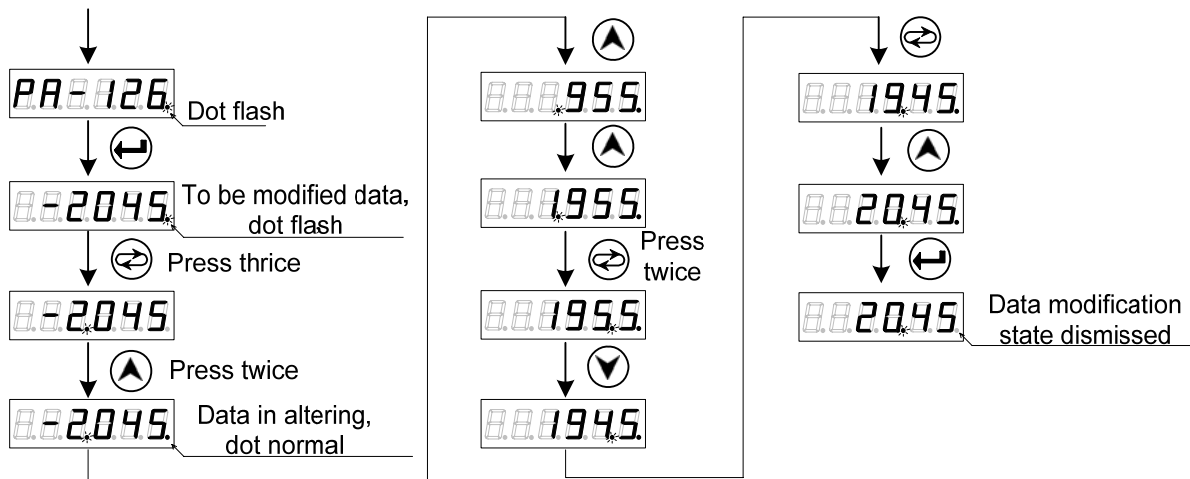
4.1 Operation Panel

➤ 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:



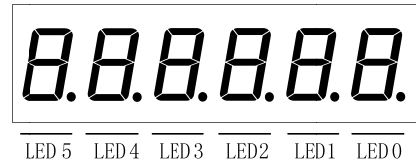
1. In the above example, directly increase in the LED2 bit by the shifting key, -45 does not change to the 1045 instead of $-45+1000=955$; It is the calculation result of the servo drive unit.

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.

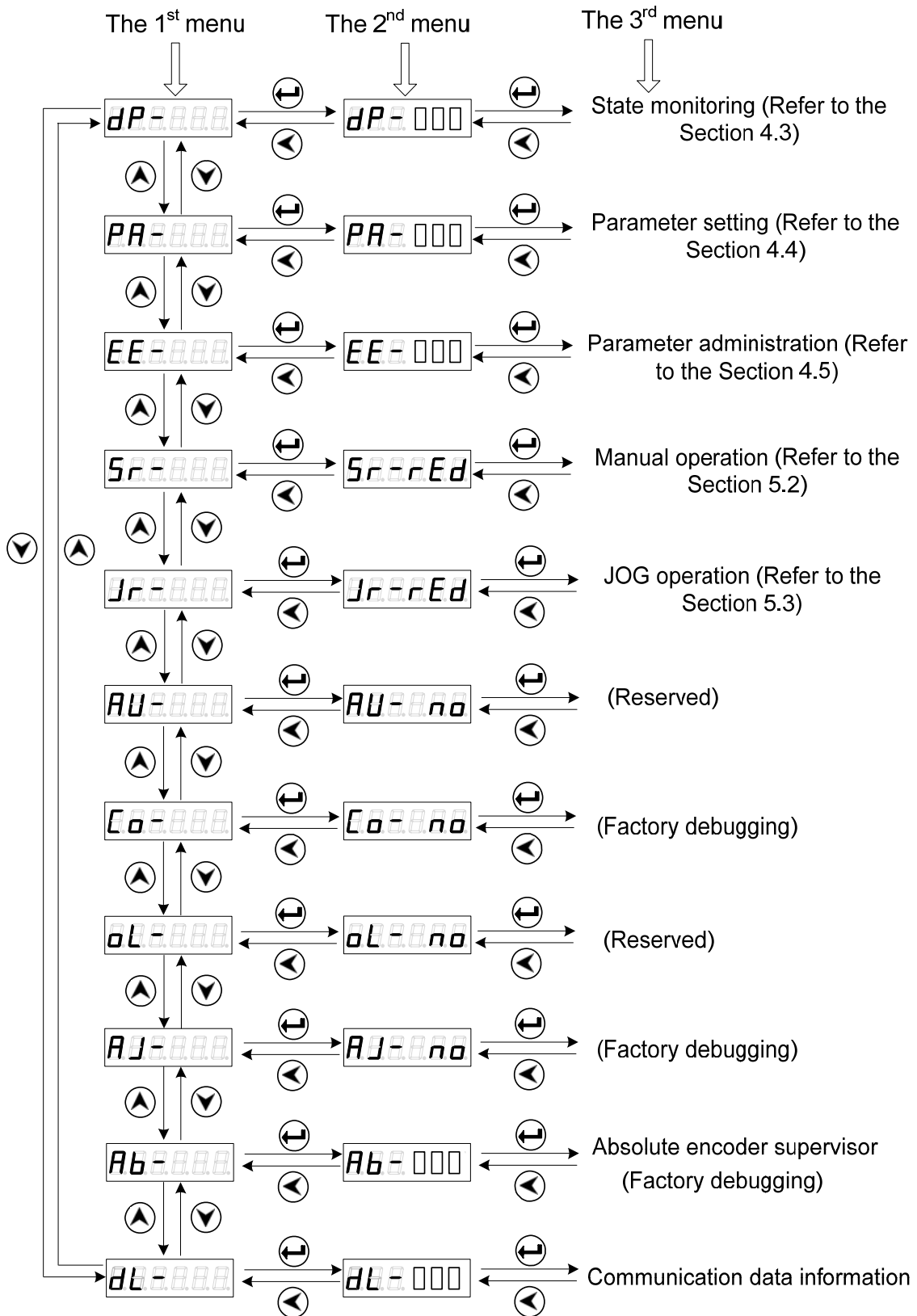


Fig. 4.1 The operation of the display menu

4.3 State Monitoring

dP-000 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 speed 100r/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 2 nd position encoder Z pulse absolute position LOW is 3256. |

| | | | | |
|--------|--------|--|---------|---|
| PA3=25 | DP-5Pa | | E.00006 | The 2 nd position encoder Z pulse absolute position HIGH is 6. |
| PA3=26 | DP-APa | | A 3256 | Motor encoder Z pulse absolute position LOW is 3256. |
| PA3=27 | DP-APa | | A.00006 | Motor encoder Z pulse absolute position HIGH is 6. |
| PA3=28 | DP-5AS | | 5 5836 | The 2 nd position encoder single-core absolute position LOW. |
| PA3=29 | DP-5AS | | 5.00000 | The 2 nd position encoder single-core absolute position HIGH. |
| PA3=30 | DP-HAS | | H.00038 | The 2 nd position encoder relative position LOW. |
| PA3=31 | DP-HAS | | H.00012 | The 2 nd position encoder relative position HIGH |
| PA3=32 | DP-Ab5 | | 6 15038 | The 1 st position encoder single-core position LOW. |
| PA3=33 | DP-Ab5 | | 6.00000 | The 1 st position encoder single-core position HIGH. |
| PA3=34 | DP-Hb5 | | H.00038 | The 1 st position multi-coil encoder numbers LOW. |
| PA3=35 | DP-Hb5 | | H.00012 | The 1 st position multi-coil encoder numbers HIGH. |
| PA3=36 | DP-Ub5 | | U 6735 | The 1 st position encoder relative LOW. |
| PA3=37 | DP-Ub5 | | U.00000 | The 1 st position encoder relative LOW. |

[1] "r" is regarded as the motor's speed code in $r.1000$, 100.0 means the motor speed is the reverse direction 100r/min. The negative speed -1000 displays if it operates CW; its unit is r/min.

Explanation: When the servo drive unit drives the spindle motor, its speed displays

$r.0000$, 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: $P.00018 \times 100000 + P45806 = 1845806$ pulses.

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

For example: $C.00018 \times 100000 + C45810 = 1845810$ pulses

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

$$P.00000 \times 100000 + P00000 = \frac{PA29}{PA30} (C.00000 \times 100000 + C00000)$$

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

$$C.00018 - P.00018 = E.00000$$

$$C45810 - P45806 = E00004$$

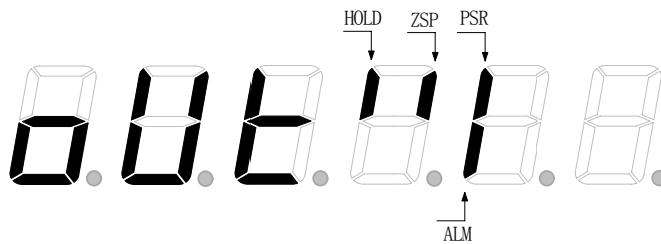
Explanation: When PA97=1, `dP-PoS` shows the current position increment of the motor encoder; when PA97=0, it displays the one of the 2nd position encoder.

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

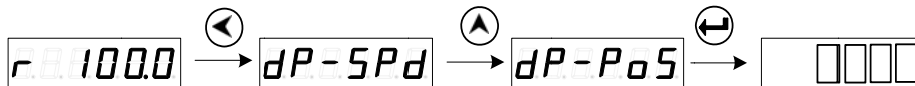


Explanation: `dP-out` monitors the brake releasing signal state via CN7.

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

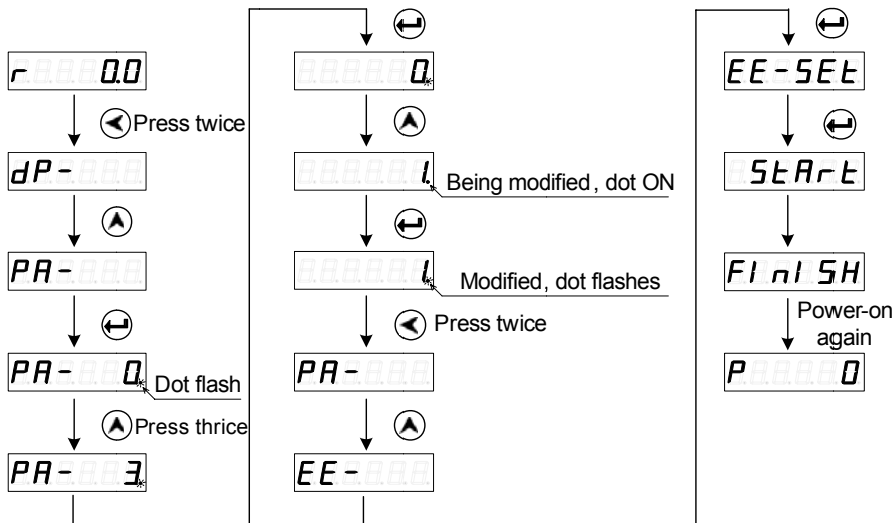


Fig. 4-2 The monitoring operation of the parameter selection state

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:

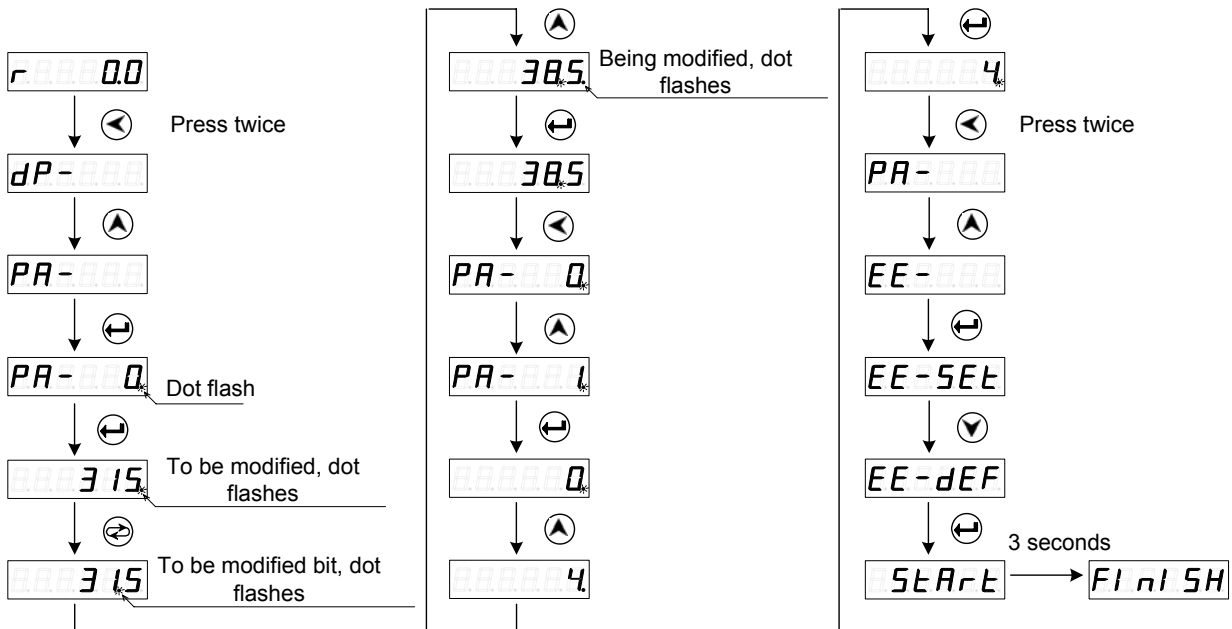


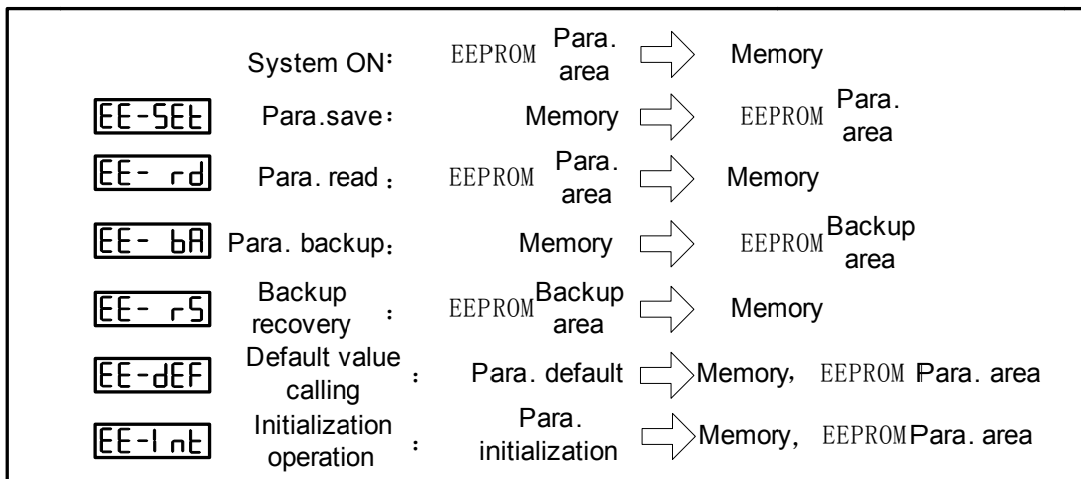
Fig. 4-3 Recover the motor's default parameter



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**

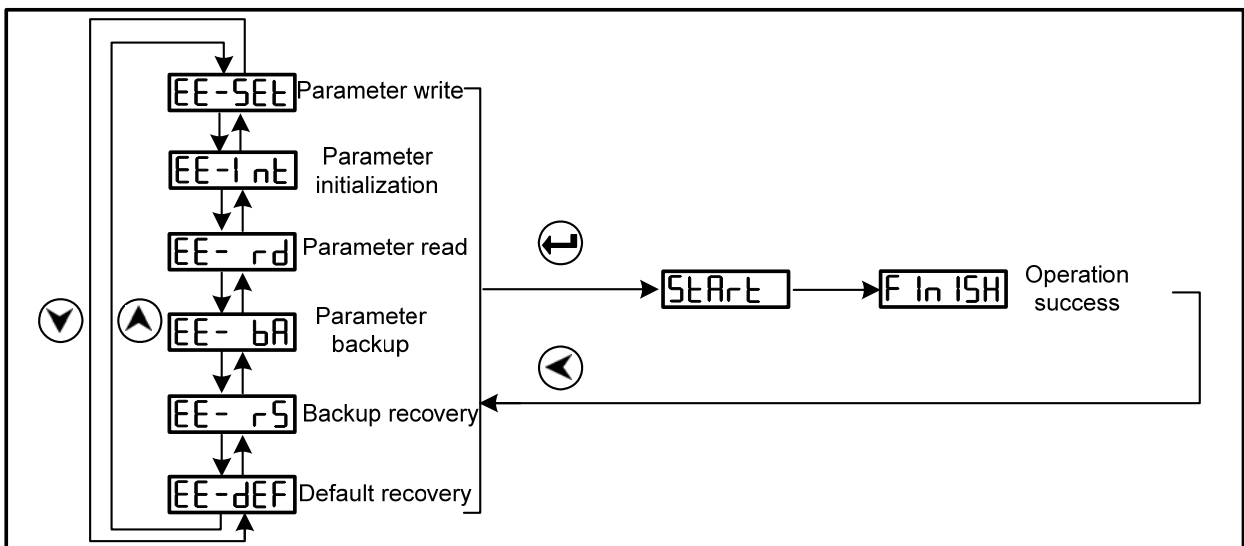
It means that the default value of one motor’s relative parameter is read to the memory, and the write to the EEPROM parameter area; the default parameter will be used next time when the power is turned on again. (Refer to the Section 4.4 Parameter Setting)

● **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

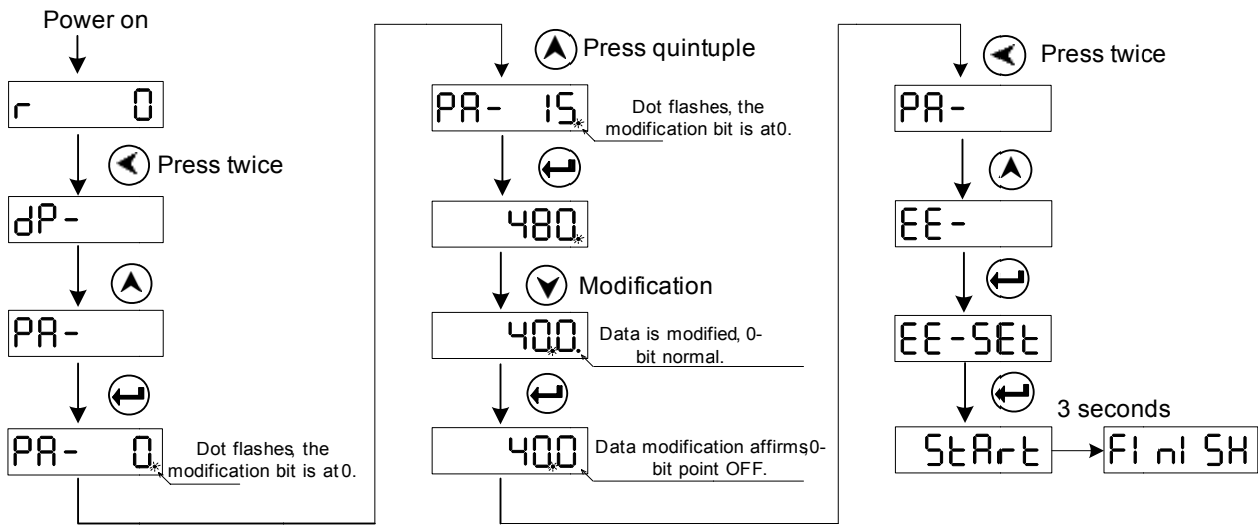


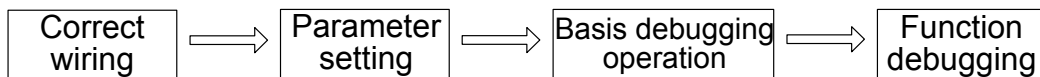
Fig. 4-4 The operation steps for saving the parameter

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 |
| | <ul style="list-style-type: none"> ● PA4=9: Manual method To operate in the <input type="text" value="Sr-"/> menu, perform the acceleration or deceleration by '▲' or '▼', separately. ● PA4=10: JOG method To operate in the <input type="text" value="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:



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

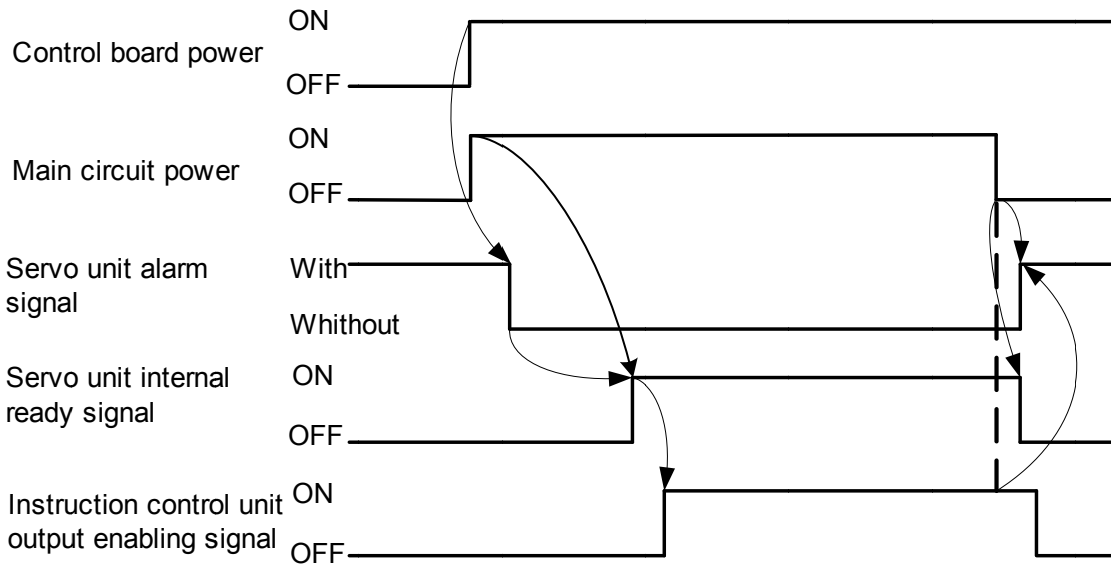


- It is suggest that user firstly perform the Manual or JOG operation without connecting the loading when using the servo drive unit at the first time. Ensure that the servo drive unit and motor can be normally operated after transporting, vibrating or installing.
- Connect the CNC system after confirming 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 | <p>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.</p> |
|---------------|---|

5.2 Manual Operation

After the servo drive unit is power on, normally, it will display $r \quad 0$. If the servo drive unit fault occurs, the alarm code $E r r - \square \square$ 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. $r \quad 0$ 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 \uparrow , motor accelerates; release it, the velocity invariable. Hold \uparrow , motor decelerates till to zero, and then accelerates reversely. The motor may immediately stop by \uparrow and \downarrow 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 r 0. If the servo drive unit fault occurs, the alarm code Err-00 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:

| | |
|--|---|
| | <ol style="list-style-type: none"> The r 0 appears as soon as the servo drive unit is turned on, which is the motor operation velocity monitoring window. 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. Set PA4=10, select the JOG operation method Set PA124=500, set the JOG velocity is 500 r/min. Set PA118=1, Internal enabling (Confirm that the motor axis rotation is without hazard before enabling.) (Set PA118=0, the internal enabling cancels) Enter the JOG operation menu according to the left figure (Regardless of the previous parameter settings). Hold J, motor operates based upon the velocity 500r/min set by PA124. Hold the J, 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.

| MDI | | RESET | | |
|---|------|---------|---|--|
| SYSTEM -> GSKLink -> SERVO -> SERVO PARAMETER -Axis C,S | | | | |
| No. | data | | comments | |
| 000 | 315 | 0~9999 | Password (315: User parameter 385:Call the defa | |
| 001 | 501 | 1~1328 | Motor type code | |
| 002* | 1 | 0~1 | Motor type (0:Synchronisation machine 1:Asynchr | |
| 003 | 0 | 0~35 | Content display in power-on initialization | |
| 004 | 21 | 9~25 | Controllable mode | |
| 005 | 0 | 0~2 | | |
| 006 | 2 | 0~2 | | |
| 007 | 2 | 0~2 | | |
| 008 | 0 | 0~1000 | | |
| 009 | 0 | 0~10 | | |
| 010 | 0 | 0~30000 | | |
| 011 | 2 | 0~11 | | |
| 012 | 0 | 0~1 | | |

10:39:23

| | | | | | | | | |
|---|----------|--------|------|--------|--------|---------|--------------|--------------|
| ^ | Axis C,S | NO.SRH | SAVE | RELOAD | BACKUP | RECOVER | EXPORT PARAM | IMPORT PARAM |
|---|----------|--------|------|--------|--------|---------|--------------|--------------|

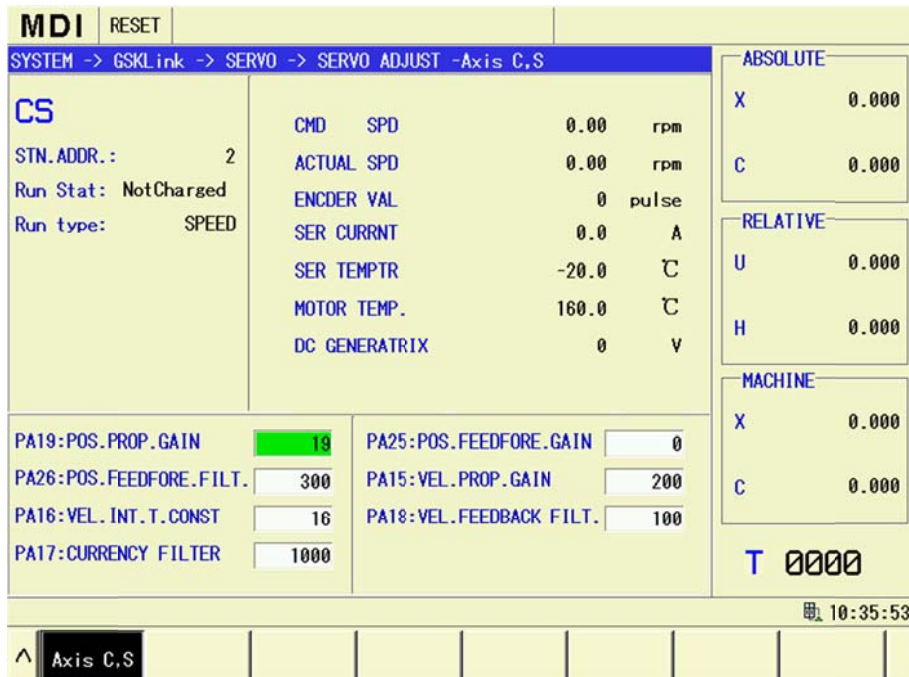
In the above-mentioned interface, enter the “System>GSKLink>Servo>Servo configuration - some one axis” to recover the motor’s default parameter operation after the value of the PA1 is

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 ($dP-AP\alpha$), 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.

| MDI | | RESET | |
|--|----------|-------------|------------------|
| SYSTEM -> GSKLink -> SERVO -> SERVO I/O - Axis C,S CNC-SER I/O | | | |
| 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 |
| | | | 10:41:07 |
| ^ | Axis C,S | CNC-SER I/O | SER-MOT I/O |

● 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 |

| | |
|--|--|
| | <p>Usually, more than one servo drive unit is set up the bus communication with the CNC system, set the corresponding servo slave 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.</p> |
|--|--|

CHAPTER SIX FUNCTION DEBUGGING

6.1 Basis Performance Parameter Debugging Explanation

| | |
|---------------|--|
| Notice | <ul style="list-style-type: none"> ■ 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. |
|---------------|--|

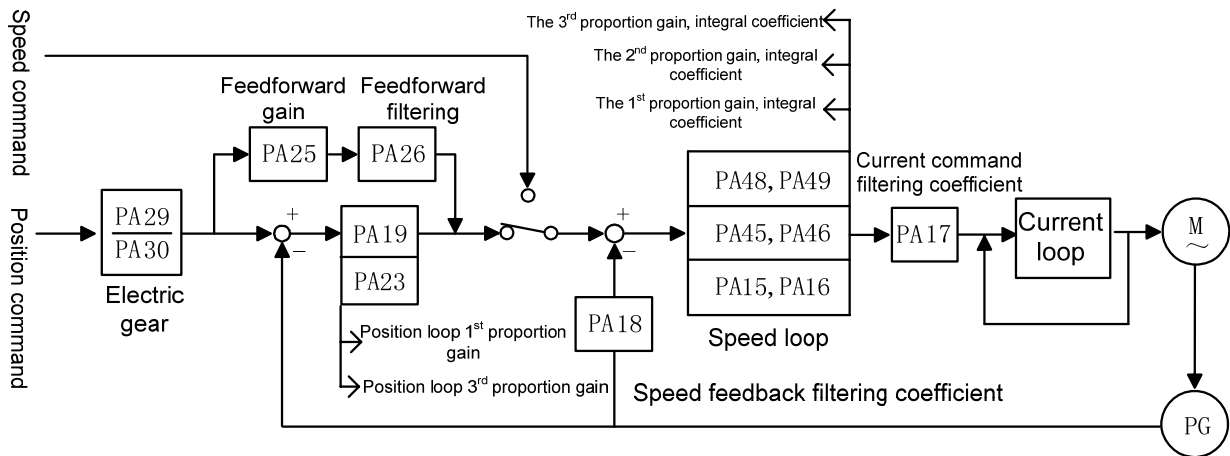


Fig. 6-1 Basis performance parameter debugging

| | |
|--|--|
| | <ul style="list-style-type: none"> ● Generally, the above-mentioned parameter should be firstly adjusted the velocity loop, then the position loop. (The current loop parameter is already optimized before delivering, so that the user needs not to adjust it again.) ● The parameter range of between the AC permanent synchronous motor and AC asynchronous 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 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 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 1 st proportional gain (PA15) of velocity loop and the 1 st integral time coefficient (PA16) are enabled. The 1 st 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 2 nd proportional gain (PA45) of velocity loop and the 2 nd integral time coefficient (PA46) are enabled. The 1 st 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 3 rd proportional gain (PA48) of velocity loop and the 3 rd integral time coefficient (PA49) are enabled. The 3 rd 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 3 rd proportional gain (PA48) of velocity loop and the 3 rd integral time coefficient (PA49) are enabled. The 3 rd 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:
$$\frac{1}{50} \leq G \leq 50$$

 Electric gear ratio, it is recommended as

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:

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

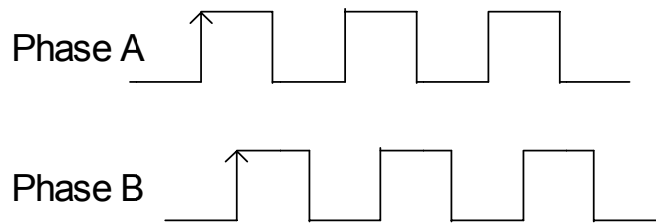
Then, the parameter PA29 is set to 2048, PA30 is set to 1875.

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 | <p>LED displays that the motor speed is positive (PA34=0).</p> | <p>LED displays that the motor speed is negative. (PA34=0).</p> |

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 | <p>The motor rotation direction is reversed when velocity command is enabled.</p> <p>PA51 = 0, velocity command is positive, motor CCW; velocity command is negative, motor CW.</p> <p>PA51 = 1, velocity command is positive, motor CW; velocity command is negative, motor CCW.</p> | | 0~1 | 0 | S |

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

| | | |
|--|---|--|
| | 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:

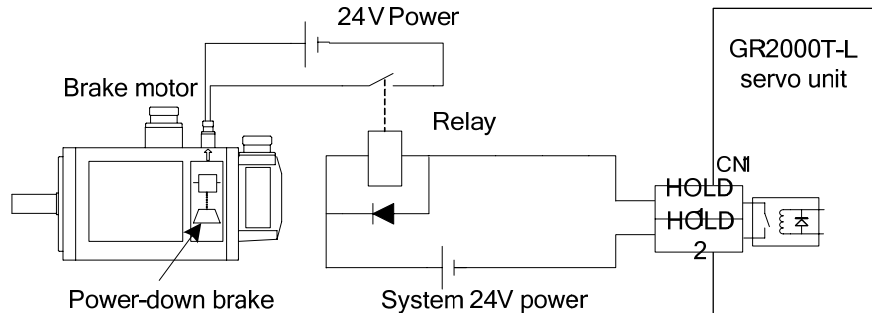


Fig. 6-2 The typical example of the HOLD± brake releasing signal

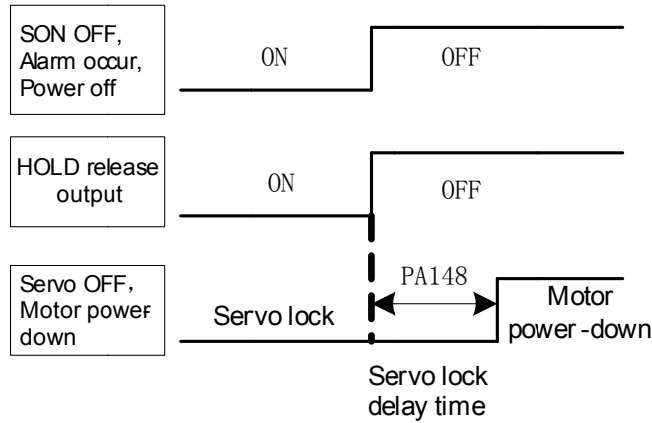
The motors with different power are matched with different power-down brake; refer to the following brake's technology parameter with different motors when user selects the 24V power.

| 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 |

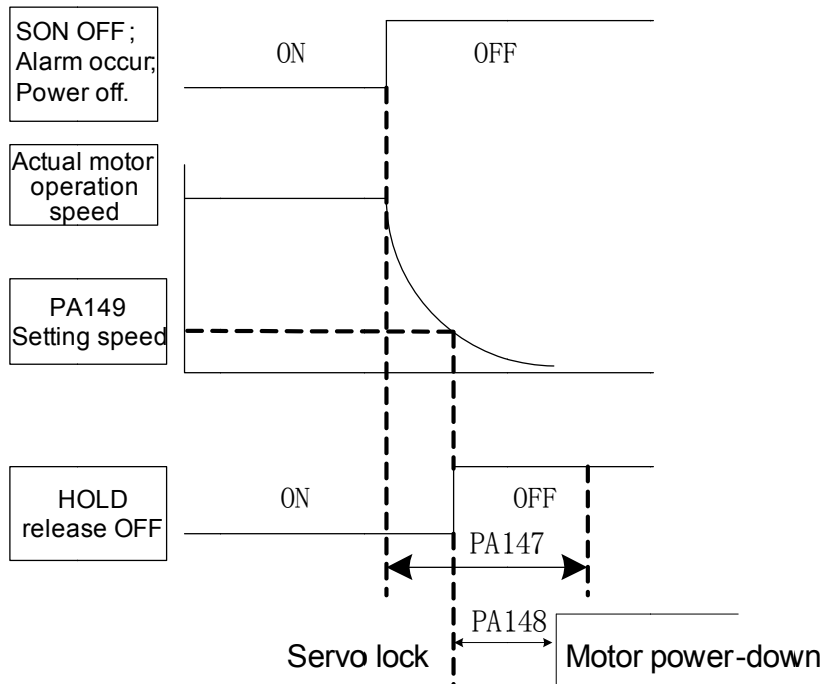
Case 1: The power of the servo drive unit is suddenly turned off in the static state of the motor.



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.



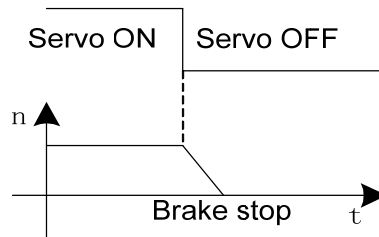


The servo drive unit can not be suddenly braked during moving with high velocity; otherwise, it may damage the brake; it is necessary to cut off the HOLD brake releasing signal at the appropriate time. The motor can be firstly decelerated and then braked by adjusting the PA147 and PA149. It is recommended 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.

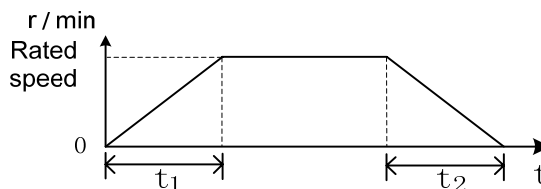


| Relevant parameter | Description | Unit | Parameter range | Initialization value |
|--------------------|--|---------|-----------------|----------------------|
| ★PA57 | Straight-line acceleration time constant | 0~10000 | 50 | S |
| ★PA58 | Straight-line deceleration time constant | 0~10000 | 100 | 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 t_1 in the following figure.

PA58 sets the desired time that the motor decelerates to rated velocity from the zero speed; refer to the t_2 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

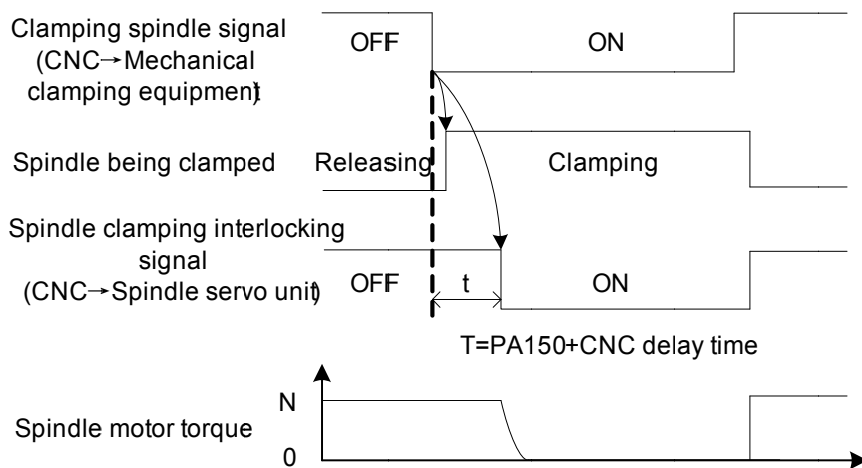
At present, partial turning machines are equipped with the mechanical clamping devices on the spindle for carrying out the drilling, tapping, etc. at the excircle of the workpiece. The spindle can be locked by machinery to ensure that of the accuracy and stability of the machining. In order to solve 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-sequence 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——

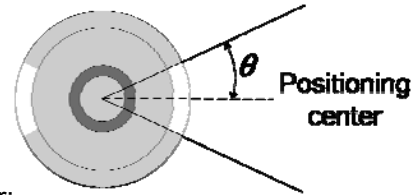
$$\theta = \frac{360^\circ}{4C} = \frac{90^\circ}{C}$$

Then, the orientation accuracy is $\pm\theta$.

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 $\pm 0.088^\circ$.



In the actual orientation, the orientation error is $\pm 2\theta$ due to the mechanical driving error.

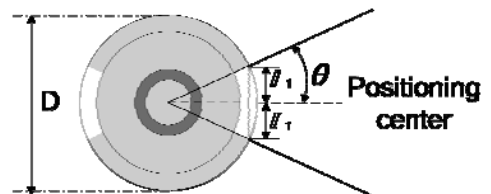
In the orientation application, the orientation accuracy, also, can be expressed by the workpiece arc length or the string length of the arc. For example, turning machine, the orientation drilling is performed at the excircle of the round workpiece; milling machine, the machining center is performed 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.

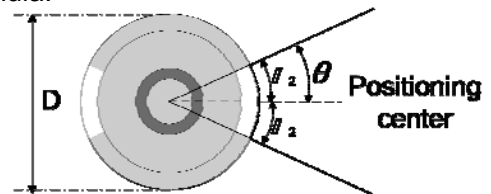


Also, it can be calculated by the following formula.

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:

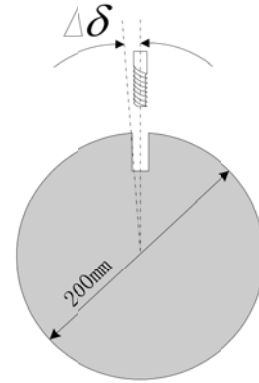
The drilling is performed at the excircle round workpiece with 200mm diameter, the orientation error of the drilling should be less than 50 μ m, calculate how many resolutions of the encoder can be required?

The arc length calculation can be performed according to our selection; the drive unit should guarantee $\Delta\delta \leq 25\mu\text{m}$ to suitable for the requirement less than 50 μ m, which can be calculated by the formula 3:

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

Then: $C \geq 6280$

And therefore, to guarantee the error of the drilling position is less than or equals to the 50 μ m, 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 $\boxed{dP-AP0}$ after the power is turned on, display the $\boxed{E \ \square\square\square\square}$ 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 $\boxed{dP-AP0}$ becomes $\boxed{\text{F} \ \square\square\square\square}$, 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 $\boxed{dP-AP0}$, write it to the PA103; as well, record the position displayed by $\boxed{dP-AP0}$, 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:

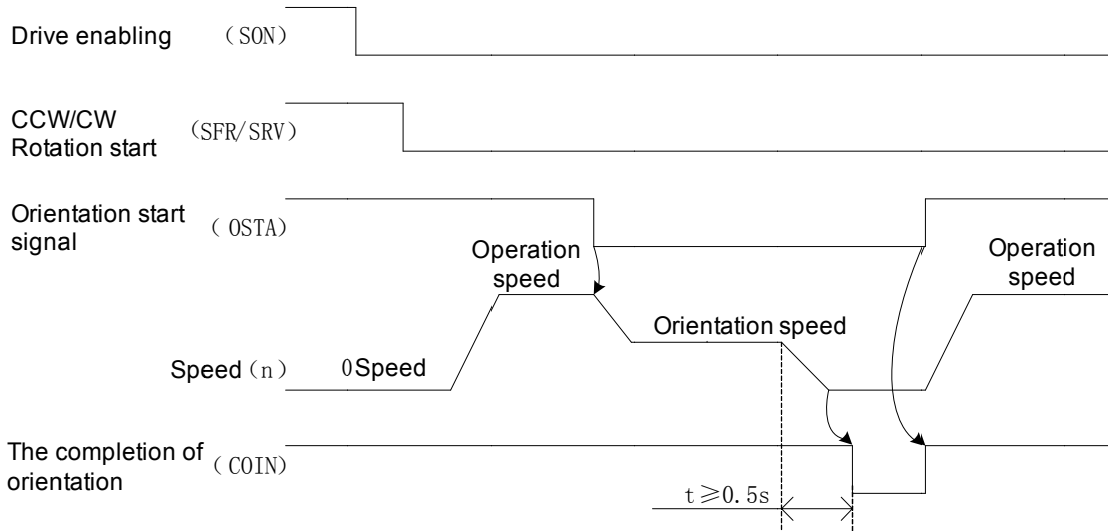
- ① Call out the monitoring menu $\boxed{dP-SP0}$, then display the $\boxed{E \ 0000}$ by , after the power is turned on. The symbol "E" means that the spindle is at the undefined orientation position, and its value can not be regarded as the reference value of the orientation position.
- ② The servo drive unit may automatically search the correct position of the 2nd position encoder when the spindle rotates one circle at least. $\boxed{dP-SP0}$ becomes $\boxed{F \ 0000}$ 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 $\boxed{dP-SP0}$, 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.



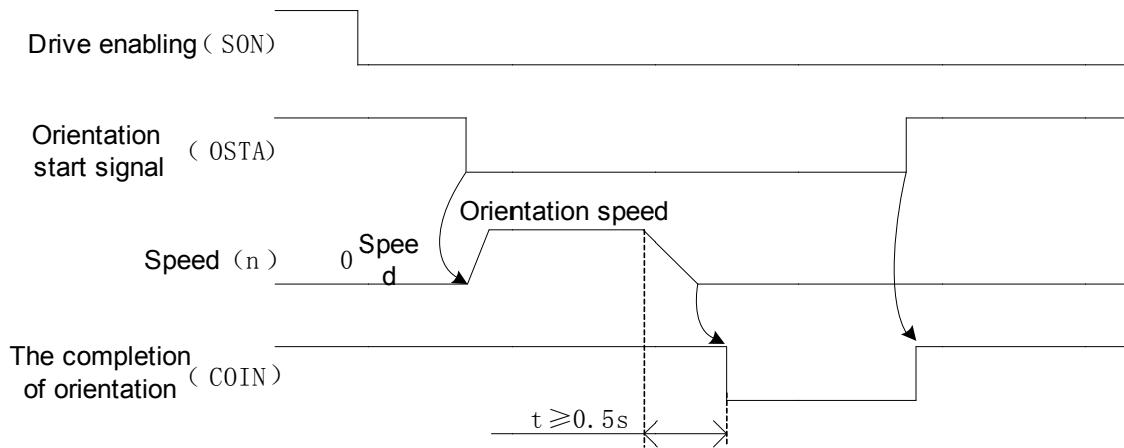
If the spindle is always rotates instead of inspecting the Z pulse when it orientates so that the orientation is unsuccessful. That is, the 2nd position encoder SCA and SCB pulses position are reversed. In this case, alter the value of the PA101 to save it, and then the orientation can be performed again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

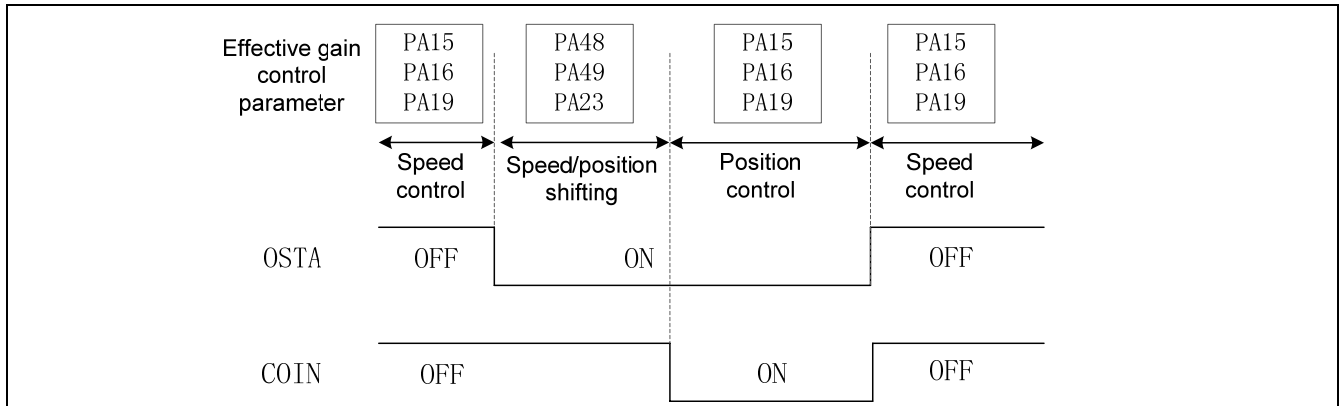


■ Spindle orientation time-sequence B (The motor is on the free or null velocity state.)



| Relevant para. | Description | Unit | Parameter range | Initializati on value | Application |
|----------------|---|------|-----------------|-----------------------|-------------|
| PA23 | The 3 rd proportional gain of the position loop | | 10~1000 | 40 | P |
| PA48 | The 3 rd proportional gain of the velocity loop | Hz | 10~3000 | 200/400 | S |
| PA49 | The 3 rd 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.

| | | | | | |
|-------|---|---|----------|------|-----|
| | The type selection of the 2 nd position encoder | | 0~30 | 0 | P/S |
| ※PA96 | 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 2 nd position input signal is treated as the position feedback input signal. In this case, the CN3 does not connect the 2 nd position encoder feedback signal, the Er-24 fault on servo drive unit may occur. | | | | |
| PA98 | The 2 nd position encoder resolution | | 10~30000 | 1024 | P/S |
| | It is enabled when set the 2 nd position encoder resolution and match with the incremental encoder. | | | | |

| Relevant para. | Description | Unit | Parameter range | Initializati on 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 2 nd position feedback input signal reverse | | 0~1 | 0 | P/S |
| | PA101=0: Maintain the original phase relationships of the 2 nd 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 |
| | <p>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.</p> <p>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.</p> | | | | |
| 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 2 nd 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 | <p>CNC system performs the M14 command</p> <p>It requires that the servo drive unit shifts to the position method from the velocity one.</p> | <p>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)</p> |
|--------|--|---|

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 | Initializati on 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. | | | | |

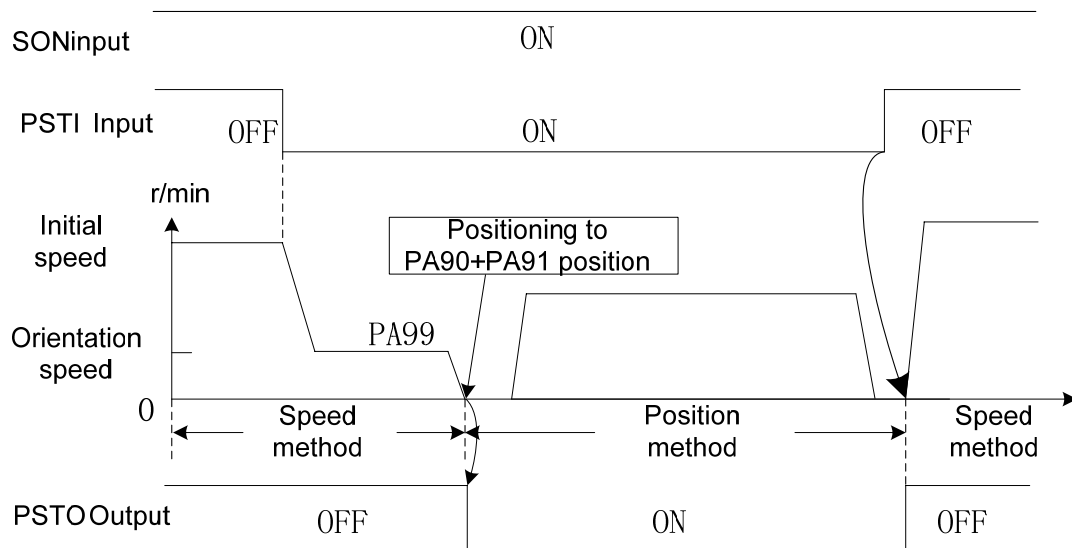
| | | |
|--------|---|--|
| Step 2 | Servo drive unit performs shifting as long as it receives the SON, PSTI input commands. | <ol style="list-style-type: none"> 1. The spindle firstly rotates based upon the setting velocity of the PA99 in the velocity mode; 2. The servo drive unit will exactly stop 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.

| | | |
|---------------|---|--|
| <p>Step 3</p> | <p>CNC system performs the M15 command The servo drive unit should be shifted to velocity mode from the position mode.</p> | <p>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.</p> |
|---------------|---|--|

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 | Initializati on value (Synchron ous/async hronous) | 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 1 st proportion gain of the velocity loop | 10~3000 | 200/400 | Hz | | 6.1 |
| ★PA16 | The 1 st 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 1 st 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 2 nd proportional gain of the velocity loop | 10~3000 | 200/400 | Hz | T, Y | 6.1 |
| ★PA46 | The 2 nd 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 3 rd proportional gain of the velocity loop | 10~3000 | 200/400 | Hz | T, Y | |
| ★PA49 | The 3 rd 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 2 nd position encoder type selection | 0~30 | 0 | | | |
| ※PA97 | Position feedback input signal selection | 0~2 | 1/0 | | | |
| PA98 | The 2 nd position encoder resolution | 10~30000 | 1024 | | | |
| PA99 | Orientation velocity | 10~1000 | 100 | r/min | | |
| PA100 | Orientation direction selection | 0~2 | 0 | | | |
| ※PA101 | The 2 nd 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 | | |

Chapter Seven Parameter

| | | | | | | |
|-------|---|---------|------|-------|------|-----|
| 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 | Initializati on value (Synchro ous/asyn chronous) | 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 | Initializati on value (Synchro ous/asyn chronous) | 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! | | | | |

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

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 |
| | <p>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</p> <p>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.</p> | | | | |
| ★PA15 | The 1 st 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 1 st 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 1 st 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

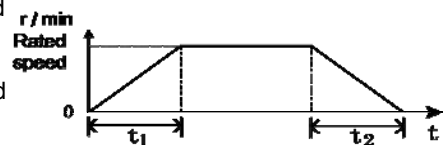
| Para. No. | Meaning | Setting range | Initializati on value | Unit | Applicatio n |
|-----------|---|---------------|-----------------------|------------|--------------|
| PA31 | Position arrival range | 0~30000 | 20 | Pulse | P |
| | When the position following-error is less than or equals to the 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: $\text{PAO or PBO phase pulse numbers} = \frac{10000}{4} = 2500 \text{ (pulse/rev.)}$ | | | | |
| ★PA45 | The 2 nd 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. | | | | |

Chapter Seven Parameter

| | | | | | |
|-------|---|---------|---------|----|---|
| ★PA46 | The 2 nd 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 3 rd 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 3 rd 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 | Initializati on 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 |
| | <p>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.</p> <p>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.</p> <p>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; ;</p> <p align="center">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.</p> | | | | |
| ★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 |



| | | | | | |
|------|---|--------|---|--|-----|
| | <p>When the actual speed is less than or equals to the zero speed output effective range, zero speed (ZSP) signal is then enabled.</p> | | | | |
| PA63 | Velocity command multiple coefficient (Refer to PA64) | 1~1024 | 1 | | S |
| PA64 | Velocity command frequency-division coefficient | 1~1024 | 1 | | S |
| | <p>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.</p> | | | | |
| PA88 | The mode selection shifting from the velocity to the position mode | 0~1 | 0 | | P/S |
| | <p>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> | | | | |

P: Position control S: Velocity control

| Para. No. | Meaning | Setting range | Initializati on value | Unit | Applicatio n method |
|-----------|--|---------------|-----------------------|------|---------------------|
| PA89 | The mode selection shifting from the position to the velocity mode | 0~1 | 0 | | P/S |
| | <p>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.</p> | | | | |
| 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 |
| | <p>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).</p> | | | | |
| ※PA96 | The 2 nd position encoder type selection | 0~30 | 0 | | |

| | | | | | |
|-------|--|--|------|-------|------|
| | <p>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</p> | <p>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.</p> <p>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.</p> | | | |
| ※PA97 | Position feedback input signal selection | 0~2 | 1 | | P. S |
| | <p>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.</p> | | | | |
| PA98 | The 2 nd 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 |
| | <p>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.</p> | | | | |

| | | | | | |
|--------|---|-----|---|--|------|
| | PA100=2, motors are all orientated along with the CW velocity no matter how the operation direction of the motor. | | | | |
| ※PA101 | The 2 nd position feedback input signal reverse | 0~1 | 0 | | P, S |
| | PA101=0: Maintain the original phase relationships of the 2 nd 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 | Initializati on value | Unit | Applicatio n 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 2 nd 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 |

Chapter Seven Parameter

| | | | | | |
|-------|--|----------|---------|-------|-----|
| 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 | Initializati on value | Unit | Applicatio n 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; 3. Fail to start the start circuit of the servo drive unit | Detect the main circuit electric control 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 ratio 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 2 nd 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°C 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) If 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; | Adjust 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 2 nd position input signal abnormality of the CN3 interface | 1. Fail to connect the 2 nd 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 2 nd 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 2 nd 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 | A4 II 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 | A4 II encoder single-coil resolution error | When the servo drive unit is ON, motor rotates more than the 100r/min. | 1. Adjust 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 | A4 II 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 | A4 II 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 encoder connection 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 2 nd position encoder sensor mode | 1. PA96 parameter setting error | Reset the 2 nd position encoder type. |
| | | 2. The 2 nd position encoder input signal connecting to the CN3 is disconnected or poorly connected. | Check the wiring of the CN3. |
| | | 3. The 2 nd position encoder is damaged. | Change a new encoder. |
| Er-54 | The 2 nd encoder CRC verification alarm | 1. The data verification error when reading the current position of the 2 nd encoder in the sensor mode. | Check the shielding layer and the grounding of the 2 nd 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 2 nd position encoder is excessive big. | Encoder or encoder cable is to be interfered. | 1. Check whether 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 2 nd position TAMAGAWA magnetic resistance encoder | Encoder or encoder cable is to be interfered. | 1. Check whether 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 whether 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 1 st and 2 nd position feedback data offset alarms due to excessive big. | 1. Fail to set the 1 st and 2 nd 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 2 nd encoder and motor is excessive big; | Data-free or loose structure of the 2 nd 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°C | 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°C | 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 | <ul style="list-style-type: none"> ■ 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 (A4 I) | PA001=154 | 130SJT-M150D (A4 I) |
| PA001=106 | 80SJT-M024E (A4 I) | PA001=156 | 130SJT-M050E (A4 I) |
| PA001=108 | 80SJT-M032C (A4 I) | PA001=158 | 130SJT-M060E (A4 I) |
| PA001=110 | 80SJT-M032E (A4 I) | PA001=160 | 130SJT-M075E (A4 I) |
| PA001=122 | 110SJT-M040D (A4 I) | PA001=162 | 130SJT-M150D (A4 I) |
| PA001=124 | 110SJT-M040E (A4 I) | PA001=166 | 175SJT-M120E (A4 I) |
| PA001=126 | 110SJT-M060D (A4 I) | PA001=168 | 175SJT-M150D (A4 I) |
| PA001=128 | 110SJT-M060E (A4 I) | PA001=170 | 175SJT-M180B (A4 I) |
| PA001=140 | 130SJT-M040D (A4 I) | PA001=172 | 175SJT-M180D (A4 I) |
| PA001=142 | 130SJT-M050D (A4 I) | PA001=174 | 175SJT-M220B (A4 I) |
| PA001=144 | 130SJT-M060D (A4 I) | PA001=176 | 175SJT-M220D (A4 I) |
| PA001=146 | 130SJT-M075D (A4 I) | PA001=178 | 175SJT-M300B (A4 I) |
| PA001=148 | 130SJT-M100B (A4 I) | PA001=180 | 175SJT-M300D (A4 I) |
| PA001=150 | 130SJT-M100D (A4 I) | PA001=182 | 175SJT-M380B (A4 I) |
| PA001=152 | 130SJT-M150B (A4 I) | | |
| PA001=204 | 80SJT-M024C (A4 II) | PA001=254 | 130SJT-M150D (A4 II) |
| PA001=206 | 80SJT-M024E (A4 II) | PA001=256 | 130SJT-M050E (A4 II) |
| PA001=208 | 80SJT-M032C (A4 II) | PA001=258 | 130SJT-M060E (A4 II) |
| PA001=210 | 80SJT-M032E (A4 II) | PA001=260 | 130SJT-M075E (A4 II) |
| PA001=222 | 110SJT-M040D (A4 II) | PA001=262 | 130SJT-M150D (A4 II) |
| PA001=224 | 110SJT-M040E (A4 II) | PA001=266 | 175SJT-M120E (A4 II) |
| PA001=226 | 110SJT-M060D (A4 II) | PA001=268 | 175SJT-M150D (A4 II) |
| PA001=228 | 110SJT-M060E (A4 II) | PA001=270 | 175SJT-M180B (A4 II) |
| PA001=240 | 130SJT-M040D (A4 II) | PA001=272 | 175SJT-M180D (A4 II) |
| PA001=242 | 130SJT-M050D (A4 II) | PA001=274 | 175SJT-M220B (A4 II) |
| PA001=244 | 130SJT-M060D (A4 II) | PA001=276 | 175SJT-M220D (A4 II) |
| PA001=246 | 130SJT-M075D (A4 II) | PA001=278 | 175SJT-M300B (A4 II) |
| PA001=248 | 130SJT-M100B (A4 II) | PA001=280 | 175SJT-M300D (A4 II) |
| PA001=250 | 130SJT-M100D (A4 II) | PA001=282 | 175SJT-M380B (A4 II) |
| PA001=252 | 130SJT-M150B (A4 II) | | |

● 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 (A4 I) |
| PA001=1115 | 175SJT-M500DH | PA001=1224 | 175SJT-M380DH (A4 I) |
| PA001=1131 | 175SJT-M380BH (A2) | PA001=1226 | 175SJT-M500BH (A4 I) |
| PA001=1132 | 175SJT-M380DH (A2) | PA001=1228 | 175SJT-M500DH (A4 I) |

● 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 paralleled, 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.

Appendix

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.

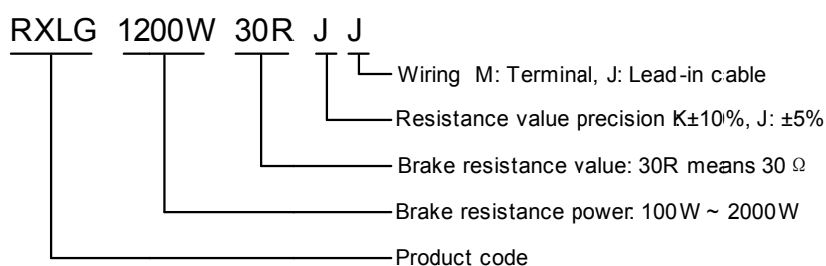
| Spindle servo drive unit output power | 3-phase AC lead-in reactor | | |
|--|---------------------------------|----------|----------------------------|
| | Rated operation voltage | | Rated operation voltage |
| 1.5 kW | 3-phase AC 380V (or 440V) /50Hz | 8A~10 A | 1.0 mH~2.5 mH |
| 2.2 kW | 3-phase 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

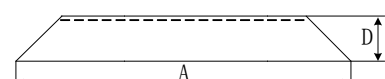
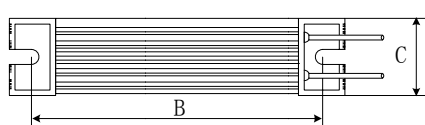


Fig.1-9-1 Installation aperture 5.5mm

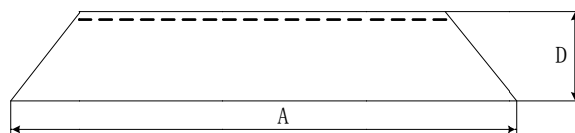
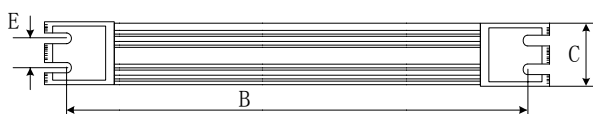
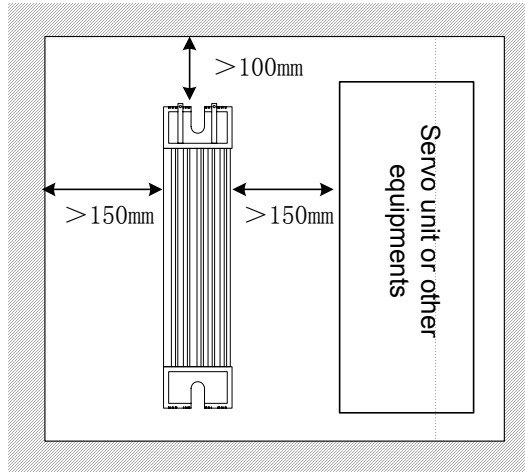


Fig.1-9-2 Installation aperture 5.5mm

| 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.