In this user manual we have tried to describe the matters concerning the operation of this CNC system to the greatest extent. However, it is impossible to give particular descriptions for all unnecessary or unallowable operations due to length limitation and products application conditions; Therefore, the items not presented herein should be regarded as “impossible” or “unallowable”.

# Preface

Dear Users,

We are honored by your purchase of this GSK 988 Turning CNC System made by GSK CNC Equipment Co., Ltd.

This book is User Manual Volume II –“Installation and Debugging”.

To ensure safe and effective running, please read this manual carefully before installation and operation.

# Warning

 Accident may occur by improper connection and operation！This system can only be operated by authorized and qualified personnel.

**Special caution:**

The power supply fixed on/in the cabinet is exclusively used for the CNC system made by GSK.

It can't be applied to other purposes, or else it may cause serious danger!

# Cautions

**■ Delivery and storage**

- Packing box over 6 layers in pile is unallowed.
- Never climb the packing box, stand on it or place heavy objects on it.
- Do not move or drag the products by the cables connected to it.
- Forbid collision or scratch to the panel and display screen.
- Avoid dampness, insolation and drenching.

**■ Open-package inspection**

- Confirm that the products are the required ones.
- Check whether the products are damaged in transit.
- Confirm that the parts in packing box are in accordance with the packing list.
- Contact us in time if any inconsistence, shortage or damage is found.

**■ Connection**

- Only qualified personnel can connect the system or check the connection.
- The system must be earthed, and the earth resistance must be less than 0.1Ω. The earth wire cannot be replaced by zero wire.
- The connection must be correct and firm so as to avoid any fault or unexpected consequence.
- Connect with surge diode in the specified direction to avoid damage to the system.
- Switch off power supply before plugging out or opening electric cabinet.

**■ Troubleshooting**

- Switch off power supply before troubleshooting or changing components.
- Check the fault when short circuit or overload occurs. Restart can only be done after troubleshooting.
- Frequent switching on/off of the power is forbidden, and the interval time should be at least 1 min.

## ANNOUNCEMENT!

- **This manual describes various possibilities as much as possible. However, operations allowable or unallowable cannot be explained one by one due to so many possibilities that may involve with, so the contents that are not specially stated in this manual shall be regarded as unallowable.**

## WARNING!

- **Please read this manual and a manual from machine tool builder carefully before installation, programming and operation, and strictly observe the requirements. Otherwise, products and machine may be damaged, workpiece be scrapped or the user be injured.**

## CAUTION!

- **Functions, technical indexes (such as precision and speed) described in this user manual are only for this system. Actual function configuration and technical performance of a machine tool with this CNC system are determined by machine tool builder's design, so functions and technical indexes are subject to the user manual from machine tool builder.**
- **Though this system adopts standard operation panel, the functions of the keys on the panel are defined by PLC program (ladder diagram). It should be noted that the keys functions described herein are for the standard PLC program (ladder diagram).**
- **For functions and effects of keys on control panel, please refer to the user manual from machine tool builder.**

**This manual is subject to change without further notice.**

# Safety Responsibility

## Manufacturer's Responsibility

——Be responsible for the danger which should be eliminated and/or controlled on design and configuration of the provided CNC systems and accessories.
——Be responsible for the safety of the provided CNC systems and accessories.
——Be responsible for the provided information and advice for the users.

## User's Responsibility

——Be trained with the safety operation of CNC system and familiar with the safety operation procedures.
——Be responsible for the dangers caused by adding, changing or altering on original CNC systems and the accessories.
——Be responsible for the failure to observe the provisions for operation, adjustment, maintenance, installation and storage in the manual.

**This manual is reserved by end user.**

**We are full of heartfelt gratitude for your support by using GSK's products.**

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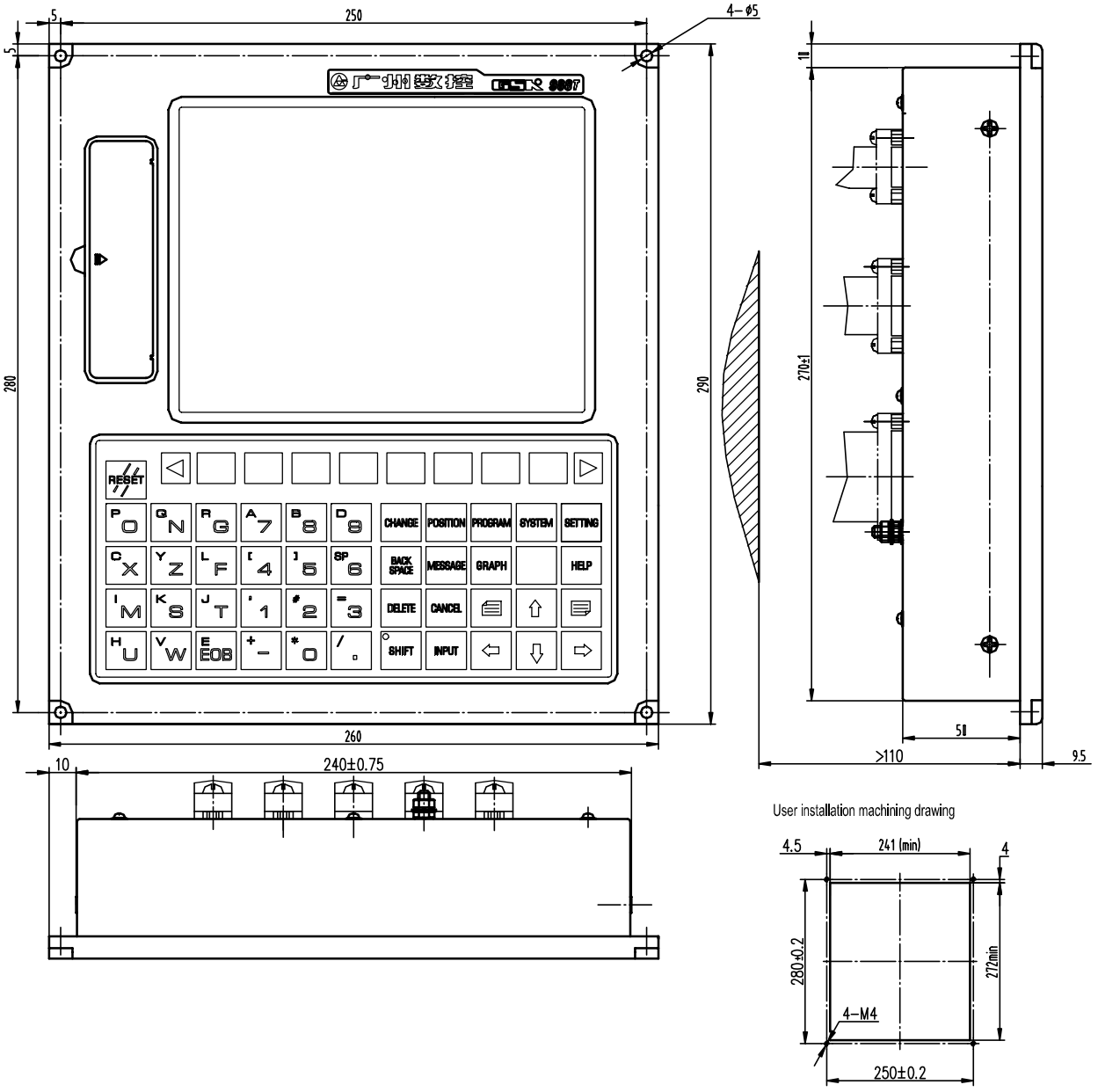
# CHAPTER I INSTALLATION LAYOUT

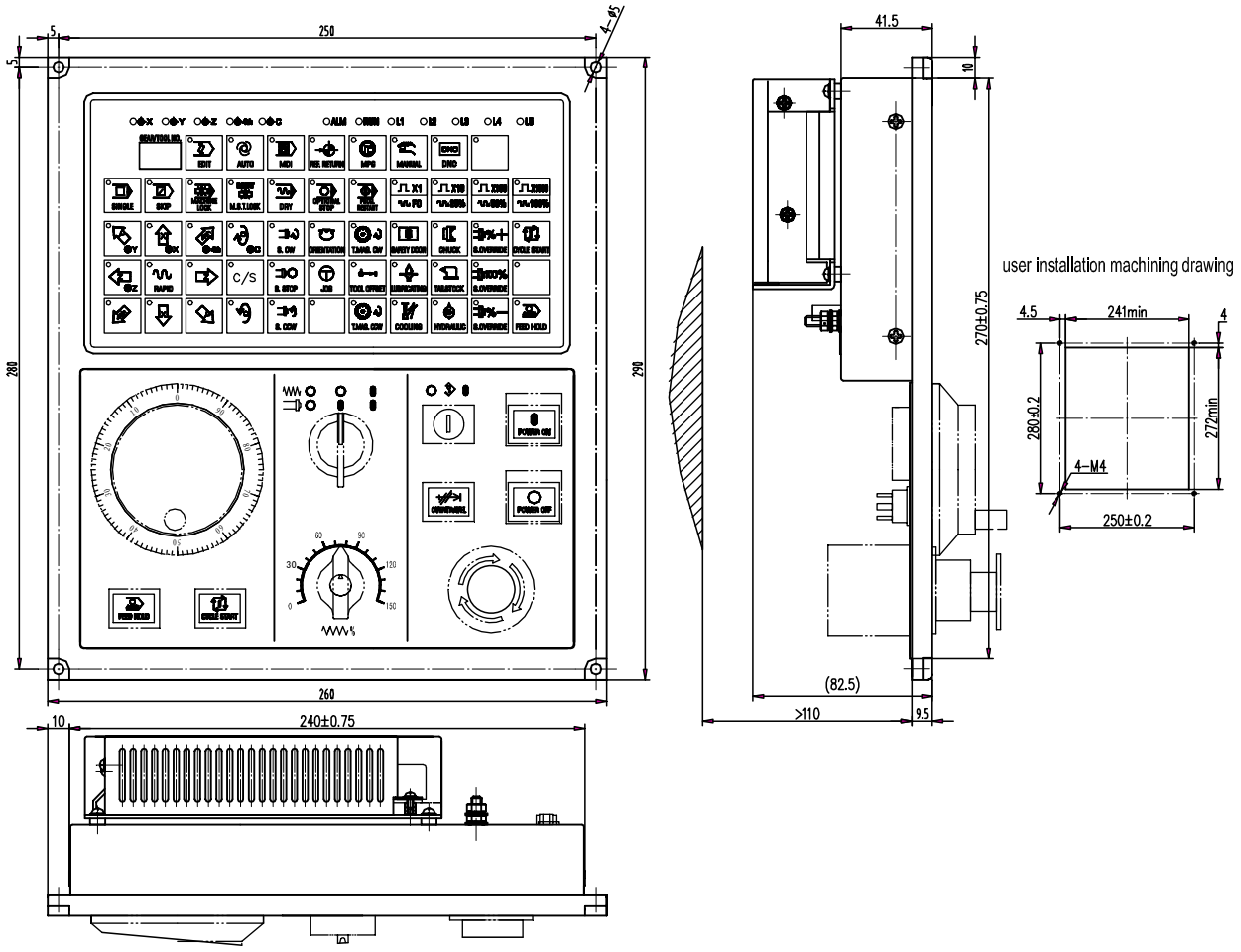
## 1.1 Overall Dimension of GSK988T and Accessories

### 1.1.1 Overall Dimension of the GSK988T Mainframe

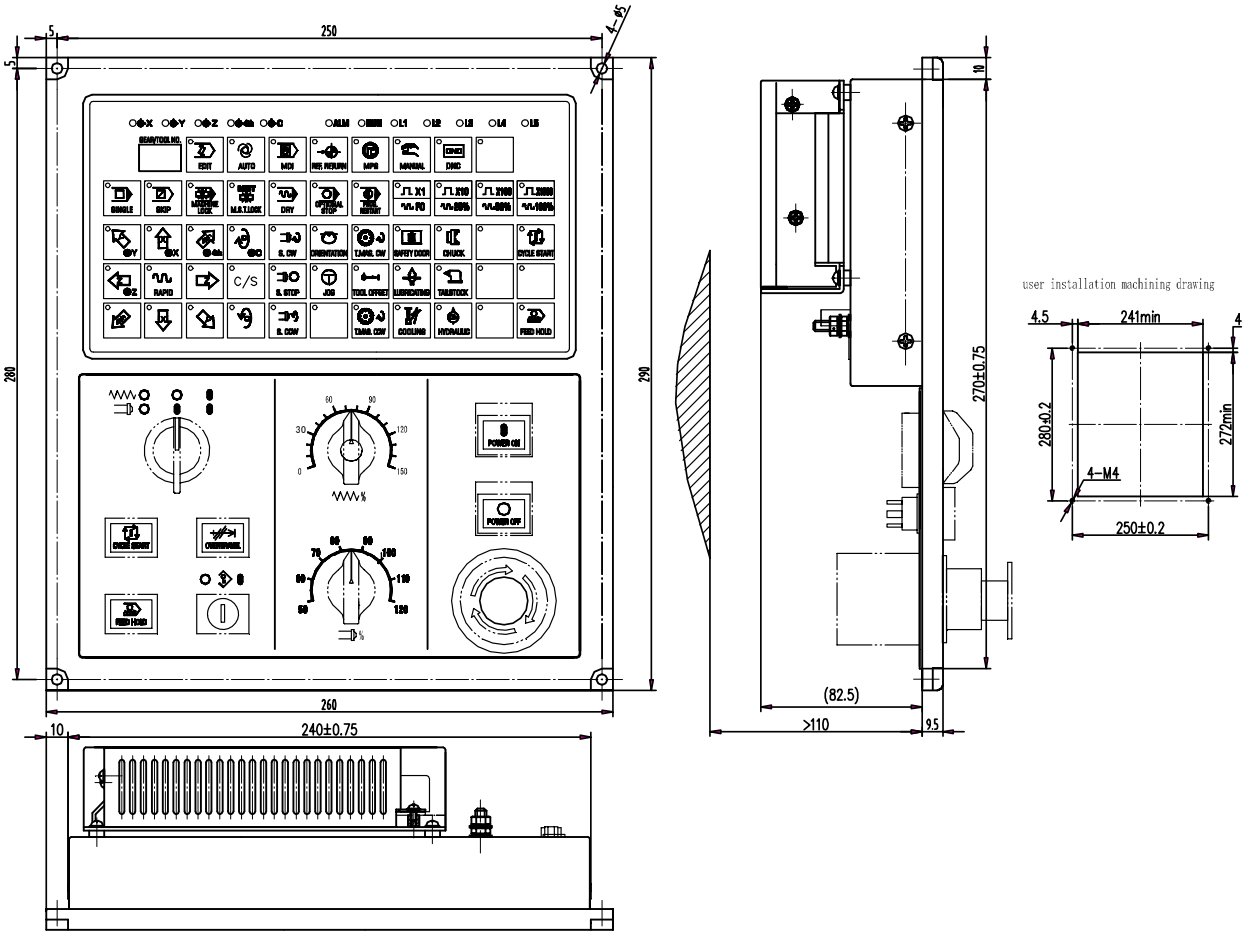



User installation machining drawing

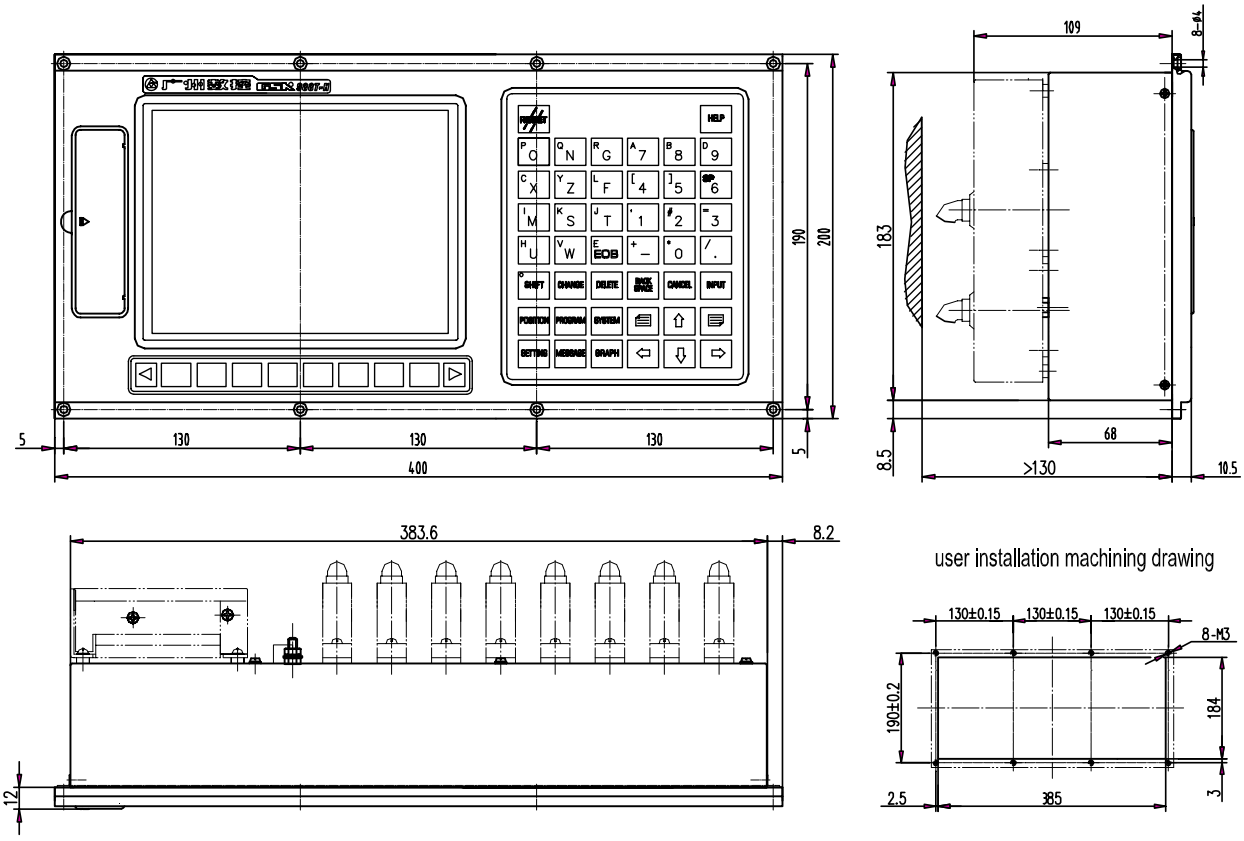
## 1.1.2 Overall Dimension of GSK988T Operation Panel MPU02A



## 1.1.3 Overall Dimension of GSK988T Operation Panel MPU02B

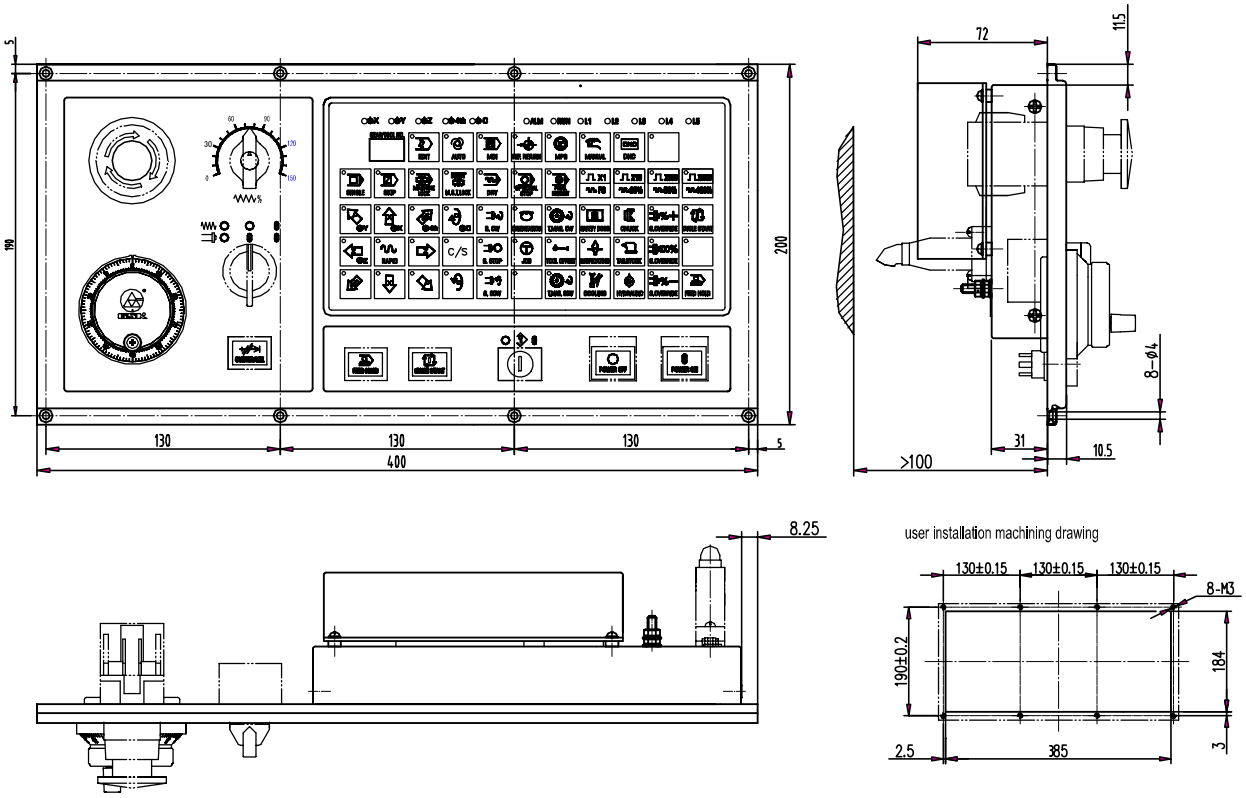


## 1.1.4 Overall Dimension of GSK988T-H Mainframe

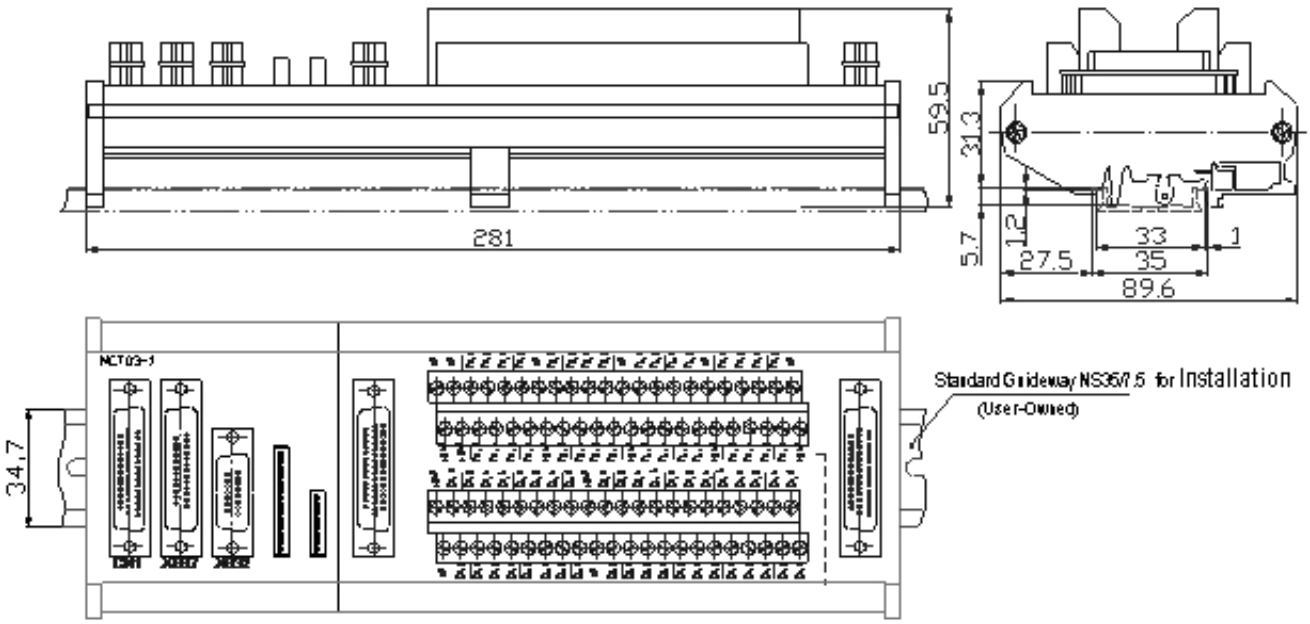



**Note: The panel of GSK988T-H is horizontal.**

## 1.1.5 Overall Dimension of GSK988T- H Operation Panel




## 1.1.6 Overall Dimension of I/O Deconcentrator MCT02



## 1.2 Structure of GSK988T Control System

### 1.2.1 Front /Rear Panel Illustrations

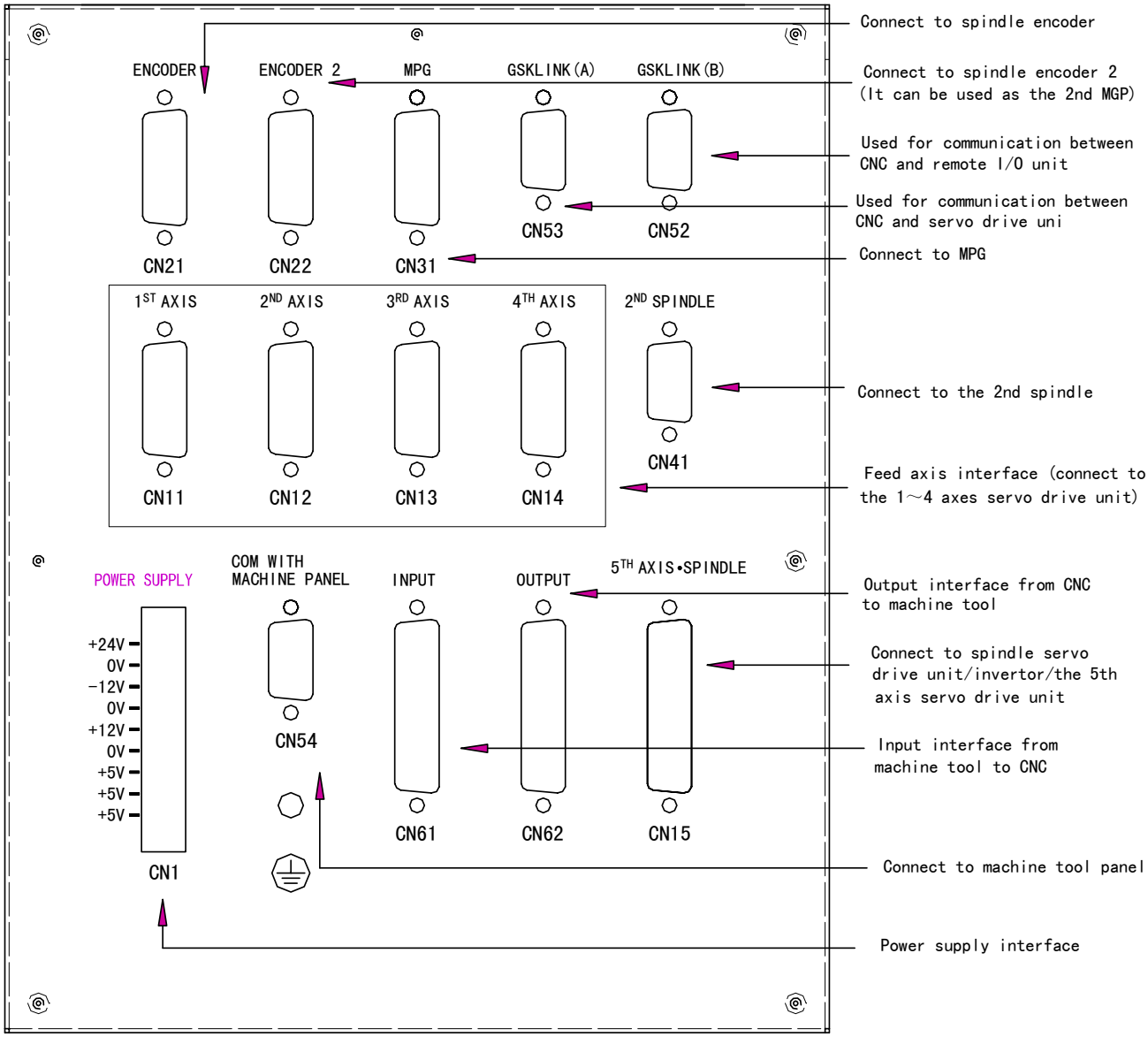



Fig. 1-2-1 The layout of GSK988T mainframe rear cover interfaces

**Note: These interfaces are compatible with GSK988T-H system. See Fig.1-2-1**

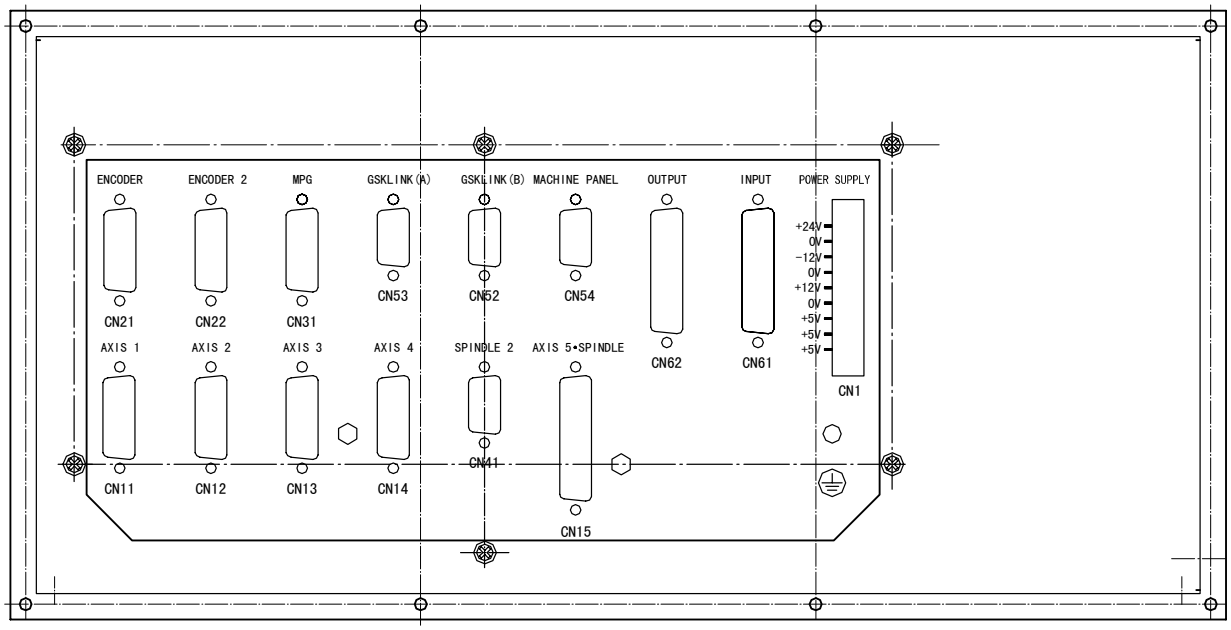



Fig. 1-2-2 The layout of GSK988T-H mainframe rear cover interfaces

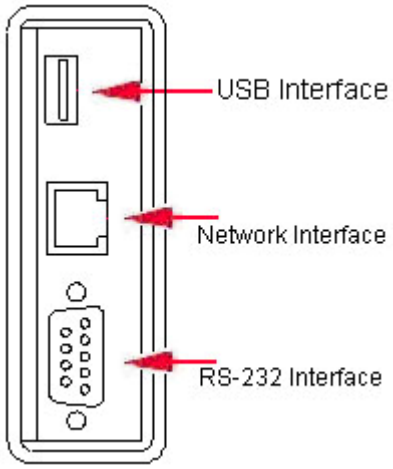



Fig. 1-2-3 The layout of GSK988T front panel interfaces

## 1.2.2 General Connection Diagram

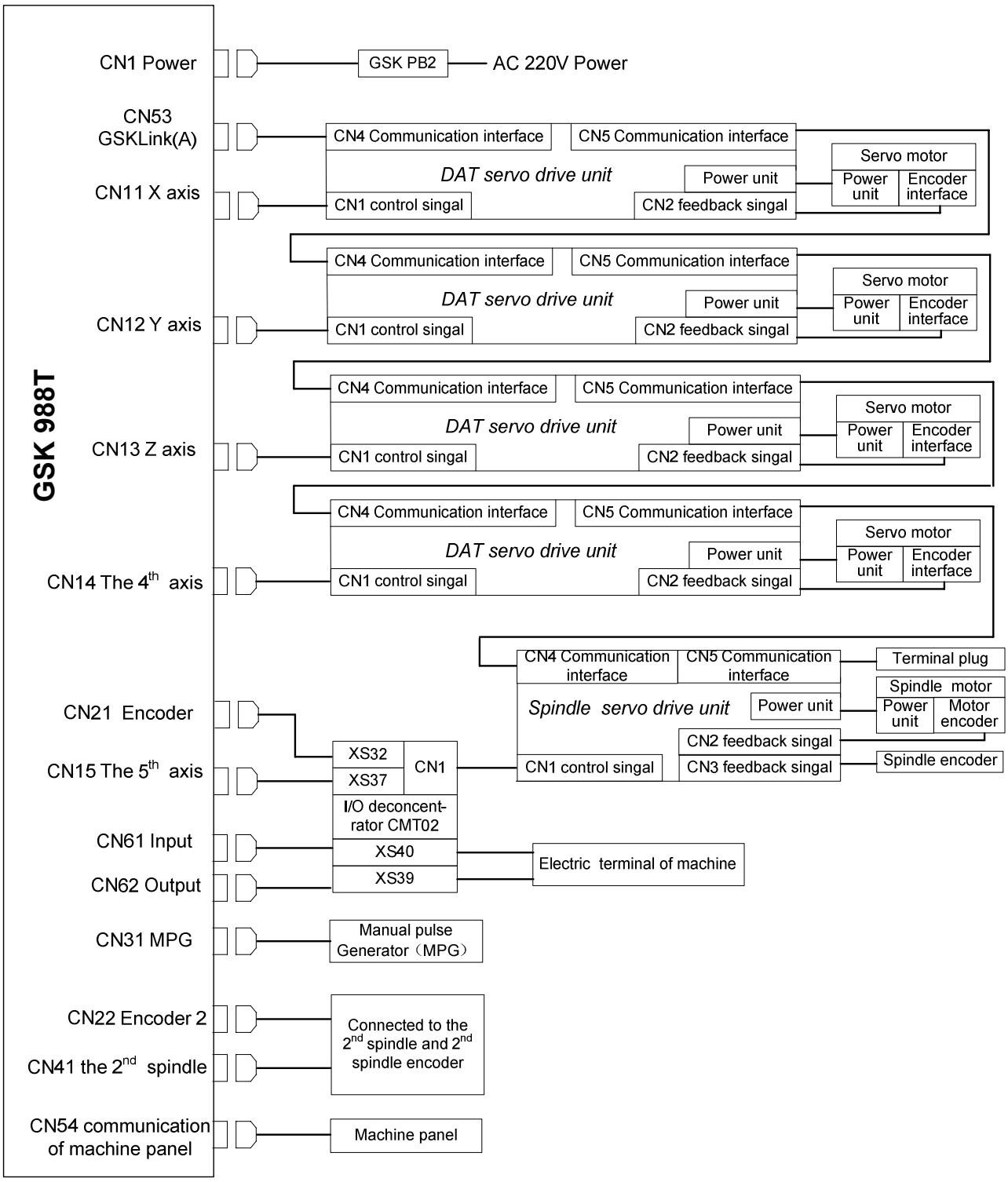



Fig. 1-2-4 GSK988T connection diagram

## 1.3 GSK988T Installation

### 1.3.1 Conditions of Electric Cabinet Installation

- Prevent the entry of dust, coolant and organic solution.
- The distance between CNC rear cover and the cabinet should not be less than 20cm. Ensure that the temperature difference (outside and inside the cabinet) will be less than 10℃ in case of temperature rising in the cabinet.
- A radiator fan can be installed inside the cabinet to ensure ventilation.
- The display panel should be installed in proper place to avoid the coolant ejection.
- The interference of external electrical equipments to the CNC should be taken into consideration and be reduced to the greatest extent.

### 1.3.2 System Grounding Requirements

The following grounding systems are for CNC machine tool:

- Signal ground
  It provides the reference voltage of telecommunication system (0V).
- Frame ground
  It is used for the sake of safety. The shell of frame unit, panel and the interface cables shield should be connected together. It can also suppress the internal and external noise.
- System ground
  It is used to connect the devices and the frame ground with the ground.

**Note 1: The connection between signal and frame ground in the CNC control unit is only made at one place.**
**Note 2: Use the AC power line with grounding wire to ensure grounding during power supply.**

### 1.3.3 Interference Prevention Methods

Measures such as shielding electromagnetic radiation, absorbing impulse current and filtering power noise are taken into CNC design, which, to some extent, protects the CNC to external interference. To ensure a steady working of CNC, it is necessary to take following measures during CNC installation:

① Keep CNC far away from the interference source (such as inverter, AC contactor, static generator, high pressure generator and sectioning for power line, etc.)

② The power to CNC should be supplied via insulation transformer; the machine installed with CNC should be grounding; the CNC and drive unit should be connected with independent grounding wire via grounding point.

③ Interference suppression: connect the RC circuits parallelly at two ends of the AC coil; the RC circuit should be installed to the inductive load as near as possible; fly-wheel diode should be inversely connected in serial at two ends of the DC coil ; surge absorber should be connected in parallel at the winding head of AC motor (see Fig. 1-3-1).

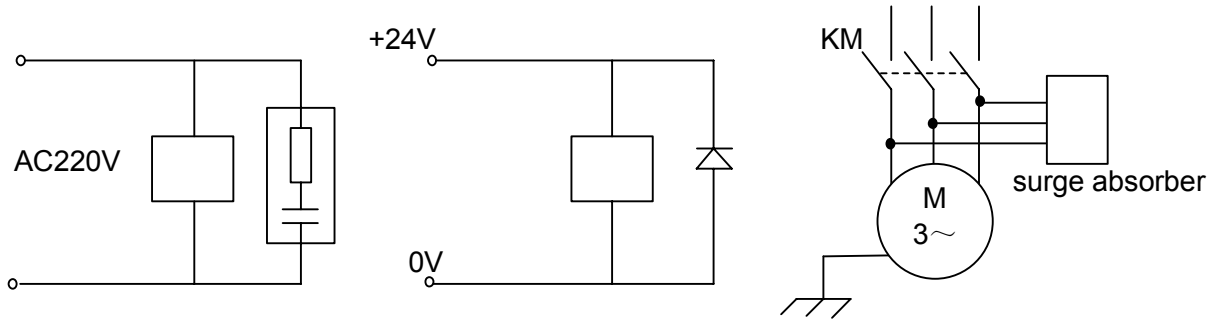



Fig. 1-3-1

④ The outgoing cable of CNC is twisted shielded cable or shielded cable; the shielding layer of the cable is single-end earthed at CNC side; the signal line should be as short as possible.

⑤ To reduce the interference between CNC signal cables and high-voltage cable, the following principles should be followed when wiring:

| Group | Cable type | Group | Cable type |
|---|---|---|---|
| A | AC power line | B | DC coil (24VDC) |
| | AC coil | | DC relay (24VDC) |
| | AC contactor | | Cables between CNC and high-voltage electric cabinet |
| C | Cables between CNC and servo drive unit | | Cables between CNC and machine tool |

**Wiring Requirements:**

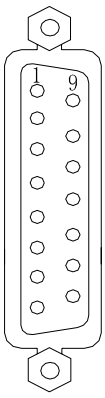
- The cable should be twisted pair.
- Bundle the cables of group A separately from the cables in groups B, C, and the distance should be no less than 10cm; or, make electromagnetic shielding for the cables in group A.
- Bundle the cables of group C separately from the cables in group A, and the distance should be no less than 10cm; or, make electromagnetic shielding for the cables in group C; the distance between group C cables and group B cables should be no less than 10cm.
- Bundle the cables of group B separately from the cables in group A; or, make electromagnetic shielding for the cables in group B; cables in group B should be bundled separately from the group C cables as far as possible.

# CHAPTER II INTERFACE SIGNAL DEFINITION AND CONNECTION

## 2.1 Connection with Drive Unit

### 2.1.1 Definition of the Drive Interface

1：nCP+
2：nDIR+
3：nPC
4：+24V
5：nALM
6：nSET
7：nEN
8：nRDY




9： nCP-
10：nDIR-
11：0V
12：+5V
13：+5V
14：0V
15：0V

| Signal | Description |
|---|---|
| nCP+, nCP- | Command pulse signal |
| nDIR+, nDIR- | Command direction signal |
| nPC | Zero point signal |
| nALM | Drive unit alarm signal |
| nEN | Axial enable signal |
| nSET | Pulse inhibition signal |
| nRDY | Servo ready signal |

Fig. 2-1-1 CN11, CN12, CN13 and CN14 interfaces (15 pins, D-type female)

**Note: CN1 is the 1st servo axis interface, CN2 is the 2nd one, CN3 the 3rd one, and CN4 the 4th one. Each controlled axis outputs the corresponding servo axis interface, which is set by parameter NO.1023.**

### 2.1.2 Signal Instruction

(1) Command pulse signal and nCP and command direction signal nDIR

nCP+ and nCP- are command pulse signals, nDIR+ and nDIR- are command direction signals, the two groups of signals all are difference (AM26LS31) output, the external is suggested to use AM26LS32 for receiving, refer to the following Fig.2-1-2 about the internal circuit:

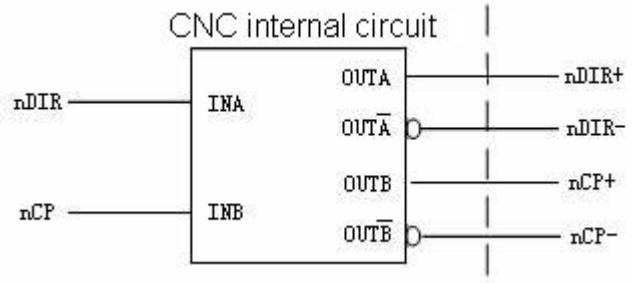



Fig. 2-1-2 Internal circuit of nCP and nDIR

(2) Drive unit alarm signal nALM

Whether the drive alarm level is low or high is set by 0 bit of parameter 1816; refer to Fig.2-1-3 for the internal circuit.

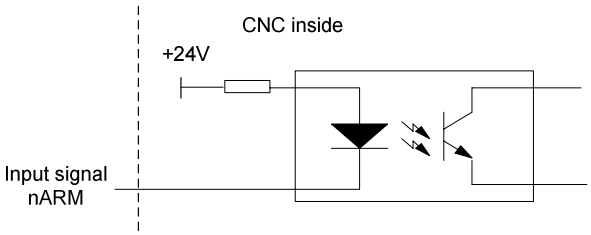



Fig. 2-1-3. Internal circuit of nALM

Input circuit of this type requires that the drive should provide the signal through the methods in the following Fig. 2-1-4:


Fig. 2-1-4. Methods of the drive unit providing signals

(3) Servo ready signal nRDY

nRDY signal is connected to the servo drive unit ready signal. See Fig. 2-1-5.

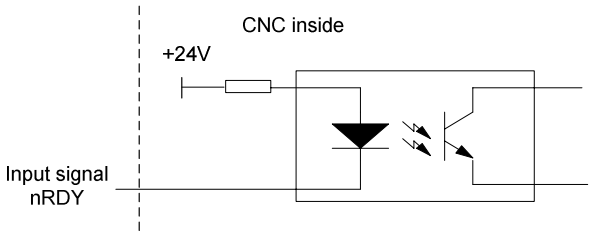



Fig. 2-1-5 Internal circuit of nRDY

(4) Axial enable signal nEN

When CNC is running normally, nEN signal output is valid (nEN signal connects with 0V), and the drive or the emergency stop alarms, CNC switched off, nEN signal outputs (nEn signal cuts off 0V). About the internal interface circuit, refer to the following Fig. 2-1-6:

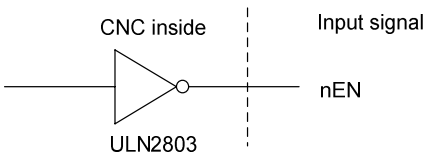



Fig. 2-1-6. Internal circuit of nEN

(5) Pulse inhibition signal nSET

nSET signal indicates the servo input inhibition. To improve the anti-interference ability between CNC and the drive, the signal is low-level when CNC outputs the pulse signal, if there isn't any pulse signals, it is high level; refer to the following Fig. 2-1-7 about the internal interface circuit:

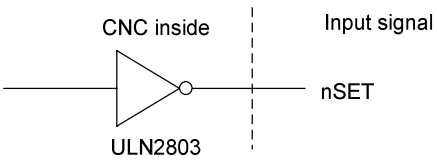



Fig. 2-1-7 Pulse forbidden signal circuit

(6) Zero point signal nPC

Take one-rotation signal of motor encoder or proximity switch signal as zero signals. About the internal connection circuit, refer to Fig. 2-1-8:

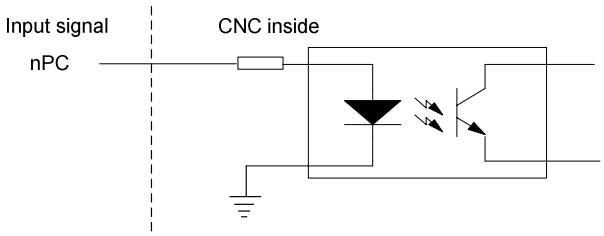



Fig. 2-1-8 Zero point signal circuit

① The illogram of PC signals provided by user is shown in Fig. 2-1-9:

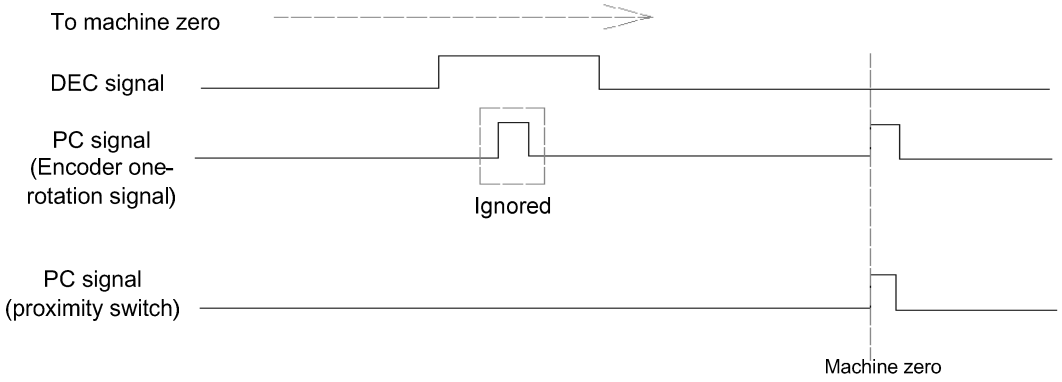



Fig. 2-1-9 Signal illogram

**Note: During machine zero return, after releasing the deceleration switch, CNC determines the position of the reference point through detecting PC signal jumping, and the rising edge check and the falling edge check are both valid.**

② Refer to Fig. 2-1-10 for the connection method of taking one NPN-type Hall unit as the deceleration signal:

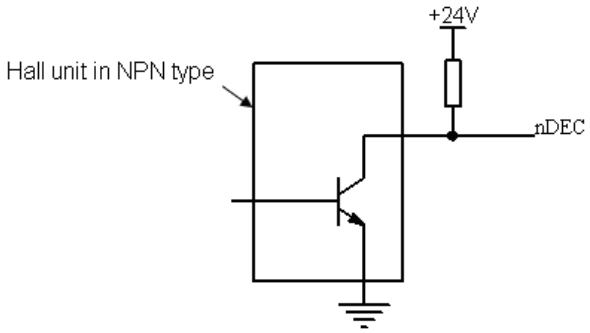



Fig. 2-1-10 Connection with NPN-type Hall unit

③ Refer to the following Fig. 2-1-11 about the connection method of taking one Hall unit in PNP type as one deceleration signal:

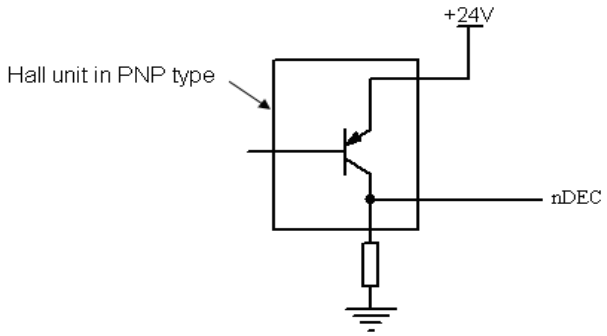



Fig. 2-1-11 Connection with Hall unit in PNP type

## 2.1.3 Connection with the Drive Unit Interface

The connection between GSK988T system and GSK DA98B drive unit is shown in the following figure.

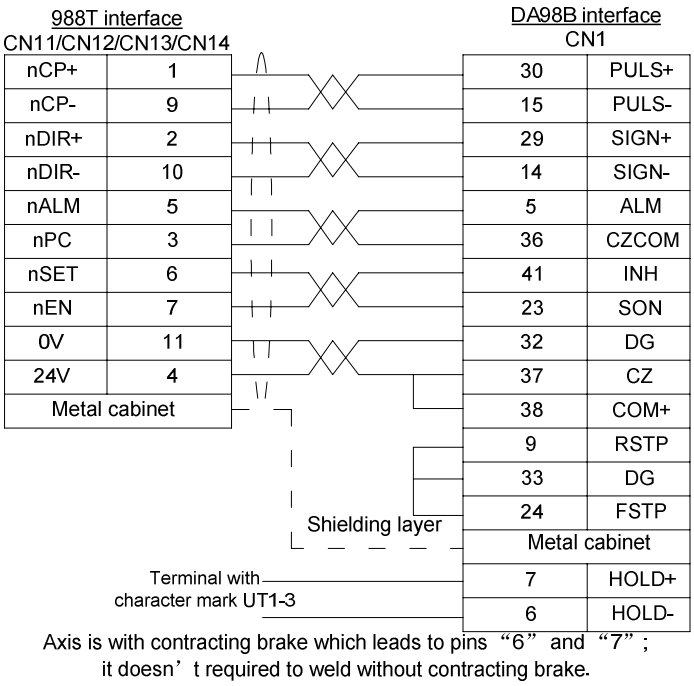



Fig. 2-1-12 Connection between GSK988T and DA98B

The connection between GSK988T and GSK DAT2000C drive unit is shown as follows:

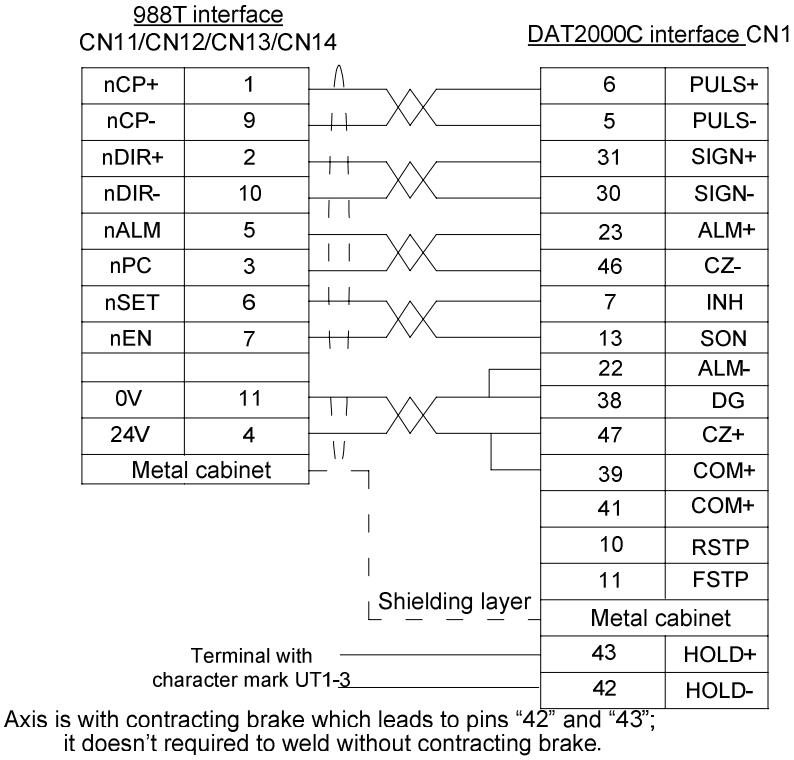



Fig. 2-1-13 Connection between GSK988T and DAT2000C drive unit

## 2.2 Connection with the Spindle

The spindle interface of GSK988T is CN15 (the fifth axis · spindle interface). It is equipped with the function of pulse output and analog voltage output, and can be adopted with the servo spindle drive unit or the common spindle Inverter, or taken as an independent 5$^{th}$ servo axial interface. Moreover, GSK988T system is also equipped with the 2$^{nd}$ spindle interface CN41 (refer to following chapters for details), and it can output 0~+10V analog voltage for extending the 2$^{nd}$ spindle or the power unit.

## 2.2.1 The 5th Axis · Spindle Interface Definition

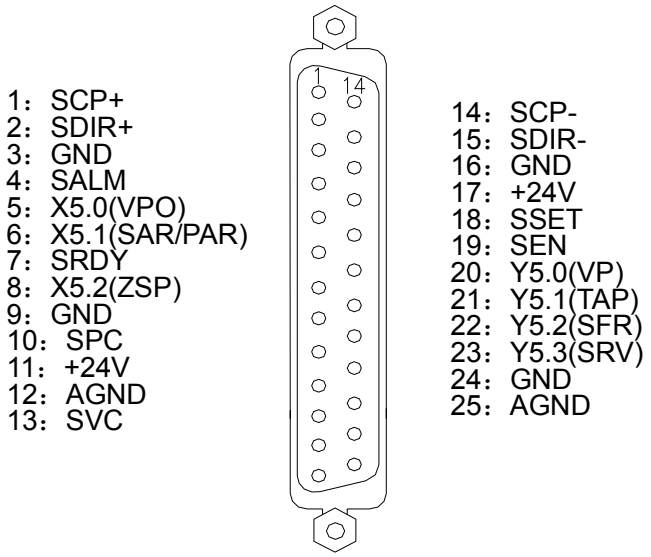



Fig. 2-2-1 CN15 servo spindle interface (25 cords, D type female)

| Signal Definition | Explanation | Function Defined by Standard PLC Address |
|---|---|---|
| SCP+, SCP- | Command pulse signal | / |
| SDIR+,SDIR- | Command direction signal | / |
| SALM | Drive unit alarm signal | / |
| SRDY | Servo ready signal | / |
| SSET | Pulse forbidden signal | / |
| SEN | Axial enable signal | / |
| SPC | Zero point signal | / |
| SVC | 0~+10V analog voltage output | / |
| AGND | Analog voltage output ground | / |
| X5.0 (VPO) | Address of PLC signal, binary input | Spindle speed/position status signal |
| X5.1 (SAR/PAR) | Address of PLC signal, binary input | Spindle position/speed reaching signal |
| X5.2 (ZSP) | Address of PLC signal, binary input | Spindle output at zero speed signal |
| Y5.0 (VP) | Address of PLC signal, binary output | Spindle speed/position switch signal |
| Y5.1 (TAP) | Address of PLC signal, binary output | Spindle speed loop gain selection signal 2 (used for tapping) |
| Y5.2 (SFR) | Address of PLC signal, binary output | Spindle CW signal |
| Y5.3 (SRV) | Address of PLC signal, binary output | Spindle CCW signal |
| +24V | +24V | / |
| GND | 0V (binary input & output signal ground ) | / |

## 2.2.2 Signal Instruction

In the 5th axis • spindle interface, the internal circuits of SCP+, SCP-, SDIR+, SDIR-, SALM, SRDY, SSET, SEN are consistent with that of the similar signal in the drive interfaces CN11,

CN12, CN13, CN14. Refer to section 2.1.2.

(1) Zero point signal SPC

SPC signal is valid at low level. It is different with the nPC signal in CN11, CN12, CN13, CN14 interfaces (high-level nPC signal is valid). The internal circuit of SPC is shown in Fig. 2-2-2:

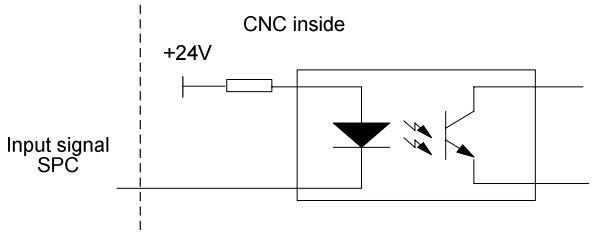



Fig. 2-2-2 Internal circuit of SPC

(2) Signals X5.0, X 5.1, X 5.2, X 5.3, X5.4

Signals X5.0, X 5.1, X 5.2, X 5.3, X 5.4 are the PLC signal addresses; binary input; the internal circuit is shown in Fig.2-2-3.

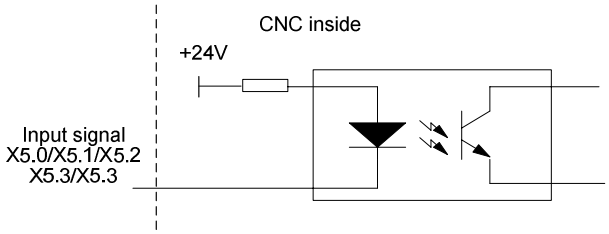



Fig.2-2-3

**Note: In the 5th axis • spindle interface, low-level signals X5.0, X5.1, X5.2, X5.3, X5.4 are valid. The X address in general input CN61 (X0.0~X0.7, X1.0~X1.7, X2.0~X2.7, X3.0~X3.7) are valid during high-level input.**

(3) Signals Y5.0, Y 5.1, Y 5.2, Y 5.3, Y 5.4

Signals Y5.0, Y 5.1, Y 5.2, Y 5.3, Y 5.4 are the PLC signal addresses; binary output. The internal circuit is shown in Fig. 2-2-4:

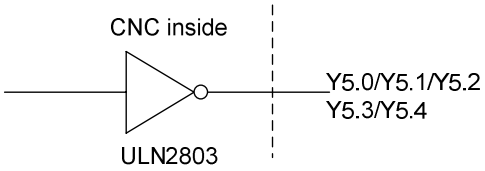



Fig. 2-2-4

## 2.2.3 Connection with the Servo Spindle Drive Unit

Connection between GSK988T and GSKDAP03C servo spindle drive unit is shown in the following figure. This connection can also be applied in spindle servo drive unit such as GSK DAP03/DAY3025C/DAY3025/DAY3100.

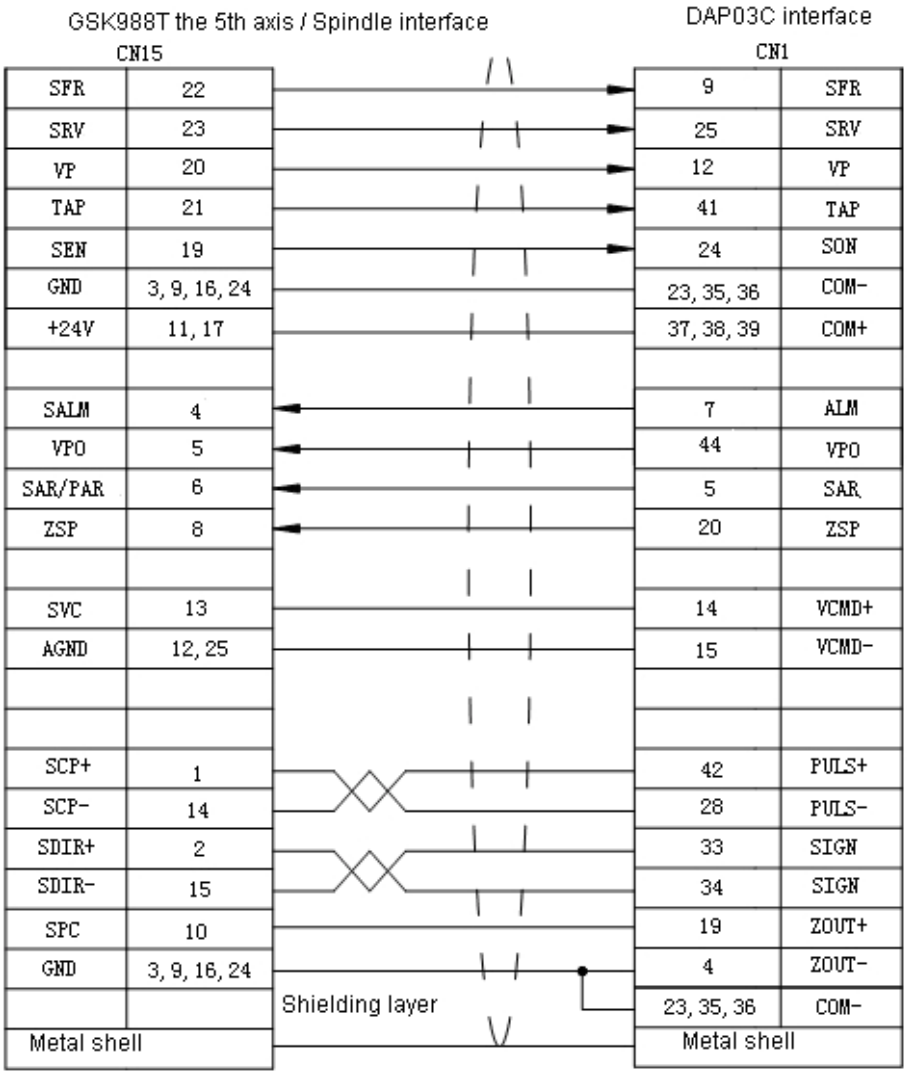



Fig. 2-2-5 Connection between GSK988T and DAP03C drive unit

## 2.2.4 Connection with the Spindle Inverter Interface

The 5th axis ·spindle interface (CN15) SVC port outputs 0~+10V voltage, the connection between GSK988T and the spindle inverter is shown in the following figure:

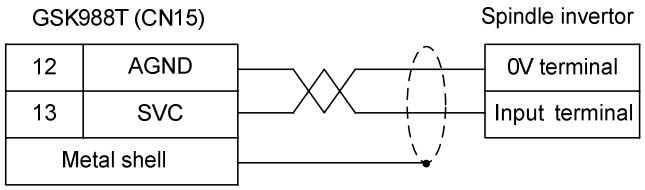



Fig. 2-2-6 Connection between GSK988T and inverter

## 2.3 Connection with the Spindle Encoder

GSK988T is equipped with two-channel encoder input interfaces (CN21 and CN22), CN21 interface is used as feedback input of spindle speed by default. When multi-spindle control function is started, select the encoder interface which receives the feedback pulse for the system control, through the selection signal PC2SLC (G28.7) of spindle encoder in PLC. When the interface (CN22) of encoder 2 does not connect to the encoder and the selection signal PC2SLC

of the position encoder is not set to 1, CN21 interface is taken as the feedback input of the spindle speed.

## 2.3.1 Interface Definition of the Spindle Encoder

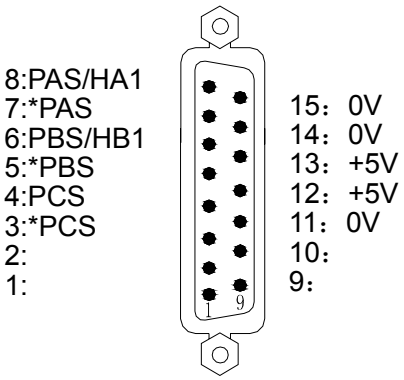



Fig. 2-3-1 Encoder interface of CN21 and CN22 (15 pins, D-type, male)

| Signal | Description |
|---|---|
| *PAS/PAS | Encoder phase A pulse |
| *PBS/PBS | Encoder phase B pulse |
| *PCS/PCS | Encoder phase C pulse |
| HA1 (Only CN22 is with the signal) | The 2nd MPG phase A signal (When it's not used in the 2nd spindle encoder, it can be used to extend the 2nd MPG) |
| HB1 (Only CN22 is with the signal) | The 2nd MPG phase B signal (When it's not used in the 2nd spindle encoder, it can be used to extend the 2nd MPG.) |

## 2.3.2 Signal Instruction

*PCS/PCS, *PBS/PBS and *PAS/PAS are difference input signals of phase C, B and A respectively; *PAS/PAS and *PBS/PBS is the orthogonal square wave with difference of 90°, the maximum signal frequency <1MHz: The quantity of GSK988T encoder pulses is set by parameter No.3773 (the quantity of the spindle encoder pulses) and No.3803 (the quantity of the 2nd spindle encoder).

## 2.3.3 Connection with the Spindle Encoder Interface

The connection between GSK988T and the spindle encoder with the twisted pair line is shown in Fig. 2-3-2, and Changchun Yiguang ZLF-12-102.4BM-C05D encoder is taken as one example:

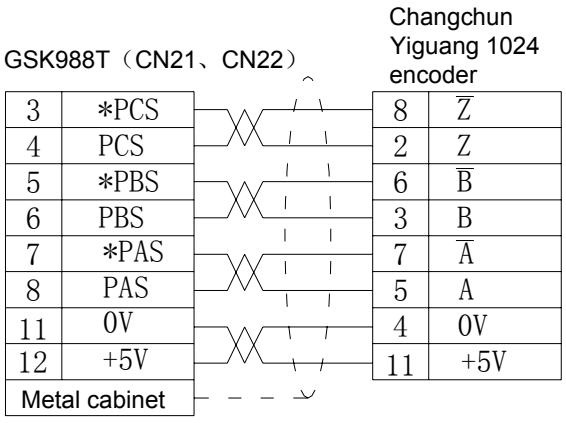
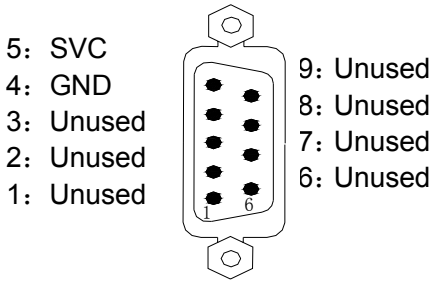



Fig. 2-3-2 Connection between GSK988T and the encoder

## 2.4 Connection with the 2nd Spindle

988T supports multi-spindle function. Two spindle analog voltage output interfaces include 5th axis ·spindle (CN15) interface and the 2nd spindle (CN41) interface. They are controlled by PLC signals. The 2nd spindle interface can be used to the 2nd inverter spindle or the unit head.

### 2.4.1 Definition of the 2nd Spindle (Analog Spindle) Interface




| Signal | Description |
|---|---|
| SVC | 0~+10V analog voltage output |
| GND | analog voltage output ground |

Fig.2-4-1
CN41 analog spindle interface
(9pins, D-type, male)

### 2.4.2 Connection with the 2nd Spindle Inverter Interface

The 2nd spindle interface SVC port outputs 0~10V voltage. The connection is shown in Fig. 2-4-2:

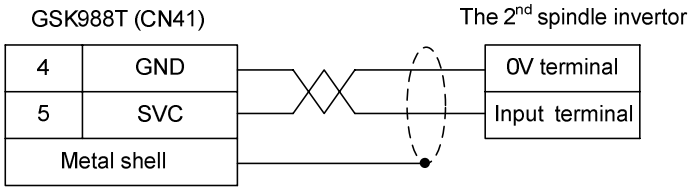
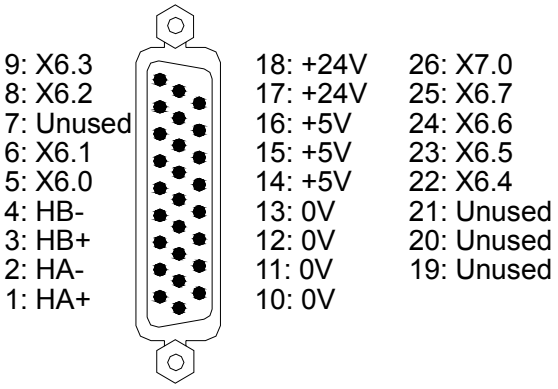



Fig. 2-4-2 Connection between GSK988T and the 2nd spindle inverter

## 2.5 Connection with MPG

### 2.5.1 Definition of MPG Interface




| Signal | Description |
|---|---|
| HA+, HA- | MPG phase A signal input |
| HB+, HB- | MPG phase B signal input |
| X6.0~X7.0 | PLC signal address; binary input |

Fig. 2-5-1 CN31 MPG interface
(26 pins, D-type male)

## 2.5.2 Signal Instruction

HA+, HA- and HB+, HB- are difference input signals of MPG phase A and B respectively. X6.0~X7.0 interfaces are input addresses defined by PLC interface, and it can also be used for axial selection of external MPG box and gear signal input.

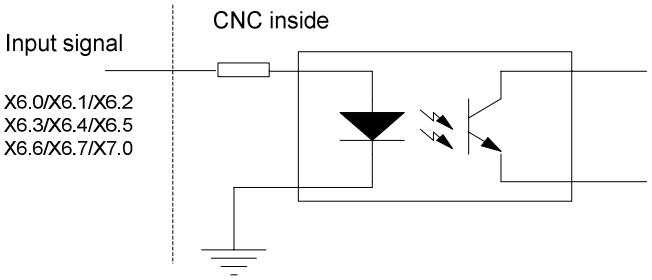



Fig. 2-5-2 Inside circuit of X6.0~X7.0 signal

## 2.5.3 Connection with MPG Interface

The typical connection between GSK988T and MPG is shown as the following figure:

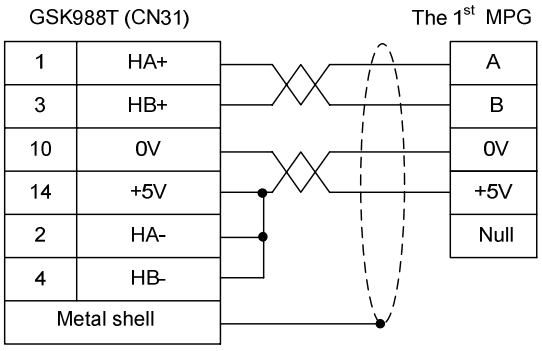



Fig. 2-5-3 Connection between GSK988T and the 1st MPG

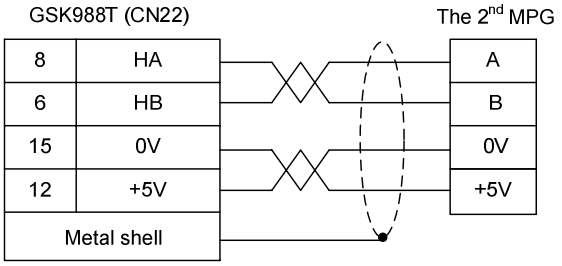



Fig. 2-5-4 Connection between GSK988T and 2nd MPG

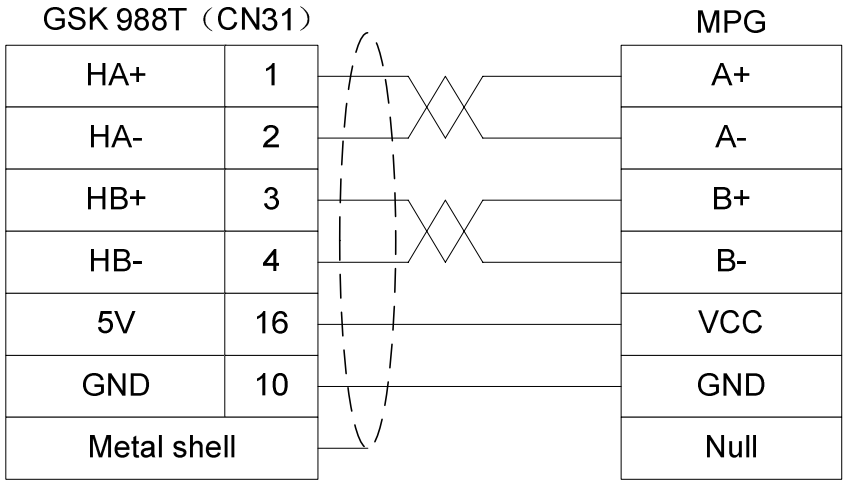
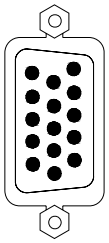



Fig.2-5-5 Connection between GSK988T and differential MPG

## 2.6 Connection with the Machine Panel

Connect between GSK988T system and the machine panel through communication.

## 2.6.1 Communication Interface Definition



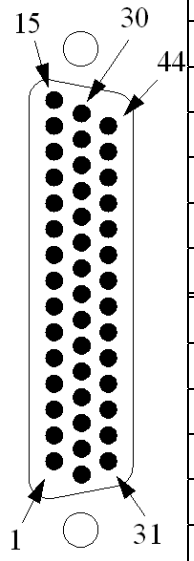
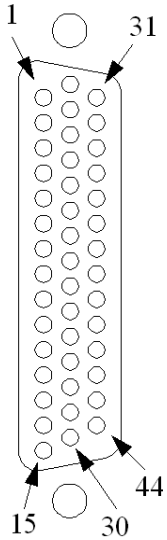
| Pin No. | Signal | IN/OUT | Description |
|---|---|---|---|
| 1 | RXDA | IN | Receive data difference signal |
| 2 | RXDB | IN | Receive data difference signal |
| 4 | TXDA | OUT | Send data difference signal |
| 5 | TXDB | OUT | Send data difference signal |
| 7 | RESET | OUT | Panel resetting signal |

Fig. 2-6-1 Standard machine panel interface CN54
(15 pins, D-type male)

# 2.7 GSK988T General I/O Interface Definition

## 2.7.1 Definition of Input & Output Addresses

Table 2-11 Definition of input & output addresses

| Interface | CN61 Pin No. | PLC Address | Interface | CN62 Pin No. | PLC Address |
|---|---|---|---|---|---|
|  CN61 (male) input | 1 | X0.0 |  CN62 (female) output | 1 | Y0.0 |
| | 2 | X0.1 | | 2 | Y0.1 |
| | 3 | X0.2 | | 3 | Y0.2 |
| | 4 | X0.3 | | 4 | Y0.3 |
| | 5 | X0.4 | | 5 | Y0.4 |
| | 6 | X0.5 | | 6 | Y0.5 |
| | 7 | X0.6 | | 7 | Y0.6 |
| | 8 | X0.7 | | 8 | Y0.7 |
| | 9 | X1.0 | | 9 | Y1.0 |
| | 10 | X1.1 | | 10 | Y1.1 |
| | 11 | X1.2 | | 11 | Y1.2 |
| | 12 | X1.3 | | 12 | Y1.3 |
| | 13 | X1.4 | | 13 | Y1.4 |
| | 14 | X1.5 | | 14 | Y1.5 |
| | 15 | X1.6 | | 15 | Y1.6 |
| | 16 | X1.7 | | 16 | Y1.7 |
| | 29 | X2.0 | | 29 | Y2.0 |
| | 30 | X2.1 | | 30 | Y2.1 |
| | 31 | X2.2 | | 31 | Y2.2 |
| | 32 | X2.3 | | 32 | Y2.3 |
| | 33 | X2.4 | | 33 | Y2.4 |
| | 34 | X2.5 | | 34 | Y2.5 |
| | 35 | X2.6 | | 35 | Y2.6 |
| | 36 | X2.7 | | 36 | Y2.7 |

| | | | | | |
|---|---|---|---|---|---|
| | 37 | X3.0 | | 37 | Y3.0 |
| | 38 | X3.1 | | 38 | Y3.1 |
| | 39 | X3.2 | | 39 | Y3.2 |
| | 40 | X3.3 | | 40 | Y3.3 |
| | 41 | X3.4 | | 41 | Y3.4 |
| | 42 | X3.5 | | 42 | Y3.5 |
| | 43 | X3.6 | | 43 | Y3.6 |
| | 44 | X3.7 | | 44 | Y3.7 |
| | 17 | X4.0 | | 17~19, 26~28 | 0V |
| | 18 | X4.1 | | 20~25 | +24V |
| | 19 | X4.2 | | | |
| | 20 | X4.3 | | | |
| | 25 | X4.4 | | | |
| | 26 | X4.5 | | | |
| | 27 | X4.6 | | | |
| | 28 | X4.7 | | | |
| | 21~24 | 0V | | | |

## 2.7.2 Input Signal

Input signal is the one which the machine electric wire or the machine panel transmits to CNC, and after connecting the input signal and +24V, the input is valid; if they are cut off, the input is invalid. The input signal of contacts on the machine side should satisfy the following conditions:

Contact capacity: DC30V, 16mA above;

Leakage current between contacts during opening: Below 1mA;

Voltage drop between contacts during closing: Below 2V (Current 8.5mA, including the cable potential drop).

There are two methods of external input for input signals: one is switch input with contacts, the connection is shown in Fig. 2-7-1:

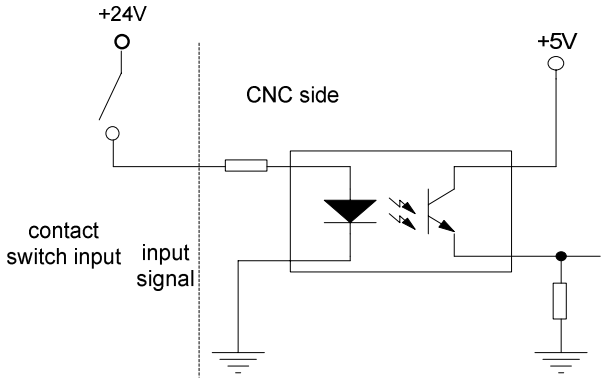



Fig. 2-7-1

The other is switch (transistor) input free of contacts; connection is shown in Fig. 2-7-2 and Fig. 2-7-3.

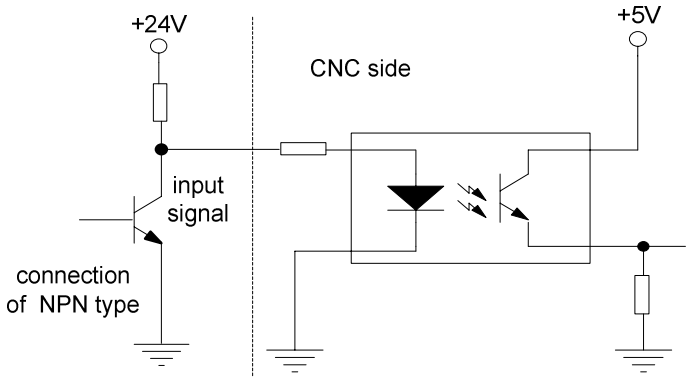



Fig. 2-7-2 NPN type

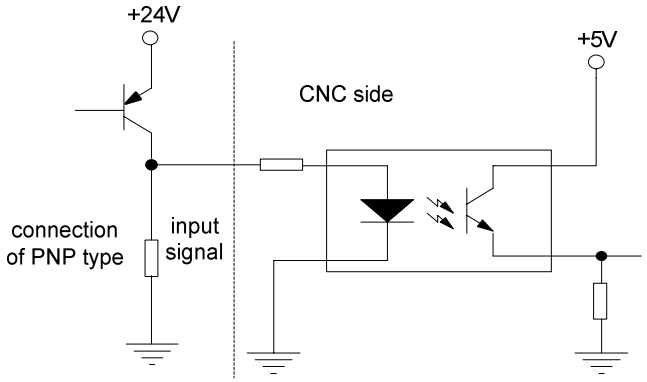



Fig. 2-7-3 PNP type

## 2.7.3 Output Signal

Output signal is used for the drive machine electrical wire side or the relay and the indicator on the machine panel side. When the output signal connects with 0V, the output function is valid (Y output signal is 1); cut off 0V, the output function is invalid (Y output signal is 0). The circuit is shown in the following Fig. 2-7-4:

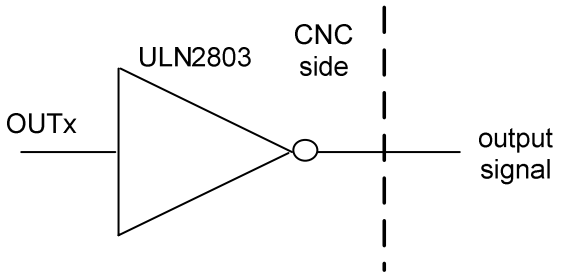



Fig. 2-7-4 Internal circuit of the output signals

Therefore, the signal has two output statuses: OV output or high resistance. The typical application is as below:

- Drive light diode

Use ULN2803 to output drive light diode and need the serial connection with one resistance, limit the current from light diode (normally 10mA), which is shown in Fig. 2-7-5:

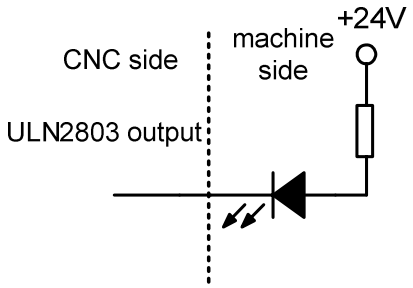



Fig. 2-7-5: Drive light diode

- Indicator in drive filament type

ULN2803 is used to output the indicator in drive filament type, and externally connect with one preheated resistance to reduce the current shock during break-over, and the value of the preheated resistance is based on that the indicator is off, which is shown in Fig. 2-7-6:

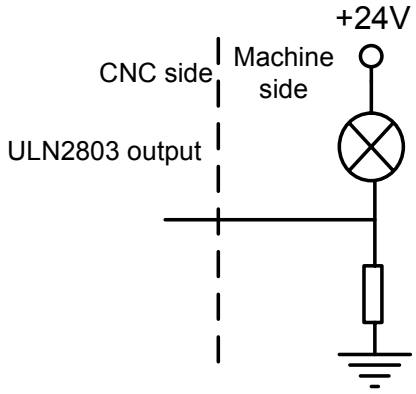



Fig. 2-7-6

- Drive inductive loading (such as the relay)

Output the drive inductive loading in ULN2803 type and it requires connecting the fly-wheel diode close to the circuit, which is to protect the output circuit and reduce the interference, which is shown in Fig. 2-7-7:

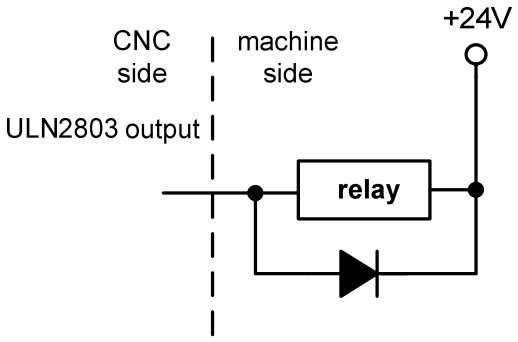


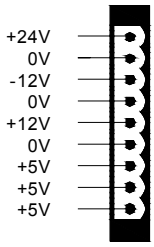

Fig. 2-7-7

## 2.8 Connection with the Power Supply

GSK988T uses GSK-PB2 power supply box, There are 4 groups of voltage: +5V (3A), +12V (1A), -12V (0.5A) and +24V (0.5A), and common port COM (0V).

### 2.8.1 Definition of Power Supply Interface

The interfaces of power supply are shown in Fig. 2-8-1 and 2-8-2:



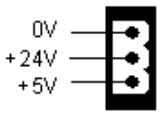




Fig. 2-8-1 power supply interface CN1 Fig. 2-8-2 power supply interface on the panel

## 2.8.2 Connection between GSK988T and GSK-PB2 Power Supply Box

When GSK988T is dispatched from the factory, GSK-PB2 power supply box and GSK988T power supply interface has been already connected, so the user just need to connect to 220V AC power supply. The connection between GSK-PB2 power supply box and GSK988T power supply interface is shown in Fig. 2-8-3:

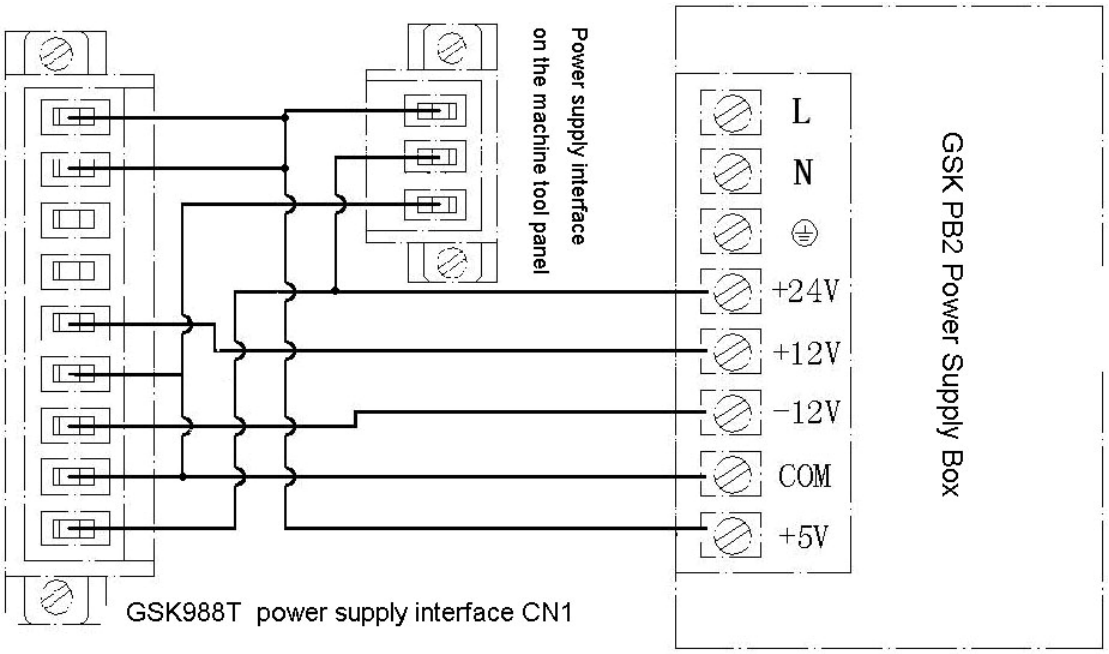



Fig. 2-8-3

## 2.9 Connection with the External Equipment

There are three interfaces on the left side of GSK988T LCD display screen: USB (flash driver), internet and RS-232 interfaces, which are shown in the following figure. All the three interfaces can be used for processing the file, two-way transmission between the system Para file and PLC file and upgrading the system software. Among them, the internet interface can also be used for remote monitor from PC to 988T system.

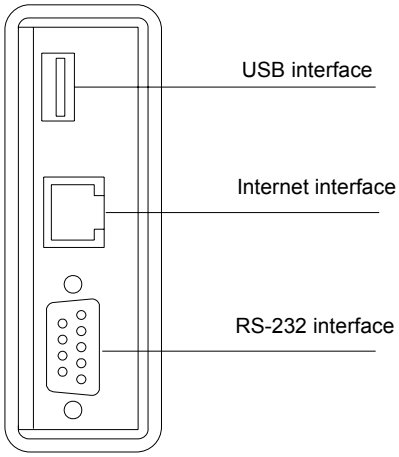
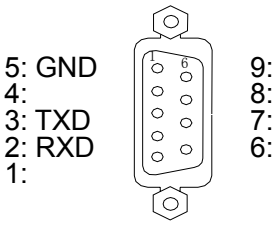



Fig. 2-9-1 GSK988T front panel interface

## 2.9.1 RS-232 Interface Definition

RS-232 communication interface:




| Pin No. | Signal |
|---|---|
| 2 | RXD |
| 3 | TXD |
| 5 | GND |

Fig. 2-9-2 RS-232 interface
(9 holes, D type female )

GSK988T executes communication through RS232 with PC (GSKComm-M communication software should be installed). The connection is shown in Fig. 2-9-3:

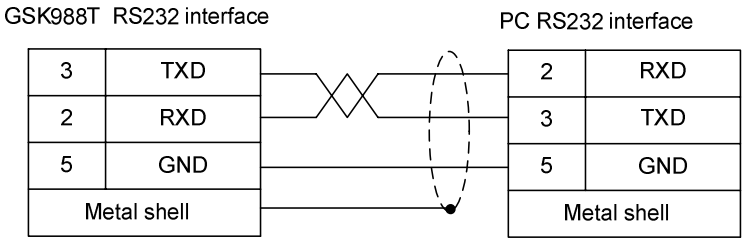
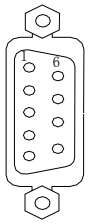



Fig. 2-9-3 Connection between GSK988T and PC

## 2.9.2 Definition of GSK-CAN Bus Interface

GSK988T is with GSK-CAN interfaces of two routes for connecting with the remote IO units and the servo drive unit with GSK-CAN communication function. Among them, CN53 (GSK-CAN serial bus A) is for communication between CNC and the servo drive unit to realize real-time monitor of servo parameter configuration and servo unit; CN52 (GSK-CAN serial bus B) is for communication between CNC and remote IO unit.

1：GND
2：CANn_L
3：
4：GND
5：



6：
7：CANn_H
8：
9：

Fig 2-9-4 GSKLink bus interface CN53 and CN52 (9 holes, D type female)

| Signal | Description |
|---|---|
| CANn_L | Low level of data difference signal |
| CANn_H | High level of data difference signal |
| GND | Signal ground |

## 2.9.3 Network Interface Definition

Network interface (standard):

| Pin No. | Signal | Pin No. | Signal |
|---|---|---|---|
| 1 | TXDLAN+ | 9 | LINK_LED |
| 2 | TXDLAN- | 11 | LAN_LED |
| 3 | RXDLAN+ | 10, 12 | VDD33 |
| 6 | RXDLAN- | 13, 14 | Chassis ground |

## 2.9.4 USB Interface Definition

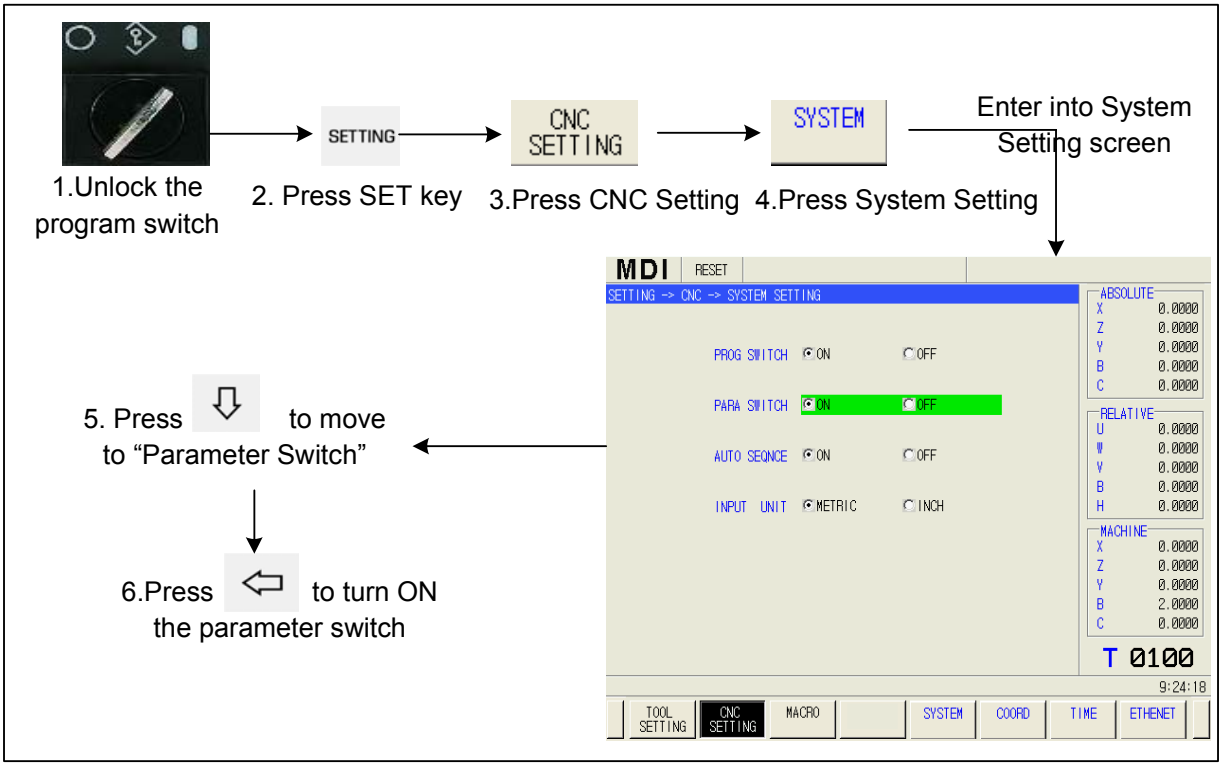
Main USB interface (standard):

| Pin No. | Signal |
|---|---|
| 1 | VCC(+5V) |
| 2 | USB_DN0 |
| 3 | USB_DP0 |
| 4 | GND |
| 5, 6 | Chassis ground |

# CHAPTER III MACHINE TOOL DEBUGGING-OPERATION

## 3.1 Parameter Setting

The modification, backup and recovery of GSK988T system parameters and servo parameters can only be done under such conditions: higher than 3rd management level; parameter switch is ON and the system is in MDI mode. The operation of turning ON the parameter switch is shown as follows:




**Note 1: After parameters are modified, the modification is valid to some parameters immediately; some will be valid only after power on again. For details, please refer to chapter 5 Parameter Instruction.**

**Note 2: To view or modify the servo parameters in CNC, please ensure the correctness of servo system connection and servo slave configuration.**

### 3.1.1 System Parameters

Press SYSTEM —> PARAM —> CNC PARAM to enter into system parameter setting screen.

The system parameters can be set and modified on this screen. The current set parameters can be backed up, and system default parameter or backup parameters can be recovered.

(1) Configuration parameter calling

On system parameter page, press > to extend the softkeys (shown in Fig. 1), then, press CONFIG to enter into parameter configuration list (shown in Fig. 2). On this page, select proper default parameter according to axes configurations by pressing key ⇧ or ⇩, then press

CONFIG PARAM to call the selected parameter, and restart the system.

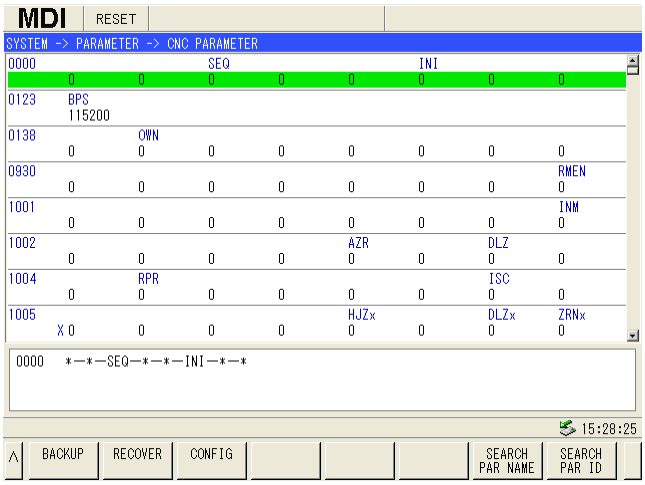



Fig. 1

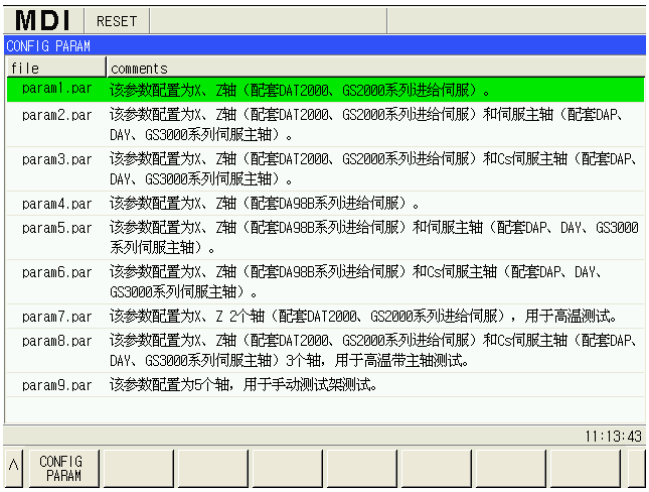



Fig.2

(2) Parameter searching

Method 1: Select a parameter to be viewed or modified through  ,  ,  or  ;

Method 2: Through parameter name: press softkey SEARCH PAR NAME and enter a parameter name, then press OK, the cursor will locate to the desired parameter;

Method 3: Through parameter number: press softkey SEARCH PAR ID and enter a parameter number, then press OK, the cursor will locate to the desired parameter.

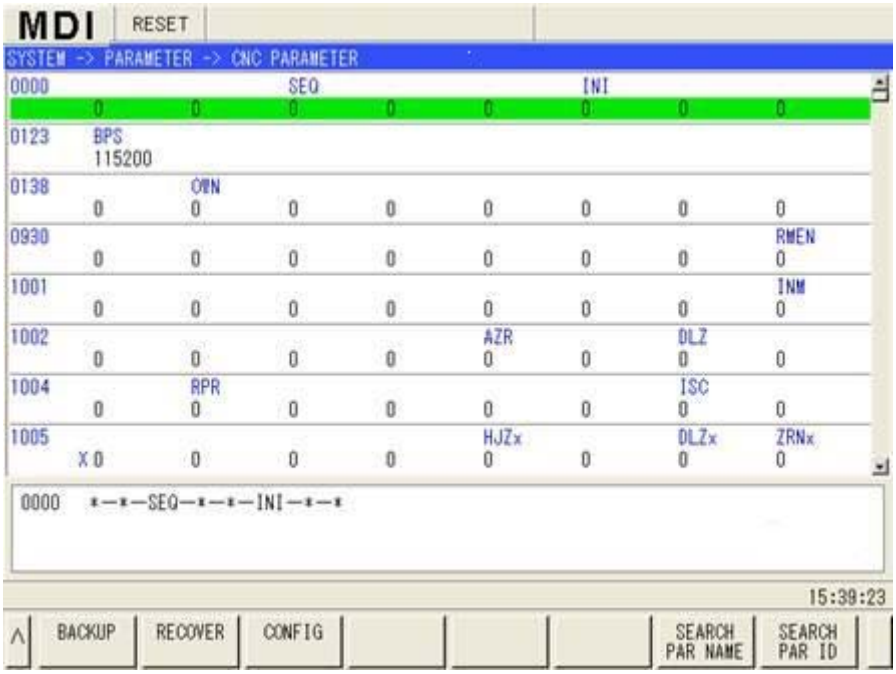


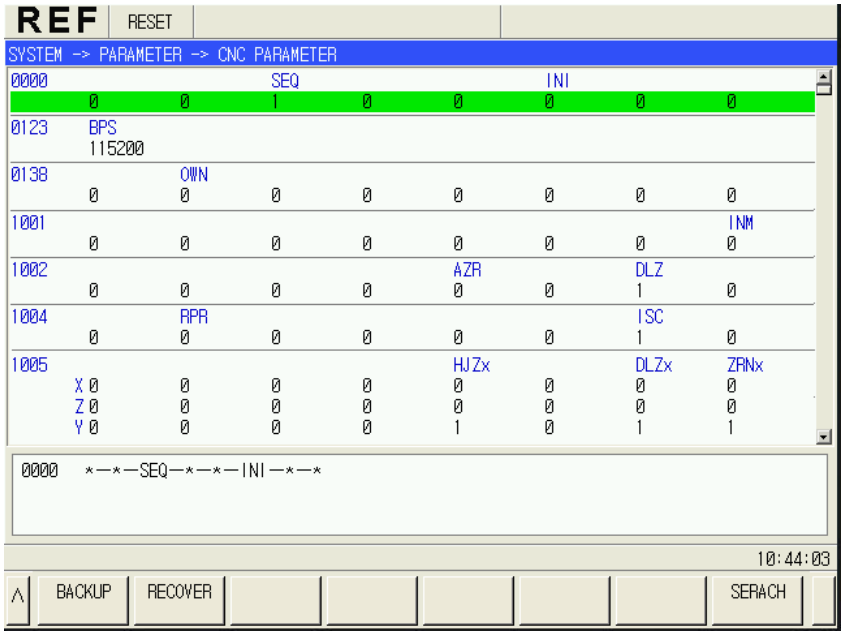

Fig. 3.1.1

**(3) Bit type parameters setting**

**Method 1:**

① Select the parameter to be modified through keys , , , ; or press SERACH softkey and input the parameter number, then press OK softkey, the cursor will move to the desired parameter.

② Press key INPUT to make the selected parameter modifiable. For example, the No.0000 parameter in the figure below:




③ Press the numeric keys to input 8 binary values, and then, press INPUT to complete the setting. (When the number input values is less than 8, fills the vacated bits with 0.)

④ Select other parameters through keys , , , .

**Method 2:**

① Select the parameter to be modified through keys , , , .

Select the bits to be modified through keys and .

② Press INPUT repeatedly, to switch the parameter bit between 0 and 1.

③ Move the cursor to complete the setting.

④ Select other parameters through keys , , , .

**(4) Numeric type parameter setting**

① Select the parameter to be modified through keys , , , ; or press SERACH softkey and input the parameter number, then press OK softkey, the cursor will move to the desired parameter.

② Press key INPUT to make the selected parameter modifiable.

③ Input the numbers to be set through numeric keys, then press INPUT to complete the setting.

④ Select other parameters through keys , , , .

**(5) Parameters backup and recovery**

Before modification, the parameters can be backed up through BACKUP softkey. When the modification is erroneous or the parameter does not need to be modified, press RECOVER softkey, the backup parameters or system default parameters can be recovered.

➢ **Parameter backup**

① Press BACKUP on the parameter screen, BACKUP PARAM Are you sure that back up parameters? will be displayed.

② Press OK to back up the current set parameters.

➢ **Parameter recovery:**

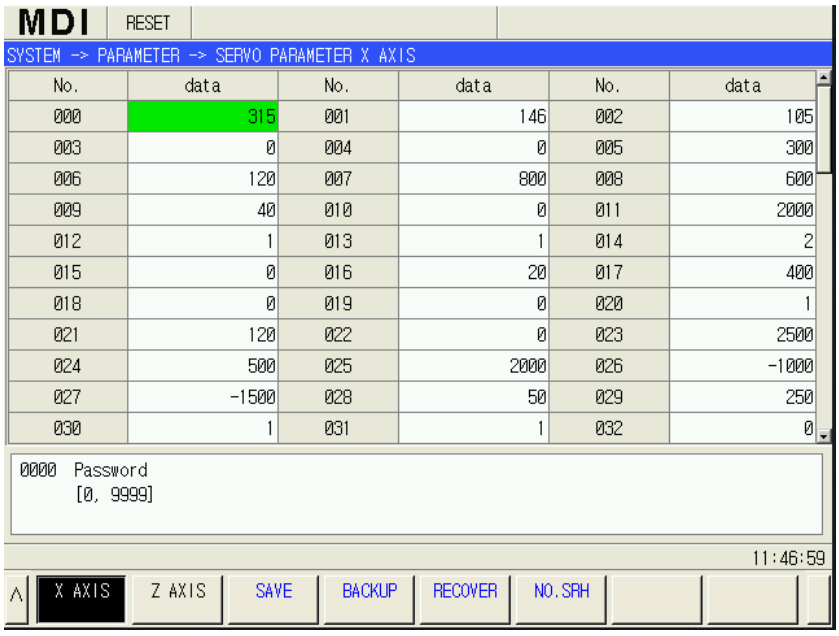
① Press RECOVER, RECOVER PARAM [USER ] Recover backup para [DEFAULT] Recover default para [CANCEL ] Cancel operation will be displayed.

② Press USER key to restore the backup parameters; Press DEFAULT to restore the system default parameters; press CANCEL to exit from the parameter screen.

## 3.1.2 Servo Parameters

**(1) Modification and save**

When the GSK-CAN communication is in normal state, on system screen, press PARAM —> SERVO PARAM, to enter into servo parameter screen.




Servo parameters can be viewed, modified, saved, backed up, restored and exported through

servo parameter screen on the CNC side. Default servo parameters can be restored.

**Axes switching:** Press X AXIS, Z AXIS or S AXIS to switch among the displayed servo parameters.

**Parameter modification:** Move the cursor to the desired position, then enter into a parameter value directly, and press INPUT to complete the modification.

**Parameter saving:** after the modification, press SAVE to save the parameter. The saved parameter remains the same after servo is turned ON again.

**Parameter backup:** Press BACKUP, the following dialogue box will pop up, then press OK to back up the file.


**Parameter recovery:** Press RECOVER, the following dialogue box will pop up, the press OK to restore the backup file.


**Default parameter recovery:** Press LOAD DEF., then a default value will be restored according to the setting value in PA1.

**Select effective parameter**: if the parameters are modified on the servo, after power-on, the system will issue prompt No.5030 "*the servo parameter in current parameter file of axis servo is inconsistent with the read servo parameter." Switch to the servo parameter screen this time, see Fig. 3-1-6 , then press SELCT EFF. PAR, see Fig. 3-1-7.

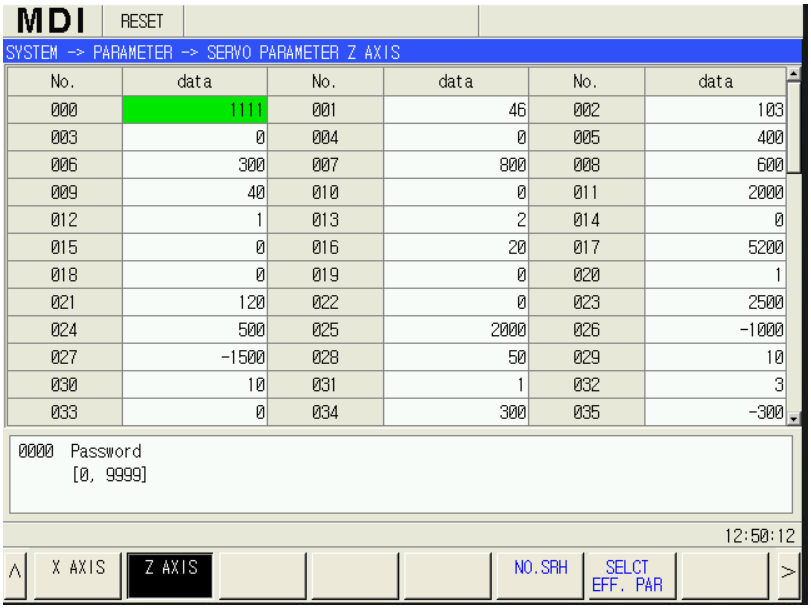



Fig.3-1-6

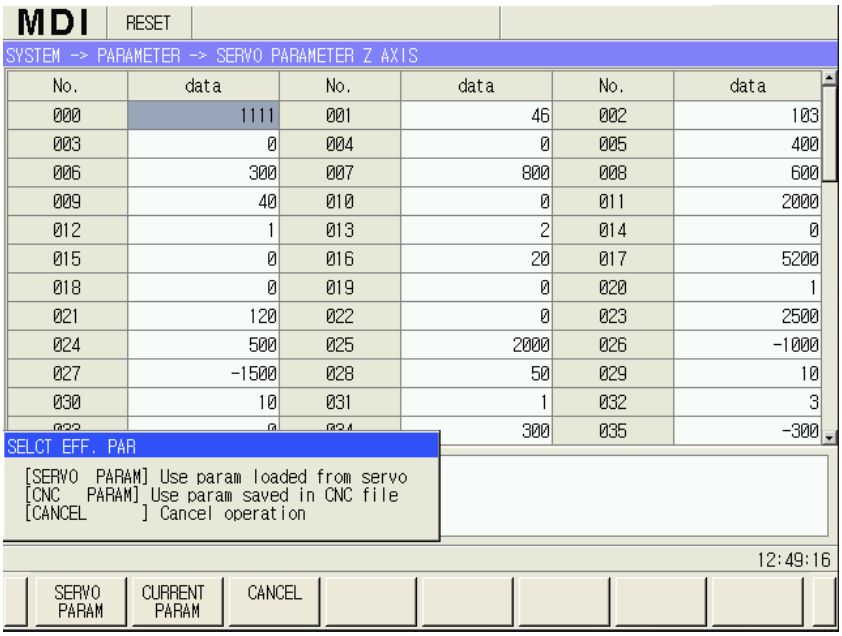



Fig. 3-1-7

Press CURRENT PARAM to validate the servo parameters in CNC; press SERVO PARAM to validate the parameters read from the servo; press CANCEL to return to the screen shown in Fig. 3-1-6.

**Note: CNC will read servo parameters directly, i.e. the parameters displayed on CNC servo page are the parameters on servo side;**

**(2) Restore motor default parameter**

**Method 1: Modify servo parameter PA1**

Refer to Appendix 2.1 (Feed Servo Motor Model List) and Appendix 2.2 (Spindle Servo Motor Model List) to find the index value in the current software version of drive unit which is connected to the motor according to the motor type given on the motor nameplate.

a. Modify servo parameter PA1 to make it equal to the searched motor index value.

b. After modifying PA1, the system automatically update the default parameter corresponding to the motor. The parameter value is valid immediately after modification.

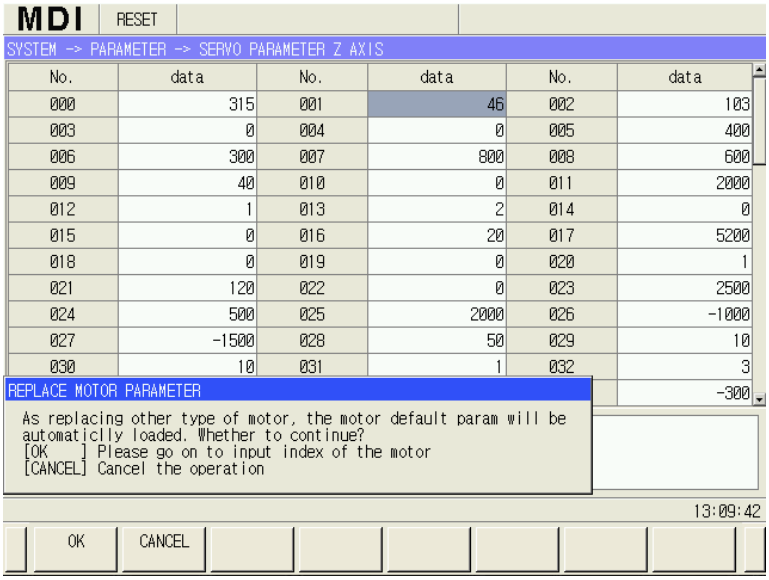



Fig. 3-1-8

**Method 2: Change motor model**

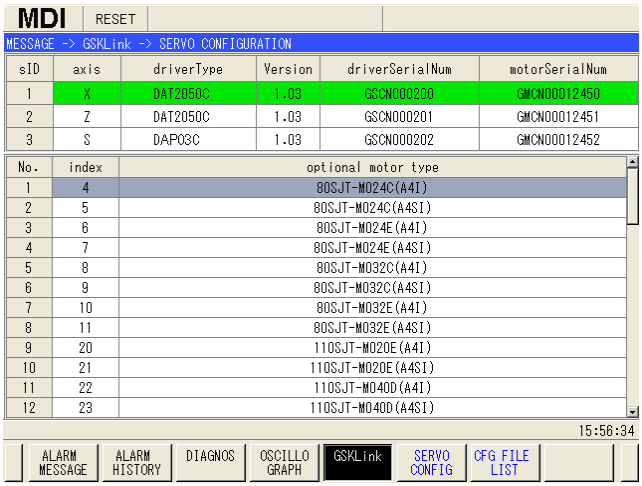



Fig. 1

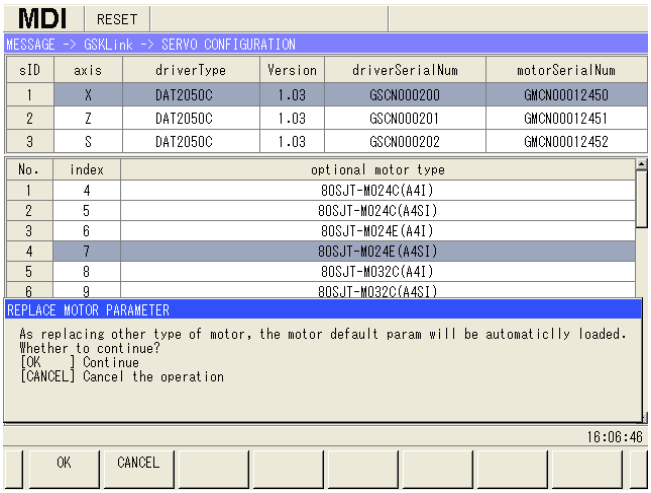


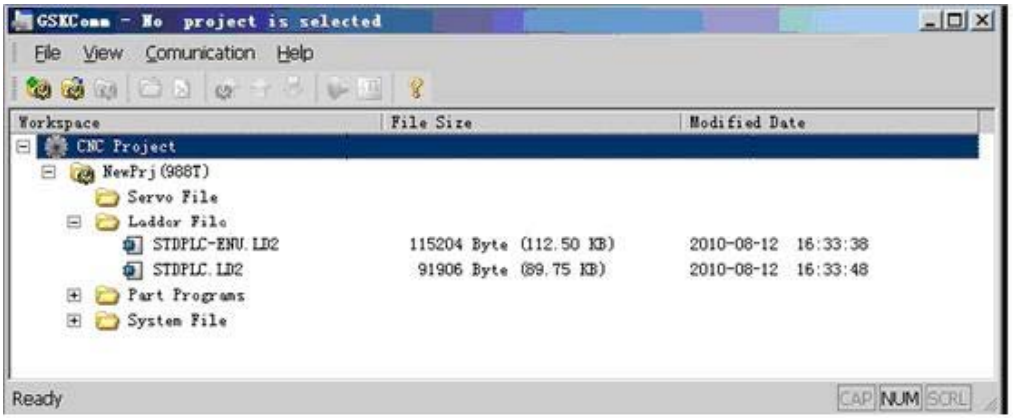

Fig. 2

- Press key MESSAGE to enter to information screen, then press GSKLink —> SERVO CONFIG to enter to slave configuration page; shown in Fig.1;
- Press SWITCH LIST or key CHANGE on MDI panel, so that the cursor can move in the optional motor type.
- Select a desired motor model, and press softkey REPLACE MOTOR, shown in Fig. 2; press OK or INPUT key on MDI panel to change motor model; the system will automatically renew the default parameters and stored them; shown in Fig. 2 (the current model is displayed in red);

## 3.2 Instruction of PC Communication Software GSKComm-M

This section is a simple instruction for the usage of the GSKComm-M during machine tool debugging. For the details, please refer to the *GSKComm-M Instructions* on the CD.

GSKComm-M is communication management software especially provided for the machine tool builders. The GSKComm-M screen is shown as follows. It can realize the following functions: upload and download of files between PC and CNC, DNC communication, CNC parameter editing, part program management and editing, viewing tool compensation data and screw pitch error compensation data, ladder diagram editing, etc. It is convenient, efficient and reliable.



## 3.2.1 Preparation for GSKComm-M

**(1) RS-232 series port connection**

- **Connection between PC and CNC**

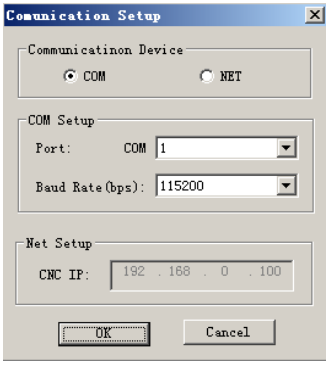
When both PC and CNC are power-off, the communication cable should be connected as follows: DB9 male is plugged into the RS-232 communication interface on the CNC; DB9 female is plugged into the 9 pins serial ports on the PC (COM0 or COM1).

- **Baudrate setting in CNC**

The baudrate is set by parameter No.0123. When data transmission is processed between CNC and PC, the setting value should not be less than 4800. (Ex-factory value:115200)

- **Baudrate setting in PC**

After the communication software is executed, left-click the menu and select “Communication－>Communication Setup”, shown in right figure.




**Setting**: select the serial port communication.

**Port selection**: select ports used for communication (COM1, COM2, COM3, COM4)

**Baudrate:** Select the baudrate (4800, 9600, 19200, 18400, 57600, 115200) (unit: bps)

**(2) Network connection**

- **Connection between PC and CNC:**

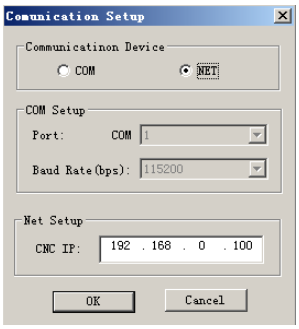
Connect the network port of GSK988T to the PC or router with normal network cable.

- **IP setting on CNC:**

Press SETTING —> CNC SETTING —> ETHENET, to enter into IP setting page to set the IP address and gateway.

- **IP setting on PC:**

After the communication software runs, left-click the menu, and select “Communication－>Communication Setup”, shown in right figure.




**Communication setting:** Select network communication.

**Network setting:** Fill in the IP set in CNC.

**(3) Authority setting**

During upload and download using GSKComm, corresponding authority should be set in advance, otherwise, the operation will fail.

| Data to be downloaded | CNC least authority level | Remark |
|---|---|---|
| PLC files | 2 level | |
| Parameters | 3 level | Parameter switch is ON |
| Part programs | 3 level | Program switch is ON |
| Macro variables | 4 level | Program switch is ON |
| Tool compensation data | 4 level | |
| Pitch error compensation data | 5 level | Parameter switch is ON |
| Tool life files | 5 level | |

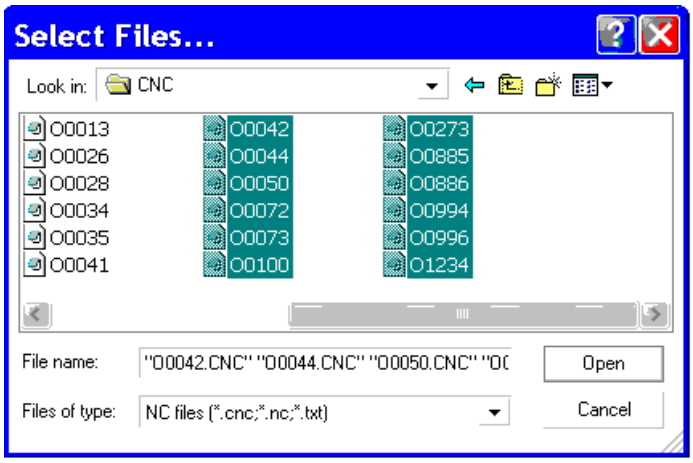
## 3.2.2 File Download (PC→CNC)

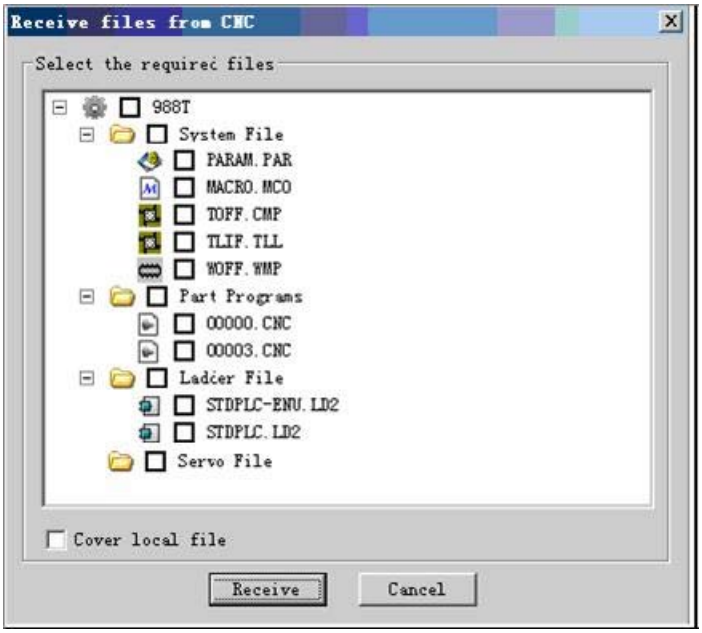
Through GSKComm, files in the PC can be transferred to CNC altogether or one by one.

**(1) Add files**

First, press the type of file to be added (for example, system file, part program file or ladder diagram file)

Then, press  or right-click, select “Add Files”, a dialog box for adding file will pop up (shown in the left figure), select the desired file (hold down “shift” key to select more files), then click “Open” to complete the action.




**(2) Add multiple files**

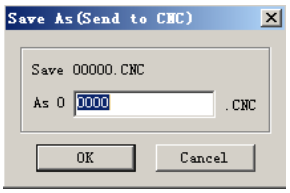
First, select the project to be transferred; then, click  or right-click the project and select “Send to CNC”, the following dialog box will pop up. (Shown in the right figure above)

In this dialog box, click the left options to select the files to be transferred. Arrow “—>” points to the file name saved in CNC, double-click it, you can change the file name.

Click “Start sending” you can transfer the selected file (with the saved file name) into CNC.

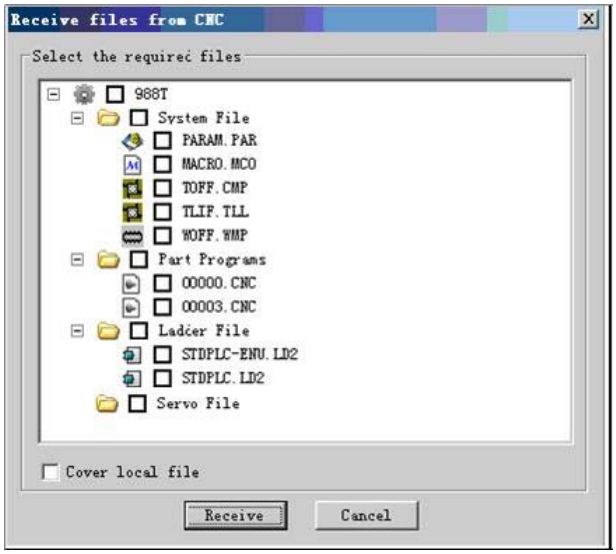
**(3) Download single file**

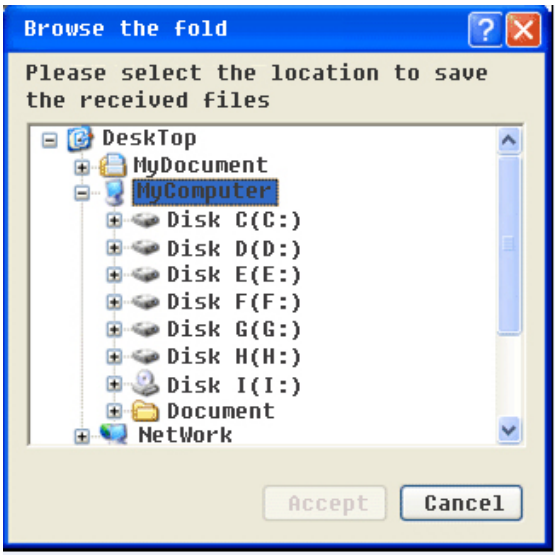
Select the file to be downloaded, and then click , or right-click the file and select “Send to CNC”, a dialog box will pop up. You can change the file name to be saved in the CNC, and then click “OK” to transfer the file.




## 3.2.3 Upload File (CNC→PC)

First, select a project, then, click , or select menu "Communication—>Receive Files from CNC”, a dialog box will pop up, (shown in the left figure below). Select the file to be uploaded, and then click “Receive”, a “Browse File” dialog box pops up (shown in the right figure below).



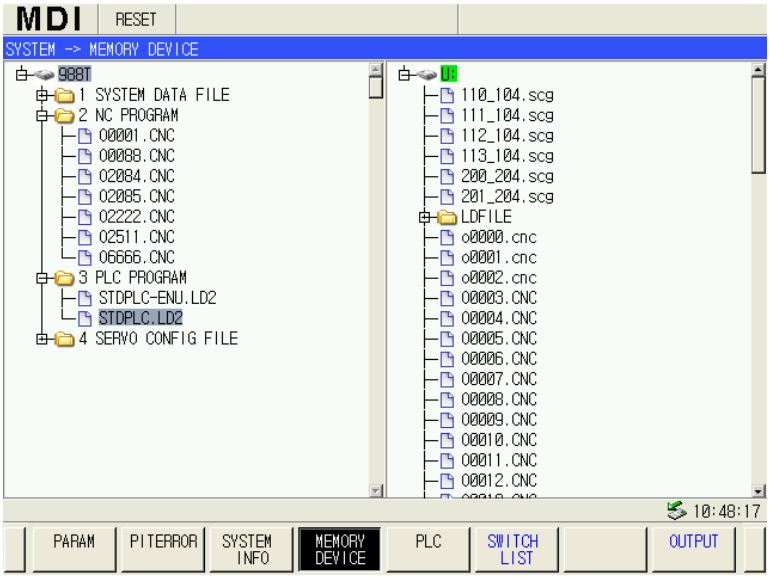

Select the file folder in which the uploaded file to be saved, and click “OK” to upload the selected file.

## 3.3 Usage of U Disk

The U disk function in GSK988T supports the bi-directional transmission of files involving machining program, PLC program, parameters, tool compensation data and pitch error compensation data. It can be operated on three screens: file management screen, program screen and ladder diagram screen.

### 3.3.1 File Management Screen

When U disk is already inserted in the USB port, press SYSTEM → MEMORY DEVICE to enter into file management screen.




Under this screen, bi-directional transfer of system files (system parameters, tool compensation data, pitch error compensation data etc.), ladder diagrams and part programs can be executed. The procedure is shown as follows:

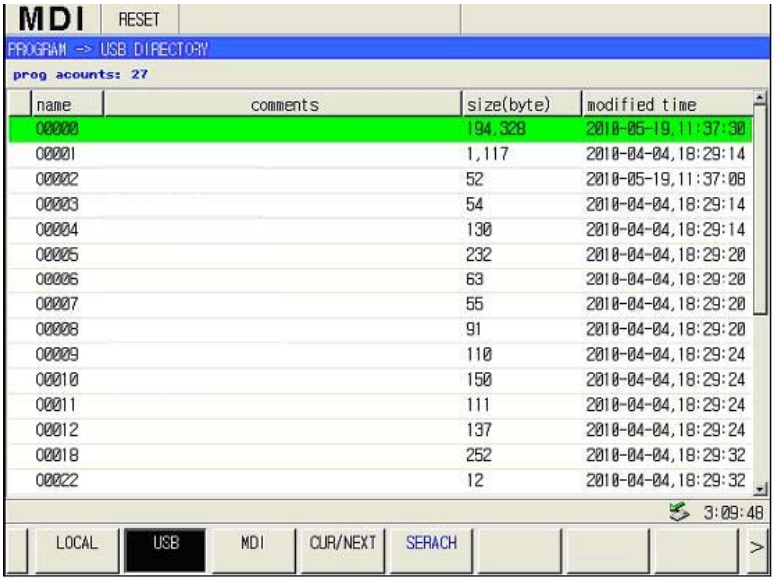
Press SWITCH LIST to switch between the system content and U disk content.

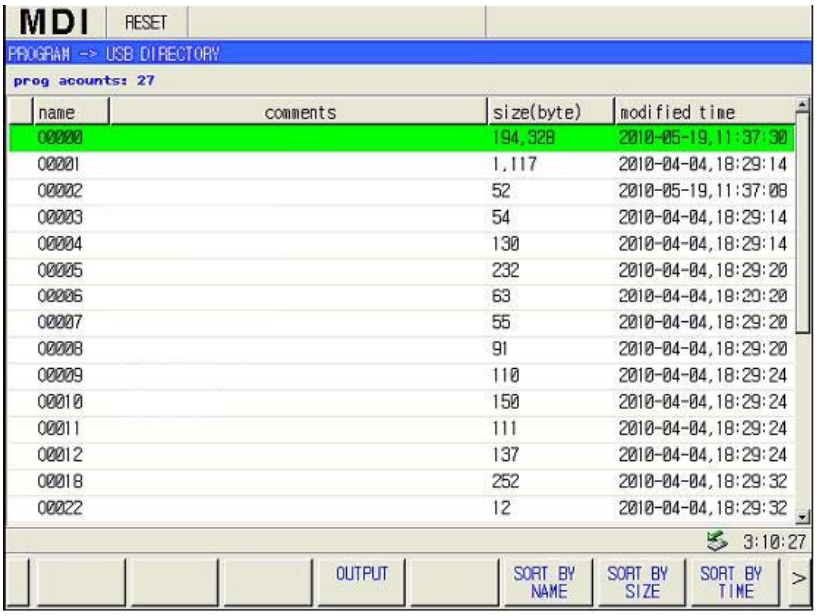
Press OUTPUT softkey to copy the selected program into local directory or U disk directory.

## 3.3.2 Program Screen

> The operation of U disk directory is the same as in the local directory. In this section, we only introduce the program transfer in U disk. For details, please refer to GSK*988T User Manual.*

When the system USB port is inserted with U disk, press PROGRAM to enter into program directory (left figure below), press >, the extended softkeys will be displayed. Then, press USB to enter into U disk directory screen, operations to the programs in U disk directory such as load, open, copy, paste, create, save as, delete, rename, search, etc, can be performed.

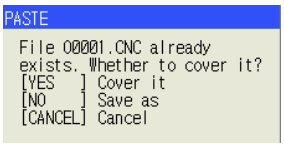





➢ **Program bi-directional transmission**

① Press LOCAL and USB to switch between the local directory and U disk directory.

② Move the cursor to the program to be copied through ⇧ and ⇩




Then, press > to view the extended softkeys (the right figure above), Press OUTPUT to copy the selected program into local directory or U disk directory.

③ When the copied program already exists, a dialog box pops up (see the right figure). Press "Yes" softkey to cover the existed program; or press "No", a dialog box


pops up, then input the program name for saving; press "Cancel" to cancel the operation.

**Note 1: When transmission is made from the U disk directory to local directory, the machining programs can be read only when it is stored in the root directory "NCPROG" file in the U disk.**

**Note 2: When transmission is made from local directory to the U disk directory, if the "NCPROG" file does not exist in the U disk, the file will be created automatically, and the machining programs will be output to the files.**

## 3.3.3 PLC Screen

When the USB port is inserted a U disk, press PROGRAM on the ladder diagram screen, the screen is shown in Fig. 3-3-4 (Local directory screen). Press USB to switch to the U disk directory screen, shown in Fig. 3-3-5.

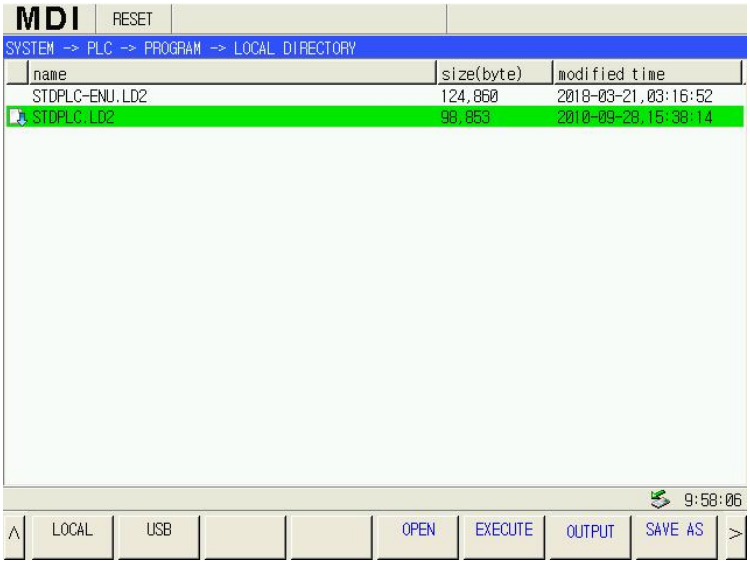



Fig. 3-3-4

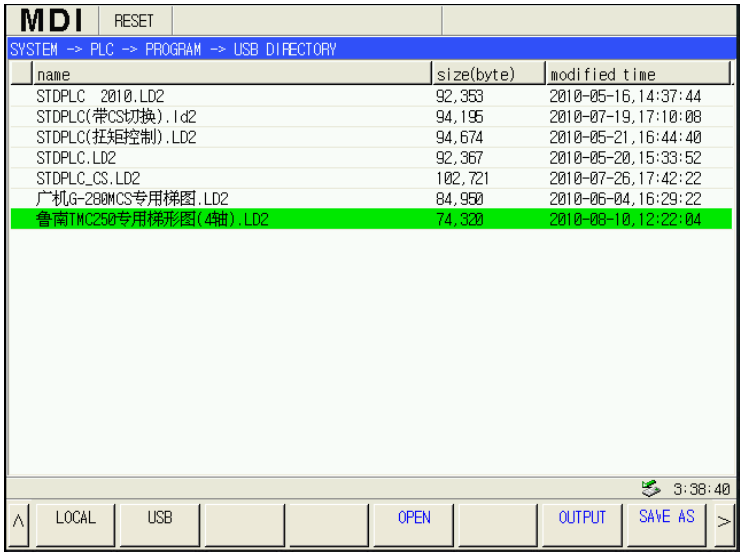



Fig. 3-3-5

Programs in the U disk directory can be copied to local directory through softkey OUTPUT, vice versa.

Take the U disk for example, the procedures are shown as follows:

① Press softkey USB to enter into U disk directory;

② Select the ladder diagram programs to be copied through ⇧ and ⇩, then, press OUTPUT to copy it to the local directory.

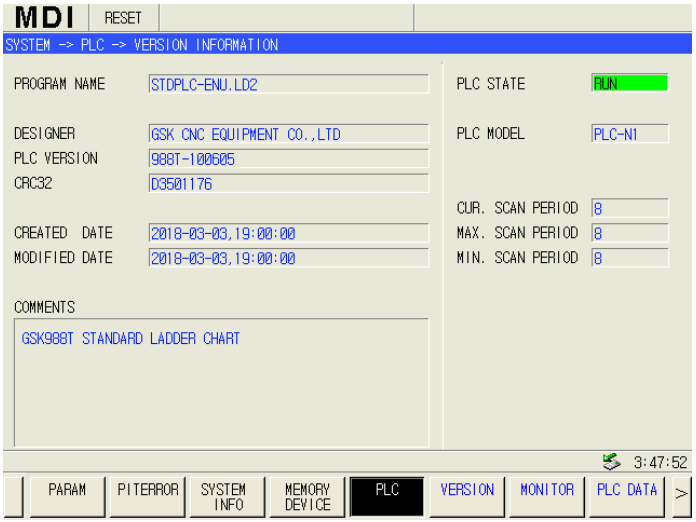
**Note 1: When PLC transmission is made from the U disk directory to local directory, the PLC programs can be read only when it is stored in the root directory "LDFILE" file in the U disk.**

**Note 2: When PLC transmission is made from local directory to the U disk directory, if the "LDFILE" file does not exist in the U disk, the file will be created automatically, and the PLC programs will be output to the files.**

## 3.4 PLC Operation

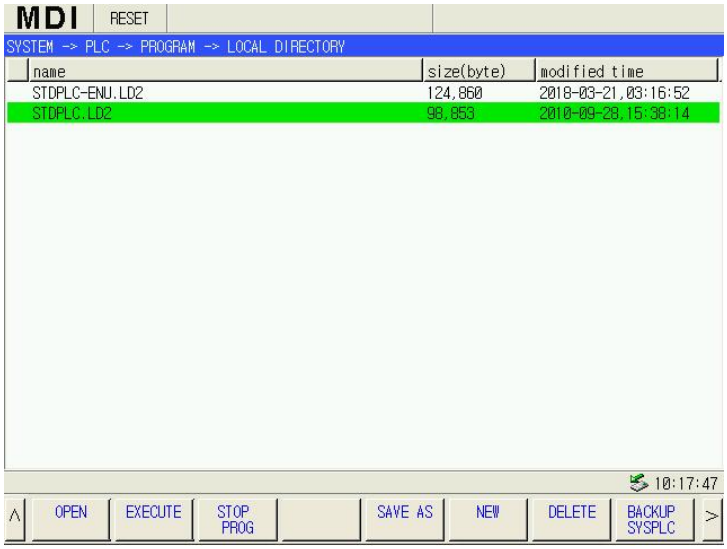
Press function key SYSTEM and then press softkey PLC to enter into PLC screen. This screen includes pages such as version information, monitor, PLC data, PLC state, program directory. Press corresponding softkeys, you can view the desired content.

After entering the PLC screen, the contents of VERSION is displayed. The version page includes the information about the PLC version, current running PLC program and the running state, etc.




### 3.4.1 PLC Execution and Stop

On PLC screen, press softkey >, then press PROGRAM → LOCAL, the following screen is displayed:




On this page, you can select PLC program through ⇧ and ⇩, then operations such as edit, running, stop, save, create, delete and backup can be performed.

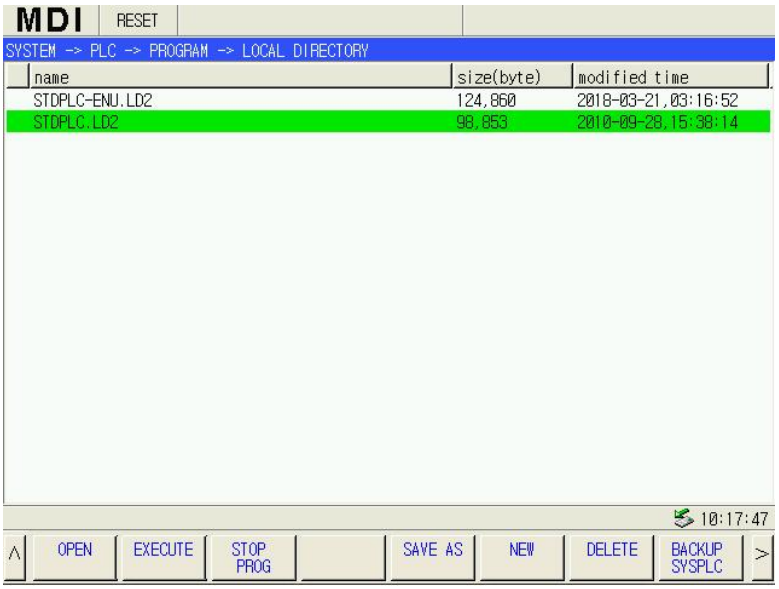
- **Execution of PLC programs**

  Select the PLC program through ⇧ and ⇩, then press EXECUTE to start running.

**Note: The current running PLC program is marked with .**

➢ **Stop PLC program execution**

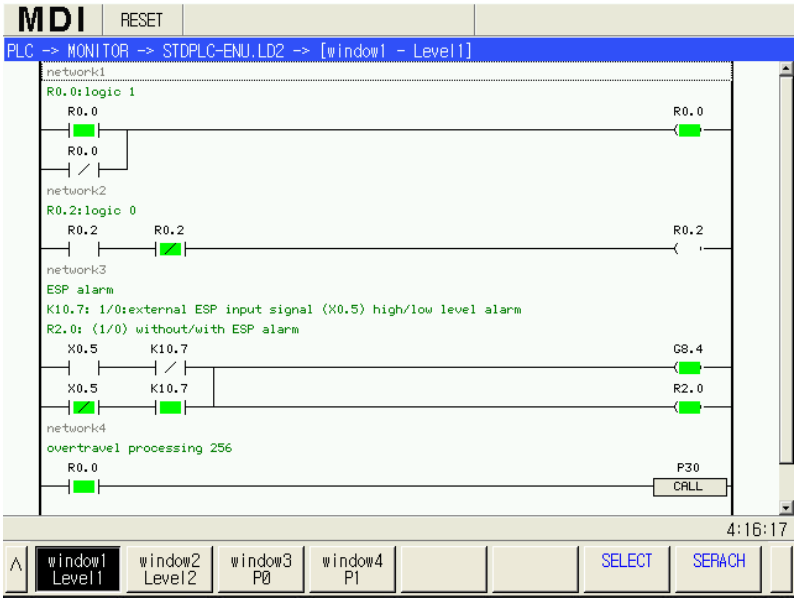
Move the cursor to the current running program through ⇧ and ⇩, then press STOP PROG, the system will be in no PLC running state.




## 3.4.2 PLC Monitoring and Diagnosis

### (1) Monitor the PLC program state

On the PLC screen, press softkey MONITOR to enter to the monitoring display screen for the current running PLC program.




You can view the state of current contact, coil conducting ON/OFF and the current value of timer and counter. When the contact and coil conduction is ON, it is indicated by green color; if not, the color is the background color of the screen. For example: X0.5 ⊣■⊢ means the contact X0.5 is conducted, Y25.2 ⊣( )⊢ means the coil Y25.2 is not conducted.

➢ **View blocks**

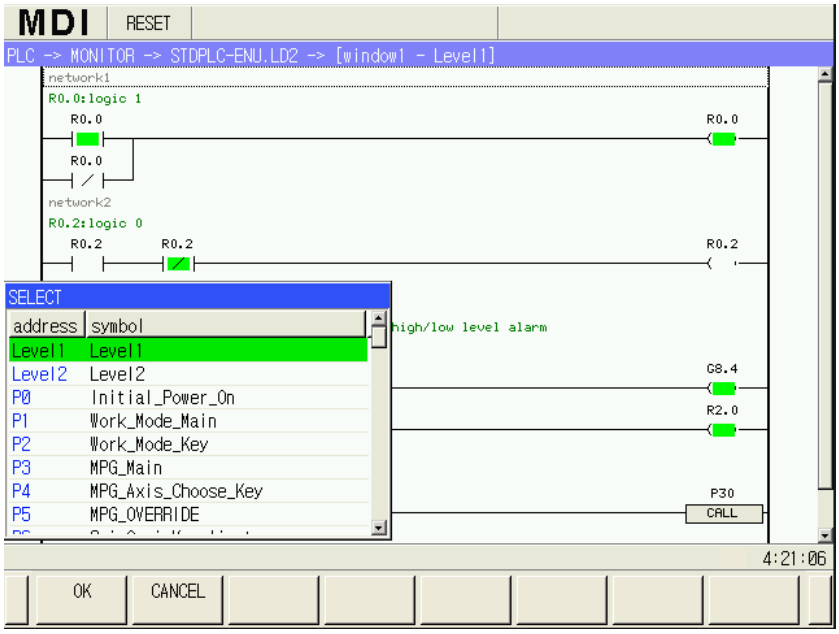
On monitoring page, there are four softkeys for monitoring four blocks: window1 Level1, window2 Level2, window3 P0, window4 P1. Each of them corresponds to a block and the corresponding PLC will be displayed on the screen.

**Note 1: Softkeys for windows 1~4 are shortcut keys which enable quick view of the corresponding blocks.**
**Note 2: The blocks corresponding to windows 1~4 can be changed, but the change will not be effective after power-off. The default block after power-on is the first four blocks in the PLC programs.**

➢ **Select block**

① Select the screen as needed.

② Press softkey SELECT, the following figure is displayed:



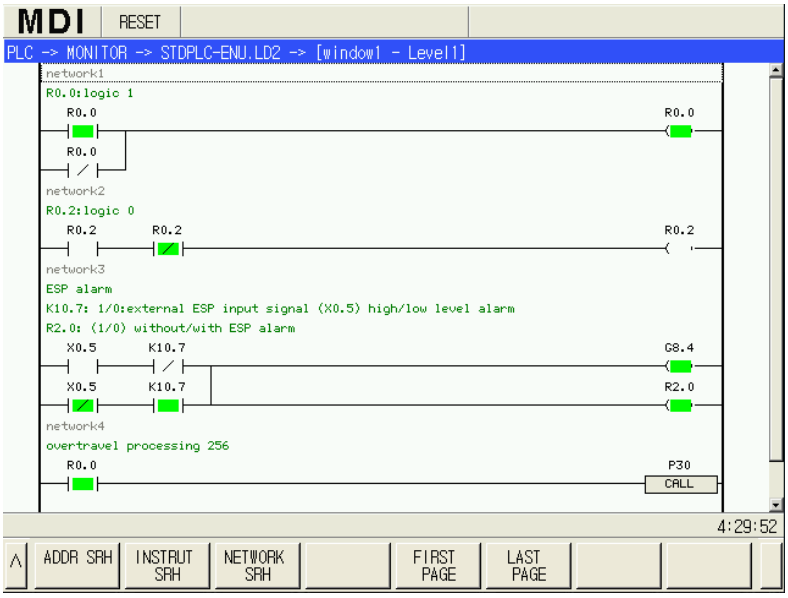

③ Press keys , , , , to select the desired window.

④ Press softkey OK to complete the selection, then, return to the previous menu; press softkey CANCEL to cancel the selection and return to the previous menu.

➢ **Search for parameters, commands and network**

① Select the window in which the command, parameter or network to be searched, i.e. press window1 Level1, window2 Level2, window3 P0, window4 P1 to display the corresponding blocks of PLC program, then, search for the command, parameter or network.

② Press softkey SERACH to enter to search page, shown as follows:

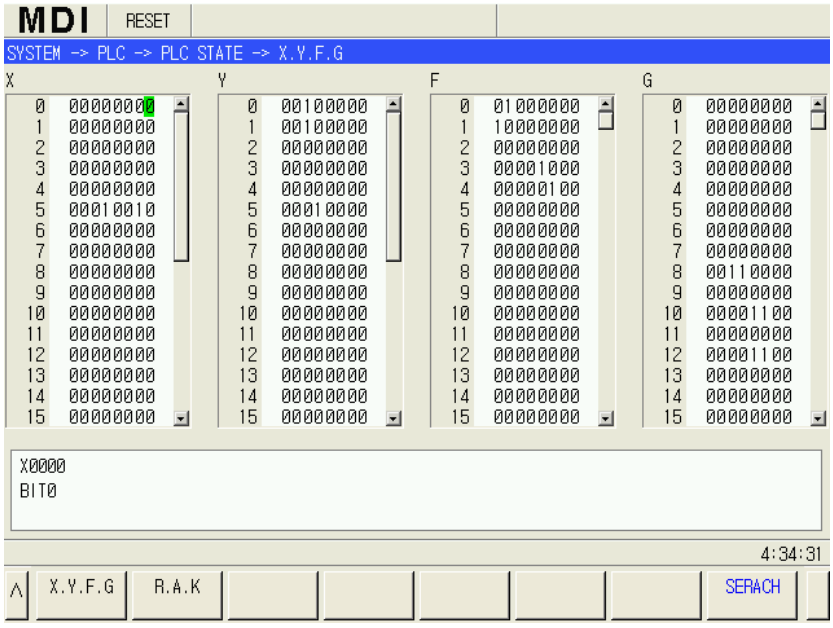



③ Press softkeys ADDR SRH, INSTRUT SRH, NETWORK SRH respectively you can search for the parameters, command, network on the corresponding screen, and move the cursor to the corresponding position.

④ Press FIRST PAGE, LAST PAGE to move the cursor to the first line and last line of the block.

**(2) PLC I/O state diagnosis**

On PLC screen, press > and PLC STATE to enter to PLC state display page, as shown in the following figure.




**Note: The notes on diagnosis screen are information of current PLC; different diagnosis information corresponds to different PLC; the current displayed notes in the above figure is defined by PLC editor;**

➢ **View the state of signals**

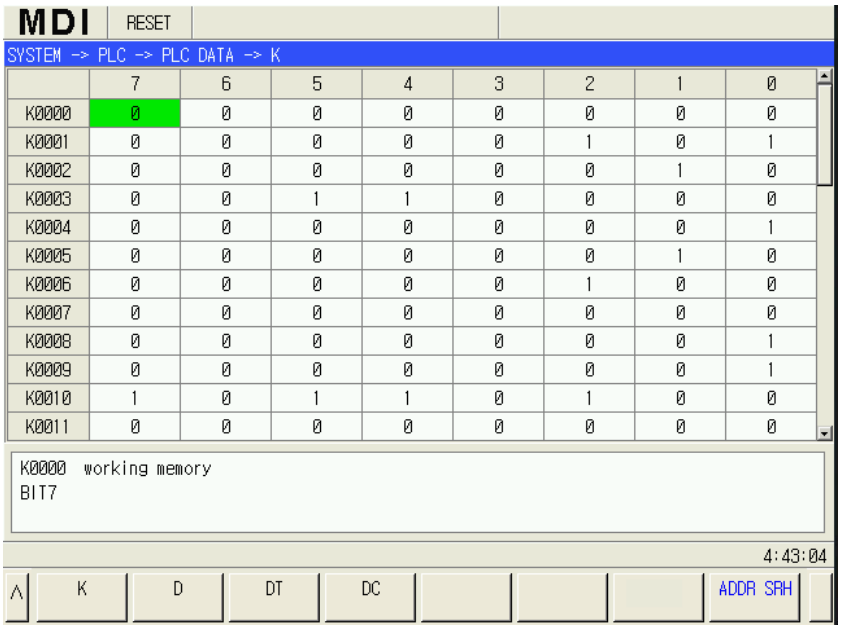
Press softkey [X.Y.F.G], the state of signals X, Y, F, G will be displayed on the screen; press softkey [R.A.K], the state of signals R, A, K will be displayed.

Press ⇦ or ⇨ to switch between softkeys X, Y, F, G signal and R, A, K signal.

Press , , ⇧, ⇩ to view the information about X, Y, F,G signals or R, A, K signals.

## 3.4.3 PLC Data Viewing and Setting

On PLC screen, press [PLC DATA] to enter into PLC data state page. It includes the setting of K, D, DT, DC parameters.




| | 7 | 6 | 5 | 4 | 3 | 2 | 1 | 0 |
|---|---|---|---|---|---|---|---|---|
| K0000 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| K0001 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 1 |
| K0002 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 |
| K0003 | 0 | 0 | 1 | 1 | 0 | 0 | 0 | 0 |
| K0004 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 |
| K0005 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 |
| K0006 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 |
| K0007 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| K0008 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 |
| K0009 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 |
| K0010 | 1 | 0 | 1 | 1 | 0 | 1 | 0 | 0 |
| K0011 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |

**(1) PLC data saving**

Through keys [K], [D], [DT], [DC] to select the PLC parameter type, then press [SAVE] to write the parameter into PLC initial value.

> **Note 1: When a PLC parameter is modified, the modified value is saved in system rather than written in PLC; therefore, this PLC parameter will not be exported with PLC;**
>
> **Note 2: After softkey [SAVE] is pressed, this PLC parameter can be exported with PLC.**

**(2) K parameter setting**

On PLC data page, press [K] softkey to enter into parameter K setting page, shown in the figure above:

**Parameter setting method:**

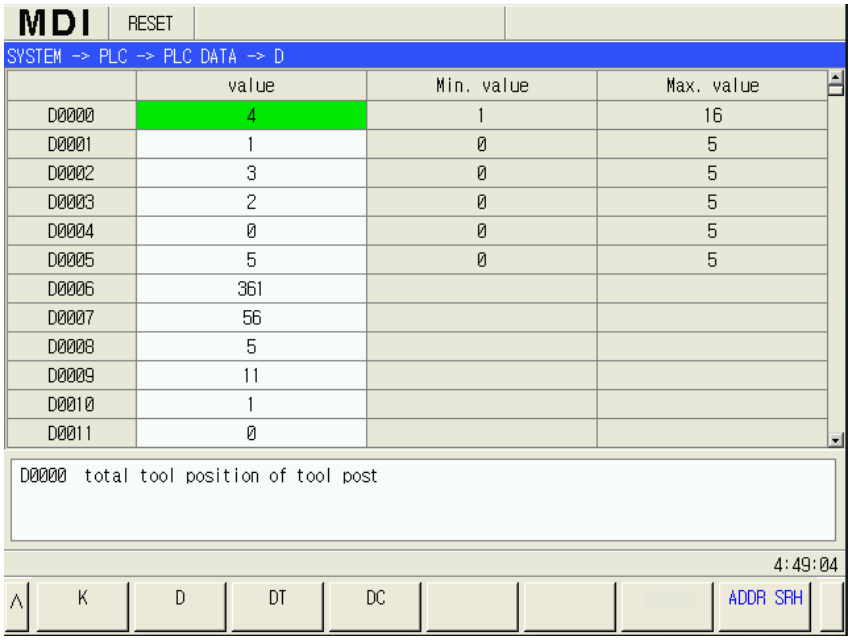
① Press keys , , , , , , you can select the parameter statues bit to be modified; or press softkey ADDR SRH to input the K variable to be selected, then press OK and move the cursor to the parameter. The meaning of the status bit is displayed at the bottom of the screen.

② Press INPUT repeatedly in K variable status bit to switch between 0 and 1, modify the status of the selected K parameter status bit.

③ Press , , , to move the cursor to complete the modification.

**(3) D parameter setting**

On PLC data page, press D to enter to the D parameter setting display page, shown in the following figure.




**Parameter setting method:**

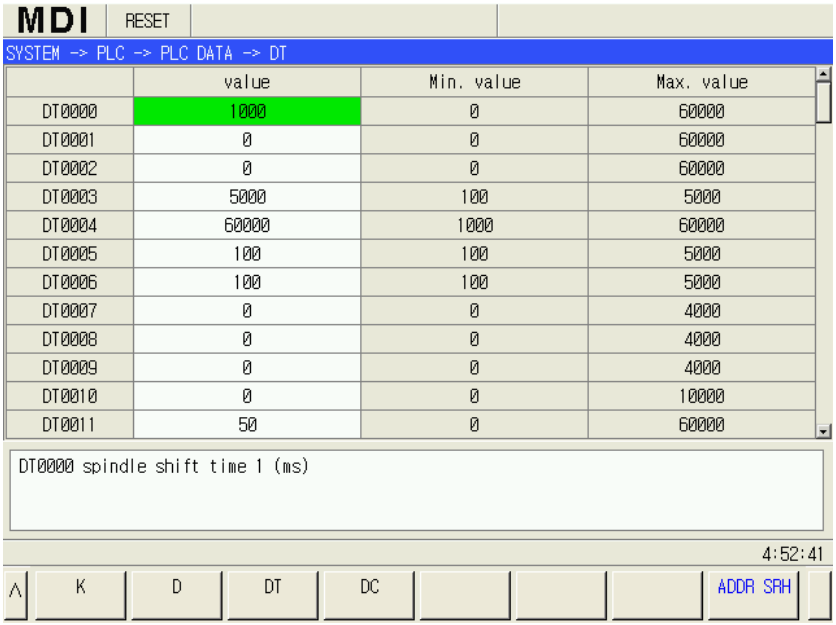
① Press keys , , , , , , you can select the D parameter to be modified; or press softkey ADDR SRH to input the D parameter to be selected, then press OK and move the cursor to the parameter. The meaning of the status bit is displayed at the bottom of the screen.

② Press INPUT to enable the selected D parameter to be modifiable.

③ Input the modified value, and press INPUT key again to finalize the modification.

**(4) DT parameter setting**

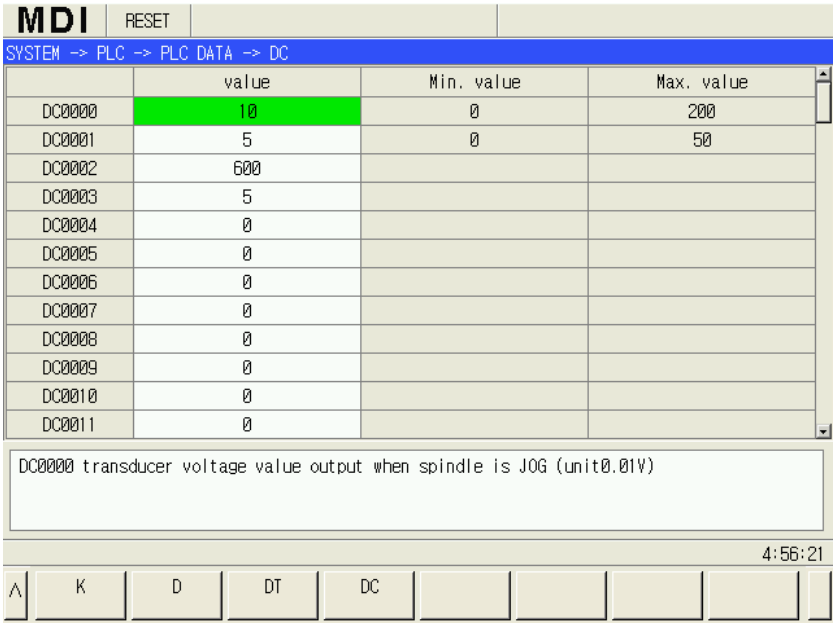
On PLC data page, press DT to enter to the DT parameter setting display page, shown in the following figure.




**Parameter setting method:** the same as D parameter setting

**(5) DC parameter setting**

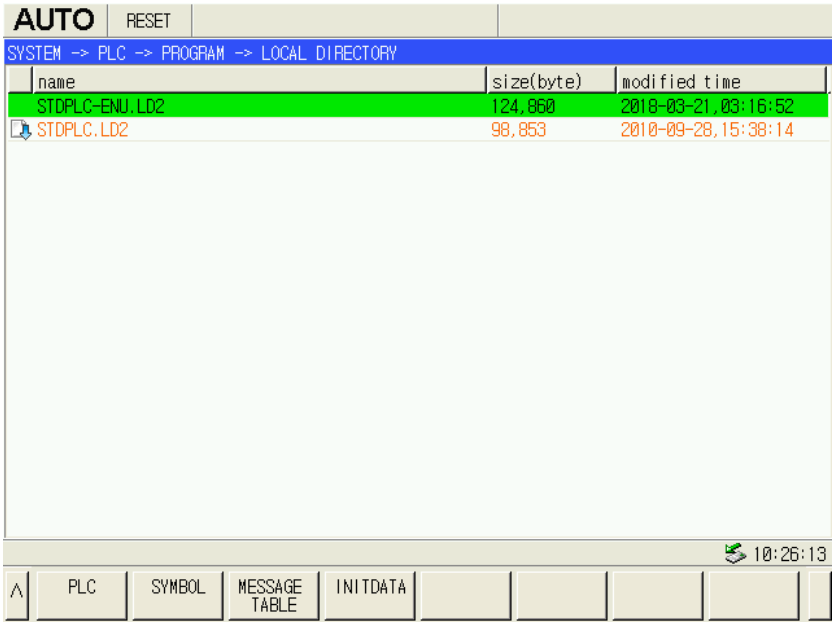
On PLC data page, press DC to enter to the DT parameter setting display page, shown in the following figure.




**Parameter setting method:** the same as D parameter setting

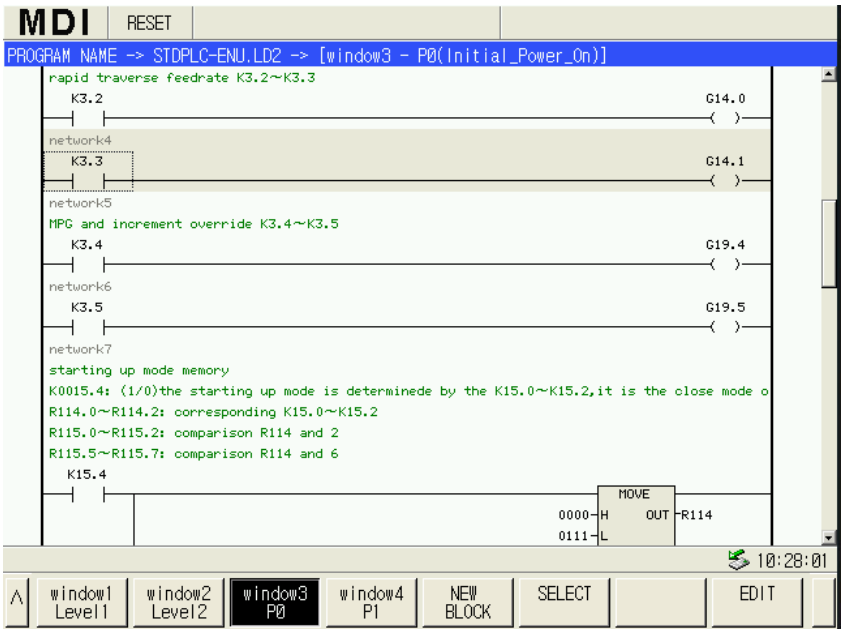
## 3.4.4 PLC On-line Modification

On PLC screen, press > → PROGRAM → LOCAL to enter into PLC program directory page, press ⇧ and ⇩ to select the program to be edited, then press softkey OPEN to enter into edit page. You can edit the ladder diagram, symbol table, information display table, initialized data table.




**(1) View and edit PLC**

On the page shown in the above figure, press PLC to enter into PLC display and editing pages. Shown as follows:




In this figure, the position where the cursor locates is indicated with dashed frame, and the background color of the network area is darker.

Press window1 Level1, window2 Level2, window3 P0, window4 P1 respectively, the corresponding blocks will be displayed and the block name will be displayed on the upper area of the window.

① **Select blocks to the windows**

Press window1 Level1, window2 Level2, window3 P0, window4 P1 according the block to be modified, and then, press SELECT you can select a block to be displayed on the corresponding window.

Press , , , to select the block, then press OK to complete the action and return. At this time, the address of corresponding block is shown on the screen. For example,

window1 Level1 indicates that the window 1 corresponds to the Level 1 block, when window1 Level1 is pressed, the content of Level 1 block is displayed on the screen.

② **Create a new block**

Press window1 Level1, window2 Level2, window3 P0 or window4 P1 to select a window on which a block is needed to be created, then, press NEW BLOCK and enter the block name, press OK to complete the action.

③ **Edit program**

Select a window to be modified, then press EDIT to enter into edit program page (see Fig. 3-4-14), press > to display the extended keys.

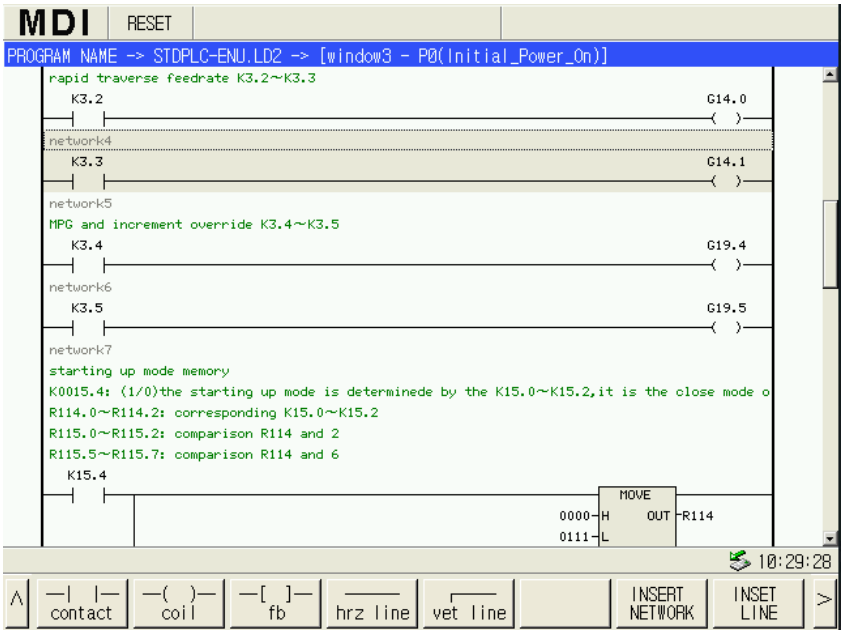



Fig. 3-4-14

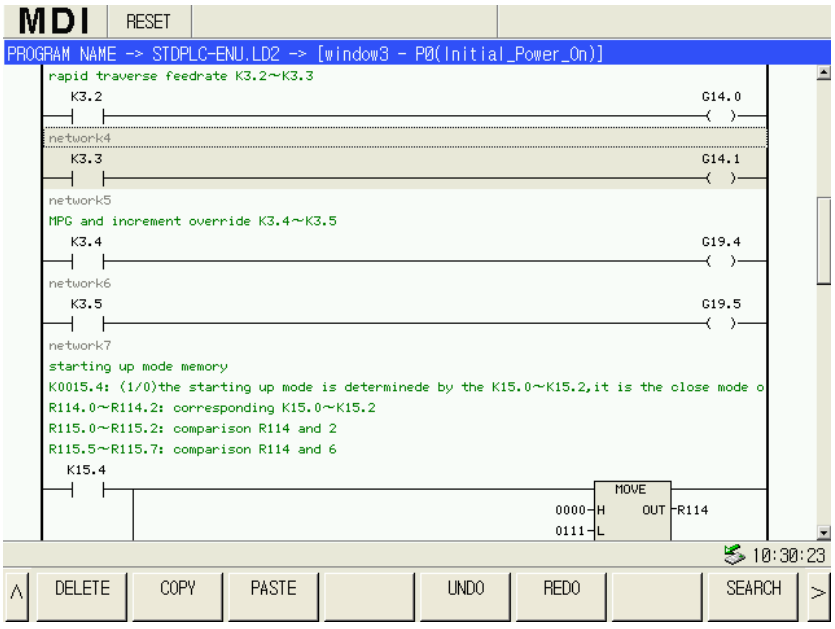



Fig. 3-4-15

A. Press , , , , to move the cursor to the line to be modified, and press



keys to move the cursor to the position to be edited.

B. Press 

to insert a network in front of the network where the cursor locates.

C. Press 

to insert a line behind the line where the cursor locates.

For example:

● Press 

, the following figure is displayed.

Move the cursor to the “Type” selection box at this time, then, press 

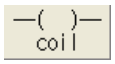


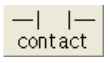
to switch between the normally-open contact and normally-closed contact.

Press 

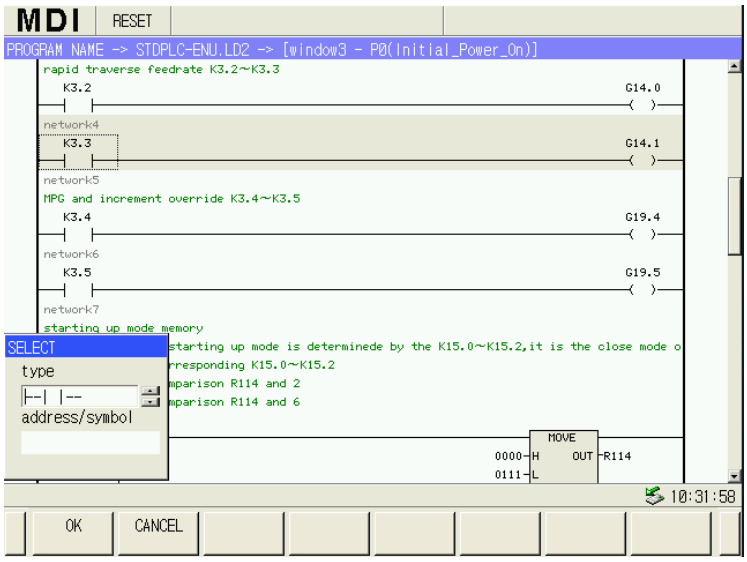
to switch to the “Add/Symb” edit box, and enter the address/symbol, then press 

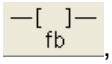
softkey or “Input” key to complete the action.

● Press softkey 

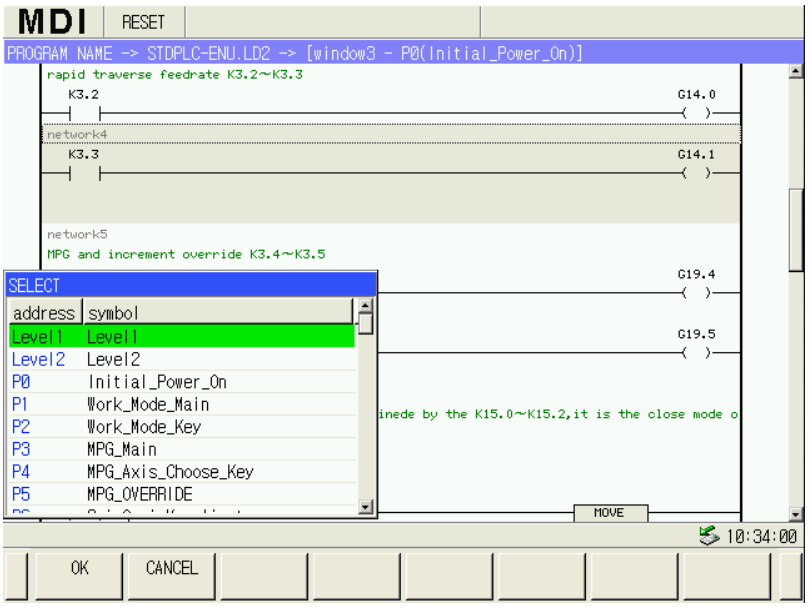
, the following operation is the same as 

softkey.

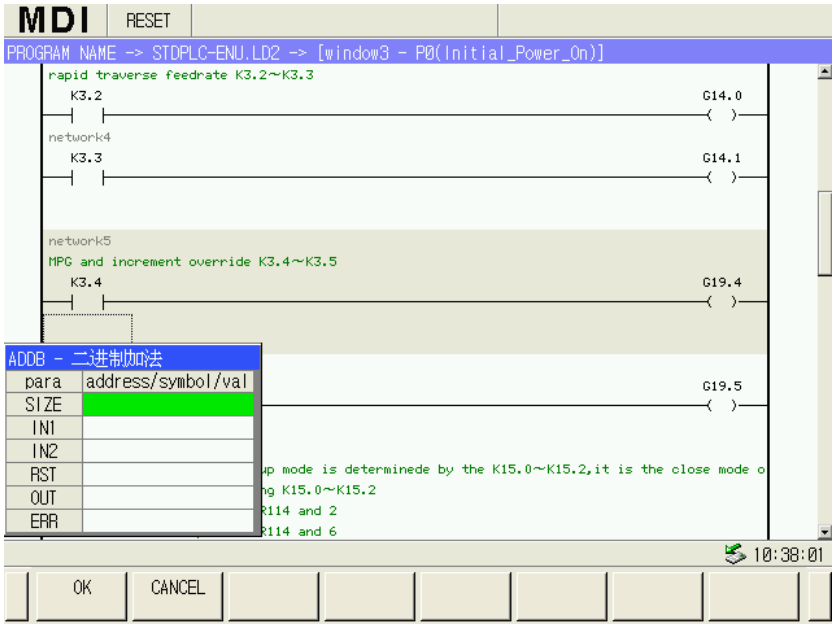



● Press softkey 

, the following figure is displayed:



Press ⇧, ⇩ to select the function command to be inserted, for example, ADDB in the figure above, press OK softkey or press INPUT, the following figure is displayed:




Press ⇧ or ⇩ in the edit box to select the parameter to be edited, then enter address or data, and press INPUT to confirm the modification, after all the editing is done, press softkey OK to complete the action.

● The operation of other function commands is the same as described above.

You can delete, copy, paste and edit all the components, lines and network at this time. You can cancel the last step or re-do the step.

● Press softkey SERACH to switch to the search page, then you can press ADDR SRH, INSTRUT SRH, or NETWORK SRH and enter relevant parameters, command, or network. Move the cursor to the position where the searched parameter (or command, network) locates, then press FIRST PAGE, LAST PAGE or move the cursor to the head of a block or end of a block.

● In a similar way, press DELETE to delete component, line or network.

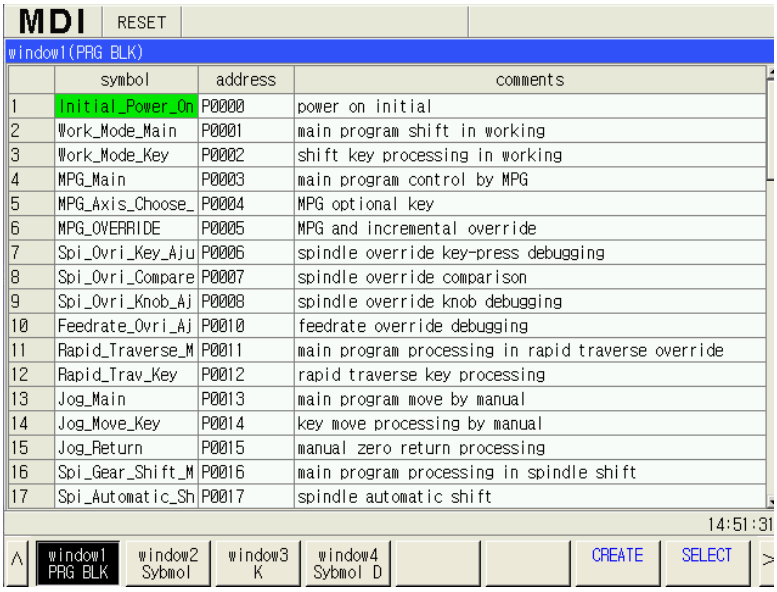
● In a similar way, press COPY to copy component, line or network. After the copy is complete, press key ⇧, ⇩ to move the cursor to the desired network, line or component , then press PASTE.

● Press UNDO to undo last operation. You can cancel up to 20 steps of operation.

● Press REDO to redo the cancellation.

**(2) View and set symbol table**

On PLC edit page, press SYMBOL to enter into symbol table display page:




| | symbol | address | comments |
|---|---|---|---|
| 1 | Initial_Power_On | P0000 | power on initial |
| 2 | Work_Mode_Main | P0001 | main program shift in working |
| 3 | Work_Mode_Key | P0002 | shift key processing in working |
| 4 | MPG_Main | P0003 | main program control by MPG |
| 5 | MPG_Axis_Choose_ | P0004 | MPG optional key |
| 6 | MPG_OVERRIDE | P0005 | MPG and incremental override |
| 7 | Spi_Ovri_Key_Aju | P0006 | spindle override key-press debugging |
| 8 | Spi_Ovri_Compare | P0007 | spindle override comparison |
| 9 | Spi_Ovri_Knob_Aj | P0008 | spindle override knob debugging |
| 10 | Feedrate_Ovri_Aj | P0010 | feedrate override debugging |
| 11 | Rapid_Traverse_M | P0011 | main program processing in rapid traverse override |
| 12 | Rapid_Trav_Key | P0012 | rapid traverse key processing |
| 13 | Jog_Main | P0013 | main program move by manual |
| 14 | Jog_Move_Key | P0014 | key move processing by manual |
| 15 | Jog_Return | P0015 | manual zero return processing |
| 16 | Spi_Gear_Shift_M | P0016 | main program processing in spindle shift |
| 17 | Spi_Automatic_Sh | P0017 | spindle automatic shift |

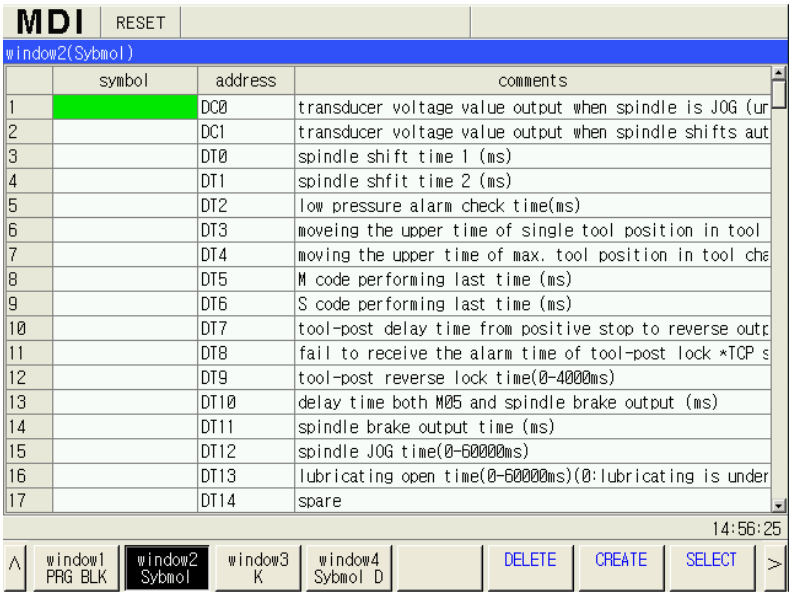
①┌ Press softkeys window1 PRG BLK, window2 Sybmol, window3 K, window4 Sybmol D respectively, you can select the symbols to be displayed on the window. The window name and corresponding symbols table name is shown on the upper area of the screen.

Press softkey SELECT to select a symbol table for each window.

Press CREATE to create a new symbol table and it is displayed on the current window (Note: if there is an empty window, the created symbol table will be displayed on the empty window preferentially.

Press window1 PRG BLK, the block symbol table is displayed and the corresponding address table is displayed as well.

② Press window2 Sybmol, the symbol table is displayed, shown as follows:




| | symbol | address | comments |
|---|---|---|---|
| 1 | | DC0 | transducer voltage value output when spindle is JOG (ur |
| 2 | | DC1 | transducer voltage value output when spindle shifts aut |
| 3 | | DT0 | spindle shift time 1 (ms) |
| 4 | | DT1 | spindle shfit time 2 (ms) |
| 5 | | DT2 | low pressure alarm check time(ms) |
| 6 | | DT3 | moveing the upper time of single tool position in tool |
| 7 | | DT4 | moving the upper time of max. tool position in tool cha |
| 8 | | DT5 | M code performing last time (ms) |
| 9 | | DT6 | S code performing last time (ms) |
| 10 | | DT7 | tool-post delay time from positive stop to reverse outp |
| 11 | | DT8 | fail to receive the alarm time of tool-post lock *TCP s |
| 12 | | DT9 | tool-post reverse lock time(0-4000ms) |
| 13 | | DT10 | delay time both M05 and spindle brake output (ms) |
| 14 | | DT11 | spindle brake output time (ms) |
| 15 | | DT12 | spindle JOG time(0-60000ms) |
| 16 | | DT13 | lubricating open time(0-60000ms)(0:lubricating is under |
| 17 | | DT14 | spare |

Notes for parameter addresses X, Y, DC, DT, T, R are displayed in the symbol table.

Press , , , , , , to select and view all parameter addresses.

Press softkey DELETE to delete the selected symbol table.

Press > to show the extended softkeys.

Press SERACH and enter the parameter address to be searched, locate the cursor to the address.

Press INSERT LINE to insert a null line below the line where the cursor locates.

Press DELETE LINE to delete the line where the cursor locates.

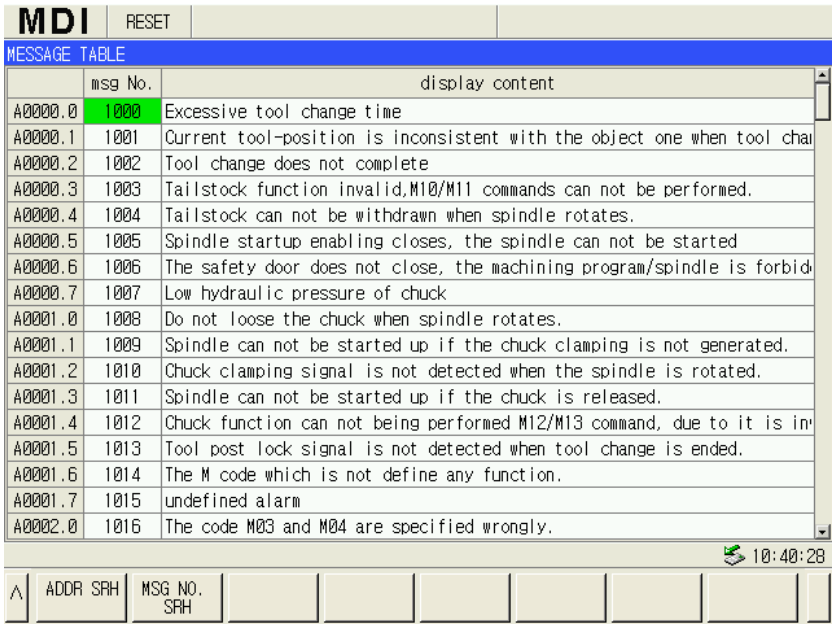
③ The operation after pressing window3 K and window4 Sybmol D is the same with window2 Sybmol.

④ Modify and edit the symbol table (the block symbol table cannot be modified here)

Select the symbol table to be modified, then press , , , , , , to select the symbol (or address, annotation) to be modified, press INPUT and input symbol, address or annotation, then press INPUT again to complete the modification.

**(3) View and Modify the message table**

On edit page, press MESSAGE TABLE to enter to message table, shown as follows:




In this information display table, PLC alarm information address A, corresponding information number and content are shown. Press , , , , , , to check these information.

① **Modification of information number and content:**

Press , , , , , , to select the information number or content to be

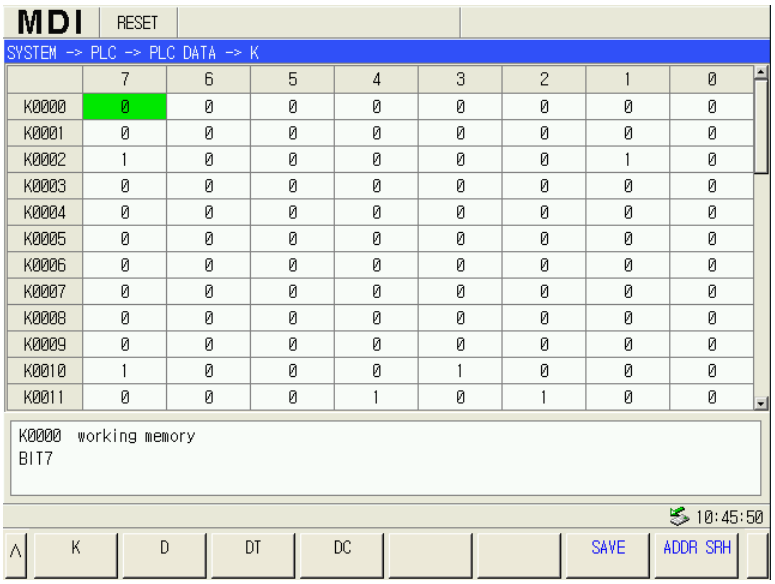
modified, then press INPUT and input the desired information number or content, press INPUT again to complete the modification.

② **Search for address and information number:**

Press ADDR SRH or MSG NO. SRH, enter the address or information number to be searched, press enter to start searching, then locate the cursor to the searched address or information number.

**(4) View and set initialized data table**

On edit page, press softkey INITDATA to enter to initialized data table display page:




① **K parameter setting**

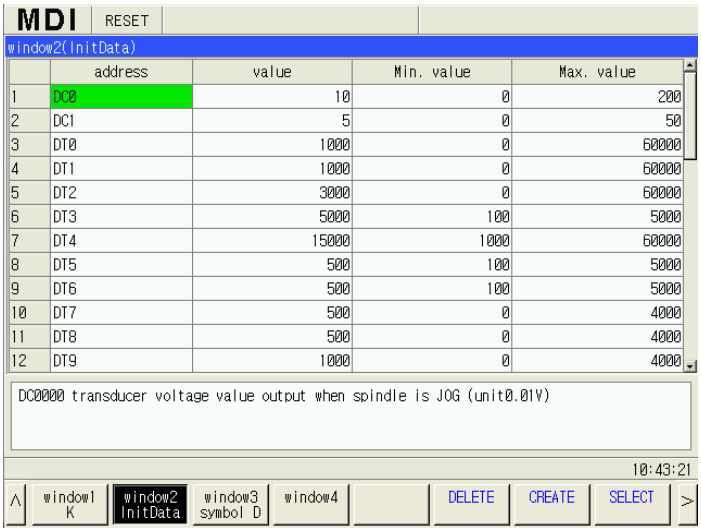
Press window1 K to select the window 1 whose corresponding K parameter is shown in the above figure.

Press , , , , , , to select a bit in the K parameter to be set or modified, the explanation for the bit in K parameter is displayed on the bottom area of the screen.

Press INPUT repeatedly, you can set the bit to 0 or 1.

② **Initialized data**

Press window2 InitData to enter the initData table display page corresponding to window 2.




③ **Data table modification and edit:**

Select the desired page by pressing  or  ; press  ,  ,  ,  to select the address or address value to be modified, the background of the selected value will turn to blue; press  and input values through numerical keys (press backspace key to delete), then press  key again to confirm the modification.

**Note: The operation for modifying and editing the initialized data table is the same as the viewing and setting of symbol table. For details, please refer to the "3.4.3 (2) View and set symbol table".**

## 3.4.5 PLC Program Transmission

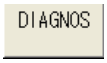
PLC program transmission is subject to authority above the 2nd level.

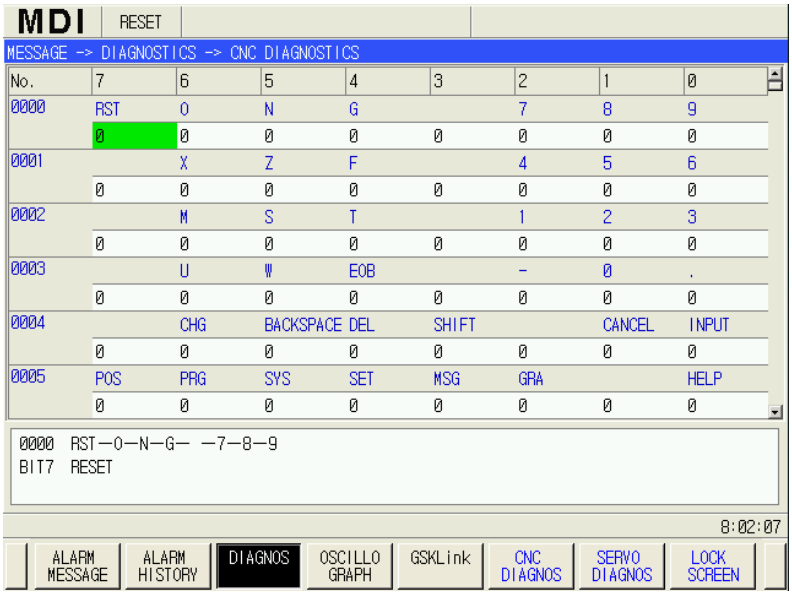
There are two method of PLC program transmission:

1. Transmit with GSKComm-M. For details, please refer to section 3.2 in this chapter.

2. Transmit PLC program one by one on PLC screen through U disk, or, make bulk transmission on file management screen. For details, please refer to section 3.3 in this chapter.

# 3.5 CNC Diagnosis

Press  to enter to information screen, and then press  to enter to diagnosis page, press  to enter to CNC diagnosis page.




On the system diagnosis page, contents such as keyboard diagnosis, state diagnosis, and auxiliary function parameter are included. They can be viewed through , , , , , , . You can press LOCK SCREEN to lock to the current screen in case of mal-operation.

On CNC diagnosis display page, there are two lines at the bottom of the screen displaying the diagnosis details: the first line shows the diagnosis number; the second line shows the explanation of a bit in the parameter where the cursor locates.

**The diagnosis information and corresponding number is shown as follows:**

- **System keyboard diagnosis information (number: 0-7)**

It can diagnose all the keys on the system keyboard. Each key is in either pressed or released state. It is used to diagnose whether the keyboard is in good condition.

- **Feed axis diagnosis information (number:10-13)**

Diagnosis numbers 10-13 contain information of servo axes 1-5. This information include the input/output state of servo drive unit connected with the feed axis, the pulse sent from feed axis to FPGA, the pulse sent from FPGA to servo drive unit, and the accumulative errors of the feed axis pulse (the difference between the FPGA received and sent pulse). It is used to diagnose whether the feed axis is in good working condition.

**Note: Only diagnosis information for used servo axis is displayed on screen. As for the unused servo axis, the corresponding information is not displayed;**

- **Pulse encoder diagnosis information (number:30~33)**

It includes the rotation direction of the two-channel pulse encoder, Z signal state, A,B phase signal state and the current counting pulse value. It is used to diagnose whether the pulse encoder is in good working condition.

- **1st and 2nd MPG diagnosis information (number: 40-43)**

It includes the rotation direction of the two-channel MPG, A, B phase signal state and current counting pulse value. It is used to diagnose whether the encoder is in good working condition.

- **1st and 2nd spindle diagnosis information (number: 50, 55)**

It includes the analog voltage input value of two-channel spindle. DA conversion 16-bit input data; 0 represent 0V, and 65535 represents 10V.

- **Machine tool panel diagnosis information (number: 60-62)**

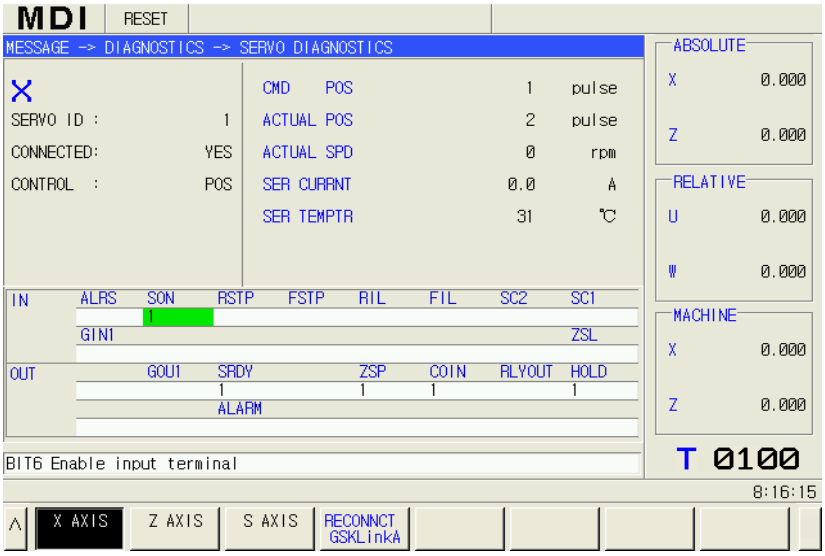
It includes the accumulative errors number, consecutive errors number and repeated number of the machine tool panel. It is used to diagnose whether the machine tool panel is in good working condition.

➢ **Edit keyboard diagnosis information (number: 63-65)**

It includes the accumulative errors number, consecutive errors number and repeated number of the edit keyboard reset. It is used to diagnose whether the edit keyboard is in good working condition.

## 3.6 Servo Diagnosis

On system screen, press DIAGNOS to enter to diagnosis page, then press SERVO DIAGNOS to enter to servo diagnosis page.




GSK988T servo diagnosis module provides the following functions:

It performs real-time monitoring to system controlled axes through servo communication feedback data, so the operator can know about the working state of some devices such as servo, motor etc.

(1) When the servo is in position control mode, the information displayed includes the command pulses received by the servo, the feedback pulses obtained from the motor encoder, actual rotation speed of the motor, servo internal current, detected temperature in the servo.

(2) When the servo is in speed control mode, the displayed information includes the specified rotation speed received by the servo, actual rotation speed obtained from the motor, command pulses received by the servo, servo internal current, detected temperature in the servo ( spindle encoder value is displayed).

(3) The I/O sate when servo is connected with system.

Explanations for various data items on servo diagnosis screen:

X : Current selected axis name

SERVO ID : The number of the slave connected to the axis

CONNECTED : The connection state of servo communication link layer

CONTROL : The servo control mode

CMD POS : The position pulses received from the system (in position control mode)

CMD SPD: The speed command value received from the system (in speed control mode)

ACTUAL SPD: The position pulses feedbacked by the servo

ACTUAL POS: The actual rotation speed of the motor

ENCDER VAL: The current value of spindle encoder (in spindle or C axis control mode)

SER CURRNT: The servo working current value at present

SER TEMPTR : The detected temperature of the servo inside

IN : The servo input point value

OUT : The servo output point value

BIT6 Enable input terminal : Details of the servo input and output points where the cursor located

**Axis switching**: Press X AXIS, Z AXIS, S AXIS to switch the displayed servo parameter among X, Z, S axis

RECONNCT GSKLinkA : When some axes are not connected or the servo communication is erroneous, press it to reset the communication link. If the connection still cannot be done, turn on the power of servo and system again.

ACT. POS ÷GEAR.R or ACT. POS ORIGINAL: These two keys that can be switched freely; it can determine whether the pulse number displayed on ACTUAL POS is POS or actual value after gear ratio calculation.

# CHAPTER IV MACHINE DEBUGGING-FUNCTIONS

## 4.1 Emergency Stop and Hardware Limit

GSK988T is equipped with the software limit function; for safety, it is suggested to adopt the hardware limit function at the same time. Install the limit switches in positive and negative directions on axes; the connection is shown in the following figure:

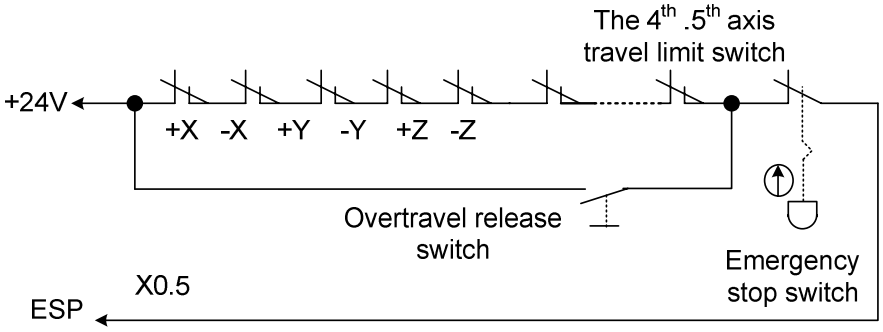



Fig. 4-1-1

In MANUAL or MPG mode, slowly move each axis to verify the validity of the overtravel limit switch, the correctness of the displayed alarm and the validity of the overtravel release button;

when it overruns or the emergency stop button is pressed, CNC alarms “emergency stop”. The alarm can be cleared through pressing the OVERTRAVEL and the axis moves in the reverse direction, or shield PLC emergency stop parameter which makes the switch invalid, and then press the resetting key to clear the emergency stop limit alarm, and the axis moves toward the worktable in the reverse direction and is off from the limit switch.

| Relevant Parameter | | | | |
|---|---|---|---|---|
| | **Parameter No.** | **Bit** | **Meaning** | **Remark** |
| **CNC parameters** | **3003** | **#7** | ESP emergency stop alarm signal (X0.5)<br>0: Emergency stop alarm occurs when the input signal is 0 (low-level signal)<br>1: Emergency stop alarm occurs when the input signal is 1 (high-level signal) | These two parameters should be set consistently. |
| **Standard PLC parameters** | **K0010** | **#7** | External emergency stop alarm signal (X0.5)<br>0: Emergency stop alarm occurs when the signal is low-level<br>1: Emergency stop alarm occurs when signal is high-level | |

## 4.2 Basic Axis Parameters Setting

### 4.2.1 Axis Property

**(1) Axis name**

The controlled axis number of 988T is 2, the extended controlled axis number is 5 (including Cs axis), and the linkage controlled axis number is 3.

| Relevant Parameter | | |
|---|---|---|
| **No.** | **Meaning** | **Remark** |
| **8130** | Total controlled axis | |
| **1010** | CNC controlled axis number | This parameter value cannot be greater than parameter No.8130 |
| **1020** | Name of each axis | The axis names cannot be the same |
| **1022** | Axis properties in basic coordinates | |
| **1023** | Servo axis number of each axis | The set axis number should correspond to the axis number of the rear cover interface. |

**(2) Axis unit**

After the above parameters are set, you can set the axis names, input/output unit (metric or inch) and incremental system as requirement.

| Relevant Parameter | | |
|---|---|---|
| **No.** | **Bit** | **Meaning** |
| **0000** | **#2** | Input unit<br>0: metric 1: inch |
| **1001** | **#0** | The least movement unit of the linear axis:<br>0: metric (metric machine) 1: inch (inch machine) |
| **1004** | **#1** | Set the least input increment and least command increment<br>0: 0.001mm 1: 0.0001mm |
| **1006** | **#3** | Set the movement amount of each axis<br>0: by radius 1: by diameter |
| **3401** | **#0** | For the addresses which decimal points can be used, when the decimal point is ignored, the setting is taken as:<br>0: the minimum setting unit 1: mm, inch, sec |

**(3) Axis type**

During machining, you can set the axis as linear axis or rotary axis according to the machining requirement.

| Relevant Parameter | | |
|---|---|---|
| **No.** | **Bit** | **Meaning** |
| **1004** | **#6** | Whether the least input increment of rotary axis is 10 times of the least command increment:<br>0: No 1: Yes |
| **1006** | **#1, #0** | 00: Linear axis 01: rotary axis (A Type) 11: rotary axis (B type) |

| | | |
|---|---|---|
| **1008** | **#0** | Whether the circle display function of rotary axis is valid:<br>0: invalid 1: valid |
| **1008** | **#1** | The rotation direction of absolute command is :<br>0: the direction closer to the object 1: specified by command value symbol |
| **1008** | **#2** | Relative coordinate is :<br>0: does not cycle by the movement amount per rotation<br>1: cycles by the movement amount per rotation |
| **1260** | | Movement amount per rotation of each rotary axis |

## 4.2.2 GSK-CAN Communication Setting of Axis and Servo

When GSK-CAN communication between feed and spindle servo drive unit is to be executed, the servo slave number and communication baudrate need to be set.

**Note 1: The slave number corresponding to the servo communication cannot be repeated. The baudrate of servo should be consistent with the system communication baudrate; otherwise, the communication cannot be set up.**

**Note 2: The parameters and slave number and baudrate in the servo should be set before the servo is connected to the GSKLink, and should be modified manually in the drive unit (valid after power-on again).**

| **Relevant Parameter** | | | | | |
|---|---|---|---|---|---|
| | **Type** | **No.** | **Bit** | **Meaning** | **Remark** |
| **CNC** | **GSK 988T System parameter** | **9000** | **#0** | System channel A GSK-CAN communication function is :<br>0: invalid 1: valid | This parameter is valid only when channel A GSK-CAN communication is used; |
| | | **9000** | **#1** | System channel B GSK-CAN communication function is :<br>0: invalid 1: valid | This parameter is valid only when channel B GSK-CAN communication is used; |
| | | **9010** | | System channel A GSK-CAN communication baudrate | Be consistent with the servo baudrate of channel A GSK-CAN; |
| | | **9011** | | System channel B GSK-CAN communication baudrate | Be consistent with the servo baudrate of channel A GSK-CAN; |
| | | **9020** | | Slave number corresponding to the servo communication of each axis | "0" means no connection;<br>1~5 means connecting with channel A GSK-CAN;<br>11~12 means connecting with channel B GSK-CAN;<br>The slave number cannot be repeated; |
| | | **9030** | | Slave number corresponding to the servo communication of each spindle | |

| | | | | | |
|---|---|---|---|---|---|
| Servo | DAT 2000C Series | PA58 | | GSK-CAN communication servo slave number | Corresponds to the CNC parameter No. 9020 |
| | | PA59 | | GSK-CAN communication baudrate | Be consistent with the CNC parameter No. 9010 when connecting with channel A; be consistent with CNC parameter No. 9011 when connecting with channel B; |
| | | PA61 | | Drive unit type | 101: 2050C； 102: 2075C |
| | DAP03C DAY3025C | PA19 | | GSK-CAN communication servo slave number | Corresponds to the slave number set by CNC parameter No. 9030 |
| | | PA20 | | GSK-CAN communication baudrate | Be consistent with the CNC parameter No. 9010 when connecting with channel A; be consistent with CNC parameter No. 9011 when connecting with channel B; |

## 4.3 Gear Ratio Calculation and Setting

**Electronic gear ratio enables the move distances of machine tool slide be consistent with the specified distance (move distance of the machine coordinate).** If the axis is set in radius system (radius or diameter programming is set by parameter No.1006#3), the actual move distance of the machine equals to the move distance displayed on the machine coordinate system; if the axis is set in diameter system, the actual move distance of the machine is the double of the move distance displayed on the machine coordinate system.

Please note that the electronic gear ratio is related to both the setting of CNC gear ratio and servo drive unit gear ratio.

| Relevant Parameter | | |
|---|---|---|
| **No.** | **Bit** | **Meaning** |
| **0000** | **#2** | Input unit:<br>0: metric 1: inch |
| **1004** | **#1** | Least input increment and least command increment:<br>0: ISB system 1: ISC system |
| **1006** | **#1, #0** | Linear axis or rotary axis<br>00: linear axis 01: rotary axis (A type) 11 : rotary axis (B type) |
| **1006** | **#3** | Movement amount of each axis is<br>0: specified by radius 1: specified by diameter |
| **1816** | **#6, #5, #4** | Set the detect multiplying ratio of each axis |
| **1820** | | Set the command multiplying ratio of each axis |

| Incremental System | | | | | | |
|---|---|---|---|---|---|---|
| | Input | Radius/ Diameter | IS−B | | IS−C | |
| | | | Least setting increment | Least command increment | Least setting increment | Least command increment |
| Metric machine | Metric | Diameter | 0.001mm | 0.0005mm | 0.0001mm | 0.00005mm |
| | | Radius | 0.001mm | 0.001mm | 0.0001mm | 0.0001mm |
| | Inch | Diameter | 0.0001 inch | 0.0005mm | 0.00001 inch | 0.00005mm |
| | | Radius | 0.0001 inch | 0.001mm | 0.00001 inch | 0.0001mm |
| Inch machine | Metric | Diameter | 0.001mm | 0.00005 inch | 0.0001mm | 0.000005 inch |
| | | Radius | 0.001mm | 0.0001 inch | 0.0001mm | 0.00001 inch |
| | Inch | Diameter | 0.0001 inch | 0.00005 inch | 0.00001 inch | 0.000005 inch |
| | | Radius | 0.0001 inch | 0.0001 inch | 0.00001 inch | 0.00001 inch |
| Rotary axis | | | 0.001deg | 0.001deg | 0.0001deg | 0.0001deg |

## 4.3.1 Gear Ratio Calculation

**Formula**

$$\text{Gear ratio} = \text{Least command increment} \times \frac{\text{encoder pulses per revoltion}}{\text{Lead}} \times \frac{Z_M}{Z_D}$$

**Note:** Least command increment is the minimum unit of command from CNC to machine tool, and the minimum increment of tool movement.

Pulse/rev = Encoder line number (absolute encoder)

= 4 × Encoder line number (incremental encoder)

$Z_M$ : Teeth number of lead screw gear

$Z_D$ : Teeth number of motor gear

**Example:**

When a machine is equipped with GSK988T and DAT2050C, and the ISC system is applied, the X axis is programmed in diameter system, the lead is 6mm, Z axis is programmed in radius system, the lead is 8mm; the motor is connected with X, Z axis lead screw directly ($Z_M$: $Z_D$=1: 1); 17-bit absolute encoder is applied (the encoder line number is $2^{17}$ , i.e. 131072), the calculation of corresponding gear ratio of X, Z axis is as follows:

**X axis:**

Least command increment: 0.00005mm (ISC system, programmed in diameter)

$$\text{Gear ratio} = \text{Least command increment} \times \frac{\text{encoder pulses per revoltion}}{\text{Lead}} \times \frac{Z_M}{Z_D}$$

$$= 0.00005 \times \frac{131072}{6} \times \frac{1}{1} = \frac{2048}{1875}$$

**Z axis:**

Least command increment: 0.0001mm (ISC system, programmed in radius)

$$\text{Gear ratio} = \text{Least command increment} \times \frac{\text{encoder pulses per revoltion}}{\text{Lead}} \times \frac{Z_M}{Z_D}$$

$$= 0.0001 \times \frac{131072}{8} \times \frac{1}{1} = \frac{1024}{625}$$

## 4.3.2 Gear Ratio Setting

**Parameter Setting of Gear Ratio**

$$\text{CNC}:\text{Gear ratio}=\frac{\text{Command multiplying ratio (CMR}:\text{No.1820)}}{\text{Detect multiplying ratio}\quad\text{(DMR}:\text{No.1816)}}$$

$$\text{Servo}:\text{Gear ratio}=\frac{\text{Position pulse command multiplying ratio (PA12)}}{\text{Position pulse command frequency division ratio (PA13)}}$$

When the numerator is greater than the dominator in CNC electronic gear ratio (CMR/DMR), the CNC permitted maximum speed will be decreased; when the numerator is smaller than the dominator, the CNC position accuracy will be decreased. To ensure the target accuracy and speed, when digital servo with electronic gear ratio function is matched, it is advised to set the CNC electronic gear ratio to 1:1, and set the calculated electronic gear ratio into digital servo.

**Example: (the gear ratio is the one in the example of Gear Ratio Calculation)**

**X axis**

**CNC gear ratio setting**

CNC electronic gear ratio is set as 1:1, i.e. CMR/DMR=1:1

Setting value of CMR (Parameter No. 1820) is 2.

Setting value of DMR (Parameter No.1816)(**DM3x**: **DM2x**: **DM1x**) is 001.

**Servo gear ratio setting**

The servo gear ratio is set as 2048 / 1875.

Setting value of PA12 is 2048.

Setting value of PA13 is 1875.

**Z axis**

**CNC gear ratio setting**

CNC electronic gear ratio is set as 1:1, i.e. CMR/DMR=1:1

Setting value of CMR (Parameter No. 1820) is 2.

Setting value of DMR (Parameter No.1816)(**DM3x**: **DM2x**: **DM1x**) is 001.

**Servo gear ratio setting**

The servo gear ratio is set as 1024 / 625.

Setting value of PA12 is 1024.

Setting value of PA13 is 625.

# 4.4 Servo Related Setting

## 4.4.1 CNC Servo Parameter Setting

After the connection between system and servo is done, and the power is on, you can set the high-level or low-level servo alarm, encoder type, pulse output type, pulse output direction of each axis and axis movement direction. The procedure is as follows:

① According to the alarm logic level of servo drive unit set corresponding alarm level of servo axis through parameter NO.1816#0 (ISAx).

② Select the pulse output method of current axis through parameter No.1811#0 (ABPx). GSK988T supports two methods of pulse command output, one is + direction pulse output; the other is orthogonal two phases (AB phase) pulse output. The parameter should be set correctly.

③ According to the encoder type of the servo motor set whether absolute encoder is used on servo through parameter No. 1815#5 (APCx).

④ According to the transmission ratio of the machine set correct gear ratio CMR/DMR (through parameter No. 1816 and No. 1820) to make the movement distance be consistent with the specified value (for details, see follow-up sections).

⑤ When the machine movement direction is inconsistent with the movement command, inverse the output movement direction of servo axis command by setting parameter No. 1811#2 (PODx).

⑥ When the detection direction of absolute encoder is opposite to the actual direction, adjust it through parameter No.1815#0 (APRx). (This detection method is: when the reference point is set, specified axis moves along + direction +U, and +U is displayed in the machine coordinate system, turn on the power again; if –U is displayed in the machine coordinate system, then, the detection direction of absolute encoder is opposite to the actual direction.)

**Note 1: In AUTO or MANUAL mode, when the specified axis direction is opposite to the actual feeding direction, modify parameter No. 1811#0.**
**Note 2: In manual mode, when the manual feed direction is opposite to the actual feeding direction (correct in AUTO or EDIT mode), modify PLC data parameter K8.0~K8.4.**

| Relevant Parameter | | | |
|---|---|---|---|
| | **No.** | **Bit** | **Meaning** |
| **GSK 988T System parameter** | **1811** | **#0** | Pulse output type:<br>0 : pulse + direction 1: AB phase pulse |
| | **1811** | **#2** | Pulse output direction:<br>0: Not reversed 1: reversed |
| | **1815** | **#0** | When absolute encoder is used, the direction of position detector:<br>0: Not reversed 1: reversed |
| | **1815** | **#5** | Position detector is:<br>0: absolute position detector 1: not absolute position detector |
| | **1816** | **#0** | Servo alarm signal level:<br>0: high-level alarm 1: low-level alarm |
| **PLC data parameter** | **K8.0～K8.4** | | Manual movement direction of each axis is:<br>0: not reversed 1: reversed |

## 4.5 Acceleration/Deceleration Characteristic Adjustment

As the acceleration/deceleration time constant increases, the acceleration/deceleration process slows down, the impact to machine tool decreases, and the machining efficiency decreases; and vice versa.

When the time constant is the same, the higher the start/end speed of acceleration/deceleration is, the greater the impact will be, so are the machining efficiency; and vice versa.

The principle of acceleration/deceleration characteristics adjustment is: to properly reduce the acceleration/deceleration time constant and increase the start/end speed of acceleration/deceleration to improve processing efficiency in the condition that the drive unit won't issue an alarm, the motor can work without the loss of steps and no obvious impact occurs to the machine tool. If the acceleration/deceleration time constant is too small or the start/end speed is set too high, it can easily lead to drive unit alarm, motor step loss or machine tool vibration.

**Note: when parameter No.1601#4=0, at the intersection point of cutting feed paths, the feedrate should be decreased to the start speed of the acceleration/deceleration, then, increased to the specified speed of the adjacent block. Accurate position of intersection point can be achieved in this way, but it may lower down the machining efficiency.**

**When parameter No.1601#4=1, two adjacent cutting paths perform smooth transition in acceleration/deceleration method directly. The feedrate does not necessarily decrease to the start speed when the previous path ends. An arc transition is formed at the intersection point (inaccurate position). This kind of transition way allows great surface smoothness and higher machining efficiency.**

| Relevant Parameter | | |
|---|---|---|
| **No.** | **Bit** | **Meaning** |
| **1420** | | Rapid traverse rate of each axis |
| **1421** | | The minimum speed of rapid traverse override |
| **1422** | | Maximum cutting feedrate of all axes |
| **1423** | | Manual feedrate of each axis |
| **1424** | | Manual rapid traverse rate of each axis |
| **1466** | | The feedrate of retraction during thread cutting |
| **1601** | **#4** | During rapid traverse, the blocks are:<br>0: not overlapped (accurate) 1: overlapped (smooth transition) |
| **1610** | **#0** | The acceleration/deceleration of cutting feedrate (including dry run feeding) is:<br>0: exponential type 1: linear type after interpolation |
| **1610** | **#4** | The acceleration/deceleration of manual feeding is :<br>0: exponential type 1: linear type or bell-shaped type after interpolation |
| **1620** | | Constant T during linear acceleration/deceleration of each axis |
| **1622** | | Acceleration/deceleration time constant of cutting feedrate after interpolation |
| **1623** | | Exponential acceleration/deceleration FL speed of cutting feedrate |
| **1624** | | Acceleration/deceleration time constant of manual feedrate after interpolation |
| **1625** | | Exponential acceleration/deceleration FL speed of manual feedrate |
| **1626** | | Acceleration/deceleration time constant during thread cutting cycle |
| **1627** | | Exponential acceleration/deceleration FL speed during thread cutting cycle |
| **1628** | | Acceleration/deceleration time constant of retraction during thread cutting |

## 4.6 Reference Point and Software Limit

GSK988T supports three kinds of method to set machine zero point (also called reference point): reference point setting without dogs, reference point setting with dogs and absolute encoder reference point setting.

| Reference Point Setting | System Parameter Setting |
|---|---|
| absolute encoder reference point setting | Parameter No.1815#5 (APCx) is set to 1 |
| reference point setting without dogs | Parameter No.1815#5 (APCx)is set to 0<br>Parameter No.1002#1 (DLZ) is set to 1 or parameter No.1005#1 ( DLZx) is set to 0 (either one of them is set to 1) |
| reference point setting with dogs | Parameter No.1815#5 ( APCx) is set to 0<br>Parameter No.1002#1 DLZ is set to 0 and parameter No.1005#1 DLZx is set to 0. |

**Note 1: When absolute encoder is used, after a reference point is set, it will be saved automatically after power-off, so it is not necessary to set the reference point the next time.**

**Note 2: When reference point is set with/without dog, the setting should be executed every time after power-on.**

| Relevant Parameter | | | |
|---|---|---|---|
| | **No.** | **Bit** | **Meaning** |
| **GSK988T System Parameter** | **1005** | **#0** | When the reference point is not set, in AUTO (MEM, DNC OR MDI) mode, if movement commands other than G28 is specified, the system will<br>0: issue an alarm 1: not issue an alarm |
| | **1006** | **#5** | Set reference point return direction of each axis<br>0: positive direction 1: negative direction |
| | **1201** | **#2** | After the manual reference point return is done, the local coordinate system is:<br>0: not cancelled 1: cancelled |
| | **1240** | | Set the coordinate value of the 1st reference point in machine coordinate system |
| | **1241** | | Set the coordinate value of the 2ndt reference point in machine coordinate system |
| | **1242** | | Set the coordinate value of the 3rd reference point in machine coordinate system |
| | **1243** | | Set the coordinate value of the 4th reference point in machine coordinate system |
| | **1425** | | Set the FL speed after deceleration during reference point return |
| **PLC Data Parameter** | **K12.2** | | Whether the direction keys of zero-return operation is automatically locked:<br>0: No 1: Yes |

## 4.6.1 Reference Point of Absolute Encoder Setting

When the machine is equipped with the absolute position encoder and its reference point return function is valid, it requires setting the absolute position encoder reference point while the system doesn't set the reference point or readjust the reference point. After setting the reference point, the system automatically saves the reference point position after power-off, therefore, it doesn't require setting the reference point position, again when it powers on in the next time.

The steps of setting the reference point of absolute encoder are shows as follows:

1. In mode of 

or 

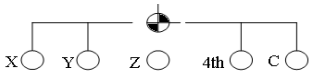
mode, the axis carriage is moved to the reference point to be set.

2. The system parameter APZx (NO.1815#4) is set as 0, cut off power supply, and power on, again, the system alarms.

3. Press 

on the panel.

4. Press the switches  related to the reference points, then the reference point return is performed.

5.,The reference point return finishing indicator (operational panel indicator)  is on, the reference point return finishes, the system saves the current encoder position, automatically sets the parameter APZ x as 1.

| Relevant Parameter | | |
|---|---|---|
| **No.** | **Bit** | **Meaning** |
| **1815** | **#0** | When absolute encoder is used, the direction of position detector is:<br>0: not reversed 1: reversed |
| **1815** | **#4** | When absolute encoder is used, the machine position and the position of absolute position detector is<br>0: inconsistent 1: consistent |
| **1815** | **#5** | Position detector:<br>0: uses absolute position detector 1: does not use absolute position detector |

## 4.6.2 Reference Point Setting with Dog

When the reference point return without dogs function is set invalid (i.e. the reference point return with dogs is valid), reference point return can be performed when the machine is installed deceleration switch. After the tool returns to the reference point, LED indicator lights up, and coordinate system is set automatically.

The procedure of setting the reference point free of block is shown as follows:

1. Confirm that the overtravel limit switch is valid.

2. Press  to switch the working mode to reference point return mode.

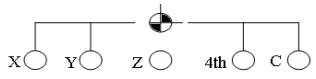
3. To reduce zero-return speed, adjust the rapid traverse override  to the low gear.

4. Press the corresponding axis icon on  , the system will read axis and the direction selection signal, then, reference point return is executed.

5. When the carriage moves to the deceleration point at the rapid traverse rate, and the deceleration signal DECx is valid (the valid level of a signal is set by parameter No. 3009#5 DECx), the speed will decrease to 0, then, the carriage keeps moving toward the reference point at the speed set by parameter No1425.

6. When the tool leaves the position of deceleration switch, set the deceleration signal DECx to 1, and the system detects the one-rotation signal nPC.

7. After the first nPC signal is detected, set the signals ZPx (reference point return finish signal)

and ZRFx (reference point setting signal) to 1, the reference point return indicator 

lights up, reference point return is done.

**Note: Usually, the machine zero return dog is installed at the maximum stroke point. The effective stroke should be over 25mm to ensure enough deceleration distance and the accuracy of zero return. The higher the machine zero return speed is, the longer the zero return collision block will be. Otherwise, the carriage will go through the collision block due to CNC acceleration/deceleration or machine inertial, thus, affects the accuracy of zero return. In addition, make sure that during the process of zero return the carriage will not be intervened by other parts of the machine tool, for the sake of security.**

The connection method of AC servo motor is shown in the following figure. Stroke switch and servo motor one-rotation signal are used.

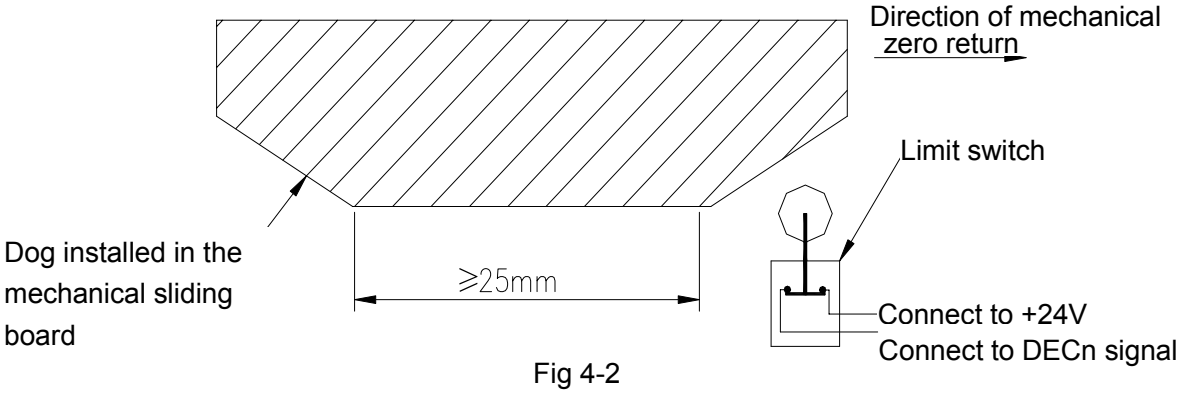


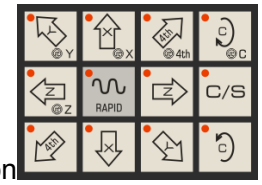

Fig 4-2

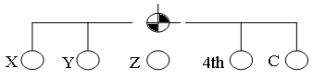
When machine zero return is performed after the deceleration switch is released, it should be noted that the encoder one-rotation signal should not be at the critical point, and be reached after half-revolution of the motor. This method is to improve the machine zero point return accuracy. The dog position can be tuned to reduce the error of zero point return.

## 4.6.3 Reference Point Setting without Dog

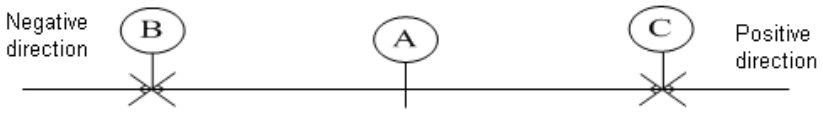
When the system sets reference point without dog function valid, the machine can perform reference point return without the installation of deceleration switch. After reference point return is done, the LED indicator lights up and the coordinate system is set automatically.

1. Axis moves along the reference point return direction, and stops close to the reference point, rather than surpasses it.
2. Press 

and set the reference point selection signal ZRN to 1 manually;
3. Select corresponding feeding axis and direction on 

, and set the axis and direction signal Jx to 1, reference point return is executed.
4. The tools moves towards the reference point along the direction set by parameter No. 1006#5 at the speed set by parameter No. 1425.
5. After the first PC signal is detected, set ZPx (reference point return end signal) and ZRFx (reference point setting signal) to 1, the LED indicator 

lights up and reference point return is done.




A: the position before the execution of reference point return without dog

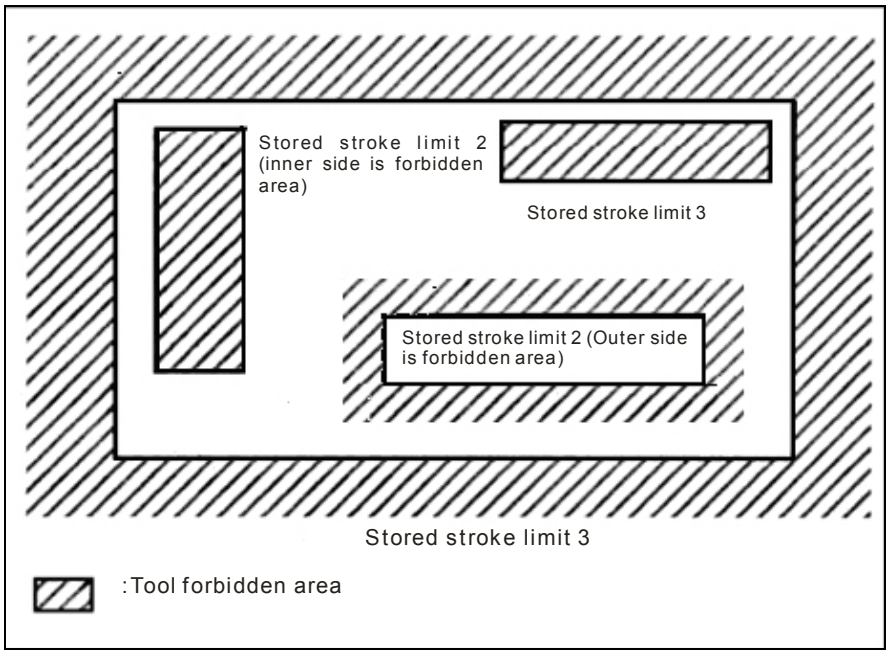
B: the position after the reference point return is executed along the negative direction, i.e. the position where the first PC signal is generated after the A point moves along the negative direction.

C: the position after the reference point return is executed along the negative direction, i.e. the position where the first PC signal is generated after the A point moves along the negative direction.

| Relevant Parameters | | |
|---|---|---|
| **No.** | **Bit** | **Meaning** |
| **1002** | **#1** | The function of reference point return without dog is<br>0: invalid 1: valid (for all axes) |
| **1002** | **#3** | The G28 command when reference point is not set:<br>0: reference point return with dog 1: P/S alarm occurs |
| **1005** | **#1** | The function of reference point setting without dog is:<br>0: invalid 1: valid |
| **1300** | **#6** | Whether the first stroke check is performed before manual reference point return after LZR power-on:<br>0: Yes 1: No |

## 4.6.4 Setting of Stored Stroke Check

There are three stored stroke check are provided in GSK988T system: stored stroke check 1, stored stroke 2 and stored stroke 3. Tool cannot enter the areas specified by them.




**Stored stroke check 1:**

Parameters (No.1320, 1321 or No. 1326, 1327) set the boundary. Outside the area of the set limits is a forbidden area. The machine tool builder usually sets this area to maximum stroke.

**Note 1: Parameter No. 1300#7 (BFA) is only valid for stroke check 1;**
**Note 2: When parameter No. 1300.7=1, the system will prejudge whether the path after execution of current block exceeds the stored stroke; if it exceeds, an alarm will be issued; otherwise, the block will be executed;**

**Stored stroke check 2: (G22 G23)**

Parameters (No.1322, 1323) or commands set the boundaries. Inside or outside the area of the limit can be set as the forbidden area. Parameter No. 1300#0 selects either inside or outside as the forbidden area. In case of program command a G22 command forbids the tool to enter the forbidden area, and a G23 command permits the tool to enter the forbidden area. Each of G22 and G23 should be command independently of another command in a block.

**Stored stroke check 3:**

Parameters No. 1324, No.1325 set the boundary. The inside area of the 3 limits is forbidden area.

**Note：If the two points for specifying a forbidden area are identical, all areas are handled as forbidden areas for stroke check 1.**
**If two points for specifying a forbidden area are identical, all areas are handled as movable areas for stored stroke check 2, 3.**

**Alarm displaying time:**

Parameter No.1300#7 (BFA) selects whether an alarm is displayed immediately before the tool enters the forbidden area or immediate after the tool has entered the forbidden area.

**Releasing the alarm:**

If the tool enters a forbidden area and an alarm is generated, the tool can be moved only in the backward direction. To cancel the alarm, move the tool backward until it is outside the forbidden area and reset the system. When the alarm is cancelled, the tool can be moved both backward and forward.

| Relevant Parameter | | |
|---|---|---|
| **No.** | **Bit** | **Meaning** |
| **1300** | **#0** | Parameters (No.1322, 1323) set the forbidden area for stored stroke check 2 to:<br>0: inside area 1: outside area |
| **1300** | **#2** | The signal EXLM (stored stroke check switch signal) is :<br>0: invalid 1: valid |
| **1300** | **#5** | Stroke check 3 releasing signal RLSOT 3 is:<br>0: invalid 1: valid |
| **1300** | **#6** | Whether the first stroke check is performed before manual reference point return after power-on:<br>0: Yes 1: No |
| **1300** | **#7** | The alarm is issued:<br>0: before the tool enters the forbidden area<br>1: after the tool enters the forbidden area |
| **1310** | **#0** | Whether stored stroke check 2 is performed on each axis:<br>0: no 1: yes |
| **1310** | **#1** | Whether stored stroke check 3 is performed on each axis:<br>0: no 1: yes |
| **1320** | | Coordinates (PC1) of stored stroke check 1 positive boundary |
| **1321** | | Coordinates (NC1) of stored stroke check 1 negative boundary |
| **1322** | | Coordinates (PC2) of stored stroke check 2 positive boundary |
| **1323** | | Coordinates (NC2) of stored stroke check 2 negative boundary |

| | | |
|---|---|---|
| **1324** | | Coordinates (PC3) of stored stroke check 3 positive boundary |
| **1325** | | Coordinates (NC3) of stored stroke check 3 negative boundary |
| **1326** | | Coordinates II (PC12) of stored stroke check 1 positive boundary |
| **1327** | | Coordinates II (NC12) of stored stroke check 1 negative boundary |

## 4.7 Pitch Error Compensation

If the pitch error compensation value is defined, the pitch error compensation of each axis can be compensated based on the detection units of each axis.

Set the pitch error compensation data for each compensation position, and its compensation position is set based on the space between each axis. The compensation origin is the reference position of the tool return.

When the pitch error compensation is performed, the following parameters must be set:

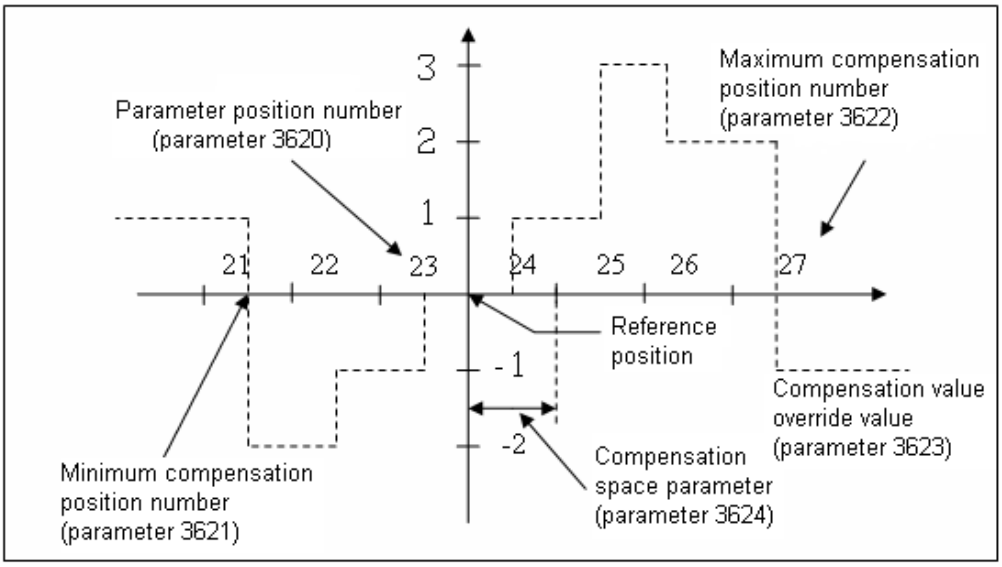
Parameter 3620: The position number of the compensation at the reference point of each axis.

Parameter 3621: The minimum position number of each axis pitch error compensation

Parameter 3622: The maximum position number of each axis pitch error compensation

Parameter 3623: The magnification of pitch error compensation

Parameter 3624: The interval of each compensation position.




| Compensation Position Number | 21 | 22 | 23 | 24 | 25 | 26 | 27 |
|---|---|---|---|---|---|---|---|
| Set Compensation Value | -3 | +1 | +1 | +1 | +2 | -1 | -3 |

**Define the compensation position:** To set the compensation position for each axis, specify the positive or negative direction for compensation based on the reference point. If the machine stroke exceeds the specified range in positive or negative direction, the screw pitch error compensation does not work.

**Compensation position number:** In screw pitch error compensation setting screen, there are 1024 compensation positions (0~1023) can be used. The parameter can be used to assign position number to each axis. Set compensation position number (parameter No.3620), minimum position number (parameter No. 3621) and maximum position number (parameter No. 3622) of each axis.

**For example:**

1. Linear axis

Machine stroke: －400mm~＋800mm

Interval of the screw pitch error compensation positions: 50mm

Compensation position number of the reference point: 70

After the above definition is finished, the furthest compensation position number in negative direction is as below:

The compensation position number of the reference point – (machine stroke in negative direction/space between compensation positions) = 70－400/50+1=63

The furthest compensation position number in positive direction is as below:

Compensation position number of the reference point + (machine stroke in positive direction/ space between compensation positions) ＝70＋800/50=86

The corresponding relation between the machine and the compensation point position number is shown as follows:

| Parameter | Setting Value |
|---|---|
| 3620: Parameter point compensation number | 70 |
| 3621: Minimum compensation position number | 63 |
| 3622: Maximum compensation position number | 86 |
| 3623: Compensation magnification | 1 |
| 3624: Space between the screw pitch error compensation positions | 50000 |

2. Rotary axis

Movement value/ revolution: 360°

Space between the screw pitch error compensation positions: 45°

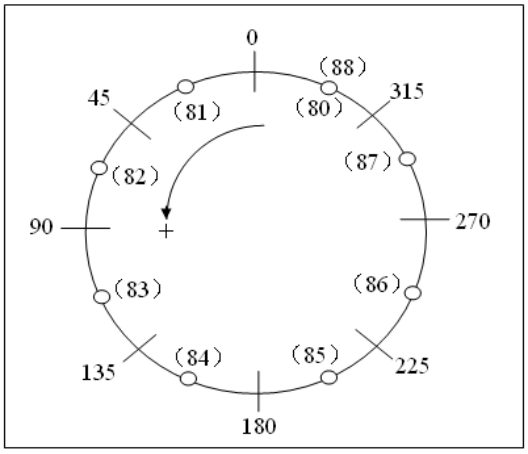
Compensation position number of the reference point: 80

After defining the above parameter, the furthest compensation position number in negative direction of the rotary axis is the compensation position number of the reference point.

The furthest compensation position number in positive direction is as follows:

The compensation position number of the reference point + (movement value of each revolution/ space between compensation positions) = 80+360/45=88

The corresponding relation between the machine coordinate and the compensation position number is as follows:




The parameter is set as follows:

| **Parameter** | **Setting value** |
|---|---|
| 3620: Compensation number of the reference point | 80 |
| 3621: Minimum compensation position number | 80 |

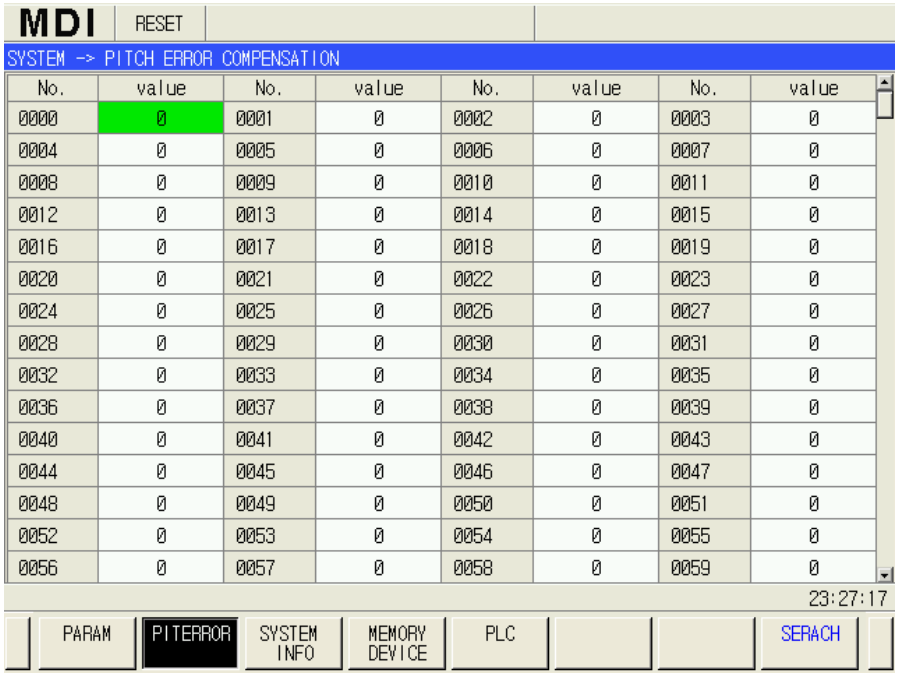
| | |
|---|---|
| 3622: Maximum compensation position number | 88 |
| 3623: Compensation magnification | 1 |
| 3624: Space between screw pitch error compensation positions | 45000 |

For the rotary axis, there may result in the position offset if the sum of the compensation value of positions 81~88 is not 0. The sum is the accumulation of screw pitch error compensation value of each revolution. Moreover, at the compensation positions 80 and 88, the same compensation value must be set. For example:

| No. of Compensation Position | 80 | 81 | 82 | 83 | 84 | 85 | 86 | 87 | 88 |
|---|---|---|---|---|---|---|---|---|---|
| Set Compensation value | +1 | -2 | +1 | +3 | -1 | -1 | -3 | +2 | +1 |

**Set pitch error compensation value**

- In system window, press PITERROR to enter into pitch error compensation window, shown as follows:




You can view and set corresponding pitch error compensation value in this window.

- Press , , or move the cursor through , , , , to select the value to be set; or, press SERACH to search for the pitch error compensation number, and move the cursor to the value to be modified.
- Press INPUT, the selected compensation can be modified, input the desired value, then press INPUT to complete the modification.

**Note: The compensation value and interval of compensation point are related to the programming method (diameter programming/radius programming affects the least command increment). When the axis movement is programmed in diameter, the parameter value should be set in diameter; when the axis movement is programmed in radius, the parameter value should be set in radius. The unit should be detection unit.**

| Relevant Parameter | | |
|---|---|---|
| **No.** | **Bit** | **Meaning** |
| **3620** | | Pitch error compensation number of reference points |
| **3621** | | Pitch error compensation number of the farthest ends in negative direction |
| **3622** | | Pitch error compensation number of the farthest ends in positive direction |
| **3623** | | Pitch error compensation magnification |
| **3624** | | Intervals of compensation points |
| **3628** | | Setting value of pitch error compensation pulse frequency |

## 4.8 Backlash Compensation

When the machine tool moves backward inverse momentum loss will occur due to the error of transmission mechanism, thus affects the machining accuracy. To reduce such error, backlash compensation function is provided in this system.

The backlash compensation value is related to the programming method (diameter programming/radius programming affects the least command increment). When the axis movement is programmed in diameter, the parameter value should be set in diameter; when the axis movement is programmed in radius, the parameter value should be set in radius. The unit should be detection unit.

Detection Unit = Least command increment/command multiplication (CMR)

The backlash compensation should be performed in a proper way to improve the machining accuracy. It is advised to use dialgauge, micrometer or laser detector rather than MPG or step method to measure the backlash. The methods are shown as follows:

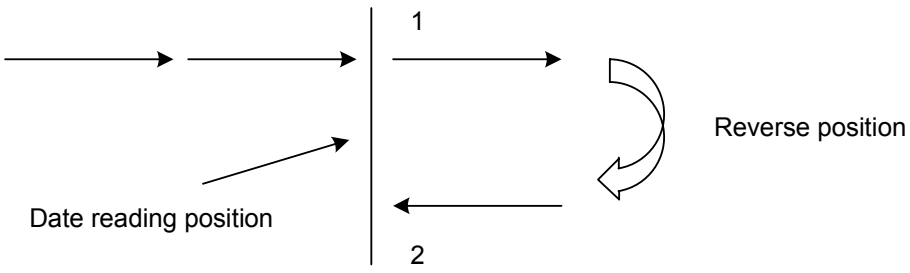
**The setting method of backlash compensation during cutting feed**

Programming:

O0001;
N10 G01 W10 F800;
N20 W15;
N30 W1;
N40 W-1;
N50 M30.

Set the backlash compensation value to 0 before measuring

Run a single block and find the measuring benchmark 1 after twice locations, record the current data, then, move further for 1mm and move backward for 1mm to benchmark 2, read the current data.




.Backlash compensation value=| data at benchmark 1- data at benchmark 2| ; then, convert the calculated data to detection unit and input the CNC data parameter No. 1851.

Data 1: the dialgauge data read at benchmark 1

Data 2: the dialgauge data read at benchmark 2

Detection unit= Least command increment/CMR

**For example**:

When IS-C system is set (parameter No.1004#1 ISC is set to 1) and the metric system is selected (parameter No.1001#0 INM is set to 0), if parameter No. 1820 (used to set the command multiplication) is set to 2, then, the system command multiplication CMR=1.

X axis: detection unit=least command increment/CMR=0.00005mm/1=0.00005mm

Z axis: detection unit=least command increment/CMR=0.0001mm/1=0.0001mm

If the backlash compensation value of X axis detected by dialgauge is 0.0150mm, the parameter No. 0851 is set to 300; If the backlash compensation value of Z axis detected by dialgauge is 0.0300mm, the parameter No. 0851 is set to 300;

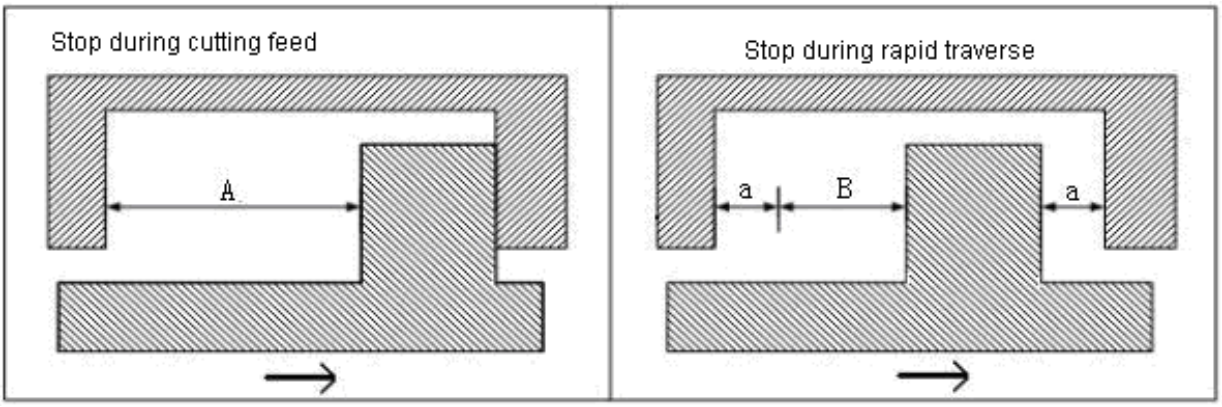
To improve the compensation accuracy, the backlash compensation value can also be set to rapid traverse and cutting feed. First, set parameter No.1800#4 (RBK) to 1, (cutting feed and rapid traverse will be performed independently), then, set the backlash compensation value to rapid traverse through parameter No.1852.

For example,

If the detected backlash compensation during cutting feed is A, and the detected backlash compensation during rapid traverse is B, according to different feeding method and move direction, the compensation value is shown in the following table:

| Feeding method / Move direction | Cutting feed to cutting feed | Rapid traverse to rapid traverse | Rapid traverse to cutting feed | Cutting feed to rapid traverse |
|---|---|---|---|---|
| The same direction | 0 | 0 | ±a | ± (-a) |
| Opposite direction | ±A | ±B | ± (B+a) | ± (B+a) |

1. a= (A-B)/2
2. The positive or negative of the compensation value determines the move direction. (P80)




**The setting steps of backlash compensation parameters are shown as follows:**

① Whether the backlash compensation is performed respectively during cutting feed and rapid traverse determines the setting of parameter No.1800#4 (RBK).

0: not performed 1: performed

② Measure the backlash compensation value in the above method, and save the results in parameter No. 1851 and No. 1852 (when parameter No. 1800#4 RBK is set to 1). Note that the parameter unit should be detection unit.

③ After the backlash compensation value is set, set the backlash compensation output method according to parameter No. 1800#7 (BDEC), 0: fixed pulse frequency output 1: output

according to acceleration/deceleration characteristics. No. 1800#4.

④ When the parameter No. 1800#7 (BDEC) is set to 0 (fixed pulse frequency output), parameter No. 1800#6 (BD8) sets the output pulse frequency.
0: the set frequency 1: 1/8 of the set frequency.
The set frequency for compensation is set by parameter No. 1853.

⑤ When parameter No. 1800#7 (BDEC) is set to 1 (according to acceleration/deceleration characteristic output), the valid time constant can be set by parameter No. 2071.

| Relevant Parameter | | |
|---|---|---|
| **No.** | **Bit** | **Meaning** |
| **1800** | **#4** | Whether backlash compensation is performed respectively during cutting feed and rapid traverse<br>0: No 1: Yes |
| **1800** | **#6** | Output pulse frequency for backlash compensation is<br>0: the set frequency by parameter No. 1853<br>1: 1/8 of the set frequency. |
| **1800** | **#7** | Backlash compensation method<br>0: fixed pulse frequency output (set by parameter No. 1853 and No.1800#6)<br>1: output according to acceleration/deceleration characteristic |
| **1851** | | Backlash compensation value |
| **1852** | | Backlash compensation value during rapid traverse |
| **1853** | | Setting value of backlash compensation pulse frequency |
| **2071** | | Valid time constant of backlash compensation acceleration/deceleration |

## 4.9 Spindle Function Adjustment

### 4.9.1 Spindle Encoder

GSK988T has two-channel encoder input interfaces (CN21 and CN22). CN21 interface is used for feedback input of spindle speed by default. The selection signal PC2SLC (G28.7) of spindle encoder in PLC selects the interface through which the feedback pulse is obtained and used for system control. When encoder interface 2 (CN22) is not connected to a encoder and the selection signal PC2SLC of position encoder is not set to 1, CN21 is always selected for the feedback input of spindle speed.

To read the actual spindle speed, relevant parameters and signals should be set correctly.

| Relevant Parameter | | | |
|---|---|---|---|
| **No.** | **Bit** | **Meaning** | **Remark** |
| **3720** | | Line number of each spindle encoder | The range is 1~9999; |
| **3721** | | Teeth number of gear on one side of spindle position encoder; | These two parameters are used to set the gear ratio during speed control; the range is 1~9999; |
| **3722** | | Teeth number of gear on one side of spindl; | |

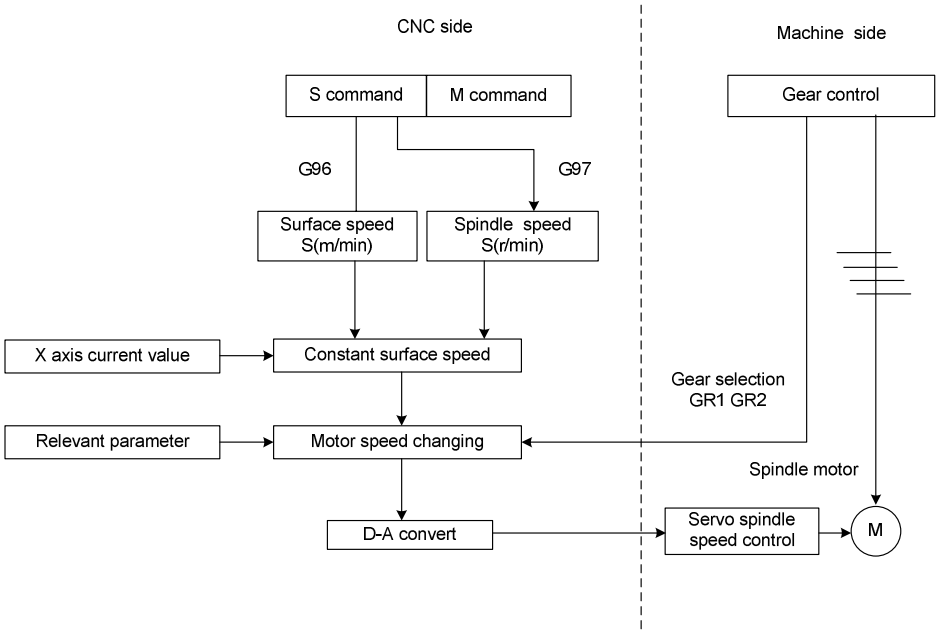
| Relevant Parameter | | |
|---|---|---|
| **No.** | **Bit** | **Meaning** |
| **3706** | **#1, #0** | Gear ratio between spindle encoder and position encoder<br>00: 1 01: 2 10: 4 11: 8 |
| **3707** | **#1, #0** | Gear ratio between spindle encoder and the 2nd position encoder<br>00: 1 01: 2 10: 4 11: 8 |
| **3773** | | Spindle encoder line number (CNT) |
| **3803** | | The 2nd spindle encoder line number (CNT2) |

## 4.9.2 Spindle Speed Analog Voltage Control

Spindle speed analog voltage control can be set through CNC parameters. The interface outputs 0~10V analog voltage to control spindle servo drive unit or Inverter. For the 0V~+10V output control, the CNC calculates the spindle speed through S command and send M code to PLC to determine the spindle output direction.

Although the S command is for spindle speed, its actual control object is spindle motor. Therefore, the spindle motor speed and gear are related. In this system, the gear selection signal (GR1, GR2) determines the current gear on the machine; CNC outputs the spindle speed corresponding to the gear.

The spindle speed control procedure is shown as follows:




When the actual spindle speed is inconsistent with the programmed one, adjust it through parameter No. 3730, No. 3731. There are two adjust methods according to spindle encoder connection.

**1. The spindle encoder is not used:**

① Set the parameter No. 3730 to 1000 (gain adjustment data of spindle speed analog output) and parameter No. 3731 to 0 (compensation value of spindle speed analog output offset voltage) before adjustment. Disconnect the CNC and spindle after power-off, and turn on the power again, then, specify a frequently-used M code (M41-M44) at spindle gear (the default first gear after power-on);

② In MDI mode, specify S code at the highest speed of current gear. For example, after the first gear

is selected, specify the highest speed of the first gear (parameter No. 3741) and press cycle start button;

③ Measure the output voltage SVC according to the interface definition in the above section.

④ Set the values in the following formula for parameter No. 3730

$$\text{setting value} = \frac{10\text{V}}{\text{Measured voltage (V)}} \times 1000$$

⑤ After the parameter is set, specify the speed analog output value of the first gear as the spindle speed of maximum voltage (parameter No. 3741), ensure that the output voltage is 10V;

⑥ Specify S0 in MDI mode;

⑦ Measure the output voltage SVC;

Set the values in the following formula for parameter No. 3731

$$\text{setting value} = \frac{-8191 \times \text{Offset voltage (V)}}{12.5}$$

Then, specify S0 again and ensure the voltage is 0V.

**2. The spindle encoder is used:**

① Set the parameter No. 3730 to 1000 (spindle speed analog output gain adjust data) and parameter No. 3731 to 0 (compensation value of spindle speed analog output offset voltage) before adjustment. Connect the CNC and spindle after power-off, and turn on the power again, then, specify a frequently-used M code (M41-M44) at spindle gear (the default first gear after power-on);

② In MDI mode, specify S code at the highest speed of current gear. For example, after the first gear is selected, specify the highest speed of the first gear (parameter No. 3741) and press cycle start button;

③ The actual speed is displayed in position screen, and it should be almost the same as the specified speed. If the value is too much different from the specified one, please check whether the encoder parameter setting is correct;

④ Set the values in the following formula for parameter No. 3730;

$$\text{setting value} = \frac{\text{Setting value of parameter No. 3741}}{\text{Actual rotation speed}} \times 1000$$

⑤ After the parameter is set, specify the speed analog output value of the first gear as the spindle speed of maximum voltage (parameter No. 3741), ensure that the actual speed is the value set by parameter No. 3741;

⑥ Specify S0 in MDI mode;

⑦ Record the actual speed in position screen;

⑧ Input the record actual speed in parameter No. 3731;

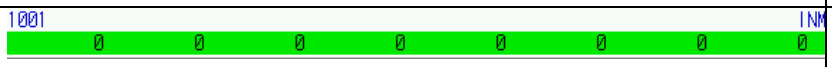
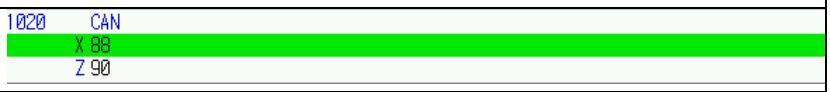
⑨ Specify command S0 again after the parameter is set, then, ensure that the output speed is 0;

| Relevant Parameter | | | |
|---|---|---|---|
| **No.** | **Bit** | **Meaning** | **Remark** |
| **3031** | | Set the permitted digits in S code | |
| **3708** | **#0** | It determines whether to check spindle speed arrival signal:<br>0: No 1: Yes | |

| | | | |
|---|---|---|---|
| **3708** | **#1** | When thread cutting execution starts, it determines whether to check spindle speed arrival signal<br>0: determined by SAR; 1: Check | |
| **3708** | **#6** | During threading or tapping cycle, the spindle override is:<br>0: Invalid (always 100%) 1: Valid; | |
| **3710** | | CNC controlled spindle number | The range is 1~3; |
| **3717** | | Amplifier number of each spindle | 0~3 (1: 5th axis; 2: analog axis; 3: channel B GSK-CAN axis) |
| **3720** | | Line number of each spindle encoder | The range is 1~9999; |
| **3721** | | Teeth number of gear on one side of spindle position encoder | These two parameters are used to set the gear ratio during speed control; the range is 1~9999; |
| **3722** | | Teeth number of gear on one side of spindle | |
| **3723** | | Channel number(1~3) corresponding to each spindle encoder | |
| **3725** | | Servo axis number (0~5) corresponding to feeding axis during Cs contour control | |
| **3730** | | Gain adjust data of spindle speed analog output | The range is 700~1250; the data unit is 0.1%; |
| **3731** | | Compensation value of spindle speed analog output offset voltage | The range is -1024-1024 |
| **3740** | | The delay time of spindle speed arrival signal | |
| **3741** | | The maximum spindle speed at gear 1 | The range is 0~32767 r/min |
| **3742** | | The maximum spindle speed at gear 2 | |
| **3743** | | The maximum spindle speed at gear 3 | |
| **3744** | | The maximum spindle speed at gear 4 | |
| **3771** | | Lowest speed of spindle during surface speed control | The range is 0~32767 r/min |
| **3772** | | Upper limit spindle speed (0~32767 r/min) | |

# CHAPTER V PARAMETER INSTRUCTION

This chapter mainly introduces CNC state and data parameters through setting different parameters to realize the different requirements of function. The parameter data mainly includes the following six types:

| Data Type | | Range |
|---|---|---|
| (1) Bit |  | 8 digits 0 or 1 |
| (2) Bit axis |  | |
| (3) Bit spindle | | |
| (4) Word |  | The exact data range is determined by specified parameters. |
| (5) Word axis |  | |
| (6) Word spindle |  | |

Each parameter should include the following information:

『Modification Authority』: System authority (1st level), Machine authority (2nd level), Equipment management authority (3rd level), Operation authority (4th level), Limited authority (5th level)

『Way of Validating』: Become valid immediately or after power-on

『Value Range』: In interval, by enumerating or special judgment

『Default Setting』: 8 digits in binary system, or 32-digit integral value

『Parameter Type』: Bit, bit axis, bit spindle, word, word axis;

**Note 1: The 『Value Range』 of bit type parameters is 0 or 1.**
**Note 2: When 『Way of Validating』 is not stated, the parameter will become valid immediately.**
**Note 3: When 『Parameter Type』 is not stated, the parameter is of bit type or word type.**

## 5.1 Parameters of System Setting

| | #7 | #6 | #5 | #4 | #3 | #2 | #1 | #0 |
|---|---|---|---|---|---|---|---|---|
| **0000** | | | **SEQ** | | | **INI** | | |

『Modification Authority』: Equipment management authority

『Default Setting』: 0000 0000

**#2 INI Input system**

0: Metric system

1: Inch system

**#5 SEQ whether insert the sequence number automatically**

0: No

1: Yes

**Note: In EDIT or MDI mode, sequence number can be inserted automatically. The incremental value of sequence number is set in parameter No. 3216.**

## 5.2 Parameters of the Interfaces of Input and Output

| 0123 | Baudrate of serial port (BPS) |
|---|---|

『Modification Authority』:Equipment management

『Value Range』: 4800, 9600, 19200, 38400, 57600, 115200

『Default Setting』: 115200

| | #7 | #6 | #5 | #4 | #3 | #2 | #1 | #0 |
|---|---|---|---|---|---|---|---|---|
| 0138 | | OWN | | | | | | |

『Modification Authority』: Equipment management authority

『Default Setting』: 0000 0000

**#6 OWN When NC data or the programs are input or output, whether the prompt box "Cover all files?" is displayed:**

0: Yes

1: No

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| 0930 | | | | | | | | RMEN |

『Modification Authority』: Machine authority

『Way of Validating』: After power-on

『Default Setting』: 0000 0000

**#0 RMEN Use remote monitor or not:**

0: No

1: Yes

## 5.3 Parameters of Axis Control/Setting Unit

| | #7 | #6 | #5 | #4 | #3 | #2 | #1 | #0 |
|---|---|---|---|---|---|---|---|---|
| 1001 | | | | | | | | INM |

『Modification Authority』: Machine authority

『Way of Validating』: After power-on

『Default Setting』: 0000 0000

**#0 INM The least movement increment of linear axis is in:**

0: Metric system (metric machine)

1: Inch system (inch machine)

| | #7 | #6 | #5 | #4 | #3 | #2 | #1 | #0 |
|---|---|---|---|---|---|---|---|---|
| 1002 | | | | | AZR | | DLZ | |

『Modification Authority』: Machine authority

『Default Setting』: 0000 0000

**#1 DLZ Whether reference setting without dog is valid:**

0: Invalid

1: Valid (for all axes)

**Note: When DLZ is 0, parameter 1005#1 (DLZx) can set valid/invalid for each axis.**

**#3 AZR G28 command when the reference point is not set:**

0: Reference point return with deceleration dog

1: P/S alarm occurs

**Note: The function of reference point return without dog (when parameter 1002#1 (DLZ) is 1 or parameter 1005#1 (DLZx) is 1) is not related to the setting of AZR.**

| | #7 | #6 | #5 | #4 | #3 | #2 | #1 | #0 |
|---|---|---|---|---|---|---|---|---|
| 1004 | | RPR | | | | | ISC | |

『Modification Authority』: Machine authority

『Way of Validating』: After power-on

『Default Setting』: 0000 0000

**#1 ISC Set the least input increment and least command increment**

0: 0.001mm, 0.001deg or 0.0001inch（IS-B）

1: 0.0001mm, 0.0001deg or 0.00001inch（IS-C）

**#6 RPR Whether set the minimum input unit of the rotary axis 10 times larger than the minimum command increment**

0: No

1: Yes

| | #7 | #6 | #5 | #4 | #3 | #2 | #1 | #0 |
|---|---|---|---|---|---|---|---|---|
| 1005 | | | | | HJZx | | DLZx | ZRNx |

『Modification Authority』: Machine authority

『Parameter Type』: Bit axis

『Default Setting』: 0000 1000

**#0 ZRNx In AUTO running (AUTO, DNC or MDI), whether the system issues an alarm if the other traverse commands than G28 are specified before reference point is set**

0: Yes

1: No

**#1 DLZx Whether the reference point setting without dog is valid.**

0: Invalid

1: Valid

**Note: Parameter DLZ (No.1002#1) is valid when it is "0". When DLZ (No.1002#1) is "1", the reference point setting without dog is valid for all axes.**

**#3 HJZx After the reference point is set, manual reference point return:**

0: is performed by using the deceleration dog;

1: is performed without using the deceleration dog;

| | #7 | #6 | #5 | #4 | #3 | #2 | #1 | #0 |
|---|---|---|---|---|---|---|---|---|
| 1006 | | | ZMIx | | DIAx | | ROSx | ROTx |

『Modification Authority』: Machine authority

『Way of Validating』: After power-on

『Parameter Type』: Bit axis

『Default Setting』: 0000 0000

**#0, #1 ROTx, ROSx set linear axis or rotary axis**

| ROSx | ROTx | Contents |
|---|---|---|
| 0 | 0 | Linear axis<br>Metric/inch conversion<br>All coordinate values are of the linear axis type.<br>The stored pitch error compensation is of the linear axis type. |
| 0 | 1 | Rotary axis (type A)<br>No metric/inch conversion<br>The machine coordinate value displays in 0～360° cycle.<br>The stored pitch error compensation is of the rotary axis type.<br>Automatically return to the reference point at the direction of the reference point return (G28 and G30), the traverse amount cannot exceed one turn. |
| 1 | 0 | Invalid setting |
| 1 | 1 | Rotary axis (type B)<br>No metric/inch conversion<br>The machine coordinate value, the relative coordinate value and the absolute coordinate value are in the linear axis, which can't display in cycle of 0～360°.<br>The stored pitch error compensation is of the linear axis type.<br>The cycle function and the indexing function of the rotary axis cannot be used at the same time. |

**#3 DIAx sets the movement amount of each axis**

0: specified by the radius

1: specified by the diameter

**#5 ZMIx sets the direction of reference point return for each axis**

0: positive direction

1: negative direction

| | #7 | #6 | #5 | #4 | #3 | #2 | #1 | #0 |
|---|---|---|---|---|---|---|---|---|
| 1008 | | | | | | RRLx | RABx | ROAx |

『Modification Authority』: Machine authority

『Way of Validating』: After power-on

『Parameter Type』: Bit axis

『Default Setting』: 0000 0000

**#0 ROAx The roll-over function of a rotary axis is:**

0: Invalid

1: Valid

**Note: ROAx is only valid for the rotary axis (parameter ROTx (No.1006#0) is 1).**

**#1 RABx In the absolute commands, the axis rotates in the direction**

0: Which the distance to the target is shorter

1: Specified by the sign of command value

**Note: RABx is valid only when parameter ROAx is 1.**

**#2 RRLx Relative coordinate are**

0: Not rounded by the amount of the shift per one rotation

1: Rounded by the amount of the shift one rotation

**Note1: RRLx is valid only when ROAx is 1.**
**Note2: Assign the amount of the shift per one rotation in parameter No. 1260.**

| 1010 | Quantity of CNC controlled axes (CCA) |
|---|---|

『Modification Authority』: Machine authority

『Way of Validating』: After power-on

『Data Range』: 0～total number

Set the maximum number of axes which are directly controlled by CNC, the others are controlled by PLC.

| | #7 | #6 | #5 | #4 | #3 | #2 | #1 | #0 |
|---|---|---|---|---|---|---|---|---|
| 1015 | DWT | WIC | | | | | | |

『Modification Authority』: Equipment management authority

『Default Setting』: 0000 0000

**#6 WIC Direct input of workpiece origin offset value is:**

0: Only valid for the selected work piece coordinate system

1: Valid for all coordinate systems

**#7 DWT When time for dwell per second is specified by P, the increment system:**

0: IS-B is 1ms, IS-C is 0.1ms.

1: 1 ms

| 1020 | Programming name of each axis (CAN) |
|---|---|

『Modification Authority』: Machine authority

『Parameter Type』: Word axis

『Value Range』: 88(X), 89(Y), 90(Z), 65(A), 66(B), 67(C)

Set the axial name of each controlled axis.

**Note: The axial name cannot be the same.**

| 1022 | The property of each axis in the basic coordinate system |
|---|---|

『Modification Authority』: Machine authority

『Way of Validating』: After power-on

『Parameter Type』: Word axis

『Value Range』: 0～7

The planes of the arc interpolation, the tool offset and the tool nose radius, etc.

G17: X－Y plane; G18: Z－X plane; G19: Y－Z plane

There are four types of controlled axes: 1, X axis and its parallel axis; 2, Y axis and its parallel axis; 3 Z axis and its parallel axis; 4, rotary axis; There are only three basic axes (X, Y, Z) and more than two parallel axes;

| Setting value | Meaning |
|---|---|
| 0 | They are neither basic three axes nor the parallel axes |
| 1 | X axis |
| 2 | Y axis |
| 3 | Z axis |
| 5 | Axis parallel to X axis |
| 6 | Axis parallel to Y axis |
| 7 | Axis parallel to Z axis |

| 1023 | Servo axis number of each axis (NSA) |
|---|---|

『Modification Authority』: Machine authority

『Way of Validating』: After power-on

『Value Range』: 1～6

『Parameter Type』: Word axis

Set the servo numbers corresponding to controlled axis. Usually, the servo axis number is the same as the controlled axis number. Controlled axis number is the sequence number of axial parameter setting.

**Note: Please set the servo axis number of the axis which is connected with B channel GSK-CAN to 6.**

## 5.4 Parameters of the Coordinate System

| | #7 | #6 | #5 | #4 | #3 | #2 | #1 | #0 |
|---|---|---|---|---|---|---|---|---|
| 1201 | WZR | | | | | ZCL | | |

『Modification Authority』: Equipment management authority

『Default Setting』: 0000 0000

**#2 ZCL After manual reference point return is performed, the local coordinate system is:**

0: Not cancelled

1: Cancelled

**#5 EWZ Upon power on, the coordinate system:**

0: Does not return to G54

1: Return to G54

**#7 WZR Upon reset, the workpiece coordinate system:**

0: Does not return to G54

1: Return to G54

| | #7 | #6 | #5 | #4 | #3 | #2 | #1 | #0 |
|---|---|---|---|---|---|---|---|---|
| 1202 | | | | | RLC | G50 | EWS | EWD |

『Modification Authority』: Equipment management authority

『Default Setting』: 0000 0000

**#0 EWD The movement direction of coordinate system caused by external workpiece origin offset amount is:**

0: The same with the external workpiece origin offset direction;

1: Not the same with the external workpiece origin offset direction;

**#1 EWS The movement amount of workpiece coordinate system and movement amount of external workpiece zero point are:**

0: Stored in different memories

1: Stored in the same memory

**#2 G50 When G50 is commanded:**

0: An alarm is not issued and G50 is executed;

1: An alarm is issued;

**#3 RLC After resetting, the local coordinate system is:**

0: Not cancelled

1: Cancelled

| | #7 | #6 | #5 | #4 | #3 | #2 | #1 | #0 |
|---|---|---|---|---|---|---|---|---|
| 1202 | | | | | RLC | G50 | EWS | EWD |

『Modification Authority』: Equipment management authority

『Default Setting』: 0000 0000

**#0 EWD The shift direction of the workpiece coordinate system is:**

0: The direction specified by the external workpiece zero point offset value

1: In the opposite direction to that specified by the external workpiece zero point offset value

**#1 EWS The external workpiece zero point offset is made:**

0: Valid

1: Invalid

**#2 G50 When G50 is commanded and the coordinate system is set,**

0: Not alarm, but execute G50

1: P/S alarms (No.010), not execute G50

**#3 RLC After resetting, the local coordinate system**

0: Not cancel

1: Cancel

| | #7 | #6 | #5 | #4 | #3 | #2 | #1 | #0 |
|---|---|---|---|---|---|---|---|---|
| 1205 | | | | | | | | MCE |

『Modification Authority』: Equipment management authority

『Default Setting』: 0000 0000

#0 MCE Whether the coordinate system is stored upon incremental encoder power-on

0: No

1: Yes

| 1206 | Deviation limit of Machine coordination upon power-on(with absolute encoder)(MER) |
|---|---|

『Modification Authority』: Equipment management authority

『Value Range』: 0~9999

It is used for the deviation detection when coordinate system is established upon power-on. When it is 0, deviation detection is not performed.

| 1220 | The origin offset amount of external workpiece coordinate system of each axis (EWO) |
|---|---|

『Modification Authority』: Equipment management authority

『Value Range』: -9999 9999～9999 9999

『Parameter Type』: Word axis

This parameter is to set the origin of the workpiece coordinate system (G54~G59). The parameter is the valid common offset amount for all workpiece coordinate system.

| Setting unit | IS-B | IS-C | Unit |
|---|---|---|---|
| Linear axis (input in metric system) | 0.001 | 0.0001 | mm |
| Linear axis (input in inch system) | 0.0001 | 0.00001 | inch |
| Rotary axis | 0.001 | 0.0001 | deg |

| 1221 | Origin offset amount of each axis in G54 workpiece coordinate system (WO1) |
|---|---|

| 1222 | Origin offset amount of each axis in G55 workpiece coordinate system (WO2) |
|---|---|

| 1223 | Origin offset amount of each axis in G56 workpiece coordinate system (WO3) |
|---|---|

| 1224 | Origin offset amount of each axis in G57 workpiece coordinate system (WO4) |
|---|---|

| 1225 | Origin offset amount of each axis in G58 workpiece coordinate system (WO5) |
|---|---|

| 1226 | Origin offset amount of each axis in G59 workpiece coordinate system (WO6) |
|---|---|

『Modification Authority』: Equipment management authority

『Parameter Type』: Word axis

『Value Range』: -99 999 999～+99 999 999

This parameter is to set the origin of the workpiece coordinate system (G54~G59). The parameter is the valid common offset amount for all workpiece coordinate system.

| SETTING UNIT | IS-B | IS-C | UNIT |
|---|---|---|---|
| Linear axis (input in metric system) | 0.001 | 0.0001 | Mm |
| Linear axis (input in inch system) | 0.0001 | 0.00001 | Inch |
| Rotary axis | 0.001 | 0.0001 | Deg |

| 1240 | **Machine coordinate value of the 1st reference point (RF1)** |
|---|---|

| 1241 | **Machine coordinate value of the 2nd reference point (RF2)** |
|---|---|

| 1242 | **Machine coordinate value of the 3rd reference point (RF3)** |
|---|---|

| 1243 | **Machine coordinate value of the 4th reference point (RF4)** |
|---|---|

『Modification Authority』: Equipment management authority

『Way of Validating』: Parameter No. 1240 is valid after power-on; parameters No.1241～1243 are valid immediately.

『Parameter Type』: Word axis

『Value Range』: -99 999 999～+99 999 999

Set the coordinate values of the 1st to the 4th reference points in the mechanical coordinate system

| SETTING UNITS | IS-B | IS-C | UNITS |
|---|---|---|---|
| Metric machine | 0.001 | 0.0001 | Mm |
| Inch machine | 0.0001 | 0.00001 | Inch |
| Rotary axis | 0.001 | 0.0001 | Deg |

| 1260 | **Movement amount per rotation of rotary axis(PRA)** |
|---|---|

『Modification Authority』: Equipment management authority

『Way of Validating』: After power-on

『Parameter Type』: Word axis

『Value Range』: 1000～9 999 999

Set the movement amount per rotation of rotary axis.

## 5.5 Parameters of the Stroke Detection

Setting units of stroke parameter Nos.1320~1327 are shown in the following table:

| SETTING UNIT | IS-B | IS-C | UNIT |
|---|---|---|---|
| Metric machine | 0.001 | 0.0001 | Mm |
| Inch machine | 0.0001 | 0.00001 | Inch |
| Rotary axis | 0.001 | 0.0001 | Deg |

| | #7 | #6 | #5 | #4 | #3 | #2 | #1 | #0 |
|---|---|---|---|---|---|---|---|---|
| 1300 | BFA | LZR | RL3 | | | LMS | | OUT |

『Modification Authority』: Equipment management authority

『Default Setting』: 0000 0000

**#0 OUT The inhibition area of stored stroke check 2 is set by parameter No.1322 or No.1323 is:**

0: Internal area

1: External area

**#2 LMS Whether the switch signal EXLM of the stored stroke check is valid:**

0: Invalid

1: Valid

**Note: There are two group parameters of inhibition area setting in stored stroke check 1. The stored stroke switch signal can be used to select the desired inhibition area.**
**(1)Inhibition area I: Parameter No.1320 or No.1321**
**(2)Inhibition area II: Parameter No.1326 or No.1327**

**#5 RL3 Whether the stored stroke check 3 release signal RLSOT3 is valid:**

0: Invalid

1: Valid

**#6 LZR Whether the stored stroke 1 is performed after power-on and before manual reference point return:**

0: Yes

1: No

**Note: When an absolute encoder is used, reference point is already established after power-on. In this case, it is not related to this parameter setting, and stored stroke check is performed directly after power-on.**

**#7 BFA When an overtravel command is issued:**

0: Alarm is raised after overtravel

1: Alarm is raised before overtravel

**Note: The tool stops before or**

| | #7 | #6 | #5 | #4 | #3 | #2 | #1 | #0 |
|---|---|---|---|---|---|---|---|---|
| 1310 | | | | | | | OT3x | OT2x |

『Modification Authority』: Equipment management

『Parameter Type』: Bit axis

『Default Setting』: 0000 0000

**#0 OT2X Whether stored stroke check 2 is performed on each axis:**

0: No

1: Yes

**#1 OT3X Whether stored stroke check 2 is performed on each axis:**

0: No

1: Yes

| 1320 | Coordinate value of boundary in positive direction of stored stroke check 1 (PC1) |
|---|---|

| 1321 | Coordinate value of boundary in negative direction of stored stroke check 1 (PC1) |
|---|---|

『Modification Authority』: Equipment management authority

『Parameter Type』: Word axis

『Default Setting』: No.1320 is 99 999 999, No.1321 is －99 999 999

『Value Range』:－99 999 999～99 999 999

Set the mechanical coordinate values of boundaries in both positive and negative directions of stored stroke check 1. Set the outer area of boundary as the forbidden area.

**Note1: The axes specified by diameter are set by diameter value.**

**Note2: When (parameter No.1320) < (parameter No.1321), and the stroke is infinite, stored stoke check 1 cannot be performed. (The stored stroke limit switching signal is invalid.) If the absolute command is specified, the coordinate value may overflow, the normal movement cannot be performed.**

**Note3: If parameter LMS (No. 1300#2) is "1", and the stored stroke limit switching signal EXLM is also "1", the forbidden area set by this parameter is invalid. Parameter No.1326 and No.1327 set the forbidden area.**

| 1322 | Coordinate value of boundary in positive direction of stored stroke check 2 (PC2) |
|---|---|

| 1323 | Coordinate value of boundary in negative direction of stored stroke check 2 (PC2) |
|---|---|

『Modification Authority』: Equipment management authority

『Parameter Type』: Word axis

『Default Setting』: 0

『Value Range』: －99 999 999～99 999 999

Set the mechanical coordinate values of boundaries in both positive and negative directions of stored stroke check 2. Parameter No. 1300#0 sets the outer area of boundary as the forbidden area.

**Note: The axis specified by diameter must be set by the diameter value.**

| 1324 | Coordinate value of boundary in positive direction of stored stroke check 3 (PC3) |
|---|---|

| 1325 | Coordinate value of boundary in negative direction of stored stroke check 3 (PC3) |
|---|---|

『Modification Authority』: Equipment management authority

『Parameter Type』: Word axis

『Default Setting』: No.1324 is 99 999 999, No.1325 is －99 999 999

『Value Range』: －99 999 999～99 999 999

Set the mechanical coordinate values of boundaries in both positive and negative directions of stored stroke check 2. Set the outer area of boundary as the forbidden area.

**Note: The axis specified by the diameter must be set by the diameter value.**

| | |
|---|---|
| **1326** | **Coordinate value II of boundary in positive direction of stored stroke check 1 (NC12)** |

| | |
|---|---|
| **1327** | **Coordinate value II of boundary in negative direction of stored stroke check 1 (NC12)** |

『Modification Authority』: Equipment management authority

『Parameter Type』: Word axis

『Default Setting』: 0

『Value Range』: －99 999 999～99 999 999

Set the mechanical coordinate values of boundaries in both positive and negative directions of stored stroke check 1. Set the outer area of boundary as the forbidden area. Only when parameter No. 1300#2 (LMS) is 1, and the stored stroke limit switching signal EXLM (G7.6) is 1, the forbidden area set by this parameter is valid (the setting of parameter 1320 and 1321 is invalid).

**Note 1: The axes programmed by the diameter must be set by the diameter value.**
**Note 2: The parameter is invalid when parameter LMS (No.1320#2) is "0", or the stored stroke limit switching signal EXLM (G7.6) is "0". Then, the forbidden area set by parameter No.1320 or No. 1321 is valid.**

## 5.6 Parameters of the Feedrate

| | #7 | #6 | #5 | #4 | #3 | #2 | #1 | #0 |
|---|---|---|---|---|---|---|---|---|
| **1401** | | **RDR** | **TDR** | **RF0** | | | | **RPD** |

『Modification Authority』: Equipment management authority

『Default Setting』: 0000 0000

**#0 RPD Manually rapid traverse from power-on to the reference point return is:**

0: Invalid (JOG speed)

1: Valid

**#4 RF0 When the cutting feedrate override is 0% during rapid traverse:**

0: tool does not stop moving

1: tool stops moving

**#5 TDR During thread cutting or tapping, dry run is:**

0: Valid

1: Invalid

**#6 RDR For rapid traverse command, dry run is:**

0: Invalid

1: valid

| | #7 | #6 | #5 | #4 | #3 | #2 | #1 | #0 |
|---|---|---|---|---|---|---|---|---|
| **1402** | | | | | | **JOV** | | |

『Modification Authority』: Equipment management authority

『Default Setting』: 0000 0000

**#2 JOV JOG override is:**

0: Valid

1: Invalid (always 100%)

| | #7 | #6 | #5 | #4 | #3 | #2 | #1 | #0 |
|---|---|---|---|---|---|---|---|---|
| 1403 | RTV | | | | | | | MIF |

『Modification Authority』: Equipment management authority

『Default Setting』: 0000 0000

**#0 MIF The minimum unit of F command (the cutting feedrate) for feeding per minute:**

0: 1mm/min (metric input)or 0.01inch/min (inch input)

1: 0.001mm/min (metric input)or 0.00001inch/min (inch input)

| | #7 | #6 | #5 | #4 | #3 | #2 | #1 | #0 |
|---|---|---|---|---|---|---|---|---|
| 1404 | | | | | | F8A | DLF | |

『Modification Authority』: Equipment management authority

『Default Setting』: 0000 0000

**#1 DLF After reference point is established, manual reference point return is:**

0: Performed in rapid traverse rate (parameter No. 1420)

1: Performed in rapid traverse rate manually (parameter No. 1424)

**#2 F8A F command range for feeding per minute is:**

0: Set according to parameter MIF (No.1403#0)

1: According to the following table

| SETTING UNITS | UNIT | IS-B | IS-C |
|---|---|---|---|
| Metric input | mm/min | 0.001～60000 | 0.001～24000 |
| Inch input | inch/min | 0.00001～2400 | 0.00001～960 |
| Rotary axis | deg/min | 1～60000 | 1～24000 |

| 1410 | Dry run speed (DRR) |
|---|---|

『Modification Authority』: Equipment management authority

『Value Range』:

| SETTING UNITS | DATA UNITS | VALID RANGE IS-B IS-C | DEFAULT SETTING |
|---|---|---|---|
| Metric machine | 1mm/min | 6～15000 | 1000 |
| Inch machine | 0.1inch/min | | |

Set the speed during dry run.

| 1411 | Feedrate in auto mode after power on (IFV) |
|---|---|

『Modification Authority』: Equipment management authority

『Default Setting』: 1000

『Value Range』:

| SETTING UNITS | | DATA UNITS | VALID RANGE | DEFAULT SETTING |
|---|---|---|---|---|
| Metric machine | G98 | 1 mm/min | 6～32767 | 1000 |
| | G99 | 0.001 mm/rev | | |
| Inch machine | G98 | 0.1 inch/min | | |
| | G99 | 0.0001 inch/rev | | |

Machine that does not need cutting speed change can use this parameter to specify a cutting feedrate, so that the feedrate is not required to be specified in the program. However, the actual feedrate is affected by parameter No. 1422 (maximum cutting feedrate for all axes).

**1420** **Each axis rapid traverse speed (RTT)**

『Modification Authority』: Machine authority

『Parameter Type』: Word axis

『Value Range』:

| SETTING UNITS | DATA UNITS | VALID RANGE | | DEFAULT SETTING |
|---|---|---|---|---|
| | | IS-B | IS-C | |
| Metric machine | 1 mm/min | 30～60000 | 6～24000 | 8000 |
| Inch machine | 0.1 inch/min | 30～24000 | 6～9600 | |
| Rotary axis | 1 deg/min | 30～60000 | 6～24000 | |

Set the rapid traverse speed of each axis when the rapid traverse override is 100%.

**1421** **F0 rate of rapid traverse override for each axis(FOR)**

『Modification Authority』: Equipment management authority

『Parameter Type』: Word axis

『Value Range』:

| SETTING UNITS | DATA UNITS | VALID RANGE | | DEFAULT SETTING |
|---|---|---|---|---|
| | | IS-B | IS-C | |
| Machine in metric system | 1 mm/min | 30～15000 | 30～12000 | 400 |
| Machine in inch system | 0.1 inch/min | 30～6000 | 30～4800 | |
| Rotary axis | 1 deg/min | 30～15000 | 30～12000 | |

Set F0 rate of rapid traverse override for each axis.

**1422** **Maximum cutting feedrate(MFR)for all axes**

『Modification Authority』: Machine authority

『Value Range』:

| SETTING UNITS | DATA UNITS | VALID RANGE | | DEFAULT SETTING |
|---|---|---|---|---|
| | | IS-B | IS-C | |
| Metric machine | 1mm/min | 6～60000 | 6～24000 | 8000 |
| Inch machine | 0.1inch/min | 6～24000 | 6～9600 | |

Set the maximum cutting feedrate.

**1423** **Feedrate in manual continuous feed (JFR) for each axis**

『Modification Authority』: Equipment management authority

『Parameter Type』: Word axis

『Value Range』:

| SETTING UNITS | DATA UNITS | VALID RANGE | | DEFAULT SETTING |
|---|---|---|---|---|
| | | IS-B | IS-C | |
| Machine in metric system | 1mm/min | 6～32767 | | 1000 |
| Machine in inch system | 0.1inch/min | | | |
| Rotary axis | 1 deg/min | | | |

Set the feedrate for each axis during continuous manual feed (JOG feeding); the actual feedrate is limited by parameter NO.1422 (the maximum cutting feedrate of all axes).

**1424** **Manual rapid traverse rate(MRR)for each axis**

『Modification Authority』: Equipment management authority

『Parameter Type』: Word axis

『Value Range』:

| SETTING UNITS | DATA UNITS | VALID RANGE | | DEFAULT SETTING |
|---|---|---|---|---|
| | | IS-B | IS-C | |
| Metric machine | 1 mm/min | 30～60000 | 30～24000 | 8000 |
| Inch machine | 0.1 inch/min | 30～24000 | 30～9600 | |
| Rotary machine | 1 deg/min | 30～60000 | 30～24000 | |

Set rate of manual rapid traverse when the traverse override is 100%;

**Note: When it is set to 0, the setting value of parameter 1420 is used.**

**1425** **FL rate of the reference position return for each axis (FLR)**

『Modification Authority』: Equipment management authority

『Parameter Type』: Word axis

『Value Range』:

| SETTING UNITS | DATA UNITS | VALID RANGE | | DEFAULT SETTING |
|---|---|---|---|---|
| | | IS-B | IS-C | |
| Metric machine | 1 mm/min | 6～15000 | 6～12000 | 200 |
| Inch machine | 0.1 inch/min | 6～6000 | 6～4800 | |
| Rotary axis | 1 deg/min | 6～15000 | 6～12000 | |

Set FL rate after deceleration when the reference position turn is performed for each axis;

## 5.7 Parameters of Control of Acceleration/Deceleration

| | #7 | #6 | #5 | #4 | #3 | #2 | #1 | #0 |
|---|---|---|---|---|---|---|---|---|
| **1601** | | | | **RTO** | | | | |

『Modification Authority』: Equipment management authority

『Default Setting』: 0000 0000

**#4 RTO During rapid running, the block is**

0: Not overlapped

1: Overlapped

| | #7 | #6 | #5 | #4 | #3 | #2 | #1 | #0 |
|---|---|---|---|---|---|---|---|---|
| 1610 | | | THLX | JGLx | | | | CTLx |

『Modification Authority』: Equipment management authority

『Parameter Type』: Bit axis

『Default Setting』: 0000 0000

**#0 CTLx Acceleration/deceleration of cutting feed (include feeding during dry run) is:**

0: Exponential type

1: Linear type after interpolation

**#4 JGLx The acceleration/deceleration during JOG feeding**

0: Exponential type

1: Linear type after interpolation

**#5 THLX The acceleration/deceleration during thread cutting retraction is:**

0: Exponential type

1: Linear type

| 1620 | Time constant T used for linear acceleration/deceleration (TT1) for each axis |
|---|---|

『Modification Authority』: Equipment management authority

『Parameter Type』: Word axis

『Value Range』: 0～4000 ms

『Default Setting』: 100

Specify a time constant used for linear acceleration/deceleration in rapid traverse

| 1622 | Time constant for acceleration/deceleration afar interpolation in cutting feed for each axis(ATC) |
|---|---|

『Modification Authority』: Equipment management authority

『Parameter Type』: Word axis

『Value Range』: 0～4000 ms

『Default Setting』: 100

Set time constant for acceleration/deceleration after interpolation in cutting feed for each axis(0～4000ms).

The actual used type is determined by parameter No. 1610#0 (CLTx). When CTLx set it to linear type, the maximum time constant of acceleration/deceleration is limited within 512ms; the exceeded value will also be reduced to 512ms.

**Note: Except for some special use, this parameter sets the same time constant for all axes. When different time constant is set, incorrect linear or circular shape will be formed.**

**1623** **FL rate of exponential acceleration/deceleration in cutting feed (FLC)for each axis**

『Modification Authority』: Equipment management authority

『Parameter Type』: Word axis

『Value Range』:

| SETTING UNITS | DATA UNITS | VALID RANGE | | DEFAULT SETTING |
|---|---|---|---|---|
| | | IS-B | IS-C | |
| Metric machine | 1 mm/min | 0，6～15000 | 0，6～12000 | 30 |
| Inch machine | 0.1 inch/min | 0，6～6000 | 0，6～4800 | 30 |
| Rotary axis | 1 deg/min | 0，6～15000 | 0，6～12000 | 30 |

Set the lower limit of exponential acceleration/deceleration in cutting feed (FL rate).

**1624** **Time constant for acceleration/deceleration after interpolation in JOG feed(JET)for each axis**

『Modification Authority』: Equipment management authority

『Parameter Type』: Word axis

『Value Range』: 0～4000ms

『Default Setting』: 100

Set time constant for acceleration/deceleration after interpolation in JOG feed(JET)for each axis(0～4000ms).

The actual used type is determined by parameter No. 1610#4 (JGLx). When CTLx set it to linear type, the maximum time constant of acceleration/deceleration is limited within 512ms; the exceeded value will also be reduced to 512ms.

**1625** **FL rate of exponential acceleration/deceleration in JOG feed (FLJ)for each axis**

『Modification Authority』: Equipment management authority

『Parameter Type』: Word axis

『Value Range』:

| SETTING UNITS | DATA UNITS | VALID RANGE | | DEFAULT SETTING |
|---|---|---|---|---|
| | | IS-B | IS-C | |
| Metric machine | 1 mm/min | 0，6～15000 | 0，6～12000 | 30 |
| Inch machine | 0.1 inch/min | 0，6～6000 | 0，6～4800 | 30 |
| Rotary axis | 1 deg/min | 0，6～15000 | 0，6～12000 | 30 |

Set the lower limit of exponential acceleration/deceleration in JOG feed (FL rate).

**1626** **Time constant of acceleration/deceleration in thread cutting cycle(TET)for each axis**

『Modification Authority』: Equipment management authority

『Parameter Type』: Word axis

『Value Range』: 0～4000ms

『Default Setting』: 40

Set time constant of acceleration/deceleration in thread cutting cycle.

| 1627 | **FL rate of exponential acceleration/deceleration in thread cutting cycle(FLT) for each axis** |
|---|---|

『Modification Authority』: Equipment management authority

『Parameter Type』: Word axis

『Value Range』:

| SETTING UNITS | DATA UNITS | VALID RANGE | | DEFAULT SETTING |
|---|---|---|---|---|
| | | IS-B | IS-C | |
| Machine in metric system | 1 mm/min | 0, 6～15000 | 0, 6～12000 | 30 |
| Machine in inch system | 0.1 inch/min | 0, 6～6000 | 0, 6～4800 | 30 |

Set the lower limit (FL rate) of exponential acceleration/deceleration in thread cutting cycle.

## 5.8 Parameter of Servo and Backlash Compensation

| | #7 | #6 | #5 | #4 | #3 | #2 | #1 | #0 |
|---|---|---|---|---|---|---|---|---|
| 1800 | BDEC | BD8 | | RBK | | | | |

『Modification Authority』: Machine authority

『Default Setting』: 1000 0000

**#4 RBK: Backlash compensation applied separately for cutting feed and rapid traverse**

0:Not performed

1:Performed

**Note: When parameter #1800.4 is set to 1, it is valid after the reference point is established; before that, the backlash value set by parameter #1851 is valid, and the backlash compensation value set by #1852 is invalid.**

**#6 BD8: Frequency of backlash compensation pulses output involved:**

0: Frequency set by parameter No. 1853

1: 1/8 of frequency set by parameter No. 1853

**#7 BDEC: Backlash compensation pulses are:**

0: f output in fixed pulse frequency (set by parameter No. 1853 and No. 1800.6)

1: output based on acceleration/deceleration

| | #7 | #6 | #5 | #4 | #3 | #2 | #1 | #0 |
|---|---|---|---|---|---|---|---|---|
| 1811 | | | | | | POD | | ABP |

『Modification Authority』: Machine authority

『Way of Validating』: After power-on

『Parameter Type』: Bit axis

『Default Setting』: 0000 0000

**#0 ABP Select pulse drive modes**

0: Pulse +direction mode

1: AB phases pulse mode

**#2 POD Selected output directions for each axis pulse**

0: Not reversed

1: Reversed

| | #7 | #6 | #5 | #4 | #3 | #2 | #1 | #0 |
|---|---|---|---|---|---|---|---|---|
| 1815 | | | APCx | APZx | | | | APRx |

『Modification Authority』: Machine authority

『Way of Validating』: After power-on

『Parameter Type』: Bit axis

『Default Setting』: 0000 0000

**#0 APRx Direction of position on absolute position detector when using absolute position encoder:**

0: Not reversed

1: Reversed

**#4 APZx Machine position and position on absolute position detector when the absolute position detector is used are:**

0: Not the same

1: The same

**Note: When the absolute position detector is used, this parameter should be set to 0 after initial setting or detector changing, then re-power on and perform manual reference point return. In this way, the mechanical position will be in accordance with the position of the detector, and this parameter will be set to 1 automatically.**

**#5 APCx Position detector is:**

0: Other than absolute position detector

1: Absolute position detector

| | #7 | #6 | #5 | #4 | #3 | #2 | #1 | #0 |
|---|---|---|---|---|---|---|---|---|
| 1816 | | DM3x | DM2x | DM1x | | | | ISAx |

『Modification Authority』: Machine authority

『Way of Validating』: After power-on

『Parameter Type』: Bit axis

『Default Setting』: 0001 0001

**#0 ISAx Servo alarm signal level is:**

0: High

1: Low

**#4-#6 DM1x-DM3x: The setting of detection multiplier ratio (DMR)**

| SETTING VALUE | | | DETECTION MULTIPLY RATIO (DMR) |
|---|---|---|---|
| DM3x | DM2x | DM1x | |
| 0 | 0 | 0 | 1/2 |
| 0 | 0 | 1 | 1 |
| 0 | 1 | 0 | 3/2 |
| 0 | 1 | 1 | 2 |
| 1 | 0 | 0 | 5/2 |
| 1 | 0 | 1 | 3 |
| 1 | 1 | 0 | 7/2 |
| 1 | 1 | 1 | 4 |

**1820** **Command multiply ratio of each axis (CMR)**

『Modification Authority』: Machine authority

『Parameter Type』: Word axis

『Value Range』:

| COMMAND MULTIPLY RATIO (CMR) | VALID RANGE OF VALUE SET BY NO.1820 | DEFAULT SETTING |
|---|---|---|
| 1/2～1/27 | 102～127 | 2 |
| 1 ～ 48 | 2～96 | |

Set the command multiply ratio (CMR) of each axis.

1. When the command multiply ratio (CMR)is 1/2～1/27, the setting value = 1 / CMR＋100;

2. When the command multiply ratio (CMR)is 1～48, the setting value = 2×CMR.

Gear ratio output by each axis＝CMR/ DMR

Detection unit=minimum movement unit/ CMR

The relations between the setting units and the minimum movement units:

| | | IS－B | | IS－C | |
|---|---|---|---|---|---|
| | Input | least input increment | Least command increment | least input increment | Least command increment |
| Metric machine | Metric | 0.001mm (diameter) | 0.0005mm | 0.0001mm(diameter) | 0.00005mm |
| | | 0.001mm (radius) | 0.001mm | 0.0001mm (radius) | 0.0001mm |
| | Inch | 0.0001 inch (diameter) | 0.0005mm | 0.00001 inch (diameter) | 0.00005mm |
| | | 0.0001 inch (radius) | 0.001mm | 0.00001 inch (radius) | 0.0001mm |
| Inch machine | Metric | 0.001mm (diameter) | 0.00005 inch | 0.0001mm (diameter) | 0.000005 inch |
| | | 0.001mm (radius) | 0.0001 inch | 0.0001mm (radius) | 0.00001 inch |
| | Inch | 0.0001 inch (diameter) | 0.00005 inch | 0.00001 inch (diameter) | 0.000005 inch |
| | | 0.0001 inch (radius) | 0.0001 inch | 0.00001 inch (radius | 0.00001 inch |
| Rotary axis | | 0.001deg | 0.001deg | 0.0001deg | 0.0001deg |

**1851** **Backlash compensation value (BCV) for each axis**

『Modification Authority』: Machine authority

『Parameter Type』: Word axis

『Value Range』: -9999～+9999 (Detection unit)

『Default Setting』: 0

Set the backlash compensation value.

After power-on, when the machine moves in a direction which is opposite to the reference point return, the backlash compensation is performed for the first time.

The detection unit is related to parameter No. 1820 and least command increment. Refer to the notes of parameter No. 1820 for the relations of setting unit and least command increment.

**1852** **Backlash compensation value used for rapid traverse(BCVR)for each axis**

『Modification Authority』: Machine authority

『Parameter Type』: Word axis

『Value Range』: -9999～+9999 (Detection units)

『Default Setting』: 0

Set the backlash compensation value used for rapid traverse. It is valid when parameter NO.1800#4(RBK) is set to 1. It can change the backlash compensation value according to the cutting feedrate/rapid traverse speed for high-precision machining.

**Note 1: Manually continuous feeding (JOG) is taken as cutting feed.**
**Note 2: When parameter No.1800#4(RBK) is set to 1, parameter No.1851 is the backlash compensation value of cutting feed, parameter No.1852 is the backlash compensation value of rapid traverse. When parameter NO.1800#4(RBK) is set to 0, parameter No.1851 is the backlash compensation value of cutting feed/rapid traverse.**

**1853** **The setting of pulse frequency for backlash compensation**

『Modification Authority』: Machine authority

『Parameter Type』: Word

『Value Range』: 1～32

『Default Setting』: 12

The setting of pulse frequency for backlash compensation(1～32)

**2071** **Backlash acceleration effective duration (BAT)**

『Modification Authority』: Machine authority

『Parameter Type』: Word axis

『Value Range』: 0～100 ms

『Default Setting』: 40

Set backlash acceleration effective duration.

| | #7 | #6 | #5 | #4 | #3 | #2 | #1 | #0 |
|---|---|---|---|---|---|---|---|---|
| **3001** | | | | | | **RWM** | | |

『Modification Authority』: Equipment management authority

『Parameter Type』: Bit axis

『Value Range』: 0～100 ms

『Default Setting』: 0000 0100

**# 2 RWM** **when a program is being rewound in program memory, RWD signal is:**
0: Not output
1: Output

## 5.9 Parameter of Input/Output

| | #7 | #6 | #5 | #4 | #3 | #2 | #1 | #0 |
|---|---|---|---|---|---|---|---|---|
| **3003** | **ESP** | | | | | | | |

『Modification Authority』: Machine authority

『Default Setting』: 1000 0000

**#7 ESP External emergency stop alarm input signal (X0.5)**

0: When the signal is 0 (low level), emergency stop alarm occurs
1: When the signal is 1 (high level), emergency stop alarm does not occur

| | #7 | #6 | #5 | #4 | #3 | #2 | #1 | #0 |
|---|---|---|---|---|---|---|---|---|
| 3004 | | | OTH | | | | | |

『Modification Authority』: Machine authority

『Default Setting』: 0010 0000

**#5 OTH Check overtravel limit signal or not:**

0: Check
1: Not check

**Note: If this parameter is set to 1 (not check) after an overtravel alarm is issued, the alarm cannot be cleared by just pressing reset key; To clear the alarm, you need to move the workpiece within the limit and set this parameter to 0.**

| | #7 | #6 | #5 | #4 | #3 | #2 | #1 | #0 |
|---|---|---|---|---|---|---|---|---|
| 3006 | | | | | | | | GDC |

『Modification Authority』: Machine authority

『Default Setting』: 0000 0000

**#0 GDC Deceleration signal of the reference point return**

0: Use X signal
1: Use G196 (X signal is invalid)

| | #7 | #6 | #5 | #4 | #3 | #2 | #1 | #0 |
|---|---|---|---|---|---|---|---|---|
| 3009 | | | DECx | | | | | |

『Modification Authority』: Machine authority

『Parameter Type』: Bit axis

『Default Setting』: 0010 0000

**#5 DECx: Deceleration signal of the reference point return**

0: When the signal is 0 (low level), it means deceleration
1: When the signal is 1 (high level), it means deceleration;

| 3010 | Delay time of the strobe signals MT, TF and SF(MFT) |
|---|---|

『Modification Authority』: Machine authority

『Value Range』: 16 ms～32767 ms

『Default Setting』: 16

Set the time from codes M, S, T and B being sent to MF, SF, TF and BF being sent.

| 3011 | Acceptable width(MAW) of M, T, S function completion signal |
|---|---|

『Modification Authority』: Machine authority

『Parameter Type』:Word type

『Default Setting』: 16

Set the minimum width of the finish signals (FIN) of M, S, T and B function.

**Note: The time is 8ms or multiple of 12, or the value will be rounded to multiple of 12.**

| 3017 | Output time of reset signal (RST) |
|---|---|

『Modification Authority』: Machine authority

『Value Range』: 0～255

『Default Setting』: 32

Set the delay time when the resetting signal RST is output.

RST signal output time =reset time + the parameter value X 16ms.

| 3030 | Allowable number of digits for M code (MCB) |
|---|---|

『Modification Authority』: Machine authority

『Value Range』: 2～8

『Default Setting』: 4

Set the allowable digits of M code.

| 3031 | Allowable number of digits for S code(SCB) |
|---|---|

『Modification Authority』: Machine authority

『Value Range』: 1～5

『Default Setting』: 4

Set the allowable number of digits for S code.

| 3032 | Allowable number of digits for T code(TCB) |
|---|---|

『Modification Authority』: Machine authority

『Value Range』: 2～8

『Default Setting』: 4

Set the allowable number of digits for T code.

## 5.10 Parameter of Display and Editing

| | #7 | #6 | #5 | #4 | #3 | #2 | #1 | #0 |
|---|---|---|---|---|---|---|---|---|
| 3101 | | | | BGD | | | | |

『Modification Authority』: Equipment management authority

『Default Setting』: 0000 0000

**#4 BGD In background editing, a program currently selected in the frontground:**

0: Cannot be selected

1: Can be selected

| | #7 | #6 | #5 | #4 | #3 | #2 | #1 | #0 |
|---|---|---|---|---|---|---|---|---|
| 3102 | | | | | CHI | | | |

『Modification Authority』: Machine authority

『Way of Validating』: After power-on

『Default Setting』: 0000 1000

**#3 CHI Select display language:**

0: English

1: Chinese

Set the display language;

| | #7 | #6 | #5 | #4 | #3 | #2 | #1 | #0 |
|---|---|---|---|---|---|---|---|---|
| 3104 | DAC | DAL | DRC | DRL | | | | MCN |

『Modification Authority』: Machine authority

『Default Setting』: 1100 0000

**#0 MCN Machine position:**

0: Displayed according to the unit of output

1: Displayed according to the unit of input

**#4 DRL Relative position:**

0: The actual position displayed takes into account tool offset

1: The programmed position displayed does not take into account tool offset

**Note: When tool geometry compensation of the T system is to be performed by shifting the coordinate system (with bit 4 (LGT) of parameter No. 5002 set to 0), the programmed position, ignoring tool offset, is displayed (with this parameter set to 1), but the programmed position, ignoring tool geometry compensation, cannot be displayed.**

**#5 DRC Relative position:**

0: The actual position displayed takes into account tool nose radius compensation

1: The programmed position displayed does not take into account tool nose radius compensation

**#6 DAL Absolute position:**

0: The actual position displayed takes into account tool offset

1: The programmed position displayed does not take into account tool offset

**Note: When tool geometry compensation of the T system is to be performed by shifting the coordinate system (with bit 4 (LGT) of parameter No. 5002 set to 0), the programmed position, ignoring tool offset, is displayed (with this parameter set to 1), but the programmed position, ignoring tool geometry compensation, cannot be displayed.**

**#7 DAC: Absolute position:**

0: The actual position displayed takes into account tool nose radius compensation

1: The programmed position displayed does not take into account tool nose radius compensation

| | #7 | #6 | #5 | #4 | #3 | #2 | #1 | #0 |
|---|---|---|---|---|---|---|---|---|
| 3107 | | | | SOR | REV | DNC | | |

『Modification Authority』: Equipment management authority

『Default Setting』: 0001 0000

**#2 DNC Upon reset, the program displayed for DNC operation is:**

0: Not cleared

1: Cleared

**#3 REV The actual speed in feed per revolution mode is displayed in:**

0: mm/min or inch/min

1: mm/rev or inch/rev

**#4 SOR Display of the program directory:**

0: Programs are listed in the order of registration

1: Programs are listed in the order of program number

| | #7 | #6 | #5 | #4 | #3 | #2 | #1 | #0 |
|---|---|---|---|---|---|---|---|---|
| 3110 | | | | | | AHC | | |

『Modification Authority』: Equipment management authority

『Default Setting』: 0000 0000

**#2 AHC With a soft key, the alarm history:**

0: Can be cleared

1: Cannot be cleared

| | #7 | #6 | #5 | #4 | #3 | #2 | #1 | #0 |
|---|---|---|---|---|---|---|---|---|
| 3111 | NPA | | | | | | | |

『Modification Authority』: Equipment management authority

『Default Setting』: 0000 0000

**#7 AHC Action taken when an alarm is generated or when an operator message is entered:**

0: The display shifts to the alarm message screen

1: The display doesn't shift to the alarm message screen

| | #7 | #6 | #5 | #4 | #3 | #2 | #1 | #0 |
|---|---|---|---|---|---|---|---|---|
| 3114 | | | | | | | | IPC |

『Modification Authority』: Equipment management authority

『Default Setting』: 0000 0000

**#0 IPC When the function key is pressed whose screen is being displayed:**

0: The screen is changed

1: The screen is not changed

| | #7 | #6 | #5 | #4 | #3 | #2 | #1 | #0 |
|---|---|---|---|---|---|---|---|---|
| 3202 | | | CPD | | | | | |

『Modification Authority』: Equipment management authority

『Default Setting』: 0000 0000

**#5 CPD When a NC program is deleted, a confirmation message and soft key are:**

0: Not output

1: Output

| | #7 | #6 | #5 | #4 | #3 | #2 | #1 | #0 |
|---|---|---|---|---|---|---|---|---|
| 3203 | MCL | MER | | | | | | |

『Modification Authority』: Equipment management authority

『Default Setting』: 0000 0000

**#6 MER When the last block of a program has been executed in the MDI mode, the executed block is:**

0: Not deleted

1: Deleted

**Note: Even MER is 0, when "%" (end code) is read in and executed, the program is also deleted ("%"is inserted in the end of the program automatically).**

**#7 MCL Whether a prepared program in MDI mode is cleared by reset:**

0: Not deleted

1: Deleted

| | #7 | #6 | #5 | #4 | #3 | #2 | #1 | #0 |
|---|---|---|---|---|---|---|---|---|
| 3209 | | | | | | | | MPD |

『Modification Authority』: Equipment management authority

『Default Setting』: 0000 0000

**#0 MPD When a subprogram is executed, the main program number is:**

0: Not displayed

1: Displayed

| 3216 | Increment in sequence numbers inserted automatically(INC) |
|---|---|

『Modification Authority』:Equipment management authority

『Value Range』: 0～9999

『Default Setting』: 10

Set the increment value in automatic sequence number insertion (when Para NO.0000#5 SEQ is set to 1).

| 3281 | Set display language (LANG) |
|---|---|

『Modification Authority』:Machine authority

『Way of Validating』: After power-on

『Parameter Type』: Word

『Value Range』: 0～2

『Default Setting』: 1

Select display language (LANG)\r0: English 1: Chinese 2: Russian

## 5.11 Parameter of Programming

| | #7 | #6 | #5 | #4 | #3 | #2 | #1 | #0 |
|---|---|---|---|---|---|---|---|---|
| 3401 | | | | | | NCK | | DPI |

『Modification Authority』: Equipment management authority

『Default Setting』: 0000 0001

**#0 DPI When a decimal point is omitted in an address that can include a decimal point:**

0: The least input increment is assumed

1: The unit of mm, inch, second is assumed

**#2 NCK The same sequence number is specified twice or more in a program:**

0: An alarm is issued

1: Not alarm

| | #7 | #6 | #5 | #4 | #3 | #2 | #1 | #0 |
|---|---|---|---|---|---|---|---|---|
| 3402 | G23 | CLR | | FPM | | | | G01 |

『Modification Authority』: Equipment management authority

『Default Setting』: 0001 0000

**#0 G01 Mode entered when the power is turned on or when the control is cleared:**

0: G00 mode (orientation)

1: G01 mode (linear interpolation)

**#4 FPM When the power is turned on:**

0: Feed per revolution mode

1: Feed per minute mode

**#6 CLR Reset button on the MDI panel, external reset signal, and emergency stop signal:**

0: Causes reset state

1: Causes clear state

**#7 G23 When the power is turned on:**

0: G22 mode(stored stroke check on)

1: G23 mode(stored stroke check off)

| | #7 | #6 | #5 | #4 | #3 | #2 | #1 | #0 |
|---|---|---|---|---|---|---|---|---|
| 3403 | | AD2 | CIR | RER | | | | |

『Modification Authority』: Equipment management authority

『Default Setting』: 0000 0000

**#4 RER When arc radius(R) not out-of-tolerance is so small that end point is not on the arc in arc interpolation:**

0: Calculate new radius for semicircle

1: Alarm is issued

**#5 CIR When neither the distance(I,J,K)from the start point to the center nor an arc radius (R) is specified in circular interpolation:**

0: The tool moves to end point by linear interpolation

1: Alarm is issued

**#6 AD2 Specification of the same address two or more times in a block:**

0: Next specification is enabled

1: Alarm is issued

**Note: When AD2 is set to 1 and G codes in the same group are specified in a block, an alarm is issued.**

| | #7 | #6 | #5 | #4 | #3 | #2 | #1 | #0 |
|---|---|---|---|---|---|---|---|---|
| 3404 | M3B | EOR | M02 | M30 | | | | |

『Modification Authority』: Equipment management authority

『Default Setting』: 0000 0000

**#4 M30 When M30 is executed in automatic operation:**

0: Control returns to the head of the program

1: Control does not return to the head of the program.

**#5 M02 When M02 is executed in automatic operation**

0:Control returns to the head of the program.

1: Control does not return to the head of the program.

**#6 EOR When an end-of-record mark(%) is read during program execution0: P/S alarms (stop auto running, display alarm state)**

1: Alarm occurs

1:No alarm occurs

**#7 M3B The number of M codes that can be specified in one block**

0: 1

1: Up to 3

| 3410 | Tolerance of arc radius(CRE) |
|---|---|

『Modification Authority』: Equipment management authority

『Value Range』: 0～9999 9999

『Default Setting』: 0

| SETTING UNITS | IS－B | IS－C | UNITS |
|---|---|---|---|
| input in mm | 0.001 | 0.0001 | mm |
| Input in inch system | 0.0001 | 0.00001 | inch |

Set tolerance of radius between start point and end point in circular interpolation (G02, G03).When the difference of radius is larger than the setting value, an alarm is issued.

**Note: When the setting value is 0, the difference of radius is not checked.**

| 3411 | M code preventing buffering 1 |
|---|---|

| 3412 | M code preventing buffering 2 |
|---|---|

| 3413 | M code preventing buffering 3 |
|---|---|

| 3414 | M code preventing buffering 4 |
|---|---|

| 3415 | M code preventing buffering 5 |
|---|---|

| 3416 | M code preventing buffering 6 |
|---|---|

| 3417 | M code preventing buffering 7 |
|---|---|
| 3418 | M code preventing buffering 8 |

『Modification Authority』: Equipment management authority

『Way of validating』: Immediately

『Parameter Type』: Word

『Value Range』: 0～9999

『Default Setting』: 0

This parameter sets M codes that prevent buffering the following blocks. If processing directed by an M code must be performed by the machine without buffering the following block, specify the M code.

| 3440 | Path error range in rough machining G64 mode (ARE) |
|---|---|

『Modification Authority』: Equipment management authority

『Way of validating』: Immediately

『Parameter Type』: Word

『Value Range』: 0～9999

『Default Setting』: 10000

Set the error range of path in the mode of G64 rough machining. Setting unit: IS-B 0.001mm; IS-C: 0.0001mm (0~99999);

| 3441 | Path error range in finish machining G61 mode (APE) |
|---|---|

『Modification Authority』: Equipment management authority

『Way of validating』: Immediately

『Parameter Type』: Word

『Value Range』: 0～9999

『Default Setting』: 0

Set the error range of path in the mode of G61 finish machining. Setting unit: IS-B 0.001mm; IS-C: 0.0001mm (0~99999);

## 5.12 Parameters of the Screw Pitch Error Compensation

| 3620 | Number of the pitch error compensation position for reference position(NPR) for each axis |
|---|---|

『Modification Authority』: Machine authority

『Way of Validating』: After power-on

『Parameter Type』: Word axis

『Value Range』: 0～1023

『Default Setting』: 0

| 3621 | Number of pitch error compensation position at extremely negative position (NEN)for each axis |
|---|---|

『Modification Authority』: Machine authority

『Way of Validating』: After power-on

『Parameter Type』: Word axis

『Value Range』: 0～1023

『Default Setting』: 0

Set the number of pitch error compensation position at extremely negative position.

| 3622 | Number of pitch error compensation position at extremely positive position (NEP) |
|---|---|

『Modification Authority』: Machine authority

『Way of Validating』: After power-on

『Parameter Type』: Word axis

『Value Range』: 0～1023

『Default Setting』: 0

Set the number of pitch error compensation position at extremely positive position.

| 3623 | Magnification for pitch error compensation (PCM) for each axis |
|---|---|

『Modification Authority』: Machine authority

『Way of Validating』: After power-on

『Parameter Type』: Word axis

『Value Range』: 0～100

『Default Setting』: 0

Set the magnification for pitch error compensation.

If the override is set to 1, the detection unit is the same as that of compensation.
If the override is set to 0, the override is the same as one when it is set to 1.

| 3624 | Interval between pitch error compensation positions (PCI) for each axis |
|---|---|

『Modification Authority』: Machine authority

『Way of Validating』: After power-on

『Parameter Type』: Word axis

『Value Range』: 0～100

『Default Setting』: 0～99 999 999

『Default Setting』: 0

| SETTING UNITS | IS－B | IS－C | UNITS |
|---|---|---|---|
| Metric input | 0.001 | 0.0001 | mm |
| Inch input | 0.0001 | 0.00001 | inch |
| Rotary axis | 0.001 | 0.0001 | deg |

The screw pitch compensation points are distributed in equal interval, and the interval value of each axis is set respectively. The minimum value of the interval is limited and set by the following formula: Minimum value = Maximum feedrate (rapid traverse feedrate) / 7500.

Unit: Screw pitch compensation minimum interval: mm, inch and deg.

Maximum feedrate: mm/min, inch/min and deg/min.

For example: When the maximum feedrate is 15000mm/min, the minimum value of the screw pitch error compensation interval is 2mm.

However, according to the setting magnification, when the absolute value of the compensation point value exceeds 100, the interval of the compensation point is magnified by the multiple which is calculated by the following formula:

Multiple = Max. compensation amount (absolute value)/128 (round up the digits after the decimal point)

Screw pitch compensation minimum interval = Value, which is obtained from the above maximum feedrate X multiple

**Note 1: The unit of the pitch error compensation value is the same as that of the detection. The detection unit is related to parameter No.1820 (command magnify ratio CMR) and the minimum movement unit. For the relation between the setting units and the minimum movement units, please refer to the introduction of parameter No.1820.**

| 3628 | Setting value of the pitch error compensation pulse frequency |
|---|---|

『Modification Authority』: Machine authority

『Parameter Type』: Word

『Value Range』:1~32

『Default Setting』: 8

The setting value of pulse frequency for pitch error compensation.

## 5.13 Parameters of the Spindle Control

| | #7 | #6 | #5 | #4 | #3 | #2 | #1 | #0 |
|---|---|---|---|---|---|---|---|---|
| 3700 | | | | | | | NRF | |

『Modification Authority』: Equipment management authority

『Default Setting』： 0000 0000

**#1 NRF The first move command (G00) after the spindle is switched to Cs axis performs:**

0: Positioning after returning to the reference position;

1: Normal positioning

| | #7 | #6 | #5 | #4 | #3 | #2 | #1 | #0 |
|---|---|---|---|---|---|---|---|---|
| 3704 | SCS3 | SCS2 | | | | | | |

『Modification Authority』: Machine authority

『Way of validating』: After power-on

『Default Setting』： 0000 0000

**#6 SCS2 The Cs contour control of the 2nd spindle is:**

0: Invalid

1: Valid

**#7 SCS3 The Cs contour control of the 3rd spindle is:**

0: Invalid

1: Valid

**Note: Parameter SC2 and SC3 are valid only when Cs contour control is used (parameter No. 8133#2 is 1).**

| | #7 | #6 | #5 | #4 | #3 | #2 | #1 | #0 |
|---|---|---|---|---|---|---|---|---|
| 3705 | | | | EVS | | | | |

『Modification Authority』: Equipment management authority

『Default Setting』: 0000 0000

**#4 EVS When the spindle control function is used, S codes and SF are:**

0: Not output for an S command

1: Output for an S command

| | #7 | #6 | #5 | #4 | #3 | #2 | #1 | #0 |
|---|---|---|---|---|---|---|---|---|
| 3708 | | TSO | | | | | SAT | SAR |

『Modification Authority』: Equipment management authority

『Default Setting』: 0000 0000

**#0 SAR The spindle speed arrival signal is:**

0: Not checked

1: Checked

**#1 SAT Check of the spindle speed arrival signal at the start of executing the thread cutting block:**

0: The signal is checked only when SAR is set

1: The signal is always checked irrespective of whether SAR is set

**Note: When the thread cutting block is executed continually, the spindle speed arrival signal is not checked after the 2nd block.**

**#6 TSO During a threading or tapping cycle, the spindle override is:**

0: Disabled (fixed to 100%)

1: Enabled

**Note: In rigid tapping, the override is fixed to 100%, and it is not related to the setting of the parameter.**

| | #7 | #6 | #5 | #4 | #3 | #2 | #1 | #0 |
|---|---|---|---|---|---|---|---|---|
| 3709 | | | | | | MSI | | SAM |

『Modification Authority』: Equipment management authority

『Default Setting』: 0000 0000

**#0 SAM The sampling frequency to obtain the average spindle speed:**

0: 4 (Normally, set to 0)

1: 1

**#2 MSI In multi-spindle control, the SIND signal is valid**

0: Only when the first spindle is valid

1: For each spindle irrespective of whether the spindle is selected

**3710 Number of CNC controlled spindles(CCS)**

『Modification Authority』: System authority

『Way of Validating』: After power-on

『Value Range』: 1～3

『Default Setting』: 1

Set the maximum number of spindles controlled by the CNC;

**3717 Number of amplifier for the spindle (NSS)**

『Modification Authority』: Machine authority

『Way of Validating』: After power-on

『Parameter type』: Word spindle

『Value Range』: 0～3

『Default Setting』: 1

This parameter specifies the number of amplifier used for each spindle.

| Setting value | Interface |
|---|---|
| 0 | None |
| 1 | 1st spindle interface |
| 2 | 2nd spindle interface |
| 3 | Channel B GSK-CAN extension interface |

**3720 Encoder line number of each spindle (CNT)**

『Modification Authority』: Machine authority

『Way of Validating』: After power-on

『Parameter type』: Word spindle

『Value Range』: 100～99999999

『Default Setting』: 1024

Set the line number of spindle encoder;

**3721 Number of gear teeth on the position encoder side for each spindle (GOE)**

『Modification Authority』: Machine authority

『Parameter type』: Word spindle

『Value Range』: 1～9999

『Default Setting』： 1

Set the number of gear teeth on the position encoder side in speed control (such as feed per revolution and threading).

**3722** **Number of gear teeth on the spindle side（GOS）**

『Modification Authority』： Machine authority

『Parameter type』： Word spindle

『Value Range』： 1～9999

『Default Setting』： 1

Set the number of gear teeth on the spindle side in speed control (such as feed per revolution and threading) .

**3723** **Channel number corresponding to each spindle encoder（CSE）**

『Modification Authority』： Machine authority

『Way of Validating』： After power-on

『Parameter type』： Word spindle

『Value Range』： 1～3

『Default Setting』： 1

Set the channel number of each spindle encoder.

| Setting Value | Interface |
|---|---|
| 1 | 1st encoder interface |
| 2 | 2nd encoder interface |
| 3 | Channel B GSK-CAN interface |

**3725** **Number of the servo axis which interpolated with the Cs contour axis (FCCS)**

『Modification Authority』： Machine authority

『Way of Validating』： After power-on

『Parameter type』： Word spindle

『Value Range』： 0～5

『Default Setting』： 0

Set the servo axis number of corresponding feed axis during Cs contour control;

| Setting Value | Servo Axis Number |
|---|---|
| 0 | None |
| 1 | 1st servo axis |
| 2 | 2nd servo axis |
| 3 | 3rd servo axis |
| 4 | 4th servo axis |
| 5 | 5th servo axis |

**3730** **Data used for adjusting the gain of analog output of spindle speed (AGS)**

『Modification Authority』： Machine authority

『Parameter type』： Word spindle

『Value Range』: 700～1250

『Default Setting』: 1000

『Data unit』: 0.1%

Set the increment adjustment data of the spindle speed analog output. (Adjusting method)

（1） Set the standard setting value 1000,

（2） Specify the spindle speed when the spindle speed analog output maximum voltage is 10V.

（3） Measure the output voltage.

（4） Set the value in the following formula in parameter No.3730:

$$\text{Setting value} = \frac{10\ (V)}{\text{Measured voltage}\ (V)} \times 1000$$

(5) After setting the parameter, specify the spindle speed analog output as the spindle speed of the maximum voltage again, and make sure the output voltage is 10V.

| 3731 | Compensation value of the spindle speed analog output offset voltage (CSS) |
|---|---|

『Modification Authority』: Machine authority

『Parameter type』: Word spindle

『Value Range』: -1024～+1024

The parameter sets the compensation value of the spindle speed analog output offset voltage.

1. Set the standard setting value to 0.
2. Specify the analog output voltage to 0V, which is theoretical spindle speed.
3. Measure the output voltage.
4. Set the value in the following formula in parameter No.3731.

$$\text{Setting value} = \frac{-8191 \times \text{offset voltage}\ (V)}{12.5}$$

5. After setting the parameter, specify the analog output voltage to 0V again, which is the theoretical spindle speed, and make sure the voltage is 0V.

| 3740 | Time elapsed prior to checking the spindle speed arrival signal(SAD) |
|---|---|

『Modification Authority』: Machine authority

『Value Range』: 5～32767ms

『Default Setting』:1000

Set the time elapsed from the execution of the S function up to the checking of the spindle speed arrival signal.

| 3741 | Maximum spindle speed for gear 1 (MSG1) |
|---|---|

| 3742 | Maximum spindle speed for gear 2 (MSG2) |
|---|---|

| 3743 | Maximum spindle speed for gear 3 (MSG3) |
|---|---|

| 3744 | Maximum spindle speed for gear 4 (MSG4) |
|---|---|

『Modification Authority』: Machine authority

『Default Setting』: 6000

『Parameter type』: Word spindle

『Value Range』: 0～32767r/min

『Default Setting』: 6000

Set the maximum speed for each gear.

| 3770 | Axis as the calculation reference in constant surface speed control(ACS) |
|---|---|

『Modification Authority』: Machine authority

『Default Setting』: 0

『Value Range』: 0～number of the controlled axes

Set the axis as the calculation reference in constant surface speed control.

**Note: When 0 is set, constant surface speed control is always applied to X axis. P value in G96 is invalid to constant surface control.**

| 3771 | Minimum spindle speed in constant surface speed control(G96) (CFL) |
|---|---|

『Modification Authority』: Machine authority

『Value Range』: 0～32767r/min

『Default Setting』: 100

Set the minimum spindle speed in constant surface speed control. When constant surface control is performed, and the spindle speed is lower than the specified speed, the minimum spindle speed is used.

| 3772 | Maximum spindle speed(MSS) |
|---|---|

『Modification Authority』: Machine authority

『Value Range』: 0～32767r/min

『Default Setting』: 6000

Set the maximum spindle speed. When specified spindle speed exceeds the upper limit of spindle speed, or the spindle speed override exceeds the upper limit, the actual spindle speed will be the maximum spindle speed.

**Note 1: When constant surface speed control is performed, the spindle speed will be limited by maximum speed no matter whether G96 or G97 is specified.**
**Note 2: When the parameter is set to 0, there is no limit for spindle speed.**
**Note 3: When the spindle is controlled by PLC, this parameter is disabled and there is no limit for spindle speed.**

## 5.14 Parameters of the Tool Compensation

| | #7 | #6 | #5 | #4 | #3 | #2 | #1 | #0 |
|---|---|---|---|---|---|---|---|---|
| 5001 | | EVO | | EVR | | | | |

『Modification Authority』: Equipment management authority

『Default Setting』: 0000 0000

**#4 EVR In tool offset compensation mode, when the compensation value is changed:**

0: A block specifying the next T code and subsequent blocks become valid

1: A block to be buffered next and subsequent blocks become valid

**#6 EVO In tool offset compensation mode, when the compensation amount is changed:**

0: A block specifying the next T code and subsequent blocks become valid

1: A block to be buffered next and subsequent blocks become valid

| | #7 | #6 | #5 | #4 | #3 | #2 | #1 | #0 |
|---|---|---|---|---|---|---|---|---|
| 5002 | | LWM | | LGT | | LWT | | LD1 |

『Modification Authority』: Equipment management authority

『Default Setting』: 0000 0000

**#0 LD1 Tool offset number is:**

0: Specified using the lower two digits of a T code

1: Specified using the lower one digit of a T code

**#2 LWT Tool wear compensation is performed by:**

0: Shifting the coordinate system

1: Moving the tool

**#4 LGT Tool offset compensation is:**

0: Compensated by the shift of the coordinate system

1: Compensated by the tool movement

**#6 LWM Tool offset (when LGT=1)**

0: Is done in the T code block

1: Is done together with the axis movement

**Note: When LGT is 0, the offset is executed in T code block, and it has nothing to do with this parameter.**

| | #7 | #6 | #5 | #4 | #3 | #2 | #1 | #0 |
|---|---|---|---|---|---|---|---|---|
| 5003 | | LVC | | | | CCN | | |

『Modification Authority』: Equipment management authority

『Default Setting』: 0000 0000

**#2 CCN When automatic reference position return (G28) is specified in tool nose radius compensation:**

0: Compensation is cancelled in movement to the intermediate position

1: Compensation is not cancelled in movement to the intermediate position, but cancelled in movement to the reference position.

**#6 LVC Tool offset value is**

0: Not cleared during reset

1: Cleared during reset

**Note: The function of tool offset clearing by reset is valid only in MDI mode.**

| | #7 | #6 | #5 | #4 | #3 | #2 | #1 | #0 |
|---|---|---|---|---|---|---|---|---|
| 5004 | | | | | | | ORC | |

『Modification Authority』: Equipment management authority

『Default Setting』: 0000 0000

**#1 ORC Tool offset value**

0: Set by the diameter specification (Can be set in only the when axis is under diameter programming)

1: Set by the radius specification

| | #7 | #6 | #5 | #4 | #3 | #2 | #1 | #0 |
|---|---|---|---|---|---|---|---|---|
| 5005 | | | | | | PRC | | |

『Modification Authority』: Equipment management authority

『Default Setting』: 0000 0000

**#2 PRC Direct input of tool offset value:**

0: Not use a PRC signal

1: Use a PRC signal

| | #7 | #6 | #5 | #4 | #3 | #2 | #1 | #0 |
|---|---|---|---|---|---|---|---|---|
| 5006 | | | | | | | TGC | OIM |

『Modification Authority』: Equipment management authority

『Way of Validating』: After power-on

『Default Setting』: 0000 0000

**#0 OIM When the unit is switched between the inch and metric systems, automatic tool offset value conversation is:**

0: Not performed

1: Performed

**#1 TGC When a T code is specified in G50, G04 or G10:**

0: No alarm occurs

1: Alarm occurs

| | #7 | #6 | #5 | #4 | #3 | #2 | #1 | #0 |
|---|---|---|---|---|---|---|---|---|
| 5008 | | CNS | CNF | MCR | CNV | | CNC | CNI |

『Modification Authority』: Equipment management authority

『Default Setting』: 0000 0000

**#0 CNI Interference check for tool nose radius compensation is:**

0: Performed

1: Not performed

**#1 During interference check of tool nose radius compensation, when the direction of movement after application of offset differs from the programmed direction by between 90 and 270 degrees:**

0: An alarm is issued

1: No alarm is issued

**#3 CNV Interference check and vector erasure of tool nose radius compensation are:**

0: Performed

1: Not performed

**#4 MCR If G41/G42(tool nose radius compensation) is specified in MDI mode, an alarm is:**

0: Not raised

1:Raised

**Note: In MDI mode, the tool nose radius compensation is not performed regardless the parameter setting.**

**#5 CNF Interference checks for tool nose radius compensation when machining the inner side of full circle:**

0: An alarm is issued

1: No alarm is issued

**#6 CNS As a step is smaller than the tool radius compensation, interference check of tool nose radius compensation:**

0: An alarm is issued

1: No alarm is issued

| 5010 | During the tool nose compensation, the limit value of the vector is ignored when the tool traverses along the corner outside (CLV) |
|---|---|

『Modification Authority』: Equipment management authority

『Value Range』: 0～16383

| SETTING UNITS | IS-B | IS-C | UNITS |
|---|---|---|---|
| Metric input | 0.001 | 0.0001 | mm |
| Inch input | 0.0001 | 0.00001 | inch |

『Default Setting』: 0

Set the limit value of the slight move which is ignored on the outside of the corner during tool nose radius compensation.

| 5013 | Maximum value of tool wear compensation (MTW) |
|---|---|

『Modification Authority』: Equipment management authority

『Default Setting』: 10

『Value Range』:

| | | IS-B | IS-C |
|---|---|---|---|
| Setting unit | Metric input | 0.001 mm | 0.0001 mm |
| | Inch input | 0.0001 inch | 0.00001 inch |
| Setting range | Metric input | 0～9 999 999 | 0～99 999 999 |
| | Inch input | | |

Set the maximum allowable tool wear compensation value.

**Note: When the absolute value of tool wear compensation exceeds this maximum value, the following alarms are issued:**
**MDI input alarm: too many digits (XXXX—XXXX) (input range in the bracket).**
**G10 input alarm: the offset value input by G10 exceeds the specified range.**

| | #7 | #6 | #5 | #4 | #3 | #2 | #1 | #0 |
|---|---|---|---|---|---|---|---|---|
| 5050 | | | | | | | | STV |

『Modification Authority』: Machine authority

『Default Setting』: 0000 0000

『Way of validating』: After power-on

**#0 STV** Whether the tool offset of current axis is valid;

0: Valid

1: Invalid

## 5.15 Parameters of Tool Life Management

| | #7 | #6 | #5 | #4 | #3 | #2 | #1 | #0 |
|---|---|---|---|---|---|---|---|---|
| 6800 | | | | GPS | SIG | LTM | GS2 | GS1 |

『Default Setting』: 0000 0000

『Modification Authority』: Equipment management authority

『Way of Validating』: After power-on

**#0 GS1, GS2** This parameter sets the combination of the mummer of tool life groups which can be entered, and the number of tools which can be entered per group; shown in the table below:

| GS2 | GS1 | Group number | Tool number |
|---|---|---|---|
| 0 | 0 | 1~1/8 of the maximum group number (No. 6813) | 1~16 |
| 0 | 1 | 1~1/4 of the maximum group number (No. 6813) | 1~8 |
| 1 | 0 | 1~1/2 of the maximum group number (No. 6813) | 1~4 |
| 1 | 1 | 1~ the maximum group number (No. 6813) | 1~2 |

**#2 LTM Tool life is:**

0: Specified by the number of times

1: Specified by time

#3 **SIG Tool group selection signal for the input of tool skip signal is:**

0: Ignored

1: Enabled

**#4 GRS Tool change reset signal:**

0: Clear only the execution data of a specified group

1: Clear the execution data of all entered groups;

| | #7 | #6 | #5 | #4 | #3 | #2 | #1 | #0 |
|---|---|---|---|---|---|---|---|---|
| 6801 | | | | | | LVF | TSM | 0 |

『Default Setting』: 0000 0000

『Modification Authority』: Equipment management authority

**#1 TSM When a tool takes several tool numbers, tool life is counted:**

0: For each of the same tool number

1: For each tool

**#2 LVF Specifies whether life count override is enabled or disabled when the extended tool life management function is used:**

0: Disabled

1: Enabled

| | #7 | #6 | #5 | #4 | #3 | #2 | #1 | #0 |
|---|---|---|---|---|---|---|---|---|
| 6802 | PMT | | | | | | | |

『Default Setting』: 0000 0000

『Modification Authority』: Equipment management authority

『Way of Validating』: Immediately

**#7 PMT** Tool life arrival notice signal TLCHB

0: The actual remaining life is longer than that specified in a parameter

1: The actual remaining life is not equal to that specified in a parameter

| | #7 | #6 | #5 | #4 | #3 | #2 | #1 | #0 |
|---|---|---|---|---|---|---|---|---|
| 6804 | | LFI | | | | | | |

『Default Setting』: 0000 0000

『Modification Authority』: Equipment management authority

『Way of Validating』: Immediately

**#6 LFI** Tool life management for selected tool is:

0: Enabled:

1: Selected by tool life disable signal LFCIV<G048.2>;

| | #7 | #6 | #5 | #4 | #3 | #2 | #1 | #0 |
|---|---|---|---|---|---|---|---|---|
| 6805 | | | | | | | FGL | |

『Default Setting』: 0000 0000

『Modification Authority』: Equipment management authority

『Way of Validating』: Immediately

**#1 FGL** When tool life is specified by time, entered data of G10 is in unit of**:**

0: 1 minute

1: 0.1 second

| 6810 | **Tool life management ignored number（TLC）** |
|---|---|

『Default Setting』: 0

『Modification Authority』: Equipment management authority

『Value Range』: 0～99999999

『Way of Validating』: Immediately

When the set value is subtracted from a T code, a remainder is used as the tool group number.

| 6811 | **Tool life count restart M code（MRN）** |
|---|---|

『Default Setting』: 0

『Modification Authority』: Equipment management authority

『Value Range』: 0～127

『Way of Validating』: Immediately

When the life is specified by the number of times, the tool exchange signal is output when this M code is specified if tool life of at least one tool group is expired. When 0 is set, it is ignored.

| 6813 | **Max. tool groups（MTN）** |
|---|---|

『Default Setting』: 0

『Modification Authority』: Equipment management authority

『Value Range』: 0, 8, 16, 32, 64, 128

『Way of Validating』: After power-on

Set max. tool groups that can be entered. Turn off the power after setting this parameter.

| 6844 | **Remaining tool life (used count)（TLP）** |
|---|---|

『Default Setting』: 0

『Modification Authority』: Equipment management authority

『Value Range』: 0～65535

『Way of Validating』: Immediately

Set a remaining tool life (use count) used to output tool arrival notice signal

| 6845 | **Remaining tool life (use duration)（TLR）** |
|---|---|

『Default Setting』: 0

『Modification Authority』: Equipment management authority

『Value Range』: 0～4300

『Way of Validating』: Immediately

Set remaining tool life (use duration) which is used to output tool arrival notice signal.

## 5.16 Parameters of the Canned Cycle

The setting unit of canned cycle parameter is shown as follows:

| | IS-B | IS-C | UNITS |
|---|---|---|---|
| Metric input | 0.001 | 0.0001 | mm |
| Inch input | 0.0001 | 0.00001 | inch |

### 5.16.1 Parameters of the Drilling Canned Cycle

| | **#7** | **#6** | **#5** | **#4** | **#3** | **#2** | **#1** | **#0** |
|---|---|---|---|---|---|---|---|---|
| **5101** | | | | | | **RTR** | | |

『Modification Authority』: Equipment management authority

『Default Setting』: 0000 0000

**#2 M*RC*** **In G83 and G87:**

0: High-speed peck drilling cycle

1: Peck drilling cycle

| | **#7** | **#6** | **#5** | **#4** | **#3** | **#2** | **#1** | **#0** |
|---|---|---|---|---|---|---|---|---|
| **5102** | | | | | | | **MRC** | |

『Modification Authority』: Equipment management authority

『Default Setting』: 0000 0000

**#1 M*RC*** A target figure other than monotonically increasing or monotonically decreasing in G71 and G72 or that on Z axis in G73:

0: No alarm is issued;

1: An alarm is issued;

| | **#7** | **#6** | **#5** | **#4** | **#3** | **#2** | **#1** | **#0** |
|---|---|---|---|---|---|---|---|---|
| **5104** | | | | | | **FCK** | | |

『Modification Authority』:Equipment management authority

『Default Setting』:0000 0000

**#2 FCK : In combined canned cycles (G71, G72 and G73), the profile is**

0: Not checked

1: Checked

**5110** **M code locking C axis in the canned drilling cycle (CMD)**

『Modification Authority』:Equipment management authority

『Default Setting』: 0

『Value Range』: 0～99

Set M code which can lock C axis during the canned drilling cycle.

**5114** **High-speed peck drilling cycle retract distance (HPDCRD)**

『Modification Authority』: Equipment management authority

『Value Range』: 0～99 999 999×（least increment unit）

『Default Setting』: 1000

Set high-speed peck drilling cycle retract distance (d).

**5115** **Clearance of peck drilling(PDCRD)**

『Modification Authority』: Equipment management authority

『Value Range』: 0～99 999 999×（least increment unit）

『Default Setting』: 1000

Set clearance of peck drilling (d) in G83/G87.

## 5.16.2 Parameters of the Thread Cutting Cycle

**5130** **Chamfering value of the thread cutting cycle (G76, G92)(THD)**

『Modification Authority』:Equipment management authority

『Default Setting』: 0

『Value Range』: 0～99× (0.1 screw pitch)

The parameter sets the chamfering value of G76 and G92 thread cutting cycle.

**5131** **Chamfering angle in threading cycle (G92, G76) (CAT)**

『Modification Authority』: Equipment management authority

『Value Range』: 0～89

『Default Setting』: 2

Set the chamfering angle in threading cycle. When the parameter is set to 0, a value of 45 degree is determined.

## 5.16.3 Parameters of the Combined Canned Cycle

**5132** **Cut-in value of the combined canned cycle G71 and G72 (THC)**

『Modification Authority』:Equipment management authority

『Default Setting』: 1000

『Value Range』: 1～99 999 999

Set the cut-in value of G71 and G72 combined canned cycle.

**5133** **Retraction amount of G71 and G72 combined canned cycle (MCE)**

『Modification Authority』:Equipment management authority

『Default Setting』: 0

『Value Range』: 0～99 999 999

Set the retraction amount of G71 and G72 combined canned cycle.

| 5135 | Retraction amount of G73 combined canned cycle along X axis direction (G73XE) |
|---|---|

| 5136 | Retraction amount of G73 combined canned cycle along Z axis direction (G73ZE) |
|---|---|

『Modification Authority』:Equipment management authority

『Default Setting』: 0

『Value Range』: -99 999 999～99 999 999

Set the retraction amount of G73 combined canned cycle along with X and Z axes direction.

| 5137 | Partition times of G73 combined canned cycle (G73DC) |
|---|---|

『Modification Authority』:Equipment management authority

『Default Setting』: 1

『Value Range』: 1～999

Set the partition times of G73 combined canned cycle.

| 5139 | Retraction amount of G74 and G75 combined canned cycles (G74G75R) |
|---|---|

『Modification Authority』:Equipment management authority

『Default Setting』: 1000

『Value Range』: 0～99 999 999

Set the retraction amount of G74 and G75 combined canned cycle.

| 5140 | Minimum cut-in value of G76 combined canned cycle (G76MID) |
|---|---|

『Modification Authority』:Equipment management authority

『Default Setting』: 0

『Value Range』: 0～99 999 999

Set the minimum cut-in value of G76 combined canned cycle.

| 5141 | Finishing allowance of G76 combined canned cycle (G76FA) |
|---|---|

『Modification Authority』:Equipment management authority

『Default Setting』: 500

『Value Range』: 1～99 999 999

Set the finishing allowance of G76 combined canned cycle.

| 5142 | Finishing cycle times of G76 combined canned cycle (G76FC) |
|---|---|

『Modification Authority』:Equipment management authority

『Default Setting』: 1

『Value Range』: 1～99

Set the finishing cycle times of G76 combined canned cycle.

| 5143 | Tool nose angle of G76 combined canned cycle (G76TNA) |
|---|---|

『Modification Authority』:Equipment management authority

『Default Setting』: 60

『Value Range』: 0～99 (deg)

Set the tool nose angle of G76 combined canned cycle.

| 5149 | Override of retraction in boring cycle G85 /G89 (BCRDOV) |
|---|---|

『Modification Authority』: Equipment management authority

『Value Range』: 0～2000

『Default Setting』: 200

Set override (%) of retraction in boring cycle G85/G89, independent of feedrate override. When set to 0, 200% of feedrate is used.

## 5.17 Parameters of the Rigid Tapping

| | #7 | #6 | #5 | #4 | #3 | #2 | #1 | #0 |
|---|---|---|---|---|---|---|---|---|
| 5200 | | FHD | | DOV | | CRG | | G84 |

『Modification Authority』:Equipment management authority

『Default Setting』: 0000 0000

**#0 G84 Method of specifying the rigid tapping**

0: An M code specifying the rigid tapping mode is specified prior to the issue of the G84 (or G74) command. (See parameter No. 5210)

1: An M code specifying the rigid tapping mode is not used. (G84 cannot be used as a G code for the tapping cycle; G74 cannot be used for the reverse tapping cycle.)

**#2 CRG Rigid mode when a rigid mode cancel command is specified (G80, G01 group G code, reset, etc.)**

0: Cancelled after rigid tapping signal RGTAP is set to 0.

1: Cancelled before rigid tapping signal RGTAP is set to 0.

**#4 DOV Override during extraction in rigid tapping is:**

0: Invalidated

1: Validated (the override value is set in parameter No. 5211)

**#5 when specified Q, PCP Tapping or rigid tapping is:**

0: Used as a high-speed peck tapping cycle

1: Used as a peck tapping cycle

**#6 FHD Feed hold and single block in rigid tapping is:**

0: Invalidated

1: Validated

**#7 SRS To select a spindle used for rigid tapping in multi-spindle control**

0:The spindle selection signal SWS1~SWS3 are used

1:The rigid tapping selection signal RGTSP1～RGTSP3 are used

| | #7 | #6 | #5 | #4 | #3 | #2 | #1 | #0 |
|---|---|---|---|---|---|---|---|---|
| 5201 | | | | OV3 | OVU | TDR | | |

『Modification Authority』:Equipment management authority

『Default Setting』: 0000 0000

**#2 TDR: Cutting time constant in rigid tapping:**

0: Is the same during cutting and extraction

1: Not the same during cutting and extraction

**#3 OVU: The increment unit of the override parameter (No.5211) for tool rigid tapping extraction is:**

0: 1%

1: 10%

**#4 OV3: The spindle speed for tool extraction is specified by program so that the override of spindle speed is:**

0: Disabled

1: Enabled

| | #7 | #6 | #5 | #4 | #3 | #2 | #1 | #0 |
|---|---|---|---|---|---|---|---|---|
| **5202** | | **OVE** | | | | | | **ORI** |

『Modification Authority』: Equipment management authority

『Default Setting』: 0000 0000

**#0 ORI When rigid tapping is started, Spindle orientation is:**

0: Not performed

1: Performed

**#6 OVE Valid data range of override for tool extraction command (address J) in rigid tapping is**

0: 100%～200%

1: 100%～2000%

| | #7 | #6 | #5 | #4 | #3 | #2 | #1 | #0 |
|---|---|---|---|---|---|---|---|---|
| **5203** | | | | **OVS** | | | | |

『Modification Authority』: Equipment management authority

『Default Setting』: 0000 0000

**#4 OVS In rigid tapping, override by the feedrate override signal and invalidation of override by the override cancel signal is:**

0: Invalid

1: Valid

**Note 1: When the feedrate override is valid, the tool extraction override is invalid;**
**Note 2: When the spindle override is fixed to 100% during rigid tapping, it is not related to this parameter;**

| | #7 | #6 | #5 | #4 | #3 | #2 | #1 | #0 |
|---|---|---|---|---|---|---|---|---|
| **5209** | | | | | | | | **RTX** |

『Modification Authority』: Equipment management authority

『Default Setting』: 0000 0000

**#0 RTX Tapping axis in rigid tapping is:**

0: Changed by plane selection command

1: Fixed to Z axis for G84, X axis for G88 G84

| **5210** | **M code commanding the rigid tapping (RTMC)** |
|---|---|

『Modification Authority』:Equipment management authority

『Default Setting』: 29

『Value Range』: 0～255

M code is set to specify the rigid tapping method. When it is set as 0, CNC takes it as M29.

**5211** **Override value during rigid tapping extraction (RTOV)**

『Modification Authority』:Equipment management authority

『Default Setting』: 120

『Data unit』: 1% or 10%

『Value Range』: 0～200

Set the override value during the rigid tapping run-out

**Note 1: The override value is valid when DOV in parameter No. 5200#4 is 1.**
**Note 2: When bit 3 of parameter No. 5201 (OVU) is 1, the unit of set data is 10%. An override of up to 200% can be applied to extraction.**

**5213** **Return or clearance in peck tapping cycle(PRTRD)**

『Modification Authority』: Equipment management authority

『Value Range』: 0～99999999

『Data Unit』:

| SETTING UNITS | IS-B | IS-C | UNITS |
|---|---|---|---|
| Linear axis (metric input) | 0.001 | 0.0001 | mm |
| Linear axis (inch input) | 0.0001 | 0.00001 | Inch |

『Default Setting』: 2000

Set the return in high-speed peck tapping or clearance in peck tapping cycle.

**5241** **Maximum spindle speed in rigid tapping(RTMS)**

『Modification Authority』:Equipment management authority

『Default Setting』: 1000

『Value Range』: 0～9999r/min

Set the maximum spindle speed in rigid tapping.

**5261** **The linear acceleration/deceleration time constant for spindle and tapping axis(RTLT) in rigid tapping (RTLT)**

『Modification Authority』:Equipment management authority

『Default Setting』: 200

『Value Range』: 0～4000ms

Set the linear acceleration/deceleration time constant for spindle and tapping axis.

**5271** **Time constant for spindle and tapping axis in extraction operation (RTET)**

『Modification Authority』:Equipment management authority

『Default Setting』: 200

『Value Range』: 0～4000ms

Set a linear acceleration/deceleration time constant for the spindle and tapping axis in extraction operation.

**Note: This parameter is valid when bit 2 of parameter No. 5201 (TDR) is 1.**

| 5275 | Compensation of encoder sampling delay in period for tapping axis in G84/G88 threading(ZBK) |
|---|---|

『Modification Authority』: Equipment management authority

『Value Range』: 0～10

『Default Setting』: 2

Set compensation of encoder sampling delay for tapping axis in G84/G88 threading. This parameter determined the in-position precision before tool exatrction. A value range of 4~8 is preferred.

## 5.18 Parameters of the Polar Coordinates Interpolation

| | #7 | #6 | #5 | #4 | #3 | #2 | #1 | #0 |
|---|---|---|---|---|---|---|---|---|
| 5450 | | | | | | | AFC | |

『Modification Authority』:Equipment management authority

『Default Setting』: 0000 0000

**#0 AFC: In polar coordinate interpolation mode, automatic override and feedrate clamp are:**

0: Not performed

1: Performed

**Note: In polar coordinate interpolation mode, the feedrate component for a rotational axis increases as the tool moves closer to the center of a workpiece. Near the center of a workpiece, the maximum cutting feedrate may be exceeded, causing servo alarm No. 411 to be issued. the automatic feedrate override function and automatic feedrate clamp function automatically control the feedrate to prevent the feedrate component on a rotation axis from exceeding a specified maximum cutting feedrate.**

| 5460 | Axis (linear axis) specification for polar coordinate interpolation (LAI) |
|---|---|

| 5461 | Axis(rotary axis) specification for polar coordinate interpolation (RAI) |
|---|---|

『Modification Authority』:Machine authority

『Value Range』: 1～number of the controlled axes

『Default Setting』: No.5460 is 0； NO.5461 is 5

Set control axis number of rotary axis and rotary axis to execute polar interpolation.

| 5462 | Maximum cutting feedrate of the polar coordinates interpolation (MFI) |
|---|---|

『Modification Authority』:Machine authority

『Default Setting』: 8000

『Value Range』:

| | IS-B | IS-C | UNITS |
|---|---|---|---|
| Metric machine | 0, 6～24 000 | 0, 6～10 000 | mm/min |
| Inch machine | 0, 6～9 600 | 0, 6～4 800 | inch/min |
| Rotary axis | 0, 6～24 000 | 0, 6～10 000 | deg/min |

Set the upper limit of the cutting feedrate that is effective during polar coordinate interpolation.

When the specified speed is larger than this value, it is limited at this maximum feedrate. When this parameter is set to 0, the upper limit is the usual maximum cutting feedrate (set by parameter No. 1422) during polar coordinate interpolation.

| 5463 | Allowable automatic override percentage in polar coordinate interpolation (API) |
|---|---|

『Modification Authority』: Equipment management authority

『Value Range』: 1～number of the controlled axes

『Default Setting』: 0

『Value Range』: 0～100 (%)

Set the allowable percentage to find an allowable feedrate on rotary axis in polar coordinate interpolation.

Allowable feedrate on rotation axis = maximum cutting feedrate×allowable percentage

In polar coordinate interpolation mode, the feedrate component on a rotation axis increases as the tool moves closer to the center of a workpiece. Near the center of a workpiece, the maximum allowable feedrate (parameter No. 5462) may be exceeded. To prevent the feedrate component on a rotation axis from exceeding the maximum allowable feedrate in polar coordinate interpolation mode, the following override is automatically applied to the feedrate (automatic override):

Override = allowable feedrate on rotation axis/feedrate component on rotation axis×100%

If the override feedrate component for a rotation axis still exceeds the allowable feedrate, the feedrate is clamped to prevent the feedrate component on a rotation axis from exceeding a maximum cutting feedrate.

**Note: When 0 is set in this parameter, a specification of 90% is assumed. Before the automatic override function and automatic feedrate clamp function can be used, bit 1 (AFC) of parameter No. 5450 must be set to 1.**

## 5.19 Parameters of the User Macro Program

| | #7 | #6 | #5 | #4 | #3 | #2 | #1 | #0 |
|---|---|---|---|---|---|---|---|---|
| 6000 | | | SBM | | | | | G67 |

『Modification Authority』:Equipment management authority

『Default Setting』: 0000 0000

**#0 G67 If G67 is specified while G66 is not set:**

0: An alarm is issued (No. 122)

1: G66 is ignored

**#5 SBM Custom macro statement:**

0: Does not stop the single block

1: Stops the single block

| | #7 | #6 | #5 | #4 | #3 | #2 | #1 | #0 |
|---|---|---|---|---|---|---|---|---|
| 6001 | CLV | CCV | | | | | | |

『Modification Authority』:Equipment management authority

『Default Setting』: 0100 0000

**#6 CCV Custom macro's common variables Nos.100～199 are:**

0: Cleared to vacant by reset

1: Not cleared by reset

**Note: In MDI mode, the macro public variables are not cleared after reset.**

**#7 CLV Custom macro's local variables Nos.1～13 are:**

0: Cleared to vacant by reset

1: Not cleared by reset

| | #7 | #6 | #5 | #4 | #3 | #2 | #1 | #0 |
|---|---|---|---|---|---|---|---|---|
| 6004 | | | | | | | MFZ | NAT |

『Modification Authority』:Equipment management authority

『Default Setting』: 0000 0000

**#0 NAT Specification of the results of custom macro function ATAN & ASIN:**

0: The result is 0～360 & 270～90

1: The result is -180～180 & -90～90

**#1 MFZ If the angle of a custom macro operation command SIN, COS or TAN is 1.0 × $10^{-8}$ or below, the result is :**

0: Handled as underflow 1: Normalized to 0

## 5.20 Parameters of the Skip Function

| | #7 | #6 | #5 | #4 | #3 | #2 | #1 | #0 |
|---|---|---|---|---|---|---|---|---|
| 6200 | SKF | | | | | | SK0 | |

『Modification Authority』:Machine authority

『Default Setting』: 0000 0000

**SK0: Specify when the skip signal is valid:**

0: Skip signal is valid when the signal is set to 1

1: Skip signal is valid when the signal is set to 0

**SKF: Dry run and override for G31 skip command are:**

0: Disabled

1: Enabled

| | #7 | #6 | #5 | #4 | #3 | #2 | #1 | #0 |
|---|---|---|---|---|---|---|---|---|
| 6210 | | MDC | | | | | | |

『Modification Authority』: Equipment management authority

『Default Setting』: 0000 0000

**#6 MDC The value of the automatic tool compensation is:**

0: Added to current tool offset

1: Subtracted from current tool offset

| | #7 | #6 | #5 | #4 | #3 | #2 | #1 | #0 |
|---|---|---|---|---|---|---|---|---|
| 6240 | IGA | | | | | | | AE0 |

『Modification Authority』: Machine authority

『Way of Validating』: After power-on

『Default Setting』: 0000 0000

**#0 AE0 Measurement position arrival is assumed when the automatic tool compensation signal (X3.6) and XAE2 (X3.7) is:**

0: 1

1: 0

**#7 IGA Automatic tool compensation is:**

0: Enabled

1: Disabled

**6242** **Feedrate during measurement of automatic tool compensation(used with signal XAE2) (ATOF2)**

『Modification Authority』: Machine authority

『Default Setting』: 1000

『Data setting』:

| SETTIN UNIT | DATA UNIT | VALID RANGE (IS-B/ IS-C) | | DEFAULT SETTING |
|---|---|---|---|---|
| | | IS-B | IS-C | |
| Metric machine | 1mm/min | 6～15000 | 6～12000 | 1000 |
| Inch machine | 0.1inch/min | 6～6000 | 6～4800 | |

These two parameters set the feedrate during measurement of automatic tool compensation.

**Note: When the setting value of parameter No. 6242 is set to 0, the setting value of parameter No. 6241 is valid.**

**6251** **γ value on X axis during automatic tool compensation (ATOR1)**

**6252** **γ value on Z axis during automatic tool compensation (ATOR2)**

『Modification Authority』: Equipment management authority

『Default Setting』: 1000

『Data range』: 1～99999999

These two parameters set the γ value during automatic tool compensation.

**Note: The value is set in radius no matter diameter or radius programming is specified.**

**6254** **ε value on X axis during automatic tool compensation(ATOE1)**

**6255** **ε value on Z axis during automatic tool compensation(ATOE2)**

『Modification Authority』: Equipment management authority

『Data range』: 1～99999999

| SETTING UNIT | IS-B | IS-C | unit |
|---|---|---|---|
| Linear axis (metric input) | 0.001 | 0.0001 | mm |
| Linear axis (inch input) | 0.0001 | 0.00001 | inch |
| Rotary axis | 0.001 | 0.0001 | deg |

These two parameters set the ε value during automatic tool compensation.

**Note: The value is set in radius no matter diameter or radius programming is specified.**

## 5.21 Parameters of the Graphic Display

| | #7 | #6 | #5 | #4 | #3 | #2 | #1 | #0 |
|---|---|---|---|---|---|---|---|---|
| 6500 | | | | | DPA | | | |

『Modification Authority』: Equipment management authority

『Default Setting』: 0000 0000

**#3 DPA Current position display on the graphic display screen:**

0: Display the actual position to ensure tool nose radius compensation

1: Display the programmed position

## 5.22 Parameter of Run Hour and Parts Count Display

| | #7 | #6 | #5 | #4 | #3 | #2 | #1 | #0 |
|---|---|---|---|---|---|---|---|---|
| 6700 | | | | | | | PRT | PCM |

『Modification Authority』: Equipment management authority

『Default Setting』: 0000 0000

**#0 PCM M code that counts the total number of machined parts and the number of machined parts:**

0: M02, or M30, or M code specified by parameter No.6710

1: M codes only specified by parameter No.6710

**#1 PRT Upon reset, signal PRTSF (F62.7), which indicates that a required number of parts have been reached is:**

0: Turned off

1: Not turned off

| 6710 | M code that counts the total number of machined parts and the number of machined parts (MPC) |
|---|---|

『Modification Authority』: Machine authority

『Value Range』: 0～9999

『Default Setting』: 0

Set the M code that counts the total number of machined parts and the number of machined parts.

**Note: It is invalid when the setting value is 0 (M00 cannot count parts), 98 and 99.**

| 6713 | Number of required parts (RPM) |
|---|---|

『Modification Authority』: Machine authority

『Value Range』: 0～9 999

『Default Setting』: 0

Required parts finish signal PRTSF (F62.7) is output when the number of machined parts reaches the number of required parts.

**Note: When the setting value is 0, the machined parts number is regarded as infinite, and PRTSF is not output.**

## 5.23 Parameter of MPG Feed

| | #7 | #6 | #5 | #4 | #3 | #2 | #1 | #0 |
|---|---|---|---|---|---|---|---|---|
| **7100** | | | | **HPF** | | | | **JHD** |

『Modification Authority』: Machine authority

『Default Setting』: 0000 0000

**#0 JHD Manual handle feed in JOG feed mode and incremental feed in the manual handle feed:**

0: Invalid

1: Valid

| | JHD=0 | | JHD=1 | |
|---|---|---|---|---|
| | JOG MODE | MPG MODE | JOG MODE | MPG MODE |
| JOG feed | O | × | O | × |
| MPG feed | × | O | O | O |
| Increment feed | × | × | × | O |

**#4 HPF When a manual handle feedrate exceeds the rapid traverse feedrate:**

0: The excess are ignored (manual MPG value is not corresponding to actual movement amount);

1: The excess are not ignored (although the MPG stops, the machine still moves with the pulse amount that is stored in CNC system, then stops);

| | #7 | #6 | #5 | #4 | #3 | #2 | #1 | #0 |
|---|---|---|---|---|---|---|---|---|
| **7102** | | | | | | | | **HNGx** |

『Modification Authority』: Machine authority

『Parameter Type』: Bit axis

『Default Setting』: 0000 0000

**#0 HNGx Axis movement direction for rotation direction of manual pulse generator:**

0: Same in direction

1: Reverse in direction

| | #7 | #6 | #5 | #4 | #3 | #2 | #1 | #0 |
|---|---|---|---|---|---|---|---|---|
| **7103** | | | | | | **HNT** | | |

『Modification Authority』: Machine authority

『Default Setting』: 0000 0000

**#2 HNT The manual handle feed/incremental feed magnification is:**

0: Multiplied by 1

1: Multiplied by 10

| | |
|---|---|
| **7110** | **Number of manual pulse generators used (NMP)** |

『Modification Authority』: Machine authority

『Value Range』: 0～2

『Default Setting』: 1

Set the number of manual pulse generators.

| 7113 | Manual handle feed magnification M (MFM) |
|---|---|

『Modification Authority』: Machine authority

『Value Range』: 1~127

『Default Setting』: 100

Set the magnification when manual handle feed movement selection signal MP1=0, MP2=1.

| 7114 | Manual handle feed magnification N (MFN) |
|---|---|

『Modification Authority』:Machine authority

『Value Range』:1～1000

『Default Setting』:1000

Set the magnification when manual handle feed movement selection signal MP1=1, MP2=1.

| MOVEMENT VALUE SELECTING SIGNAL | | MOVEMENT VALUE (MPG FEED) |
|---|---|---|
| MP2 | MP1 | |
| 0 | 0 | Least input increment × 1 |
| 0 | 1 | Least input increment × 10 |
| 1 | 0 | Least input increment × M |
| 1 | 1 | Least input increment × N |

| 7117 | Allowable numbers of pulses that can be accumulated during manual handle feed (APM) |
|---|---|

『Modification Authority』: Machine authority

『Value Range』: 0～99999999

『Default Setting』: 10000

If manual handle feed is specified such that the rapid traverse rate will be exceeded momentarily, those pulses received from the manual pulse generator that exceed the rapid traverse rate are accumulated rather than canceled. This parameter sets the maximum number of pulses which can be accumulated in such a case.

Note: when the manual pulse generator is rotated at high speed with a large magnification such as 100, the axis feedrate is clamped at the rapid traverse rate and those pulses received from the manual pulse generator that exceed the rapid traverse rate are ignored. In such a case, therefore, the scale on the manual pulse generator may differ from the actual amount of travel. If such a difference is not acceptable, this parameter can be set to temporarily accumulate the excess pulses in the CNC, rather than ignoring them, up to the specified maximum (pulses in excess of the set maximum are ignored). The accumulated pulses are output and converted to a move command once the feedrate falls below the rapid traverse rate by reducing the rotational speed of the manual pulse generator or stopping its rotation altogether. Note, however, that if the maximum number of pulses to be accumulated is too large, stopping the rotation of the manual pulse generator does not stop feeding until the tool moves by an amount corresponding to the pulses accumulated in the CNC.

## 5.24 Parameter of PLC Axis Control

| | #7 | #6 | #5 | #4 | #3 | #2 | #1 | #0 |
|---|---|---|---|---|---|---|---|---|
| 8001 | | | NCC | | RDE | OVE | | MLE |

『Modification Authority』: Machine authority

『Default Setting』: 0000 0000

**#0 MLE Whether axis machine lock signal MLK is valid for PLC-controlled axes:**

0: Valid

1: Invalid

**#2 OVE Signals related to dry run and override used in PLC axis control are:**

0: Same signals as those used for the CNC

1: Signal specific to the PLC

**#3 RDE Whether dry run is valid for rapid traverse in PLC axis control:**

0: Invalid

1:Valid

**#5 NCC When a travel command is issued for the PLC-controlled axis according to the program:**

0: An alarm is issued when PLC controls the axis with an axis control command. When the PLC does not control the axis, a CNC command is enabled.

1: PS alarm No. 139 is issued.

**#6 AUX** The number of bytes for the code of an auxiliary function to be output is:

0: 1

1: 2

| | #7 | #6 | #5 | #4 | #3 | #2 | #1 | #0 |
|---|---|---|---|---|---|---|---|---|
| 8002 | FR2 | FR1 | PF2 | PF1 | F10 | | DWE | RPD |

『Modification Authority』: Machine authority

『Default Setting』: 0000 0000

**#0 RPD Rapid traverse rate for PLC-controlled axes:**

0: Rapid traverse rate for PLC-controlled axes

1: Feedrate specified with the feedrate data in an axis control command

**#1 DWE Minimum time which can be specified in a dwell command in PLC axis control when the increment system is IS-C is:**

0: 1ms

1: 0.1ms

**#3 F10 Least increment for the feedrate for cutting feed (per minute) in PLC axis control:**

| F10 | METRIC INPUT | INCH INPUT |
|---|---|---|
| 0 | 1mm/min | 0.01inch/min |
| 1 | 10mm/min | 0.1inch/min |

**#4,#5 PR1, PR2 Set the feedrate of feed per rotation in PLC axis control:**

| PR2 | PR1 | SPEED |
|---|---|---|
| 0 | 0 | 1/1 |
| 0 | 1 | 1/10 |
| 1 | 0 | 1/100 |
| 1 | 1 | 1/1000 |

**#6,#7 FR1, FR2 Set the feedrate unit of feed per rotation in PLC axis control:**

| FR2 | FR1 | METRIC INPUT | INCH INPUT |
|---|---|---|---|
| 0 | 0 | 0.0001mm/rev | 0.000001inch/rev |
| 1 | 1 | | |
| 0 | 1 | 0.001mm/rev | 0.00001inch/rev |
| 1 | 0 | 0.01mm/rev | 0.0001inch/rev |

| | #7 | #6 | #5 | #4 | #3 | #2 | #1 | #0 |
|---|---|---|---|---|---|---|---|---|
| 8004 | | NCI | DSL | | | JFM | | |

『Modification Authority』: Machine authority

『Default Setting』: 0000 0000

**#2 JFM Set the feedrate unit of continuous feed in PLC axis control:**

| INCREMENT SYSTEM | JFM | METRIC INPUT | INCH INPUT | ROTARY AXIS |
|---|---|---|---|---|
| IS-B | 0 | 1mm/min | 0.01inch/min | 1deg/min |
| | 1 | 200mm/min | 2.00inch/min | 200deg/min |
| IS-C | 0 | 0.1mm/min | 0.001inch/min | 0.1deg/min |
| | 1 | 20mm/min | 0.200inch/min | 20deg/min |

**#5 DSL If the selection of an axis is changed when PLC axis selection is disabled:**

0: An alarm is issued (P/S232)

1: The changed is valid, and no alarm is issued for an unspecified system

**#6 NCI In axis control by the PLC, a position check at the time of deceleration is:**

0: Performed

1: Not performed

| | #7 | #6 | #5 | #4 | #3 | #2 | #1 | #0 |
|---|---|---|---|---|---|---|---|---|
| 8005 | | | | | | R10 | CDI | |

『Modification Authority』: Machine authority

『Default Setting』: 0000 0000

**#1 CDI For PLC axis control, when diameter programming is specified for a PLC-controlled axis:**

0: The amount of travel is specified in radius

1: The amount of travel is specified in diameter

**#2 R10 When the RPD parameter (No.8002#0) is set to "1", the unit for specifying a rapid traverse rate for the PLC axis is:**

0: ×1

1: ×10

| | #7 | #6 | #5 | #4 | #3 | #2 | #1 | #0 |
|---|---|---|---|---|---|---|---|---|
| 8006 | EAL | | | EFD | | | | |

『Modification Authority』: Machine authority

『Default Setting』: 0000 0000

**#4 EFD** In axis control by PLC, the unit for specifying feed cutting for PLC axis is:

0: ×1

1: ×100

**#7 EAL** In axis control by PLC, the function that allows the alarm signal to be reset by a CNC reset operation is:

0: Disabled

1: Enabled

| 8010 | **Selection of the DI/DO group for each axis controlled by PLC (PSA)** |
|---|---|

『Modification Authority』: Machine authority

『Parameter Type』:Word axis

『Default Setting』:0

『Value Range』:0～4

Specify the DI/DO group to be used for each PLC-controlled axis;

| NUMBER | INSTRUCTION |
|---|---|
| 0 | The axis is not controlled by PLC |
| 1 | DI/DO in group A is used |
| 2 | DI/DO in group B is used |
| 3 | DI/DO in group C is used |
| 4 | DI/DO in group D is used |

**8022** **Upper-limit of feedrate per rotation during PLC axis control (PAMS)**

『Modification Authority』: Machine authority

『Parameter Type』: Word axis

『Default Setting』: 6

『Value Range』:

| INCREMENT SYSTEM | DATA UNITS | VALID DATA RANGE | |
|---|---|---|---|
| | | IS-B | IS-C |
| Metric machine | 1mm/min | 6~15000 | 6~12000 |
| Inch machine | 0.1inch/min | 6~6000 | 6~4800 |
| Rotary axis | 1deg/min | 6~15000 | 6~12000 |

Set the maximum feedrate of feeding/per rotation controlled by PLC axis.

**8028** **Linear acceleration/deceleration time constant of speed command for PLC axis control (PALT)**

『Modification Authority』: Machine authority

『Parameter Type』: Word axis

『Default Setting』: 200

『Value Range』: 0~3000ms

Set the time required for the servo motor rotation speed to increase or decrease in JOG feed.

**Note: If it is specified as "0", the system does not perform acceleration/deceleration control.**

## 5.25 Parameters of the Basic Function

**8130** **Total number of controlled axes(TCA)**

『Modification Authority』: System authority

『Way of Validating』: After power-on

『Default Setting』: 2

『Data Range』: 2～6

Set the total number of controlled axes by the CNC and PLC.

| | #7 | #6 | #5 | #4 | #3 | #2 | #1 | #0 |
|---|---|---|---|---|---|---|---|---|
| 8131 | | | | | | | | HPG |

『Modification Authority』: Machine authority

『Way of Validating』: After power-on

『Default Setting』: 0000 0001

**#0 HPG MPG is:**

0: Not used

1: Used

| | #7 | #6 | #5 | #4 | #3 | #2 | #1 | #0 |
|---|---|---|---|---|---|---|---|---|
| **8132** | | | | | | | | **TLF** |

『Modification Authority』: Machine authority

『Way of Validating』: After power-on

『Default Setting』: 0000 0000

**#0 TLF : Tool life management is:**

0: Not used

1: Used

| | #7 | #6 | #5 | #4 | #3 | #2 | #1 | #0 |
|---|---|---|---|---|---|---|---|---|
| **8133** | | | | | **MSP** | **SCS** | **AXC** | **SSC** |

『Modification Authority』: Machine authority

『Way of Validating』: After power-on

『Default Setting』: 0000 0001

**#0 SSC Constant surface speed control is:**

0: Not used

1: Used

**#1 AXC Spindle positioning is:**

0: Not used

1: Used

**#2 SCS CS contour control is:**

0: Not used

1: Used

**#3 MSP Multi-spindle control is:**

0: Not used

1: Used

## 5.26 Parameters of GSK-CAN Communication Function

| | #7 | #6 | #5 | #4 | #3 | #2 | #1 | #0 |
|---|---|---|---|---|---|---|---|---|
| **9000** | | | | | | | **BCAN** | **ACAN** |

『Modification Authority』: Machine authority

『Way of Validating』: After power-on

『Default Setting』: 0000 0000

**#0 ACAN GSKLinkA function on all system is:**

0: Invalid

1: Valid

**#1 BCAN GSKLinkB function on all system is:**

0: Invalid

1: Valid

| | |
|---|---|
| **9010** | **Communication baudrate of GSK-CAN channel A (ABPS)** |

『Modification Authority』: Machine authority

『Way of Validating』: After power-on

『Default Setting』: 500 (kbps)

『Data Range』; 500, 600, 800 or 1000 (kbps)

**Set communication baudrate of GSKLinkA function on system.**

**Note: The baudrate of servo drive unit that connected with GSK-CANA should be in accordance with this parameter setting.**

**9011** **Communication baudrate of GSK-CAN channel B (BBPS)**

『Modification Authority』: Machine authority

『Way of Validating』: After power-on

『Value Range』: 500, 600, 800, 1000（kbps）

『Default Setting』: 500 (kbps)

**Set communication baudrate of GSKLinkB function on system.**

**Note: The baudrate of servo drive unit that connected with GSK-CANB should be in accordance with this parameter setting.**

**9020** **Servo slave number of all axes communication (SIDx)**

『Modification Authority』:Machine authority

『Parameter Type』:Word axis

『Way of Validating』:After power-on

『Value Range』:0~5, 11~12

『Default Setting』:0

**Set the servo slave number of axes;**

**Note 1: "0" represents that the axis is not connected with servo slave;**
**Note 2: "1~5" represents that this axis is connected with channel A GSK-CAN, and the corresponding servo slave numbers are 1~5;**
**Note 3: "11~12" represents that this axis is connected with channel B GSK-CAN, and the corresponding servo slave numbers are 6~7;**

**9030** **Servo slave number of all spindles communication(SIDS)**

『Modification Authority』:Machine authority

『Parameter Type』:Word axis

『Way of Validating』: After power-on

『Value Range』: 0~5, 11~12

『Default Setting』: 0

**Set the servo slave number of all spindles communication;**

**Note 1: "0" represents that the axis is not connected with servo slave;**
**Note 2: "1~5" represents that this axis is connected with channel A GSK-CAN, and the corresponding servo slave numbers are 1~5;**
**Note 3: "11~12" represents that this axis is connected with channel B GSK-CAN, and the corresponding servo slave numbers are 6~7;**

# CHAPTER VI STANDARD PLC FUNCTION CONFIGURATION

## 6.1 Standard Panel on the Machine Tool


Fig. 6-1-1 Standard layout of operation panel

## 6.2 Addresses X, Y Definition

**Caution:**

**The general I/O signal (except those signals marked for fixed addresses) in GSK988T CNC system is defined by the embedded PLC (ladder diagram) program. When this CNC system is installed, the exact I/O functions are determined by the machine tool builder. Please refer to the manual from machine tool builder for details.**

**Pay attention that in this chapter, the functions of general I/O signal (i.e. X,Y addresses) are just described for GSK988T standard PLC program.**

### 6.2.1 General I/O Interface on Machine Tool

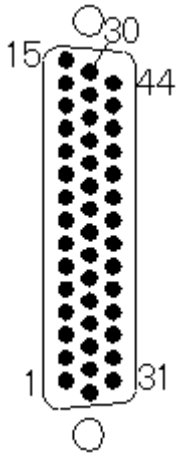



Fig 6-2-1 CN61 (male) input

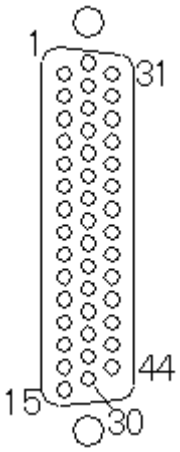



Fig. 6-2-2 CN62 (female) output

| DB Pin | PLC address | Function defined by standard PLC address | | Remark |
|---|---|---|---|---|
| CN61.1 | X0.0 | SAGT | Protection door detection signal | |
| CN61.2 | X0.1 | | Reserved | |
| CN61.3 | X0.2 | DIQP | Chuck input signal | |
| CN61.4 | X0.3 | DEC1 | The 1st axis deceleration signal | Fixed address |
| CN61.5 | X0.4 | DITW | Tailstock control signal | |
| CN61.6 | X0.5 | ESP | Emergency stop input signal | Fixed address |
| CN61.7 | X0.6 | PRES | Pressure detection signal | |
| CN61.8 | X0.7 | T05 | Tool position signal 5/ tool post pre-indexing signal (Yantai AK31)/Sensor E (Liuxin Tool Post) | |
| CN61.9 | X1.0 | T06 | Tool position signal 6/ tool post pre-indexing signal (Yantai AK31)/Sensor F (Liuxin Tool Post) | |

| DB Pin | PLC address | Function defined by standard PLC address | | Remark |
|---|---|---|---|---|
| CN61.10 | X1.1 | T07 | Tool position signal 7/ tool post overheat signal (Yantai AK31) | |
| CN61.11 | X1.2 | T08 | Tool position signal 8 | |
| CN61.12 | X1.3 | DEC3 | The 3rd axis deceleration signal | Fixed address |
| CN61.13 | X1.4 | | Reserved | |
| CN61.14 | X1.5 | M41I | The 1st gear stage in-position | |
| CN61.15 | X1.6 | M42I | The 2nd gear stage in-position | |
| CN61.16 | X1.7 | T01 | Tool position signal 1/T1 (Yantai AK31)/Sensor A (Liuxin Tool Post) | |
| CN61.29 | X2.0 | T02 | Tool position signal 2/T2 (Yantai AK31)/<br>Sensor B (Liuxin Tool Post)<br>Sensor A (Liuxin Tool Post) | |
| CN61.30 | X2.1 | T03 | Tool position signal 3/T3 (Yantai AK31)/Sensor C (Liuxin Tool Post) | |
| CN61.31 | X2.2 | T04 | Tool position signal 4/T4 (Yantai AK31)/Sensor D (Liuxin Tool Post) | |
| CN61.32 | X2.3 | DEC2 | The 2nd axis deceleration signal | Fixed address |
| CN61.33 | X2.4 | DEC4 | The 4th deceleration signal | Fixed address |
| CN61.34 | X2.5 | DEC5 | The 5th deceleration signal | Fixed address |
| CN61.35 | X2.6 | TCP | Tool post lock signal<br>Tool post proximity switch signal (Yantai AK31) | |
| CN61.36 | X2.7 | COIN | Spindle orientation completed signal | |
| CN61.37 | X3.0 | LMI1+ | The 1st axis + side overtravel signal | |
| CN61.38 | X3.1 | LMI2+ | The 2nd axis + side overtravel signal | |
| CN61.39 | X3.2 | LMI3+ | The 3rd axis + side overtravel signal | |
| CN61.40 | X3.3 | WQPJ | Chuck in-position signal (outer chuck clamping and inner chuck unclamping) | |
| CN61.41 | X3.4 | NQPJ | Chuck in-position signal (inner chuck clamping and outer chuck unclamping) | |
| CN61.42 | X3.5 | SKIP | G31 skip signal | Fixed address |
| CN61.43 | X3.6 | G36 | G36 skip signal | Fixed address |
| CN61.44 | X3.7 | G37 | G37 skip signal | Fixed address |

| DB Pin | PLC address | Function defined by standard PLC address | | Remark |
|---|---|---|---|---|
| CN61.17 | X4.0 | LMI1- | The 1st axis – direction overtravel signal | |
| CN61.18 | X4.1 | LMI2- | The 2nd axis – direction overtravel signal | |
| CN61.19 | X4.2 | LMI3- | The 3rd axis – direction overtravel signal | |
| CN61.20 | X4.3 | LMI4+ | The 4th axis + direction overtravel signal | |
| CN61.25 | X4.4 | LMI4- | The 4th axis - direction overtravel signal | |
| CN61.26 | X4.5 | LMI5+ | The 5th axis + direction overtravel signal | |
| CN61.27 | X4.6 | LMI5- | The 5th axis - direction overtravel signal | |
| CN61.28 | X4.7 | | Reserved | |
| CN61.21～CN61.24 | 0V | | | |
| | | | | |
| CN62.1 | Y0.0 | M08 | Cooling output signal | |
| CN62.2 | Y0.1 | M32 | Lubrication output signal | |
| CN62.3 | Y0.2 | | Reserved | |
| CN62.4 | Y0.3 | M03 | Spindle CCW signal | |
| CN62.5 | Y0.4 | M04 | Spindle CW signal | |
| CN62.6 | Y0.5 | M05 | Spindle stop signal | |
| CN62.7 | Y0.6 | | Reserved | |
| CN62.8 | Y0.7 | SPZD | Spindle braking output signal | |
| CN62.9 | Y1.0 | M41 | Spindle gear 1 output signal | |
| CN62.10 | Y1.1 | M42 | Spindle gear 2 output signal | |
| CN62.11 | Y1.2 | M43 | Spindle gear 3 output signal | |
| CN62.12 | Y1.3 | M44 | Spindle gear 4 output signal | |
| CN62.13 | Y1.4 | M12(DOQPJ) | Outer chuck clamping output / Inner chuck unclamping output signal | |
| CN62.14 | Y1.5 | M13(DOQPS) | Outer chuck unclamping output /inner chuck clamping output signal | |
| CN62.15 | Y1.6 | TL+ | Tool post forward rotation output signal | |
| CN62.16 | Y1.7 | TL- | Tool post reverse rotation output signal | |
| CN62.29 | Y2.0 | | Tool post motor braking signal (Yantai AK31)/ tool post unclamping output (Liuxin Tool Post) | |

| DB Pin | PLC address | Function defined by standard PLC address | | Remark |
|---|---|---|---|---|
| CN62.30 | Y2.1 | | Tool post pre-indexing electromagnet signal (Yantai AK31)/ Tool post lock output (Liuxin Tool Post) | |
| CN62.31 | Y2.2 | YLAMP | Tri-colored lamp – yellow (normal state, non-running, non-alarm) | |
| CN62.32 | Y2.3 | GLAMP | Tri-colored lamp – green (running state) | |
| CN62.33 | Y2.4 | RLAMP | Tri-colored lamp – red (alarm state) | |
| CN62.34 | Y2.5 | M10 | Tailstock advancing output signal | |
| CN62.35 | Y2.6 | M11 | Tailstock retracting output signal | |
| CN62.36 | Y2.7 | | Reserved | |
| CN62.37 | Y3.0 | | Reserved | |
| CN62.38 | Y3.1 | | Reserved | |
| CN62.39 | Y3.2 | | Reserved | |
| CN62.40 | Y3.3 | | Reserved | |
| CN62.41 | Y3.4 | SORI | Spindle orientation signal | |
| CN62.42 | Y3.5 | SEC0 | Spindle orientation selection signal 1 | |
| CN62.43 | Y3.6 | SEC1 | Spindle orientation selection signal 2 | |
| CN62.44 | Y3.7 | SEC2 | Spindle orientation selection signal 3 | |
| CN62.17～CN62.19<br>CN62.26～ CN6228 | | | 0V | |
| CN62.20～CN62.25 | | | +24V | |

**Note1: Addresses X0.0~X0.7,X1.0~X1.7,X2.0~X2.7,X3.0~X3.7 are valid at a high-level, i.e. when the input signal +24V is connected, the state of address X signal is 1; when disconnected, the state is 0.**

**Note 2: When the state of address Y signal is 1, the output signal is connected to 0V (0V output); when the sate of address Y signal is 0, the output signal is at high-impedance state.**

## 6.2.2 MPG Interface

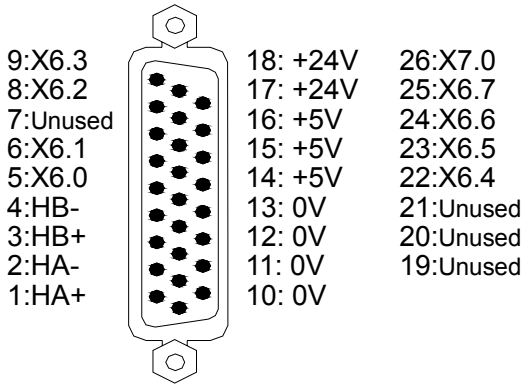



Fig. 6.2.3 CN31 MPG (26-pin, D type, Male)

| DB Pin | Signal Definition | Signal Instruction | Function defined by standard PLC address |
|---|---|---|---|
| CN31.1,CN31.2 | HA+，HA- | MPG phase A signal input | / |
| CN31.3,CN31.4 | HB+，HB- | MPG phase B signal input | / |
| CN31.5 | X6.0 | PLC signal address, binary input | External hand-held unit X axis selection signal |
| CN31.6 | X6.1 | PLC signal address, binary input | External hand-held unit Y axis selection signal |
| CN31.8 | X6.2 | PLC signal address, binary input | External hand-held unit Z axis selection signal |
| CN31.9 | X6.3 | PLC signal address, binary input | External hand-held unit ×1 gear signal |
| CN31.22 | X6.4 | PLC signal address, binary input | External hand-held unit ×10 gear signal |
| CN31.23 | X6.5 | PLC signal address, binary input | External hand-held unit ×100 gear signal |
| CN31.24 | X6.6 | PLC signal address, binary input | External hand-held unit ×1000 gear signal |
| CN31.25 | X6.7 | PLC signal address, binary input | External hand-held unit the 4th axis selection signal |
| CN31.26 | X7.0 | PLC signal address, binary input | External hand-held unit the 5th axis selection signal |
| CN31.10，CN31.11 CN31.12，CN31.13 | 0V | 0V | / |
| CN31.14，CN31.15 CN31.16 | +5V | +5V | / |
| CN31.17,CN31.18 | +24V | +24V | / |

**Note: X6.0~X7.0 input are valid at high-level, i.e. when the input signal is connected to +24V, the input is valid and the state of X address is 1; when disconnected, the state of X address is 0.**

## 6.2.3 Spindle Interface

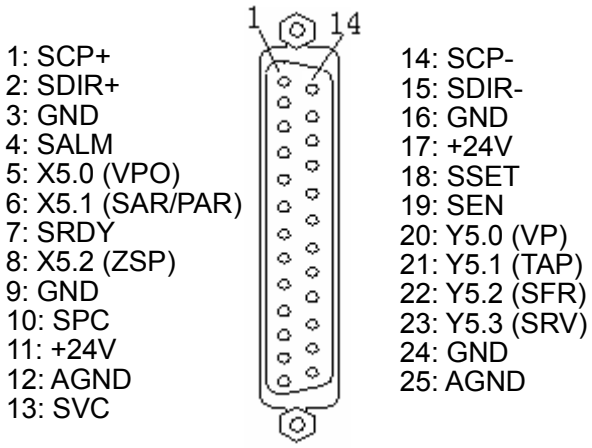



Fig. 6.2.4 CN15 the 5th axis ·spindle interface (25-pin, D type, female)

| DB Pin | Signal Definition | Signal Instruction | Function defined by standard PLC address |
|---|---|---|---|
| CN15.1,CN15.14 | SCP+，SCP- | Command pulse signal | / |
| CN15.2,CN15.15 | SDIR+,SDIR- | Command direction signal | / |
| CN15.4 | X5.3 (SALM) | Drive unit alarm signal | / |
| CN15.7 | SRDY | Servo ready signal | / |
| CN15.18 | SSET | Pulse disabled signal | / |
| CN15.19 | SEN | Axis enable signal | / |
| CN15.10 | SPC | Zero point signal | / |
| CN15.13 | SVC | Spindle analog voltage output | / |
| CN15.12,CN15.25 | AGND | Spindle analog voltage output common port | / |
| CN15.5 | X5.0(VPO) | PLC signal address, binary input | Spindle speed/position state signal |
| CN15.6 | X5.1(SAR/PAR) | PLC signal address, binary input | Spindle position/speed arrival signal |
| CN15.8 | X5.2(ZSP) | PLC signal address, binary input | Spindle zero-speed output signal |
| CN15.20 | Y5.0(VP) | PLC signal address, binary input | Spindle speed/position switch signal |
| CN15.21 | Y5.1(TAP) | PLC signal address, binary input | Spindle speed loop gain 2 selection signal, used for tapping |
| CN15.22 | Y5.2(SFR) | PLC signal address, binary input | Spindle CCW signal |
| CN15.23 | Y5.3(SRV) | PLC signal address, binary input | Spindle CW signal |
| CN15.11,CN15.17 | +24V | +24V | / |
| CN15.3,CN15.9, CN15.16,CN15.24 | GND | 0V<br>Binary signal grounding | / |

**Note 1: X5.0, X5.1, X5.2 input are valid at a low level, i.e. when the input signal is connected to 0V, the input is valid and X address state is 1; when disconnected, the state is 0. Please note that the valid low-level input is different with the I/O addresses X0~X3 in general machine.**
**Note 2: When the state of Y address signal is 1, the output signal is connected to 0V (0V output); when the state is 0, the output signal is at high-impedance state.**

## 6.2.4 Standard Operation Panel

**(1) Address X**

| Address defined by PLC | Corresponding Key on the Panel | Remark |
|---|---|---|
| X18.0 | Block skip | |
| X18.1 | Auxiliary lock | |

| | | |
|---|---|---|
| X18.2 | Spindle override increase | |
| X18.3 | Single block | |
| X18.4 | Machine tool lock | |
| X18.5 | Dry run | |
| X18.6 | Spindle override decrease | |
| X18.7 | Spindle override 100% | |
| X19.0 | C axis moves along – direction(C -) /MPG C | |
| X19.1 | C/S switch | |
| X19.2 | Cycle start | |
| X19.3 | Tailstock | |
| X19.4 | The 4th axis moves along – direction (4th -)/MPG 4th | |
| X19.5 | Z axis moves along – direction (Z-)/ MPG Z | |
| X19.6 | Y axis moves along – direction (Y-)/ MPG Y | |
| X19.7 | X axis moves along – direction (X-)/ MPG X | |
| X20.0 | Protection door | |
| X20.1 | Tool post forward rotation | |
| X20.2 | Tool offset | |
| X20.3 | Tool post reverse rotation | |
| X20.4 | Cooling | |
| X20.5 | Spindle stop | |
| X20.6 | Manual rapid traverse | |
| X20.7 | Optional stop | |
| X21.0 | Program restart | |
| X21.1 | Spindle CW | |
| X21.2 | Spindle jog | |
| X21.3 | Spindle CCW | |
| X21.4 | The 4th axis moves along + direction (4th+) | |
| X21.5 | C axis moves along + direction (C+) | |
| X21.6 | Spindle exact stop | |
| X21.7 | Feed hold | |
| X22.0 | MPG mode | |
| X22.1 | Space key on the right of DNC | |
| X22.2 | MANUAL mode | |
| X22.3 | MDI mode | |
| X22.4 | DNC mode | |
| X22.5 | AUTO mode | |

| | | |
|---|---|---|
| X22.6 | REFERENCE POINT RETURN mode | |
| X22.7 | EDIT mode | |
| X23.0 | Rapid traverse override 100%/MPG×1000 | |
| X23.1 | Z axis moves along + direction (Z+) | |
| X23.2 | Rapid traverse 50%/ MPG×100 | |
| X23.3 | Rapid traverse 25%/ MPG×10 | |
| X23.4 | Y axis moves along + direction (Y+) | |
| X23.5 | Rapid traverse F0/ MPG×1 | |
| X23.6 | X axis moves along + direction (X+) | |
| X23.7 | Hydraulic pressure | |
| X24.0 | Space key below the cycle start | |
| X24.1 | Chuck | |
| X24.2 | Lubrication | |
| X24.3 | Space key on the right of spindle CCW | |
| X24.4 ～ X24.7 | Undefined | System reserved |
| X25.0 ～ X25.7 | Connected to terminal strip | Reserved for user |
| X26.0 ～ X26.7 | Connected to terminal strip | Reserved for user |
| X27.0 ～ X27.7 | Connected to terminal strip | Reserved for user |
| X28.0 | Connected to terminal strip | Connected to panel baud switch (spindle override OV 1) |
| X28.1 | Connected to terminal strip | Connected to panel baud switch (spindle override OV 2) |
| X28.2 | Connected to terminal strip | Connected to panel baud switch (spindle override OV 3) |
| X28.3 | Connected to terminal strip | Connected to panel baud switch (spindle override OV 4) |
| X28.4 | Connected to terminal strip | Connected to panel baud switch (feedrate override OV1) |
| X28.5 | Connected to terminal strip | Connected to panel baud switch (feedrate override OV2) |
| X28.6 | Connected to terminal strip | Connected to panel baud switch (feedrate override OV3) |
| X28.7 | Connected to terminal strip | Connected to panel baud switch (feedrate override OV4) |
| X29.0 | Connected to terminal strip | Connected to panel button (cycle start) |
| X29.1 | Connected to terminal strip | Connected to panel button (feed hold) |
| X29.2 | Connected to terminal strip | Connected to panel key switch button (program protection lock) |

| | | |
|---|---|---|
| X29.3 | Connected to terminal strip | Connected to panel knob normally-open terminal (spindle rotation allowed) |
| X29.4 | Connected to terminal strip | Connected to panel knob normally-closed terminal (feed allowed) |
| X29.5 ～ X29.7 | Connected to terminal strip | Reserved for user |

**Note: The PLC address X18~X24 are the fixed addresses input by keys on the panel, and their functions are fixed. Addresses X25~X29 are lead to the terminal strip on the backboard of the panel, the exact functions are defined by the PLC run in the system.**

**(2) Address Y**

| Address defined by PLC | Corresponding key on the panel | Remark |
|---|---|---|
| Y18.0 | Block skip indicator | |
| Y18.1 | Auxiliary lock key indicator | |
| Y18.2 | L5 indicator | |
| Y18.3 | Single block indicator | |
| Y18.4 | Machine lock key indicator | |
| Y18.5 | Dry run key indicator | |
| Y18.6 | C/S switch key indicator | |
| Y18.7 | C/S axis – direction key indicator | |
| Y19.0 | C axis + direction (C+) key indictor | |
| Y19.1 | The $4^{th}$ axis + direction ($4^{th}$+) key indicator | |
| Y19.2 | Cycle start key indicator | |
| Y19.3 | Feed hold key indicator | |
| Y19.4 | Program restart key indicator | |
| Y19.5 | Optional stop key indicator | |
| Y19.6 | Spindle override decrease key indicator | |
| Y19.7 | Spindle override 100% key indicator | |
| Y20.0 | Spindle override increase indicator | |
| Y20.1 | Hydraulic pressure key indicator | |
| Y20.2 | Tailstock key indicator | |
| Y20.3 | Lubrication key indicator | |
| Y20.4 | Protection door key indicator | |
| Y20.5 | Tool post forward rotation key indicator | |
| Y20.6 | Tool offset key indicator | |
| Y20.7 | Tool post reverse rotation key indicator | |
| Y21.0 | Digitron (right) output ( value 1) | |
| Y21.1 | Digitron (right) output (value 2) | |
| Y21.2 | Digitron (right) output ( value 4) | |

| | | |
|---|---|---|
| Y21.3 | Digitron (right) output (value 8) | |
| Y21.4 | Digitron (left) output ( value 1) | |
| Y21.5 | Digitron (left) output ( value 2) | |
| Y21.6 | Digitron (left) output ( value 4) | |
| Y21.7 | Digitron (left) output ( value 8) | |
| Y22.0 | MPG mode indicator | |
| Y22.1 | Indicator of space key on the right of DNC | |
| Y22.2 | MANUAL mode indicator | |
| Y22.3 | MDI mode indicator | |
| Y22.4 | DNC mode indicator | |
| Y22.5 | AUTO mode indicator | |
| Y22.6 | REF. mode indicator | |
| Y22.7 | EDIT mode indicator | |
| Y23.0 | Rapid traverse override 100% indicator | |
| Y23.1 | Z axis + direction indicator | |
| Y23.2 | Rapid traverse override 50% indicator | |
| Y23.3 | Rapid traverse override 25% indicator | |
| Y23.4 | Y axis + direction indicator | |
| Y23.5 | Rapid traverse override F0 indicator | |
| Y23.6 | X axis + direction indicator | |
| Y23.7 | System alarm (ALM) indicator | |
| Y24.0 | Cooling key indicator | |
| Y24.1 | Chuck key indicator | |
| Y24.2 | Indicator of space key on the right of the spindle CCW key | |
| Y24.3 | Spindle exact stop key indicator | |
| Y24.4 | Spindle stop key indicator | |
| Y24.5 | Spindle CW key indicator | |
| Y24.6 | Spindle jog key indicator | |
| Y24.7 | Spindle CCW key indicator | |
| Y25.0 | The $4^{th}$ – direction key indicator | |
| Y25.1 | Z axis – direction (Z-) key indicator | |
| Y25.2 | Y axis – direction (Y-) key indicator | |
| Y25.3 | Z axis machine zero point indicator | |
| Y25.4 | Y axis machine zero point indicator | |
| Y25.5 | Z axis machine zero point indicator | |
| Y25.6 | X axis – direction (X-) key indicator | |
| Y25.7 | Rapid traverse key indicator | |
| Y26.0 | Indicator of space key below the cycle start key | |
| Y26.1 | L4 indicator | |

| | | |
|---|---|---|
| Y26.2 | L3 indicator | |
| Y26.3 | L2 indicator | |
| Y26.4 | L1 indicator | |
| Y26.5 | System running (RUN) indicator | |
| Y26.6 | C axis machine zero point indicator | |
| Y26.7 | 4th axis machine zero point indicator | |
| Y27.0～Y27.7 | Connected to terminal strip | Reserved for user |
| Y28.0～Y28.7 | Connected to terminal strip | Reserved for user |
| Y29.0 | Connected to terminal strip | Connected to panel button indicator (cycle start) |
| Y29.1 | Connected to terminal strip | Connected to panel button indicator (feed hold) |
| Y29.2～Y29.7 | Connected to terminal strip | Reserved for user |

**Note: The PLC addresses Y18~Y26 are the fixed addresses of indicator output on the panel; their functions fixed. Addresses Y27~Y29 are lead to the terminal strip on the backboard of the panel; the exact functions are defined by PLC.**

## 6.3 Standard PLC Functions

### 6.3.1 M Commands

| Command | Function | Remark |
|---|---|---|
| M00 | Program stop | |
| M03 | Spindle CW | Function interlocked and state retains |
| M04 | Spindle CCW | |
| *M05 | Spindle stop | |
| M08 | Coolant ON | Function interlocked and state retains |
| *M09 | Coolant OFF | |
| M10 | Tailstock advance | Function interlocked and state retains |
| *M11 | Tailstock retreat | |
| M12 | Chuck clamp | Function interlocked and state retains |
| M13 | Chuck release | |
| M32 | Lubrication ON | Function interlocked and state retains |
| *M33 | Lubrication OFF | |
| M41, M42 M43, M44 | Spindle automatic gear change | Function interlocked and state retains |
| M51 ~ M58 | Spindle 8-point positioning | Function interlocked and state retains |

Note: Commands with "*" in the standard PLC commands are valid after power-on.

### 6.3.2 Cycle Start and Feed Hold

The standard operation panel consists of a group of keys and a group of external buttons which is used to realize the function of cycle start and feed hold. Please note the difference between addresses of keys and buttons.

- **Address definition**

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| X0019 | | | | | | | BIT2 | | |
| X0021 | | BIT7 | | | | | | | |

X19.2: Input address of cycle start key on the panel

X21.7: Input address of feed hold key on the panel

| Y0019 | | | | | | BIT3 | BIT2 | | |
|---|---|---|---|---|---|---|---|---|---|

Y19.2: Output address of cycle start indicator on the panel

Y19.3: Output address of feed hold indicator on the panel

| X0029 | | | | | | | | BIT1 | BIT0 |
|---|---|---|---|---|---|---|---|---|---|

X29.0: Input address of external cycle start button

X29.1: Input address of external feed hold button

| Y0029 | | | | | | | | BIT1 | BIT0 |
|---|---|---|---|---|---|---|---|---|---|

Y29.0: Output address of external feed hold button indicator

Y29.1: Output address of external cycle start button indicator

**Control logic**

When the system is in automatic running state, press feed hold key or external feed hold button, the running process will be suspended.

When the system is in stop or suspended state, press cycle start key or external cycle start button, the automatic running will be performed.

## 6.3.3 Feed/Spindle Hold

- **Address definition**

| X0029 | | | | | BIT4 | BIT3 | | | |
|---|---|---|---|---|---|---|---|---|---|

X29.3: Input address of feed enabled (connected to the feed/spindle knob)

X29.4: Input address of spindle knob enabled (connected to the feed/spindle knob)

- **Control parameter**

| K0010 | | | | | | KNEN | | | |
|---|---|---|---|---|---|---|---|---|---|

K10.3 =1: The function of feed hold knob on the machine tool is enabled;

=0: The function of feed hold knob on the machine tool is disabled;

**Control logic**

The feed/spindle hold knob can enable the spindle rotation and cycle start;

When the spindle is rotating, and the knob is set to the spindle hold position, the spindle output is disabled.

When the spindle is not rotating, and the knob is set to the spindle hold position, the spindle cannot be started.

When the knob is set to feed hold position during automatic running, the feed stops and “Dwell” is displayed.

When the knob is set to feed hold position during automatic running, press “Cycle Start” button, the program execution is disabled.

## 6.3.4 Program Lock

- **Address definition**

| X0029 | | | | | | | BIT2 | | |
|---|---|---|---|---|---|---|---|---|---|

X29.2: Input address of program protection signal

**Control parameter**

| K0009 | | | | | | | | | RPRT |
|---|---|---|---|---|---|---|---|---|---|

K9.0 =1: Program lock is shielded

=0: Program lock is not shielded

- **Control logic**

When K9.0 is set to 1, the program lock is disabled, regardless of the signal X39.2; and both the program and parameter writing are enabled.

When K9.0 is set to 0, the program lock is enabled.

When signal X29.2 is valid, both program and parameter writing are enabled.

When signal X29.2 is invalid, both program and parameter writing are disabled.

## 6.3.5 Feedrate Override

- **Address definition**

| X0028 | BIT7 | BIT6 | BIT5 | BIT4 | | | | |
|---|---|---|---|---|---|---|---|---|

X28.4: Feedrate override signal OV0

X28.5: Feedrate override signal OV1

X28.6: Feedrate override signal OV2

X28.7: Feedrate override signal OV3

- **Control logic**

It adopts digital code rotary switch; the code is two's complement.

## 6.3.6 Spindle Override

- **Address definition**

| X0018 | BIT7 | BIT6 | | | | BIT2 | | |
|---|---|---|---|---|---|---|---|---|

X18.2: + Spindle override +

X18.6: Spindle override -

X18.7: 100% Spindle override 100%

| Y0019 | BIT7 | BIT6 | | | | | | |
|---|---|---|---|---|---|---|---|---|
| Y0020 | | | | | | | | BIT0 |

Y19.6: Spindle override – key indicator

Y19.7: Spindle override 100% key indicator

Y20.0: Spindle override + key indicator

**Relevant parameter**

| DT0023 | Spindle override indicator flicker period (100-1000ms) |
|---|---|

- **Control logic**

①When the spindle override is greater than 100%:

Override <120%: spindle override+indicator flickers; the flicker period is set by DT23

Override = 120%: spindle override + indicator normally lights up.

② When the spindle override equals to 100%

Spindle override 100% key indicator normally lights up;

③ when spindle override is less than 100%:

Override > 50%: spindle override – key indicator flickers, the flicker period is set by DT23;

Override= 50%: spindle override – key indicator normally lights up;

**Note: When thread cutting is being performed, spindle override is disabled.**

## 6.3.7 Spindle CCW/CW Control

- **Address definition**

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| Y0000 | SPZD | | M5 | M4 | M3 | | | |

Y0.3: Spindle CCW output signal (M3)
Y0.4: Spindle CW output signal (M4)
Y0.5: Spindle stop signal (M5)
Y0.7: Spindle braking output signal (SPZD)

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| X0020 | | | BIT5 | | | | | |
| X0021 | | | | | BIT3 | | BIT1 | |

X20.5: Spindle stop key
X21.1: Spindle CW key
X21.3: Spindle CCW key

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| Y0024 | BIT7 | | BIT5 | BIT4 | | | | |

Y24.4: Spindle stop indicator
Y24.5: Spindle CW indicator
Y24.7: Spindle CCW indicator

- **Control parameter**

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| K0010 | | | | | | | BIT1 | |

K10.1 =1: When the system is reset, the output signals M03, M04, M08, M32 are NOT OFF
K10.1 =0: When the system is reset, the output signals M03, M04, M08, M32 are OFF.

| | |
|---|---|
| DT0005 | MTIME |
| DT0010 | SPDDLT |
| DT0011 | SPZDTIME |

DT05: the execution time of M code (ms); value range: 100~5000ms
DT10: M05 and the delay time (ms) of spindle braking output; value range:0~10000ms
DT11: Spindle braking output time; value range: 50~60000ms

- **Motion sequence**

The sequence of spindle motion is shown as follows:

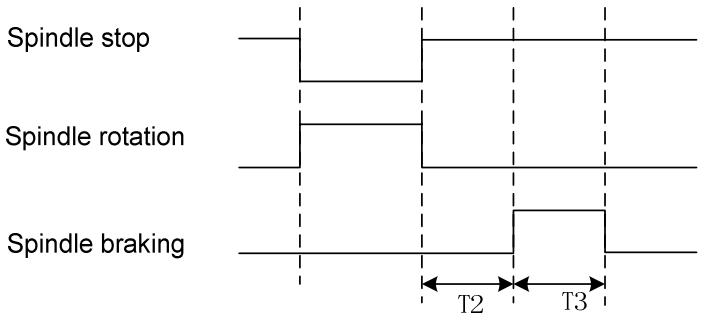



Fig. 6-3-1 Sequence diagram of spindle CCW/CW

**Note: T2 is the delay time counting from the issuing of spindle stop signal to spindle braking signal; T3 is the spindle braking duration.**

- **Logic control**

After power-on, M05 output is enabled.
When M05 is enabled, and M03 or M04 is executed, M03 or M04 output is enabled and remains

unchanged; meanwhile, M05 output is disabled.

When M03 or M04 is enabled, and M05 is executed, M03 or M04 output is disabled and M05 output is enabled and remains unchanged.

When M03 or M04 output is enabled, the execution of M04 or M03 will lead to system alarm.

The delay time of spindle braking signal SPZD is set by parameter DT0010, and the duration is set by DT0011.

**Note: when CNC performs emergency stop, signal M03 or M04 output is disabled, and signal M05 is output at the same time.**

## 6.3.8 Spindle Jog

- **Address definition**

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| X0024 | | BIT6 | | | | | | |

X24.6: Spindle jog mode signal

- **Control parameter**

| | |
|---|---|
| DT12 | spindle jog duration (ms) |

- **Logic control**

In increment, MPG or MANUAL mode, press 

to enable the spindle jog mode; press key 

the spindle rotates CCW; press 

, spindle rotates CW; the rotating duration is set by PLC parameter DT12.

**Note: Spindle JOG speed is the rotation speed corresponding to analog voltage value set by DC00.**

## 6.3.9 Spindle 8-Point Pre-Orientation

- **Address definition**

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| Y0003 | | SEC2 | SEC1 | SEC0 | SORI | | | |

Y3.4: Spindle orientation signal

Y3.5～Y3.7: Spindle orientation selection signal

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| X0002 | | COIN | | | | | | |

X2.7: Spindle orientation completed signal

- **Control logic**

① After commands M51~M58 are executed, PLC issues orientation selection signals SEC0, SEC1, SEC2 to Drive to determine the position.

② After 40ms delay, PLC issues spindle orientation signal SORI to Drive;

③ Drive starts orientation;

④ After the orientation is finished. Drive sent the spindle orientation completed signal COIN to PLC;

⑤ If the PLC does not receive the COIN signal in 6000ms after the orientation selection signal is issued, the system will issue an alarm “spindle orientation time is too long”.

⑥ The spindle can be in rotating or stop state before the orientation, and it will be in stop state after the orientation.

➢ **Control sequence diagram**

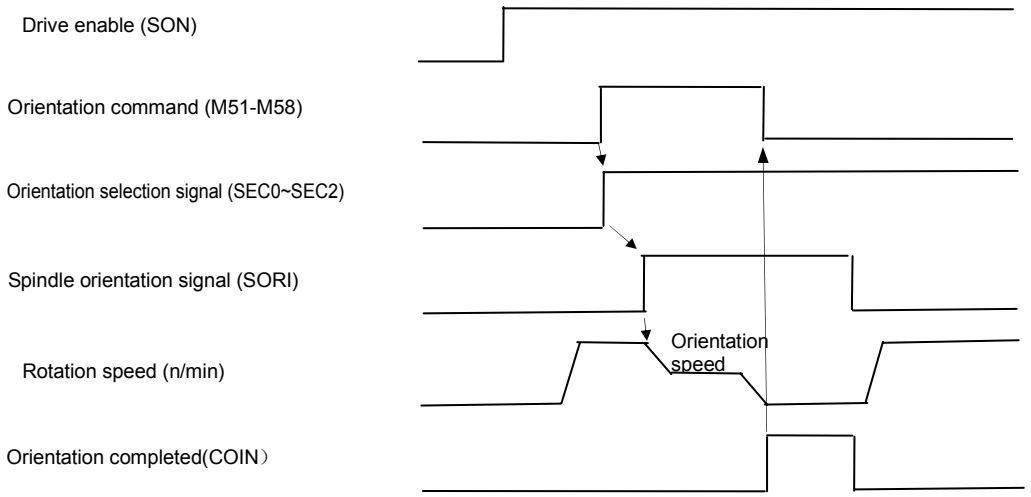



Fig. 6-3-2 Pre-orientation sequence

➢ **8-Point Pre-Orientation Method:**

① Connect the system and servo drive unit correctly. The interfaces includes: enable signal interface (SON), forward/reverse rotation interface (SRF/SRV), position start signal interface (STAO), position completed signal interface (COIN) and multi-point orientation selection input signal (SP0~SP2). Refer to the spindle servo manual for details.

② First, set the parameters related to servo spindle drive unit correctly.

a) Set the servo spindle drive unit parameter No. PA4 (i.e. speed control mode) to 1.

b) PA55 sets the spindle speed during orientation.

c) PA56 sets the position screen during orientation.

d) When PA66 selects the orientation, the signal of selected encode is used as position feedback input signal;

e) PA67 sets the spindle encoder line numbers according to the actual machine tool configuration.

③ Bring up the monitoring menu dP-APo, and press ↵, then, E □□□□ is displayed; symbol “E” means the spindle is at an uncertain position, its value cannot be the reference value for orientation.

④ The spindle should rotate one circle at least. After the drive unit detects the Z pulse signal of the spindle encoder, and finds the right position, dP-APo will turn into F □□□□, which indicates that the position of current encoder is right.

⑤ Adjust the spindle to orientation point gradually, then record the displayed position in dP-APo; write it in parameter PA58, then save the parameter. This reference value is position 1.

⑥ User can adjust 8 orientation points continuously and the position of the points will be recorded and written in parameters PA58~65 by sequence. In this method, multi-point orientation is performed.

The relationship between speed selection input signals(SP0, SP1, SP2) and parameters PA58~PA56 is shown in the table below:

| Output signals / Commands | SEC2 (Y3.7) | SEC1 (Y3.6) | SEC0 (Y3.5) | Corresponding positions |
|---|---|---|---|---|
| M51 | 0 | 0 | 0 | Orientated position 1 ( PA58) |

| | | | | |
|---|---|---|---|---|
| M52 | 0 | 0 | 1 | Orientated position 2 ( PA59) |
| M53 | 0 | 1 | 0 | Orientated position 3 (PA60) |
| M54 | 0 | 1 | 1 | Orientated position 4 (PA61) |
| M55 | 1 | 0 | 0 | Orientated position 5 (PA62) |
| M56 | 1 | 0 | 1 | Orientated position 6 (PA63) |
| M57 | 1 | 1 | 0 | Orientated position 7 (PA64) |
| M58 | 1 | 1 | 1 | Orientated position 8 (PA65) |

⑦ Enable the drive unit (input SON signal and SFR signal), input the orientation start signal (STAO), and keep the low-level signal valid, the servo motor runs at the speed set by PA55; after the orientation point is found (determined by SP0~SP2), the servo motor keeps at the position and outputs orientation completed signal (COIN).

⑧ After the system detected COIN signal, the orientation completion is confirmed. Cancel the orientation start signal to proceed to the next operation.

## 6.3.10 Spindle Gear Control

➢ **Address definition**

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| Y0001 | | | | | | S04/M44 | S03/M43 | S02/M42 | S01/M41 |

M41～M44: Automatic spindle gear change output signal

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| X0001 | | | M42I | M41I | | | | | |

M41I～M42I: The in-position signal when spindle changes to 1 or 2 gear automatically.

**Control parameter**

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| K0010 | | | | BIT4 | | | | |
| K0013 | AGER | AGIN | AGIM | ASTR | | | | |

K10.4 =1: Gear spindle—the spindle speed is controlled by gear stage.

K10.4 =0: Analog spindle—the spindle speed is controlled by analog voltage control.

K13.4 =1: Automatic spindle gear change is valid.

K13.4 =0: Automatic spindle gear change is invalid.

K13.5 =1: Checks the gear change in-position signal during automatic spindle gear change

K13.5 =0: Does not check the gear change in-position signal during automatic spindle gear change.

K13.6 =1: Gear change in-position signal is valid when connected to +24V

K13.6 =0: Gear in-position signal is valid when disconnected to +24V.

K13.7 =1: Spindle gear stage is stored when power-off.

K13.7 =0: Spindle gear stage is not stored when power-off.

| | |
|---|---|
| 3741 | The maximum spindle speed at gear stage 1 (MSG1) |
| 3742 | The maximum spindle speed at gear stage 2 (MSG2) |

| | |
|---|---|
| 3743 | The maximum spindle speed at gear stage 3 (MSG3) |
| 3744 | The maximum spindle speed at gear stage 4 (MSG4) |

MSG1, MSG2, MSG3, MSG4: When spindle analog voltage output is 10V, they correspond to the maximum spindle speeds at gear stages 1, 2, 3, 4. When spindle automatic gear change is valid, they corresponds to the spindle speed commanded by M41, M42, M43, M44; when the spindle gear stage is not stored after power-off, the default setting is gear stage 1 after CNC is power-on.

| | |
|---|---|
| DT0000 | Automatic gear change signal output delay time 1 (SFT1TME) |
| DT0001 | Automatic gear change signal output delay time 2 (SFT2TME) |

- **Function description**

The spindle automatic gear change function is used to control the spindle mechanical gear automatic switch; when CNC executes S_____ command, it calculates the analog voltage which is output to spindle servo or inverter, according to the parameters (No. 3741~No. 3744) of current gear stages controlled by M4n.

## 6.3.11 Cooling Control

- **Address definition**

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| Y0000 | | | | | | | | M08 |
| X0020 | | | | BIT4 | | | | |
| Y0024 | | | | | | | | BIT0 |

Y0.0: Cooling signal output (M08)

X20.4: Cooling key input

Y24.0: Cooling key indicator

- **Function description**

After CNC is power-on, M09 is valid, which means M08 output is disabled.

When M08 is executed, M08 output is enabled and the cooling pump is ON; when M09 is executed, M08 output is cancelled and the cooling pump is OFF.

Press the cooling key 

on the operation panel, the M08 output state is inverted.

**Note 1: When emergency stop or M30 is executed, M08 output is cancelled and cooling is OFF.**
**Note 2: When CNC is reset, the bit 1 of K10 sets whether the M08 output is cancelled or not.**
**Note 3: M09 corresponds to no output signal. When M09 is executed , M08 output is cancelled and the cooling is OFF.**

## 6.3.12 Lubricating Control

- **Address definition**

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| Y0000 | | | | | | | M32 | |
| X0024 | | | | | | BIT2 | | |
| Y0020 | | | | | BIT3 | | | |

Y0.1: Lubrication output signal (M32)

X24.2: Lubrication key

Y20.3: Lubrication key indicator

| | |
|---|---|
| DT0013 | Manual lubrication output time |
| DT0016 | Automatic lubrication interval time |

| DT0017 | Automatic lubrication output time |
|---|---|

DT13: Lubrication duration (0~60000ms); when it is set to 0, lubrication output state is unchanged.

DT16: Automatic lubrication interval time (0~60000ms)

DT17: Automatic lubrication output time (0~60000ms)

- **Function description**

The lubrication function defined by GSK988T standard PLC program includes two kinds: non-auto-lubrication and auto-lubrication. When DT16=0 or DT17=0, the auto-lubrication function is disabled.

**a) Non-auto-lubrication**

When DT>0, lubrication output is executed at regular time. The key 

on the panel is enabled or when M32 is executed, lubrication Y0.1 output is valid, meanwhile, the indicator signal Y20.3 output is valid. When the time set by DT13 ends, lubrication Y0.1 and Y20.3 output is cancelled; if M33 is executed before the time approaches, the lubrication Y0.1 output and Y20.3 output is cancelled.

When DT13=0, the lubrication output is inverted. The key 

is enabled or when M32 is executed, lubrication Y0.1 output is valid, meanwhile, indicator signal Y20.3 output is valid; When key 

is enabled again or M33 is executed, lubrication Y0.1 output is OFF, meanwhile, indicator signal Y20.3 is OFF.

**b) Auto-lubrication**

When DT16 > 0, DT17>0, the system starts to countdown for the duration set by DT16 after system power-on, then, the lubrication output is performed. When the time set by DT17 ends, the lubricating stops, and so forth. During automatic lubrication, 

key and M32, M33 commands are valid in the interval time, and they are disabled in the lubrication output time.

**Note 1: During emergency stop or the execution of M30, M32 output will be cancelled and the lubrication is OFF.**
**Note 2: When CNC is reset, the bit 1 of K10 sets whether the M32 output is cancelled or not.**
**Note 3: M33 corresponds to no output signal. When M33 is executed , M32 output is cancelled and the cooling is OFF.**

## 6.3.13 Chuck Control

- **Address definition**

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| Y0001 | | | DOQPS | DOQPJ | | | | |

Y1.4: Outer chuck clamping/inner chuck unclamping output

Y1.5: Outer chuck unclamping/inner chuck clamping output signal

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| X0000 | | | | | | DIQP | | |
| X0003 | | | | NQPS | WQPJ | | | |

X0.2 : Chuck control input signal (DIQP)

X3.3: Outer chuck clamping in-position/inner chuck unclamping in-position signal (WQPJ)

X3.4: Outer chuck unclamping in-position/inner chuck clamping in-position signal (NQPJ)

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| X0024 | | | | | | | BIT1 | |

| Y0024 | | | | | | | BIT1 | |
|---|---|---|---|---|---|---|---|---|

X24.1: Chuck key

Y24.1: Chuck key indicator

- **Control parameter**

| K0013 | | | | | | | SLSP | SLQP |
|---|---|---|---|---|---|---|---|---|

K13.0 = 1: Chuck control function is enabled.

K13.0=0: Chuck control function is disabled.

K13.1=1: When chuck function is enabled, the system checks whether the chuck is clamping.

K13.1=0: When the chuck function is enabled, the system does not check whether the chuck is clamping or not; If the chuck is unclamping, the spindle cannot be started.

| K0014 | | | | | | PB2 | | PB1 |
|---|---|---|---|---|---|---|---|---|

K14.0 = 1: Check chuck in-position signal

K14.0 =0: Does not check chuck in-position signal

K14.2 = 0:Outer chuck mode, WQPJ is outer chuck clamping signal, NQPJ is outer chuck unclamping signal

K14.2 =1: Inner chuck mode, NQPJ is inner chuck clamping signal, WQPJ is inner chuck unclamping signal.

- **Control logic**

| | | |
|---|---|---|
| Signals in outer chuck mode | Clamping | WQPJ(X3.3): Chuck clamping in-position signal |
| | | DOQPJ (Y1.4): Chuck clamping output signal |
| | Unclamping | NQPJ(X3.4): Chuck unclamping in-position signal |
| | | DOQPS (Y1.5): Chuck unclamping output signal |
| Signals in inner chuck mode | Clamping | NQPJ(X3.4): Chuck clamping in-position signal |
| | | DOQPS (Y1.5): Chuck clamping output signal |
| | Unclamping | WQPJ(X3.3): Chuck unclamping in-position signal |
| | | DOQPJ (Y1.4): Chuck unclamping output signal |

When then system is power-on, the signals DOQPJ and DOQPS is the state before power-off last time. i.e. DOQPJ and DOQPS are stored when power-off.

When chuck control input (DIQP) is valid or the key 

is pressed, the chuck clamping/unclamping signal is output alternatively, i.e. each time the chuck control input signal is enabled, the output state changes.

When the spindle is rotating, DIQP input and chuck key on the panel are disabled; M13 cannot be executed, and an alarm will occur. The output state will not change.

In reset or emergency stop state, the output state of DOQPJ, DOQPS remain unchanged.

➢ **Sequence diagram:**

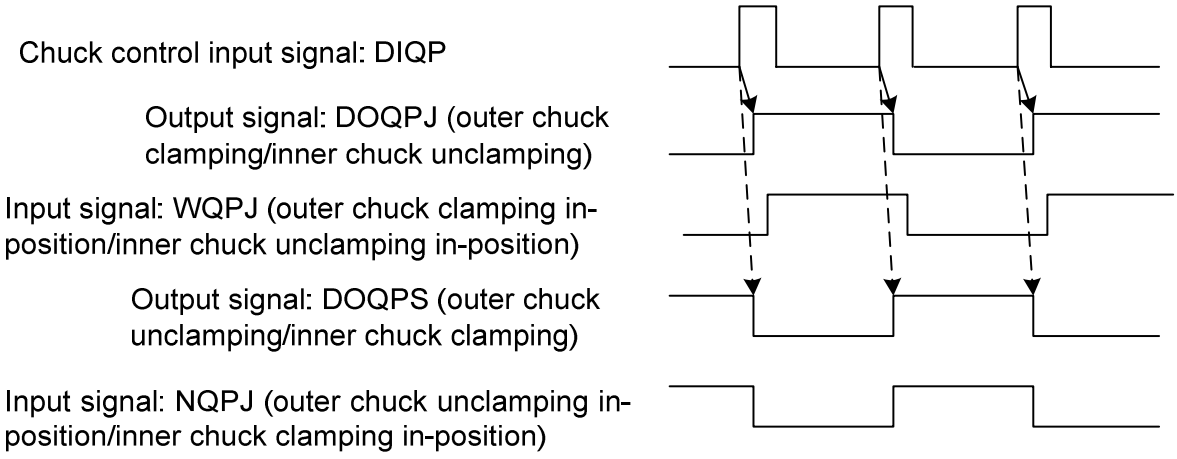



Fig.6-3-2 Chuck control sequence diagram

The control logic for signals K13.1 and K14.0:

When K13.1=1, K14.0=0:

After chuck clamping signal is output, the spindle can be started, otherwise, system alarm will be issued.

When K13.1＝1， K14.0＝1:

When the chuck clamping signal and in-position signal are valid, the spindle can be started, otherwise, system alarm will be issued.

When K13.1＝0，K14.0＝0:

No matter the chuck is clamping or not, spindle can be started.

When K13.1＝0，K14.0＝1:

When the chuck in-position signal is valid, the spindle can be started, otherwise, system alarm will be issued.

## 6.3.14 Tailstock Control

➢ **Address definition**

| Y0002 | | | M11 | M10 | | | | | |
|---|---|---|---|---|---|---|---|---|---|

Y2.5: Tailstock advancing output signal (DOTWJ)

Y2.6: Tailstock retracting output signal (DOTWS)

| X0000 | | | | | DITW | | | | |
|---|---|---|---|---|---|---|---|---|---|

X0.4: Tailstock control input signal

| X0019 | | | | | | BIT3 | | | |
|---|---|---|---|---|---|---|---|---|---|

X19.3: Tailstock key on the panel

| Y0020 | | | | | | | BIT2 | | |
|---|---|---|---|---|---|---|---|---|---|

Y20.2: Tailstock key indicator on the panel

➢ **Control parameter**

| K0013 | | | | | | | SLTW | | |
|---|---|---|---|---|---|---|---|---|---|

K13.2 =1: Tailstock control function enabled

K13.2 =0: Tailstock control function disabled

➢ **Sequence diagram**

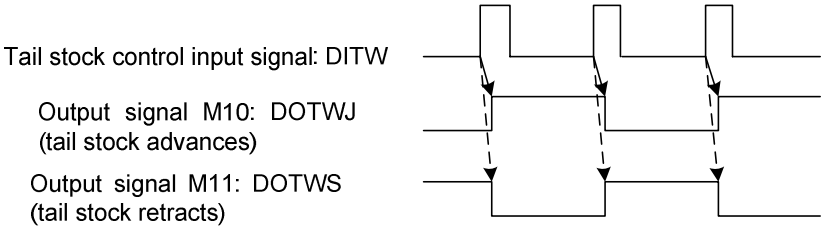



Fig. 6-3-3 Tail stock control sequence diagram

After power-on, the signals DOTWJ and DOTWS remain the state when power-off the previous time, i.e. DOTWJ and DOTWS are stored when power-off.

When tailstock control input (DITW) or the key TAILSTOCK are enabled, the tailstock advance/retract signal is output alternatively, i.e. each time when the tailstock control input signal is valid, the output state changes.

After M10 is executed, the signal DOTWJ is output, and the tailstock advances; after M11 is executed, signal DOTWS is output, and the tailstock retracts.

When the spindle is rotating, the tailstock control DITW input and tailstock key on the panel are disabled; the execution of M11 is invalid and will trigger an alarm. The output state keeps the same.

When CNC is reset or in emergency stop state, the output state of signal DOTWJ/DOTWS remains unchanged.

## 6.3.15 Low Pressure Detection

➢ **Address definition**

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| X0000 | | PRES | | | | | | |

X0.6: Low pressure detection signal (PRES)

➢ **Control parameter**

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| K0014 | | | BIT5 | BIT4 | | | | |

K14.4 =0: High-level alarm; When PRES is connected to 24V, the low pressure alarm is issued.

K14.4 =1: Low-level alarm; When PRES is disconnected with 24V, the low pressure alarm is issued.

K14.5 =0: Low pressure detection function is disabled.

K14.5 =1: Low pressure detection function is enabled.

| | |
|---|---|
| DT0002 | Low pressure alarm detection time |

The delay time before the low pressure alarm is issued: 0~60000ms

➢ **Function description**

When the low pressure detection function is selected, the PRES signal is valid. As the delay time set by DT0002 passed, CNC issues an alarm; meanwhile, the feed axis stops, spindle stops and the automatic cycle function cannot be started. Press RESET key or turn off the power to cancel the alarm.

## 6.3.16 Overtravel Signal of Axes

➢ **Address definition**

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| X0003 | | | | | | LMI3+ | LMI2+ | LMI1+ |
| X0004 | | LMI5- | LMI5+ | LMI4- | LMI4+ | LMI3- | LMI2- | LMI1- |

X3.0: 1st axis + direction overtravel signal X4.0: 1st axis – direction overtravel signal
X3.1: 2nd axis + direction overtravel signal X4.1: 2nd axis – direction overtravel signal
X3.2: 3rd axis + direction overtravel signal X4.2: 3rd axis – direction overtravel signal
X4.3: 4th axis + direction overtravel signal X4.4: 4th axis – direction overtravel signal
X4.5: 5th axis + direction overtravel signal X4.6: 5th axis – direction overtravel signal

- **Control parameter**

| K0010 | | | | | | BIT2 | | |
|---|---|---|---|---|---|---|---|---|

K10.2 =1: Low-level signal of each axis is valid
K10.2=0: High-level signal of each axis is valid

## 6.3.17 Tool Change Control

The tool post control logic supported by standard ladder diagram is realized through the combination of Bit 7, Bit 6, and Bit2 of parameter K.

| K0011 | BIT7 | BIT6 | | | | BIT2 | | |
|---|---|---|---|---|---|---|---|---|

K11.6=0, K11.7=0: Standard tool change method (select tool change method A or B by K11.2)
K11.2=1: Tool change method A (adopts Jingcheng Tool Post)
K11.2=0: Tool change method B (adopts Changzhou Tool Post)
K11.6=1, K11.7=0: Adopts Yantai Tool Post AK31 Series (8-position, 10-position, 12-position tool post)
K11.6=0，K11.7=1: Adopts Taiwan Liuxin 8-position hydraulic tool post
K11.6=1, K11.7=1: Adopts Changzhou Yaxing HLT hydraulic tool post (6-position, 8-position, and 12-position tool post);

- **Control parameter**

| K0011 | BIT7 | BIT6 | BIT5 | BIT4 | BIT3 | BIT2 | BIT1 | BIT0 |
|---|---|---|---|---|---|---|---|---|

K11.0= 1: The tool post lock signal is low-level;
K11.0 = 0: The tool post lock signal is high-level;
K11.1= 1: The tool position signal is low-level;
K11.1 = 0: The tool position signal is high-level;
K11.3= 1: Check the tool position signal after tool change
K11.3=0: Does not check the tool position signal after tool change
K11.4 = 1: Check tool post lock signal
K11.4 = 0: Does not check tool post lock signal

| | |
|---|---|
| DT0007 | Delay time from the tool post forward rotation to reverse rotation output (0-1000ms) |
| DT0008 | Alarm time when the TCP signal is not received (0-1000ms) |
| DT0009 | Tool post reverse rotation lock time (0-1000ms) |

**Note: K11.0,K11.1 ,K11.3, K11.4,DT0007,DT0008,DT0009 are used for the control in standard tool change method only (when the standard tool change mode is selected i.e. K11.6=0, K11.7=0, these parameters are valid).**

- **Address definition**

| K11.7 | K11.6 | K11.2 | Tool Post Type | Address to be Used |
|---|---|---|---|---|
| 0 | 0 | 1 | Tool change method A | X1.7(T1),X2.0(T2),X2.1(T3),X2.2(T4),X0.7(T5),X1.0(T6), X1.1(T7),X1.2(T8),X2.6(TCP),Y1.6(TL+),Y1.7(TL-) |
| 0 | 0 | 0 | Tool change method B | |
| 0 | 1 | / | Yantai Tool Post AK31 Series (8, 10, 12-position) | X1.7(T1), X2.0(T2), X2.1(T3), X2.2(T4), X2.6 (lock proximity switch signal), X0.7(tool post pre-indexing proximity switch), X1.0 (tool table strobe signal), X1.1(tool table overheat detection), Y1.6(TL+), Y1.7(TL-), Y2.0(TZD tool table braking),Y2.1(tool table pre-indexing electromagnet) |
| 1 | 0 | / | Liuxin Hydraulic Tool Post LS120 (8-position) | X1.7(T1), X2.0(T2), X2.1(T3), X2.2(T4), X0.7(tool post stop and lock sensor),X1.0(tool post releasing\lock output sensor),Y2.0(tool post releasing output) ,Y2.1(tool post lock output),Y1.6(tool post forward rotation output),Y1.7(tool post reverse rotation output) |

- **Control logic**

**A) K11.7=0，K11.6=0，K11.2=1: Tool change method A**

**1) Control parameters**

| K0011 | BIT7 | BIT6 | BIT5 | BIT4 | BIT3 | BIT2 | BIT1 | BIT0 |
|---|---|---|---|---|---|---|---|---|

K11.0 1: Tool post lock signal is at low level;
0: Tool post lock signal is at high level;
K11.1 1: Tool post position signal is at low level;
0: Tool post position signal is at high level;
K11.3 1: Check tool position signal after tool change;
0: Does not check tool position signal after tool change;
K11.4 1: Check tool post lock signal;
0: Does not check tool post lock signal;

| | |
|---|---|
| DT0007 | Delay time of tool post rotating from CW stop to CCW output (0~1000ms) |
| DT0008 | Alarm duration when tool clamping TCP signal is not received (0~1000ms) |
| DT0009 | Tool post CCW rotation clamping time (0~1000ms) |

**2) Process of tool change**

- In MANUAL, MDI or AUTO mode, tool change is executed, CNC outputs the tool post forward rotation signal (TL+) and detects the tool position signal. After the tool position signal is detected, CNC turns OFF the tool post forward rotation signal (TL+), and check whether the tool position signal transition occurs, if it does, the tool post reverse rotation signal (TL-) is output and then turned OFF after the time set by PLC parameter DT009 ends.
- If the Bit 4 of K0011 is set to 1 (lock detection signal), the system detects the tool post

lock signal. If the TCP signal is not received within the time set by PLC parameter DT008, a system alarm will be generated.

- If the Bit 3 of K0011 is set to 1 (tool position check signal after the tool change), when the tool post reverse rotation time ends, confirm the consistency of the current tool position input signal and current tool number; if they are not consistent, the system will issue an alarm.
- The tool change is finished.

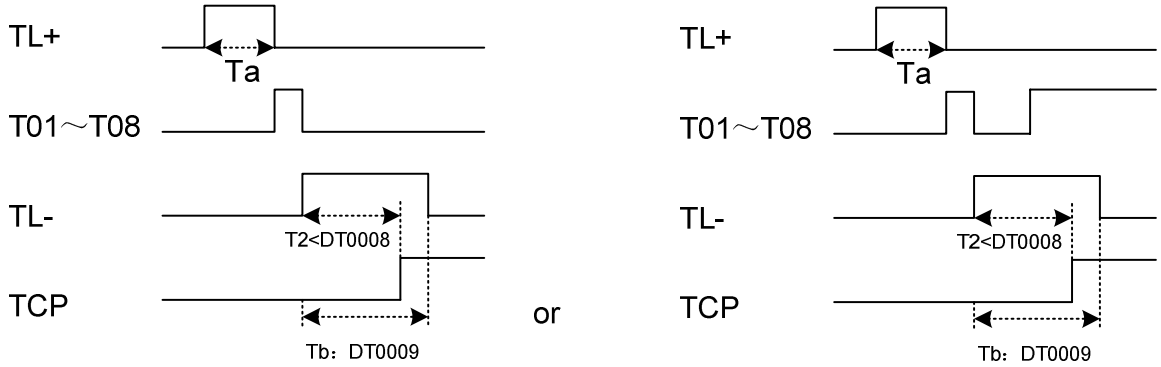



Fig. 6-3-4 Tool change A sequence diagram

**B) K11.7=0，K11.6=0，K11.2=0: B Tool change method B**

**1) Process of tool change**

- When the tool change is executed, the system outputs the tool post forward rotation signal TL+, and detects the tool position signal. After the tool position signal is detected; TL+ output is turned OFF. When the time set by PLC parameter DT007 ends, the tool post reverse rotation signal TL- is output; when the time set by parameter DT009 ends, the tool post reverse signal TL- is turned OFF.
- If the Bit 4 of K0011 is set to 1 (lock detection signal), the system starts to detect the tool post lock signal; if the system does not receive TCP signal within the time set by parameter DT008, an alarm will be generated.
- If the Bit3 of K0011 is set to 1 (tool position check signal after tool change), when the tool post reverse rotation time ends, confirm the consistency of the current tool position input signal and current tool number; if they are not consistent, the system will issue an alarm.
- The tool change is finished.

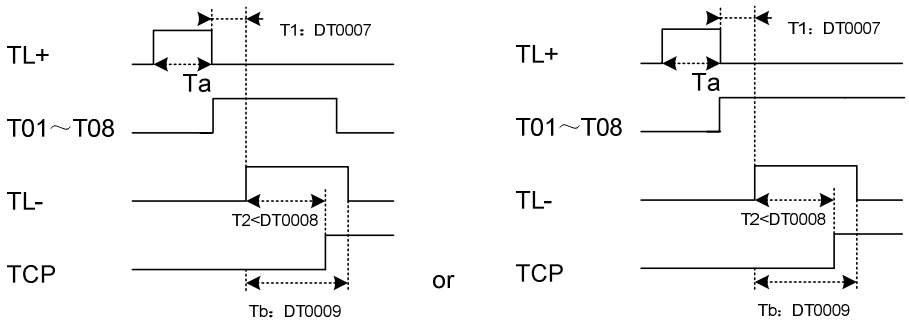



Fig. 6-3-5 Tool change B sequence diagram

**C) K11.7=0，K11.6=1: Yantai Tool Post AK31 Series**

**1) Control parameter**

| | |
|---|---|
| DT0034 | Upper limit of tool change duration for AK31 tool post (ms) |
| DT0035 | Upper limit of proximity switch signal detection for AK31 tool post |

**2) Process of tool change**

- Confirm that the tool post braking signal TZD is OFF.
- The system determines the shortest path according to object tool number and current tool number, and selects the output rotation direction under the principle of “select the nearest tool”, and determines the output signal is TL+ or TL-. Then, as the tool post rotates, the tool selection begins.
- In the process of rotation, the system decodes according to the tool position encode signal T1~T4, and identifies the current tool number. When the tool post rotates to the position before the object one, the system starts to detect the transition of tool post strobe signal. The strobe signal transition of the tool position before the object position is from on to off. The system outputs the tool post pre-indexing electromagnet signal, the tool post pre-indexing electromagnet supplies power.
- When the detected tool post pre-indexing proximity switch input signal is at high level, turn off the tool post rotation output signal (TL+ or TL-), and the motor stops running.
- After delaying 50ms, the system outputs a signal (TL- or TL+) which is inverted to the original rotation direction, then, the tool post rotates in a reversed direction.
- When the detected tool post lock proximity switch input signal is at high level, turn off the tool post rotation output signal (TL+ or TL-), the motor stops running, then, the system outputs tool post braking signal (TZD), the motor braking device is energized.
- After delaying 200ms, turn off the tool post pre-indexing electromagnet output signal, the tool post pre-indexing electromagnet is de-energized.
- When the current tool number is detected again, confirm the consistency of the current tool position encoder signal and object tool number.
- Confirm that the lock proximity switch signal is at high level again.
- If the steps listed above are correct, turn off the tool braking signal TZD, the tool change is finished.
- In the process of tool change, if the motor overheat signal is detected, an alarm is raised, and all signals output are turned OFF.

**3) Tool change flow chart**

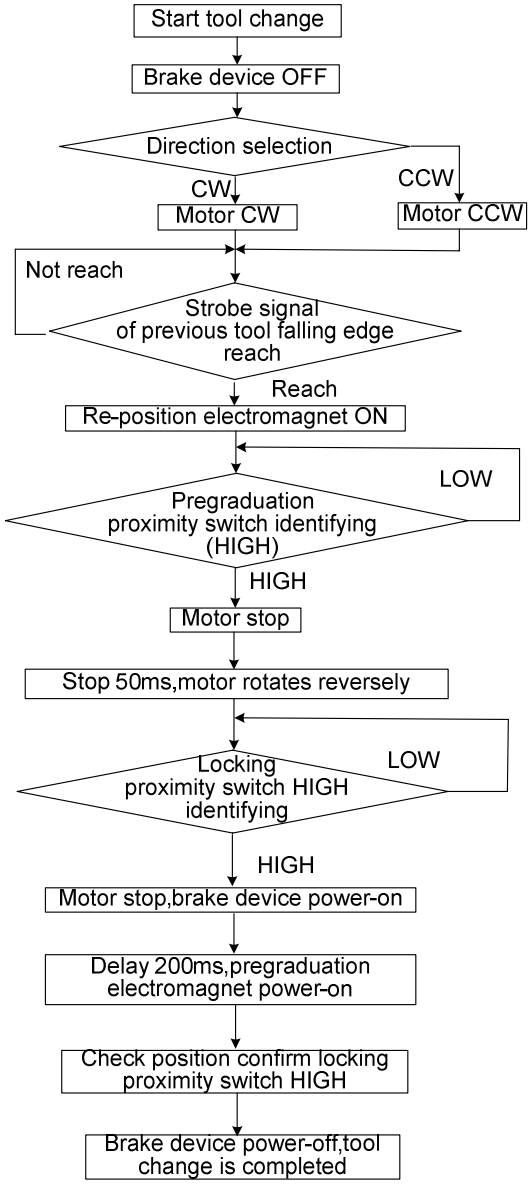



Fig. 6-3-6 AK31 Tool change flow chart

**D) K11.7=1，K11.6=0: Liuxin 8-position hydraulic tool post**

**1）Control parameter**

| | |
|---|---|
| DT0032 | Upper limit of tool change duration (ms) |

**2) Input/output configuration**

Sensor A: Tool position detection sensor→T1(X1.7): tool position signal

Sensor B: Tool position detection sensor→T2(X2.0): tool position signal

Sensor C: Tool position detection sensor→T3(X2.1): tool position signal

Sensor D: Tool position detection senso→T4(X2.2): tool position signal

Sensor E: Tool post rotation stop and lock sensor→SSE(X0.7): tool post rotation stop and lock signal

Sensor F: tool post release/lock signal output sensor→SSF(X1.0): tool post release/lock signal

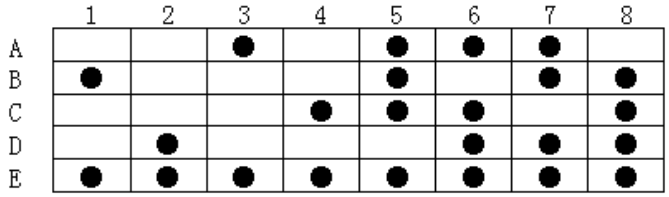
Sol A: tool post release/lock magnetic valve→ Y2.0: tool post release output

Y2.1: tool post lock output

Sol B: tool post forward/reverse rotation magnetic valve→TL+(Y1.6):tool post forward rotation output

→TL-(Y1.7): tool post reverse rotation output

**3) Position and signal table**




**4) Signal instruction**

Sensor A,B,C,D: provide tool position detection; but no motion signal is issued.

Sensor E: each time a tool is changed, the tool post stop and lock signal is issued. When the tool post rotates to the desired position, Sensor E induces and cut off the power of rotation magnetic valve, making the tool post rotation stopped, then, it starts the tool post lock magnetic valve to ensure that the tool post is locked.

Sensor F: Release/lock confirmation signal; When Sensor F does not induce, i.e. the tool post is released, tool post rotation can be started; when Sensor F induces, i.e. the tool post is locked, the tool change is finished.

Sol A: Controls the tool post release/lock

Sol B: Controls the tool post forward/reverse rotation

**5) Description of tool change process**

Example: Tool is changed from No.1 to No. 4

Step 1: Sol A is energized (tool post released)

Step 2: Confirm that the Sensor F does not induce, Sol B is energized, oil hydraulic motor rotates.

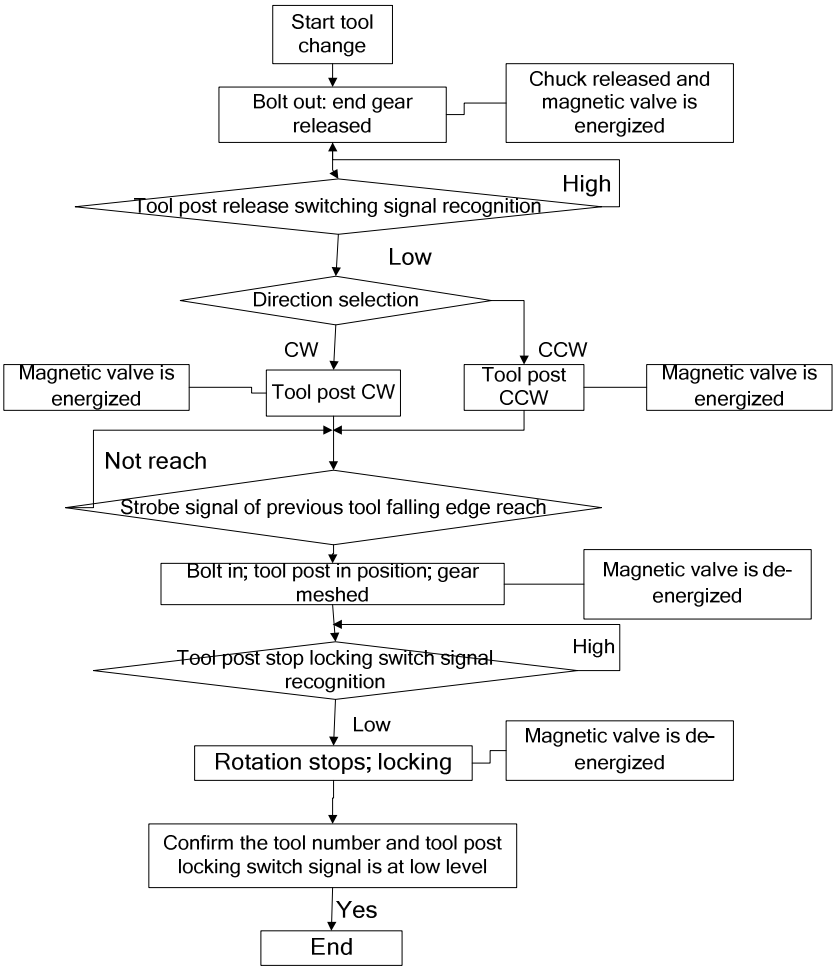
Step 3: Start to detects the tool position signal (Note: Sensor E induces at tool position 1, 2, 3, but when the position 4 is not reached, the motion of lock is not performed; when the tool position 3 signal is confirmed, set the anticipation of Sensor E, when the tool post rotates to the position 4, Sensor E induces i.e. cut off the power of Sol B, tool post stops rotation; meanwhile Sensor E controls the Sol A to lock the tool post.

**(E) Changzhou Yaxing HLT Hydraulic Tool Post: K11.7=1，K11.6=1**

**1）Process of tool change**

1. After receiving tool change signal, the system issues tool post release signal, and then the tool post release magnetic valve is energized;
2. The system determines the shortest path according to object tool number and current tool number under the principle of “select the nearest tool”, selects the output rotation direction, and determines the output signal is TL+ or TL-. Then, as the tool post rotates, the tool selection begins.
3. In the process of rotation, the system decodes according to the tool position encode signal T1~T4, and identifies the current tool number. When the tool post rotates to the position before the object one, the system starts to detect the transition of tool post strobe signal. The strobe signal transition of the tool position before the object position is from on to off. The system outputs the tool post lock signal, the tool post release electromagnet supplies power (tool post lock and release value is controlled by electromagnet).
4. When the detected tool post lock switch signal is at low level, turn off the tool post rotation output signal (TL+ or TL-), and the motor stops running.
5. When the current tool number is detected again, confirm the consistency of the current tool position encoder signal and object tool number.
6. Confirm that the lock proximity switch signal is at low level. The tool change is finished.

**2) Tool change flow chart**




## 6.3.18 Emergency Stop

- **Address definition**

| X0000 | | | | ESP | | | | | |
|---|---|---|---|---|---|---|---|---|---|

X0.5: Emergency stop input signal

- **Control parameter**

| K0010 | ESP | | | | | | | |
|---|---|---|---|---|---|---|---|---|

K10.7 =1: External emergency stop input signal (X0.5) high-level alarm

K10.7 =0: External emergency stop input signal (X0.5) low-level alarm

| 3009 | ESP | | | | | | | |
|---|---|---|---|---|---|---|---|---|

3009#7 =1: Emergency stop alarm is raised when external emergency stop signal (X0.5) is 1.

3009#7 =0: Emergency stop alarm is raised when external emergency stop signal (X0.5) is 0.

**Note: The values of k10.7 and No. 3003#7 should be set consistently.**

## 6.3.19 Tri-Colored Lamp

- **Address definition**

| Y0002 | | | | | BIT4 | BIT3 | BIT2 | |
|---|---|---|---|---|---|---|---|---|

Y2.2: Tri-colored lamp –yellow, normal state (non-running, non-alarm state)

Y2.3: Tri-colored lamp – green, running state

Y2.4: Tri-colored lamp – red, alarm state

- **Control parameter**

| K0012 | | | LAMP | | | | | |
|---|---|---|---|---|---|---|---|---|

K12.5 =1: Tri-colored lamp output function is valid

K12.5=0: Tri-colored lamp output function is invalid.

## 6.4 Standard PLC Parameter Instruction

### 6.4.1 Parameter K

**Note: K0~K7 do not need to be set.**

| Address | Parameter meaning | Initial value |
|---|---|---|
| K8.0 | X axis manual movement direction (1: reversed, 0: not reversed) | 0 |
| K8.1 | Y axis manual movement direction (1: reversed, 0: not reversed) | 0 |
| K8.2 | Z axis manual movement direction (1: reversed, 0: not reversed) | 0 |
| K8.3 | The 4th axis manual movement direction (1: reversed, 0: not reversed ) | 0 |
| K8.4 | C axis manual movement direction (1: reversed, 0: not reversed) | 0 |
| K9.0 | Shield program protection lock (1: shield, 0: does not shield) | 0 |
| K9.7 | Alarm occurs when invalid M code is commanded (1: yes, 0: no) | 0 |
| K10.0 | Feed override (1: inverted, 0: not inverted) | 0 |
| K10.1 | Turn off the spindle, cooling and lubrication output during reset (1: No, 0: Yes) | 0 |
| K10.2 | Axes overtravel input signal alarm level (1:low-level alarm, 0: high-level alarm) | 0 |
| K10.3 | Machine panel feed/spindle enable knob (1:valid, 0: invalid) | 1 |
| K10.4 | Spindle type (1: gear, 0: analog) | 0 |
| K10.7 | External emergency stop input signal (X0.5) (1: high-level alarm, 0: low-level alarm) | 0 |
| K11.0 | Tool post lock signal (1: low-level, 0: high-level) | 0 |
| K11.1 | Tool position signal (1: low-level, 0: high-level) | 0 |
| K11.2 | Tool change method when standard tool change mode is selected (1: method A, 0: method B) | 1 |
| K11.3 | Check tool position signal after tool change (1: Yes, 0: No) | 0 |
| K11.4 | Check tool post lock signal (1: Yes, 0: No) | 1 |
| K11.6 | Tool post selection (PB8 PB7: 00 standard tool post/01 Yantai Tool Post/10 Liuxin Tool post) | 0 |
| K11.7 | Tool post selection (PB8 PB7: 00 standard tool post/01 Yantai Tool Post/10 Liuxin Tool post) | 0 |
| K12.0 | 1/0: manual inverted tool change is valid/invalid | 0 |

| | | |
|---|---|---|
| K12.2 | Zero return direction locked automatically (1: Yes, 0: No) | 0 |
| K12.5 | Tri-colored lamp output function (1: enabled, 0: disabled) | 0 |
| K12.6 | External hand-held unit (1: enabled, 0: disabled) | 0 |
| K12.7 | Machine tool operation panel (1: MPU02B, 0: MPU02A) | 0 |
| K13.0 | Chuck control function (1:enabled, 0:disabled) | 1 |
| K13.1 | If the chuck function is valid, check the chuck clamping state when the spindle is started (1: Yes, 0: No) | 1 |
| K13.2 | Tailstock control function (1: valid, 0: invalid) | 0 |
| K13.4 | Spindle gear stage is stored when power-off (1: Yes, 0: No) | 1 |
| K13.5 | Spindle automatic gear change in-position signal active level (1: low-level, 0: high-level) | 0 |
| K13.6 | Check spindle automatic gear change in-position signal (1: Yes, 0: No) | 0 |
| K13.7 | Spindle automatic gear change function (1: valid, 0: invalid) | 0 |
| K14.0 | Check chuck clamping/unclamping signal (1:Yes, 0: No) | 0 |
| K14.2 | Chuck mode (1: inner chuck, 0: outer chuck) | 0 |
| K14.4 | Low-pressure alarm signal level (1: low-level alarm, 0: high-level alarm) | 0 |
| K14.5 | Low-pressure alarm function (1: valid, 0: invalid) | 0 |
| K14.6 | Protection door input signal alarm level (1: low-level alarm, 0: high-level alarm) | 0 |
| K14.7 | Protection door alarm function (1: valid, 0: invalid) | 0 |
| K15.0 | Starting up operation mode MD1 | 0 |
| K15.1 | Starting up operation mode MD2 | 0 |
| K15.2 | Starting up operation mode MD4 | 0 |
| K15.4 | Starting up operation mode (1: MD2, MD2, MD4, 0: the mode when power-off the last time) | 0 |
| K15.6 | Servo spindle 8-point orientation function (1: valid, 0: invalid) | 0 |
| K15.7 | Issue an alarm when spindle servo alarm signal is at low/high level | 0 |

## 6.4.2 Parameter DT

| DT Address | PLC Initial Value | Minimum Input Value | Maximum Input Value | Meaning |
|---|---|---|---|---|
| DT0000 | 1000 | 0 | 60000 | Spindle gear change time 1 (ms) |
| DT0001 | 1000 | 0 | 60000 | Spindle gear change time 2 (ms) |
| DT0002 | 3000 | 0 | 60000 | Low-pressure alarm detection time (ms) |
| DT0003 | 5000 | 100 | 5000 | Tool change (for one tool position) time upper limit (ms) |
| DT0004 | 15000 | 1000 | 60000 | Tool change (for maximum tool positions) time upper limit (ms) |
| DT0005 | 500 | 100 | 5000 | M code execution duration (ms) |

| | | | | |
|---|---|---|---|---|
| DT0006 | 500 | 100 | 5000 | S code execution duration (ms) |
| DT0007 | 500 | 0 | 4000 | Delay time of the tool post from forward rotation stop to reverse rotation output (ms) |
| DT0008 | 500 | 0 | 4000 | Alarm time when the TCP signal is not received (ms) |
| DT0009 | 1000 | 0 | 4000 | Tool post reverse rotation lock time (ms) |
| DT0010 | 0 | 0 | 10000 | Delay time of M05 and spindle braking output (ms) |
| DT0011 | 50 | 0 | 60000 | Spindle braking output time (ms) |
| DT0012 | 100 | 0 | 60000 | Spindle jog time (ms) |
| DT0013 | 0 | 0 | 60000 | Lubricating start time (0-60000ms) (0: no limit) |
| DT0016 | 0 | 0 | 60000 | Automatic lubricating interval time (ms) |
| DT0017 | 0 | 0 | 60000 | Automatic lubricating output time (ms) |
| DT0019 | 1000 | 100 | 60000 | Chuck function execution duration when in-position signal is not checked (ms) |
| DT0021 | 1000 | 100 | 60000 | Spindle stop, chuck operation enable delay time (ms) |
| DT0022 | 500 | 100 | 1000 | Alarm indicator flickering period (100-1000) (ms) |
| DT0023 | 500 | 100 | 1000 | Spindle override indicator flickering period (100-1000) (ms) |
| DT0024 | 400 | 100 | 2000 | Feed override knob debounce time (ms) |
| DT0025 | 400 | 100 | 2000 | Spindle override knob debounce time (ms); valid when the machine tool panel is MPU02B |
| DT0032 | 10000 | 0 | 60000 | Liuxin 8-Position Hydraulic Tool Change alarm time (ms) |
| DT0034 | 10000 | 0 | 60000 | AD31 Series Tool Post allowable continuous time upper limit (ms) |
| DT0035 | 1000 | 0 | 4000 | AK31 Series Tool Post lock proximity switch signal detection time upper limit (ms) |
| DT0036 | 10000 | 0 | 60000 | Upper limit of tool change duration for Changzhou Yaxing HLT hydraulic tool post (ms) |

### 6.4.3 Parameter DC

| DC Address | PLC Initial Value | Minimum Input Value | Maximum Input Value | Meaning |
|---|---|---|---|---|
| DC0000 | 50 | 0 | 200 | The output voltage value of inverter during spindle jog (0.01V) |
| DC0001 | 5 | 0 | 50 | The output voltage value of inverter during spindle automatic gear change (0.01V) |

### 6.4.4 Parameter D

| D Address | PLC Initial Value | Minimum Input Value | Maximum Input Value | Meaning |
|---|---|---|---|---|
| D0 | 4 | 1 | 16 | Number of tools on a tool post |
| D1 | 1 | 0 | 5 | Internal controlled axis number corresponding to X axis manual movement key (the key is invalid when it is set to 0) |
| D2 | 0 | 0 | 5 | Internal controlled axis number corresponding to Y axis manual movement key (the key is invalid when it is set to 0) |
| D3 | 2 | 0 | 5 | Internal controlled axis number corresponding to Z axis manual movement key (the key is invalid when it is set to 0) |
| D4 | 0 | 0 | 5 | Internal controlled axis number corresponding to the 4th axis manual movement key (the key is invalid when it is set to 0) |
| D5 | 0 | 0 | 5 | Internal controlled axis number corresponding to C axis manual movement key (the key is invalid when it is set to 0) |

## 6.5 Signals G, F Used in Standard PLC

### 6.5.1 Signal G

| Address | Function | Symbol |
|---|---|---|
| G4.3 | Auxiliary function end signal | FIN |
| G4.4 | The 2M function end signal | MFIN2 |
| G4.5 | The 3M function end signal | MFIN3 |
| G5.0 | Miscellaneous function end signal | MFIN |
| G5.2 | Spindle function end signal | SFIN |
| G5.3 | Tool function end signal | TFIN |
| G5.6 | Auxiliary function lock signal | AFL |
| G6.2 | Manual absolute value signal | ABSM |
| G6.4 | Override cancel signal | OVC |
| G7.2 | Cycle start signal | ST |
| G7.4 | Stroke check 3 release signal | RLSOT3 |
| G7.6 | Stored stroke limit selection signal | EXLM |
| G8.4 | Emergency stop signal | ESP |
| G8.5 | Feed dwell signal | SP |
| G8.7 | External reset signal | ERS |

| Address | Function | Symbol |
|---|---|---|
| G10,G11 | Manual feedrate override signal | JV0～JV15 |
| G12 | Feedrate override signal | FV0～FV7 |
| G14.0, G14.1 | Rapid traverse override signal | ROV1,ROV2 |
| G18.0～G18.3 | MPG 1 feed axis selection signal | HS1A～HS1D |
| G18.4～G18.7 | MPG 2 feed axis selection signal | HS2A～HS2D |
| G19.4，G19.5 | MPG/STEP override signal | MP1,MP2 |
| G19.7 | Manual rapid traverse selection signal | RT |
| G27.0～G27.2 | Spindle selection signal | SSW1～SSW3 |
| G27.3～G27.5 | Spindle stop signal | SSTP1～SSTP3 |
| G28.1，G28.2 | The 1st spindle gear selection signal | GR11，GR12 |
| G29.0，G29.1 | The 2nd spindle gear selection signal | GR21，GR22 |
| G29.2，G29.2 | 3rd spindle gear selection signal | GR31，GR32 |
| G26.0, G28.7 | Position encoder selection signal | PC3SLC, PC2SLC |
| G29.6 | Spindle stop signal | SSTP |
| G30 | Spindle override signal | SOV0～SOV7 |
| G32.0～G32.7<br>G33.0～G33.3 | Signal of the 1st spindle motor speed command input by PLC | R01I～R12I |
| G34.0～G34.7<br>G35.0～G35.3 | Signal of the 2nd spindle motor speed command input by PLC | R01I2～R12I2 |
| G36.0～G36.7<br>G37.0～G37.3 | 3rd spindle motor speed command signal from PLC | R01I3～R12I3 |
| G33.7 | The 1st spindle motor speed selection command signal | SIND |
| G35.7 | The 2nd spindle motor speed selection command signal | SIND2 |
| G37.7 | 3rd spindle motor speed selection command signal | SIND3 |
| G43.0～G43.2,G43.5,G43.7 | Mode selection signal | MD1,MD2,MD4, DNC1,ZRN |
| G44.0 | Optional block skip signal | BDT1 |
| G44.1 | Machine lock for all axes signal | MIK |
| G46.1 | Signal block signal | SBK |
| G46.7 | Dry run signal | DRN |
| G100.0～G100.4 | Feed axis and direction selection signal | +J1～+J5 |
| G102.0～G102.4 | | -J1～-J5 |
| G114.0～G114.4 | Overtravel signal | +L1～+L5 |
| G116.0～G116.4 | | -L1～-L5 |
| G136.0～G136.4 | PLC controlled axis selection signal | EAX1～EAX5 |
| G137.0, G137.1 | PLC axis rapid traverse override signal | ROV1E, ROV2E |
| G137.5 | PLC axis override cancel signal | OVCE |
| G137.6 | PLC axis manual rapid traverse selection signal | RTE |
| G137.7 | PLC axis dry run signal | DRNE |
| G138 | PLC axis feedrate override signal | FV0E～FV7E |
| G140.0 | PLC axis miscellaneous function completion signal | EFINA |

| Address | Function | Symbol |
|---|---|---|
| G140.2 | PLC axis buffering inhibited signal | EMBUFA |
| G140.3 | PLC block end signal (group 1) | ESBKA |
| G140.5 | PLC axis control pause signal (group 1) | ESTPA |
| G140.6 | PLC reset signal (group 1) | ECLRA |
| G140.7 | PLC control command read signal (group 1) | EBUFA |
| G141.0～G141.6 | PLC axis control signal (group 1) | EC0A～EC6A |
| G141.7 | PLC block stop disabled signal (group 1) | EMSBKA |
| G142, G143 | PLC axis control feedrate signal (group 1) | EIF0A～EIF15A |
| G144～G147 | PLC axis control data signal (group 1) | EID0A～EID31A |
| G150.0 | PLC axis miscellaneous function completion signal | EFINB |
| G150.2 | PLC axis buffering inhibited signal | EMBUFB |
| G150.3 | PLC block end signal (group 2) | ESBKB |
| G150.5 | PLC axis control pause signal (group 2) | ESTPB |
| G150.6 | PLC reset signal (group 2) | ECLRB |
| G150.7 | PLC control command read signal (group 2) | EBUFB<br>EC0B～EC6B |
| G151.0～G151.6 | PLC axis control signal (group 2) | |
| G151.7 | PLC block stop disabled signal (group 2) | EMSBKB |
| G152, G153 | PLC axis control feedrate signal (group 2) | EIF0B～EIF15B |
| G154～G157 | PLC axis control data signal (group 2) | EID0B～EID31B |
| G160.0 | PLC axis miscellaneous function completion signal | EFINC |
| G160.2 | PLC buffering inhibited signal | EMBUFC |
| G160.3 | PLC block end signal (group 3) | ESBKC |
| G160.5 | PLC axis control pause signal (group 3) | ESTPC |
| G160.6 | PLC reset signal (group 3) | ECLRC |
| G160.7 | PLC control command read signal (group 3) | EBUFC |
| G161.0～G161.6 | PLC axis control signal (group 3) | EC0C～EC6C |
| G161.7 | PLC block stop disabled signal (group 3) | EMSBKC |
| G162, G163 | PLC axis control feedrate signal (group 3) | EIF0C～EIF15C |
| G164～G167 | PLC axis control data signal (group 3) | EID0C～EID31C |
| G170.0 | PLC axis miscellaneous function completion signal | EFIND |
| G170.2 | PLC buffering inhibited signal | EMBUFD |
| G170.3 | PLC block end signal (group 4) | ESBKD |
| G170.5 | PLC axis control pause signal (group 4) | ESTPD |
| G170.6 | PLC reset signal (group 4) | ECLRD |
| G170.7 | PLC control command read signal (group 4) | EBUFD |
| G171.0～G171.6 | PLC axis control signal (group 4) | EC0D～EC6D |
| G171.7 | PLC block stop disabled signal (group 4) | EMSBKD |
| G172, G173 | PLC axis control feedrate signal (group 4) | EIF0D～EIF15D |
| G174～G177 | PLC axis control data signal (group 4) | EID0D～EID31D |
| G200.0 | Spindle jog function signal | SPHD |

## 6.5.2 Signal F

| Address | Function | Symbol |
|---|---|---|
| F0.4 | Feed dwell signal | SPL |
| F0.5 | Cycle start signal | STL |
| F0.6 | Servo ready signal | SA |
| F0.7 | Automatic running signal | OP |
| F1.0 | Alarm signal | AL |
| F1.1 | Reset signal | RST |

| Address | Function | Symbol |
|---|---|---|
| F1.3 | Assignment end signal | DEN |
| F1.4 | The 1st spindle enable signal | ENB |
| F1.7 | CNC ready signal | MA |
| F2.0 | Inch input signal | INCH |
| F2.1 | Rapid traverse signal | RPDO |
| F2.2 | Constant surface speed cutting signal | CSS |
| F2.3 | Thread cutting signal | THRD |
| F2.7 | Dry run detection signal | MDRN |
| F3.0 | STEP mode detection signal | MINC |
| F3.1 | MPG mode detection signal | MH |
| F3.2 | MANUAL mode detection signal | MJ |
| F3.3 | MDI mode detection signal | MDI |
| F3.4 | DNC mode detection signal | MRMT |
| F3.5 | AUTO mode detection signal | MMEM |
| F3.6 | EDIT mode detection signal | MEDT |
| F4.0 | Optional block skip detection signal | MBDT1 |
| F4.1 | Machine lock for all axes detection signal | MMLK |
| F4.2 | Manual absolute detection signal | MABSM |
| F4.3 | Single block detection signal | MSBK |
| F4.4 | Auxiliary function lock detection signal | MAFL |
| F4.5 | Machine zero return mode detection signal | MREF |
| F7.0 | Auxiliary function strobe signal | MF |
| F7.2 | Spindle speed function strobe signal | SF |
| F7.3 | Tool function strobe signal | TF |
| F8.4 | The 2M auxiliary function strobe signal | MF2 |
| F8.5 | The 3M auxiliary function strobe signal | MF3 |
| F9.4 | M decoding signal | DM30 |
| F9.5 | | DM02 |
| F9.6 | | DM01 |
| F9.7 | | DM00 |
| F10～F13 | Auxiliary function code signal | M00～M99 |
| F14～F15 | The 2M auxiliary function code signal | M200～M299 |
| F16～F17 | The 3M auxiliary function code signal | M300～M399 |
| F22～F25 | Spindle speed code signal | S00～S31 |
| F26～F29 | Tool function code signal | T00～T31 |
| F36.0～F26.7<br>F37.0～F37.3 | The 1st spindle S12-digit code signal | R01O～R12O |
| F38.2 | The 2nd spindle enable signal | ENB2 |
| F38.3 | 3rd spindle enable signal | ENB3 |
| F40～F41 | The 1st spindle actual speed signal | AR00～AR15 |
| F62.7 | Object parts counting reach signal | PRTSF |
| F94.0～ F94.4 | Machine zero return end signal | ZP1～ZP5 |
| F96.0～ F96.4 | The 2nd reference point machine zero return end signal | ZP21～ZP25 |

| Address | Function | Symbol |
|---|---|---|
| F98.0~F98.4 | The 3rd reference point machine zero return end signal | ZP31～ZP35 |
| F100.0~F100.4 | The 4th reference point machine zero return end signal | ZP41～ZP45 |
| F102.0~F102.4 | Axis movement signal | MV1～MV5 |
| F129.5 | PLC axis override 0% signal | EOV0 |
| F129.7 | PLC controlled axis selection status signal | EAXSL |
| F140.0 | PLC axis in-position signal | EINPA |
| F140.1 | PLC axis following error zero checking signal | ECKZA |
| F140.2 | PLC axis alarm signal | EIALA |
| F140.3 | PLC miscellaneous function execution signal | EDENA |
| F140.4 | PLC axis move signal | EGENA |
| F140.5 | PLC axis + direction overtravel signal | EOTPA |
| F140.6 | PLC axis - direction overtravel signal | EOTNA |
| F140.7 | Axis control command read completed signal (PLC axis control group 1) | EBSYA |
| F141.0 | PLC miscellaneous function strobe signal | EMFA |
| F141.1 | PLC buffer full signal | EABUFA |
| F141.2 | PLC miscellaneous function 2 strobe signal | EMF2A |
| F141.3 | PLC miscellaneous function 3 strobe signal | EMF3A |
| F142, F143 | PLC miscellaneous function code signal | EM11A～EM48A |
| F150.0 | PLC axis in-position signal | EINPB |
| F150.1 | PLC axis following error zero checking signal | ECKZB |
| F150.2 | PLC axis alarm signal | EIALB |
| F150.3 | PLC miscellaneous function execution signal | EDENB |
| F150.4 | PLC axis move signal | EGENB |
| F150.5 | PLC axis + direction overtravel signal | EOTPB |
| F150.6 | PLC axis – axis direction overtravel signal | EOTNB |
| F150.7 | Axis control command read completed signal (PLC axis control group 2) | EBSYB |
| F151.0 | PLC miscellaneous function strobe signal | EMFB |
| F151.1 | PLC buffer full signal | EABUFB |
| F151.2 | PLC miscellaneous function 2 strobe signal | EMF2B |
| F151.3 | PLC miscellaneous function 3 strobe signal | EMF3B |
| F152, F153 | PLC miscellaneous function code signal | EM11B～EM48B |
| F160.0 | PLC axis in-position signal | EINPC |
| F160.1 | PLC axis following error zero checking signal | ECKZC |
| F160.2 | PL axis alarm signal | EIALC |
| F160.3 | PLC miscellaneous function execution signal | EDENC |
| F160.4 | PLC axis move signal | EGENC |
| F160.5 | PLC axis + direction overtravel signal | EOTPC |
| F160.6 | PLC axis – direction overtravel signal | EOTNC |
| F160.7 | Axis control command read completed signal (PLC axis control group 3) | EBSYC |
| F161.0 | PLC miscellaneous function strobe signal | EMFC |
| F161.1 | PLC buffer full signal | EABUFC |
| F161.2 | PLC miscellaneous function 2 strobe signal | EMF2C |
| F161.3 | PLC miscellaneous function 3 strobe signal | EMF3C |
| F200.0～F200.7<br>F201.0～F201.3 | 2nd spindle S12-digit code signal | R01O2～R12O2 |
| F204.0～F204.7<br>F205.0～F205.3 | 3rd spindle S12-digit signal | R01O3～R12O3 |
| F202～F203 | 2nd spindle actual speed signal | AR002～AR152 |
| F206～F207 | 3rd spindle actual speed signal | AR003～AR153 |

# APPENDIX A ALARM LIST

## A.1 Program Alarms (P/S Alarms)

| No. | Message | Contents |
|---|---|---|
| 000 | Emergency stop alarm, ESP input open circuit | Recover ESP signal input to clear the alarm. |
| 001 | Part program open failure | Press RESET key to cancel the alarm, or turn on the power again. |
| 002 | More than 256 character in a program line | Too many characters in a program line; modify the program. |
| 003 | Data exceeds permissive range | Input data exceeds permissive range, or the specified data exceeds 8 digits. Modify the data. |
| 004 | Address not found | No address but only digits or characters are input at the head of a block. Modify the program. |
| 005 | No data follows address | No data follow address or expression format which follows the address is wrong (no brackets). Modify the program. |
| 006 | Illegal use of negative sign | Sign "-" was input after an address or two or more "-" was input. Modify the program. |
| 007 | Illegal use of decimal point | Decimal point "." was input after an address or two or more "." was input. Modify the program. |
| 008 | Input illegal address | Unusable address is input in significant area. Modify the program. |
| 009 | Incorrect G code | Unusable G code or G code with functions not provided is specified. Modify the program. |
| 010 | Address repetition error | Specified same address twice or more in a block, or specified two or more G codes in same group in a block. Refer to parameter No. 3403#6 AD2. Modify the program. |
| 011 | Command cannot run in DNC mode exists. | Command cannot run in DNC mode exists. Modify the program. |
| 012 | Too many M codes | Multiple M codes cannot be specified in a block. Refer to parameter No.3404#7 M3B to modify the program. |
| 014 | Divided by zero | Divisor was 0 (including tan90°). Modify the program. |
| 017 | Parameter modified failure. | Check that whether the parameter file is abnormal. The customer area may be ruined! |
| 018 | Part program operation failure | Reset to clear alarm. |
| 019 | End of record | Specify end symbol (%) of record, or not specify end of program. Refer to parameter No. 3404#6 EOR to modify the program. |
| 020 | DNC time out | DNC transmission failure, please check it. |
| 021 | Feedrate out of range | Feedrate was not commanded to a cutting feed or the feedrate was inadequate. The meaning of F is determined by G98/G99, please check current modal of G98/G99. Modify the program. |
| 022 | Spindle speed out of range | Improper spindle speed or spindle surface speed value. Refer to parameter No.3031 SCB to modify the program. |
| 023 | Number followed M code out | Specified undefined M code. Refer to parameter No. |

| No. | Message | Contents |
|---|---|---|
| | of range | 3030 MCB to modify the program. |
| 024 | Improper G code | The G code cannot be in the same block with other G codes. Modify the program. |
| 025 | Illegal tool number | Specify a tool number which does not exist, Refer to parameter No. 3032 TCB to modify the program. |
| 026 | Illegal offset number | Tool offset number selected by T code is too large. Modify the program. |
| 027 | Illegal offset value | Tool offset value selected by T code too large. Modify the program. |
| 028 | T code not allowed in the block | T code cannot be specified in the block where G50, G10, G04 are specified. Modify the program according to parameter No. 5006#1 TGC. |
| 029 | Tool life data running error. | Tool group number exceeds the maximum allowable value, or the tool group commanded in the machine program is not set. Modify the program or modify the tool life data. |
| 031 | Too many axes commanded | Attempt was made to move the tool along more than maximum number of simultaneously controlled axes. Modify the program. |
| 032 | Illegal axis for interpolation | An axis not included in selected plane commanded in interpolation command, or basic axis with its parallel axis is commanded simultaneously that impossible to interpolate. Modify the program. |
| 033 | Illegal plane axis commanded | An axis not included in selected plane commanded in circular interpolation. Modify the program. |
| 034 | No radius commanded | In circular interpolation, R, I, J, K has not been specified, referring to Para. 3403#5 CIR. Modify the program. |
| 035 | Illegal radius | In circular interpolation, address R value is wrong. Please refer to parameter 3403#4 RER and modify the program. |
| 036 | Exceeds the radius difference range | In circular interpolation, the difference between the distance from the start point to the center point and distance from the end point to the center point exceeds the value set by parameter. Please refer to parameter and modify the program. |
| 037 | Thread run-out length J, K value commanded incorrectly in thread cutting. | The run-out length exceeds the permitted range. K value is less than zero in G32, G34 commands; J value or K value is less than zero in G92 and G76. Modify the program. |
| 038 | Illegal lead command | Lead command value F is out of the range; or in variable lead thread cutting, the lead variation exceeds the range. Modify the program. |
| 039 | In thread cutting command, the thread run-out length of long axis is excessive. | The thread run-out length of long axis exceeds the thread cutting length. Modify the program. |
| 040 | Chamfering amount too large of latitude axis in threading. | Chamfering amount of latitude axis in G92 was greater than the distance between start point and end point. Modify the program. |
| 041 | Illegal plane selection | In plane selection command, more than one parallel axes are specified in the same direction. Modify the program. |
| 042 | Metric/inch conversion command error | The metric/inch conversion command is not specified alone in a line, or is not specified in the first line. Metric/inch conversion is performed when a subprogram is called. Modify the program. |
| 043 | Reference point return | The reference point return cannot be performed |

| No. | Message | Contents |
|---|---|---|
| | uncompleted | normally because the reference point return start point is too close to the reference point or the speed is too slow. Separate the start point far enough from the reference point, or specify a sufficient fast speed for reference point return. |
| 044 | Reference point return uncompleted | When automatic operation dwells, manual reference point return cannot be performed. |
| 045 | Axes not on reference point | During the reference point return check (G27), the specified axis does not return to the reference point. Modify the program. |
| 046 | G28 found in sequence return | A program restart command is specified without the execution of reference point return after power-on or emergency stop, and G28 is found during research. Perform the reference point return. |
| 047 | The specified axis does not return to the reference point. | The specified axis does not return to the reference point by cycle start. Please perform reference point return. |
| 048 | Wrong reference point commanded | In G30 block, a value other than 2~4 is specified by P. Modify the program. |
| 051 | G37 reach signal not acquainted | In the automatic tool compensation function (G36, G37), the measurement position reach signal (XAE or EAE) is not turned on in the area specified by parameter. This may be caused by a setting or operation error. |
| 052 | Offset number not found in G37 | G36, G37 automatic tool compensation is specified without T code. Modify the program. |
| 053 | T coded not allowed in G37 | T code and automatic tool compensation (G36, G37) are specified in the same block. Modify the program. |
| 054 | Illegal axis command in automatic tool compensation | In auto tool compensation function (G36,G37),an invalid axis is specified or the command is incremental. Modify the program. |
| 055 | G37 command invalid | The automatic tool compensation function (G36, G37) is invalid. Check parameter No. 6240#7 IGA and modify the program. |
| 056 | G31 cannot be used in feed-per-rotation mode | In feed-per-rotation mode, skip cutting command is specified. Modify the program. |
| 058 | G31 cannot be used in feed-per-rotation mode | In feed-per-rotation mode, skip cutting command is specified. Modify the program. |
| 059 | G31 cannot be used in tool nose radius compensation mode | Skip cutting command is specified in tool nose radius compensation mode. Modify the program. |
| 061 | Illegal P specified in G10 | The P value which specifies the offset value is too large, or no P value is specified. Modify the program. |
| 062 | Illegal compensation value in G10 | The specified offset value is too large. Modify the program. |
| 063 | Format error in G10 or L50 | G10 and G11 are not matched or G10 is not specified before G11. Modify the program. |
| 064 | Illegal command in Entering data from program | Axis or G code is specified in Entering data from program. Modify the program. |
| 065 | The offset value are accumulated excessively | In G50 offset accumulation, the accumulated offset exceeds the permitted range. Modify the program. |
| 068 | Stroke check range setting error | In the stroke check range set by command G22, the specified positive coordinate value or parameter value is not greater than the negative coordinate value, or the differential between them is less than 2000 least |

| No. | Message | Contents |
|---|---|---|
| | | input increment. Check parameter No. 1322 or No. 1323, and modify the program. |
| 071 | Spindle orientation unexecuted | Without any spindle orientation, an attempt was made for spindle indexing. Perform spindle orientation. |
| 072 | C/H code and movement command in the same block | Spindle indexing command C, H and other axis movement command are in the same block. Modify the program. |
| 073 | M code and movement command in the same block | Spindle indexing M code and other axis movement command are in the same block. Modify the program. |
| 074 | Illegal command G12.1/G13.1 | When the polar coordinate interpolation is started or cancelled, the condition is wrong.<br>1). G12.1/G13.1 is specified in the mode that is not specified by G40.<br>2). Error is found in plane selection. The parameter specifying is erroneous. Modify the program or the parameter. |
| 075 | An unusable G code is specified in polar coordinate interpolation | An unusable G code is specified in polar coordinate interpolation. Modify the program or the parameter. |
| 076 | Illegal G07.1 command | Specified axis not used for circular interpolation, or incorrect radius of cylinder, or Tool compensation C is used. Modify the program. |
| 077 | Improper G-code in circular interpolation | Specified improper G-code in circular interpolation. Modify the program. |
| 081 | Undefined address P | In the programs commanded by M98, G65, G66, the address P (program number) is not defined. Modify the program. |
| 082 | Subprogram nesting error | The nested subprogram exceeds 12 levels. |
| 083 | Program number not found | The program number was not found specified by P in M98,M99,G65 or G66. Modify the program. |
| 084 | Subprogram call error | A higher-level program or the subprogram itself is called by M98, G66 or G66. Modify the program. |
| 085 | Program call statement cannot be run in MDI and DNC modes. | Macro program call and subprogram call in MDI and DNC modes are not supported. Modify the program. |
| 090 | Axis specified error in constant surface speed control | In G96 modal, the specified axis by parameter is wrong. Modify the parameter. |
| 101 | Over-speed of spindle in threading | In threading, the spindle speed specified is too fast for the threading axis. Modify the program. |
| 102 | Spindle speed too low in threading | S command was not specified or is set to zero. Spindle encoder feedback is abnormal. Modify the program or check the status of encoder. |
| 103 | Signal of 1-rotation not detected | Signal of 1-rotation timed out in threading. Check the status of encoder. |
| 105 | Spindle encoder lines out of 100~5000. | This type of encoder is not support in taping. Check the set of Para No.3773, or replace the encoder. |
| 106 | Spindle rotation signal (SFR,SRV) detected error in taping. | Check the output of G signal SFR,SRV. Modify the program or PLC. |
| 107 | Spindle speed too low in taping | S command specified a value equal to zero or out of range; Encoder feedback abnormal. Modify the program or check the status of encoder. |
| 110 | Machine coordinate system initial error | Machine coordination established immediately after power on varies beyond the deviation limit comparing with the memorized one. Possible reasons were that: 1) Machine table moved when power off; 2) The |

| No. | Message | Contents |
|---|---|---|
| | | deviation limit set in Para. No.1206 (MER) is too small. Please re-establish machine reference position. |
| 121 | Canned cycle command is specified in non-ZX plane. | The canned cycle command is not specified in the basic ZX coordinate system. Modify the program. |
| 122 | Axis not included in the basic ZX coordinate system is specified in canned cycle. | Axis not included in the ZX coordinate system is specified in canned cycle. Modify the program. |
| 123 | The R value (radius value) is greater than the U value (absolute value) in G90, G92 commands. | In G90, G92 commands, when the plus or minus signs for the R and U are different, the absolute value of R value (radius value) is greater the U value (absolute value). Modify the program. |
| 124 | In G94 command, the R absolute value is greater than W absolute value | In G94 command, when the plus or minus signs for the R and W are different, the absolute value of R is greater that of the W value. Modify the program. |
| 126 | Illegal plane selection in multiple-cycle command | Cycle command is not specified in ZX plane. Modify the program. |
| 127 | Axis not included in the ZX plane is specified in G70~G76. | Axis not included in the ZX plane is specified in G70~G76 commands or the G70~G76 loop. Modify the program. |
| 128 | Incorrect G code in G70~G73 | An unusable G code is commanded between the two blocks which is specified by addresses P and Q in G70~G73. Modify the program. |
| 129 | G70~G73 commands cannot be run in MDI mode | G70~G73 commands including addresses P, Q are specified in MDI mode. |
| 130 | Macro statement execution is not allowed in G70~G73 loop | Macro statement execution is not allowed in G70~G73 loop. Modify the program. |
| 131 | Subprogram is called in G70~G73 loop | Subprogram cannot be called in G70~G73 loop. Modify the program. |
| 132 | Subprogram is called in G70~G73 command lines | Subprogram cannot be called in G70~G73 command lines. Modify the program. |
| 133 | In G70~G73 commands, the addresses P or Q is out of the range | In G70~G73 commands, the addresses P or Q is undefined or out of the range. Modify the program. |
| 134 | The sequence number not found in G70~G73 commands | The sequence number specified by address P or Q is not found in G70~G73 commands. Modify the program. |
| 135 | P and Q commands error in G70~G73 commands | In G70~G73 commands, the command values of P and Q are the same. Modify the program. |
| 136 | Two continuous blocks is not found in G71~G73 commands | Two continuous blocks is not found in G71~G73 commands, which will cause error. Modify the program. |
| 137 | In G71~G73 commands, the number of Ns-Nf blocks exceeds 100. | In G71~G73 commands, the Ns-Nf blocks are excessive. Modify the program. |
| 138 | In G71~G73 commands, the Ns-Nf blocks are non-monotonic | In multiple cycle command (G71 or G72), a non-monotonic object structure is defined; or in G73 cycle, the Z axis is non-monotonic; when the Z axis is set with retraction amount or finishing allowance, the X axis is non-monotonic. Please refer to parameter 5102#1 MRC and modify the program. |
| 139 | The orientation point commanded by G71~G73 is within the cutting range | When the orientation point commanded by G71~G73 is within the cutting range, tool collision may occur. Please refer to parameter 5104#2 FCK and modify the program. |

| No. | Message | Contents |
|---|---|---|
| 140 | Too many concaves in G71 type II | More than 10 concaves are specified in G71 type II. Modify the program. |
| 141 | In G73 cycle, the tool retraction direction of X axis is inconsistent with the finishing allowance direction. | In G73 cycle, the tool retraction direction of X axis is opposite to the finishing allowance direction. Modify the program. |
| 142 | In G73 cycle, the tool retraction direction of Z axis is inconsistent with the finishing allowance direction. | In G73 cycle, the tools retraction direction of Z axis is opposite to the finishing allowance direction. Modify the program. |
| 143 | Finishing allowance in G70~G73 exceeds the range | Finishing allowance of G70~G73 exceeds the range. Modify the program. |
| 144 | G00 or G01 is not commanded in starting block of the G71~G72 loop. | G00 or G01 needs to be commanded in starting block of the G71~G72 loop. Modify the program. |
| 145 | None of G00-G03 is commanded in starting block of the G73 loop | G00, G01, G02 or G03 is not commanded in the starting block of the G73 loop. Modify the program. |
| 146 | Only X axis increment is needed in the starting block of G71 loop | X axis is not commanded in the starting block of the G71 loop, or the X axis increment is zero, or X axis is not commanded. Modify the program. |
| 147 | Only Z axis increment is needed in the starting block of G72 loop | Z axis is not commanded in the starting block of the G71 loop, or the Z axis increment is zero, or X axis is commanded. Modify the program. |
| 148 | The single feeding amount in G71 or G72 command is less than zero | The single feeding amount in G71 or G72 command is less than zero. Modify the program. |
| 149 | The single tool retraction amount R(e) in G71 or G72 command is less than zero | The single retraction amount R(e) in G71 or G72 command is less than zero. Modify the program. |
| 150 | The total cutting amount in G73 exceeds the permitted range | The total cutting amount in G73 exceeds the permitted range. Modify the program. |
| 151 | The number of repetition R(d) in G73 command is out of the permitted range | The number of repetition R(d) in G73 command is less than 1 or greater than 000 after rounding. Modify the program. |
| 152 | The orientation point specified by G73 is out the cutting range, which may lead to overcut | The orientation point specified by G73 is out the cutting range, which may lead to overcut. Modify the program. |
| 153 | Q value in G74 is not in the range | Q value in G74 is not in the needed range. Modify the program. |
| 154 | X axis command is not input in G75 | X axis command is not input in G75. Modify the program. |
| 155 | P value in G75 is not in the range | The P value in G75 is not in the needed range. Modify the program. |
| 156 | R(e) is less than zero in G74 or G75 command | Single tool retraction amount R(e) is less than zero in G74 or G75 command. Modify the program. |
| 157 | R(△d) is less than zero in G74 or G75 command | The tool retraction amount R(△d) is less than zero in G74 or G75 command when the cutting feed reaches the end point. Modify the program. |
| 158 | In G74 or G75, single cutting amount exceeds the range | In G74 or G75, the single cutting amount along Z or Z direction exceeds the permitted range. Modify the program. |
| 160 | In G76, X or Z axis movement amount is 0 | In G76, X or Z axis movement amount is 0. Modify the program |

| No. | Message | Contents |
|---|---|---|
| 161 | The repetition number of G76 is less than 1 or greater than 99 | The repetition number of G76 is less than 1 or greater than 99. Modify the program. |
| 162 | In G76, the thread chamfering angle exceeds the permitted range | In G76, the thread chamfering angle exceeds the permitted range. Modify the program. |
| 163 | In G76, the tool nose angle exceeds the permitted range | In G76, the tool nose angle exceeds the permitted range. Modify the program. |
| 164 | In G76, Q(△dmin) exceeds the permitted range | In G76, the minimum cut-in amount Q(△dmin) exceeds the permitted range. Modify the program. |
| 165 | The G76 finishing allowance R(d) exceeds the permitted range | The G76 finishing allowance R(d) is less than a minimum increment. Modify the program. |
| 166 | During taper thread cutting commanded by G76, the R value and U value are unmatched | During taper thread cutting commanded by G76, the start point of machining is between the thread start point and thread end point. Modify the program. |
| 167 | Thread height P value is not specified in G76 command | Thread height P value is not specified in G76 command. Modify the program. |
| 168 | The G76 thread height is less than the finishing allowance or the minimum cutting amount | The G76 thread height is less than the finishing allowance or the minimum cutting amount. Modify the program. |
| 169 | The Q value in G76 command is not within the range | The first cutting depth is not defined in G76 command: the Q value is not within the range or not input. Modify the program. |
| 170 | Taper of thread is larger than 45 in G76 | Taper of thread is larger than 45 in G76. Modify the program. |
| 171 | Taper is paralleled to the tool nose in G76 | Taper is paralleled to the tool nose in G76. Modify the program. |
| 172 | Improper G76 specified | Unusual angel of tool nose or thread taper is specified. Modify the program. |
| 180 | Illegal S command in rigid tapping | The S code in rigid tapping is undefined or out of the range. Modify the program. |
| 181 | Illegal K command in rigid tapping | The specified repetition number K value is out of the range in rigid tapping. Modify the program. |
| 182 | Illegal F command in rigid tapping | The cutting feedrate value is F is out of the range in rigid tapping. Please check the modal G98 and G99 and modify the program. |
| 183 | Program error in rigid tapping | The M code and S value is not in the same block in rigid tapping. Modify the program. |
| 184 | Illegal axis operation in rigid tapping | A move axis is specified between the M code and G84 command in rigid tapping. Modify the program. |
| 185 | The spindle cannot perform rigid tapping | In rigid tapping, the spindle is not selected. Modify the parameter. |
| 186 | Plane alteration during rigid tapping | During rigid tapping, a non-G18 plane is switched or the rigid tapping is enabled in non-G18 plane. Modify the program. |
| 187 | Data error in rigid tapping | The specified distance is too short or too long in rigid tapping. Modify the program. |
| 188 | Data repetition in rigid tapping | The same M code or S code is repeated between M code and G84 in rigid tapping. Modify the program. |
| 189 | M code repetition in rigid tapping | In rigid tapping, the M code cannot be in the same block with the M code which locks C axis in drilling canned cycle. Modify the program. |
| 190 | Servo spindle command | The increment of the servo spindle occurs in |

| No. | Message | Contents |
|---|---|---|
| | occurs in rigid tapping | orientation command in rigid tapping. Modify the program. |
| 191 | Rigid tapping signal is off | Possible reason: 1. RGTAP signal is not detected or rigid tapping mode is not specified before tapping; 2. The spindle selection signal for rigid tapping is not sent properly; 3. Rigid tapping is not specified by M29 or other M codes, or parameter No. 5200 is not set to 1; 4. In spindle Cs contour control, the corresponding servo axis number is incorrect. Please refer to parameter 8133#2 or 3704#7, #6. Modify the program or check the PLC. |
| 197 | C axis command error in spindle mode | When signal CON (G27#7) is OFF, CS contour controlled axis is commanded to move. Modify the program or find the reason why the signal is not ON in ladder diagram. |
| 198 | Spindle speed arrival signal not found | During cutting feed, the spindle speed arrival signal SAR is not valid. Modify the program or check the ladder diagram. |
| 201 | Incorrect command used in macro program | An unusable function is specified in custom macro program. Modify the program. |
| 202 | Format error in macro program | There is a format error in <Formula>. Modify the program. |
| 203 | Illegal variable number is used in macro program. | A value not defined as variable number is designated in the custom macro. Modify the program. |
| 204 | Macro program call repetition | M98, G65 or G66 is called in G66 modal state in the same program. Modify the program. |
| 205 | Bracket nesting error | The number of bracket nesting level exceeds 5. Modify the program. |
| 206 | Illegal operation data | The argument of SQRT is a negative value; The arguments of BCD and BIN are negative values, or the BIN argument value cannot convert to correct BCD code. Modify the program. |
| 207 | Excessive macro program modal call | Macro call or macro program modal call nesting exceeds 4 levels. Modify the program. |
| 208 | Branch of macro program cannot used in DNC and MDI operation | Branch of macro program is used in DNC and MDI operation. Modify the program. |
| 209 | End statement absent | DO-END is not 1: 1; the END block contains other illegal command or the branch cannot be made to a location within the loop. Modify the program. |
| 210 | Limited authority | Argument assignment cannot be executed in MDI or DNC mode due to limited authority. Modify the program. |
| 211 | Illegal repetition number | Condition 1≤n≤3 is not fulfilled (n in Don). Modify the program. |
| 212 | NC statement and macro call statement coexist in the same block | NC statement and macro call statement are used. Modify the program. |
| 213 | Illegal macro sequence number | The defined sequence number in branch command is not within 1~99999, or they cannot by searched. Modify the program. |
| 214 | Illegal argument address | An unallowable address is specified in <argument>. Modify the program. |
| 215 | Tool radius direction data error | The custom macro data used for tool radius direction input should be in the range of 0~9 after rounded. Please modify the macro statement. |

| No. | Message | Contents |
|---|---|---|
| 216 | Illegal argument value | The argument value is erroneous or illegal. Modify the program. |
| 217 | Data error in logical operation command | The data in logical operation command OR, XOR, AND are negative values. Modify the program. |
| 218 | G67 modal call cancel is commanded | When G66 macro modal call is not specified, G67 modal call cancel is commanded. Check if it is necessary to write G66 command. Please refer to parameter 6000#0G67 and modify the program. |
| 231 | The axis commands of NC and PLC compete with each other | The axis commands of NC and PLC compete with each other. Modify the program or ladder diagram. |
| 232 | PLC controlled axis unchangeable | PLC axis selection has been made among the PLC controlled axes. Modify the Ladder Diagram. |
| 251 | The intersection point cannot be determined in tool nose radius compensation mode | The intersection point cannot be determined in tool nose radius compensation mode. Modify the program. |
| 252 | Tool nose radius compensation mode cannot be set or canceled in circular interpolation | Tool nose radius compensation mode is set or canceled in circular interpolation. Modify the program. |
| 253 | Compensation plane switching is not allowed in tool nose radius compensation | Compensation plane is changed in tool nose radius compensation mode. Modify the program. |
| 254 | Interference is generated in circular block in tool nose radius compensation mode | In tool nose radius compensation mode, the start point or end point of an arc is the same as the center point, or the end point is not on the arc, which may cause overcut. Modify the program. |
| 255 | In tool nose radius compensation mode, interference occurs in G90 or G94 block | Overcut may occur when tool nose radius compensation is commanded in G90 or G94 block. Modify the program. |
| 256 | Overcut occurs during interference check in tool nose radius compensation mode | The overcut may occur in tool nose radius compensation mode. Modify the program. |
| 257 | The cutter path direction is different with the programmed path direction in tool nose radius compensation mode. | The tool path direction is different with the programmed path direction in tool nose radius compensation mode (90°~270° difference). Overcut may occur. Modify the program. |
| 258 | G41 or G42 execution is not allowed in MDI mode | G41 or G42 (tool nose radius compensation) is specified in MDI mode. Please refer to parameter 5008#4 MCR and modify the program. |
| 259 | Overcut is produced within the cutting full circle | Overcut is produced within the cutting full circle in tool nose radius compensation mode. Please refer to parameter 5008#5 CNF and modify the program. |
| 260 | Overcut may be produced when a step less than the tool radius is machined | In tool nose radius compensation mode, overcut may be produced when a step less than the tool radius is machined. Please refer to parameter 5008#6 CNS and modify the program. |
| 261 | The circular radius is less than the tool radius when a inner circle is machined | In tool nose radius compensation mode, overcut may occur if the circular radius is less than the tool radius when an inner circle is machined. Modify the program. |
| 262 | Circular command occurs when tool nose radius | In tool nose radius compensation mode, when G command for which the compensation mode needs to |

| No. | Message | Contents |
|---|---|---|
| | compensation is temporarily cancelled or set | be temporarily cancelled is specified, circular command is specified to set or cancel the compensation mode. Modify the program. |
| 263 | Error is found in tool nose radius compensation mode | Programming error or operation error is found in tool nose radius compensation mode. Modify the program. |
| 271 | Chamfering or corner R cannot be specified in the current block | Chamfering or corner R is needed to be specified in G01, G02, G03 modal commands. |
| 272 | Chamfering or corner R is not followed by G01G02/G03 modal commands | Commands other than G01G02/G03 are specified after chamfering or corner R blocks. Modify the program. |
| 273 | Unneeded axis address follows chamfering or corner R | The movement axis in the block which is behind the block that specifies chamfering or corner R is not the axis specified by panel. Modify the program. |
| 274 | Panel selection command is specified after chamfering or corner R | Panel selection command is specified after chamfering or corner R. Modify the program. |
| 275 | The movement amount in chamfering block or corner R block is too small | The movement amount in chamfering block or corner R block is smaller than chamfering amount or corner R. Modify the program. |
| 276 | Data error in chamfering or corner R | Data is erroneous in chamfering or corner R. Modify the program. |
| 281 | Illegal tool group number | The tool group number is larger than permitted. Modify the program. |
| 282 | Tool group number not found | The specified tool is not set. Modify the program or parameter. |
| 283 | Low capacity for tool storage | The tool number in one group exceeds the maximum amount. Modify the program. |
| 284 | T code not found | In tool lift management storage, specified T code is not stored. Modify the program. |
| 285 | P/L command not found | P and L commands are not at the head of the program which sets the tool group. Modify the program. |
| 286 | Too many tool groups | The set tool group number exceeds the maximum amount. Modify the program. |
| 287 | Illegal tool life data | The tool life value is too large. Modify the setting value. |
| 288 | Tool data setting uncompleted | When the tool life data is setting, the power is turned off. Set the data again. |
| 289 | Tool life management command not matched | T[][]99 is not specified or T[][]99 is incorrect before T[][]88 is used. Modify the program. |

## A.2 Parameter Alarms

| No. | Message | Contents |
|---|---|---|
| 400 | Parameter writing is enabled | Press 【RESET】key to cancel the alarm. |
| 401 | The same servo communication property is set. | Please modify parameter No.9020. |
| 402 | Parameter backup failure | Please check the memory or re-power on. |
| 403 | Parameter recovery failure | Please check if the parameter is being writing, or re-power on and try it again. |

| No. | Message | Contents |
|---|---|---|
| 404 | The same axis name is set. | Modify the parameter NO.1020. |
| 406 | The slave numbers of non-Cs axis and spindle are set the same | Modify parameter No. 3704, No.8133,No.9020,No.9030. |
| 407 | The slave numbers Cs axis and spindle are inconsistent | Modify parameter No.3704,No.8133,No.9020,No.9030 |
| 408 | The slave numbers of spindle is set the same | Modify parameter No. 9030 |
| 450 | Parameter modification is done, please re-power on. | The input parameter is valid only after re-power-on. |
| 452 | The CNC controlled axis number is greater than the total axis number. | Please check parameter No. 1010 and 8130. |
| 453 | The same axis property is set. | Modify parameter No. 1022. |
| 454 | The same servo axis number is set. | Modify parameter No. 1023. |
| 455 | The rotary axis is conflicting with the axis property. | Parameter No.1006 conflicts with parameter No. 1022. The axis property of rotary axis cannot be non-0 value. Modify parameters No. 1006 or No. 1022. |

## A.3 Pulse Encoder Alarms

| No. | Message | Contents |
|---|---|---|
| 500 | n-th axis origin return (n represents axis number) | Manual reference position return is required for the n-th axis. |
| 501 | The n-th axis communication error | n-th axis absolute pulse encoder (APC)communication error; Failure in data transmission. Possible causes include a faulty APC, cable, or servo interface module. |
| 502 | The n-th axis overtime | n-th axis APC overtime error; Failure in data transmission. Possible causes include a faulty APC, cable or servo interface module. |

## A.4 Servo Alarms

| No. | Message | Contents |
|---|---|---|
| 604 | n-th axis servo alarm | Faulty digital servo system of n-th axis |
| 650 | Power failure alarm | The power is turned off when the movement command is executed by the servo. It may lead to incorrect coordinate position. Please perform reference point return again. |

## A.5 Overtravel Alarms

| No. | Message | Contents |
|---|---|---|
| 700 | n axis + side stroke limit 1 | The positive stored stroke limit 1 has been exceeded. Modify the parameter No. 1320 or 1326. |
| 701 | n axis - side stroke limit 1 | The negative stored stroke limit 1 has been exceeded. Modify the parameter No. 1321 or 1327. |
| 702 | n axis + side stroke limit 2 | The positive stored stroke limit 2 has been exceeded. Modify the parameter No. 1322. |
| 703 | n axis - side stroke limit 2 | The negative stored stroke limit 2 has been exceeded. Modify the parameter No. 1323. |
| 704 | n axis + side stroke limit 3 | The positive stored stroke limit 3 has been exceeded. Modify the parameter No. 1324. |
| 705 | n axis - side stroke limit 3 | The negative stored stroke limit 3 has been exceeded. Modify the parameter No. 1325. |
| 706 | Overtravel: +n | The positive hardware stroke limit has been exceeded. Please press overtravel release or modify parameter No. 3004. |
| 707 | Overtravel : -n | The negative hardware stroke limit has been exceeded. Please press overtravel release or modify parameter No. 3004. |
| 708 | Excessive shift | Pulses exceed the limit that FPGA can manage. Please specify a lower speed or modify the CMR. |

## A.6 Spindle Alarms

| No. | Message | Contents |
|---|---|---|
| 800 | Spindle 1 alarm | Spindle 1 alarm occurs. |
| 810 | Spindle 2 alarm | Spindle 2 alarm occurs. |
| 850 | GSKLinkB spindle speed command communication error. | |
| 851 | GSKLinkB feed axis command communication error. | |
| 852 | GSKLinkB feed axis command execution error. | |

## A.7 System Alarms

| No. | Message | Contents |
|---|---|---|
| 900 | Memory alarm | Memory distribution error |
| 908 | NVRAM data error | NVRA data is not exit or ruined. Data that backed up has been recovered automatically. |
| 909 | The running time is up. The system cannot work normally | Please contact the sales personnel. |
| 910 | Initialized parameter error | Parameter file is not existed or the data is corrupted. The default configuration is used. |
| 911 | Initialized CNC configuration error | CNC configuration file is not existed or the data is corrupted. The default configuration is used. |
| 912 | Initialized tool compensation data error | The tool compensation file is not existed or the data is corrupted. The default data is used. |

| | | |
|---|---|---|
| 913 | Initialized tool life data error | Tool life file is not existed or the data is corrupted. The default data is used. |
| 914 | Initialized pitch error compensation data error | The pitch error compensation data file is not existed or the data is corrupted. The default data is used. |
| 915 | Initialized PLC program error | File read failure or compilation error during loading |
| 916 | CNC initialization failure | Turn ON the power again |
| 917 | GSK-CAN initialization failure | (1). Check whether the baudrates of CNC and slave is consistent (parameter No. 9010 and 9011).<br>(2). Check whether the slave number is consistent (parameter No. 9020 and 9030).<br>(3). Check whether the communication interface is loose, power well grounded or end resistor installed.<br>Press【RESET】key to cancel the alarm or re-power on. |
| 918 | Editing keyboard or panel fault | Press【RESET】key to cancel the alarm, or re-power on. |
| 919 | Memory fault | Remove the alarm by pressing RESET key. Please re-power on or resort to depot repair. |
| 920 | Too many alarms or prompts | The total number of alarms exceeds 14 or prompts exceed 20. |
| 921 | Unrecognized alarm number | There is no alarm content corresponds to the alarm number. |
| 922 | Data error in alarm information | In alarm information or operation information, some data are erroneous. |
| 923 | PLC alarm information table error | The alarm num specified is not found in PLC alarm information table or out of the range 1000~2999. Modify the PLC alarm information table. |
| 950 | The pulse number inconsistent | The FPGA pulse number send from the system is inconsistent with the actual feedback pulse number. |
| 998 | Abnormal data | Please contact system developer. |

## A.8 Operation Panel Communication Prompts

| No. | Message | Contents |
|---|---|---|
| 4200 | Panel communication error | Check the connection between panel and the system. |
| 4201 | Edit keyboard communication error | Edit keyboard and system communication error; |

## A.9 GSK-CAN Communication Prompts

| No. | Message | Contents |
|---|---|---|
| 5000 | GSK-CAN slave configuration method error | GSK-CAN extended function unusable. |
| 5001 | I/O unit missing in GSK-CAN communication | The IO unit control function is unusable. |
| 5002 | Extended slave is missing in GSK-CAN communication | The extended axis function is unusable. |
| 5003 | GSK-CANA | Please check whether the communication interface is |

| No. | Message | Contents |
|---|---|---|
| | communication error | loose, the power supply grounded properly, or the end resistance installed, then, turn on the power. |
| 5004 | GSK-CAN slave ID number conflicted | Modify the parameter for slave number and re-power on (cut off the GSK-CAN connection before parameter modification at the server side) |
| 5005 | All GSK-CAN slaves connections failure | Check the setting of parameter No.9000-No.9030 and check whether the communication interface is loose, the power supply grounded properly or the end resistance installed, then turn ON the power again. |
| 5006 | n-th axis GSK-CAN slave connection failure | Check whether the communication interface is loose or the power supply grounded properly. |
| 5020 | n-th servo parameter read failure | Please check whether the communication interface is loose or the power supply grounded |
| 5021 | IO unit is missing in GSK-CANB communication | GSK-CANIO unit control function cannot be used. |
| 5022 | Slave is missing in GSK-CANB communication | GSK-CAN extension axis cannot be used. |
| 5023 | GSK-CANB communication error | Check whether the communication interface is loose, the power grounded or terminating resistor installed. Then, re-connect the interface or re-power on. |
| 5024 | GSK-CANB slave ID repetition | Re-power on after modifying the slave number on drive unit (disconnect with GSK-CAN before modification) |
| 5025 | n-th axis GSK-CANB slave connection failure | Check the setting of parameters No. 9000-9030; then check whether the communication interface is loose, power is grounded or the terminating resistor is installed; then try to re-power on or re-connect the interface. |
| 5026 | n-th axis GSK-CANB slave connection failure | Check whether the communication interface is loose, power is grounded or the terminating resistor is installed; then try to re-power on or re-connect the interface. |
| 5027 | Physical disconnection between CNC and servo slave | Check whether the servo is in normal state; then check whether the communication interface is loose, power is grounded or the terminating resistor is installed; then try to re-power on or re-connect the interface. |
| 5028 | n-th axis servo dsp hardware reset | Check whether the servo is in normal state. Re-power on or re-connect after troubleshooting. |
| 5029 | Communication overtime | Servo does not receive data from master in n millisecond (n=200) |
| 5030 | n-th axis servo slave communication failure | Check whether the servo is in normal state. |
| 5050 | n-th axis servo type and software version read failure | Try to re-connect or re-power on. |
| 5051 | n-th axis servo configuration failure | Update corresponding servo configuration files and re-connect or re-power on. |
| 5052 | n-th axis servo configuration file has updated | The corresponding configuration file is being used. Reconnect or re-power on to validate it. |
| 5060 | n-th axis servo parameter read failure | Try to re-connect or re-power on. |
| 5061 | Nth axis servo parameter | Validate the servo parameters in the imported |

| No. | Message | Contents |
|---|---|---|
| | has imported | parameter files. Before that, the current running parameters cannot be saved. |
| 5070 | n-th axis CNC servo parameter is inconsistent with the read parameter | Select a valid servo parameter. |
| 5071 | n-th production servo parameter inconsistent | The detected production parameter in CNC servo parameter file is inconsistent with the read servo parameter (such as encoder zero-shift, driver version etc.). |
| 5080 | Parameter is changing in double speed motor | Data is in processing, please wait. |

## A.10 Servo Internal Alarms

**Note:** (1). n represents the sequence number of GSK-CAN servo slaves set by system parameters (ranges from 1~9).

(2). The examples shown in the following table are feed servo V1.03 and spindle V2.02. Previous versions are compatible.

(3). The following content is valid till this user manual is issued and it is changed without further notice. Please refer to the latest servo manual.

| Feed Servo | DAT2030C, DAT2050C, DAT2075C, DAT2100C (V1.03) | |
|---|---|---|
| **No.** | **Message** | **Contents** |
| 5n00 | Normal | |
| 5n01 | Overspeed | The speed of servo motor exceeds the setting value. |
| 5n02 | Overvoltage | The main voltage is too high. |
| 5n03 | Undervoltage | The main voltage is too low. |
| 5n04 | Excess position deviation | The position deviation value exceeds the setting value. |
| 5n05 | Overheat | The temperature of the motor is too high. |
| 5n06 | Speed amplifier saturated | The speed regulator is saturated for a long time. |
| 5n07 | Drive unit inhabitation abnormal | The drive unit input inhabitation is OFF. |
| 5n08 | Position deviation counter overflow | The absolute value of position deviation counter value exceeds $2^{30.}$ |
| 5n09 | Coder fault | Coder signal error |
| 5n10 | Undervoltage of control power | The voltage of the control power is less than ±12V. |
| 5n11 | IPM module fault | IPM intelligent module fault |
| 5n12 | Overcurrent | The current of the motor is excessive. |
| 5n13 | Unused | |
| 5n14 | Braking fault | Braking circuit fault |
| 5n15 | Unused | |
| 5n16 | Motor overheat | The heat value of the motor exceeds the setting |

| | | |
|---|---|---|
| | | value. (I^2t detection) |
| 5n17 | Unused | |
| 5n18 | Unused | |
| 5n19 | Unused | |
| 5n20 | EEPROM error | (EEPROM) error |
| 5n21 | Phase lose alarm | Phase lose during the three-phase AC current input |
| 5n22 | Coder zeroing alarm | The encoder cannot perform normal regulation. |
| 5n23 | Current sampling circuit fault | A/D chip or current sensor error |
| 5n24 | Unused | |
| 5n25 | Unused | |
| 5n27 | Unused | |
| 5n28 | Software upgrade prompt alarm | The alarm is issued when the system software is upgrading. |
| 5n29 | Parameter error | The parameter is out of the controllable range. |
| 5n30 | Unused | |
| 5n31 | Unused | |
| 5n32 | Illegal code in UVW signal | Full high-level or full low-level exists in UVW signal. |
| 5n33 | Power charging fault | Charging circuit is damaged. |
| 5n34 | Pulse electronic gear ratio excessive | The parameter of pulse electronic gear ratio is incorrect. |
| 5n35 | No externally connected brake pipe | There is no externally connected brake pipe or the pipe is faulty. |
| 5n36 | Three-phase power OFF | Three-phase power OFF or three-phase power detection circuit is faulty. |
| 5n37 | The temperature of the radiator is too low | |
| 5n38 | The temperature of the radiator is too high | |
| 5n39 | Absolute encoder single-ring read alarm | |
| 5n40 | Absolute encoder multi-ring read alarm | |
| 5n41 | Encoder type configuration error | The encoder type set by drive unit is inconsistent with the encoder type of the motor. |
| 5n42 | EEPROM alarm in absolute encoder | |
| 5n43 | EEPROM check error in absolute encoder | |
| 5n44 | Coder type error | Please check parameter No.PA97. |
| 5n45 | Data check error in absolute encoder | Data check error in sensor mode. |

| Spindle Servo | DAY3025C, DAY3100C, DAP03C | |
|---|---|---|
| **No.** | **Message** | **Contents** |
| 5n00 | Normal | |
| 5n01 | Motor overspeed | The speed of the spindle motor exceeds the setting value. |
| 5n02 | Main circuit overvoltage | The voltage of the main circuit power is excessive. |
| 5n03 | Main circuit undervoltage | The voltage of the main circuit power is too low. |
| 5n04 | Excess position deviation | The position deviation value exceeds the setting value. |
| 5n05 | Motor overheat | The temperature of the motor is too high. |
| 5n06 | Unused | |
| 5n07 | Unused | |
| 5n08 | Position deviation counter overflow | The absolute value of position deviation counter value exceeds 2^30. |
| 5n09 | Motor encoder fault | The signal of motor encoder is faulty. |
| 5n10 | Unused | |
| 5n11 | IPM module fault | IPM intelligent module fault |
| 5n12 | Unused | |
| 5n13 | Overload | The current of the motor is excessive. |
| 5n14 | Unused | |
| 5n15 | Unused | |
| 5n16 | Motor overheat | The spindle servo drive unit and motor are overloaded (temporary overheat). |
| 5n17 | Excess braking time | This alarm is issued when the discharging time is too long. |
| 5n18 | Braking circuit fault 1 | No braking signal, no braking feedback |
| 5n19 | Braking circuit fault 2 | No braking signal, no braking feedback |
| 5n20 | EEPROM error | EEPROM error |
| 5n21 | Phase lose alarm | At least one of the R,S,T of three-phase power is off. |
| 5n22 | Unused | |
| 5n23 | Excessive current error | The zero drift is excessive. |
| 5n24 | Spindle encoding disk fault | The spindle encoder signal error |
| 5n25 | Orientation failure | The position cannot be found. |
| 5n26 | Cooling fans overheated | The cooling fans are overheated. |
| 5n27 | U, V, W connection error | The three-phase (U, V, W) sequence is wrong |
| 5n28 | The parameters are not re-adjusted or stored after upgrading | |
| 5n29 | The parameter value detected after power-on is out of the range | |
| 5n30 | Communication error | The connection between servo and CNC is failed. |

| | | |
|---|---|---|
| 5n31 | Unused | |
| 5n32 | Unused | |
| 5n33 | Charging alarm fault | The input voltage is less than 304V (DC bus voltage 430V). |
| 5n34 | Abnormal thermistor status | TEP-OH (TEM higher than 90°) or TEP-OL(TEP lower than -30°), the thermistor is short-circuited or cut off. |

# APPENDIX B MOTOR TYPE CODE LIST

## B.1 DAT2000C Series Motor Model Code List

| DAT2050C(5.03) | | | |
|---|---|---|---|
| **Model Code Value** | **Model** | **Model Code Value** | **Model** |
| PA001=0 | 130SJT-M075D(A4) | PA001=3 | 130SJT-M100D(A4S) |
| PA001=1 | 130SJT-M075D(A4S) | PA001=4 | 130SJT-M150D(A4) |
| PA001=2 | 130SJT-M100D(A4) | PA001=5 | 130SJT-M150D(A4S) |

| DAT2075C(5.03) | | | |
|---|---|---|---|
| **Model Code Value** | **Model** | **Model Code Value** | **Model** |
| PA001=0 | 130SJT-M075D(A4) | PA001=3 | 130SJT-M100D(A4S) |
| PA001=1 | 130SJT-M075D(A4S) | PA001=4 | 175SJT-M300D(A4) |
| PA001=2 | 130SJT-M100D(A4) | PA001=5 | 175SJT-M300D(A4S) |

| DAT2000C(V1.03) | | | |
|---|---|---|---|
| **Model Code Value** | **Model** | **Model Code Value** | **Model** |
| PA001=0 | Reserved | PA001=43 | 130SJT-M050D(A4SI) |
| PA001=1 | Reserved | PA001=44 | 130SJT-M060D(A4I) |
| PA001=2 | Reserved | PA001=45 | 130SJT-M060D(A4SI) |
| PA001=3 | Reserved | PA001=46 | 130SJT-M075D(A4I) |
| PA001=4 | 80SJT-M024C(A4I) | PA001=47 | 130SJT-M075D(A4SI) |
| PA001=5 | 80SJT-M024C(A4SI) | PA001=48 | 130SJT-M100B(A4I) |
| PA001=6 | 80SJT-M024E(A4I) | PA001=49 | 130SJT-M100B(A4SI) |
| PA001=7 | 80SJT-M024E(A4SI) | PA001=50 | 130SJT-M100D(A4I) |
| PA001=8 | 80SJT-M032C(A4I) | PA001=51 | 130SJT-M100D(A4SI) |
| PA001=9 | 80SJT-M032C(A4SI) | PA001=52 | 130SJT-M150B(A4I) |
| PA001=10 | 80SJT-M032E(A4I) | PA001=53 | 130SJT-M150B(A4SI) |
| PA001=11 | 80SJT-M032E(A4SI) | PA001=54 | 130SJT-M150D(A4I) |
| PA001=12 | Reserved | PA001=55 | 130SJT-M150D(A4SI) |
| PA001=13 | Reserved | PA001=56 | Reserved |
| PA001=14 | Reserved | PA001=57 | Reserved |
| PA001=15 | Reserved | PA001=58 | Reserved |
| PA001=16 | Reserved | PA001=59 | Reserved |
| PA001=17 | Reserved | PA001=60 | Reserved |
| PA001=18 | Reserved | PA001=61 | Reserved |
| PA001=19 | Reserved | PA001=62 | Reserved |
| PA001=20 | 110SJT-M020E(A4I) | PA001=63 | Reserved |
| PA001=21 | 110SJT-M020E(A4SI) | PA001=64 | Reserved |
| PA001=22 | 110SJT-M040D(A4I) | PA001=65 | Reserved |
| PA001=23 | 110SJT-M040D(A4SI) | PA001=66 | Reserved |
| PA001=24 | 110SJT-M040E(A4I) | PA001=67 | Reserved |

| | | | |
|---|---|---|---|
| PA001=25 | 110SJT-M040E(A4SI) | PA001=68 | 175SJT-M150D(A4I) |
| PA001=26 | 110SJT-M060D(A4I) | PA001=69 | 175SJT-M150D(A4SI) |
| PA001=27 | 110SJT-M060D(A4SI) | PA001=70 | 175SJT-M180B(A4I) |
| PA001=28 | 110SJT-M060E(A4I) | PA001=71 | 175SJT-M180B(A4SI) |
| PA001=29 | 110SJT-M060E(A4SI) | PA001=72 | 175SJT-M180D(A4I) |
| PA001=30 | Reserved | PA001=73 | 175SJT-M180D(A4SI) |
| PA001=31 | Reserved | PA001=74 | 175SJT-M220B(A4I) |
| PA001=32 | Reserved | PA001=75 | 175SJT-M220B(A4SI) |
| PA001=33 | Reserved | PA001=76 | 175SJT-M220D(A4I) |
| PA001=34 | Reserved | PA001=77 | 175SJT-M220D(A4SI) |
| PA001=35 | Reserved | PA001=78 | 175SJT-M300B(A4I) |
| PA001=36 | Reserved | PA001=79 | 175SJT-M300B(A4SI) |
| PA001=37 | Reserved | PA001=80 | 175SJT-M300D(A4I) |
| PA001=38 | Reserved | PA001=81 | 175SJT-M300D(A4SI) |
| PA001=39 | Reserved | PA001=82 | 175SJT-M380B(A4I) |
| PA001=40 | 130SJT-M040D(A4I) | PA001=83 | 175SJT-M380B(A4SI) |
| PA001=41 | 130SJT-M040D(A4SI) | PA001=84 | Reserved |
| PA001=42 | 130SJT-M050D(A4I) | PA001=85 | Reserved |

## B.2 DAP03C, DAY3025C Model Code List

| DAP03C,DAY3025C | | | |
|---|---|---|---|
| **Model Code Value** | **Model** | **Model Code Value** | **Model** |
| PA001=0 | GM7101-4SB61，3.7kW | PA001=16 | ZJY265-7.5A-B3(21.0A) |
| PA001=1 | GM7103-4SB61，5.5kW | PA001=17 | ZJY182-1.5B-B35(7.3A) |
| PA001=2 | GM7105-4SB61，7.5kW | PA001=18 | ZJY182-2.2B-B35(7.5A) |
| PA001=3 | GM7131-4SB61，11kW | PA001=19 | ZJY182-3.7B-B35(15.5A) |
| PA001=4 | GM7103-4SC61，7.5kW | PA001=20 | ZJY208-2.2B-B5(B3)(6.3A), |
| PA001=5 | GM7100-4SB61，2.2kW | PA001=21 | ZJY208-2.2B-B5(B3)(9.3A) |
| PA001=6 | GM7109-4SB61，11kW | PA001=22 | ZJY208-3.7B-B5(B3)(9.1A) |
| PA001=9 | YPNC-50-2.2-B，2.2kW | PA001=23 | ZJY208-5.5B-B5(B3)(13.2A) |
| PA001=10 | YPNC-50-3.7-B，3.7kW | PA001=24 | ZJY208-7.5B-B5(B3)(17.3A) |
| PA001=11 | YPNC-50-5.5-B，5.5kW | PA001=25 | ZJY265-7.5B-B5(B3)(18A) |
| PA001=12 | YPNC-50-7.5-B，7.5kW | PA001=26 | ZJY265-11B-B5(B3)(26A) |
| PA001=13 | YPNC-50-11-B，11kW | PA001=27 | ZJY265-15B-B5(B3) |
| PA001=14 | YPNC-50-15-B，15kW | PA001=28 | ZJY265-15A-B5(B3)(48.3A) |

# APPENDIX C COMMON ALARM REMEDY

## C.1 CNC Common Alarm Remedy

| No. | Meaning | Possible Reason | Remedy |
|---|---|---|---|
| 000 | Emergency stop, ESP open circuit | 1. Whether the emergency button is pressed.<br>2. Incorrect connection<br>3. Parameter No. 3007#7 (ESP) is set different from the actual connection.<br>4. Parameter K10.7 is set different from the actual connection. | Modify the parameter or check the connection status. |
| 001 | Part program open failure | Program is not downloaded before the running in AUTO mode. | Download the program to be executed. |
| 400 | Parameter writing enabled | Parameter writing is enabled. | Press RESET key to cancel the alarm |
| 450 | Parameter modification finished, turn ON the power again | Parameter is modified and is only valid after power-on again. | Turn ON the power again. |
| 500 | The nth axis reference point return | The feed axis whose motor adopts absolute encoder did not perform manual reference point operation after power-on. | Execute reference point return for corresponding axis. |
| 604 | The nth axis servo alarm | Digital servo system fault | Check and cancel servo alarm. |
| 917 | GSK-CAN initialization failure | 1. The servo slave number set by system parameter is inconsistent with the one set in servo system.<br>2. GSK-CAN Communication line is connected improperly. | Modify the parameter and check the communication line status. |

## C.2 GSK-CAN Communication Prompts

| No. | Message | Possible Reason |
|---|---|---|
| 5003 | GSK-CANA communication error | During GSK-CAN communication, if error continuously occurs in all slaves, this prompt is displayed. Try re-connect, or power on again; |
| 5004 | GSK-CANA slave ID number conflicted | This prompt is displayed when two slave numbers of servos are set the same. Modify the servo slave number; |
| 5005 | All GSK-CANA slaves connections failure | When GSK-CAN is restarted or re-connected, all the slaves are cut OFF. The possible reasons are:<br>(1). Parameter Nos. 9000-9003 setting error; |

| No. | Message | Possible Reason |
|---|---|---|
| | | (2). Poor contact of system GSK-CAN communication interface;<br>(3). Poor contact of servo slave GSK-CAN communication interface;<br>(4). End resistor is not installed on the servo slave which is the farthest from the system;<br>(5). GSK-CAN communication is interrupted;<br>(6). Power supply is not grounded; |
| 5006 | n-th axis GSK-CANA slave connection failure | The same as the prompt No. 5005, but this prompt indicates that only some slaves' connection is failed. |
| 5023 | GSK-CANB communication error | During GSK-CAN communication, if error continuously occurs in all slaves, this prompt is displayed. Try re-connect, or power on again; |
| 5024 | GSK-CANB slave ID number conflicted | This prompt is displayed when two slave numbers of servos are set the same. Modify the servo slave number; |
| 5025 | All GSK-CANB slaves connections failure | When GSK-CAN is restarted or re-connected, all the slaves are cut OFF. The possible reasons are:<br>(1). Parameter No. 9000-9003 setting error;<br>(2). Poor contact of system GSK-CAN communication interface;<br>(3). Poor contact of servo slave GSK-CAN communication interface;<br>(4). End resistor is not installed on the servo slave which is the farthest from the system;<br>(5). GSK-CAN communication is interrupted;<br>(6). Power supply is not grounded; |
| 5026 | n-th axis GSK-CANB slave connection failure | The same as the prompt No. 5025, but this prompt indicates that only some slaves' connection is failed. |
| 5027 | Physical connection between CNC and servo slave failure | Check whether the servo is in normal state, the communication cable connected, the power supply grounding, or the terminal resistance installed. Then try re-connect, or power on again. |
| 5028 | n-th axis servo DSP reset | Check whether the servo is in normal state and correct the fault. Then try re-connect, or power on again. |

## C.3 DAT Feed Servo Alarm Remedy

| No. | Meaning | Main Reason | Remedy |
|---|---|---|---|
| **Err-1** | AC current motor speed exceeds the value set by PA23 (refer to the speed upper limit set by parameter PA23) | 1, Encoder feedback signal abnormal | Check the motor encoder and its signal connection status. |
| | | 2. The specified command exceeds the limit set by PA23. | Check the electronic gear ratio and PA23 setting. |
| **Err-2** | Main circuit DC bus voltage excessive | 1. Braking resistor is disconnected or damaged. | Check braking resistor and its connection. |

| No. | Meaning | Main Reason | Remedy |
|---|---|---|---|
| | | 2. Braking resistor is unmatched (resistance value is excessive)<br>Note: Smaller resistance means greater current, which will easily cause damage to the braking pipe of the braking circuit. | A, Change to a new braking resistor whose resistance is matched with the power.<br>B, Reduce the ON/OFF frequency according to actual usage. |
| | | 3. Power supply voltage instable; | Check the power supply. |
| | | 4.Internal braking circuit damaged. | Change the drive unit. |
| **Err-3** | Main circuit DC bus voltage too low | 1. If it occurs when the motor is running, the line of input power is cut off or the connection is improper. | Check the input power line |
| | | 2. If it occurs when the motor is running, it means the input power voltage is lower than AC180V. | Check the power voltage |
| | | 3. If it occurs when the power is turned ON, it means the braking transistor of drive unit is damaged. | Change the drive unit |
| **Err-4** | The value in position difference counter exceeds the setting value (refer to the range set by parameter PA17);<br>(When PA18=0, detects the position difference alarm, when PA18=1, does not detects the position difference alarm) | 1. The pulse command frequency is too high or the electronic gear ratio is too large. | Check the command frequency of principal computer; check the electronic gear ratio set by PA12/PA13. |
| | | 2. The load inertial is excessive or the drive unit torque is insufficient. | A, Check the setting of motor torque limit.<br>B, Improve the drive unit and motor power.<br>C, Lighten the load. |
| | | 3. Motor encoder fault or encoder zeroing error. | A, Check the motor encoder and its connection.<br>B, re-zeroing the encoder. |
| | | 4. In position mode, the motor U, V, W phase sequence is wrong. | Correct the connection. |
| | | 5. position loop or speed loop gain setting is too small (refer to parameter PA5, PA6, PA9) | Adjust the speed loop or position loop gain. |
| | | 6. The valid range of position difference is set too small. | Set the PA17 correctly. |
| **Err-5** | Motor overheat alarm; the drive unit | 1. No temperature detection device in the motor. | Set PA57=0, shield the motor overheat alarm. |

| No. | Meaning | Main Reason | Remedy |
|---|---|---|---|
| | detects the overheat alarm signal output by the motor. (when PA57=0, the motor overheat alarm is not detected) | 2. The temperature detection device type is different with the one set by parameter PA57. | Set the temperature detection device type correctly by PA57. |
| | | 3. Overload leads to severe heat of the motor. | Increase the power of drive unit or reduce the load. |
| | | 4. In case of severe load, the start/stop frequency is too high. | Reduce the start/stop frequency, and improve the heat radiation condition. |
| | | 5. The temperature detection device in the motor is damaged, or the motor inner fault occurs. | Change the AC servo motor. |
| | | 6. If the motor temperature detection signal is normal, the drive unit is faulty. | Change the drive unit. |
| **Err-6** | Speed amplifier saturation fault | 1. Insufficient motor rigidness due to small torque limitation. | Increase the toque limitation value so as to increase the rigidness. |
| | | 2. In speed mode, U, V, W phase sequence is reversed. | Connect the U, V, W correctly. |
| **Err-7** | Drive prohibition abnormal | The drive prohibition input end terminals FSTP, RSTP are cut OFF. | A. Check the connection and the 24V power of input point. |
| **Err-9** | Motor encoder signal feedback abnormal | 1. PA48 parameter setting is erroneous. | According to the matched encoder type, set the PA48 correctly and adjust to the default setting. |
| | | 2. The motor encoder signal is poor connectedly or the connection is wrong. | Check the connection and signal line welding status. |
| | | 3. Motor encoder signal feedback cable is too long, which reduces the signal voltage. | Shorten the cable length within 30m. |
| | | 4. Motor encoder is damaged. | Change the motor or encoder. |
| | | 5. Drive unit fault. | Change the drive unit. |
| **Err-11** | Drive unit inner IPM module fault | 1. It occurs when the power is ON, and the drive unit is not enabled. It cannot be removed after power-on.<br>A, drive unit fault<br>B, Short circuit occurs when braking resistor terminal is grounding | Remedy for reason A is to change to a new drive unit.<br>Remedy for reason B is to check the correct the braking resistor connection. |

| No. | Meaning | Main Reason | Remedy |
|---|---|---|---|
| | | 2. It occurs when the power is ON, and the drive unit is not enabled. It is removed after power-on again. | It may be caused by external interference or poor grounding. Check the grounding status and interference source. |
| | | 3. It occurs when the power is turned ON, and the drive unit is enabled. It cannot be removed after power-on.<br>A. short circuit occurs among motor power line U, V, W, or between U, V, W and PE.<br>B. Drive unit IPM module is damaged.<br>C. Current sampling circuit of drive unit is cut off. | The remedy for reason A is to change the motor line or the motor.<br>The remedy for reasons B, C is to change the drive unit. |
| | | 4. It occurs when the motor is starting or stopping and it can be removed after power-on.<br>A, The default parameter of the motor set by drive unit is wrong.<br>B. The load inertial is too large, the commanded accelerated speed is too large when starting or stopping. | The remedy for reason A is to recover the motor default parameter.<br>The remedy for reason B is to increase the acceleration/deceleration time, lower down the accelerated speed or load inertial. |
| **Err-14** | Braking circuit fault | 1. The braking circuit is low in capacity. | A. Reduce the load.<br>B. Change to a new drive device of higher power.<br>C, Lower down the braking frequency. |
| | | 2. The inner braking circuit is damaged. | Change to a new drive unit. |
| | | 3. Braking resistor is cut off. | Re-connect the braking resistor line. |
| **Err-16** | Motor thermal overheat | 1. The rated current parameter is set incorrectly. | Set the parameter according to the motor nameplate. |
| | | 2. The motor is running with excess current for a long time. | A. Reduce the load.<br>B. Change to a drive device and motor of higher power.<br>C Check whether the mechanical part is abnormal. |
| **Err-20** | When the power is ON, EEPROM alarm occurs in the | 1. When the power is ON, the drive unit fails to read the data in EEPROM. | Recover the motor default parameter. |

| No. | Meaning | Main Reason | Remedy |
|---|---|---|---|
| | inner driver unit. | 2, EEPROM chips or circuit board fault; | Change the servo drive unit. |
| **Err-21** | Power open-phase alarm | Power open phase occurs. | Check the input power. |
| **Err-23** | Current sampling error | 1. The current sensor's working voltage is abnormal or the device is damaged. | Change the drive unit. |
| | | 2. Current sampling circuit resistor is damaged. | |
| **Err-25** | Power failure alarm | 1. The main power is cut OFF after it is ON. | Check the power supply line. |
| | | 2. The rectification part of the drive unit is damaged. | Change the drive unit. |
| **Err-32** | Illegal code of encoder signals U,V,W | 1. PA48 parameter setting is erroneous. | According to the matched encoder type, set the PA48 correctly and adjust to the default setting. |
| | | 2. The interface is poorly contacted or the cable is poorly shielded. | Check the encoder interface and shielding line. |
| | | 3. Encoder U,V,W signals are damaged. | Chang a new encoder. |
| | | 5. Encoder interface circuit fault. | Change to a new drive unit. |
| **Err-33** | Power charging fault | The charging circuit is damaged. | Change the drive unit. |
| **Err-34** | Pulse electronic gear ratio | The parameter setting of pulse electronic gear ratio is irrational. | Set the PA12/PA13 correctly. |
| **Err-35** | Alarm for the absence of external brake pipe | The external brake pipe is loose, or the external brake pipe is faulty. | Re-connect the brake pipe, or change the brake pipe. |
| **Err-36** | Three-phase main power OFF | 1. The three-phase power is OFF. | Check the main power and ensure the three-phase AC220V input. |
| | | 2. The power detection circuit is faulty. | Change the drive unit. |
| **Err-37** | Alarm occurs when the temperature of radiator is below -30℃. | The environmental temperature is too low. | Improve the environmental temperature. |
| **Err-38** | Alarm occurs when the temperature is higher than 75℃. | 1. The motor overload running for a long time. | Reduce the load. |
| | | 2. The environmental temperature is too high. | Improve the ventilation condition. |
| | | 3. The drive unit is damaged. | Change the drive unit. |

| No. | Meaning | Main Reason | Remedy |
|---|---|---|---|
| **Err-39** | Data read error in sensor mode of absolute encoder | 1. PA48 parameter setting error; | Set the value of PA48 according to the matched encoder type of the motor, then, adjust to the default value. |
| | | 2. Encoder feedback signal CN2 is disconnected or poorly connected. | Check the CN2 line connection status. |
| | | 3. The absolute encoder is damaged. | Change the motor. |
| **Err-41** | Encoder type configuration error | The encoder type set by the drive unit is inconsistent with the actual type. | Change the encoder or change the encoder type of drive unit. |
| **Err-42** | EEPROM error read in absolute encoder | 1. PA48 parameter setting error. | Set the value of PA48 according to the matched encoder type of the motor, then, adjust to the default value. |
| | | 2. When the power is ON, the drive unit reads encoder EEPROM error. | Check the CN2 line connection status. |
| | | 3. Motor encoder EEPROM is damaged. | Change the motor. |
| **Err-43** | Check error when EEPROM is read | 1. PA48 parameter setting error; | Set the value of PA48 according to the matched encoder type of the motor, then, adjust to the default value. |
| | | 2. After the drive unit reads the encoder EEPROM, data check error occurs. | Execute the Ab-Set encoder write operation. |
| **Err-44** | Encoder single-ring/multi-ring configuration error | PA48 parameter setting error; | Set the value of PA48 according to the matched encoder type of the motor, then, adjust to the default value. |
| **Err-45** | Encoder data check error | In sensor mode, data check error occurs when the encoder current position is read. | Check the grounding status. |

## C.4 Spindle Servo Alarm Remedy

| No. | Meaning | Main Reason | Remedy |
|---|---|---|---|
| **Err-1** | The spindle motor speed exceeds the setting value (refer to the upper limit set by parameter PA23) | 1. Encoder feedback signal is abnormal. | Check the motor or the second position encoder and its signal connection status. |
| | | 2. In speed mode, the acceleration/deceleration time constant is set too small, which lead to excessive speed overshoot. | Increase the accelerated time (PA39) or the decelerated time (PA40). |
| | | 3. Setting value of PA23 (maximum speed limit) is too small or the setting value of PA49 (motor encoder line number) is smaller than the actual encoder line number. | Set the PA23, PA49 value according to the motor nameplate. |
| | | 4, Control board is faulty. | Change the drive unit. |
| **Err-2** | The DC bus voltage of main circuit is too high | 1. The brake resistor is disconnected or damaged. | Check brake resistor and its connection. |
| | | 2. The brake resistor is not matched (resistance is too large) Note: The smaller the brake resistance is, the larger the current of the brake circuit is, which will easily cause damage to the brake pipe. | A. Change to a brake motor whose resistor is matched with the power.<br>B. Reduce the start/stop frequency according to the usage.<br>C. Adjust the acceleration/ deceleration time and speed mode according to the usage. |
| | | 3. The power voltage is instable. | Check the power supply. |
| | | 4. The internal brake circuit is damaged. | Change the drive unit. |
| **Err-3** | The DC bus voltage of main circuit is too low | 1. The input voltage capacity is not enough, which leads to the low voltage. | Check the power capacity and electric part of the control cabinet. |
| | | 2. If it occurs when the power is ON, it means the drive unit control board is faulty. | Change the drive unit. |
| **Err-4** | The value of position deviation counter exceeds the setting value (refer to the | 1. The pulse command frequency is too high or the set electronic gear ratio is too large. | Check the command frequency on principal computer and the electronic gear ratio set by PA12/PA13. |

| No. | Meaning | Main Reason | Remedy |
|---|---|---|---|
| | position deviation detection range set by PA17) (PA18=0: detects the alarm of position deviation; PA18=1 : does not detect the alarm of position deviation) | 2. The load inertial is excessive, or the torque is insufficient. | A. Check the overload magnification setting of the motor. (refer to PA34)<br>B. Increase the power of the drive unit and the motor.<br>C. Reduce the load. |
| | | 3. The motor encoder is faulty or the encoder line number setting is erroneous. | Check the motor encoder and its connection status; check the setting of PA49. |
| | | 4. The U, V, W phase sequence is erroneous, and | Exchange any two phases. |
| | | 5. When the second position encoder is used, PA68 is set incorrectly; the feedback signal is abnormal. | Check the setting of PA68. |
| | | 6. The position loop or speed loop gain setting is too small. (refer to PA5, PA6, PA9); | Adjust the speed loop or position loop gain. |
| | | 7. The valid range of position deviation is set too small. | Set PA17 correctly. |
| **Err-5** | Motor overheat alarm; the drive unit detects the overheat alarm signal output by the motor. (PA73=0: detects the motor overheat alarm; PA73=1: does not detects the overheat alarm) | 1. There is no temperature detection device in the motor. | Set PA73 to 1 to shield the motor overheat alarm. |
| | | 2. Overload leads to severe heat of the motor. | Increase the power of drive unit and motor or reduce the load. |
| | | 3. In overload condition, the start/stop frequency is too high. | Reduce the start/stop frequency, and improve the motor heat radiation condition. |
| | | 4. The motor temperature detection device is damaged, or the motor inner is faulty, or the cooling fan is damaged. | Change the spindle servo motor. |
| | | 5. If the temperature detection signal is normal, the drive unit control board is faulty. | Change the drive unit. |
| **Err-8** | Position deviation counter overflow | 1. The electronic gear ratio is too large. | Check the setting of parameters PA12, PA13. |
| | | 2. Input command pulse is abnormal. | Check the principal command pulse frequency. |
| **Err-9** | The encode signal feedback is abnormal. | 1. The motor encoder signal is poorly connected or the connection is erroneous. | Check the connector and signal line welding status. |
| | | 2. The motor encoder signal feedback cable is too long, leading to low signal voltage. | Shorten the cable length within 30m. |

| No. | Meaning | Main Reason | Remedy |
|---|---|---|---|
| | | 3. Motor encoder is damaged. | Change the motor or the encoder. |
| | | 4. Drive unit control board is faulty. | Change the drive unit. |
| **Err-11** | Drive unit inner IPM module fault | 1. It occurs when the power is ON, and the drive unit is not enabled. It cannot be removed after power-on.<br>A, drive unit fault<br>B, Short circuit occurs when braking resistor terminal is grounding | Remedy for reason A is to change to a new drive unit.<br>Remedy for reason B is to check the correct the braking resistor connection. |
| | | 2. It occurs when the power is ON, and the drive unit is not enabled. It is removed after power-on again. | It may be caused by external interference or poor grounding. Check the grounding status and interference source. |
| | | 3. It occurs when the power is turned ON, and the drive unit is enabled. It cannot be removed after power-on.<br>A. short circuit occurs among motor power line U, V, W, or between U, V, W and PE.<br>B. Drive unit IPM module is damaged. | The remedy for reason A is to change the motor line or the motor.<br>The remedy for reasons B is to change the drive unit. |
| | | 4. It occurs when the motor is started or stopped, and can be removed after power-on.<br>A. The default parameter set by the drive unit is erroneous.<br>B. The load inertia is too large; the command accelerated speed during start/stop is too large. | The remedy for reason A is to recover the motor default parameter. (refer to 4.4 section for the procedures);<br>The remedy for reason B is to increase the acceleration/ deceleration time so as to reduce the command speed rate or the load inertia. |
| **Err-13** | Overload alarm when the motor is running | 1. long time overcurrent; | Reduce the load. |
| | | 2. The parameter is set incorrectly. The motor may be accompanied with vibration or noise. | Adjust the parameter related to the motor performance (refer to the instruction to PA5, PA6, PA8, PA9, PA34) |
| | | 3. The setting value of PA49 is larger than the actual encoder line number. | Set the line number correctly. |

| No. | Meaning | Main Reason | Remedy |
|---|---|---|---|
| | | 4. Lines for U, V, W are connected incorrectly. The status after power-on is similar to the description in Err-27. | Exchange any two phases. |
| **Err-16** | Overload alarm when the motor is running | The motor is running in overload state for a long time (longer than the time in Err-13). | A. Reduce the load.<br>B. Change to a drive device with higher power. |
| **Err-17** | Excessive braking time | 1. The voltage of input power is too high for a long time. | Supply with the power which meets the need of drive unit working condition. |
| | | 2. The braking resistance is too large, and the energy cannot be released during braking, leading to the rise of inner DC voltage. | Change to a new braking resistor (refer to section 1.4.3); |
| **Err-18** | No feedback for the braking start signal | 1. The brake circuit is faulty. | Change the drive unit. |
| | | 2. The braking resistance is too large. | Measure the resistance with a universal meter and adjust the resistance. |
| **Err-19** | Excessive DC bus voltage without braking | 1. Braking circuit is faulty. | Change the drive unit. |
| | | 2. The braking resistor is loose or disconnected. | Check the connection status of the braking resistor. |
| **Err-20** | EEPROM alarm when the power is ON | 1. When the power is ON, the drive unit fails to read the data in EEPROM. | Recover the motor default parameter. Refer to section 4.4 for the procedures. |
| | | 2. EEPROM chip or circuit is faulty. | Change the servo drive unit. |
| **Err-21** | R, S, T open phase alarm | 1. The input power line is disconnected or the power is open-phase | A. Check the input power line;<br>B. Check the input three-phase power. |
| | | 2. The input power circuit of drive unit is faulty. | Change the drive unit. |
| **Err-23** | Excessive current error | 1. The current detection circuit is faulty. | Change the drive unit. |
| | | 2. The current sensor is damaged. | |
| | | 3. The voltage of control power supply is faulty. | |
| **Err-24** | The second position input signal of CN3 interface is abnormal. | 1. Parameter PA66 is set to 1 when no second position feedback signal is received. | Set the PA66 to 0. |
| | | 2. The spindle encoder feedback signal is abnormal. (The reason is the same as described in Err-9) | A. Check the second position encoder signal connection line, welding status and plug connection status.<br>B. Shorten the cable within 30m. |

| No. | Meaning | Main Reason | Remedy |
|---|---|---|---|
| **Err-25** | Drive unit positioning failure | 1. No Z pulse signal is detected. | Check the connection of feedback input signal. |
| | | 2. Because of excess load inertia, the corresponding parameter is set incorrectly or the gain setting is too large. | Check relevant motor parameter values PA49, PA66, PA67. Relevant gain parameter PA5, PA6, PA8, PA9. (Refer to section 6.1 for the adjustment method.) |
| | | 3. When the positioning is performed with the second position input signal, the A/B phase sequence of spindle encoder is inconsistent with that of the motor encoder. | Modify parameter PA68 and reconcile the phase. Refer to instruction of parameter PA68 for details. |
| **Err-26** | Drive unit radiator overheat alarm | 1. The radiator temperature is too high or the radiator fan is damaged. | Turn OFF the power and start the motor after cooling down. Check the radiator fan, clean the radiation passage and reduce the load. |
| | | 2. The temperature detection switch or circuit is damaged. | Change the drive unit. |
| **Err-27** | U, V, W connection error | The phase sequence of U, V, W is incorrect. | Exchange any two phases. |
| **Err-28** | Parameter for updating software erroneous | Parameters are not adjusted or saved after programming or software updating. | Re-call the default parameter and save them, then, turn on the power again. |
| **Err-29** | Parameter detection error after power-on | Conflict arises when the old version software is replaced by the new one. | Re-writer the parameter and turn ON the power again. |
| **Err-33** | Voltage of the main circuit is abnormal when the power is ON | 1. At the power-on moment, the input power voltage is too low or it fluctuates greatly. | Check the input power. |
| | | 2. The rectifier is damaged or the soft-start circuit is faulty. | Change the drive unit. |
| **Err-34** | The temperature of radiating fan is abnormal. (Applied to DAY3025, DAY3100) | 1. The temperature of the radiating fan is out of the range -30℃～90℃. | Lower down the temperature. |
| | | 2. The thermistor is abnormal. | Change the drive unit. |