

 The user manual is for GSK980TC3 Series Bus Turning CNC System, divided into Programming and Operation.

 This manual describes the various matters concerning the operations of this CNC system as much as possible. However, it is impossible to give detailed descriptions to all the unnecessary or unallowable operations due to space limitation and product specific applications. Therefore, the matters not specially described herein should be considered as “impossible” or “unallowable”.

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## Preface

Dear users,

It is our pleasure for your patronage and purchase of this machining center CNC system of GSK980TC3 Series Bus Turning CNC system produced by GSK CNC Equipment Co., Ltd.

This book is “Programming and Operation Manual”, which introduces the programming and operation of GSK980TC3 Series Bus CNC Turning System (software version V1.4) in detail.

To ensure the product works in a safe and efficient state, please read this manual carefully before installation and operation.

## Warnings



Improper operations may cause unexpected accidents. Only those qualified staff are allowed to operate this system.

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

It cannot be applied for other purposes, or else it may cause serious danger.

**Declaration!**

- We try to describe all the various matters as much as possible in this manual. However, it is impossible to give detailed descriptions to all the unnecessary or unallowable operations because there are too many possibilities. Therefore, the matters not specially described herein should be considered as “impossible” or “unallowable”.

**Warning!**

- Before installing, connecting, programming and operating the product, please read this manual and the manual provided by the machine tool builder carefully, and operate the product according to these manuals. Otherwise, the operation may cause damage to the product and machine tool, or even cause personal injury.

**Caution!**

- The functions and specifications (e.g., precision and speed) described in this manual are only for this product itself. For those CNC machine tools installing this product, the actual function configuration and specifications depend on the designs of the machine tool builders. Moreover, the function configuration and specifications of the CNC machine tool are subject to the manual provided by the machine tool builder.

All specifications and designs in this manual are subject to change without notice.

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# Safety notes

## ■ Transportation and storage

- Do not pile up the packing boxes over 6 layers.
- Never climb the packing box, neither stand on it, nor place heavy objects on it.
- Do not move or drag the product by the cables connected to it.
- Avoid impact or scratch to the panel and screen.
- Packing box should be protected from dampness, insolation and drench.

## ■ Open-package inspection

- Confirm the product is the one you purchased after opening the package.
- Check whether the product is damaged during transportation.
- Confirm all the elements are complete without damage by referring to the list.
- If there is incorrect product type, incomplete accessories or damage, please contact us in time.

## ■ Connection

- Only qualified personnel can connect and inspect the system.
- The system must be earthed. The earth resistance should not be greater than  $0.1\Omega$ , and a neutral wire (zero wire) cannot be used as an earth wire.
- The connection must be correct and secured. Otherwise, the product may be damaged or unexpected results may occur.
- Connect the surge absorbing diode to the product in the specified direction; otherwise the product may be damaged.
- Turn off the power before inserting or unplugging a plug, or opening the electric cabinet.

## ■ Troubleshooting

- Turn off the power supply before troubleshooting or replacing components.
- Overhaul the system when there is a short circuit or overload, and do not restart it until the trouble is removed.
- Do not turn ON/OFF the product frequently, and the ON/OFF interval should be 1 minute at least.

## Safety Responsibility

### **Manufacturer Responsibility**

- Be responsible for the danger which should be eliminated on the design and configuration of the provided CNC systems
- Be responsible for the safety of the provided CNC and its accessories
- Be responsible for the provided information and advice

### **User Responsibility**

- Be trained with the safety operation of CNC system operation procedures and familiar with the safety operation.
- Be responsible for the dangers caused by adding, changing or modifying the original CNC systems and accessories.
- Be responsible for the danger caused by failing to observe the operation, maintenance, installation and storage in the manual.

This user manual shall be kept by the end user.

Thank you for your kind support when you are using the products of GSK CNC Equipment Co., Ltd.

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## **I Programming**

Introduce the technical specification, product type series and parameter configuration, command code and program format of GSK980TC3 Series Bus Turning CNC system.

## **II Operation**

Introduce PLC' operations of GSK980TC3 Series Bus Turning CNC system.

## **III Function Description**

Introduce the main function of GSK980TC3 Series Bus Turning CNC system.

## **IV Installation and Connection**

Introduce the installation, connection and setting methods of GSK980TC3 Series Bus Turning CNC system.

## **Appendix**

Introduce the usage of GSK980TC3 Series Bus Turning CNC system matched with a servo turret.

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# I Programming



## Chapter 1 Sequence Program Creating Process

### 1.1 GSK980TC3 PLC Specification

GSK980TC3 PLC is shown below:

Table 1-1-1

Specification	GSK980TC3 PLC
Programming language	Ladder
Program level	2
The 1 <sup>st</sup> level program execution cycle	8ms
Basis code average treatment time	5 $\mu$ s
Programming capacity	8000 steps
Code	Basis code + function code
Internal relay (R)	0~990 ( byte )
PLC alarm detection (A)	0~63 ( byte )
Nonvolatile memory area	
Timer (T)	0~127 ( byte )
Counter (C)	0~127 ( word )
Data base (D)	0~255 ( word )
Nonvolatile relay (K)	0~63 ( byte )
Counter prevalue data register (DC)	0~127 ( word )
Timer prevalue data register (DT)	0~127 ( word )
Subprogram (P)	0~99
Mark (L)	0~99
Input signal of NC side (F)	0~255 ( byte )
Signal outputs to the NC side (G)	0~255 ( byte )
I/O module (X)	0~127 ( byte )
(Y)	0~127 ( byte )

### 1.2 What is a Sequence Program

The programming is performed a logic control to the machine tool and its relative equipments, which is called sequence programming.

After the programming is converted into some kind of format, CPU can be performed the code and calculation treatment for it, and its fruits can be memorized to RAM. CPU can be rapidly read each code stored in the memory, which can be performed the programming according to the calculation operation.

The compiling of the sequence programming starts with developing of the ladder diagram.

### 1.3 Distribution Interface (Step 1)

The interface can be distributed after confirming the controlled object and calculating the points of the corresponding input/output signal.

Refer to the Chapter Four Input/output interface signal table in the part of the Installation and Connection when distributing the interface.

### 1.4 Ladder Diagram Programming (Step 2)

GSK980TC3 ladder diagram is not permitted by an on-line modification but is edit by the software Lad Edit.exe on the computer. The control operation required by the machine tool can be expressed by the ladder diagram. The functions, such as the timer and counter, can not be expressed by relay symbols, which can be indicated by the specified function code symbols.

The compiled ladder diagram should be upgraded to the system.

### 1.5 Sequence Programming Debugging (Step 3)

The sequence programming can be debugged using the following methods:

#### 1) Debugging with emulator

The machine tool can be replaced by an emulator (it composes of the lights and switches). The input signal state of the machine tool can be expressed by the ON or OFF of the switches; and the output signal state can be indicated by the ON or OFF of the light.

#### 2) Debugging with actual operation

Debug on the actual machine tool. It is better to prepare the precautions before debugging, due to an unexpected behavior may occur.

## Chapter 2 Sequence Program

The operating principle is different with the common relay, because the PLC sequence controlling is carried out by the ladder diagram Lad Edit.exe compiling.

And therefore, it is better to thoroughly understand the sequence controlling principle when designing the PLC sequence programming.

### 2.1 Performance Process of Sequence Programming

In the general relay controlling circuits, each of them can be simultaneously operated. When the relay A is operated in the following figure, the relay D and E can be operated (when the contactor A and B are closed) at the same. Each relay in the PLC sequence control is operated in turn. The relay D is operated before relay A, and then the relay E operates (refer to the following figure). Namely, each relay is operated based upon the sequence of the ladder diagram (compiling sequence).

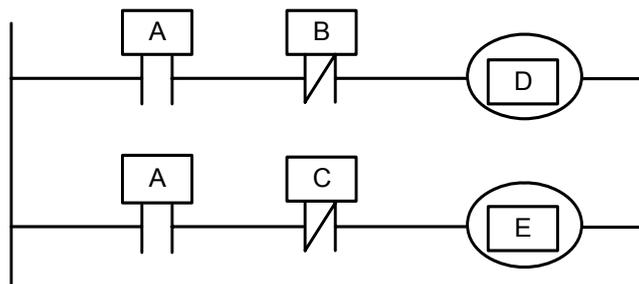


Fig. 2.1 (a) Circuit illustration

The differences between the relay circuit and PLC programming operation are shown below in the Fig. 2.1 (b) and Fig. 2.1 (c).

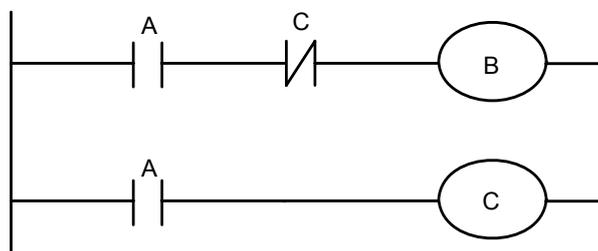


Fig. 2.1 (b)

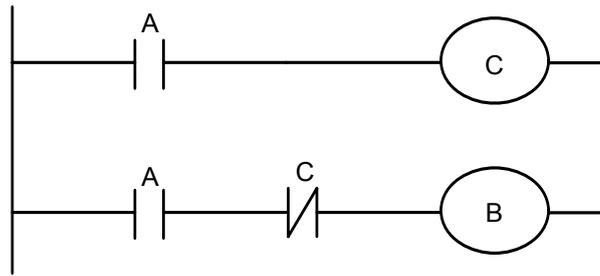


Fig. 2.1 (c)

(1) Relay circuit

Both Fig. 2.1 (b) and Fig. 2.1 (c) are shared a same operation. B and C are switched on after A is turned on. B is cut off after C is ON.

(2) PLC program

A same relay is shared a same circuit, refer to the Fig. 2.1 (b); B and C are switched on after A is turned on. B is cut off after one cycle of the PLC program is performed. In the Fig. 2.1 (c), C is ON instead of B, after C is turned on.

Programming

## 2.2 The Performance of the Cycle

PLC performs from the beginning to the end of the ladder diagram. It performs again from the beginning of the ladder diagram after this diagram is performed, which is called cycle performance.

The performance time from the beginning to the end of the ladder diagram is abbreviated as a period of a cycle treatment. The shorter of the treatment period is, the stronger of the response capacity of the signal is.

## 2.3 The Priority Sequence of the Performance (the 1st Level, the 2nd level)

GSK980TC3 PLC program are composed of two parts: the 1<sup>st</sup> level program and the 2<sup>nd</sup> level program, which are inconsistent with the performance period.

The 1<sup>st</sup> level program performs once each 8ms, which can be treated some fast corresponding and short pulse.



## 2.4 Sequence Programming Structure

The ladder diagram is compiled with sequence in the traditional PLC. It owns the following advantages in the ladder diagram language allowing the structured programming:

1. The program is easy to comprehend and compile.
2. It is more convenient to find the faults during the programming.
3. It is easy to find some reasons when the operation malfunction occurs.

The methods of the main structure programming are shown below:

### 1) Sub-program

The subprogram is regarded as a treatment unit based on the ladder diagram.

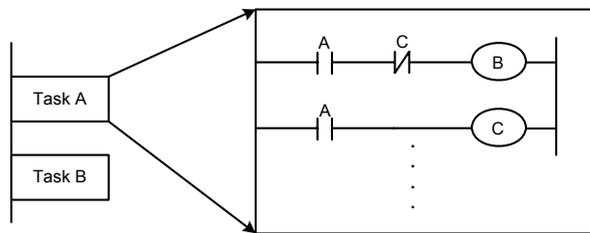


Fig. 2-4-1

### 2) Nesting

One subprogram can be performed the task by calling another one.

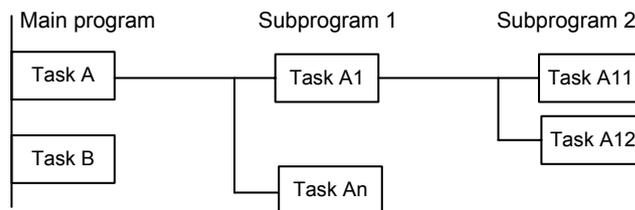


Fig. 2-4-2

### 3) Conditional branch

The main program is performed circularly, and checks whether its conditions are suitable. The corresponding subprograms are performed under these conditions, vice versa.

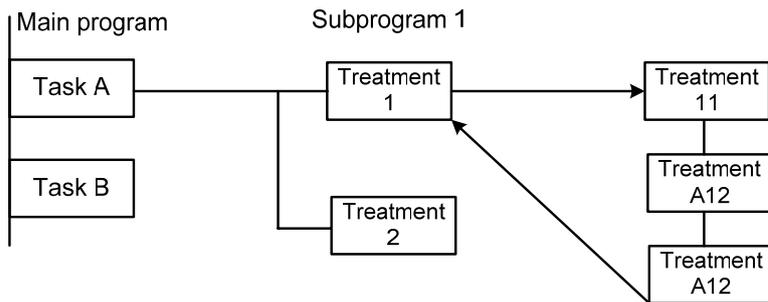


Fig. 2-4-3

## 2.5 The Treatment of the Input/Output Signal

The treatment of the input signal:

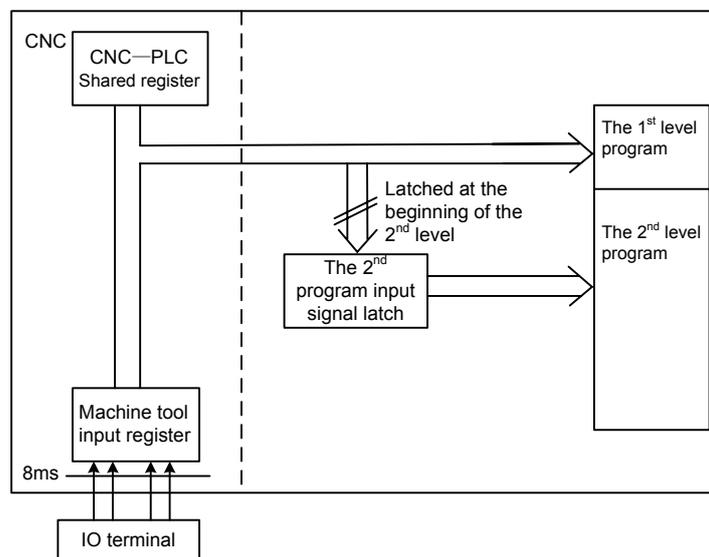


Fig. 2-5-1

The treatment of the output signal:

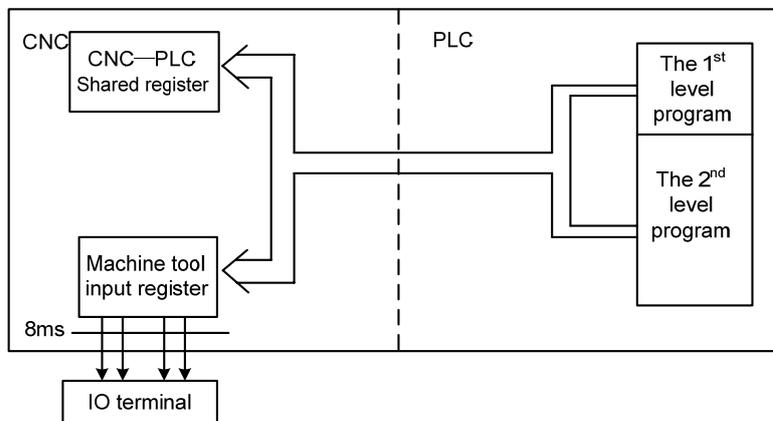


Fig. 2-5-2

## 2.5.1 Input Signal Treatment

### (1) NC input register

The NC input signals from the NC are memorized into the NC input register, which are transferred to PLC each 8ms. The 1<sup>st</sup> level program performs the corresponding treatment using state of these signals.

### (2) Machine tool input register

The machine tool input register is scanned and memorized its input signal from the machine each 8ms. The 1<sup>st</sup> level program is also performed the corresponding treatment by using this signals directly.

### (3) The 2<sup>nd</sup> level program input register

The 2<sup>nd</sup> level program input signal register is also called the 2<sup>nd</sup> level program synchronic input signal register. Wherein, the stored input signal is treated by the 2<sup>nd</sup> level program. This signal state in the register is synchronic with the 2<sup>nd</sup> level one.

The signals both in the NC and machine tool input register can be locked to the 2<sup>nd</sup> level program input latch, as long as the 2<sup>nd</sup> level program performs. The signal state in this latch keeps invariable during the performance of the 2<sup>nd</sup> level program.

## 2.5.2 The Treatment of the Output Signal

### (1) NC output register

The output signal transfers to the NC output register from the PLC each 8ms.

### (2) Machine tool output register

The signal memorized in the machine tool output register conveys to the machine tool each 8ms.

**Note:** The signal states, such as the NC input register, NC output register, machine input register and machine output register, which can be displayed by the self-diagnosis function. The diagnosis number is the address number in the sequence programming.

## 2.5.3 The Distinguish of the Signal State Between the 1st Level and the 2nd Level Program

As for the same input signal, their states may different between the 1<sup>st</sup> and 2<sup>nd</sup> level programming, that is the reason that different registers are used between two levels programming. Namely, the input signal used with the 2<sup>nd</sup> level program is the one of the 1<sup>st</sup> level who is locked. And therefore,

the signal in the 2<sup>nd</sup> level program is later than the 1<sup>st</sup> level one. At the worst case, one 2<sup>nd</sup> level program performance cycle can be lagged.

It is better to remember this point when programming the ladder diagram.

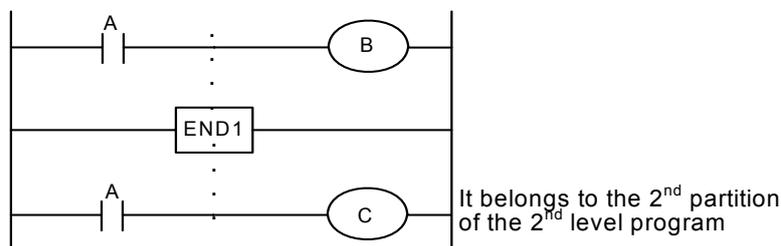


Fig. 2-5-3-1

A=1 performs the 1<sup>st</sup> level program when the 1<sup>st</sup> 8ms is performed, then B=1. And therefore, the 2<sup>nd</sup> level program is performed, the A=1 is latched to the 2<sup>nd</sup> level program, and then the first partition of the 2<sup>nd</sup> level program is completed.

A turns into 0 to perform the 1<sup>st</sup> level program when the 2<sup>nd</sup> 8ms is performed, then B=0. And therefore, the 2<sup>nd</sup> partition of the 2<sup>nd</sup> level program is performed; in this case, the state of the A is still latched as the one last time. So, C=1.

In this way, the state both B and C are different.

## 2.6 Interlocking

In the sequence control, the interlocking is very important from the safety issue.

It is necessary to use the interlocking in the sequence control programming. Simultaneously, the hard interlocking is used in the relay control circuit of the strong electric cabinet of the machine tool sides. This is the reason that the interlocking is disabled when the hardware of the performance sequence programming malfunctions, even if the interlocking is logically used in the sequence program (software). And therefore, the interlocking can be ensured the safety for the user, and prevent the machine tool from damaging in the strong electric cabinet of the machine sides.



## Chapter 3 PLC Address

Address distinguishes signal. Different address is separately corresponding to the I/O signal at the side of the machine tool, the I/O signal at the side of the CNC, the internal relay, the counter, the timer, the keep relay and the data list. Each address is composed of the address number and bit number, and its number is as shown below:

Address number rules:

Address number consists of address type, address number and bit number.

X    000    .    6

Type    Address number    Bit number

Address type: X, Y, R, F, G, K, A, D, C and T

Address number: Decimal number means one byte.

Bit number: Octonary number system, 0~7 are separately indicated the bytes (0~7 bits) in the front of the address number.

The address type of the GSK980TC3 PLC is shown below:

Table 3-1

Address	Address explanation	Length
X	Machine →PLC (128 bytes)	INT8U
Y	PLC→machine(128 bytes)	INT8U
F	CNC→PLC(256 bytes)	INT8U
G	PLC→CNC(256 bytes)	INT8U
R	Intermediate relay (990 bytes)	INT8U
D	Data register (0~255)	INT16U
DC	The data register of the counter preset value	INT16U
C	Counter (0~127)	INT16U
A	PLC alarm detection	INT8U
T	Timer (0~127)	INT16U
DT	The data register of the timer preset value	INT16U
K	Keep relay (64 types)	INT8U

INT8U data type is 8-bit character type without symbol, INT16U data type is 16-bit integral type without symbol.

### 3.1 Machine → PLC address (X)

The X address of the GSK980TC3 PLC composes of two types:

1. The X address is assorted with the I/O input terminal, XS40.

2. The X address is assorted with the input button on the MDI panel of the system.

### 3.1.1 X Address on the I/O Input

16 addresses are defined as INT8U from X8 to X9, which are distributed on the I/O input terminal, XS40.

Users can define the signal significance of the X address of the I/O ports based upon the actual cases, which can be connected the machine tool and compiled the corresponding ladder diagram. Refer to IV Installation and Connection, Table 3-1-1 for the initial definition of the input address.

### 3.1.2 X Address on the MDI Panel

There are 8 bytes from the addresses X16.0~X23.7, which are corresponded with the button input on the MDI panel one by one. User can not modify its signal definition. The buttons on the MDI panel should be firstly responded by CNC, and then conveys the X signal to PLC.

The corresponding relationships are shown below:

Table 3-1-2-1

Button input	PLC address	Button input	PLC address
Edit	X16.1	Rapid 100%	X19.1
Auto	X16.2	Axis +4th	X19.2
MDI	X16.3	Manual feed axis +X	X19.3
Zero return	X16.4	Manual feed axis Y	X19.4
Single step	X16.5	CCW axis C	X19.5.
Manual	X16.6	Tool change	X19.6
MPG	X16.7	Spindle override reduce	X19.7
DNC	X17.0	Manual feed axis +Y	X20.0
Skip	X17.1	Manual feed axis X	X20.1
Machine tool lock	X17.2	Axis +4th	X20.2
M.S.T Lock	X17.3	CW axis +C	X20.3
Dry run	X17.4	Cooling	X20.4
Optional stop	X17.5	Spindle override increase	X20.5
Rapid F0	X17.6	Spindle CW	X20.6
Rapid 25%	X17.7	Federate override increase	X20.7
MPG trial-cut	X18.0	Spindle stop	X21.0
USER1\hydraulic	X18.1	Federate override100%	X21.1
Manual feed axis+Z	X18.2	Spindle CCW	X21.2
Rapid traverse switch	X18.3	Federate override reduce	X21.3

Button input	PLC address	Button input	PLC address
Manual feed axis Z	X18.4	Cycle start	X21.4
C/S axis switch	X18.5	Feed hold	X21.5
Lubricating	X18.6	Chuck (980TC3-V)	X21.6
JOG	X18.7	Tailstock (980TC3-V)	X21.7
Rapid 50%	X19.0		

## 3.2 PLC → Address of the Machine Tool Side (Y)

Y addresses of GSK980TC3 are distributed to each light on the MDI panel.

### 3.2.1 Y Address on the MDI Panel

There are 8 bytes from the addresses Y16 ~ Y23 which these addresses are corresponded with the button input on the MDI panel one by one. User can not modify its signal definition. PLC system reports to the CNC system keyboard module after calculating, and it is used for displaying the indicator signal.

The corresponding relationships of each prompt light:

Table 3-2-1-1

Keyboard indicator output	PLC address	Keyboard indicator output	PLC address
Edit key indicator	Y16.1	Tool change indicator	Y19.6
Auto key indicator	Y16.2	+Y axis key indicator	Y20.0
MDI key indicator	Y16.3	+X axis key indicator	Y20.1
Zero return key indicator	Y16.4	+4th axis key indicator	Y20.2
MPG\Step key indicator	Y16.5	+C axis key indicator	Y20.3
Manual key indicator	Y16.6	Cooling indicator	Y20.4
Program zero return indicator	Y16.7	Spindle stop indicator	Y21.0
Single indicator	Y17.0	Feedrate override 100%	Y21.1
Skip indicator	Y17.1	Cycle start indicator	Y21.4
Machine lock indicator	Y17.2	Feed hold indicator	Y21.5
Miscellaneous lock indicator	Y17.3	Chuck indicator (980TC3-V)	Y21.6
Drun run indicator	Y17.4	Tailstock indicator (980TC3-V)	Y21.7
Optional stop indicator	Y17.5	LED output code 0 (BCD)	Y22.0
Rapid F0	Y17.6	LED output code 1 (BCD)	Y22.1
Rapid 25%	Y17.7	LED output code 2 (BCD)	Y22.2
MPG trial cut indicator	Y18.0	LED output code 3 (BCD)	Y22.3
USER1\hydraulic indicator	Y18.1	LED output code 4 (BCD)	Y22.4
+Z axis indicator	Y18.2	LED output code 5 (BCD)	Y22.5
Rapid traverse switch indicator	Y18.3	LED output code 6 (BCD)	Y22.6
Spindle override increasing indicator	Y18.4	LED output code 7 (BCD)	Y22.7
C/S switch indicator	Y18.5	X axis key indicator	Y23.0
Lubricating indicator	Y18.6	Y axis key indicator	Y23.1

Keyboard indicator output	PLC address	Keyboard indicator output	PLC address
JOG key indicator	Y18.7	Z axis key indicator	Y23.2
Rapid 50%	Y19.0	4th axis key indicator	Y23.3
Rapid 100%	Y19.1	C axis key indicator	Y23.4
Spindle override decreasing indicator	Y19.2	Alarm indicator	Y23.5
CCW indicator	Y19.3	Ready indicator	Y23.6
CW indicator	Y19.4	Run indicator	Y23.7
Feedrate override decreasing	Y19.5		

### 3.3 PLC→CNC Address (G)

The addresses from G0 to G63, its definition type: INT8U, totally 64 bytes.  
The operation panel key signal is shown below:

Table 3-3-1

Operation panel key signal	PLC address	Operation panel key signal	PLC address
Mode selection signal	G43.0~G43.2	Chuck status	G60.0/G60.1
Increment feed	G43.3	Cycle start	G7.2
MPG trial cut selection signal	G43.4	Feed hold	G8.5
Program zero return	G43.6	Rapid switch	G19.7
Manual reference point return selection signal	G43.7	Manual feed axis +1st	G100.0
Skip	G44.0	Manual feed axis +2nd	G100.1
Single	G46.1	Manual feed axis +3rd	G100.2
Dry run	G150.7	Manual feed axis +4th	G100.3
Miscellaneous lock	G5.6	Manual feed axis +C	G100.4
Machine lock	G44.1	Manual feed axis -1st	G102.0
Spindle CCW	G26.2	Manual feed axis -2nd	G102.1
Spindle CW	G26.3	Manual feed axis -3rd	G102.2
Spindle JOG orientation gear change	G29.5	Manual feed axis -4th	G102.3
Cs contour control switch signal	G27.7	Manual feed axis +C	G102.4

**Note:** the rapid override and MPG step width are determined by a binary system with 2 G addresses: G14.0=0, G14.1=0 are rapid F0; G14.0=1, G14.1=0 are rapid 25%; G14.0=0, G14.1=1 are rapid 50%; G14.0=1, G14.1=1 are rapid 100%; G19.4=1, G19.5=0, G19.6=0 are MPG step width \*1; G19.4=0, G19.5=1, G19.6=0 are MPG step width \*10; G19.4=1, G19.5=1, G19.6=0 are MPG step width \*100; G19.4=0, G19.5=0, G19.6=1 are MPG step width specified by a parameter.

### 3.4 CNC→PLC Address (F)

The addresses from F0 to F63 are defined as: INT8U, totally 64 bytes.  
Refer to the Chapter Three Function for details.

### 3.5 Internal Replay Address (R)

The address area is reset when the system is turned on. R990 and R5991 are used by the system. Its definition type is: INT8U, totally 990 bytes.

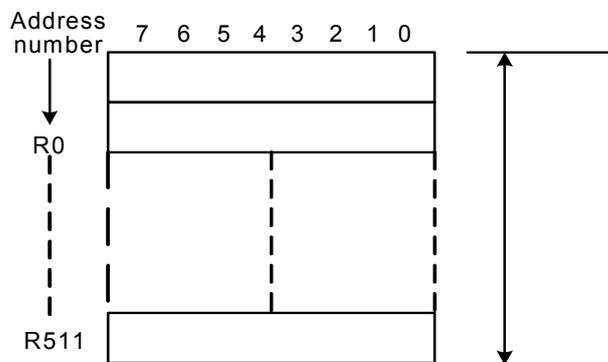


Fig. 3-5-1

#### System program administration area

R990

The signal of R990.0 address is set to 1 when PLC starts and restarts, which is used the signal set by the initial user. The R990.0 is reset to 0 after the ladder diagram is performed once

R991 (System timer)

The following four signals can be used for system timer:

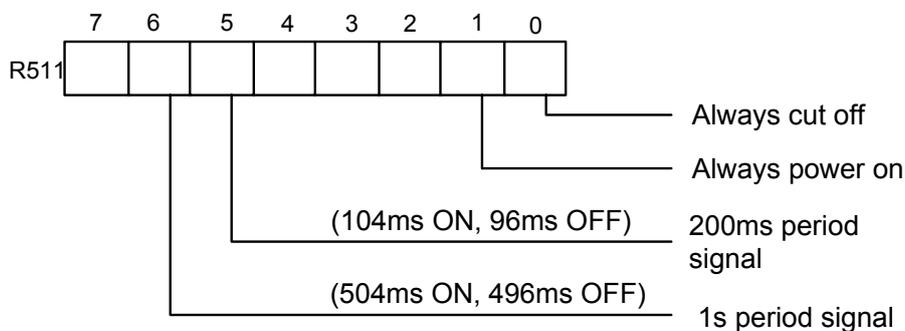


Fig. 3-5-2

### 3.6 Nonvolatile Relay Address (K)

This address area is used for nonvolatile replay and PLC parameter setting. This area is called nonvolatile relay area, namely, the content inside the register will not lose even if the system is turned off. K000~K005 are used by the system, which is used to protect the PLC system parameter, it is very convenient for user to control PLC in the CNC system.

Its definition type: INT8U, totally 64 bytes.

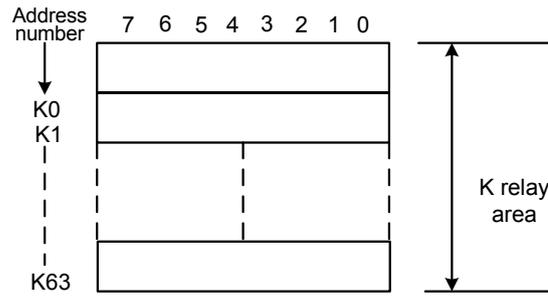


Fig. 3-6-1

**Note:** When PLC address K005.2 =1, PLC enters the debugging mode. All of the external alarms are cancelled, and the machine interlocking signals are then cancelled, the tool-change code can not be performed. The parameter can be modified only when comprehending the parameter, so that the damage in the machine tool or injury of the person may occur.

### 3.7 Information Display Request Address (A)

This address area is reset when the system is turned on  
 Its definition type: INT8U, totally 32 bytes.

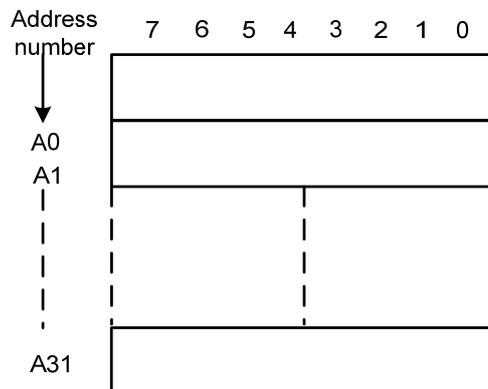


Fig. 3-7-1

### 3.8 Counter Timer (C)

This area is used for placing the current count value of the counter. The data is reset after the system is turned off.  
 Its definition type: 128 addresses.

### 3.9 Counter Preset Value Address (DC)

This address area is used for storing the counter preset, which is a nonvolatile storage area, that is, the memorized content may not loose even the system is power off.  
 Its definition type: 128 addresses. The setting value of the DC is only read instead of writing.

### 3.10 Timer Address (T)

This address area is used for storing the current numerical value of the timer. The data initial is presetting value after the system is power off. Current data is presetting value when it is set to 0.  
Its definition type: 128 addresses

### 3.11 Presetting Value Address of the Timer (DT)

This address area is used for placing the timer preset value. This area is nonvolatile register area, namely, the content inside the register will not lose even if the power of the system is turned off.  
Its definition type: 128 addresses. The setting value of the DT is only read instead of writing.

### 3.12 Data Table Address (D)

The content inside the memory will not lose even if the power of the system is turned off.  
Its definition type: totally 256 addresses.

### 3.13 Sign Address (L)

It is used to specify signs both skip object and the LBL code in the JMPB code.  
Its range: 0~99

### 3.14 Subprogram Number (P)

It is used to specify the called object subprogram number in the CALL code and the subprogram number in the SP code.  
Its range: 0~99



## Chapter 4 PLC Basic Codes

The design of the sequence program begins from the compiling of the ladder diagram. The ladder diagram consists of relay contact and function code. The logic relationship in the ladder diagram composes of sequence program. There are two methods of the sequence program input: one is that the input method uses the mnemonic symbol language (The system is not temporarily supported the PLC command code of the RD, AND and OR); the other one that is used the relay symbol. The programming can be compiled using ladder diagram, and do not comprehend the PLC code based upon the latter.

Actually, the sequence program inside the system can be converted into corresponding PLC code even if it is input by the relay symbol.

The basis codes are commonly used codes when designing the sequence programming, which are performed one-digit calculation.

The basis command codes of the GSK980TC3 series are shown below:

Table 4-1

Code name	Function
RD	Left shift one bit of the content of the register, the signal state specified by address set to ST0
RD.NOT	Left shift one bit of the content of the register, the signal state specified by address is set to ST0 after its state is set to NOT.
WRT	Output the logic calculation result to the specified address
WRT.NOT	Output the logic calculation result after NOT to the specified address.
AND	Logic AND
AND.NOT	Logic AND after the specified state is set to NOT.
OR	Logic OR
OR.NOT	Logic OR after the specified state is set to NOT.
OR.STK	Right shift one bit of the stacked memory after ST0 and ST1 logic OR
AND.STK	Right shift one bit of the stacked memory after ST0 and ST1 logic AND

### 4.1 RD, RD.NOT, WRT, and WRT.NOT Codes

Mnemonic symbol and function

Table 4-1-1

Mnemonic symbol	Function
RD	Left shift one bit of the content of the register, the signal state specified by address is set to ST0.
RD.NOT	Left shift one bit of the content of the register, the signal state specified by address is set to ST0 after it is set to NOT.
WRT	Output the logic calculation result to the specified address
WRT.NOT	Output the logic calculation result after NOT to the specified address

#### Code explanation

- WRT and WRT.NOT codes are the coil drive code of the output relay and internal relay, but

the input relay can not be used.

- The paratactic WRT command can be used multiply, but it outputs with multicoil .

Refer to the following programming:



Fig. 4-1-1

## 4.2 AND, AND.NOT Code

Mnemonic symbol and function

Table 4-2-1

Mnemonic symbol	Function
AND	Logic AND
AND.NOT	Logic AND after the specified state is NOT

Code explanation

- Connect 1 contact with series connection by using AND, AND.NOT code. The numbers of series connection contacts are unconstrained, and this code can be used for dozens of times.

Refer to the following programming:

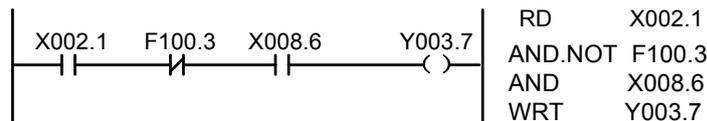


Fig. 4-2-1

## 4.3 OR, OR.NOT Code

Mnemonic symbol and function

Table 4-3-1

Mnemonic symbol	Function
OR	Logic OR
OR.NOT	Logic OR after the specified state is NOT

Code explanation

- Connect 1 contact with series connection using the OR and OR.NOT code.
- OR, OR.NOT is started from the step of this code; it can be connected with series connection

with the abovementioned RD, RD.NOT code step.

Refer to the following programming:

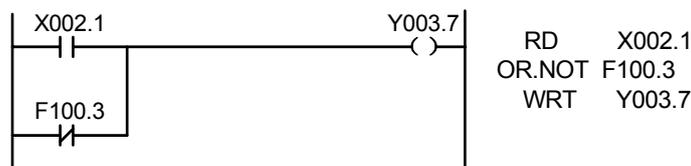


Fig. 4-3-1

### 4.4 OR. STK Code

Mnemonic symbol and function

Table 4-4-1

Mnemonic symbol	Function
OR. STK	Right shift one bit of the stacked register after ST0 and ST1 logic OR

#### Code explanation

- OR.STK code is the separate code without any address.

Refer to the following programming:

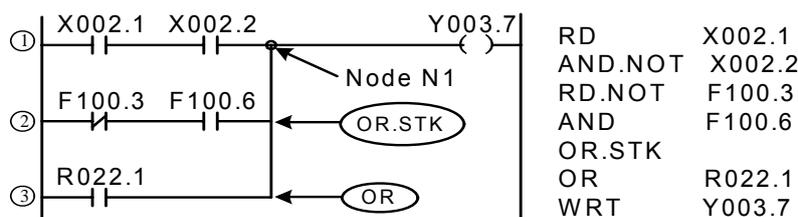


Fig. 4-4-1

There are three branches ①, ② and ③ from the left bus to the node N1. The branches ① and ② are series connection circuit block. When the series connection circuit block is performed between bus to node or among the nodes, other than the first branch, use the RD code when the following branch is ended. The branch ③ is not a series connection circuit block, which can be used by the OR code.

OR. STK and AND. STK are the code without operation component, which indicates the OR , AND relationships between circuit blocks.

### 4.5 AND.STK Code

Mnemonic symbol and function

Table 4-5-1

Mnemonic symbol	Function
AND.STK	Right shift one bit of the stacked memory after ST0 and ST1 logic AND

#### Code explanation

- Use the AND. STK coded when the branch circuit (parallel circuit block) is connected with series connection with the front of the circuit. The start of the branch is used RD, RD.NOT

code. Use the AND. STK code is connected with series connection with the front of the circuit after the series connection circuit block is executed.

- AND. STK code is the separate code without any address.

Refer to the following programming:

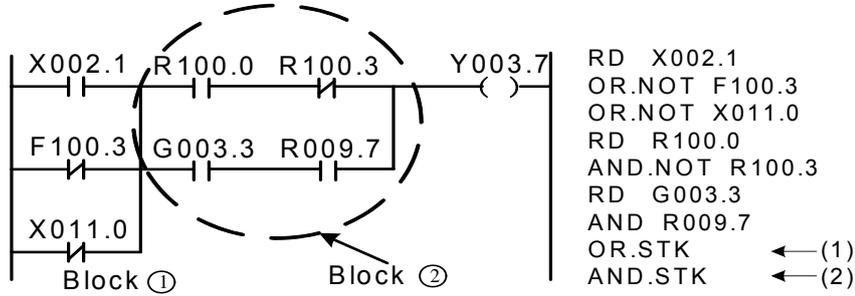


Fig. 4-5-1

As for the abovementioned ladder diagram and command table, (1)OR.STK indicates parallel connection of the series connection circuit block in the block ②, (2)AND.STK expresses the series connection between circuit block ① and ②.

## Chapter 5 PLC Functional Code

Basic codes such as controlling operations of machine tool are difficult to program, therefore, functional instructions are available to facilitate programming.

Table 5-1 (980TC3 PLC functional command code)

No.	Code	Function	No.	Code	Function
1	END1	End of a 1 <sup>st</sup> level ladder program	19	ROT	Binary rotation control
2	END2	End of a 2 <sup>nd</sup> level ladder program	20	SFT	Register shift
3	CALL	Subprogram call	21	DIFU	Rising edge check
4	CALLU	Unconditional subprogram call	22	DIFD	Falling edge check
5	SP	Subprogram	23	COMP	Binary comparison
6	SPE	End of subprogram	24	COIN	Coincidence check
7	SET	Set	25	MOVN	Transfer of an arbitrary number of bytes
8	RST	Reset	26	MOVB	Transfer of 1 byte
9	JMPB	Label jump	27	MOVW	Transfer of 2 bytes
10	LBL	Label	28	XMOV	Indexed data transfer
11	TMR	Timer	29	DSCH	Binary data search
12	TMRB	Fixed timer	30	ADD	Binary addition
13	TMRC	Timer	31	SUB	Binary subtraction
14	CTR	Binary meter	32	ANDF	Functional AND
15	DEC	Binary decoding	33	ORF	Functional OR
16	COD	Binary code conversion	34	NOT	Logical Negation
17	COM	Common line control	35	EOR	Exclusive OR
18	COME	End of common line control			

### 5.1 END1 (1<sup>st</sup> Level Sequence Program End)

Function:

It must be specified once in a sequence program, either at the end of the 1<sup>st</sup> level sequence, or at the beginning of the 2<sup>nd</sup> level sequence when there is no 1<sup>st</sup> level sequence. It can write 500 steps.

Format:

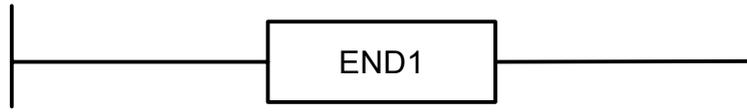


Fig. 5-1-1

## 5.2 END2 (2<sup>nd</sup> level sequence program end)

Function

Specify at the end of 2<sup>nd</sup> level sequence.

Format:

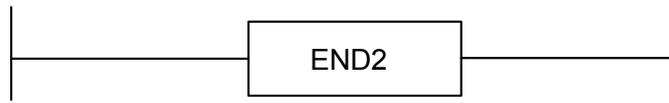


Fig.5-2-1

## 5.3 CALL (call subprogram)

Function

Call a specified subprogram.

CALL has the following additional functions:

The subprogram may be nested up to 18 levels by other subprograms, but if a dead cycle is made by the closed loop calling, an alarm will be issued by system. Therefore to execute the data volume under the control, the allowable subprogram calling times are 100, and the subprogram calling in the 1st level is disabled. Alarm will be issued for the instructions or network between SP and END2, SPE and SP which can't be executed by system.

Format:

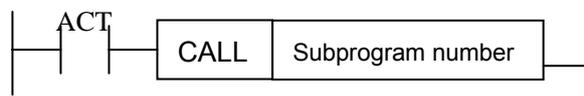


Fig. 5-3-1

Control condition:

ACT=0, execute the next instruction behind CALL.

ACT=1, call subprogram which number is specified.

Parameter:

Subprogram number: specifies the subprogram number of a subprogram to be coded following this

instruction. Range: 0~99.

## 5.4 CALLU (Unconditional Subprogram Call)

### Function:

Uncoditionally call a specified subprogram.

It has the following characteristics and limits:

The subprogram may be nested up to 18 levels by other subprograms, but if a dead cycle is made by the closed loop calling, an alarm will be issued by system. Therefore to execute the data volume under the control, the allowable subprogram calling times are 100, and the subprogram calling in the 1st level is disabled. Alarm will be issued for the instructions or network between SP and END2, after SPE and before SP which can't be executed by system.

### Format:

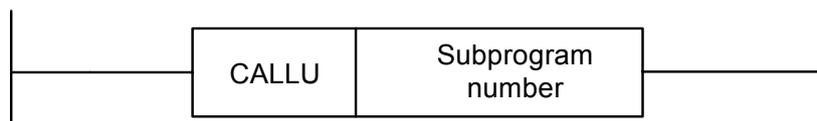


Fig.5-4-1

### Parameter:

Subprogram number: specifies the called subprogram number. Range: 0~99.

## 5.5 SP (Subprogram)

### Function:

The SP functional instruction is used to create a subprogram. A subprogram number is specified as a subprogram name. SP is used with the SPE functional instruction to specify the subprogram range.

### Note:

1. A subprogram must be written after END2.
2. Another subprogram cannot be nested into a subprogram.

### Format:

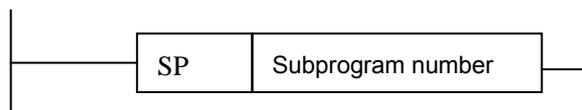


Fig. 5-5-1

### Parameter:

Subprogram number: specifies the called subprogram number. Range: 0~99.

## 5.6 SPE (Subprogram End)

### Function:

- \* it is used to specify the range of subprogram when SPE is used with the S P.
- \* the control will return to the main program which called the subprogram when the instruction is executed.
- \* the subprogram is written after END2.

### Format:

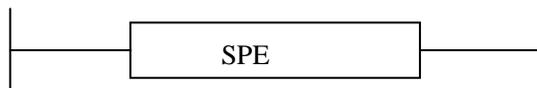


Fig. 5-6-1

### Example:

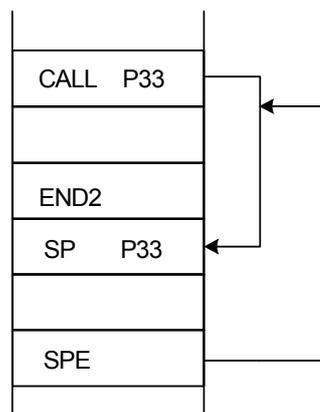


Fig. 5-6-2

## 5.7 SET (Set)

### Function:

Set to 1 for the specified address.

### Format:

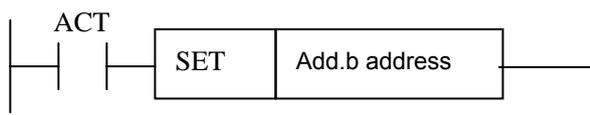


Fig. 5-7-1

### Control condition:

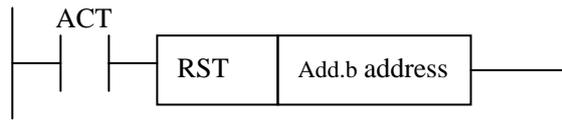
- ACT=0, keep add.b invariably.
- ACT=1, set add.b to1.

**Parameter:**

Add.b: set element address bit can be the output coil, Add= Y, G, R, K, A.

**5.8 RST (Reset)****Function:**

Set to 0 for the specified address.

**Format:****Fig. 5-8-1****Control condition:**

ACT=0, keep add.b invariably.

ACT=1, set add.b to1.

**Parameter:**

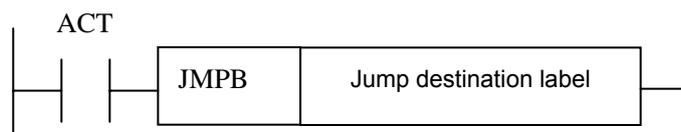
Add.b: reset element address bit can be the output coil, Add= Y, G, R, K, A.

**5.9 JMPB (Label Jump)****Function:**

The JUMP functional instruction transfer control to a Ladder immediately after the lable set in a ladder program.

JMPB has the following additional functions:

- \* More than one jump instruction can be coded for the same label.
- \* Jumped END1 and END2 are forbidden.
- \* Jumped subprogram and subprogram are forbidden.
- \* Jump back is permitted, but the user should handle the infinite loop may be caused by it .
- \* Jumped main program and subprogram are forbidden.

**Format:****Fig. 5-8-1****Control conditions:**

ACT=0: The next instruction after the JMPB instruction is executed.

ACT=1: jump to the specified label and executes the next instruction behind the label

**Parameter:**

Lx: specifies the label of the jump destination. A value from 0 to 99 can be specified.

### 5.10 LBL (Label)

**Function:**

The LBL functional instruction specifies a label in a ladder program. It specifies the jump destination for JMPB functional instruction.

Note: one xx label is only specified one time with LBL. Otherwise, the system alarms.

Format:

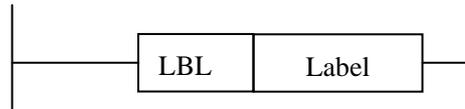


Fig. 5-10-1

**Parameter:**

xx: specifies the label of the jump destination. Label number range: 0~99.

**Example:**

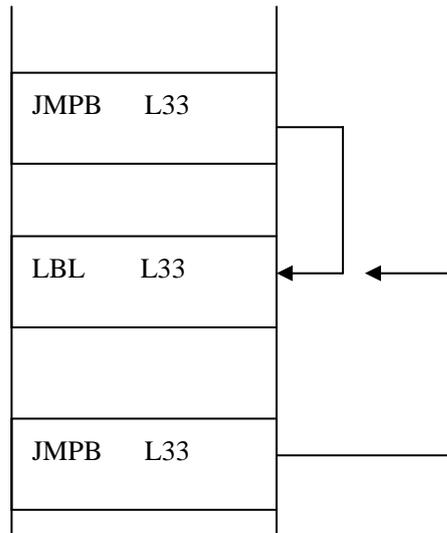


Fig. 5-10-2

### 5.11 TMR (Timer)

**Function:**

This is an on-delay timer.

Format:

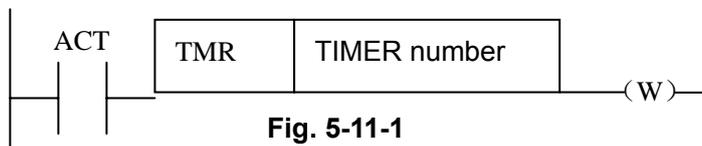


Fig. 5-11-1

**Control condition:**

ACT=0: turns off the timer relay.

ACT=1: initiates the timer. i.e. timing from 0.

**Detailed functions:**

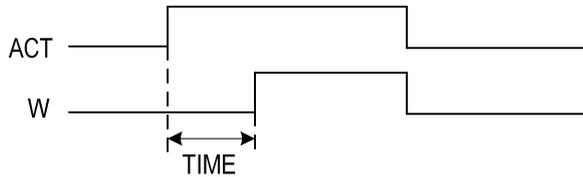


Fig. 5-11-2

**Parameter:**

TIMER : timer serial number is named with xxx which are numbers (0~127).

**Output:**

W : output coil. W=1 when the output reaches the preset value. W=0 when the output does not reach the preset value.

**Note:**

Timer is executed each 8ms, take ms as its setting unit, and 8ms is taken as the execution base. Those time less than 8ms are taken as 8ms. i.e. it is set for 54ms,  $54=6*8+6$ , 2ms is needed to be added, so the actual execution time is 56ms.

The time of the timer is set under the **【TMR】** of **【PLCPAR】** in PRG interface.

The system will automatically detect the range of the sequence number of the timer, alarm will be issued for those duplicate or beyond range sequence numbers.

## 5.12 TMRB (Fixed Timer)

**Function:**

This is an on-delay timer.

**Format:**

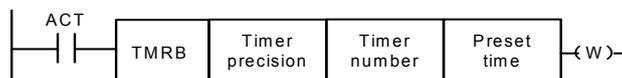


Fig. 5-12-1

**Control condition:**

ACT=0: turns off the timer relay.

ACT=1: initiates the timer.

**Detailed functions:**

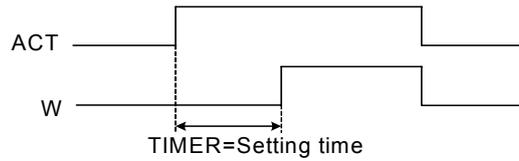


Fig. 5-12-2

**Parameter:**

TIMER : timer serial number is named with xxx which are numbers (0~127).

Table 5-12-1 (timer accuracy)

Type of timer	Setting number	Setting time	Error
8ms	0	8ms to 524.280s	0 to the 1 <sup>st</sup> level scanning period
48ms	1	48ms to 31.456min	0 to the 1 <sup>st</sup> level scanning period
1s	2	1s to 546 min	0 to the 1 <sup>st</sup> level scanning period
10s	3	10s to 182 h	0 to the 1 <sup>st</sup> level scanning period
1min	4	1min to 65535min	0 to 1s
1ms	5	1ms to 65.4s	0 to the 1 <sup>st</sup> level scanning period

Preset time:

The fixed time setting of the fixed timer, range: 0~65535.

**Output:**

W : output coil. W=1 when the output reaches the preset value. W=0 when the output does not reach the preset value.

**Note:** The system automatically check the timer's sequence number range. An alarm occurs when the serial number is repetitive or exceeds its range. The preset time of the timer is solidified in ROM with the ladder diagram, modifying the ladder diagram can modify the timer' time.

### 5.13 TMRC (Timer)

**Function:**

This is an on-delay timer.

**Format:**

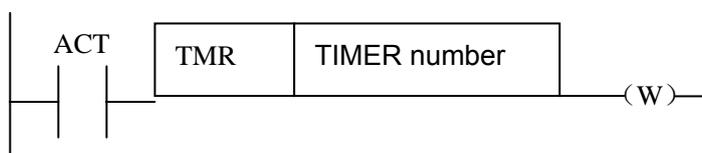


Fig. 5-10-1

**Control condition:**

ACT=0: turns off the timer relay.

ACT=1: initiates the timer. i.e. timing from 0.

**Detailed functions:**

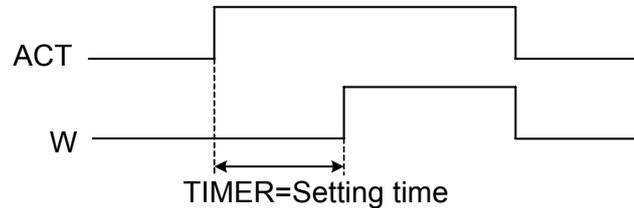


Fig. 5-13-2

**Parameter:**

TIMER : timer serial number is named with xxx which are numbers (0~127).

Table 5-12-1 (timer accuracy)

Type of timer	Setting number	Setting time	Error
8ms	0	8ms to 524.280s	0 to the 1 <sup>st</sup> level scanning period
48ms	1	48ms to 31.456 min	0 to the 1 <sup>st</sup> level scanning period
1s	2	1s to 546 min	0 to the 1 <sup>st</sup> level scanning period
10s	3	10s to 182 h	0 to the 1 <sup>st</sup> level scanning period
1min	4	1min to 65535min	0 to 1s
1ms	5	1ms to 65.4s	0 to the 1 <sup>st</sup> level scanning period

**Output:**

W : output coil. W=1 when the output reaches the preset value. W=0 when the output does not reach the preset value.

**Note:** Time of the timer is set under the **【TMR】** of **【+PLCPAR】** in PRG interface. TMRC timer and TMR timer share one address, so their sequence numbers cannot be repetitive. The system automatically check the timer's sequence number range. An alarm occurs when the serial number is repetitive or exceeds its range.

## 5.14 CTR (Binary Counter)

**Function:**

The data in the counter are binary and their functions are as follows:

- 1) Preset counter

Preset the count. It outputs a signal when the preset count is reached.

- 2) Ring counter

Upon reaching the preset count, returns to the initial value by issuing another counter signal.

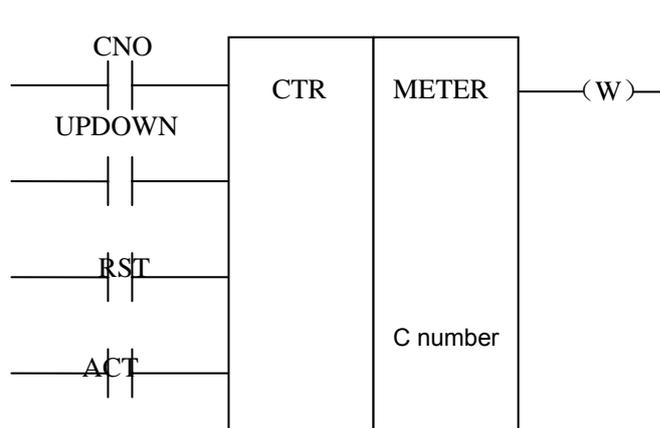
3) Up/down counter

The count can be either up or down.

4) Selection of initial value

Its initial value is 0 or 1.

**Format:**



**Fig. 5-14-1**

**Control condition:**

Specifies the initial value(CN0):

CN0=0: begins the value of the counter with 0.

CN0=1 begins the value of the counter with 1.

Specify up or down counter (UPDOWN):

UPDOWN=1: Up counter

UPDOWN=0: Down counter

Reset (RST):

RST=0: release reset.

RST=1: enable reset. When W=0, the integrated value is reset to the initial value.

RST is set to 1 only when reset is required.

Count signal(ACT):

ACT=1: count is made by catching the rise of ACT.

ACT=0: counter does not operate. W does not change.

**Parameter:**

METER: specifies the counter serial number with xxx which are numbers (0~127).

**Output:**

W: coil output. W=1 when the counter reaches the preset value.

**Note 1: The system automatically check the counter's sequence number range. An alarm occurs when the serial number is repetitive or exceeds its range.**

**Note 2:** After the ladder is upgraded, the current value of the counter is cleared.

To get reliable counter counting, reset the counter by the pulse signal before counting.

## 5.15 DEC (Binary Decode)

### Function:

DEC can decode binary code data. Outputs 1 when the eight-digit BCD signal is equal to a specified number, and 0 when not.

It is mainly used to decode M or T function.

### Format:

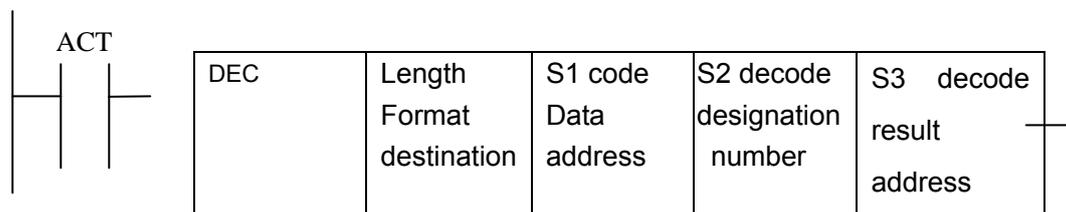


Fig. 5-15-1

### Control condition:

ACT=0 : resets all the output data bit.

ACT=1 : decode data. Results of processing is set in the output data address.

### Parameter:

length : Set the size of code data to the 1<sup>st</sup> digit of the parameter.

0001: code data is in binary format of 1 byte length.

0002: code data is in binary format of 2 byte length.

S1 : code data address. Specifies an address at which code data is stored.

S2 : number specification decode designation. Specifies the first of the 8 (1 byte) or 16 (2 bytes) continuous numbers to be decoded.

S3 : decode result address. Specifies an address where the decoded result shall be output.

A one-byte or two-byte area is necessary in the memory for the output.

### Example:

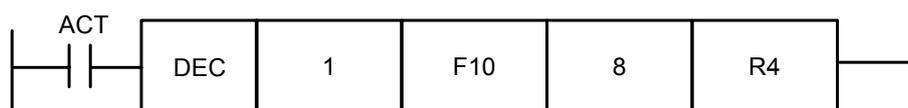


Fig. 5-15-2

When ACT=1 and F10=8, R4=0000,0001;

When ACT=1 and F10=9, R4=0000,0010;

.....  
 When ACT=1 and F10=15, R4=1000,0000;

## 5.16 COD (Binary Code Conversion)

### Function:

COD instruction automatically creates a table with corresponding size used for user inputting conversion table data when it inputs the data capacity. Each table has 10 lattices and if it is not divided by 10, count the lattices by its quotient adding 1, but its capacity data does not change.

### Format:

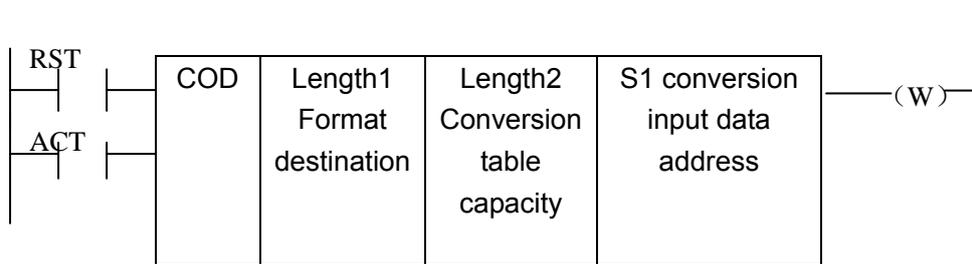


Fig. 5-16-1

Table 5-16-1

S1	0	1	2	.....	9
S2	XXX	YYY	AAA	.....	.....
S1	10	11	12	.....	N-1
S2	.....	.....	.....	.....	UUU

### Control conditions:

Reset (RST):

RST=0: do not reset.

RST=1: reset error output W.

Activate instruction (ACT):

ACT=0: do not execute COD.

ACT=1: execute COD. Take value of "Conversion input data address(S1)" as the table number of conversion table, take out a corresponding conversion data which corresponds to the table number from the conversion table, output the output address used for the conversion data (S2).

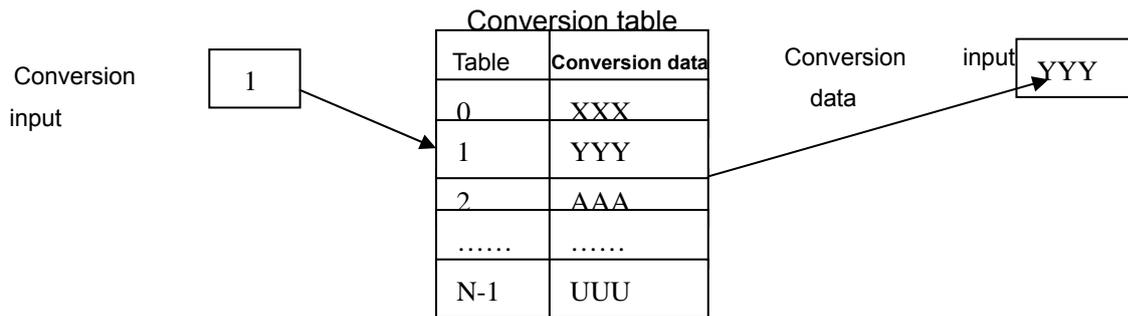


Fig. 5-16-2

**Parameter:**

Length1 : designates binary numerical size in the conversion table.

- 1: Numerical data is binary 1-byte data.
- 2: Numerical data is binary 2-byte data.

length2 : Capacity of conversion table data. 100 data can be made. 100 bytes when designating 1 byte format, and 100 words when 2 byte format. All number is at most 512 bytes in COD conversion table.

S1 : Data in the conversion data table can be taken out by specifying the table number. The address specifying the table number is called conversion input data address, and 1-byte memory is required from the specified address.

S2 : Conversion data output address. Memory of the byte length specified in the format designation is necessary from the specified address.

**Output:**

If there are any abnormality when executing the CODB instruction, W=1

**Note:** Size of the conversion data table is maximum 100. This conversion data table is programmed between the parameter conversion data output address of this instruction and the error output (W).

## 5.17 COM (Common Line Control)

**Function:**

This function can be used for specifying the number of coil till the common end code COME. If the common line end instruction is not specified, the system will alarm.

**Format:**

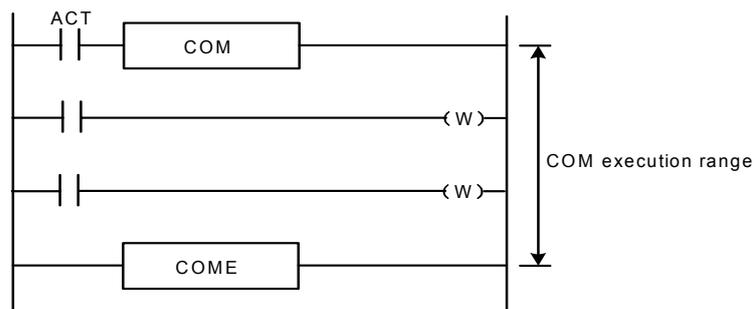


Fig.5-17-1

**Control condition:**

ACT=0: The specified number of coils or the coils within the region specified are unconditionally turned off (W=0).

ACT=1 it is the same with COM which is not executed.

**Note 1:** In the range specified with a COM instruction, no additional COM instruction can be specified.

**Note 2:** The coil for WRT.NOT in the range specified with a COM instruction is singly set to 1 when COM ACT=0.

**Note 3:** Do not use JMPB,END, END2, CALL, CALLU, LBL,SP,SPE, COM, COM between COM and COME, otherwise, an alarm occurs.

## 5.18 COME (Common Line Control End)

**Function:**

The instruction can be used to specify the control range of the common control line instruction (COM). This instruction cannot be used alone. It must be used together with the COM instruction.

**Format:**



Fig. 5-18-1

## 5.19 ROT (Binary Rotation Control)

**Function:**

Controls rotors, such as the tool post, rotary table, etc., and it is used for the following functions.

1. Selection of the rotation direction via the shorter path.
2. Calculation of the number of steps between the current position and the goal position; calculation of the position on position before the goal to the number of steps up to one position before the goal.
3. To calculate the position number just before the target position or the steps to the position just before the target position.

**Format:**

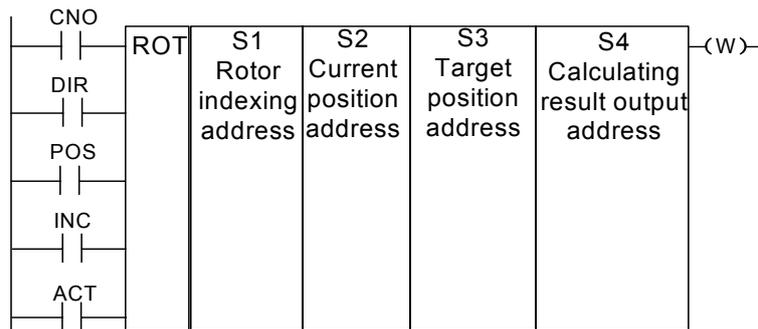


Fig.5-19-1

**Control conditions:**

Specify the starting number of the rotor(CNO):

CNO=0: begins the number of the position of the rotor with 0.

CNO=1: begins the number of the position of the rotor with 1.

Select the rotation direction via the shorter path or not: (DIR):

DIR=0: no direction is selected. The direction of rotation is only forward.

DIR=1: selected. The direction of rotation is forward/backward.

Specify the operating conditions (POS):

POS=0: calculate the goal position.

POS=1: calculates the position one position before the goal position.

Specify the position or the number of steps(INC):

INC=0: calculates the number of the position. If the position one position before the goal position is to be calculated, specify INC=0 and POS=1.

INC=1: calculates the number of steps. If the difference between the current position and the goal position is to be calculated, specify INC=1 and POS=0.

Execution instruction (ACT):

ACT= 0: the ROT instruction is not executed. W does not change.

ACT= 1: executed. Normally, set ACT=0. If the operation results are required, set ACT=1.

**Parameter:**

S1 : specify the rotor indexing number.

S2 : specify the address storing the current position.

S3 : specify the address storing the goal position(or instruction value), for example the address storing the CNC output T code.

S4 : calculate the number of steps for the rotor to rotate, the number of steps up to the position one position before, or the position before the goal. When the calculating result is to be used, always check that if ACT=1.

**Output:**

W: The direction of rotation for control of rotation via the shorter path is output to W. When W=0, the direction is forward (FOR) when 1, reverse (REV). The definition of FOR and REV is shown in the following figure. If the number given to the rotor is ascending, the rotation is FOR; if descending, REV. The address of W can be determined arbitrarily. When, however, the result of W is to be used, always check that ACT=1.

**Example:**

Rotor rotation direction:

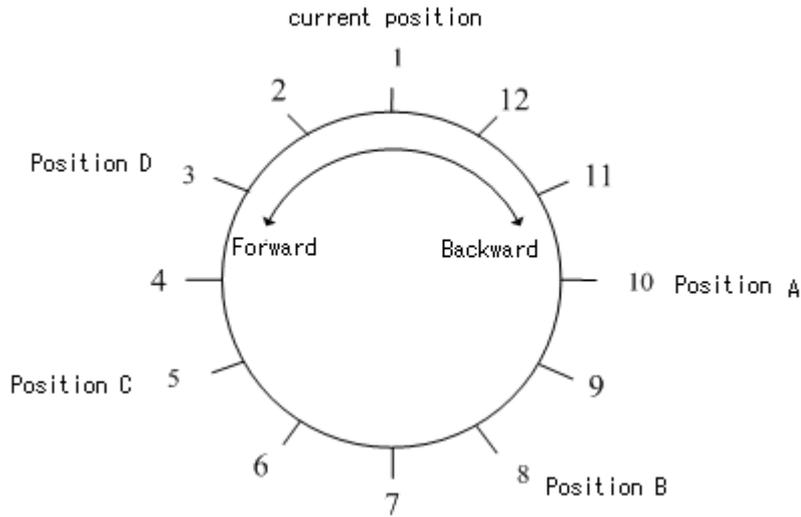


Fig. 5-19-2

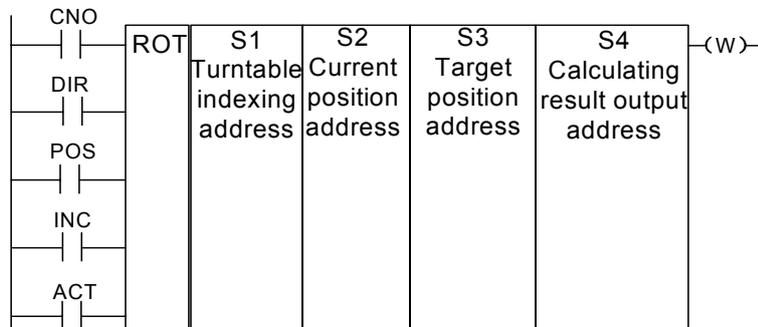


Fig. 5-19-3

Perform the short path rotation, and calculate the position number of previous one position of goal position.

Current position number S2=1, position number of rotation graduation S1=12, CNO=1, DIR=1 POS=1, INC=0:

- When S3=10 goal position is A, and ACT=1, S4=11, W=1.
- When S3=8 goal position is B, and ACT=1, S4=9, W=1.
- When S3=5 goal position is C, and ACT=1, S4=4, W=0.
- When S3=3 goal position is D, and ACT=1, S4=2, W=0.

## 5.20 SFT (Shift Register)

### Function:

This instruction can each time shift a byte data (8 bits) by a bits number set by a Parameter, For the circular shifting, each overflowing "1" will be added reversely, i.e. If the highest bit "1" is overflowed by the left shifting, so the lowest bit will be filled by "1", vice versa.

### Format:

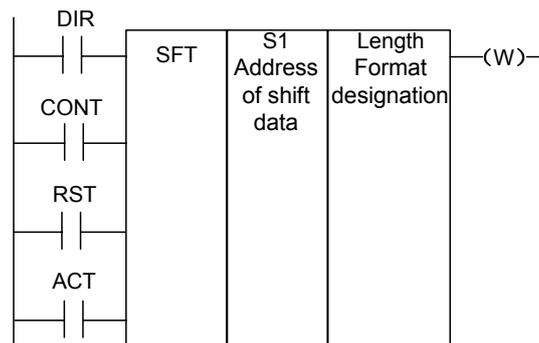


Fig.5-20-1

### Control conditions:

Shift direction specification (DIR)

DIR=0: Left shift

DIR=1: Right shift

Condition specification (CONT)

CONT=0: do not cycle shift

CONT=1: cycle shift

Reset (RST)

The shifted out data(W=1) is reset (W=0).

RST=0: W is not reset.

RST=1: W is reset (W=0).

Actuation signal (ACT)

ACT=0: do not execute SFT instruction.

ACT=1: shifting processing is done when ACT=1. For shifting one bit only, execute an instruction when ACT=1, and then, set ACT to 0.

### Parameter:

S1 : set the big shift data address which consists of a storage area with one byte.

Length : a 4-digit number, its definition is shown below:

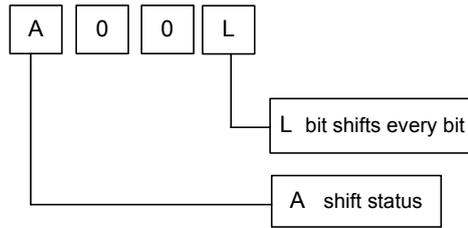


Fig. 5-20-2

L : range: 0~8.

A : bit parameter. A=0: When ACT=1 is shifting, the shift period is one bit.

A=1: ACT is taken as a pulse signal, it is 1 from 0, shift one bit.

**Output:**

W : W=0: "1" was not shifted out because of the shift operation.

W=1: "1" was shifted out because of the shift operation.

### 5.21 DIFU (Rising Edge Check)

**Function:**

The DIFU instruction sets the output signal to 1 for one scanning cycle on a rising edge of the input signal.

**Format:**

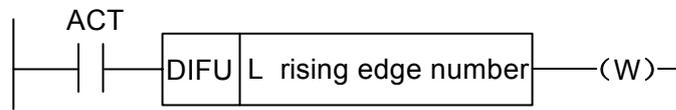


Fig. 5-21-1

**Control condition:**

Input signal: On a rising edge (0→1) of the input signal, the output signal is set to 1.

Output signal: The output signal level remains at 1 for one scanning cycle of the ladder level where this functional instruction is operating.

Parameter: Rising edge number

**Parameter:** L : rising edge number, range 0~255. Another DIFU instruction or DIFD instruction in the ladder uses the same number, an alarm occurs.

**Operation:**

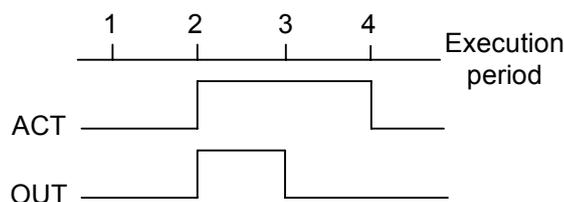


Fig. 5-21-2

The system will check the sequence number of the rising edge automatically, when the number exceeds the range or the number is duplicated, an alarm occurs.

## 5.22 DIFD (Falling Edge Check)

### Function:

The DIFD instruction set the output signal to 1 for one scanning period on a falling edge of the input signal.

### Format:

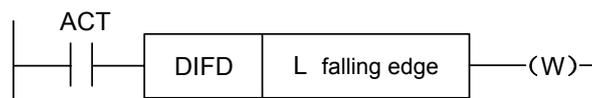


Fig. 5-22-1

### Control conditions:

Input signal: on a falling edge (1→0) of the input signal, the output signal is set to 1.

Output signal: the output signal level remains at 1 for one scanning period of the ladder level where this functional instruction is operating.

### Parameter:

L : rising edge number, range 0~255. Another DIFU instruction or DIFD instruction in the ladder uses the same number, the system will alarm.

### Operation

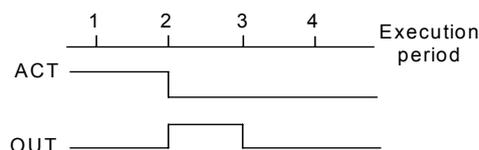


Fig. 5-22-2

The system checks the sequence number of the falling edge automatically, when the number exceeds the range or the number is duplicated, alarm occurs.

## 5.23 COMP (Binary Comparison)

### Function:

Compares binary values. Specifies enough byte to store the input data and the comparison data in the memory.

### Format:

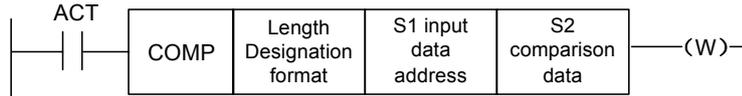


Fig. 5-23-1

**Control conditions:**

ACT=0: The COMP instruction is not executed. W does not alter.

ACT=1: The COMP instruction is executed.

**Parameter:**

Length: specification format( constant or address) and data length(1 or 2 bytes) for the input data.

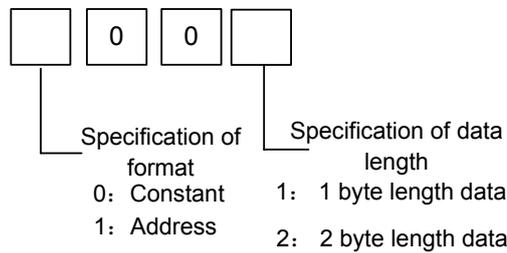


Fig. 5-23-2

S1, S2: content of comparison source 1 and comparison source 2. It can be constant and also be address number.

Address number: R, X, Y, F, G, K, A, D, T, C.

**Output:**

W=0: input data > comparison data

W=1: input data ≤ comparison data

## 5.24 COIN (Coincidence Check)

**Function:**

Check whether the input value and comparison value coincide.

**Format:**

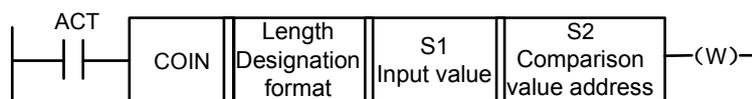


Fig.5-24-1

**Control conditions:**

ACT=0, the COIN instruction is not executed. W does not change.

ACT=1, the COIN instruction is executed.

**Parameter:**

Length: specification format( constant or address) and data length(1 or 2 bytes) for the input data.

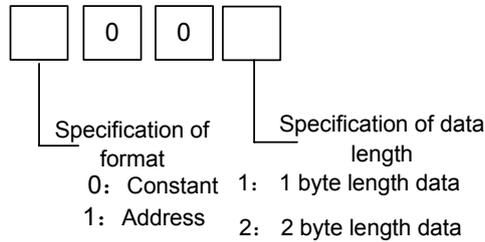


Fig. 5-24-2

- S1 : The input data can be specified as either a constant or an address storing it.
- S2 : address storing of comparison data.

**Output:**

- W : W=0: input value ≠comparison value
- W=1: input value=comparison value

## 5.25 MOVN (Transfer of Data)

**Function:**

The MOVN instruction transfers data from source address and a specified binary data to a specified destination address.

**Format:**

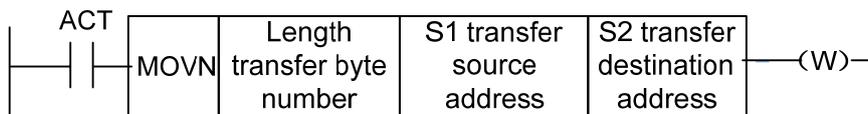


Fig. 5-25-1

**Control condition:**

- ACT=0: No data is transferred.
- ACT=1: The byte of specified number is transferred.

**Parameter:**

- Length : transferred byte number.
- S1 : stating byte of address or constant of source data.  
Selecting transfer format according to S1:
  1. S1 is constant: if S2 is single byte address, S1 in byte unit is copied to address corresponding to Length byte which takes S2 as

the initial; if S2 is word unit, S2 in word unit is copied to the address corresponding to Length word which takes S2 as the initial.

2. S1 is address: S1 and S2 transmit the data in byte in spit if S1 and S2 address classifications are matched.

S2 : starting byte of destination address.

**Example:**

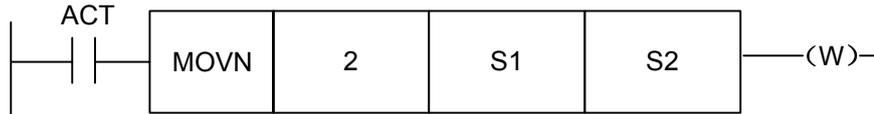


Fig. 5-25-2

1. When S1 is the constant, 5 and S2 is R60, R60=00000101, R61=00000101
2. When S1 is the constant, 5 and S2 is D60, D60=5, D61=5.
3. When S1 is the address D, 50 and S2 is D60, D60=50

W=1, the specified number byte is delivered.

W=0, no data be delivered.

If it detects that it exceeds the range of parameter type in transferring, an alarm occurs.

## 5.26 MOVB (Transfer of One Byte)

**Function:**

The MOVB instruction transfer one-byte data from a specified source address to a specified destination address.

**Format:**

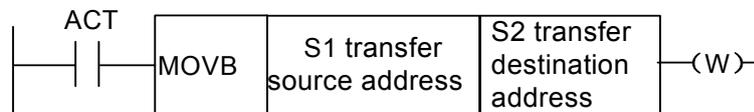


Fig. 5-26-1

**Control conditions:**

ACT=0, No data is transferred.

ACT=1, one-byte data is transferred.

**Parameter:**

S1 : source address or constant.

when S2 is a single-byte address, S1 with byte value is copied to S2 address; when S2 is a word address, S1 with byte value is copied to S2 lower-byte address.

S2 : destination address.

## 5.27 MOVW (Transfer of Two-Byte)

### Function:

The MOVW instruction transfer two-byte data from a specified source address to a specified destination address.

### Format:

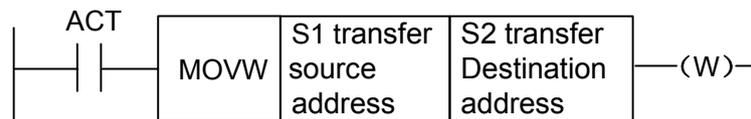


Fig. 5-27-1

### Control conditions:

ACT=0, no data is transferred.

ACT=1, two-byte is transferred.

### Parameter:

S1 : source address or constant.

S2 : destination address.

## 5.28 XMOV (Binary Index Modifier Data Transfer)

### Function:

This function instruction instructs reading and rewriting of data in the data table. Number of data (table capacity) in the data table can be specified by specifying the address. In PLC run, perform the data table according to the user' setting.

### Format:

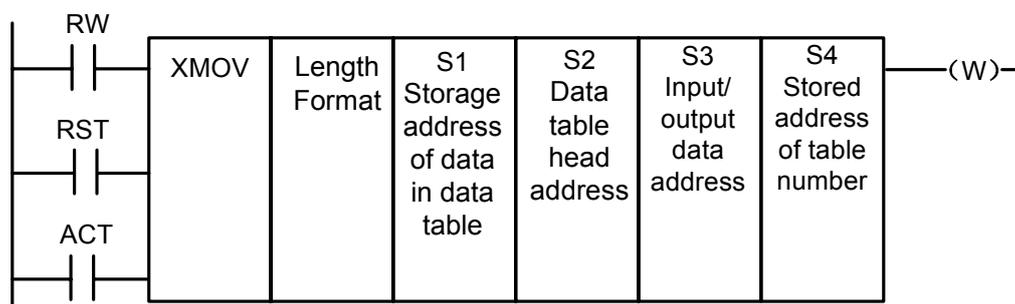


Fig. 5-28-1

### Control conditions:

Read, write designation (RW)

RW=0: read data from data table.

RW=1: write data to data table.

Reset (RST)

RST=0: reset release.

RST=1: reset W=0.

Activation code(ACT)

ACT=0 : do not execute XMOV, and there is no change in W.

ACT=1 : execute XMOV code.

**Parameter:**

Length : specifies the transferred data length.

1: 1-byte long data.

2: 2-byte long data

S1 : data capacity 's stored address of the data table. The address is used to store the data table's data capacity. Its occupied byte quantity meets the length specified by Length, and the valid range of data is determined by the byte length specified by Length1 format.

1-byte length: 1 to 512.

2-byte length: 1 to 256. namely  $256 \times 2 = 512$  bytes, which is the PLC data table's capacity.

S2 : set head address in the data table. The memory area of data table (byte length) X number of data table. The table head address must be the value set in D data table.

S3 : Input/output data address. In case of reading, set the address of memory which stores a reading result. In case of the writing, set the address of the memory which stores a writing result, its occupied byte number meets the setting of Length format. Limit the address to D register.

S4 : Index storage address. It is used to read or write store an index value. Its occupied byte number meets the designation. When the set index address is more than the data stored in S1, error output W=1.

Actual transmission address= head address + index value, index value is  $0 \sim (S1-1)$ , the actual transmission address cannot exceed the data table.

**Output:**

In the case where the index value exceeds the value set in S1, W=1, the reading or writing of the data table isn't executed.

W=0, no error.

W=1, error found

## 5.29 DSCH (Binary Data Search)

**Function:**

The DSCH instruction is used to search the binary data in data table. The number of data (table

capacity) in the data table can be specified by specifying the address. Thus allowing change in table capacity even after writing the sequence program in the ROM.

**Format:**

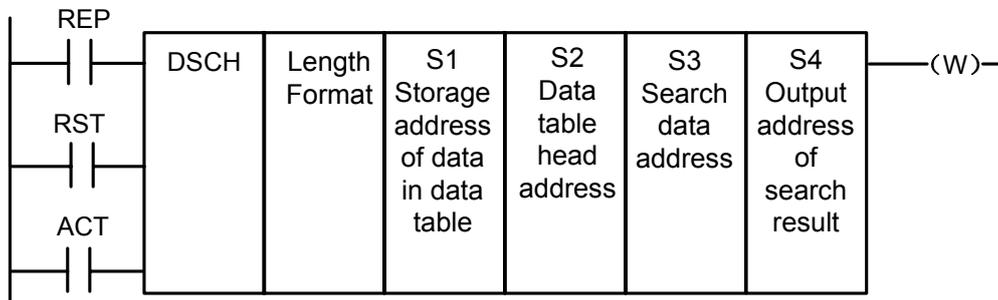


Fig. 5-29-1

**Control conditions:**

Check repetition (REP)

REP=0: Execute the DSCH instruction, search begins from the head address, and the repetition will be omitted, the search stops when the target data is found in the first time, and output its address. If the searched data is not found, W=1.

REP=1: Execute the DSCH instruction, if the searched data is not found or is two (or more than two) , W=1.

Reset (RST)

RST=0: Release reset.

RST=1: Reset. W=0.

Activation instruction (ACT):

ACT=0 : Do not execute DSCH instruction, W does not change.

ACT=1 : Execute DSCH instruction. If the search data is found, table number where the data is stored will be output. If the search data is not found, W becomes 1.

**Parameter:**

Length : Specifies data length

1: 1-byte long data.

2: 2-byte long data.

S1 : Storage address of number of data in data table. This address requires memory of number of byte according to the format designation. Number of data in the table is n+1(head number in the table is 0 and the last number is n).

S2 : Data table head address.

S3 : Search data input address.

S4 : Search result output address. Actual transmission address=head address +index value, index value is 0~(S1-1), the actual transmission address

cannot exceed the data table. After searching, if search data is found, the table number where the data is stored will be output. The searched table number is output in this search result output address. This address requires memory of number of byte according to the format designation.

**Output:**

- W=0, Search data found.
- W=1, Search data not found.

### 5.30 ADD (Binary Addition)

**Function:**

This instruction performs binary addition between 1-, 2-byte data. In the operation result register, operation data is set besides the numerical data representing the operation results. The required number of bytes is necessary to store each augend, the addend, and the operation output data.

**Format:**

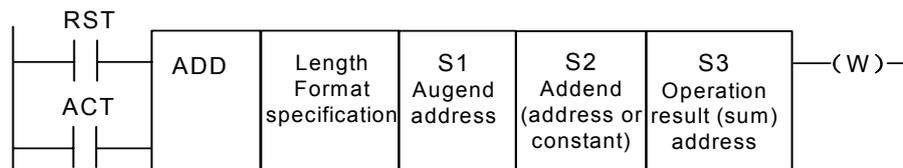


Fig. 5-30-1

**Control conditions:**

Reset (RST):

- RST=0: Release reset.
- RST=1: Reset. W=0.

Activation instruction (ACT):

- ACT=0 : Do not execute ADD. W does not changed.
- ACT=1 : Execute ADD.

**Parameter:**

Length : Specifies data length(1 or 2 bytes) and the format for the addend(constant or address).

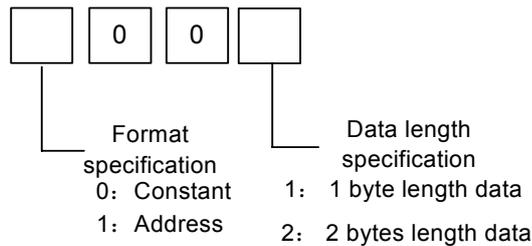


Fig. 5-30-2

- S1 : Address containing the augend
- S2 : Length specification determines the format of the addend.
- S3 : Specify the address to contain the result of output operation.

**Output:**

W=0: Operation correct.

W=1: Operation incorrect.

When W=1, the result of addition exceeds the specified data length.

### 5.31 SUB (Binary Subtraction)

**Function:**

This instruction executes the subtraction operation in the binary format of 1 or 2 bytes. In the operation result register, operation data is set besides the numerical data representing the operation. A required number of bytes is necessary to store the subtrahend, and the result.

**Format:**

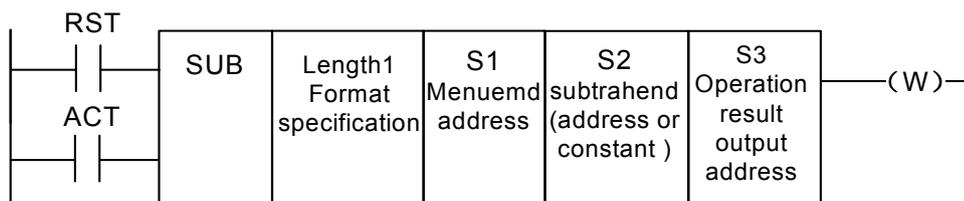


Fig. 5-31-1

**Control conditions:**

Reset (RST):

RST=0: Release reset.

RST=1: Reset. W=0.

Activation instruction (ACT):

ACT=0 : Do not execute SUB. W does not change.

ACT=1 : Execute SUB.

**Parameter:**

Length : Specifies data length(1 or 2 bytes) and the format for the subtrahend(constant or address).

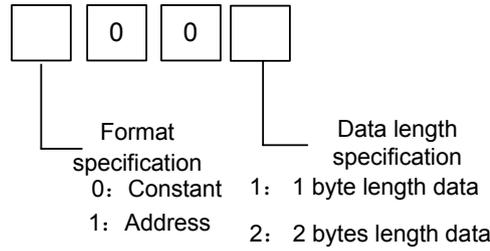


Fig. 5-31-2

- S1 : Address containing the minuend.
- S2 : Specification determines the Length.
- S3 : Specifies the address to contain the result of operation.

**Output:**

W=0: Operation correct.

W=1: Operation incorrect.

When W=1, the result of subtraction exceeds the specified data length.

### 5.32 ANDF (Functional And)

**Function:**

The ANDF instruction ANDFs the contents of address A with a constant (or the contents of address B), and stores the result at address C.

**Format:**

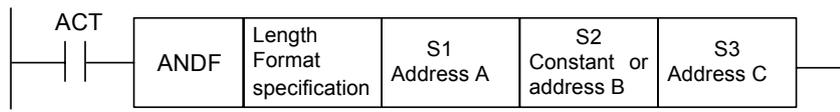


Fig. 5-32-1

**Control conditions:**

ACT=0 : The ANDF instruction is not executed.

ACT=1 : The ANDF instruction is executed.

**Parameter:**

Length : Specify a data length (1 or 2 bytes), and an input data format (constant or address specification).

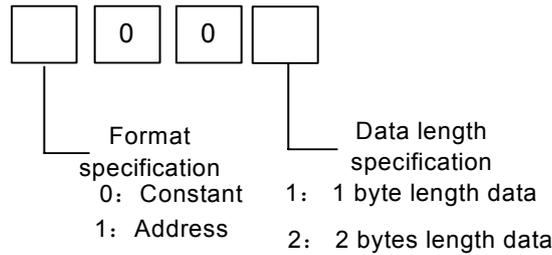


Fig. 5-32-2

- S1 : Input data to be ANDed. The data that is held starting at this address and has the data length specified in Length format specification is treated as input data.
- S2 : Input data to be ANDed with. When address specification is selected in format specification, the data that is held starting at this address and has the data length specified in Length format specification is treated as input data.
- S3 : Address used to store the result of an ANDF operation. The result of and ANDF operation is stored starting at this address, and has the data length specified in Length format specification.

**Example::**

When address A and address B hold the following data:

Address A	1	1	1	0	0	0	1	1
Address B	0	1	0	1	0	1	0	1

The result of the ANDF operation is as follows:

Address C	0	1	0	0	0	0	0	1
-----------	---	---	---	---	---	---	---	---

### 5.33 ORF (Functional Or)

**Function::**

The ORF instruction ORFs the contents of address A with a constant (or the contents of address B), and stores the result at address C.

**Format:**

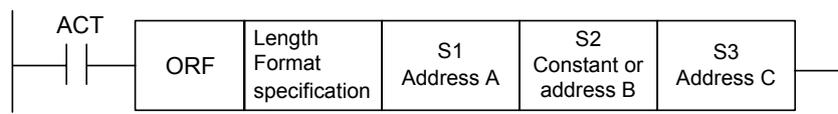


Fig. 5-33-1

**Control conditions:**

ACT=0 : The ORF instruction is not executed.

ACT=1 : The ORF instruction is executed.

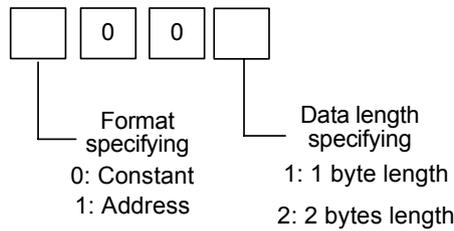


Fig. 5-33-2

**Parameter:**

Length: Specify a data length(1 or 2 bytes), and an input data format(constant or address specification).

- S1 : Specify the input data to ORed. The data that is held starting at this address and has the data length specified in Length format specification is treated as input data.
- S2 : Input data to be ORed with. When address specification is selected in format specification, the data that is held starting at this address and has the data length specified in Length format specification is treated as input data.
- S3 : Address used to store the result of an ORF operation. The result of an ORF operation is stored starting at this address, and has the data length specified in format specification.

**Example:**

When address A and address B hold the following data:

Address A	1	1	1	0	0	0	1	1
-----------	---	---	---	---	---	---	---	---

Address B	0	1	0	1	0	1	0	1
-----------	---	---	---	---	---	---	---	---

ORF operates results are as follows:

Address C	1	1	1	1	0	1	1	1
-----------	---	---	---	---	---	---	---	---

**5.34 NOT (Logical Not)**

**Function:**

The NOT instruction inverts each bit of the contents of address A, and stores the result at address B.

**Format:**

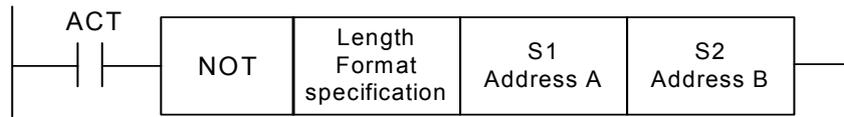


Fig. 5-34-1

**Control condition:**

ACT=0: The NOT instruction is not executed.

ACT=1: The NOT instruction is executed.

**Parameter:**

Length : Specifies a data length (1 or 2 bytes).

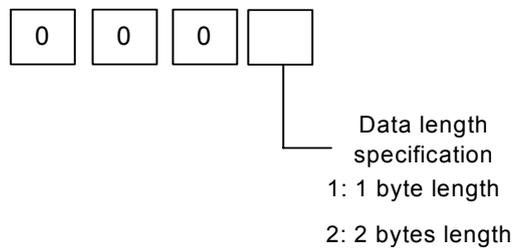


Fig. 5-34-2

S1 : Input data to be inverted bit by bit. The data that is held starting at this address and has the data length specified in Length format specification is treated as input data.

S2 : Address used to output the result of a NOT operation. The result of a NOT operation is stored starting at this address. And has the data length specified in Length format specification.

**Example:**

When address A holds the following data:

Address A	1	1	1	0	0	0	1	1
-----------	---	---	---	---	---	---	---	---

The result of the NOT operation is as follows:

Address B	0	0	0	1	1	1	0	0
-----------	---	---	---	---	---	---	---	---

### 5.35 EOR (exclusive or)

**Function:**

The EOR instruction exclusive-Ors the contents of address A with a constant (or the contents of

address B), and stores the result at address C.

**Format:**



Fig. 5-35-1

**Control conditions:**

ACT=0 : The EOR instruction is not executed.

ACT=1 : The EOR instruction is executed.

**Parameter:**

Length : Specify a data length (1 or 2 bytes) and an input data format(constant or address specification).

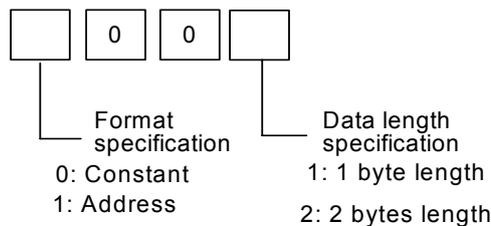


Fig. 5-35-2

- S1: Input data to be exclusive-ORed. The data that is held starting at this address and has the data length specified in Length format specification is treated as input data.
- S2: Input data to be exclusive-ORed with. When address specification is selected report that specification, the data that is held starting at this address and has the data length specified in Length format specification is treated as input data.
- S3: Address used to store the result of an exclusive EOR operation. The result of an exclusive EOR operation is stored starting at this address, and has the data length specified in Length format specification.

**Example:**

When address A and B hold the following data:

Address A

1	1	1	0	0	0	1	1
---	---	---	---	---	---	---	---

Address B

0	1	0	1	0	1	0	1
---	---	---	---	---	---	---	---

The result of the exclusive EOR operation is as follows:

Address C

1	0	1	1	0	1	1	0
---	---	---	---	---	---	---	---

## Chapter 6 Ladder Writing Limit

1. Sequence program must have END1 and END2 which are taken as the end marks of 1<sup>st</sup> level and 2<sup>nd</sup> level sequence part, and END1 must be before END2.
2. They only support the parallel output and do not support the multi-level output.
3. The result output address in all basic instructions and output function instruction are not set the following addresses:
  - 1) Counter preset address DC, timer preset address DT.
  - 2) K0~K5 address are occupied by the system, and the user can't define them.
  - 3) R990, R991 address are occupied by the system. and the user can't define them.
  - 4) X address on IO input interface and CNC→PLC F address.
4. Such case like vertical line overhanging, node disconnected, horizontal through line paralleling to the node network will result in the nodes or network that can't be executed, so alarm will be issued by the system.
5. Star network, in which there is no direct connection between the vertical lines of different lines in a column, and a line in the middle isn't jointed with a vertical line. So alarm will be issued because the case can't be processed by the system.
6. The upward convex is not allowed in the network. That is there is a parallel network above the nodes of a line, and no line can be connected to this network. So alarm will be issued

The followings are the phrasing error, and an alarm occurs.

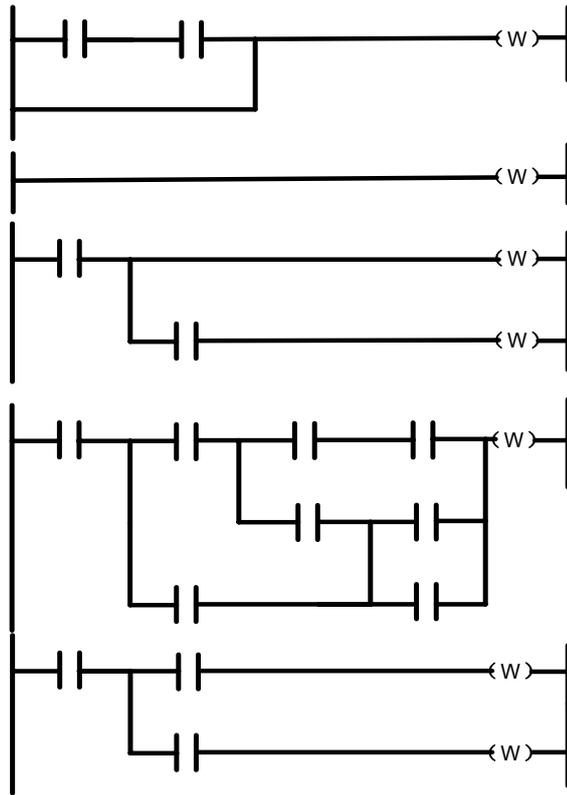


Fig.6-1

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## II Operation



## Chapter 1 PLC Interface Display

### 1.1 Automatic Operation when GSK980TC3 PLC Power on

PLC starts after power on: it will make use of R910.0 to conduct the net contain it during the first period, and then set R910.0 to "0" which can't be output, the value of the keep relay gets from the PLC last output before stop running.

**Note:** The keys during < > are the panel; the ones in【 】are the soft keys; 【 】 is the interface corresponding the current soft key;  reports there is the sub-menu in the menu; all operations in PCL are executed during MDI mode and only view and search can be executed during other modes.

### 1.2 INFO interface display

#### 1.2.1 INFO interface

Press <INFO> key on the panel to enter the default INFOR interface as Fig. 1-2-1-1. If the **【INFO】** soft key has not found on the below of the screen, the bit parameter No: 26#6=1 can be defined to set the key on the PLC interface, and then <INFO> is pressed to enter INFO interface. There is the version number, modification data, PLC I/O interface definition state and so on INFO interface.

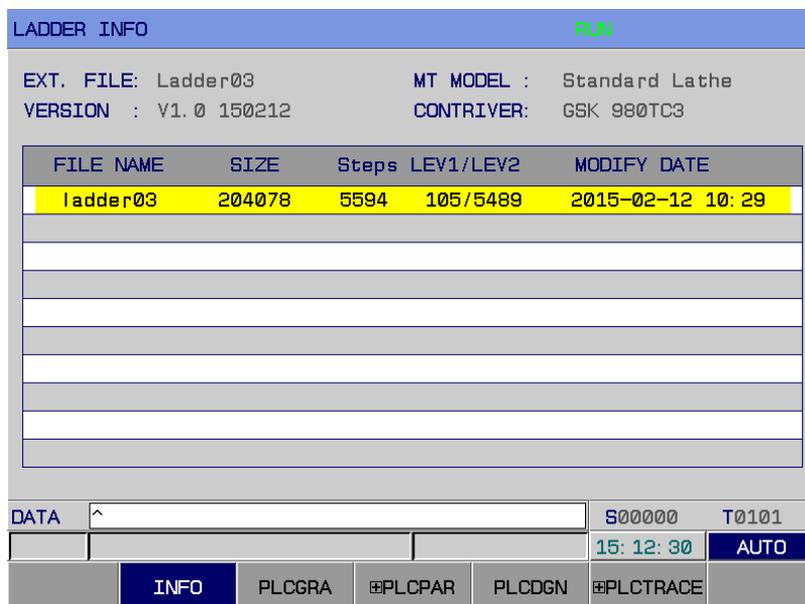


Fig. 1-2-1-1

- (1) The system appears the ladder name which is running in the interface. The ladder is divided into three: the ladder is the only one that is running, other 15 ladders in No.0-15 ladder besides the one is running, up to 4 ladders which can be editable or referred.(they can be named with 2-digit serial number except for 0-15).
- (2) When the system is turned on, the bit parameter 53#0~#3 setting value is the binary combination parameter, when the setting value is 0, No.0 ladder is used; when it is 1~15, No. 0~15 parameter is used. After the system determines to load some ladder which is running ( the operation maybe appear the danger, it is enabled after the system restarts). If the format is incorrect, the ladder is deleted to recreated, and the user needs to specify the running ladder No. carefully. Names of all ladder files must be with "ladderXX.grp" (XX is the serial number) , otherwise, the system does not identify the files. The file format is determined by the system, and the user cannot modify the file outside of the system, otherwise, the file maybe be deleted or cannot be identified.
- (3) Selecting ladder. Move the cursor or input "LX"/"LXX" (X/XX is number) to specify the file name, the system checks whether "X"/"XX" is the known file number after "Enter" is pressed, if the system has not checked it, it creates an ladder with the name "ladder0X.grp" or "ladderXX.grp" . The system automatically creates "END1" and "END2" when the file is created.
- (4) The file head includes the basic information of file, such as row number, step number. The step information is the new one when it is converted. The user can delete the ladder which is not opened and is not running, which must be executed orderly. After the user opens the ladder which is not running, the system stops refreshing the ladder network information to avoid the mistake. When the cursor stops in the background edit file the user can press "Change" to open 【LADDER】 to modify the file ground (including ladder version number, adaptive machine tool, ladder maintenance personnel).

### 1.2.2 PLCGRA Interface

Press 【**PLCGRA**】 to enter **PLCGRA** interface or define the bit parameter N0: 26#6=1 to press <INFO> key on the PLC interface to enter **PLCGRA** interface as Fig.1-2-2-1:



Fig. 1-2-2-1

Contents and operations on **PLCGRA** interface:

PLCGRA[ladder03]: current ladder name.

1/1259: current line position specified by the cursor during the ladder the cursor.

RUN: operation state of ladder, including RUN/run, STOP/stop, DEBUG/debug.

Diagram: ladder program.



Input: display the input data. Press  in the panel to view the input data.

MEA: Commentaries of element positioned by the cursor.

MDI mode: current operation mode

Press the Page Up/Page Down, four Direction keys to search, view and modify the elements.

### 1.2.3 PLCPAR Interface

Press **[PLCGRA]** to enter **PLCPAR** interface or define the bit parameter N0: 26#6=1 to press **<INFO>** key on the PLC interface to enter **PLCPAR** interface as Fig.1-2-3-1.

K PARAMETER									RUN
ADDR	Bit7	Bit6	Bit5	Bit4	Bit3	Bit2	Bit1	Bit0	
K000	0	0	0	0	0	0	0	0	
K001	0	0	0	0	0	1	1	0	
K002	0	0	0	0	0	0	0	0	
K003	0	0	0	0	0	0	0	0	
K004	0	0	0	0	0	0	0	0	
K005	0	0	0	0	0	0	0	0	
K006	0	0	0	0	0	1	0	0	
K007	1	0	0	0	0	0	0	1	
K008	0	0	0	0	0	0	0	0	
K009	0	0	0	0	0	0	1	0	
K010	0	0	0	0	0	0	0	0	
K011	0	0	0	0	0	0	0	0	

PLCPAR \*\*\*\*\* CLEANY SIGN PARSW

DATA	^	S00000	T0101
		15:13:03	AUTO

INFO    PLCGRA    **PLCPAR**    PLCDGN    PLCTRACE

Fig. 1-2-3-1

Contents and operations on PLCPAR interface:

RUN : operation state of ladder

ADDR: keep relay address

Bit0~Bit7 : bit status of keep relay address

1: the address maintains the state before power OFF

0: the address resets to default state after power OFF

Input: display the input data.

MDI mode: current operation mode(note: the relative parameter of PLCPAR can be modified only in MDI mode).

Press the Page Up/Page Down, four Direction keys to search, view and modify the elements.

### 1.2.4 PLCDGN Interface

Press **PLCDGN** to enter PLCDGN interface or define the bit parameter N0: 26#6=1 to press **<INFO>** key on the PLC interface to enter PLCDGN interface as Fig.1-2-4-1.

SIGNAL DIAGNOSE									RUN
ADDR	Bit7	Bit6	Bit5	Bit4	Bit3	Bit2	Bit1	Bit0	
F000	0	1	0	0	0	0	0	0	
F001	0	0	0	0	0	0	0	0	
F002	0	0	0	0	0	0	0	0	
F003	0	0	1	0	0	0	0	0	
F004	0	0	0	0	0	0	0	0	
F005	0	0	0	0	0	0	0	0	
F006	0	0	0	0	0	0	0	0	
F007	0	0	0	0	0	0	0	0	
F008	0	0	0	0	0	0	0	0	
F009	0	0	0	0	0	0	0	0	
F010	0	0	0	0	0	0	0	0	
F011	0	0	0	0	0	0	0	0	

DP SA STL SPL \*\*\*\*\* \*\*\*\*\* \*\*\*\*\* RWD

DATA	^	S00000	T0101
		15:13:38	AUTO

INFO PLCGRA **PLCDGN** PLCTRA

Fig. 1-2-4-1

Contents and operations on PLCDGN interface:

RUN: operation state of ladder.

ADDR: address of diagnosis number.

N.0~N.7: bit number state of diagnosis address.

1: the signal is connected;

0: the signal is not connected.

Input: display the input data.

MDI mode: current operation mode.

Press the Page Up/Page Down, four Direction keys to search the corresponding diagnosis number.

Generally, only the searching can be operated in the interface, the I/O interface of PLC enters the signal debug mode only when the user gets the authority to set K0.1 to 1. At the moment, the user can modify the X, Y signal.

### 1.2.5 PLCTRA Interface

PLCTRA interface is consist of two interfaces "Setting" and "TRACE". Press **【PLCTRA】** to enter PLCTRA "SETTING" interface.

PLCTRA "SETTING" interface is shown in Fig.1-2-5-1:

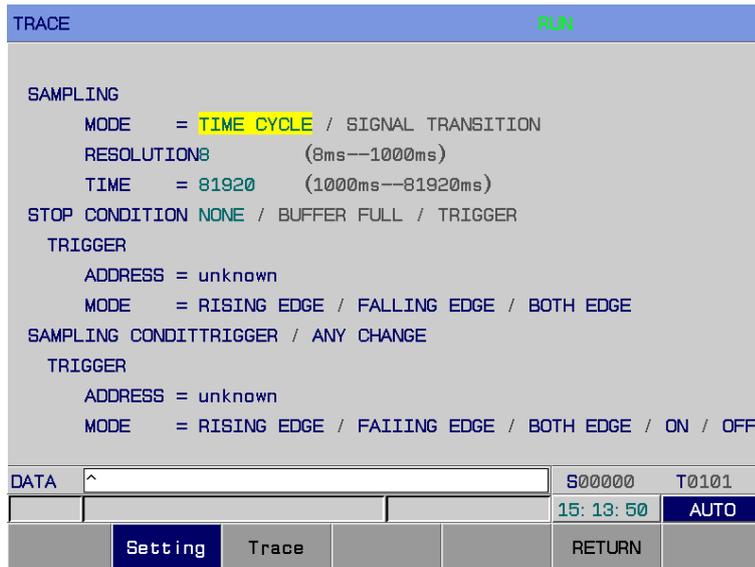


Fig. 1-2-5-1

The content and operation of the **PLCTRA** “SETTING” interface

(1) Mode:

- - Periodic cycle: periodic sampling for each time.
- - Signal change: sampling for the change of current signal.

(2) Resolution:

Input the sampling resolution, the default value is the least resolution (8ms), its range is (8ms --1000ms).

The input value uses the multiple of the 8ms.

(3) Time limit:

When the sampling mode is set to “periodic cycle”, then display this parameter. Input the performance time of the trace. The numerical range of the “periodic cycle” is determined by the value of the “resolution” or the specified signal address quantity, and its range is displayed at the right side.

(4) Frame limit:

When the sample mode is set to “signal change”, then display this parameter. Input the sampling quantity, and its range is displayed at the right side.

(5) Stop condition:

- - without: Do not stop tracing.
- - Buffer area full: It stops tracing when the buffer area is full.
- - Signal trigger: It stops tracing by the signal trigger.

Trigger setting: This parameter is enabled when the “stop condition” is selected to the “signal trigger”.

1. Address: The input signal address is regarded as trigger stopping. (R address can not be

used for trigger stopping)

2. Mode; It determines that what kind trigger mode is used to stop tracing.

Rising edge: The tracing is automatically stopped by the rising edge of the trigger signal.

Falling edge: The tracing is automatically stopped by the falling edge of the trigger signal.

Any change: The tracing is automatically stopped by the rising or falling edge of the trigger signal.

(6) Sampling condition: This parameter is enabled when the sampling mode is set to “signal change”, which is determined the sampling condition.

- - Signal trigger: The specified mode changes when the signal specified by the trigger address which is set by the sampling condition, collect the signal.

- - Any change: Any change occurs when the signal specified by the trigger address which is set by the sampling condition.

Trigger setting: When the sampling mode is set to “signal change”, and then the sampling condition is set to “signal trigger”, this parameter is enabled.

1. Address: The input signal address, instead of using the R address, is treated as the sampling of the trigger signal.

2. Mode: The trigger mode inputs the specified trigger signal.

Rising edge: The rising edge sampling of the trigger signal specifies the signal state.

Falling edge: The falling edge sampling of the trigger signal specifies the signal state.

Any change: Specify the signal state by the rising or falling edge sampling of the trigger signal.

Switch on: Sample the specified signal state when the trigger signal is switched on.

Switch off: Sample the specified signal state when the trigger signal is switched off.

Enter the PLCTRACE “trace” interface by pressing the [trace] soft key. Refer to the 1-2-5-2:

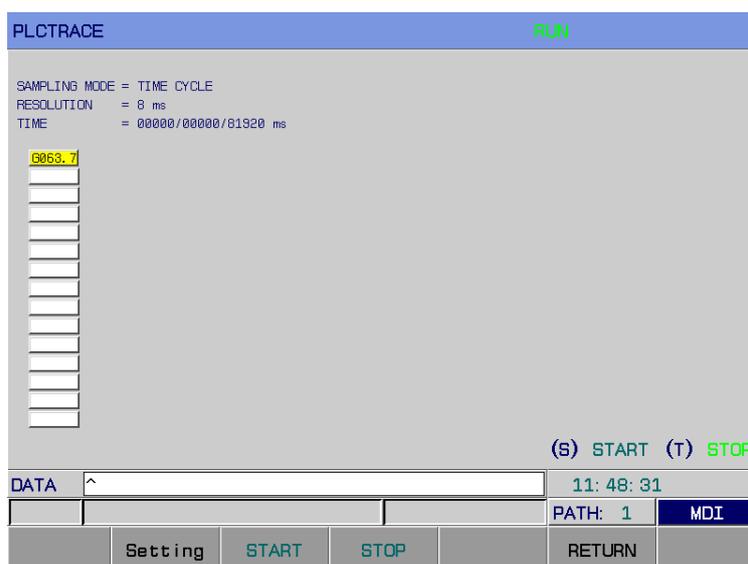


Fig.1-2-5-2

The content and operation of the **PLCTRACE** “trace” interface

- (1) Sampling mode: Display the current sampling mode of the system.
- (2) Period: Display the current sampling period of the system, that is, resolution
- (3) Time: This parameter displays when the “sampling mode” selects the “periodic cycle”.
  - Format display when tracing: the current timing is at the left side, and the max. allowance timing is at the right side.
  - Format display when stopping: the most right side timing is placed at the right side; the timing of trace stopping is placed at the middle side, and the max. allowance timing is placed at the right side.

- (4) Setting address: Move the cursor by the  and , the signal address that will be traced is inputted inside the , it can be traced 15 signals at the same time. Any address can be inputted. As for the R address, the previous 3 positions can be inputted the address before 256; the 4th and 5th position can be inputted 2 addresses after 255.

- (5) (S) start: The signal trace can be performed pressing  key after the trace parameter is set correctly.

- (T) Stop: Stop the signal trace after controlling the  key.

Clear: Clear the value under the cursor pressing the  key.

Extension page: press  and the system uses the current whole page to trace the signal address where the cursor is.

## Chapter 2 PLC Address, Parameter Setting

The addresses and parameters, such as the counter, timer, data list and nonvolatile relay may be used in the PLC; the viewing and setting of these addresses and parameter should be performed in the corresponding interface. Press the [PLCPAR] soft key again in the PLCPAR interface, then enter the PLC address and parameter setting interfaces, refer to the Fig. 2-1, which includes the nonvolatile relay, timer, data list, counter, F address corresponding with the M function. It is used for checking and setting these addresses, parameters and data list. (User can set it after the debugging password is input and gained an authority).

PLCPARA		RUN							
ADDR	Bit7	Bit6	Bit5	Bit4	Bit3	Bit2	Bit1	Bit0	
K000	0	0	0	0	0	0	0	0	
K001	0	0	0	0	0	1	0	1	
K002	0	0	0	0	0	0	0	1	
K003	0	0	0	0	0	0	0	0	
K004	0	0	0	0	0	0	0	0	
K005	0	0	0	0	0	0	1	0	
K006	0	0	0	0	0	0	0	0	
K007	0	0	0	0	0	0	0	0	
K008	0	1	0	0	0	1	0	1	
K009	0	0	0	0	0	0	0	0	
K010	0	0	0	0	0	0	0	0	
K011	0	0	0	0	0	0	0	0	

DATA		11:56:43
		PATH: 1 MDI
KPAR	TMR	DATA
CTR	RETURN	▶

Fig. 2-1

### 2.1 Nonvolatile/Hold Relay

Press the [KPAR] soft key in the Fig. 2-1, then enter the checking and setting interfaces of the nonvolatile relay, refer to the Fig. 2-1-1.

PLCPARA		RUN							
ADDR	Bit7	Bit6	Bit5	Bit4	Bit3	Bit2	Bit1	Bit0	
K000	0	0	0	0	0	0	0	0	
K001	0	0	0	0	0	1	0	1	
K002	0	0	0	0	0	0	0	1	
K003	0	0	0	0	0	0	0	0	
K004	0	0	0	0	0	0	0	0	
K005	0	0	0	0	0	0	1	0	
K006	0	0	0	0	0	0	0	0	
K007	0	0	0	0	0	0	0	0	
K008	0	1	0	0	0	1	0	1	
K009	0	0	0	0	0	0	0	0	
K010	0	0	0	0	0	0	0	0	
K011	0	0	0	0	0	0	0	0	

DATA	^	11: 56: 43
		PATH: 1 MDI
KPAR	TMR	DATA
CTR	RETURN	▶

Fig. 2-1-1

The content and operation of the nonvolatile replay interface:

RUN: Ladder diagram operation state.

ADDR: Nonvolatile relay address.

Bit0~Bit7: Bit number state of the nonvolatile replay address.

1: This address remains the state before power off after the power is turned off;

0: This address resets on default state after the power is turned off.

Input: Input data display.

MDI mode: Current working mode.

[Return]: Return to the previous menu.

After modification, the system displays “KPAR downloading successful”; the system displays: “downloading fail” when the save is incorrect; the “illegal downloading parameter” displays without downloading conditions.

The search and positioning can be performed by the pageup, pagedown and four direction keys on the panel; checking and modifying of the nonvolatile relay address can be performed.

## 2.2 Timer

Press the [TMR] soft key in the Fig. 2-1, then enter the checking and setting interfaces of the timer, refer to the Fig. 2-2-1.

PLCPARA					RUN
NO.	ADDR.	CURT.	SET.	REMARK	
000	T000	00000	00000	STANDBY	
001	T001	00500	00500	STANDBY	
002	T002	00500	00500	STANDBY	
003	T003	00500	00500	STANDBY	
004	T004	00000	00000	STANDBY	
005	T005	00000	00000	STANDBY	
006	T006	00500	00500	STANDBY	
007	T007	00500	00500	STANDBY	
008	T008	00500	00500	STANDBY	
009	T009	03000	03000	STANDBY	
010	T010	03000	03000	STANDBY	
011	T011	00000	00500	STANDBY	

DATA ^ 11:28:41

KPAR TMR DATA CTR PATH: 1 MDI RETURN ▶

Fig. 2-2-1

The content and operation of the timer:

RUN: Operation state of ladder diagram.

NO: Timer serial number; Do not change.

ADDR.: Timer address; Do not change.

CURT: Current value of the timer; Do not change.

SET: Presetting value of the timer; it can be changed after the password authority is open.

Input: display the input data

MDI mode: Current working mode

[Return]: Return to the previous menu

After modification, the system displays “KPAR downloading successful”; the system displays: “downloading fail” when the save is incorrect; the “illegal downloading parameter” displays without downloading conditions.

The search and positioning can be performed by the pageup, pagedown and four direction keys on the panel; checking and modifying of the timer can be performed.

## 2.3 Data List

Press the [DATA] soft key in the Fig. 2-1, then enter the checking and setting interface of the data list, refer to the Fig. 2-3-1.

PLCPARA				RUN
NO.	ADDR.	DATA	REMARK	
000	D000	00000	STANDBY	
001	D001	00001	STANDBY	
002	D002	00002	STANDBY	
003	D003	00003	STANDBY	
004	D004	00004	STANDBY	
005	D005	00005	STANDBY	
006	D006	00006	STANDBY	
007	D007	00007	STANDBY	
008	D008	00008	STANDBY	
009	D009	00009	STANDBY	
010	D010	00010	STANDBY	
011	D011	00011	STANDBY	

DATA	<input type="text"/>	11: 28: 51
		PATH: 1 MDI
KPAR	TMR	DATA
		CTR
		RETURN
		▶

Fig. 2-3-1

The content and operation of the data list:

RUN: Operation state of ladder diagram.

NO: data list serial number; Do not change.

ADDR.: data list address; Do not change.

CURT: Current value of the data list; Do not change.

SET: Presetting value of the data list; it can be changed after the password authority is open.

Input: display the input data

MDI mode: Current working mode

[Return]: Return to the previous menu

After modification, the system displays “KPAR downloading successful”; the system displays: “downloading fail” when the save is incorrect; the “illegal downloading parameter” displays without downloading conditions.

The search and positioning can be performed by the pageup, pagedown and four direction keys on the panel; checking and modifying of the data list can be performed.

## 2.4 Counter

Press the [CTR] soft key in the Fig. 2-1, then enter the checking and setting interface of the counter, refer to the Fig. 2-4-1.

PLCPARA					RUN
NO.	ADDR.	CURT.	SET.	REMARK	
000	C000	00000	00000	STANDBY	
001	C001	00000	00000	STANDBY	
002	C002	00000	00000	STANDBY	
003	C003	00000	00000	STANDBY	
004	C004	00000	00000	STANDBY	
005	C005	00000	00000	STANDBY	
006	C006	00000	00000	STANDBY	
007	C007	00000	00000	STANDBY	
008	C008	00000	00000	STANDBY	
009	C009	00000	00000	STANDBY	
010	C010	00000	00000	STANDBY	
011	C011	00000	00000	STANDBY	

DATA	^	11: 29: 02
		PATH: 1 MDI
KPAR	TMR	DATA
CTR	RETURN	▶

Fig. 2-4-1

The content and operation of the counter:

RUN: Operation state of ladder diagram.

NO: Counter serial number; Do not change.

ADDR.: Counter address; Do not change.

CURT: Current value of the counter; Do not change.

SET: Presetting value of the counter; it can be changed after the password authority is open.

Input: display the input data

MDI mode: Current working mode

[Return]: Return to the previous menu

After modification, the system displays “KPAR downloading successful”; the system displays: “downloading fail” when the save is incorrect; the “illegal downloading parameter” displays without downloading conditions.

The search and positioning can be performed by the pageup, pagedown and four direction keys on the panel; checking and modifying of the counter can be performed.



## Chapter 3 Instructions of The Ladder Diagram Edit Software

### 3.1 Summary

At present, the GSK980TC3 system supports the compilation software of the configured GSK ladder diagram.

The compilation software of the GSK ladder diagram is a ladder diagram editor on the PC machine of the GSK 980TC3 and machine center CNC, which mainly offers the functions such as the edit, conversion, debugging and printing of the GSK 980TC3 series ladder diagram. This software can be used in the Interfaces 98, Interfaces Me, Interfaces 2000, Interfaces XP and Interfaces 2003.

### 3.2 Software Introduction

#### 3.2.1 Software Start

The compilation software of the GSK ladder diagram is a green one without installing, which includes two files (Lad Edit. Exe and Diag.me) and one folder (LadFile). The Ladder01 file in the LadFile folder is the standard ladder diagram of the system. The software can be operated by clicking Lad Edit. Exe twice. When the Ladder03 ladder diagram in the LadFile folder is opened in the software, the interface is shown below:

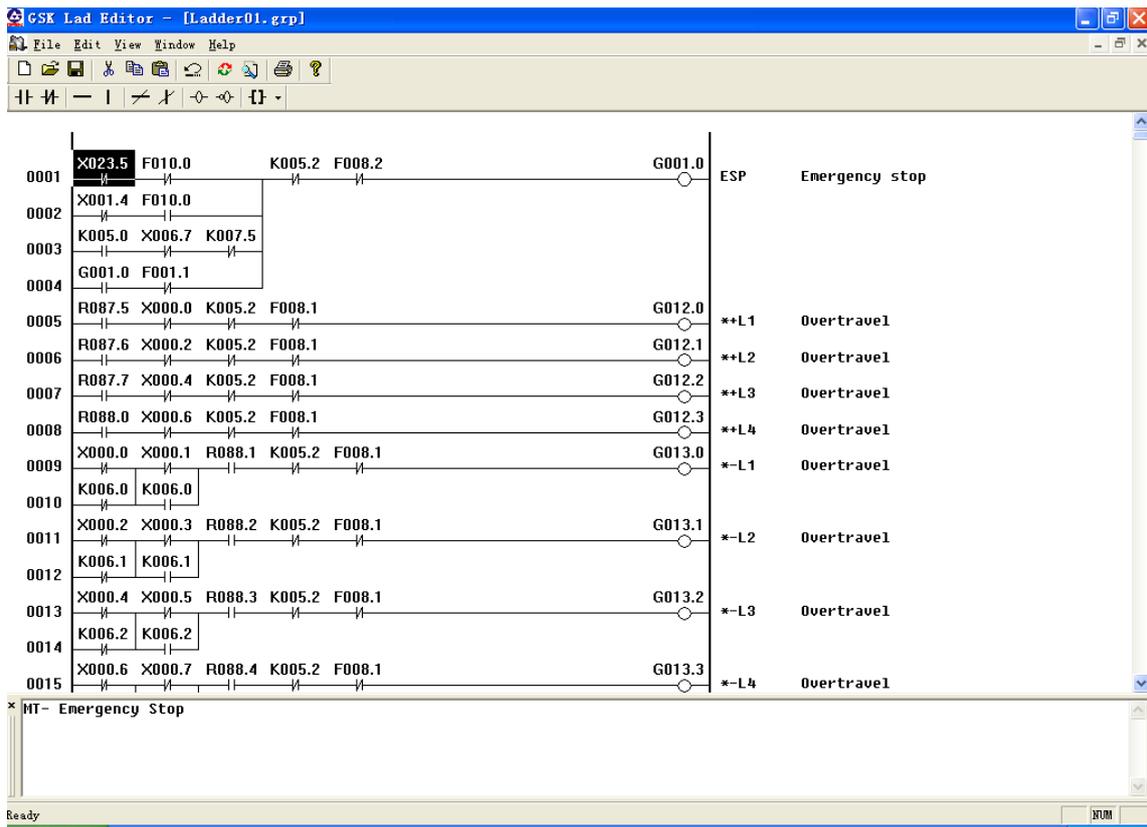


Fig.3-2-1-1

### 3.2.2 Function Introduction

#### ● File menu

The file menu includes some program files, namely, the new, open and save, which can be produced some functions, such as the performable ladder diagram file or binary system file, printing, printing preview and printing setup and the recently opened file list.

**Note:** In the “ladder diagram editing” dialog box, each volume of the “ladder diagram version number”, “suitable machine” and “ultimate modifier”, can be indicated by English, instead of Chinese, otherwise, the error may occur after transferring.

#### ● Edit menu

The edit menu includes some functions such as the cutting, copy, pasting, searching, conversion and editing etc.

#### ● View menu

Control the display and concealing of the toolbar, state bar, output and command list windows.

#### ● Window menu

Control the selection and layout of each window.

#### ● Help menu

Version information of this software

## 3.3 Software Operation

### 3.3.1 Toolbar

There are two toolbars of the main view frame, which are related with the ladder diagram compilation.

#### 3.3.1.1 Main Toolbar



-  New ladder diagram file
-  Open the ladder diagram file
-  Save the ladder diagram file
-  Cut the selected content to the clipboard
-  Copy the selected content to the clipboard
-  Paste content from the clipboard
-  Ladder diagram conversion
-  Component search
-  Print the ladder
-  About the dialog box

#### 3.3.1.2 Editing Toolbar



-  Insert the normally opened contact
-  Insert the normally closed contact
-  Insert the horizontal breakover line
-  Insert the vertical breakover line (place at the lower right corner of the cursor)
-  Delete single cell or horizontal breakover line
-  Delete the vertical breakover line at the lower right corner of the component



Insert the input coil



Insert the output coil reverse



Function code button: There are two methods in the Edit function code:

1. Pop up the drawing menu by click the small arrow at the right, and then select the function codes.

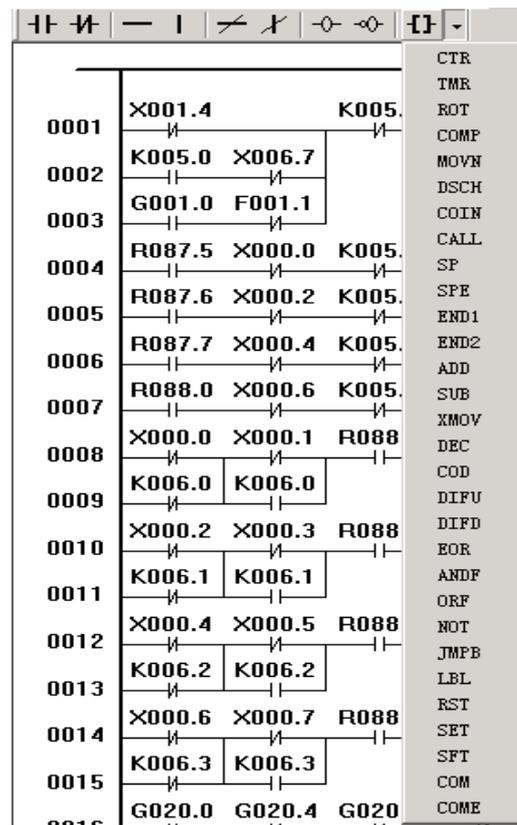


Fig. 3-3-1-2-1

2. Or, click the button icon, set the function code in the function code selection dialog.

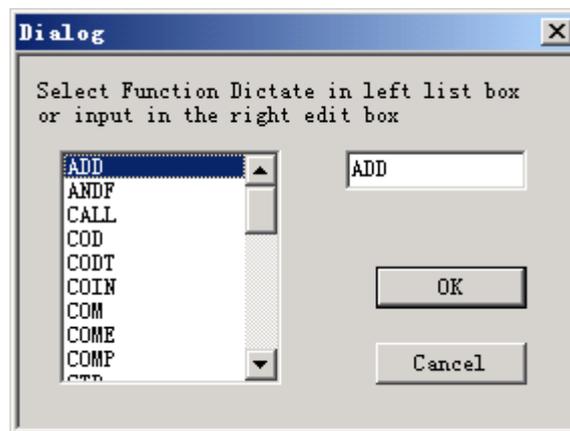


Fig. 3-3-1-2-2

### 3.3.2 Selecting a Figure

In the editing view of the ladder diagram, the black rectangle shadow means cursor, click the left key of the mouse in the figure editing area between two bus cables, and select the position where the figure unit needs to be edited. Refer to the following figure.

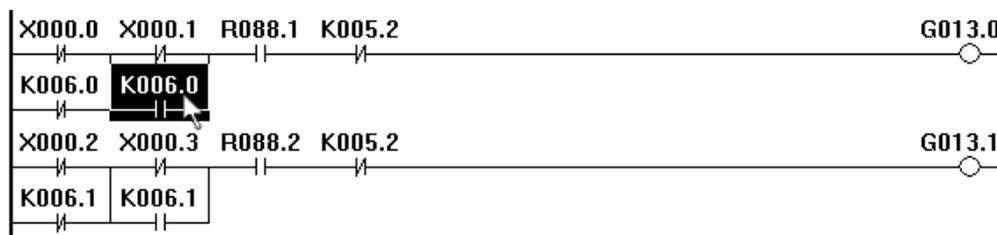


Fig. 3-3-2-1

When the block is selected, press the mouse left key at the beginning position of the block, then drag to the end. The selected area indicates by the rectangle with dotted line before releasing the left key.

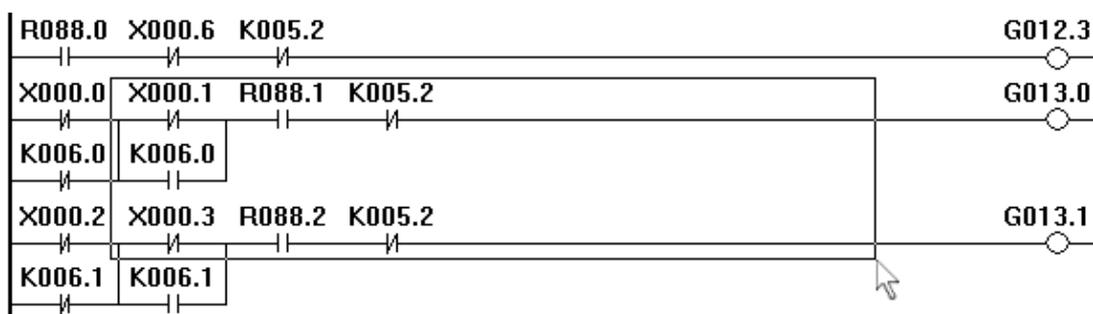
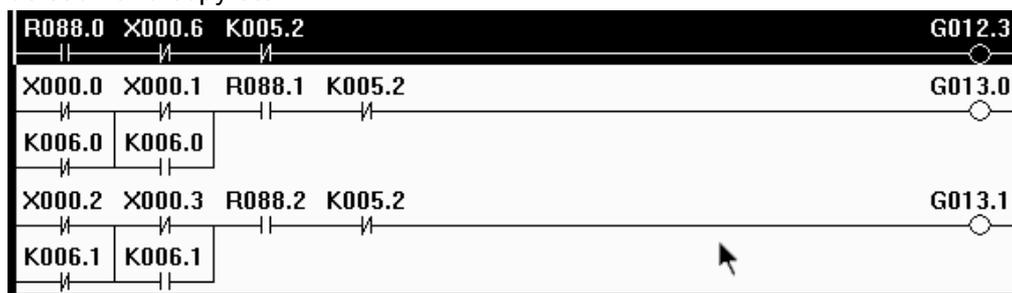


Fig. 3-3-2-2

The inverted color of the whole ladder diagram after releasing, that is, the ladder diagram within this range is selected, and the next operation can be performed. For example, cutting, deletion and copy etc..



(the drawing is executed with inverse colors)

Fig.3-3-2-3

### 3.3.3 Editing a Figure

#### 3.3.3.1 Cutting

There are three ways for carrying out this operation after the ladder diagram area to be edited is selected:

1. Select the cutting after springing the environment menu by clicking the right key of the mouse;

2. Select the Edit [Alt+E]--- Cutting [T] of the main menu;
3. Shortcut key [Ctrl+X].

The cut content is placed to the clipboard, which is copied to the ladder diagram by the paste operation.

### 3.3.3.2 Copy

There are three ways for carrying out this operation after the ladder diagram area to be copied is selected:

1. Select the copy after springing out the environment menu by clicking the right key of the mouse;
2. Select the Edit [Alt+E]--- Copy [C] of the main menu;
3. Shortcut key [Ctrl+C].

The selected content after copying is put to the clipboard, which is copied to the ladder diagram by the paste operation.

### 3.3.3.3 Pasting

There are three ways for carrying out this operation after the ladder diagram area to be pasted is selected:

1. Select the pasting after springing out the environment menu by clicking the right key of the mouse;
2. Select the Edit [Alt+E]--- Pasting [P] of the main menu;
3. Shortcut key [Ctrl+V].

### 3.3.3.4 Deletion

There are three ways for carrying out this operation after the ladder diagram area to be deleted is selected:

1. Select the basis code ---- Deletion node after springing out the environment menu by clicking the right key of the mouse once;
2. Click the [Deletion node] button on the editing bar;
3. Shortcut key [Delete];

### 3.3.3.5 Insertion Line

There are three ways for carrying out this operation after moving the cursor to the position to be inserted the ladder diagram line:

1. Select the insert after springing out the environment menu by clicking the right key of the mouse;
2. Select the Edit [Alt+E]---Insertion line [I] of the main menu;
3. Shortcut key [Insert];

### 3.3.3.6 Deletion Line

There are three ways for carrying out this operation after moving the cursor to the position to be deleted the ladder diagram line:

1. Select the insert after springing out the environment menu by clicking the right key of the mouse;

2. Select the Edit [Alt+E]--- Deletion line [D] of the main menu;
3. Shortcut key [Ctrl+Delete];

### 3.3.3.7 Conversion

There are three ways for carrying out this operation after the ladder diagram of the current editing interface is converted into the command list program:

1. Select the Edit [Alt+E]--- Conversion [V] of the main menu;
2. Click once the [Ladder diagram conversion] button on the editing bar;
3. Shortcut key [F7];

## 3.3.4 Ladder Diagram Note

### 3.3.4.1 The Line Note of the Ladder Diagram

Click the left key of the mouse twice out of the bus area at the ladder diagram right; input the notes in the editing frame.

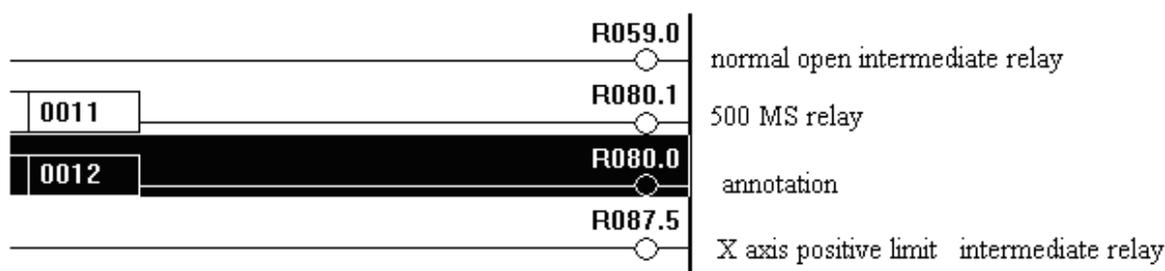


Fig.3-3-4-1-1

### 3.3.4.2 Notes of the Ladder Diagram's Component

There are two ways for carrying out this operation after moving the cursor to the position to be modified the ladder diagram component:

1. Click the right key of the mouse after the component is selected; select the modified notes [M] in the springing environment menu;

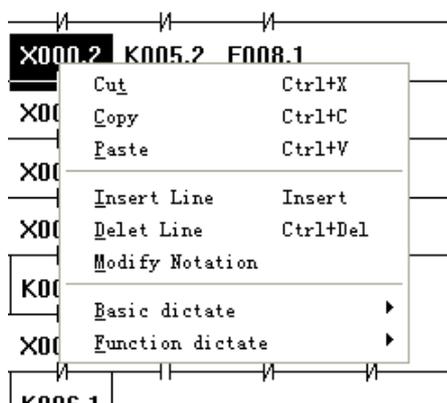


Fig. 3-3-4-2-1

2. Select the edit [Alt+E]----Note modification [M] of the main menu.

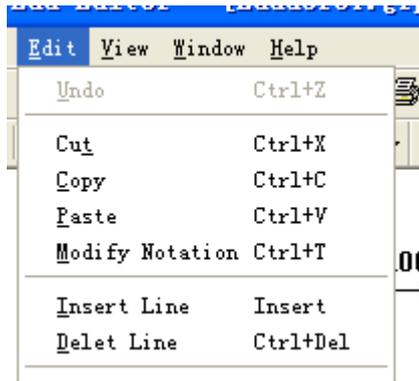


Fig.3-3-4-2-2

3. Shortcut key [Ctrl+T].

Input the notes in the springing dialog box; save it by clicking the OK button.

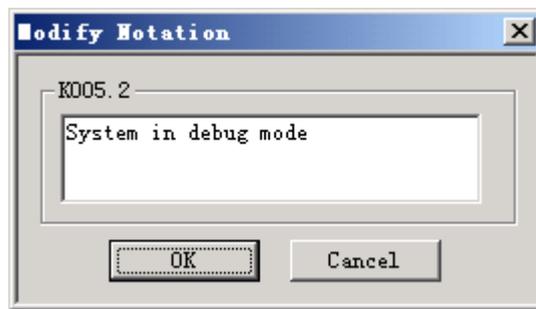


Fig.3-3-4-2-3

The notes saved will be displayed the output window under the screen when the component is selected each time, refer to the following figure:

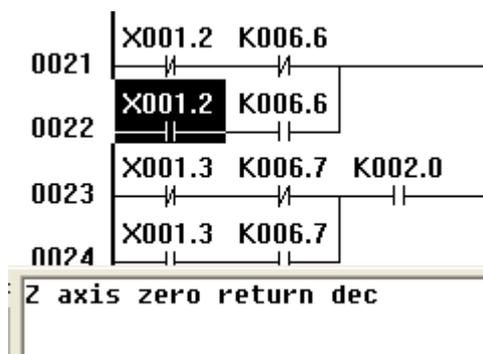


Fig. 3-3-4-2-4

### 3.3.5 Export

The ladder diagram file should be converted when it is edited and saved, which can be generated the performable file after converting, and then transfer to the CNC using the serial-port

communication software or U disk that it is performed by the PLC from the CNC system. Refer to the **Chapter 11 System Communication, GSK980TC3 Programming and Operation User Manual**.

The ladder diagram file is then produced.

Select the file [Alt+F]----Ladder diagram file producing [L] of the main menu, save it after inputting the name and path, the ladder diagram file with the extension name “.grp” is produced, which can be used in GSK98TC3.

The ladder allocated with a file format is shown in Appendix 2.



---

## III Function



## Chapter 1 Controlled Axis

### 1.1 Output Signal of Controllable Axis

**General** The movement state of each axis can be output to the PLC.

**Signal** Binary signal of system's controllable axis number  
 AXIS1~AXIS4 (F171#0~F171#3)  
 Example: when the system's controllable axis number is 3, (F#171=0000 0011)

### 1.2 Output of Axis Movement State

**General** The movement state of each axis can be output to the PLC.

**Signal** **Axis movement signal**

**MV1~MV5 (F102#0~F102#4)**

[Type] Output signal

[Function] These signals are indicated that one controllable axis is being moved.

MV1: the 1<sup>st</sup> axis is moving.

MV2: the 2<sup>nd</sup> axis is moving.

MV3: the 3<sup>rd</sup> axis is moving.

MV4: the 4<sup>th</sup> axis is moving.

MV5: the 5<sup>th</sup> axis is moving

[Output condition]

The signal turns into 1 in the following case:

- The corresponding axis has been moved.

The signal turns into 0 in the following case:

- The corresponding axis has been stopped.

**Signals of the axis movement direction**

**MVD1~MVD5 (F106#0~F106#4)**

[Type] Output signal

[Classification] These signals indicate the movement direction of controlled axis.

MVD1: movement direction signal of the 1<sup>st</sup> axis

MVD2: movement direction signal of the 2<sup>nd</sup> axis

MVD3: movement direction signal of the 3<sup>rd</sup> axis

MVD4: movement direction signal of the 4<sup>th</sup> axis

MVD5: movement direction signal of the 5<sup>th</sup> axis

[Output conditions]

“0” indicates the corresponding axes are negatively moving,

“1” indicates the corresponding axes are positively moving.

**Caution:**

These signals maintain their condition during a stop, indicating the direction of the axes' movement before stopping.

**Signal address**

	#7	#6	#5	#4	#3	#2	#1	#0
F102				MV5	MV4	MV3	MV2	MV1
F106				MVD5	MVD4	MVD3	MVD2	MVD1

**1.3 Servo Ready Signal**

**Signal** servo ready signal

**SA (F000#6)**

[Classification] Output signal

[Function] After the servo is ready, SA signal becomes 1. For the axis with absorption brake, release the brake when outputting the signal, execute the brake when the system does not output the signal.

**Signal address**

	#7	#6	#5	#4	#3	#2	#1	#0
F000		SA						

## Chapter 2 Preparation for Operation

### 2.1 Emergency stop

**General** If you press Emergency Stop button on the machine operator's panel, the machine movement stops in a moment.

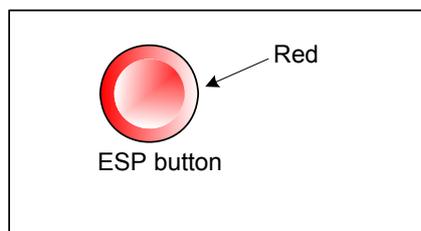


Fig. 2-1

The button is locked when it is pressed, although it varies with the machine to builder, the button can usually be unlocked by twisting it right.

#### Signal ESP Signal

**\*ESP ( G008.4)**

[Classification] Input signal

[Function] Activating an emergency stop signal stops the machine instantly.

[Operation] When the emergency stop \*ESP becomes 1, the emergency stop is applied to the machine and the CNC is reset.

#### Signal address

G008				*ESP				
------	--	--	--	------	--	--	--	--

### 2.2 CNC Overtravel Signal

**General** When the tool tries to move beyond the stroke end set by the machine tool limit switch, the tool decelerates and stops as a result of tripping the limit switch, and an Over TRAVEL is displayed. The signal can be output with an alarm.

#### Signal Overtravel signal

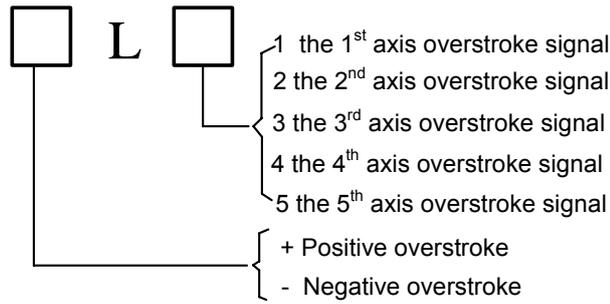
+L1~+L5 (G114#0~G114#4)

-L1~-L5 (G116#0~G116#4)

[Classification] Input signal

[Function] Indicates that the control axis has reached its stroke limit. There are individual signals for each direction in every control axis.

The + /- in the signal name indicates the direction and the number corresponds to the control axis.



[Operations] when the signal becomes “0”: the controlled unit operates as follows:

- \* Automatic operation: If even one axis overtravel signal becomes 1, all axes are decelerated to stop, an alarm is given and operation is halted.
- \* Manual operation: Only the axis whose overtravel signal has become 1 is decelerated to a stop, and the axis can be moved in the opposite direction.
- \* Once the axis overtravel signal has become 1, the axis direction is registered. Even if the signal returns to 0, it is not possible to move that axis in that direction until the alarm is cleared.

**Signal address**

	#7	#6	#5	#4	#3	#2	#1	#0
G114				+L5	+L4	+L3	+L2	+L1
G116				*-L5	*-L4	*-L3	*-L2	*-L1

### 2.3 Alarm Signal

**General** When an alarm is triggered in the CNC, the alarm is displayed on the screen, and the alarm signal is set to 1.

**Signal Alarm signal**

**AL (F001#0)**

AL (F001#0)

[Classification] Output signal

[Function] Alarm signal reports CNC is in an alarm state as follows:

- a) P/S alarm
- b) Overtravel alarm
- c) Servo alarm

[Output conditions] These alarm signals are set to 1 when:

—The CNC is placed in the alarm state.

These alarm signals are set to 0 when:

—The alarm has been released by resetting the CNC.

**Signal address**

	#7	#6	#5	#4	#3	#2	#1	#0
F001								AL

## 2.4 Operation Mode Selection

**Signal** Mode selection signal

Set the following mode to select modes by signals

Mode selection signal

**MD1,MD2,MD4 (G043#0~#2)**

**Manual reference point return's selection signal**

**ZRN (G043#7)**

**Incremental feed selection signal**

**INC (G043#3)**

**MPG trial cut selection signal**

**TEACH (G043#4)**

**Program zero return selection signal**

**PRGZ (G043#6)**

**Run mode check signal**

**Incremental feed selection confirmation signal**

**MINC (F003#0)**

**MPG feed selection confirmation signal**

**MH (F003#1)**

**Manual continuous feed selection confirmation signal**

**MJ (F003#2)**

**Manual data input selection confirmation signal**

**MMDI (F003#3)**

**Storage run selection confirmation signal**

**MMEM (F003#5)**

**Program edit selection confirmation signal**

**MEDT (F003#6)**

**MPG trial cut selection confirmation signal**

**RHPG (F006#3)**

**Manual reference point return selection confirmation signal**

**MREF (F004#5)**

**Table 2-4-1 relationship between mode selection signal and confirmation signal**

Mode		Input signal							Output signal
		MD1	MD2	MD4	INC	TEACH	PRGZ	ZRN	
		G43.0	G43.1	G43.2	G43.3	G43.4	G43.6	G43.7	
Automatic run	Manual data input(MDI)	0	0	0	-	-	-	-	MMDI
	Storage run (Auto mode)	1	0	0	-	0	-	-	MMEM
	MPG trial cut	1	0	0	-	1	-	-	RHPG
	Storage edit (EDIT)	1	1	0	-	-	-	-	MEDT
Manual run	MPG	0	0	1	0	-	-	-	MH
	Incremental feed (Step)	0	0	1	1	-	-	-	MINC
	Manual JOG feed	1	0	1	-	-	-	0	MJ
	Manual reference point return	1	0	1	-	-	0	1	MREF
	Program zero return	1	0	1	-	-	1	1	

Note: (“-” is irrelevant with the signal status)

Signal address

	#7	#6	#5	#4	#3	#2	#1	#0
F003		MEDT	MMEM		MMDI	MJ	MH	MINC
F004			MREF					
F006					RHPG			

## 2.5 Status Output Signal

### Cutting feed signal

#### CUT (F002 #6)

[Classification] Output signal

[Function] These signals indicate that the cutting feed is being performed by automatic operation.

[Output conditions] These signals are 1 when:

Cutting feed is being performed by automatic operation (cutting feed for linear interpolation, circular interpolation, helical interpolation, thread cutting, skip cutting).

Note:

1. Do not output the signal in the state of feed hold.
2. Output the signal during the interlock or the feedrate override is set to 0.

Signal address

	#7	#6	#5	#4	#3	#2	#1	#0
F002		CUT						

## Chapter 3 Manual Operation

### 3.1 JOG Feed/Incremental Feed

#### General

**JOG feed** In JOG mode, setting a feed axis and direction selection bit to 1 on the machine operator's panel moves the machine along the selected axis in the selected direction.

**Incremental feed** In incremental feed mode, setting a feed axis and direction selection bit to 1 on the machine operator's panel moves the machine one step along the selected axis in the selected direction. The minimum distance the machine moves, is the least input increment. The step can be 10, 100, or 1000 times the least input increment (step increment has 1000 times but the MPG increment has no 1000 times).

The only difference between JOG feed and incremental feed is the method of selecting the feed distance. In JOG feed, the machine continues to be fed while the following signals selecting the feed axis and direction are 1: +J1, -J1, +J2, -J2, +J3, -J3, etc. In incremental feed, the machine is fed by one step. Using MANUAL feedrate override dial can regulate JOG feedrate. The step distance can be selected by MPG feed movement distance MP1, MP2, MP3 G019 #4~G019 #6.

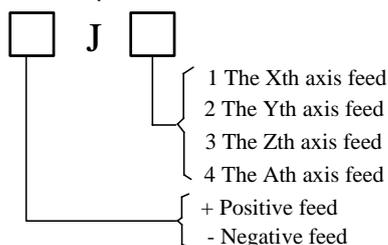
#### Signal **Feed axis and direction selection signal**

+J1~ +J5 (G100 #0~G100 #4)

-J1~ -J5 (G102 #0~G28 #4)

[Classification] Input signal

[Function] In JOG feed or Incremental feed mode, select the required feed axis and direction. +/- in the signal name indicates the feed direction, the number corresponds to the controlled axis.



[Operation] When the signal is set to 1, the control unit operate as follows:

- \* When JOG feed or incremental feed is allowed, the control unit moves the specified axis in the specified direction.

When the signal is set to 1 in JOG feed, the control unit continues to move that axis,  
 \* In incremental feed, the control unit feeds the requested axis by the step distance which is specified by the manual handle feed move distance selection signal, then the axis stops. Even if the signal is set to 0 while the axis is being fed, the control unit does not stop moving.

To feed the axis again set the signal to 0, then to 1 again.

#### Manual rapid traverse selection signal

RT (G019 #7)

[Classification] Input signal

[Function] Select the rapid traverse rate in MANUAL feed or incremental feed mode.

[Use] When the signal becomes 1, the control unit operates as follows:

- The control unit executes the MANUAL feed or incremental feed at a rapid traverse rate. The rapid traverse override is valid.
- When the signal is switched from 1 to 0 or vice versa in MANUAL feed or incremental feed, the feedrate is decelerated until it reaches zero, then increased to the specified value. During acceleration and deceleration, the feed axis and direction selection signal can be kept 1.

### Signal address

	#7	#6	#5	#4	#3	#2	#1	#0
G019	RT							
G100				+J5	+J4	+J3	+J2	+J1
G102				-J5	-J4	-J3	-J2	-J1

## 3.2 MPG / Step Feed

**General** In MPG/Step feed mode, the machine moves by rotating the manual pulse generator(MPG) or Step. Select the axis along which the machine moves with the MPG feed axis selection signal/axis move signal.

**Signal** **MPG/Incremental select signal**

(G19#4~G19#6)

[Classification] Input signal

[Function] MPG/Step feed movement amount selection signal

This signal uses two G signals to perform binary coding, which means to the movement distance per step.

MPG/Step feed amount selection signal			MPG	Step
G19.4(MP1)	G19.5(MP2)	G19.6(MP4)	mm/inc	mm/inc
0	0	0	--	--
1	0	0	*1	*1
0	1	0	*10	*10
1	1	0	*100	*100
0	0	1	Parameters specifying	*1000

## Chapter 4 Reference Point Return

### 4.1 Manual Reference Point Return

**General** In manual reference point return mode, the machine tool move in the specified direction by setting the position parameter N0: 7#0~#4 to execute the reference point return. The selected axis on the panel reports the axis to execute the machine zero return, which is not related to the move direction of axis.

The following signals are related to the manual reference point return:

Table 4-1-1

	Manual reference point return
Reference point return deceleration signal	DECX, DECY, DECZ, DEC4, DEC5
Reference point return completion signal	ZP1, ZP2, ZP3, ZP4, ZP5

#### Signal

##### Reference point return completion signals

ZP1~ZP5(F094 # 0~F094 # 4)

[Classification] Output signal

[Function] These signals report that the machine tool is at the reference point on a controlled axis.

These signals correspond separately to all axes.

Table 4-1-2

ZP1	The 1 <sup>st</sup> axis reference point return completion signal
ZP2	The 2 <sup>nd</sup> axis reference point return completion signal
ZP3	The 3 <sup>rd</sup> axis reference point return completion signal
ZP4	The 4 <sup>th</sup> axis reference point return completion signal
ZP5	The 5 <sup>th</sup> axis reference point return completion signal

[Output conditions] When these signals becomes 1:

- Manual reference point return is completed and the current position is in the in-position area.
- The automatic reference point return(G28) is completed and the current position is in the in-position area.
- The reference point return check is completed and the current position is in the in-position area.

When the signal becomes 0:

- The machine tool moves from the reference point.
- The emergency stop signal appears.
- The servo alarm appears.

##### Reference point return deceleration signal check

\*DEC1~\*DEC5 (G0196#0~G0196#4)

[Classification] Input signal

[Function] These signals decelerate the feedrate for manual reference point return to a low feedrate in order to approach the reference point at the low feedrate.

**Note: when the system uses the manual reference point return with absolute mode, it automatically returns to the machine zero.**

## Chapter 5 Automatic Operation

### 5.1 Cycle Start/Feed Hold

#### General

**Start of automatic Operation(cycle start)** When automatic operation start signal ST is set to 1 then 0 while the CNC is in memory mode, DNC operation mode or MDI mode, the CNC enters the automatic operation start state then starts operating.

The signal ST is ignored as follows:

1. When the CNC is in other modes except for Auto or MDI mode.
2. When the feed hold signal (\*SP) is set to 1.
3. When the emergency stop signal (\*ESP) is set to 1.
4. When the reset & tape rewinding signal RRW is "1".
5. When <RESET> on MDI panel is pressed.
6. When CNC is in the state of alarm.
7. When the automatic operation is started.
8. When the program restart signal (SRN) is set to 1.
9. When CNC is searching one sequence number.

In automatic operation, the CNC enters the feed hold and stops running as follows:

1. When the feed hold signal (\*SP) is set to 1.
2. The single block instruction is end when the single block is running.
3. MDI operation is completed.
4. CNC alarms.
5. The single block instruction is end after the mode is changed to others or Edit mode.

In automatic operation, the CNC enters the reset and stops running as follows:

1. When the emergency stop signal (\*ESP) is set to 1.
2. When <RESET> on MDI panel is pressed.

#### \* Halt of automatic operation

(Feed hold)

When the feed hold signal \*SP is set to 0 in automatic operation, the CNC enters the feed hold state and stops operation. At the same time, cycle start lamp signal STL is set to 0 and feed hold lamp signal SPL is set to 1. Re-setting signal SP to 0 in itself will not restart automatic operation. To restart automatic operation, first set signal SP to 0, then set signal ST to 1 and to 0.

#### Signal Cycle start signal

##### **ST (G007#2)**

[Classification] Input signal

[Function] Start the automatic operation.

[Operation] In Auto, MDI mode, ST has checked the fall edge, the CNC enters the cycle start state and starts operations.

#### Feed hold signal

##### **\*SP (G008#5)**

[Classification] Input signal

- [Function ] Halt the automatic operation
- [Operation] In Auto mode, SP signal position checks the fall edge, CNC enters the feed hold and stops running. When SP signal is set to 0, the automatic operation does not start.

Cycle start lamp signal

**STL (F000 #5)**

- [Classification] Output signal
- [Function] The signal reports PLC that the automatic operation start is entered.
- [Output conditions] The signal is set to 1 or 0, which is determined by CNC state as Table 5-1.

Feed hold lamp signal

**SPL (F000 #4)**

- [Classification] Output signal
- [Function] The signal reports PLC that the feed hold is entered.
- [Output conditions] The signal is set to 1 or 0, which is determined by CNC state as Table 5-1.

Automatic operation signal

**OP (F000 #7)**

- [Classification] Output signal
- [Function] The signal reports PLC that the automatic operation is entered.
- [Output conditions] The signal is set to 1 or 0, which is determined by CNC state as Table 5-1.

Table 5-1

	Cycle start lamp STL	Feed hold lamp SPL	Automatic operation lamp OP
Cycle start	1	0	1
Feed hold	0	1	1
Automatic operation stopping	0	0	0
Reset	0	0	0

Signal address

	#7	#6	#5	#4	#3	#2	#1	#0
G007						ST		
G008			*SP					
F000	OP		STL	SPL				

## 5.2 Reset

General CNC is reset and enters the reset state in the following conditions:

1. When the emergency signal (\*ESP) is set to 0.
2. When <RESET> on MDI panel is pressed.

When the CNC is reset, the resetting signal RST is output to the PLC. The resetting signal RST is set to 0 when the resetting signal output time, set by No. 203, has elapsed after the above conditions have been released.

$$RST = T_{\text{reset}} \text{ (Reset processing time)} + \text{parameter setting value by No. 203}$$

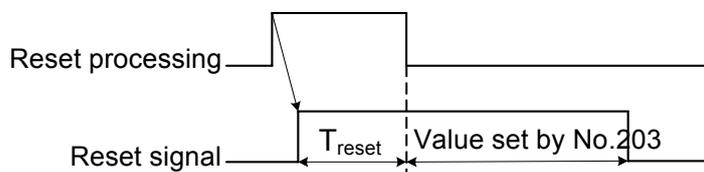


Fig. 5-2

When the CNC is reset in automatic operation, the automatic operation is stopped and movement axis is decelerated and stopped.

When the CNC is reset during the execution of the M, S, T function, signal MF, SF or TF is set to 0 within 16ms.

**RST (F001#1)**

[Classification] Output signal

[Function] The signal reports PLC that CNC is reset.

[Output conditions] The signal is set to 1 when:

- 1: When the emergency stop signal (ESP) is set to 1.
- 2: When <RESET> on MDI panel is pressed.

The signal is set to 0 when:

When the reset signal output time set by No. 203# is completed after the above are released and CNC is reset.

**Signal address**

	#7	#6	#5	#4	#3	#2	#1	#0
F001							RST	

**5.3 Testing a Program**

**General** Before machining is started, the automatic running check can be executed. It checks whether the established program can operate the machine as desired. This check can be accomplished by running the machine or view the position display change without running the machine.

**5.3.1 Machine Tool Lock**

**General** The change of the position display can be monitored without moving the machine. When all-axis machine lock signal MMLK is set to 1, output pulses to the servo motors are stopped in manual or automatic operation. The instructions are distributed, however, updating the absolute and relative coordinates. The operator can therefore check if the instructions are correct by monitoring the position display.

**All-axis machine lock signal**

**MMLK (F004#1)**

[Classification] Output signal

- [Function] The signal reports PLC of the state of all-axis machine tool lock signal.
- [Output condition] When the signal is set to 1, all-axis machine tool lock signal is set to 1.  
When the signal is set to 0, all-axis machine tool lock signal is set to 0.

**Signal address**

	#7	#6	#5	#4	#3	#2	#1	#0
F004							MMLK	

**5.3.2 Dry Run**

**General** Dry run is valid only for automatic, MDI operation. The machine moves at a constant feedrate regardless of the feedrate specified in the program. The feedrate is set by P86. This function is used to check the movement of the machine without a workpiece.

**Signal Dry run signal**

**DRN (G046#7)**

- [Classification] Input signal
- [Function] Enables dry run.
- [Operation] When the signal is set to 1, the machine tool moves at the feedrate specified for dry run.  
When the signal is 0, the machine tool normally moves.

**Note:**

When the dry run signal is changed from 0 to 1 or 1 to 0 during the movement of the machine, the feedrate of the machine is first decelerated to 0 before being accelerated to the specified feedrate.

**Signal address**

	#7	#6	#5	#4	#3	#2	#1	#0
G046	DRN							

**5.3.3 Single Block**

**General** When the single block signal (SBK) is set to 1 in Auto, MDI mode, the CNC enters the automatic operation stop state after executing the current block. In subsequent automatic operation, the CNC enters the automatic operation stop state after executing each block in the program. When the single block signal (SBK) is set to 0, normal automatic operation is stored.

**Signal Single block signal**

**SBK (G046#1)**

- [Classification] Input signal
- [Function] Enables single block operation.
- [Operation] Execute the single block when the signal is set to 1.  
Execute the normal operation when the signal is set to 0.

**Single block check signal**

**MSBK (F004#3)**

[Classification] Output signal

[Function] The signal reports PLC of the state of single block signal.

[Operation] The signal is set to 1 as follows:

—When the single block signal SBK is set to 1.

The signal is set to 0 as follows:

—When the single block signal SBK is set to 0.

**Note:**

Operations in thread cutting.

When the SBK signal becomes 1 during the thread cutting and the thread cutting code is executed, the operation stops at the 1<sup>st</sup> non thread cutting block.

**Signal address**

	#7	#6	#5	#4	#3	#2	#1	#0
G046							SBK	
F004					MSBK			

## 5.4 Optional Block Skip

**General** When a slash followed by a number is specified at the head of a block, and optional block skip signal BDT is set to 1 during automatic operation, the block is ignored.

**Signal** Skip optional block signal

**BDT (G044#0)**

[Classification] Input signal

[Function] Select whether a block with “/” is neglected.

[Operation] During automatic operation, when BDT is 1, the block with “/” is neglected.

The program is normally executed when BDT is 0.

Optional block skip check signal

**MBDT (F004#0)**

[Classification] Output signal

[Function] The signal reports PLC of the state of skip optional block BDT.

**Signal address**

	#7	#6	#5	#4	#3	#2	#1	#0
G044								BDT
F004								MBDT



## Chapter 6 Feedrate Control

### 6.1 Rapid Traverse Rate

**General** The 4 gears ( F0, 25%, 50%, 100%) can be used for rapid traverse rate.

Feedrate: Actual moving speed is obtained by multiplying the override value by the value set by the data parameter P088~092 either in the auto mode or manual operation mode (including manual reference point return and program zero return).

F0 : it is set by the data parameter P093.

**Signal rapid traverse override coded signal (G14#0~G14#2)**

[Classification] Input signal

[Function] It is the rapid traverse override signal

[Operation] The coded signal is corresponded to the following override

Rapid traverse override coded signal			Override value	
RV4	RV2	RV1	ROV1=0	ROV2=1
0	0	0	0%	0%
0	0	1	25%	20%
0	1	0	50%	40%
0	1	1	100%	60%
1	0	0	—	80%
1	0	1	—	100%

### 6.2 Feedrate Override

**General** A programmed feedrate can be reduced or increased by a percentage selected by the override dial. This feature is used to check a program. For example, when a feedrate of 100 mm/minute is specified during the program, setting the override to 50% to move the tool at 50 mm/min.

**Signal Feedrate override coded check signal (G012#0~G012#4)**

[Classification] Input signal

[Function] Cutting feedrate override signal divided into 5 binary coded signals which are corresponded to the override:

The override can be selected with 10% increment within 0~200%.

[Operation] Actual feedrate is obtained by multiplying the specified speed by the override value selected by this signal.

[Operation] The coded signal is corresponded to the following override

Cutting feedrate override coded signal					Override value
FV16	FV8	FV4	FV2	FV1	
0	0	0	0	0	0%

0	0	0	0	1	10%
.....	.....	.....	.....	.....	.....
.....	.....	.....	.....	.....	.....
1	0	0	1	1	190%
1	0	1	0	0	200%

### 6.3 Override Cancel

**General** The override cancel signal fixes the feedrate override to 100%.

**Signal** Override cancel signal

**OVC (G006#4)**

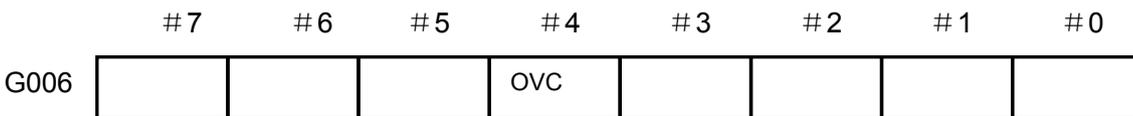
[Classification] Input signal

[Function] The feedrate override is fixed to 100%.

[Operation] When the signal is 1, CNC operates as follows:

- The feedrate override is fixed to 100% irrespective of the feedrate override signal.
- Rapid traverse override and spindle speed override are not affected.

**Signal address**



## Chapter 7 Miscellaneous Function

### 7.1 M code Miscellaneous Function

**General** M code miscellaneous function When one 8-digit value following M is commanded, M coded signal and strobe signal are transmitted to PLC which use these signals to start or cut off its relative functions.

Generally, only one M code in one block is valid, but up to 3 M codes can be commanded (set by NO.33#7 M3B). Besides, No.204 specifies max. digits. When the commanding exceeds its max. digits, an alarm occurs.

Basic procedure

The following signals are used for the following functions.

Table 7-1-1

Function	Program address	Output signal			Response and completion signal
		M code coded signal	Strobe signal	Distribution completion signal	
M code miscellaneous function	M**	M00~M31 (F010#0~F013#7)	MF (F007 # 0)	DEN (F001#3)	FIN (G004#3)
The 2 <sup>nd</sup> miscellaneous function	M**	M200~M215 (F014#0~F015#7)	MF2 (F008#4)		
The 3 <sup>rd</sup> miscellaneous function	M**	M300~M315 (F016#0~F017#7)	MF3 (F008#5)		
Spindle function	S***	S00~S31 (F22#0~F25#7)	SF (F007#2)		
Tool function	T****	T00~T31 (F26#0~F29#7)	TF (F007#3)		

Addresses and signals of the miscellaneous function (M code), spindle function (S code) and tool function (T code) are different, but their signal change steps are the same in all functions, which is shown below:

- (1) Assume that Mxxx is commanded in a command program. xxx can specify max. digit of each function by parameters (No.204~No.206), an alarm occurs when the commanded digit exceeds its max. digit.
- (2) The output code signals M00~M31 is executed within the time TMF (standard setting: 64msec) set by No.207, the strobe pulse signal MF becomes '1'. The code signal expresses the program command value xxx with the binary system. It with the miscellaneous function command other functions(traverse command, pause, spindle function), the system simultaneously execute the code signal output and other function execution start.
- (3) At PLC side, when the strobe pulse signal becomes'1', the system reads the code signal and executes a corresponding operation.
- (4) When the traverse command, pause command are completed in the same block to execute their corresponding operations, wait the distribution completion signal DEN to become '1'.
- (5) At PLC side, when the corresponding operation is completed, the completion signal FIN is set '1'. But, the completion signal shares in the external operation function of miscellaneous function, spindle function, tool function. When these functions are executed

simultaneously, the completion signal FIN is set to '1' after all functions are completed.

- (6) The completion signal remains '1' over the time TFIN (standard setting: 64msec) set by No. No.208, the CNC sets the strobe pulse signal to '0', and informs it has received the completion signal.
- (7) At PLC side, the completion signal is set to '0' when the strobe pulse signal becomes '0'.
- (8) When the completion signal becomes '0', the CNC sets the code signals to '0', and the miscellaneous function's sequences are completed.
- (9) CNC waits the other commands to complete in the same block, and enters the next block.

Using the time chart expresses the above conditions, which is shown below:

Example 1: miscellaneous function is commanded independently

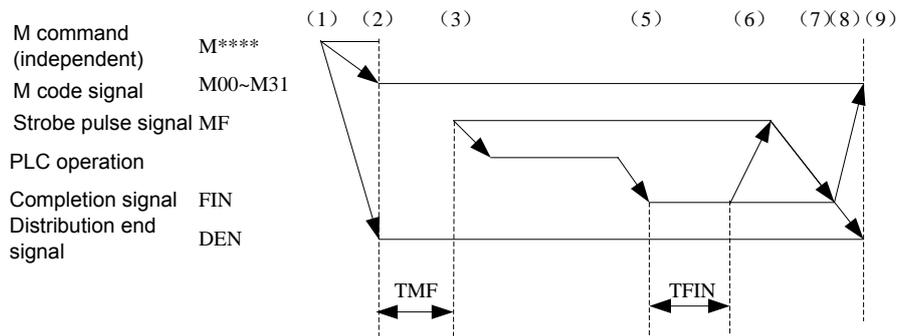


Fig. 7-1-1

Example 2: the miscellaneous function and the traverse command are in the same block

- a. Do not wait the traverse command completion and execute the miscellaneous function

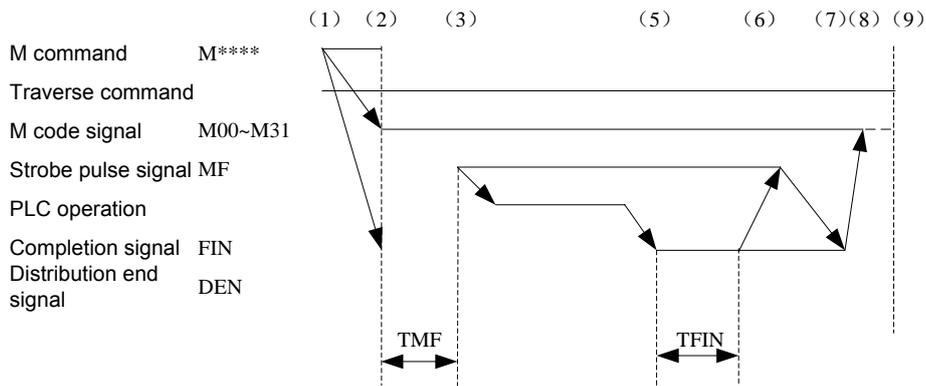


Fig. 7-1-2

- b. Wait traverse command completion to execute miscellaneous

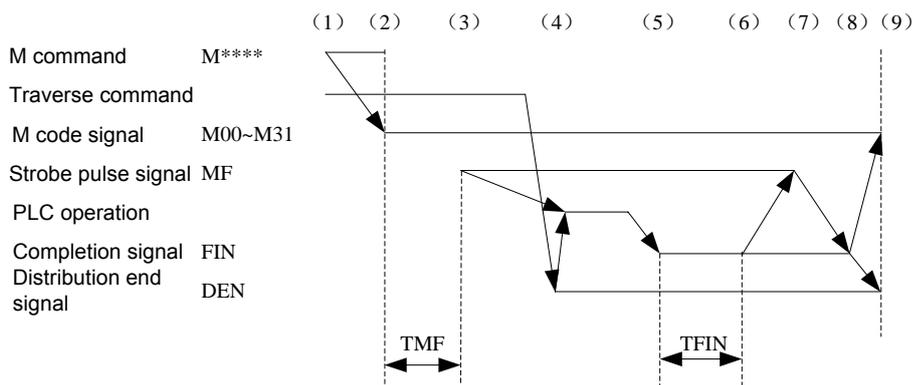


Fig. 7-1-3

## 7.2 S Code Miscellaneous Function

**General** When the S code is to be executed, the I/O point or analog control is set by bit parameter No.1#2.

Basic procedure for spindle S code I/O point control:

Table 7-2-1

Function	Program address	Output signal		Response and completion signal
		F address signal	Strobe signal	
S code miscellaneous function	S*	S* (F22)	SF (F007 # 2)	FIN(G004#3)

The followings describe these S code functions:

- (1) Suppose that SX is specified in a program:  
X range is 1~8, alarm is issued if it is beyond this range, and S1~S8 correspond to F address signals F22#0~#7 respectively. (For S1, it corresponds to the F address signal F22#0.)
- (2) If a non-M, S, T instruction such as move, dwell is specified in the same block with the miscellaneous function, these instructions will be executed simultaneously.
- (3) When S1 is executed, the F address signal F22#0 and the strobe signal F007#2 should be set to 1, and the response signal FIN(G004#3) should be set to 0 by PLC.
- (4) When S1 is completed, FIN(G004#3) is set to 1. M, S, T code miscellaneous functions are to be executed simultaneously, the completion signal FIN (G004#3) can't be set to 1 till they are finished.
- (5) M, S, T codes in a same block will be executed simultaneously, and only the completion signal FIN is set to 1 could next block be executed.

### Basic procedure for spindle S code analog control

Table 7-2-2

Function	Program address	Output signal		Response and completion signal
		F address signal	Strobe signal	
S code miscellaneous function	S****	S** (F22#0~F25#7) (F34#0~#3)	SF (F007 # 2)	FIN(G004#0)

These S code functions are explained as the following:

- (1) Suppose that SXXX is specified in a program: (F34#0~#2 is defined by data parameter

P246~249, this signal can be used for gear exchange by PLC. S500 by 1000 set by data parameter P246.)

- (2) If a non-M, S, T instruction such as move, dwell is specified in the same block with the miscellaneous function, these instructions will be executed simultaneously.
- (3) When S500 is to be executed, the F address signal F34#0 and the strobe signal F007#2 should be set to 1, and the response signal FIN(G004#3) should be set to 0 by PLC.
- (4) When S500 is completed, PLC completion signal FIN(G004#3) is set to 1. M, S, T code miscellaneous functions are to be executed simultaneously, the completion signal FIN (G004#3) can't be set to 1 till they are finished.
- (5) M, S, T codes in a same block will be executed simultaneously, and only the completion signal FIN is set to 1 could next block be executed.
- (6) In miscellaneous state, executing S code can change the system S mode.

### 7.3 T Code Miscellaneous Function

**General** T code Miscellaneous function T code with M code are used together. Such as T060M03;  
When the T code is to be executed, the code signal (D241) and the strobe signal are sent to PLC, by these signals PLC switch on or off its functions.

Basic processing

The signals are used for the following functions:

Table 7-3-1

Function	Program address	Output signal		Response and completion signal
		Data address	Strobe signal	
T code miscellaneous function	T***	(F026#0~F029#7)	TF (F007#3)	FIN(G004#0)

- (1) Suppose that TXX is specified in a program (XX is sent to code signal D241) :
- (2) If a non-M, S, T instruction such as move, dwell is specified in the same block with the miscellaneous function, these instructions will be executed simultaneously. If multiple MST codes are specified in the same block, these codes will be executed by sequence.
- (3) If TXX is to be executed, the strobe signal F007#3 is set to 1, at the moment, the PLC sets the respond signal FIN(G004#3) to 0.
- (4) As the operation is finished, the completion signals TFIN (G00#5) and FIN (G00#0) are set to 1 by PLC. If M, S, T codes are to be executed simultaneously, the completion signal FIN (G00#0) can't be set to 1 till they are finished.
- (5) M, S, T codes in a same block will be executed simultaneously, and only the completion signal FIN is set to 1 could next block be executed.

### 7.4 Miscellaneous Function Strobe Signal

**M code miscellaneous function strobe signal**  
**MF1 (F007#0)**

[Classification] output signal

[Function] these signals informs M function has been specified.

#### **The 2M code miscellaneous function strobe signal**

##### **MF2 (F008#4)**

[Classification] output signal

[Function] these signals informs M function has been specified.

#### **The 3M code miscellaneous function strobe signal**

##### **MF3 (F008#5)**

[Classification] output signal

[Function] these signals informs M function has been specified.

[Output condition] about output conditions and execution process, refer to 7.1 M Code Miscellaneous Function.

**Note: the following miscellaneous functions are executed in the CNC: it is not output even if it is commanded in programs:**

- \* M98, M99
- \* call subprogram's M code
- \* call customer macro program's M code

#### **S code miscellaneous function strobe signal**

##### **S F (F007#2)**

[Classification] output signal

[Function] these signals informs the actual specified spindle speed.

[Output condition] about output conditions and execution process, refer to 7.2 S Code Miscellaneous Function.

#### **T code miscellaneous function strobe signal**

##### **TF (F007#3)**

[Classification] output signal

[Function] these signals informs the actual specified tool function.

[Output condition] about output conditions and execution process, refer to 7.3 T Code Miscellaneous Function.

#### **Miscellaneous function end signal**

##### **FIN (G004#3)**

[Classification] input signal

[Function] the signal indicates ends of M code miscellaneous function, S code miscellaneous function, T code miscellaneous function.

[Operation] when the signal changes 1--0—1, the control unit's operation and execution process are referred to Section 7.1, Section 7.2, Section 7.3.

#### **Warning**

The above all functions share one end signal FIN (G004#3), and the signal must be set to 1 after all functions end.

## **7.5 Auxiliary Function Lock**

**General** Inhibits execution of a specified M, S, and T function. That is, code signals and strobe signals are not issued. This function is used to check a program.

**Signal** **Auxiliary function lock signal**

**AFL (G005#6)**

[Classification] Input signal

[Function] The signal selects the auxiliary function lock, i.e., the signal disables the execution of the specified M, S, T function.

[Operation] When the signal becomes 1, the control unit functions are as follows:

1. The control unit does not execute M, S, and T functions. That is, the control unit stops the output of code signals and strobe signals.
2. If this signal becomes “1” after code signal output, the output operation is executed during the ordinary manner until its completion( that is, until the FIN signal is received, and the strobe signal becomes to “0”.)
3. Among the miscellaneous function, M00,M01, M02 and M30 are executed even when this signal is “1”. All code signals, strobe signals, decode signals are output during the ordinary manner.
4. Even when this signal is “1”, M98 and M99 are executed during the control unit without outputting their execution results are executed during the ordinary manner.

**Warning** Even when this signal is “1”, THE spindle analog voltage output is executed.

Auxiliary function lock check signal

**MAFL (F004#4)**

[Classification] Output signal

[Function] The signal reports the state of auxiliary function lock signal AFL.

[Output conditions] When the signal is 1, the auxiliary function lock signal AFL is 1.

When the signal is 0, the auxiliary function lock signal AFL is 0.

Signal address

	#7	#6	#5	#4	#3	#2	#1	#0
G005		AFL						
F004				MAFL				

## Chapter 8 Spindle Speed Function

### 8.1 Spindle Speed Control Mode

**General** For GSK980TC3 system, the spindle is divided into gear spindle and analog spindle:

1. In gear spindle mode, CNC changes S code to switch value to output to the spindle to control the spindle speed.
2. During analog spindle, changes S code to analog value to output to the spindle to control the spindle speed.

The control mode is I / O or analog is set by bit parameter NO:1#2.

#### 8.1.1 Gear Spindle

**General** The gear spindle is defined that the spindle S code is controlled by I/O point.

**Signal** Spindle speed strobe signal

**SF (F007#2)**

Gear spindle address signal

**F034#0~F034#4**

[Classification] Output signal

[Function] These signals report the actually specified the spindle speed function.

[Output conditions] For the output conditions and procedure, see “7.2 S code Miscellaneous Function, Spindle S Code I/O Control”.

**Note:** The system's ladder has only three gears S1, S2, S3 to provide for users, S4~S8 cannot be used, if necessary, corresponding ladder must be added.

#### 8.1.2 Analog Spindle

**General** The analog spindle is defined that the spindle speed is controlled by the analog voltage value from the CNC. The CNC changes S code into the analog voltage value to output to the spindle of machine tool to control the spindle speed.

The actual output analog voltage value equals to the S value controlled by the spindle multiplying the spindle override.

**Signal** Spindle override coded signal (G030#0~G030#7)

[Classification] Input signal

[Function] Spindle override code detection signal has 3 binary system code signals which are corresponding with the override:

So, the spindle override can be selected based upon the 10% unit within the 50~120%.

When the spindle speed control is performed instead of using the spindle speed override, the setting override value is 100%.

**Note:** The spindle speed override function is invalid in thread cutting.

Gear change process:

Although S instructs the spindle speed, the actual is to control the spindle motor. So, the CNC needs to confirm the corresponding relation between the spindle motor and gear. Like S

instruction selection, CNC selects the gear according to the previously defined gear speed range by parameter to report PLC to select the corresponding the gear by using the gear change select signal (GR4, GR3, GR2, GR1). At the same time, CNC outputs the spindle motor speed according to the selected gear. CNC outputs the instruction corresponded to the spindle (GR1, GR2, GR3, GR4 output) speed by specifying S0~S99999 during MDI mode. 2 or 4 speed gear (GR1, GR2, GR3, GR4) is set by No.246~249 to simultaneously output to the gear select signal. When the gear select signal is changed, CNC simultaneously output SF signal.

Specification of gear change signal is as follows:

Table 8-1-2-1

Gears	Explanation
GR1	No.1 gear speed
GR2	No.2 gear speed
GR3	No.3 gear speed
GR4	No.4 gear speed

- When the code voltage is 10V, the spindle speed is A (No.246) (min<sup>-1</sup>)
  - When the code voltage is 10V, the spindle speed is B (No.247) (min<sup>-1</sup>)
  - When the code voltage is 10V, the spindle speed is C (No.248) (min<sup>-1</sup>)
  - When the code voltage is 10V, the spindle speed is D (No.249) (min<sup>-1</sup>)
- S and spindle motor speed instruction the voltage (0~10V) and gear select signal, (GR1, GR2, GR3, GR4) is as the above table.

III Function

### M type gear change

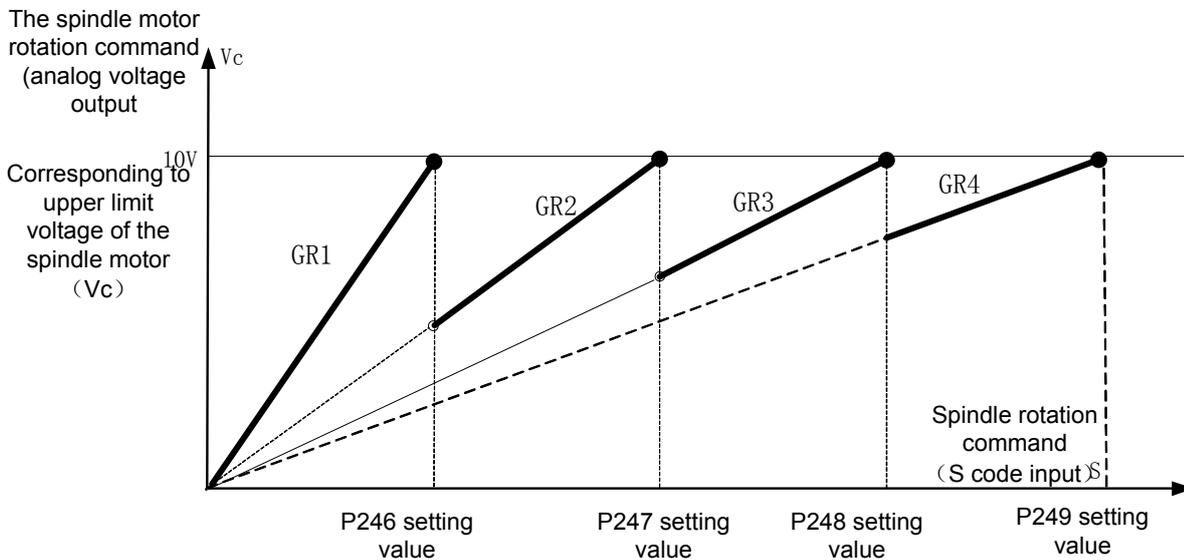


Fig. 8-1-2-1

Signal: Gear selection signal

GR1, GR2, GR3

**GR1, GR2, GR3, GR4 (F034#0~#3)**

[Classification] Output signal

[Function] These signals report PLC the selected gear.

[Output conditions] For the definition of these signals, see Gear change Mode.

Gear change select signal (input)

**GR1, GR2, GR3, GR4 (G028#0~#3)**

[Classification] Input signal

[Function] These signals report CNC the current selected gear.

[Output conditions] For the definition of these signals, see Gear change Mode.

**Signal address**

	#7	#6	#5	#4	#3	#2	#1	#0
G028					GR4	GR3	GR2	GR1
F007						SF		
F034					GR4	GR3	GR2	GR1

**T type gear change**

When 38#5 is set o 1, the system uses T type gear change mode.

When T type gear change is commanded, the gear change mode selects a corresponding spindle gear by PLC's G signals (G28.0~G28.3), and the data parameters (P246~P249) confirm the maximum speed corresponded to the gears. The system counts and sets the corresponding parameter by the machine's gear transmission ratio, and realizes the gear change operation by PLC compiling, and IO or M code can command the gears. After the corresponding gears are commanded, S code is executed, the system counts the output spindle analog voltage according to the gears' max. speed.

Table 8-1-2-2

Gear selection signal	Corresponding G signal	Gear number	Max. spindle speed parameter
GR1	G28.0	1	P246
GR2	G28.1	2	P247
GR3	G28.2	3	P248
GR4	G28.3	4	P249

Example: After the PLC is connected to G signals, executing S code can convert the analog voltage according to corresponding data parameter value. Example, P246 is set to 3000, P247 is set to 6000, when G28.0 is connected, executing S1500 can output 5V analog voltage; when G2.1 is connected, executing S1500 can output 2.5V analog voltage.

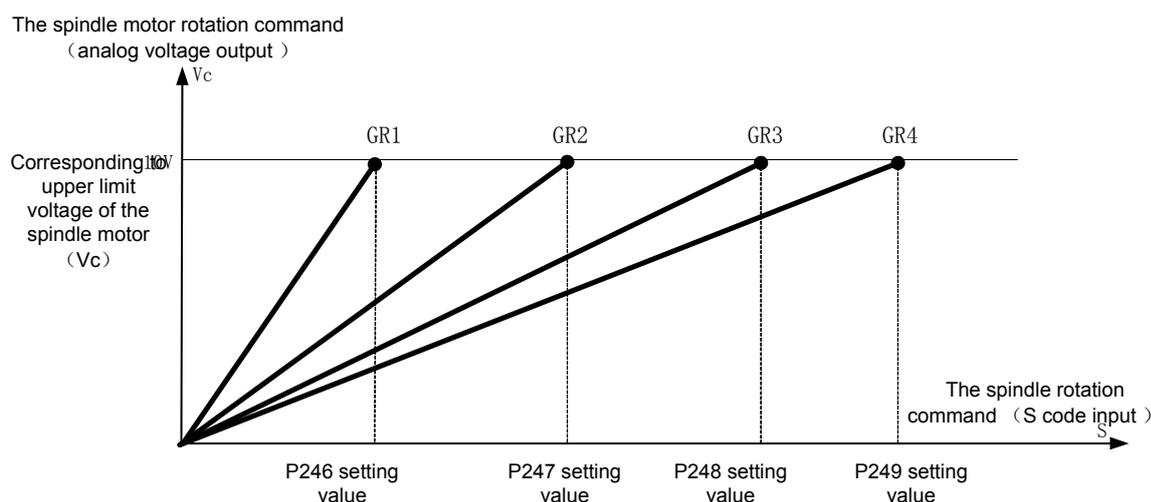


Fig. 8-1-2-2

**8.2 PMC Axis Control Mode**

- **General** The axis leaves from the CNC by setting a corresponding parameter, and it no longer receives the CNC commands, but the PLC sends the run command data to the axis to execute the specified operation function. The PLC axis can separately run without a link interpolation relationship with the CNC axis. The system can control 2 PLC axes, generally used

to indexing table, turret and other device controls. The PLC axis can realize the control function:

1. rapid traverse
2. return to the reference point
3. select a machine coordinate system

**Note:** PLC axis control can realize all kind of control function by PLC command control signals, and the CNC provides one group of input/output signal group 1 for the PLC axis control.

● **Step**

- (1) Set the PLC axis control's controlled axes in P540~P541;
- (2) Use the PLC direct control axis, the controlled axes' selection signal EAX1~EAX4 is set to "1" according to the set group number, which makes them become the PLC axes from the CNC management. P381 set the least increment of the PLC axis control' controlled axis.
- (3) Specify the PLC axis execution operations. Using the axis control command signals EC0g~EC6g specify the operation classification, the axis feedrate signals EIF0g~EIF15g specify the axis control federate, the axis control data signals EID0g~EID31g specify the movement amount or other data. The above signals and block stop/inhibit signals specify one block's command. Theses signals are called the axis control block data signa.
- (4) When one block's set data operation is specified completely, current logic of the axis control command signal turns over, when the previous EBUFg is 0, it is set to 1; when the previous is 1, it is set to 0. Their logic of the axis control command read completion signal EBUYg of the CNC output signal and the signal BEUFg must be the same, otherwise, they cannot turn over.

● **Control parameters**

**System parameters**

0	6	0	PMCA	PMCP				PMCS		
---	---	---	------	------	--	--	--	------	--	--

- PMCS** =1: PMC axis' axis selection is specified by G signals  
 =0: PMC axis' axis selection is not specified by G signals
- PMCP** =1: PMC axis zero return mode selection: one-rotation signal  
 =0: PMC axis zero return mode selection: no one-rotation signal
- PMCA** =1: an alarm occurs when PMC axis does not return to the machine coordinate system selection mode  
 =0: no alarm occurs when PMC axis does not return to the machine coordinate system selection mode

**Data parameter**

0 5 4 0	PMC axis control's system axis number ( 0 : none 1 ~ 5 : the 1 <sup>st</sup> axis~the 5 <sup>th</sup> axis)
0 5 4 1	PMC axis control data's least increment (0.0001~360.0)

**8.2.1 Signal Address**

	#7	#6	#5	#4	#3	#2	#1	#0
F130	EBSY			EGEN		EIAL		EINP
F133	EBSY			EGEN		EIAL		EINP
F136	EBSY			EGEN		EIAL		EINP
F139	EBSY			EGEN		EIAL		EINP

F131						MABUF	
F134						MABUF	
F137						MABUF	
F140						MABUF	

### 8.2.2 Command

Table 8-2-2-1

Command	Operation	Data 1	Data 2	Explanation
00	Rapid traverse	Rapid traverse speed	Total movement amount	Execute operations which are the same with the CNC G00
05	Reference point return	-----	-----	Execute operations which are the same with the CNC manual reference point return
32	Machine coordinate system selection	Rapid traverse speed	Machine coordinates	Execute operations which are the same with the CNC G53

**Note:** “Command” means the axis control command signals EC0g-EC6g.  
 “Data 1” means the axis control feedrate speed signal EIF0g-EIF15g.  
 “Data 2” means the axis control data signal EID0g-EID31g.  
 The continuous feed command is the immediate command and the CNC terminal does not buffer commands.

### 8.2.3 Command Operation Time Diagram

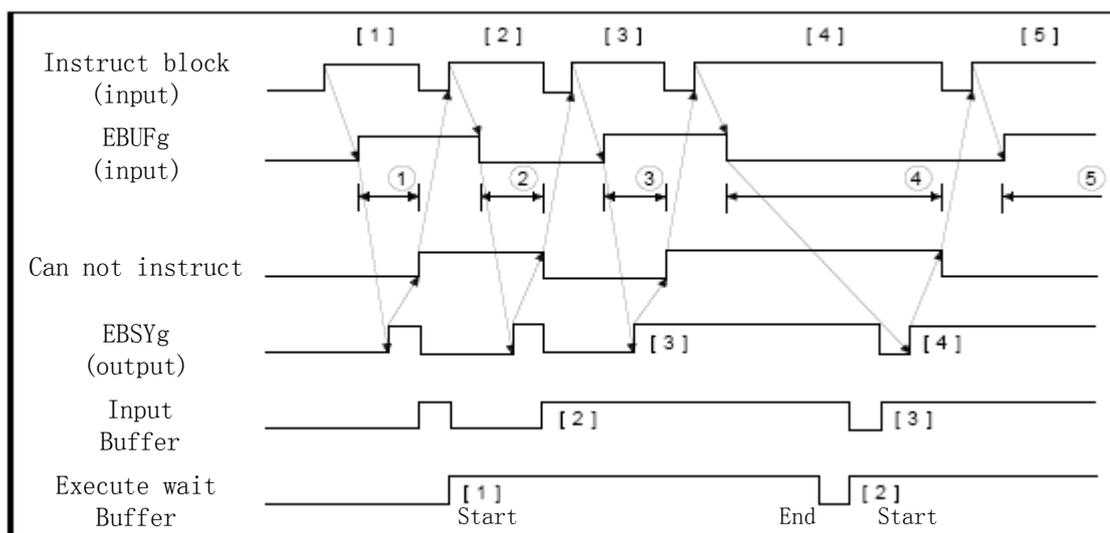


Fig. 8-2-3-1

### 8.2.4 Signal Explanation

g ( blank space, B) marks No.0 or 2PMC axis.

- (1) **PMC axis selection signal (PMC axis control)**  
 Signal symbol: EAXg1~ EAXg6 (G136.0~G136.4 )  
 Signal type: PLC →NC  
 Signal function:

III Function

- (2) **Axis control command signal (PMC axis control)**  
 Signal symbol: EC0g~EC6g (G143.0~G143.6 , G155.0~G155.6, G167.0~G167.6  
 G179.0~ G179.6)  
 Signal type: PLC →NC  
 Signal function:
- (3) **Control feedrate signal (PMC axis control)**  
 Signal symbol: EIF0g~EIF15g (G144.0~G145.7 , G156.0~G157.7)  
 Signal type: PLC →NC  
 Signal function:
- (4) **Axis control data signal (PMC axis control)**  
 Signal symbol: EID0g~EID31g (G146.0~G149.7, G158.0~G161.7, G170.0~G173.7,  
 G182.0~G182.7)  
 Signal type: PLC →NC  
 Signal function: the binary data specifies the movement amount but cannot command the  
 movement direction.
- (5) **Control command read signal (PMC axis control)**  
 Signal symbol: EBUFg (G142.7, G154.7, G166.7, G178.7)  
 Signal type: PLC →NC  
 Signal function: command the CNC to read PLC axis controlling 1 block amount's command  
 data.
- (6) **Axis control read completion signal (PMC axis control)**  
 Signal symbol: EBSYg (F130.7, F133.7, F136.7, F139.7)  
 Signal type: NC →PLC  
 Signal function: CNC informs the PLC has read the PLC axis controlling one block amount's  
 command data into the buffer signal.
- (7) **Reset signal**  
 Signal symbol: ECLRg (G142.6 , G154.6, G166.6, G178.6)  
 Signal type: PLC →NC  
 Signal function: when the system resets the PLC axis control command and the signal is set  
 to "1" :  
 A. when the axis moves: the axis decelerates to stop  
 B. when temporarily executing: stop execution  
 C. when the miscellaneous function is executed: when the execution is stop and the buffered  
 commands are cleared, the input control command is invalid while the signal is 1. When the  
 continuous feed command (EC0g~EC6g : 06h) is specified, the reset signal ECLRg is  
 set to 1, i.e., the command ends. This moment, the servo motor decelerates to stop, the  
 axis moving signal EGENg is set to 0, and the control axis selection status signal EAXSL is  
 also set to 0. Before the control axis selection status signal EAXSL is set to 0, the reset  
 signal ECLRg remains 1. Besides, before the axis moving signal EGENg is set to 0, the  
 reset signal ECLRg remains 1.
- (8) **Block stop signal**  
 Signal symbol: ESBKg (G142.3, G142.3)  
 Signal type: PLC →NC block stops the invalid signal's signal symbol: EMSBKg (G143.7,  
 G167.7)  
 Signal type: PLC →NC  
 Signal function: stop each command block or forbid stop for each block. In the course of  
 executing the PLC sending commands, when the block stop signal ESBKg  
 is set to 1 and the current executing block ends, the system stops the axis  
 control. The block stop signal ESBKg is set 0, the system executes the  
 buffered command. But, when the block stop inhibit signal EMSBKg is set to  
 1, the block stop signal ESBKg is invalid.
- (9) **In-position signal**  
 Signal symbol: EINPg (F136.0, F139.0)

Signal type: NC→PLC

Signal function: it means whether the PLC axis is in-position status. The signal becomes 1 when the PLC controlling axis is in-position status. When it is in the axis movement's deceleration status, the system executes in-position check; when it does not reach the position width range, the next command is not executed.

**(10) Alarming signal (PMC axis control)**

Signal symbol: EIALg (F130.2, F133.2, F136.2, F139.2,)

Signal type: NC→PLC

Signal function: it means the alarm statuses relevant with the PLC axis control. The signal becomes when the PLC controlling axis sends the servo alarm, overtravel alarm or an alarm occurs. Executing the following operations can release the alarm, the reset signal ECLRg is set to 1, the signal becomes 0. Resolve the alarm reason about the servo alarm, and reset the CNC. For the overtravel alarm, move the axis in the stored travel limit, and reset the CNC. In overtravel alarm, make the axis movement's commands(including (EC0g~EC6g ))in the stored travel limit.

**(11) Axis moving signal (PMC axis control)**

Signal symbol: EGENg (F130.4, F133.4, F136.4, F139.4)

Signal type: NC→PLC

Signal function: it means the axis' movement state.

**(12) Zero return end signal**

Signal symbol: reference point return completion signal ZP1~ZP5 (F094.0~F094.4)

Signal type: NC→PLC

Signal function: reference point return signal definitions of PLC axis and CNC controlled axis are the same. The last digit means the controlled axis' serial number. The signal becomes when the reference point return completion and in-position are performed. The signal becomes "0" when the reference point moving out, emergency stop is performed or the servo alarm occurs.

## 8.3 Cs Contour Control Mode

**General** The servo spindle can position, and also execute interpolation with other servo axes, and can command the linear interpolation between the spindle and the servo axis.

Controlling the servo spindle's spindle speed is called the spindle rotation control (the speed command S makes the spindle rotate); controlling the spindle's position is called the spindle contour control (the movement command makes the spindle rotate). The spindle's contour control function is called Cs contour control function.

Switching the spindle rotating control and Cs contour control is determined by PLC sending output signals. Cs contour controlled axis' manual run and automatic run are the same with the general servo axis. (about the reference point return, refer to Function, Section 4.1.

### 8.3.1 Cs Contour Controlled Axis Setting

When (No37#7 SCS) = "1", Cs contour control function is valid. It can execute the spindle's Cs contour control. The axis executing Cs contour control is taken as one axis in the CNC controlled axes. (the 5<sup>th</sup> axis is fixed to be Cs contour axis and the CNC controlled axes are set to 5, which cannot be changed)

### 8.3.2 Switch Spindle Rotation Control/Cs Contour Control

1. Switch the spindle rotation control mode into Cs contour control mode: when Cs contour control switch signal CON (G033#4) is "1", the spindle becomes Cs contour controlled axis. the system is switched into Cs contour control in the spindle rotation, the spindle immediately stops and executes switch.
2. Switch Cs contour control mode into the spindle rotation control mode: Cs contour control switch

signal CON (G033#4) is “0”, the spindle becomes the spindle rotation control mode. After the system confirms the spindle movement command relative to automatic run/manual run completely ends, the switch is performed. When the switch in the spindle movement is executed, an alarm occurs.

### 8.3.3 Axis Setting of Cs Contour Controlled Axis Executing Interpolation

The servo axis with Cs contour controlled axis executes interpolation, up to 2 axes but only linear interpolation is valid.

### 8.3.4 Cs Contour Controlled Axis' Reference Point Return

When (No37#5 CsZR) =“0”, Cs contour controlled axis' reference point return function is invalid. After the spindle rotation control mode is switched into Cs contour control mode, the CNC takes the current point as the zero. (adaptive to GS series spindle servo unit: the servo unit's position mode is switched into the mode selection 0, the servo unit positions to the set position, and the position setting is referred to GS Series Spindle Servo Unit.

When (No37#5 CsZR) =“1”, Cs contour controlled axis' reference point return function is valid.

#### Operation steps:

##### 1. Manual run mode

After the servo spindle is switched into Cs contour control mode, and when the feed axis direction selection signal (G100#4) is set to “1” in the reference point return mode, the spindle starts the reference point return operation. After positioning to the reference point, the reference point return completion signal ZP5 (F094#4) becomes “1”.

##### 2. Automatic run mode

###### (1) G00 command

After the servo spindle is switched into Cs contour control mode, and G00 is executed without performing the reference point return one time, the servo spindle executes the reference point return operation. When G00 is commanded, the servo spindle executes the reference point return. After the reference point return ends, the reference point return completion signal ZP5 (F094#4) becomes “1”, and positions to the commanded position. G00 which executes the reference point return above one time becomes a general positioning operations.

Differences between the reference point return based on G00 and G28 or manual reference point return are that the later is always to position to the reference point, but in G00, it can position to any command positions.

###### (2) G28 command

After the servo spindle is switched into Cs contour control mode and when G28 is commanded, and after the spindle motor stops, the spindle moves to the middle. Then, the reference point return operation is executed, the reference point return completion signal ZP5 (F094#4) becomes “1”. After the servo spindle is switched into Cs contour control mode, the reference point return is executed, and positioning to the reference point is done, ZP5 is set to “1”.

##### 3. Interrupting the reference point return

- (1) In manual run mode, when the reset, emergency stop, feed axis' direction selection signal is set to “0”, the reference point return operation can be interrupted. The reference point return operation after interruption is executed again from the original.
- (2) In automatic run mode, interruption can be performed by reset, emergency stop or feed hold. In any conditions, the reference point return operation after interruption is executed again from the original.

### 8.3.5 Cs Contour Controlled Axis' Run (Auto/Manual)

After it is switched into Cs contour control mode and the reference point return is executed, it with general servo axes run. It is not taken as Cs controlled axis in the spindle rotation control mode. An alarm PS0197 occurs in automatic run.

Besides, the manual run relative to Cs contour controlled axis is performed by PLC ladder time sequence, which make it not rotate in the spindle rotation mode.

#### Signals :

**CS contour control switch signal CON (G027#7)**

**【Classification】** input signal

**【Function】** command the spindle's spindle rotation control mode and Cs contour control mode. It is valid when (No37#7)="1".

**Spindle Cs contour control switch completion signal FCSS1 (F042#6) 's 1<sup>st</sup> spindle**

**【Classification】** output signal

**【Function】** it informs the spindle has been switched to Cs contour control mode.

**【Output condition】** it becomes "1" in the following condition.

Its subordinated spindle does not become Cs contour control mode (the spindle rotation control mode). It is valid when No37#7="1".

**Time chart**

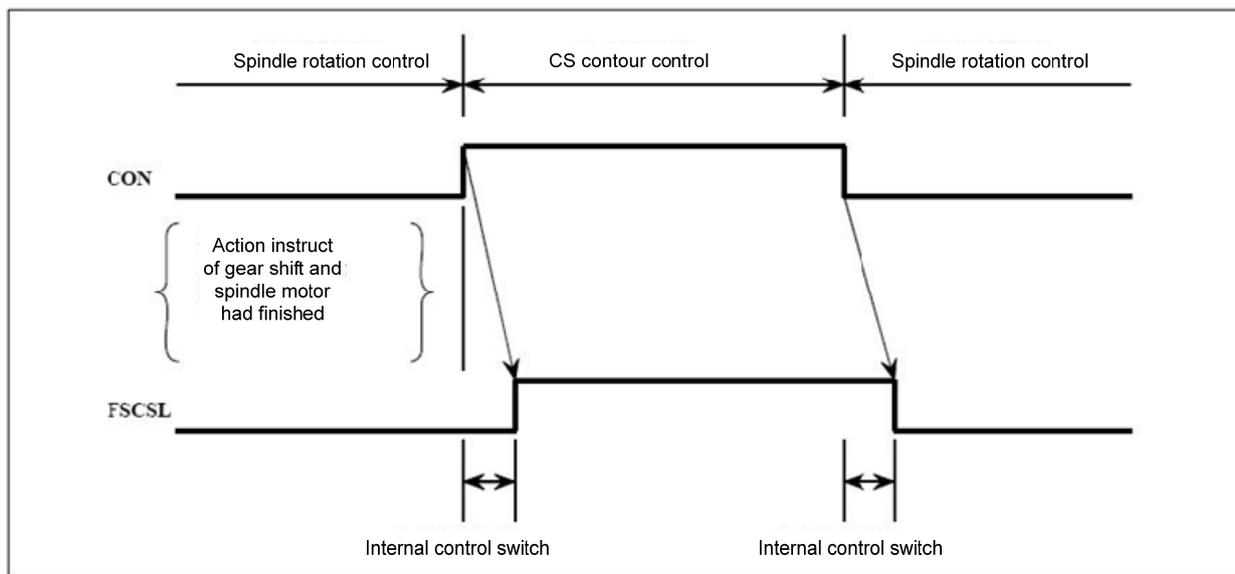


Fig. 8-3-5-1

**Signals relevant with CS contour control**

**Gear selection signal GR10, GR20, GR30, GR40, ( F034#0~F34#3 )**

**【Classification】** output signal

**【Function】** PMC command gear change series.

**Gear selection signals GR1, GR2, GR3, GR4 ( G028#0~G29#3 )**

**【Classification】** input signal

**【Function】** these signal informs the CNC currently selected gear series

**Table 8-3-5-1**

M type gear change (CNC side)				
Gears	Gear selection			
	GR40	GR30	GR20	GR10
1	0	0	0	1
2	0	0	1	0
3	0	1	0	0
4	1	0	0	0

T type gear change (PLC side)				
Gears	Gear selection			
	GR40	GR30	GR20	GR10
1	0	0	0	1
2	0	0	1	0
3	0	1	0	0
4	1	0	0	0

**Cs contour controlled axis' reference point return completion signal ZP5 (F094#4 )**

**【Classification】** output signal

**【Function】** it means the Cs contour controlled axis' reference point return has completed.

ZP□

- : 1....the 1<sup>st</sup> axis' reference point return signal
- 2.... the 2<sup>nd</sup> axis' reference point return signal
- 3.... the 3<sup>rd</sup> axis' reference point return signal

**【Output condition】** in Cs contour control mode, execute the manual reference point return or G28 automatic reference point return, Cs contour controlled axis is at the reference point, the signal becomes 1.

## Chapter 9 Programming Code

### 9.1 Custom Macro Program

**General** Although subprograms are useful for repeating the same operation, the custom macro function also allows use of variables, arithmetic and logic operations, and conditional branches for easy development of general programs. A machining program can call a custom macro with a simple instruction, just like a subprogram.

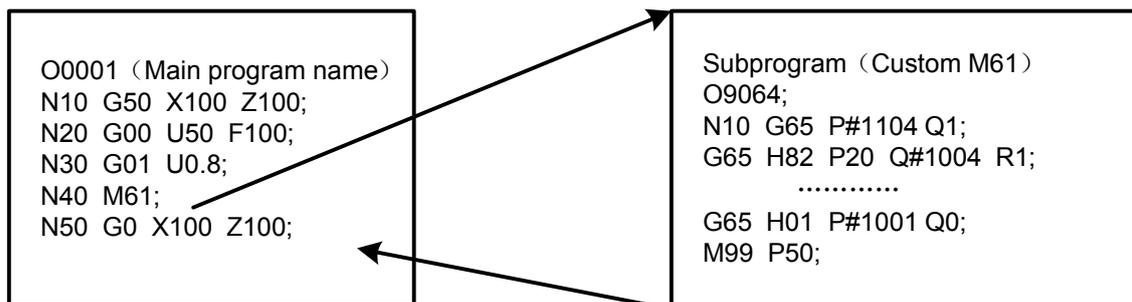


Fig. 9-1-1

This reports some function programmed by macro program can be taken as the general function. i.e., the program can be written by the data variable(variable data or unknown data. For example, the custom program can be used for technology.

#### Signal Custom macro program input signal

**UI000~UI015 (G054, G055)**

[Classification] Input signal

[Function] The signals do not provide any functions for the control unit. These signals which are taken as one of system variable is read by macro program, used for the interface signal between macro program and PLC.

The system variable corresponding to these signals are as follows:

Table 9-1-1

Signal	Address	Variable
UI000	G54#0	#1000
UI001	G54#1	#1001
UI002	G54#2	#1002
UI003	G54#3	#1003
UI004	G54#4	#1004
UI005	G54#5	#1005
UI006	G54#6	#1006
UI007	G54#7	#1007
UI008	G55#0	#1008
UI009	G55#1	#1009
UI010	G55#2	#1010
UI011	G55#3	#1011
UI012	G55#4	#1012
UI013	G55#5	#1013
UI014	G55#6	#1014
UI015	G55#7	#1015
UI000~UI015	G54, G55	#1032

Note: #1032 is variable with 16-digit as follows:

Signal address

	#7	#6	#5	#4	#3	#2	#1	#0
# 1032	UI007	UI006	UI005	UI004	UI003	UI002	UI001	UI000
# 1032	UI015	UI014	UI013	UI012	UI011	UI010	UI009	UI008

Custom macro program output signal

**UO000~UO015**

(F054~F055)

[Classification] Output signal

[Function] The signals do not provide any functions for the control unit. These signals which are taken as one of system variable are read/written by macro program, used for the interface signal between macro program and PLC.

The system variable corresponding to these signals are as follows:

Table 9-1-2

Signal	Address	Variable
UO000	F54#0	#1100
UO001	F54#1	#1101
UO002	F54#2	#1102
UO003	F54#3	#1103
UO004	F54#4	#1104
UO005	F54#5	#1105
UO006	F54#6	#1106
UO007	F54#7	#1107
UO008	F55#0	#1108
UO009	F55#1	#1109
UO010	F55#2	#1110
UO011	F55#3	#1111
UO012	F55#4	#1112
UO013	F55#5	#1113
UO014	F55#6	#1114
UO015	F55#7	#1115
UO000~UO015	F54,F55	#1132

Note: #1132 is a 16-digit variable.

Composition is as follows:

	#7	#6	#5	#4	#3	#2	#1	#0
# 1132	UO007	UO006	UO005	UO004	UO003	UO002	UO001	UO000
# 1132	UO015	UO014	UO013	UO012	UO011	UO010	UO009	UO008

## Chapter 10 Display/Set

### 10.1 Clock Function

**General** Display the date time: year/month/date/hour/minute/second format on **【CNC SET】** .  
(Note: the clock is set only on the page.)

### 10.2 Displaying Operation History

**General** The alarm page displays the current inside/outside user alarm messages of the system.  
The alarm history page displays the current and previous alarm message of the system.  
Operation record page display history operation records of the operator modifying the bit parameters and data parameters

### 10.3 Help Function

**General** The help function displays on the screen detailed report about alarms issued during the CNC and about CNC operations:  
System message, system operation, G code, parameter table, macro command, PLC addresses.  
The alarm list can display the system's all alarms and solutions.  
The counter function helps the operator to count the data.



## Chapter 11 Measurement

**General** Linear interpolation can be commanded by specifying axial following the G31 instruction, like G01. If an external skip signal is input during the execution of this instruction, execution of the instruction is halted and the next block is executed.

The skip function is used when the end of machining is not programmed but specified with a signal from the machine, for example, during grinding. It is used also for measuring the dimensions of a workpiece.

The coordinate values when the skip signal is turned on can be used during a custom macro because they are stored during the custom macro system variable #5016~#5019, as follows:

- #5016** X-axis block' end point position
- #5017** Y-axis block' end point position
- #5018** Z-axis block' end point position
- #5019** 4TH-axis block' end point position

**Signal**      **Skip signal**  
**SKIP (G001#1)**

[Classification] Input signal

[Function] This signal terminates skip cutting. That is, the position where a skip signal turns to "1" during a block containing G31 is stored during a custom macro variable, and the move instruction of the block is terminated at the same time.

[Operation] When a skip signal turns to "1", the control unit works as described below.

- When a block contains a skip cutting instruction G31, the control unit reads and stores the current position of the specified axis at that time. The control unit stops the axis, then cancels the remaining distance that the block was supposed to be moved.
- The skip signal is monitored not for a rising edge, but for its state. So, if a skip signal continues to be "1", a skip condition is assumed to be satisfied immediately when the next skip cutting is specified.

**Note: The skip signal width requires at least 10ms.**

**Signal address**

	#7	#6	#5	#4	#3	#2	#1	#0
G001							SKIP	



## Chapter 12 Panel Locked Setting

**Signal**      **Lock edit signal**

LEDT (G046#3)

[Type]    Input signal

[Function] The signal locks the press key on the edit panel.

[Operation] When the signal is set to 1, all keys on the panel are locked and disabled.  
When the signal is set to 0, all keys on the panel are enabled.**Signal address**

	#7	#6	#5	#4	#3	#2	#1	#0
G016					LEDT			



## Appendix 1 Addresses between PLC and CNC

1: CNC→PLC address: F000 ----- F205

Table - 1

Signal name	Symbol	Address
Tape rewinding signal	RWD	F000#0
Feed dwell signal	SPL	F000#4
Cycle start signal	STL	F000#5
Servo ready signal	SA	F000#6
Automatic operation signal	OP	F000#7
Alarm signal	AL	F001#0
Resetting signal	RST	F001#1
Spindle speed arrival signal	DEN	F001#3
Spindle enabling signal	ENB	F001#4
Tapping signal	TAP	F001#5
Ready signal	MA	F001#7
Inch input signal	INCH	F002#0
Signal in rapid traverse	RPDO	F002#1
Signal in constant surface speed	CSS	F002#2
Signal in thread cutting	THRD	F002#3
Signal in feed cutting	CUT	F002#6
Dry run detection signal	MDRN	F002#7
Detection signal of increment feed selection	MINC	F003#0
Detection signal of MPG feed selection	MH	F003#1
JOG feed detection signal	MJ	F003#2
Detection signal of Auto operational selection	MMDI	F003#3
Detection signal of Auto operational selection	MMEM	F003#5
Detection signal of register Edit selection	MEDT	F003#6
Optional block skip confirmation signal	MBDT1	F004#0
Detection signal of overall axes machine lock	MMLK	F004#1
Manual absolute confirmation signal	MABSM	F004#2
Detection signal of single block	MSBK	F004#3
Auxiliary function lock signal	MAFL	F004#4
Detection of manual reference position return	MREF	F004#5
Reset confirmation signal based on MDI	MDIRST	F006#1
MPG trial cut status signal	RHPG	F006#3
Signal in grammar checking	SCHK	F006#4
The system model selection	CNCS	F006#5
Signal in MPG interruption starting	HSIL	F006#7
Strobe signal of M code miscellaneous function	MF	F007#0
Strobe signal of S code miscellaneous code	SF	F007#2
Strobe signal of T code miscellaneous code	TF	F007#3
The 2M~3M function strobe pulse signal	MF2 , MF3	F008#4~#5
M decoding signal	DM99 ~DM98 DM30 , DM00~DM02	F009#2~#3 F009#4~#7
Miscellaneous function code signal	M00~M31	F010#0~F13#7
The 2M function code signal	M200~M215	F014#0~F15.#7
The 3M function code signal	M300~M315	F016#0~F017#7
The spindle function code signal	S00~S31	F022#0~F025#7
T function code signal	T00~T31	F026#0~F029#7
Gear selection signal (output)	GR10~GR40	F034#0~F034#3

Signal name	Symbol	Address
The spindle change check alarm signal	SPAL	F035#0
S12 bit code signal	R010~ R120	F036#0~F037#3
The spindle clamping signal	SCLPA	F038#0
The spindle releasing signal	SUCLPA	F038#1
The spindle enabling signal	ENB2	F038#2
Signal in the spindle orientation mode	MSPOSA	F039#0
Actual spindle speed signal	AR00~AR15	F040#0~F41#7
Cs contour control switch completion signal	FCSS1~FCSS2	F042#0~#1
User macro program using an output signal	UO000~UO131	F054#0~F059#7
External data input using a read completion signal	EREND	F060#0
External data input using a search completion signal	ESEND	F060#1
External data input using a search cancellation signal	ESCAN	F060#2
Required part quantity arrival signal	PRTSF	F062#7
Polygon main control axis not arrival signal	PSE1	F063#0
Polygon synchronous axis not arrival signal	PSE2	F063#1
Polygon spindle speed arrival signal	PSAR	F063#2
Inter-path spindle command confirmation signal	COSP1 ~COSP2	F063#3~#4
Waiting signal	WATO	F063#6
Signal in polygon synchronization	PSYN	F063#7
Too change signal	TLCH	F064#0
New tool selection signal	TLNW	F064#1
Tool-by-tool change signal	TLCHI	F064#2
Tool life anticipating signal	TLCHB	F064#3
Spindle rotation direction signal	RGSP ,RGSPM	F065#0~#1
Spindle synchronous speed ratio control clamped signal	RSMAX	F065#2
Retreating completion signal	RTRCTF	F065#4
Tapping return completion signal	RTPT	F066#1
Machining start point signal	RTNMVS	F066#3
Position switch signal	PSW01~PSW15	F070#0~F071#7
P code macro program output signal	EUO00~EUO15	F084#0~F085#7
The 1 <sup>st</sup> axis releasing signal	UCLP1~UCLP5	F086#0~#4
The 1 <sup>st</sup> axis clamping signal	CLP1~CLP5	F088#0~#4
Signal in reverse traversing	MRVMD	F091#0
Signal in forbidding turning	MNCHG	F091#1
Signal in forbidding reverse moving	MRVSP	F091#2
Signal in check mode	MMMOD	F091#3
Signal in tool life count invalid	LFCIF	F093#2
The 1 <sup>st</sup> axis ~the 5 <sup>th</sup> axis' reference point return completion signal	ZP1~ZP5	F094#0~#4
The 1 <sup>st</sup> axis ~the 5 <sup>th</sup> axis' the 2 <sup>nd</sup> reference point return completion signal	ZP21~ZP25	F096#0~#4
The 1 <sup>st</sup> axis ~the 5 <sup>th</sup> axis' the 3 <sup>rd</sup> reference point return completion signal	ZP31~ZP35	F098#0~#4
The 1 <sup>st</sup> axis ~the 5 <sup>th</sup> axis' the 4 <sup>th</sup> reference point return completion signal	ZP41~ZP45	F100#0~#4
Signal in The 1 <sup>st</sup> axis ~the 5 <sup>th</sup> axis' axis moving	MV1~MV5	F102#0~#4
The 1 <sup>st</sup> axis ~the 5 <sup>th</sup> axis' axis in-position signal	INP1 ~INP5	F104#0~#4
The 1 <sup>st</sup> axis ~the 5 <sup>th</sup> axis' axis moving direction signal	MVD1~MVD5	F106#0~#4
The 1 <sup>st</sup> axis ~the 5 <sup>th</sup> axis imagine confirmation signal	MMI1~MMI5	F108#0~#4
Signal in the 1 <sup>st</sup> ~the 5 <sup>th</sup> axis controllable axis dismantled	MDTCH1~MDTCH 5	F110#0~#4

## Appendix

Signal name	Symbol	Address
The 1 <sup>st</sup> axis ~the 5 <sup>th</sup> axis distribution completion signal(PMC axis control)	EADEN1~EADEN5	F112#0~#4
The 1 <sup>st</sup> axis ~the 5 <sup>th</sup> axis torque limit arrival signal	TRQL1~TRQL5	F114#0~#4
The 1 <sup>st</sup> axis ~the 5 <sup>th</sup> axis returning to workpiece origin completion signal	PRZP1~ PRZP5	F116#0~#4
Signal in the 1 <sup>st</sup> axis ~the 5 <sup>th</sup> axis' reference point creation	ZRF1~ZRF5	F120#0~#4
Signal in the 1 <sup>st</sup> axis ~the 5 <sup>th</sup> axis' positive overtravel alarm	+OT1 ~ +OT5	F124#0~#4
Signal in the 1 <sup>st</sup> axis' negative overtravel	-OT1 ~ -OT5	F126#0~#4
Override 0% signal (PMC axis control)	EOV0	F129#5
Controllable axis selection status signal (PMC axis control)	*EAXSL	F129#7
In-position signal (PMC axis control)	EINPA	F130#0, F133#0 F136#, F139#0
Signal in accumulated zero checking (PMC axis control)	ECKZA	F130#1, F133#1 F136#1, F139#1
Signal in alarm (PMC axis control)	EIALA	F130#2, F133#2 F136#2, F139#2
Signal in miscellaneous function execution (PMC axis control)	EDENA	F130#3, F133#3 F136#3, F139#3
Signal in axis moving (PMC axis control)	EGENA	F130#4, F133#4 F136#4, F139#4
Overtravel's positive direction (PMC axis control)	EOTPA	F130#5, F133#5 F136#5, F139#5
Overtravel's negative direction (PMC axis control)	EOTNA	F130#6, F133#6 F136#6, F139#6
Axis control command read completion signal (PMC axis control)	EBSYA	F130#7, F133#7 F136#7, F139#7
Miscellaneous function strobe signal (PMC axis control)	EMFA	F131#0, F134#0 F137#0, F140#0
Buffer full signal (PMC axis control)	EABUFA	F131#1, F134#1 F137#1, F140#1
Miscellaneous function's the 2 <sup>nd</sup> strobe pulse signal (PMC axis control)	EMF2A	F131#2, F134#2 F137#2, F139#2
Miscellaneous function's the 3 <sup>rd</sup> strobe pulse signal (PMC axis control)	EMF3A	F131#3, F134#3 F137#3, F139#3
Miscellaneous function code signal (PMC axis control)	EM11A, EM12A EM14A, EM18A EM21A, EM22A EM24A, EM28A EM11B , EM12B EM14B, EM18B EM21B, EM22B EM24B, EM28B EM11C, EM12C EM14C, EM18C EM21C, EM22C EM24C, EM28C	F132#0~#7 F135#0~#7 F138#0~#7 F141#0~#7 F151#0~#7

Signal name	Symbol	Address
	EM11D, EM12D EM14D, EM18D EM21D, EM22D EM24D, EM28D EM31D, EM32D EM34D, EM38D EM41D, EM42D EM44D, EM48D	
Multi-spindle address P signal	MSP00~MSP17	F160#0~F161#7
System controllable axis quantity's binary signal	AXIS1, AXIS2 AXIS4, AXIS8	F171#0~F171#3
Ignore the hard limit	LALM	F172#1
Ignore the emergency stop signal	EALM	F172#2
Signal in the 1 <sup>st</sup> axis~the 5 <sup>th</sup> axis control (PMC axis control)	EACNT1~EACNT5	F182#0~#4
S12 digit code signal	R01O2~R12O2 R01O3 ~R12O3	F200#0~F201#3 F204#0~F205#3
Actual spindle speed signal	AR002~AR152	F202#0~F203#7

III Function

2: PLC→CNC address: G000 ----- G205

Table 2

Signal	Symbol	Address
External data input using data signal	ED00~ED15	G000#0~G001#7
External data input using address signal	EA0 ~EA6	G002#0~#6
External data input using read signal	ESTB	G002#7
Completion signal	FIN	G004#3
The 2M function completion	MFIN2	G004#4
The 3M function completion	MFIN3	G004#5
M function completion signal	MFIN	G005#0
S function completion signal	SFIN	G005#2
T function completion signal	TFIN	G005#3
Miscellaneous function lock signal	AFL	G005#6
Override cancellation signal	OVC	G006#4
Skip signal	SKIPP	G006#6
Automatic run start signal	ST	G007#2
All axes interlock signal	*IT	G008#0
Cutting block starting interlock signal	*CSL	G008#1
Block starting interlock signal	*BSL	G008#3
Emergency stop signal	*ESP	G008#4
Automatic run stop signal	*SP	G008#5
Reset & rewinding signal	RRW	G008#6
External reset signal	ERS	G008#7
External workpiece number search signal	PN1 , PN2 PN4, PN8	G009#0~#4
Manual feedrate override signal	*JV00~*JV15	G010#0~G011#7
Feedrate override signal	*FV0~*FV7	G012#0~#7
Rapid traverse override signal	ROV1,VOV2,ROV4	G014#0~#2
F1 digit feed selection signal	F1D	G016#7
The 1 <sup>st</sup> manual control MPG feed axis selection signal	HS1A~HS1D	G018#0~#3

Manual MPG feed movement amount selection signal(incremental feed signal)	MP1, MP2, MP4	G019#4~#6
Manual rapid traverse selection signal	RT	G019#7
Extended external workpiece number searching signal	EPN00 ~EPN13	G024#0~G025#5
Spindle rotation CW	SFR1,SFR2, SFR3	G026#2, #4, #6
Spindle rotation CCW	SRV1 ,SRV2,SRV3	G026#3, #5, #7
Spindle selection signal	SWS1~SWS3	G027#0~#2
Each spindle stop signal	*SSTP1~*SSTP3	G027#3~#5
Cs contour control switch signal	CON ,CONS1	G027#7,G033#4
Gear selection signal(input)	GR1~GR4 GR21~GR24	G028#0~#3, G029#0~3
Speed arrival signal	SAR	G029#4
Spindle orientation signal	SOR	G029#5
Spindle stop signal	*SSTP	G029#6
Spindle speed override signal	SOV0~SOV7	G030#0~#7
The 2 <sup>nd</sup> spindle ~the 4 <sup>th</sup> spindle speed override signal	SOV20~ SOV22	G031#0~#2
The spindle motor speed command signal	R01I ~R12I R01I2~R12I2	G032#0~G033#3 G034#0~G035#3
The spindle motor command outputting polar command signal	SGN ,SGN2	G033#5,G035#5
The spindle motor command outputting polar selection signal	SSIN ,SSIN2	G033#6,G035#6
The spindle motor speed command selection signal	SIND SIND2	G033#7,G035#7
Tool compensation number selection signal	OFN0~OFN 5	G039#0~#5
Workpiece origin compensation amount's measure mode selection signal	WOQSM	G039#6
Tool compensation amount's measure mode selection signal	GOQSM	G039#7
Tool compensation number selection signal	OFN6 ~OFN9	G040#0~#3
Position record signal	PRC	G040#6
Workpiece coordinate system's offset amount write signal	WOSET	G040#7
Manual MPG interruption axis selection signal	HS1IA ~HS1ID	G041#0~#3
Mode selection signal	MD1~MD4	G043#0~#2
Incremental feed mode selection signal	INC	G043#3
MPG trial cut mode selection signal	TEACH	G043#4
Program zero return mode selection signal	PRGZ	G043#6
Manual reference point return selection signal	ZRN	G043#7
Optional block skip signal	BDT1	G044#0
Machine lock signal	MLK	G044#1
Memory protective signal	KEYP	G046#0
Single block signal	SBK	G046#1
Memory protective signal	KEY1~KEY4	G046#3~#6
Dry run signal	DRN	G046#7
Tool group number selection signal	TL1 ,TL2,TL4,TL8 TL16,TL32,TL64, TL128	G047#0~#7
Tool life count invalid signal	LFCIV	G048#2
Tool skip signal	TLSKP	G048#5
Tool-by-tool change reset signal	TLRSTI	G048#6
Tool change reset signal	TLRST	G048#7

Tool life count override signal	*TLV0 ~*TLV9	G049#0~G051#1
User macro program using input signals	UI000~UI15	G054#0~G055#7
External read start signal	EXRD	G058#1
External read/output stop signal	EXSTP	G058#2
External output start signal	EXWT	G058#3
Chuck status signal	CHUCK	G060#0
Tailstock shield selection signal	*TSB	G060#7
Rigid tapping signal	RGTAP	G061#0
Rigid tapping spindle selection signal	RGTSP1	G061#4~#5
Tapping return start signal	RTNT	G062#6
Spindle simple synchronous control	ESRSYC	G064#6
Retreat signal	RTRCT	G066#5
The 1 <sup>st</sup> axis~the 5 <sup>th</sup> axis releasing completion signal	EULP1~EULP5	G086#0~#4
The 1 <sup>st</sup> axis~the 5 <sup>th</sup> axis clamping completion signal	ECLP1~ECLP5	G088#0~#4
The 1 <sup>st</sup> axis~the 5 <sup>th</sup> axis feed axis' positive selection signal	+J1~+J5	G100#0~#4
The 1 <sup>st</sup> axis~the 5 <sup>th</sup> axis feed axis' negative selection signal	-J1~-J5	G102#0~#4
The 1 <sup>st</sup> axis~the 5 <sup>th</sup> axis imagine signal	M11~M15	G106#0~#4
The 1 <sup>st</sup> axis' positive external deceleration signal	*+ED3~*+ED35	G107#0~#4
The 1 <sup>st</sup> axis~the 5 <sup>th</sup> axis machine lock signal	MLK1~MLK5	G108#0~#4
The 1 <sup>st</sup> axis~the 5 <sup>th</sup> axis positive travel limit's external set signal	+LM1~+L5	G110#0~#4
The 1 <sup>st</sup> axis~the 5 <sup>th</sup> axis negative travel limit's external set signal	-LM1~-LM5	G112#0~#4
The 1 <sup>st</sup> axis~the 5 <sup>th</sup> axis positive travel limit's external set signal	*+L1~*+L5	G114#0~#4
The 1 <sup>st</sup> axis~the 5 <sup>th</sup> axis negative overtravel Signal	*-L1~*-L5	G116#0~#4
The 1 <sup>st</sup> axis~the 5 <sup>th</sup> axis servo OFF signal	SVF1~SVF5	G126#0~#4
The 1 <sup>st</sup> axis~the 5 <sup>th</sup> axis' axis lock signal	*IT1~*IT5	G130#0~#4
The 1 <sup>st</sup> axis~the 5 <sup>th</sup> axis' controlled selection signal(PMC axis control)	EAX1~ EAX5	G136#0~#4
Miscellaneous function completion signal's group 1~group 4 use(PMC axis control)	EFINA	G142#0,G154#0 G166#0,G178#0
Accumulated zero check signal's group 1~group 4 use (PMC axis control)	ELCKZA	G142#1,G154#1 G166#1,G178#1
Buffer inhibit signal's group 1~group 4 use (PMC axis control)	EMBUFA	G142#2,G154#2 G166#2,G178#2
Block stop signal's group 1~group 4 use (PMC axis control)	ESBKA	G142#3,G154#3 G166#3,G178#3
Servo OFF signal's group 1~group 4 use (PMC axis control)	ESOFA	G142#4,G154#4 G166#4,G178#4
Axis control's temporary stop signal's group 1~group 4 use (PMC axis control)	ESTPA	G142#5,G154#5 G166#5,G178#5
Reset signal's group 1~group 4 use (PMC axis control)	ECLRA	G142#6,G154#6 G166#6,G178#6
Axis control command read signal's group 1~group 4 use (PMC axis control)	EBUFA	G142#7,G154#7 G166#7,G178#7
Axis control command signal group 1 use (PMC axis control)	EC0A ~EC6A	G143#0~G143#6
Block stop inhibit signal's group 1~group 4 use (PMC axis control)	EMSBKA	G143#7,G155#7 G167#7,G179
Axis control feedrate signal's group 1 use	EIF00A ~EIF15A	G144#0~G145#7

(PMC axis control)		
Axis control data signal's group 1 use (PMC axis control)	EID00A~EID31A	G146#0~G149#7
Rapid traverse override signal (PMC axis control)	EROV1 ~EROV2	G150#0~#1
Override cancellation signal group 1 use (PMC axis control)	EOVC	G150#5
Manual rapid traverse selection signal (PMC axis control)	ERT	G150#6
Dry run signal(PMC axis control)	EDRN	G150#7
Feedrate override signal's group 1 use (PMC axis control)	*EFOV0~*EFOV7	G151#0~#7
Axis control command signal's group 2 use (PMC axis control)	EC0B~ECB6	G155#0~#6
Axis control feedrate signal's group 2 use (PMC axis control)	EIF00B~EIF15B	G156#0~G157#7
Axis control data signal's group 2 use (PMC axis control)	EID00B~EID31B	G158#0~G161#7
Override cancellation signal's group 2 use (PMC axis control)	EOVCB	G162#5
Feedrate override signal's group 2 use (PMC axis control)	*EFOV0B~EFOV7B	G163#0~#7
Axis control command signal's group 3 use (PMC axis control)	EC0C~EC6C	G167#0~#6
Axis control feedrate signal's group 3 use (PMC axis control)	EIF00C ~EIF15C	G168#0~G169#7
Axis control data signal's group 3 use (PMC axis control)	EID00C~EID31C	G170#0~G173#7
Override cancellation signal's group 3 use (PMC axis control)	EOVCC	G174#5
Feedrate override signal's group 2 use (PMC axis control)	*EFOV0C~*EFOV7C	G175#0~#7
Axis control command signal's group 4 use (PMC axis control)	EC0D~EC6D	G179#0~#6
Axis control feedrate signal's group 4 use (PMC axis control)	EIF00D~EIF15D	G180#0~G181#7
Axis control data signal's group 4 use (PMC axis control)	EID00D~EID31D	G182#0~G185#7
Override cancellation signal's group 4 use (PMC axis control)	EOVCD	G186#5
Feedrate override signal's group 4 use (PMC axis control)	*EFOV0D~*EFOV7D	G187#0~#7
The 1 <sup>st</sup> axis ~the 5 <sup>th</sup> axis' reference point return using deceleration signal	*DEC1~ *DEC5	G196#0~#4
Manual MPG feed selection signal	IOLBH1 ~IOLBH2	G199#0~#1



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## **IV Installation and Connection**



## Chapter 1 System Structure and Installation

### 1.1 System Composition

GSK980TC3 CNC system mainly consists of the following units as Fig. 1-1.

- (1) GSK980TC3 CNC system
- (2) Additional operator panel(optional)
- (3) Digital AC Servo Drive Unit
- (4) Servo motor
- (5) AC transformer

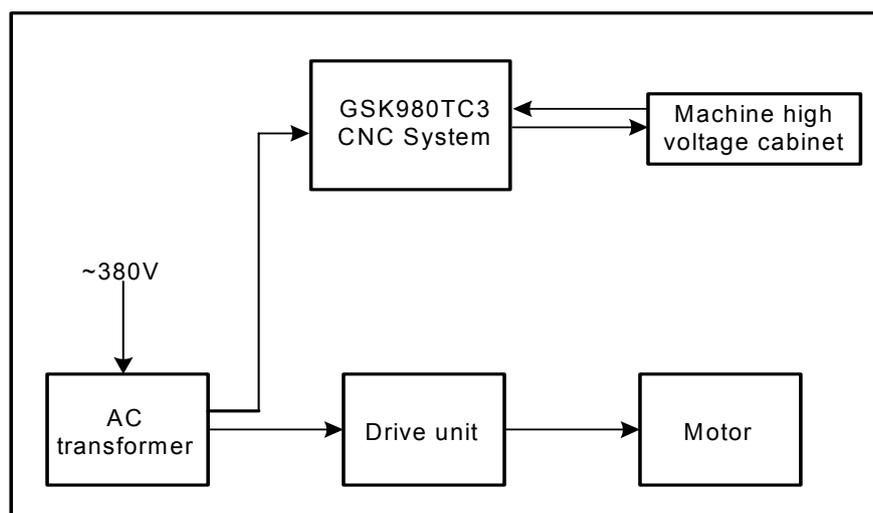


Fig. 1-1

### 1.2 System Installation & Connection

Firstly, check if the CNC system, driver, motor, and photoelectric encoder are ready, intact and matched.

The CNC system must be fixed stably, and there is some space around the system to ensure the air circulates, and the heat radiates. The installation position of CNC system must be convenient to the operation and avoid the position of processing chip and cooling.

The high/low voltage should be separated. The power supplies of CNC system and driver are provided by transformer, which are separated from the machine high voltage. All kind of signal line should be far from AC contactor to avoid the interference. The photoelectric encoder, limit signal and emergency stop signal should be directly connected to the CNC system. The power supply must be strictly grounded.

All kind of plug and bolt must be fixed stably, and forbid the signal connector is ON/OFF after the CNC system is turned on.

The system panel cannot be damaged by hard thing and sharp weapon when the CNC system is installed; the CNC system should be carried down to avoid dirtying the system panel.

There is no the source of high voltage, magnetic field around the CNC system, and the system should be far from the inflammable, explosive substance and all sort of dangerous things.

### 1.3 CNC System Installation Dimension

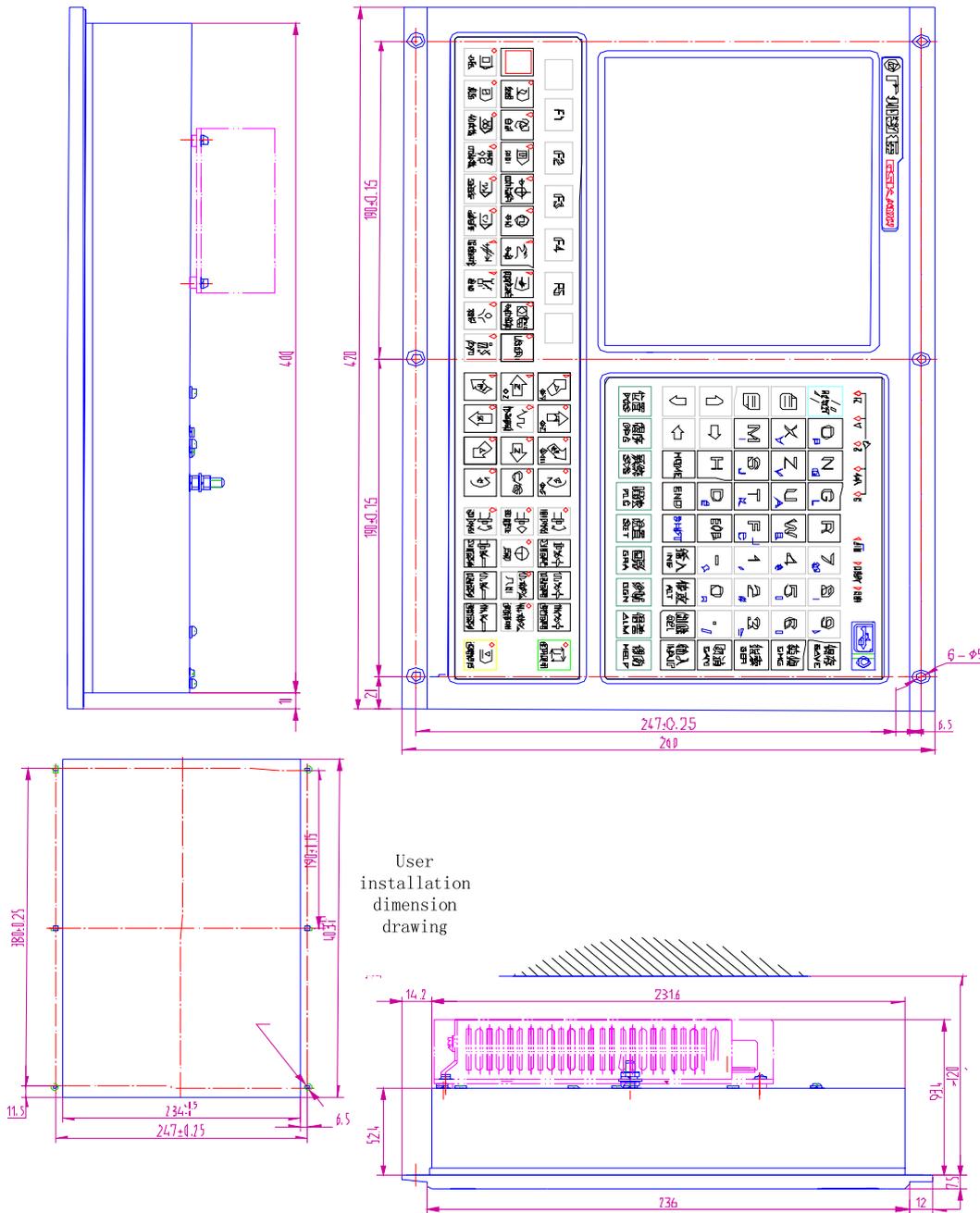


Fig.1-3-1 GSK980TC3 system installation dimension drawing

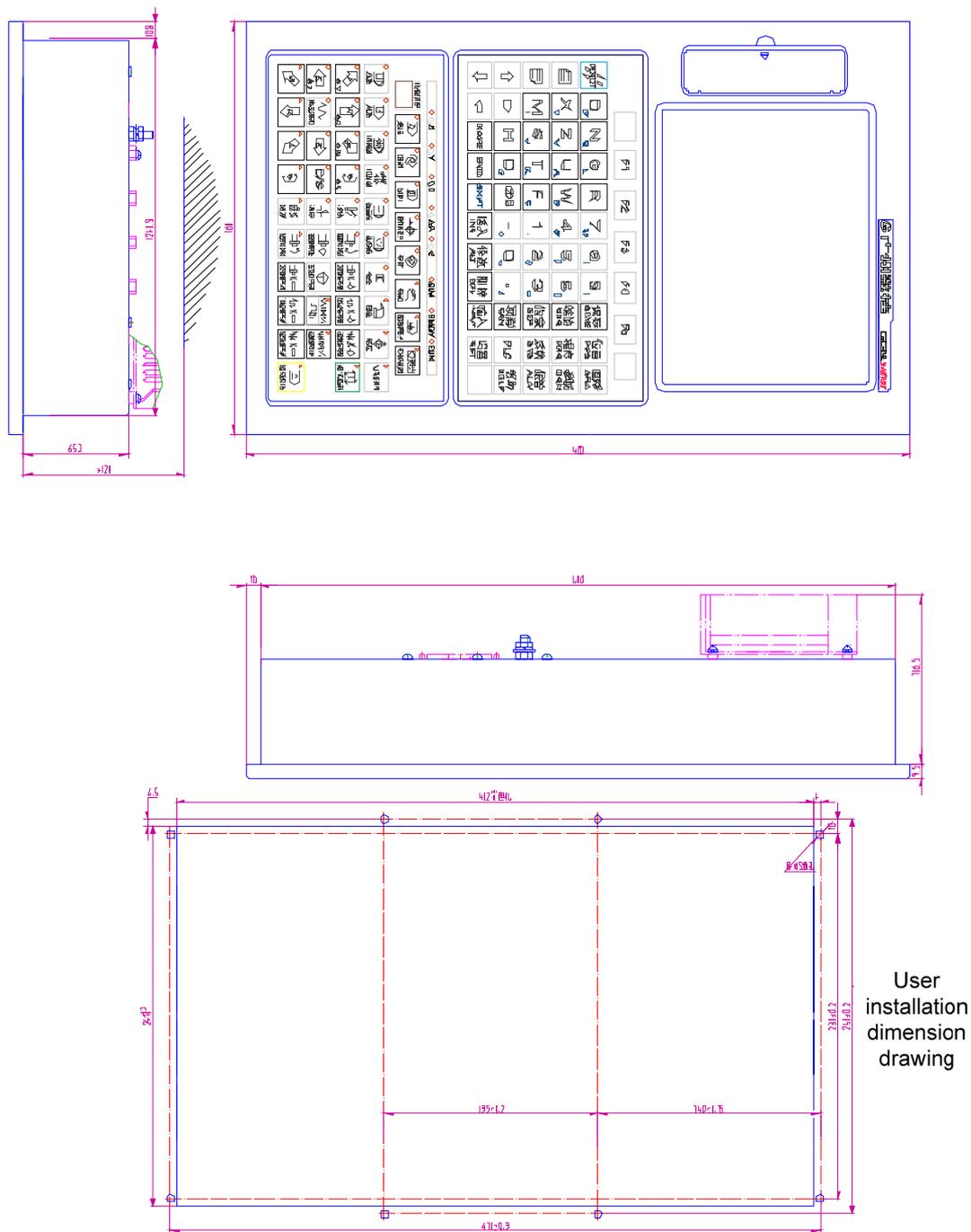


Fig.1-3-2 GSK980TC3-V system installation dimension drawing

## 1.4 Additional Panel

980TC3's additional panels are selected by the user, and its additional panels are divided into GSK980TC3, GSK980TC3-V:

- **Additional panel AP01 (adaptive to 980TC3, underneath assembly)**

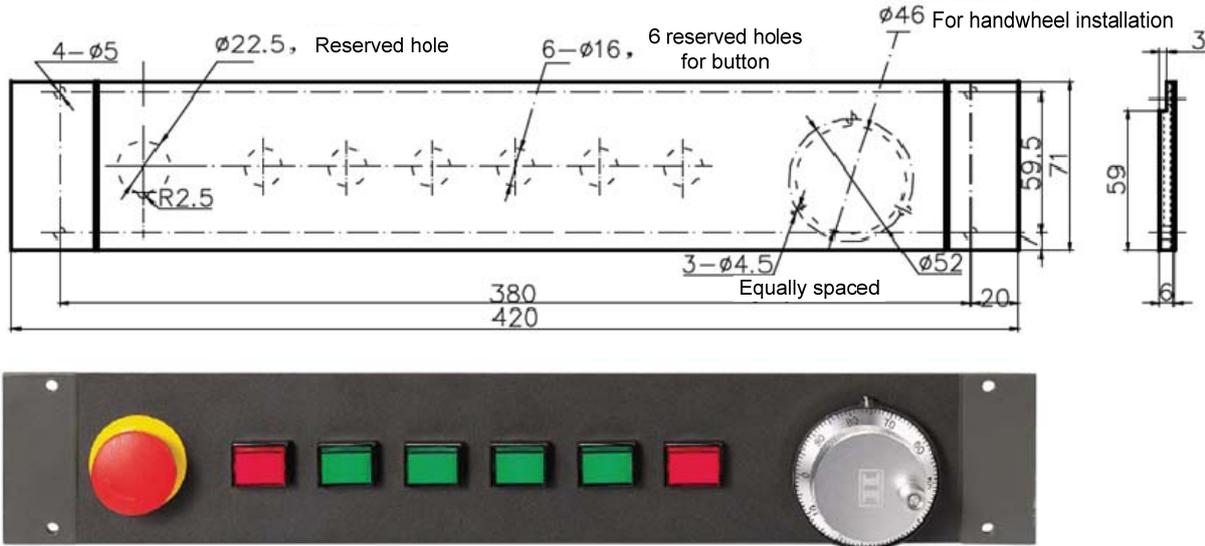


Fig.1-4-1 GSK 980TC3 additional panel AP01 and installation dimension

● Additional panel AP02 (adaptive to 980TC3, side assembly)

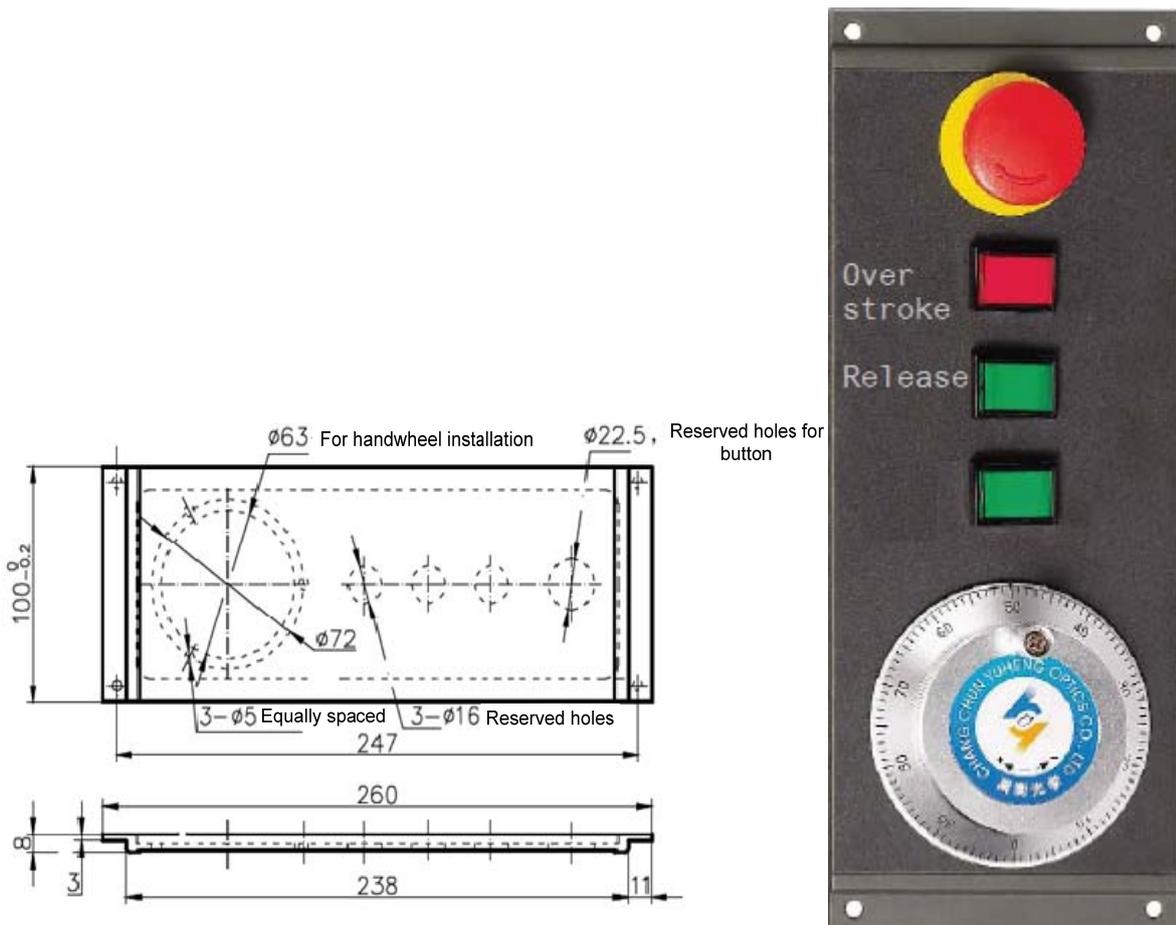


Fig. 1-4-2 GSK 980TC3 additional panel AP02 and installation dimension

● **Additional panel AP03 (adaptive to 980TC3-V, underneath assembly)**

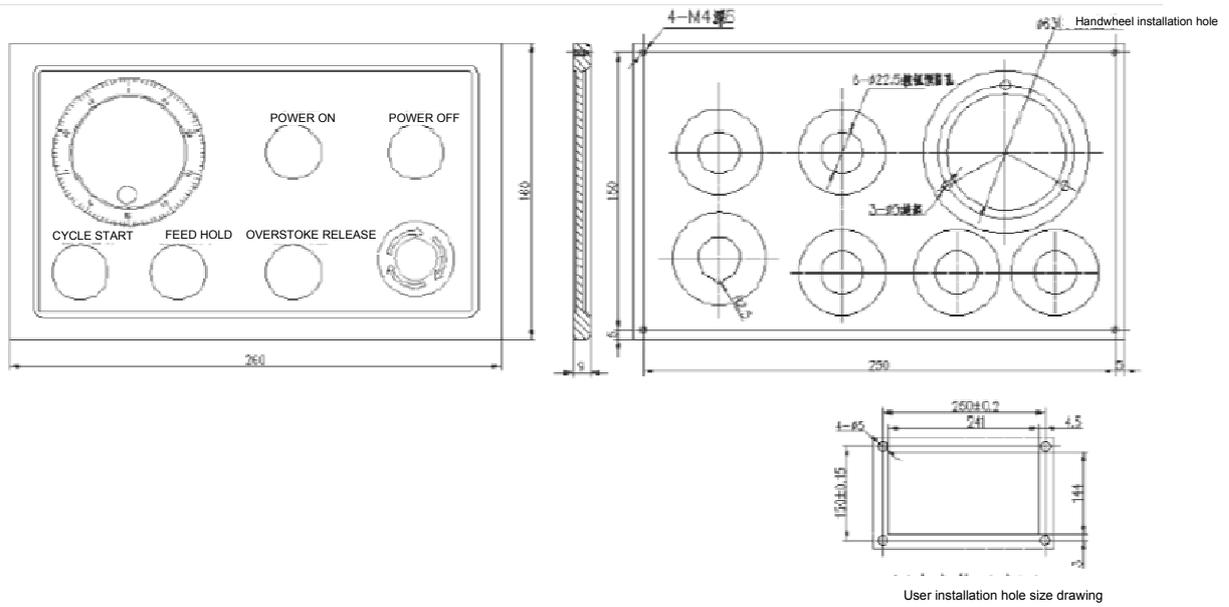


Fig.1.4.3 GSK 980TC3 additional panel AP03 and installation dimension



## Chapter 2 Device Connection

### 2.1 CNC External Connection

#### 2.1.1 Interface Layout

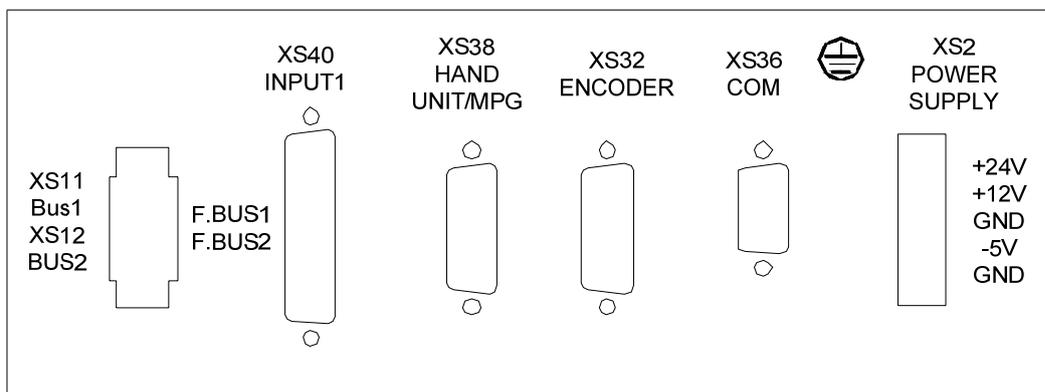


Fig.2-1-1-1 980TC3 interface diagram

### 2.1.2 Bus Servo Connection Diagram

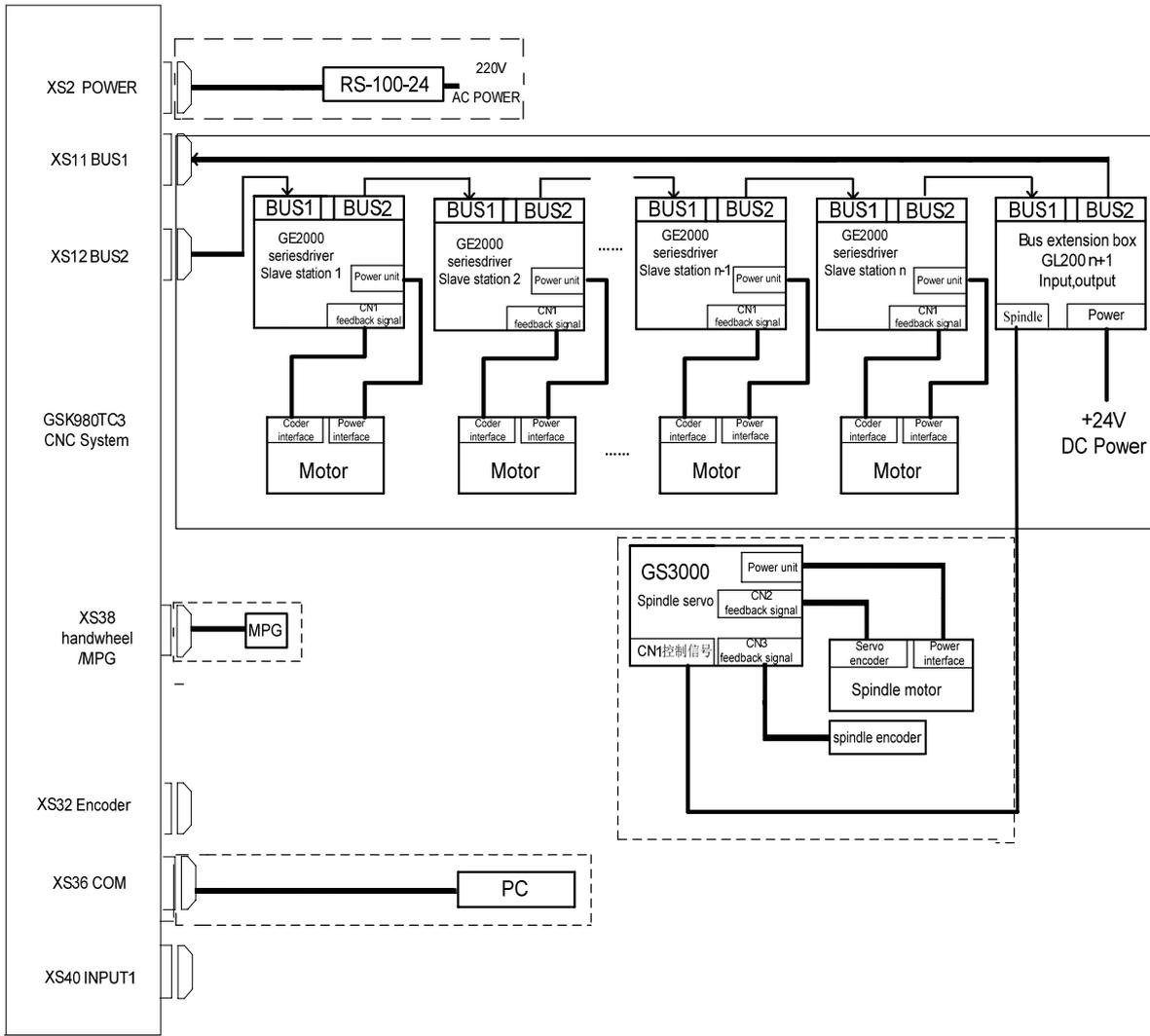


Fig. 2-1-2-1

The system CNC bus interface 2 (i.e., CNC XS12 interface) is connected to the slave station 1 (i.e., the 1<sup>st</sup> axis) servo BUS1 (GT17 interface), BUS2 (GT17 interface) to the system bus interface 1 (i.e., CNC XS11 interface) 's servo is the last axis.

## 2.2 Connection between the System and the Drive Unit

### 2.2.1 System Interface Drawing

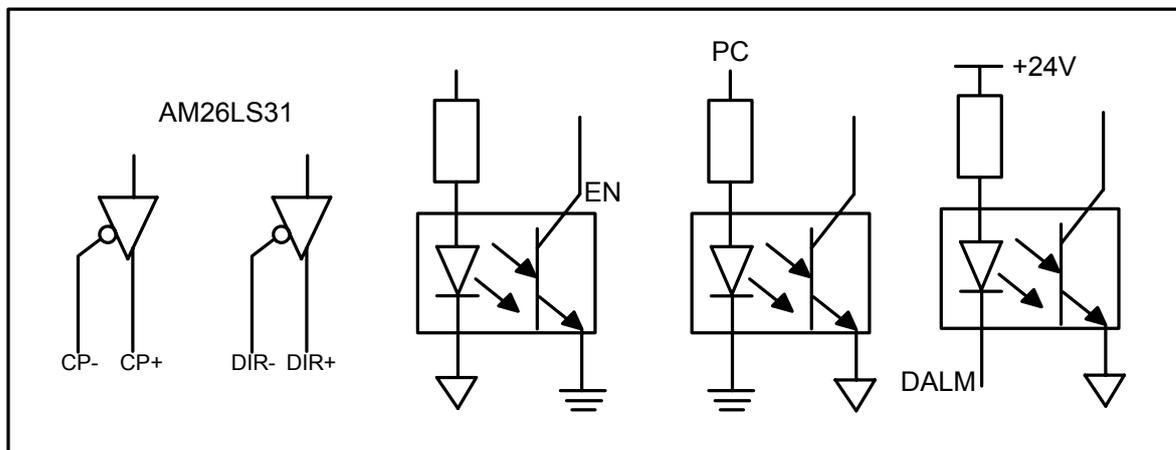


Fig.2-2-1-1

### 2.2.2 Signal Explanation

#### 1. The drive unit alarm signal ALM (input)

The signal's receiving mode at the side of the system is shown below. No.19 sets the drive unit alarm HIGH or LOW to be valid(HIGH or LOW is consistent with the drive unit's setting).

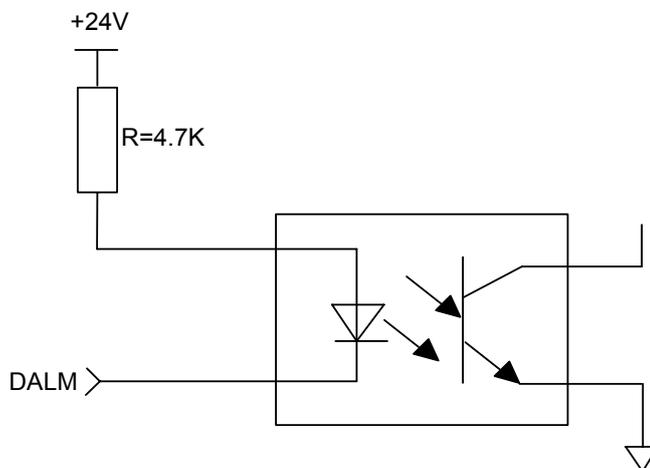


Fig. 2-2-2-1

#### 2. CNC system ready signal EN (contact output)

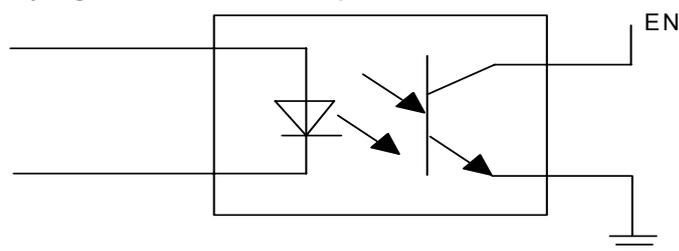


Fig. 2-2-2-2

### 3. Reference point return signal PC

The system supports +24V zero return and +5V zero return. The signal's receiving circuit at the side of the CNC system is shown below:

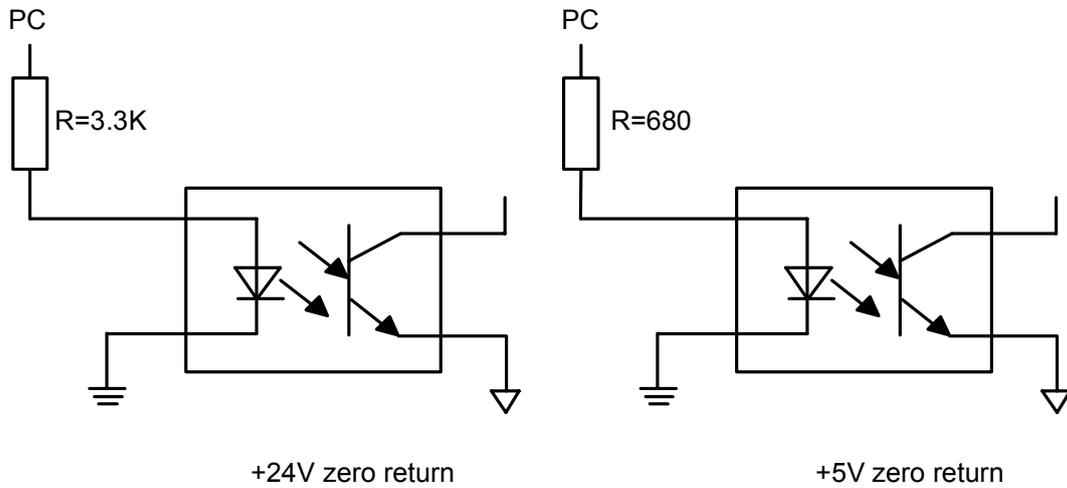


Fig. 2-2-2-3

PC signal's wave provided by the user is shown below:

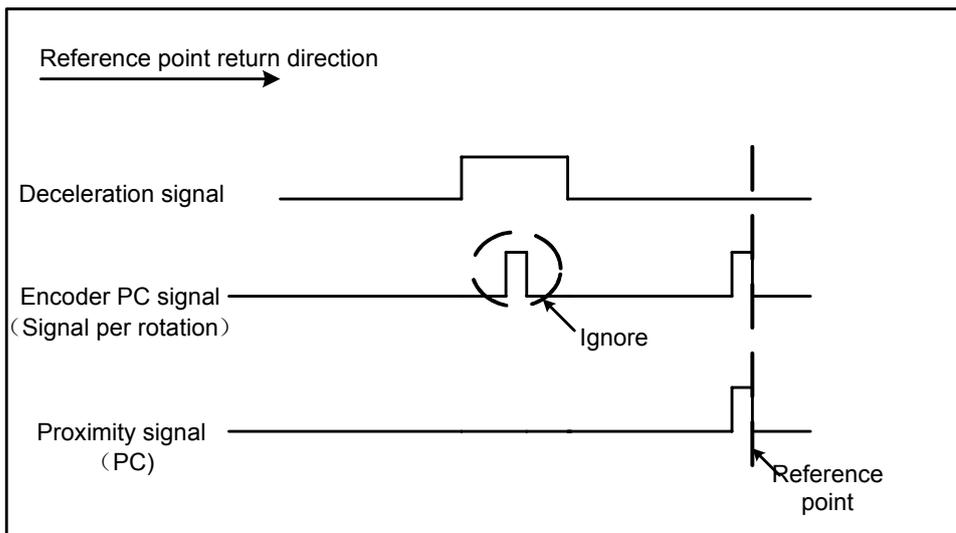


Fig. 2-2-2-4

### 2.2.3 GSK-LINK Cable Connection Drawing

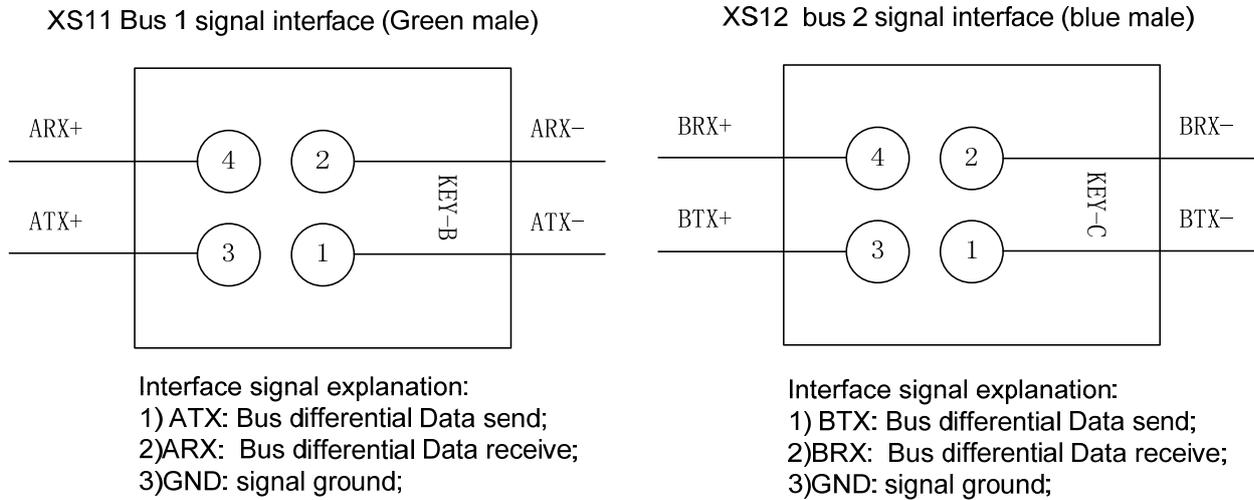


Fig. 2-2-3-1 CNC terminal bus interface definition diagram

GT17-4DS-HU (KEYB green) connected with GT17-8DS-HU						
GT17VS-4DS-HU(KEYB green) XS11			wire	GT17VS-8DS-HU(Line ball) GE series CN2		
No.	Signal name	Network color		No.	Signal name	Network color
2	PHY1_RX-	Green and white	↔	1	PHY1_RX-	Orange and white
4	PHY1_RX+	Green	↔	2	PHY1_RX+	Orange
1	PHY1_TX-	Orange and white	↔	3	PHY1_TX-	Green and white
3	PHY1_TX+	Orange	↔	4	PHY1_TX+	Green
PG	Shielding net		↔	PG	Shielding net	
Note: 1. Industrial Ethernet type:IE-5CC4*2*AWG26/7-PVC (Weidmuller)						

Fig. 2-2-3-2 Connection between CNC terminal bus interface 1 and driver

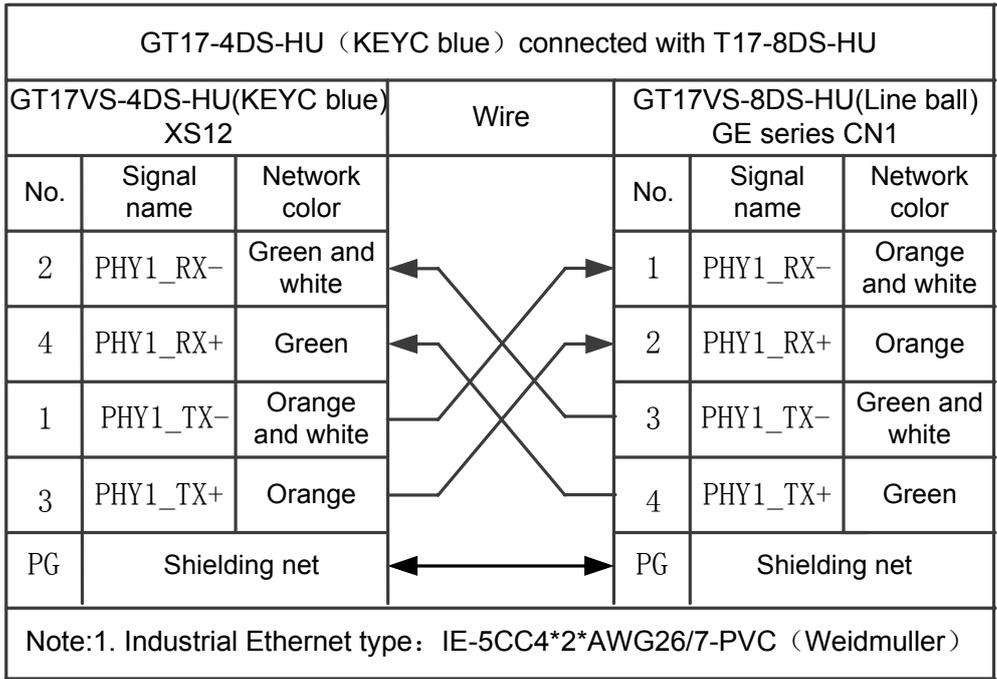


Fig. 2-2-3-3 Connection between CNC terminal bus interface 2 and driver

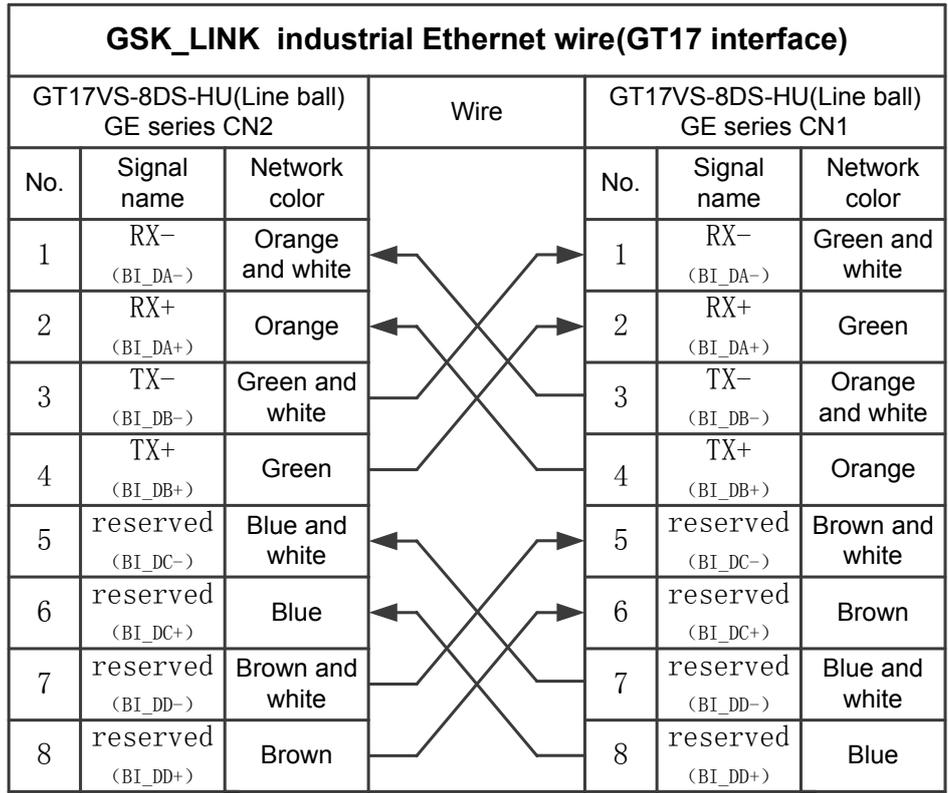


Fig. 2-2-3-4 connection among drivers

## 2.3 RS232 Standard Serial Interface

GSK980TC3 CNC system can communicate with the general-purpose PC (must match with GSK980TC3 communication software) by RS232-C. Its connection is as follows:

Connection of cable is as follows. The shielded line is connected with BDN, and the metal shell is not connected with the shielded line:

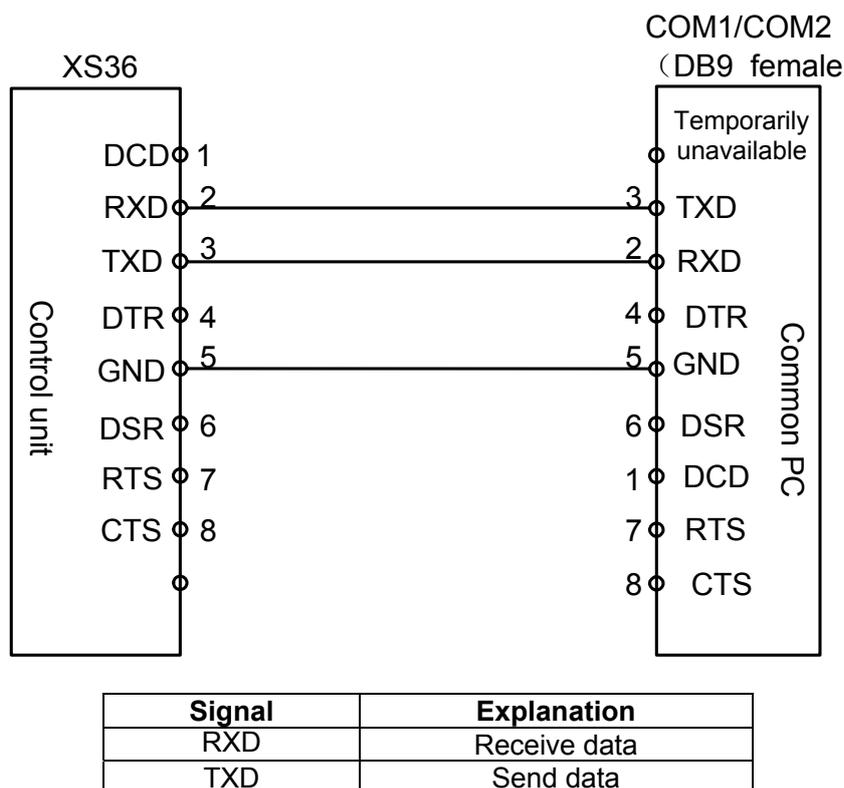


Fig. 2-3-1

**Note:** The shielded lay's welding is on the plug's metal body.

## 2.4 Connection between MPG and Handhold Unit

### 2.4.1 Interface Signal Diagram

980TC3 system can be equipped with MPG or handhold unit in difference type or non-difference, the interface signal is shown below:

XS38 Handhold unit/MPG signal interface (male)

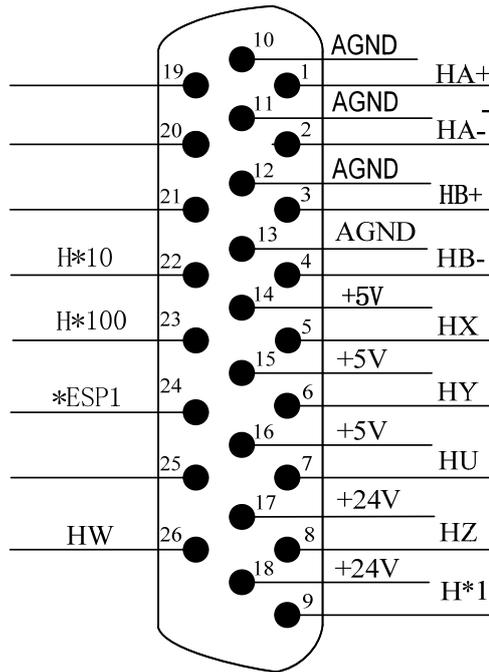


Fig. 2-4-1-1

### 2.4.2 Introduction of Interface Signals

HA+, HA-, HB+ and HB-: with MPG in different type MPG (with non-difference type MPG: HA+, HB+ with +5V; HA- with MPG A; HB- with MPG B);  
 ESP1 and ESP2: Emergency stop signal of handhold unit;  
 HX, HY, HZ, HU, H4, H5: They are respectively the axis selection signals of X, Y, Z, 4<sup>th</sup>, 5<sup>th</sup>  
 H\*1, H\*10, H\*100: They are respectively the override signals of MPG pulse equivalent;  
 VCOM: Common port of handhold unit.

The connection diagram of 980TC3 with the internal MPG is shown as below:

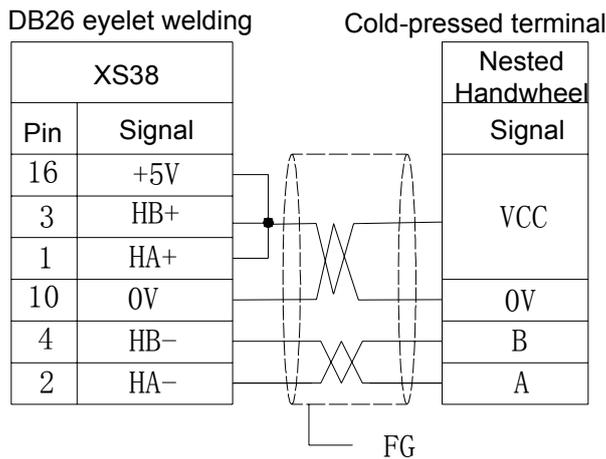


Fig. 2-4-2-1

Connection diagram of GSK980TC3 with handhold unit in difference type (L)

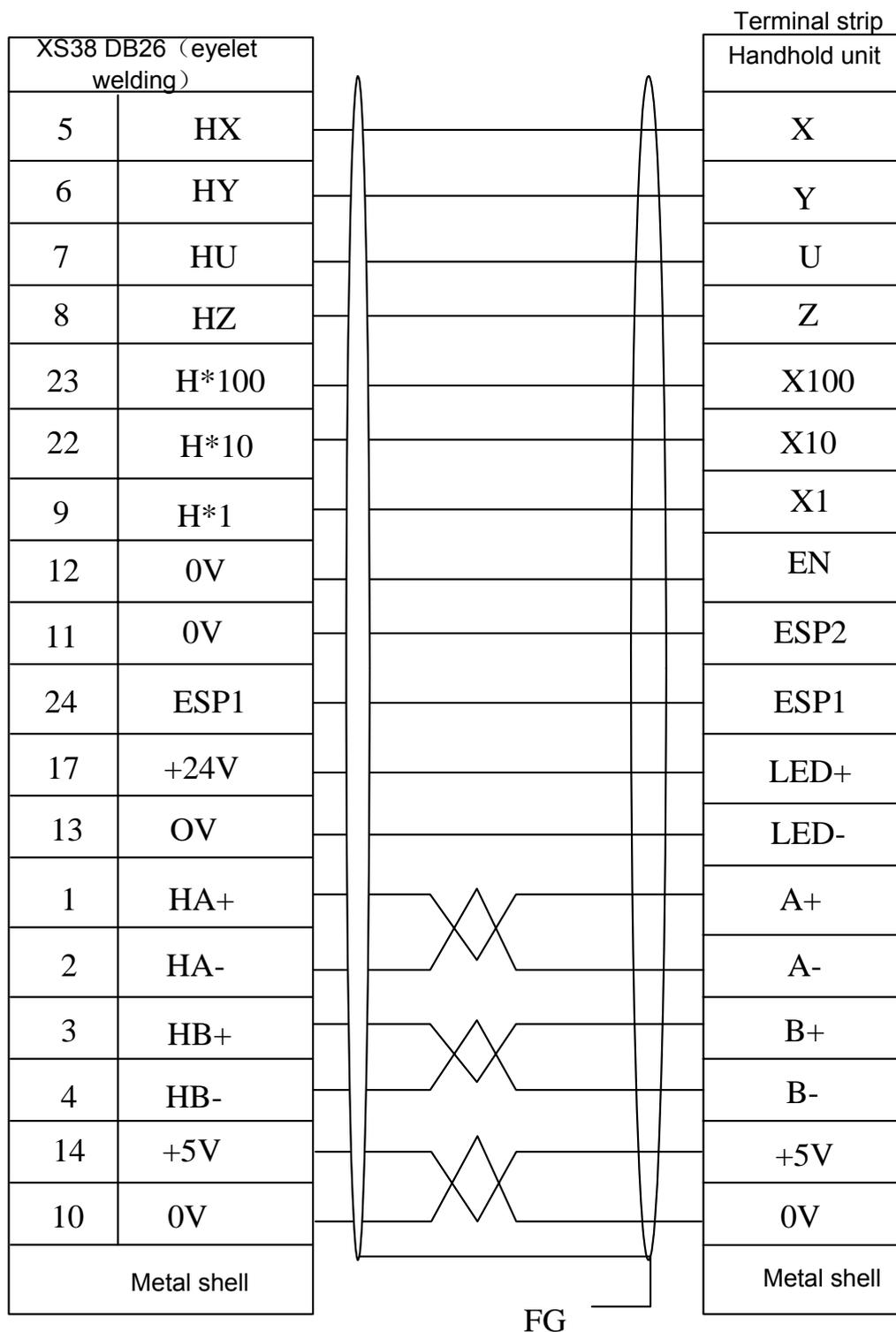


Fig. 2-4-2-2

Connection diagram of GSK980TC3 with handhold unit in voltage type (E)

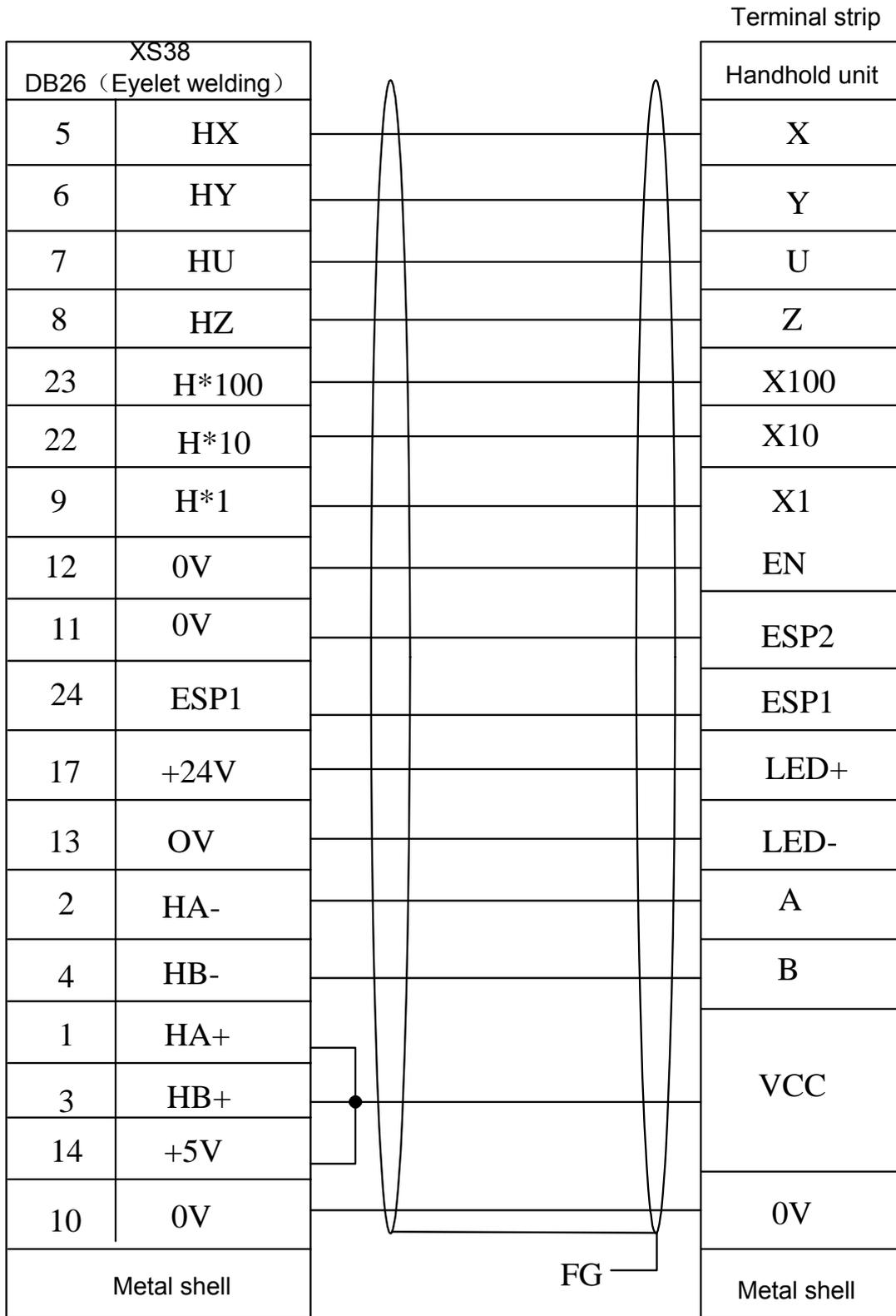


Fig. 2-4-2-3

### 2.4.3 Handhold Unit's Interface Circuit

- a) The handhold unit receives only 0V level input instead of 24V input.
- b) The axis selection and override signal circuit are shown in Fig 3-2-2-1:

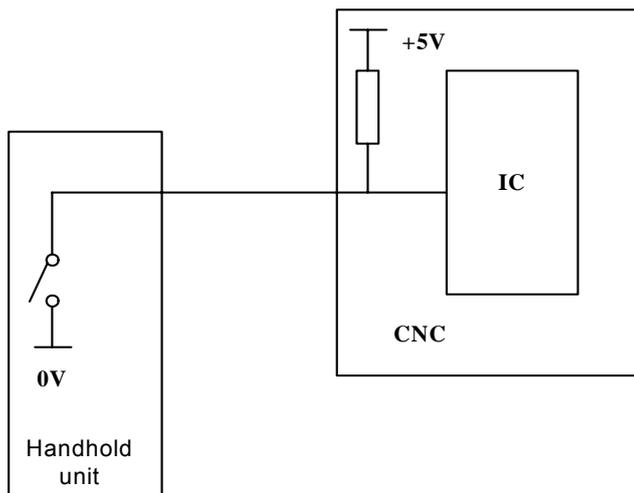


Fig. 2-4-3-1

Pins definitions of handhold unit's interfaces are shown below:

Address	Signal interface	Interface pin	Definition	Contact selection
X10.0	XS38	26	External handwheel's 5 <sup>th</sup> axis selection	Normally open contact
X11.0	XS38	24	External emergency stop	Normally closed contact
X11.1	XS38	23	External handwheel step width *100	Normally open contact
X11.2	XS38	22	External handwheel step width *10	Normally open contact
X11.3	XS38	9	External handwheel step width *1	Normally open contact
X11.4	XS38	7	External handwheel's 4 <sup>th</sup> axis selection	Normally open contact
X11.5	XS38	8	External handwheel's 3 <sup>rd</sup> axis selection	Normally open contact
X11.6	XS38	6	External handwheel's 2 <sup>nd</sup> axis selection	Normally open contact
X11.7	XS38	5	External handwheel's 1 <sup>st</sup> axis selection	Normally open contact

## 2.5 System Power Supply Interface

The system's input voltage is +24V. The power supply's interface is shown below:

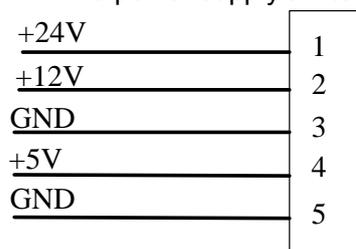


Fig. 2-5-1

## 2.6 Connection of the Spindle Encoder

The system can use an incremental position encoder with 1024lines or 1200lines. \*PCS, PCS, \*PBS, PBS, \*PAS, PAS in the following figure separately corresponds to  $\bar{Z}$ , Z,  $\bar{B}$ , B,  $\bar{A}$ , A.

XS32 encoder signal interface(male)

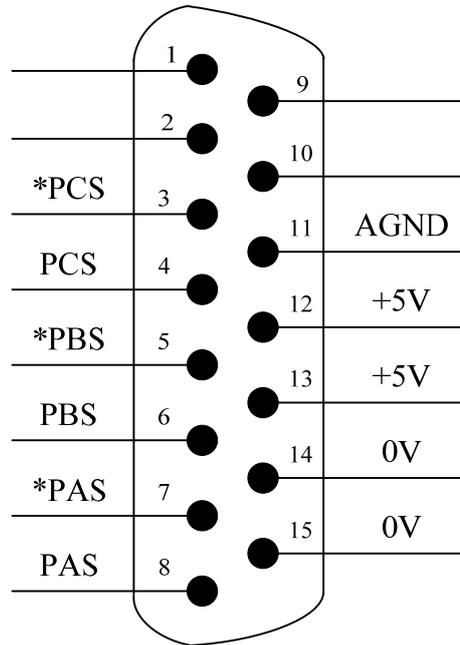
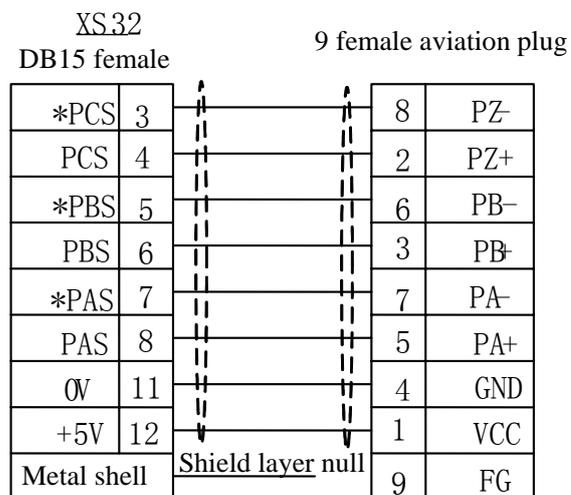


Fig. 2-6-1

### 2.6.1 Interface Signal Introduction

- 1) Encoder A-phase pulse: PAS, \*PAS
- 2) Encoder B-phase pulse: PBS, \*PBS
- 3) Encoder Z-phase pulse: PCS, \*PCS

## 2.6.2 Cable Connection Diagram



Note: Welding by this method when match with 1024 encoder of our company.

Fig. 2-6-2-1

## 2.7 GL200 Bus Module Overboard Connection Diagram

GL200 bus box has three function modules: the power supply module is used to the power supply's input; the spindle module is used to the spindle input/output; I/O module is used to I/O interface input/output.(as Fig. 2-7-1)

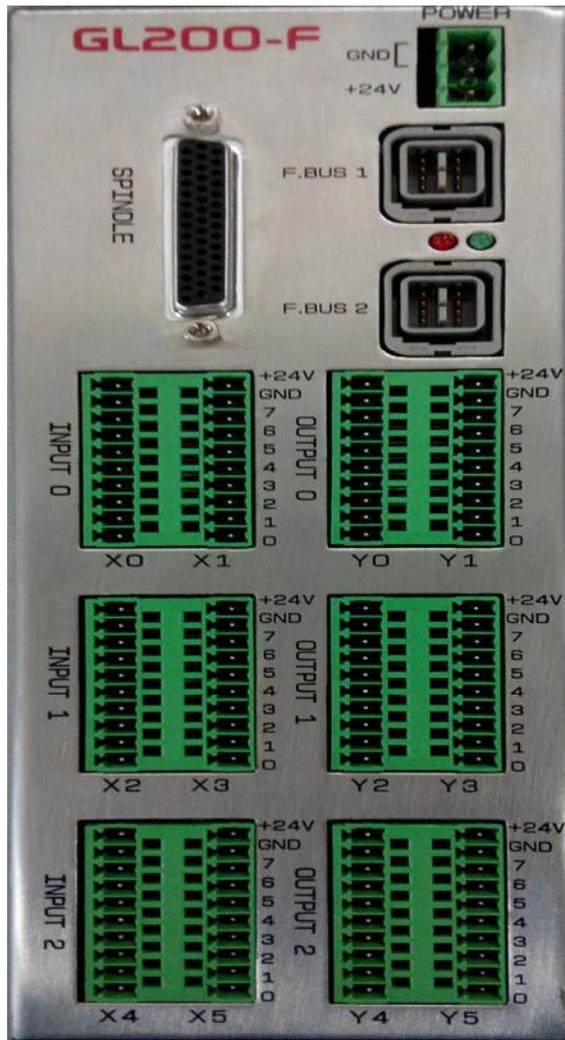


Fig. 2-7-1 GL200 bus module

Connection line of GL200 power supply box

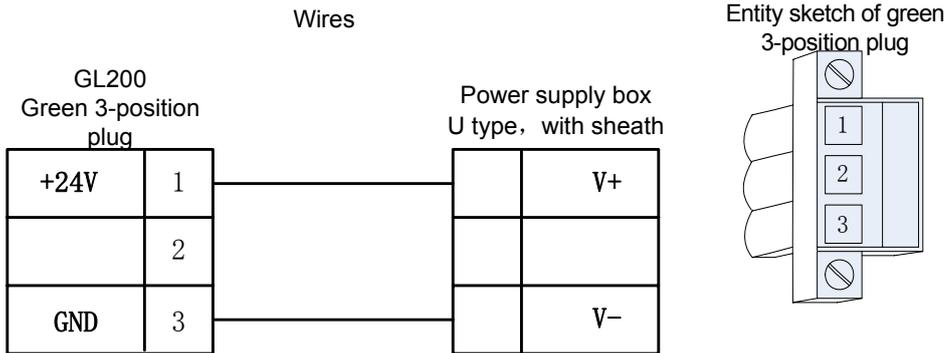


Fig. 2-7-2 power supply input line

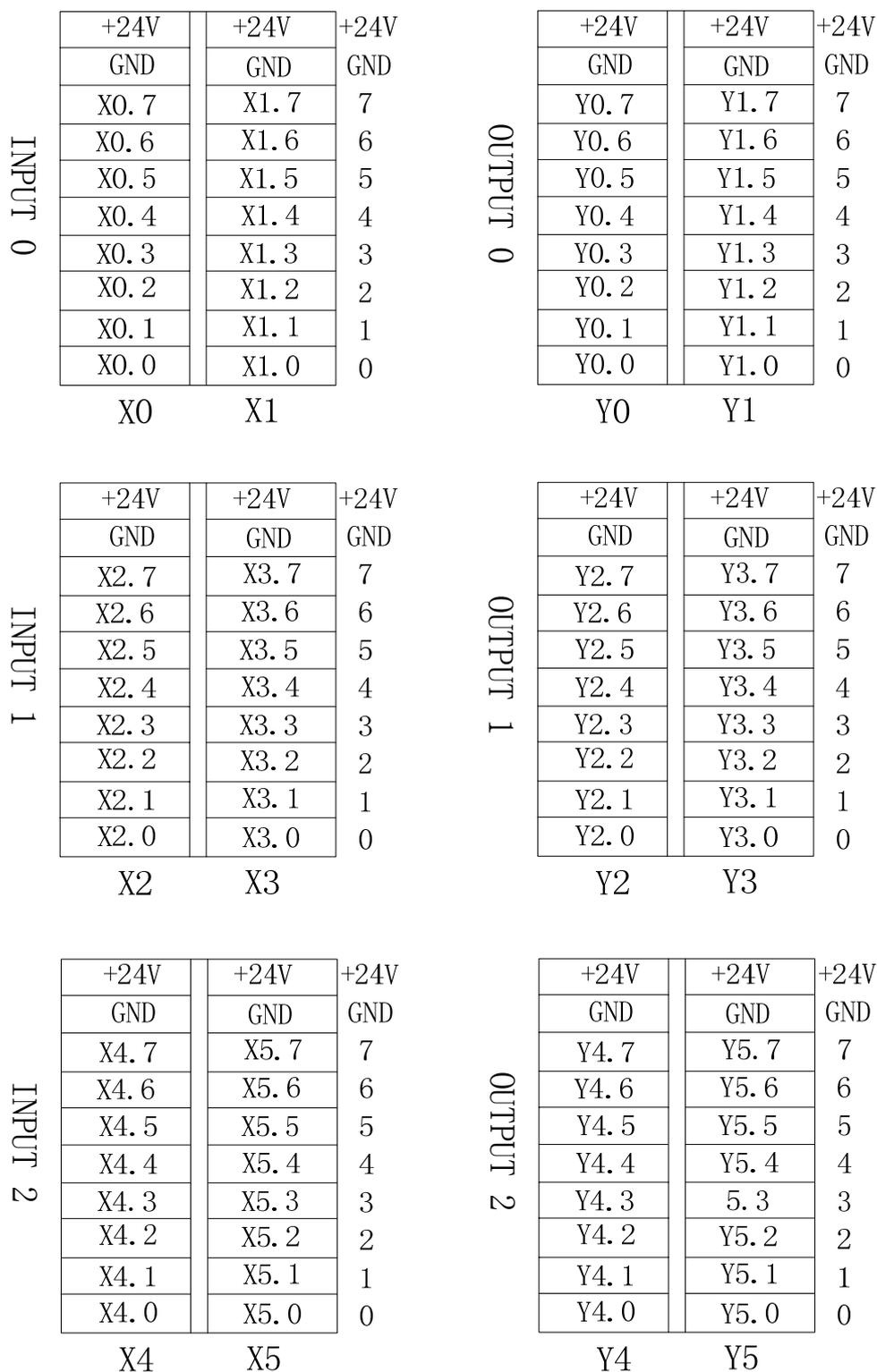


Fig. 2-7-3 GL200 bus I/O module definition diagram

### 2.7.1 X Address Definition Input

X address definition input is shown below:

Table 2-7-1-1

Address	Definition	Contact selection
X0.0	The 1 <sup>st</sup> axis limit signal (positive direction with biswitch)	Normally closed contact
X0.1	The 1 <sup>st</sup> axis negative limit signal (valid with biswitch)	Normally closed contact
X0.2	The 3 <sup>rd</sup> axis limit signal (positive direction with biswitch)	Normally closed contact
X0.3	The 3 <sup>rd</sup> axis negative limit signal (valid with biswitch)	Normally closed contact
X0.4	Deceleration signal of the 1 <sup>st</sup> axis zero return	Specified by K6.4
X0.5	Deceleration signal of the 3 <sup>rd</sup> axis zero return	Specified by K6.4
X0.6	Deceleration signal of the 5 <sup>th</sup> axis zero return	Specified by K6.4
X0.7	Protective door check signal	Normally closed contact
X1.0	Chuck release control input	Normally open contact
X1.1	Check clamp in-position signal	Specified by K11.2
X1.2	Chuck release in-position signal	Specified by K11.2
X1.3	Tailstock control signal	Normally open contact
X1.4	Tailstock forward in-position check	Normally open contact
X1.5	Tailstock backward in-position check	Normally open contact
X1.6	Lubricating pressure low check	Normally open contact
X1.7	Air source, air pressure check	Normally open contact
X2.0	The spindle's 1 <sup>st</sup> gear in-position	Normally open contact
X2.1	The spindle's 2 <sup>nd</sup> gear in-position	Normally open contact
X2.2	The spindle's 3 <sup>rd</sup> gear in-position	Normally open contact
X2.3	The spindle's 4 <sup>th</sup> gear in-position	Normally open contact
X2.4	Undefined	---
X2.5	Undefined	---
X2.6	Tool post lock signal	Specified by K12.0
X2.7	Tool post release signal	Specified by K12.0
X3.0	Cutter spacing signal T1	Specified by a parameter
X3.1	Cutter spacing signal T2	Specified by a parameter
X3.2	Cutter spacing signal T3	Specified by a parameter
X3.3	Cutter spacing signal T4	Specified by a parameter
X3.4	Cutter spacing signal T5/tool post worktable strobe signal	Specified by a parameter
X3.5	Cutter spacing signal T6	Specified by a parameter
X3.6	Cutter spacing signal T7	Specified by a parameter
X3.7	Cutter spacing signal T8	Specified by a parameter
X4.0	The 2 <sup>nd</sup> axis limit signal (positive direction with biswitch)	Normally closed contact
X4.1	The 2 <sup>nd</sup> axis negative limit signal (valid with biswitch)	Normally closed contact
X4.2	The 4 <sup>th</sup> axis limit signal (positive direction with biswitch)	Normally closed contact
X4.3	The 4 <sup>th</sup> axis negative limit signal (valid with biswitch)	Normally closed contact
X4.4	The 5 <sup>th</sup> axis limit signal (positive direction with biswitch)	Normally closed contact
X4.5	The 5 <sup>th</sup> axis negative limit signal (valid with biswitch)	Normally closed contact
X4.6	Deceleration signal of the 2 <sup>nd</sup> axis zero return	Specified by K6.4
X4.7	Deceleration signal of the 4 <sup>th</sup> axis zero return	Specified by K6.4
X5.0	Undefined	---
X5.1	Undefined	---
X5.2	Undefined	---
X5.3	Undefined	---
X5.4	Undefined	---
X5.5	Undefined	---
X5.6	Undefined	---
X5.7	Undefined	---

## 2.7.2 Y Address Definition Output

Table 2-7-2-2

Address	Definition
Y0.0	Feed axis brake
Y0.1	Cooling
Y0.2	Hydraulic start
Y0.3	Lubricating output
Y0.4	Undefined
Y0.5	Green light
Y0.6	Red alarm light
Y0.7	Yellow light
Y1.0	Spindle rotation CW (double spindle is the spindle 2 rotation CW)
Y1.1	Spindle stop (double spindle is the spindle 2 stop)
Y1.2	Spindle rotation CCW (double spindle is the spindle 2 rotation CCW)
Y1.3	Spindle brake (spindle 1)
Y1.4	Spindle's 1 <sup>st</sup> gear (frequency conversion /I0's frequency conversion control)
Y1.5	Spindle's 2 <sup>nd</sup> gear (frequency conversion /I0's frequency conversion control)
Y1.6	Spindle's 3 <sup>rd</sup> gear (frequency conversion /I0's frequency conversion control)
Y1.7	Spindle's 4 <sup>th</sup> gear (frequency conversion /I0's frequency conversion control)
Y2.0	Outside chuck clamping output signal / Outside chuck releasing output signal
Y2.1	Inside chuck clamping output signal / inside chuck clamping output signal
Y2.2	Tailstock forward output
Y2.3	Tailstock backward output
Y2.4	Undefined
Y2.5	Undefined
Y2.6	Undefined
Y2.7	Tool post servo enabling
Y3.0	Target tool number output TDO0
Y3.1	Target tool number output TDO1
Y3.2	Target tool number output TDO2
Y3.3	Target tool number output TDO3
Y3.4	Cutter locking output
Y3.5	Cutter releasing output
Y3.6	Tool post rotation CW TL+/ MDO
Y3.7	Tool post rotation CCW TL-/ MDI
Y4.0	Undefined
Y4.1	Undefined
Y4.2	Undefined
Y4.3	Undefined
Y4.4	Undefined
Y4.5	Undefined
Y4.6	Undefined
Y4.7	Undefined
Y5.0	Undefined
Y5.1	Undefined
Y5.2	Undefined
Y5.3	Undefined
Y5.4	Undefined
Y5.5	Undefined
Y5.6	Undefined
Y5.7	Undefined

## 2.8 Connection of Spindle Unit

### 2.8.1 Interface Signal Diagram

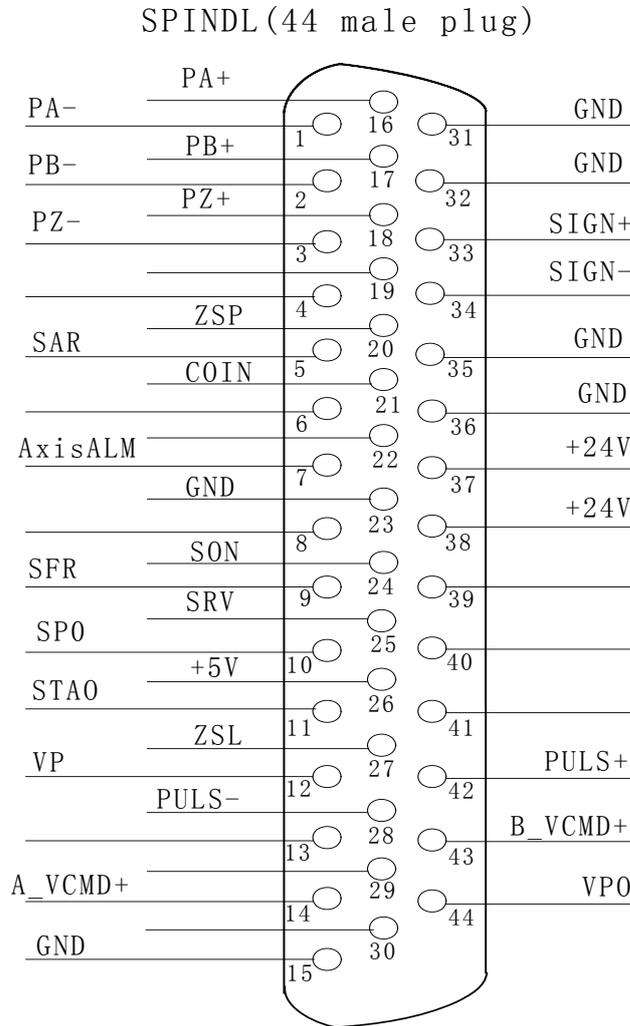


Fig. 2-8-1-1 GL200-F spindle interface

### 2.8.2 Spindle Interface Definition

Table 2-8-2-1

Label	Definition	Explanation
14	A_VCMD+	The 1 <sup>st</sup> path spindle analog voltage output 0~10V or -10V~10V (determined by K7.6)
15	GND	
43	B_VCMD+	The 2 <sup>nd</sup> path spindle analog voltage output 0~10V or -10V~10V (determined by a parameter)
36	GND	
1, 2, 3	PA-, PB-, PZ-	Encoder feedback signal
16, 17, 18	PA+, PB+, PZ+	Encoder feedback signal
28	PULS-	The spindle pulse difference signal output
42	PULS+	
33	SIGN+	The spindle pulse direction difference signal
34	SIGN-	
26	+5V	The spindle encoder DC+5V voltage output
7	AxisALM	The spindle alarm input
10	SPO	Orientation selection

27	ZSL	Zero speed clamp Y6.6
9	SFR	The spindle rotation CW Y6.4
25	SRV	The spindle rotation CCW Y6.5
24	SON	The spindle enabling Y6.0
11	STAO	The spindle orientation Y6.3
12	VP	Speed/position switch Y6.2
44	VPO	Speed/position switch completion X6.5
21	COIN	The spindle orientation completion signal X6.6
5	SAR	The spindle speed arrival X6.2
20	ZSP	The spindle zero speed check X6.3
37, 38, 39	+24V	+24V DC voltage output
23, 31, 32, 35	GND	The spindle grounding

### 2.8.3 Cable Connection Diagram

#### 1. GSK980TC3 matched with DAP03 control line's interface wire:

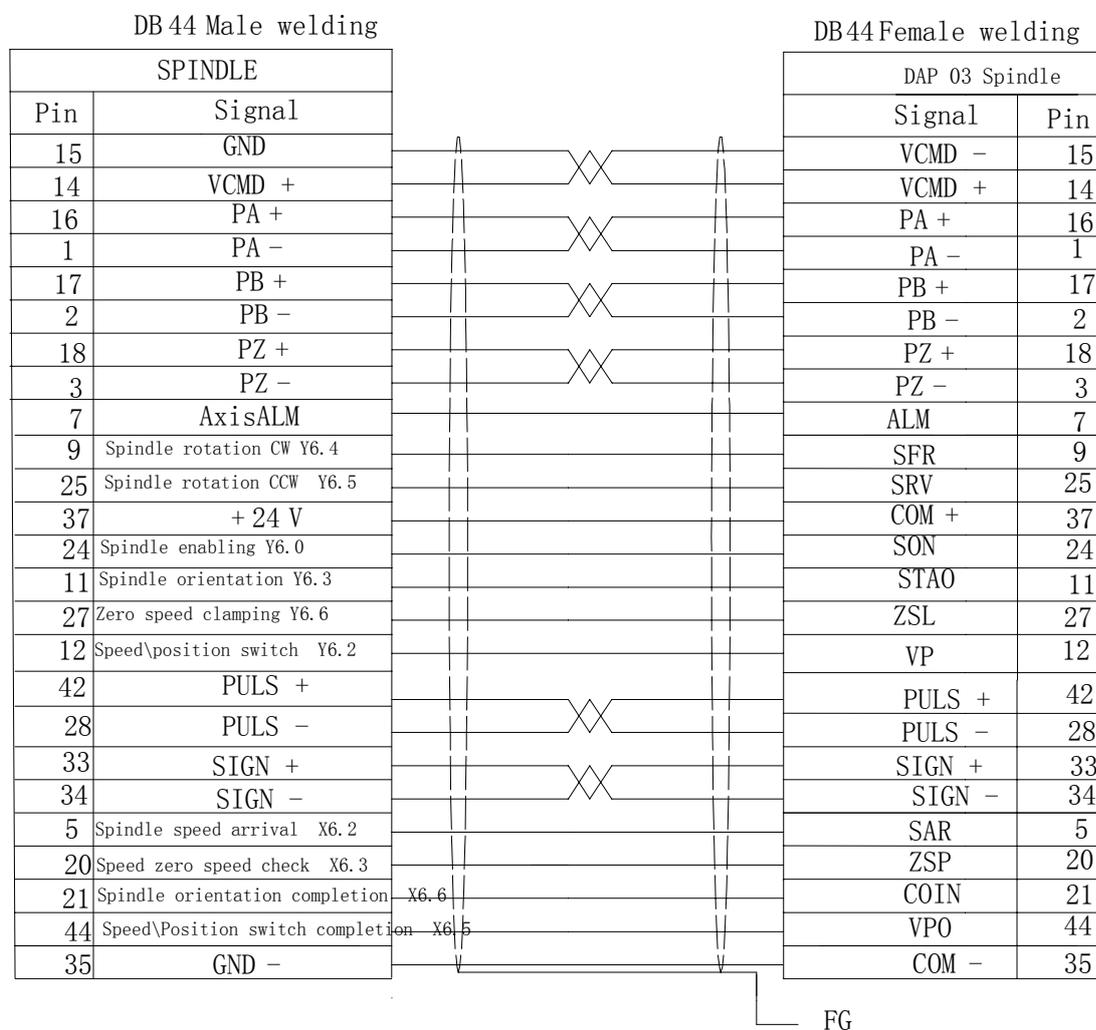


Fig. 2-8-3-1

#### 2. GSK980TC3 matched with GS3000 control line's interface wire:

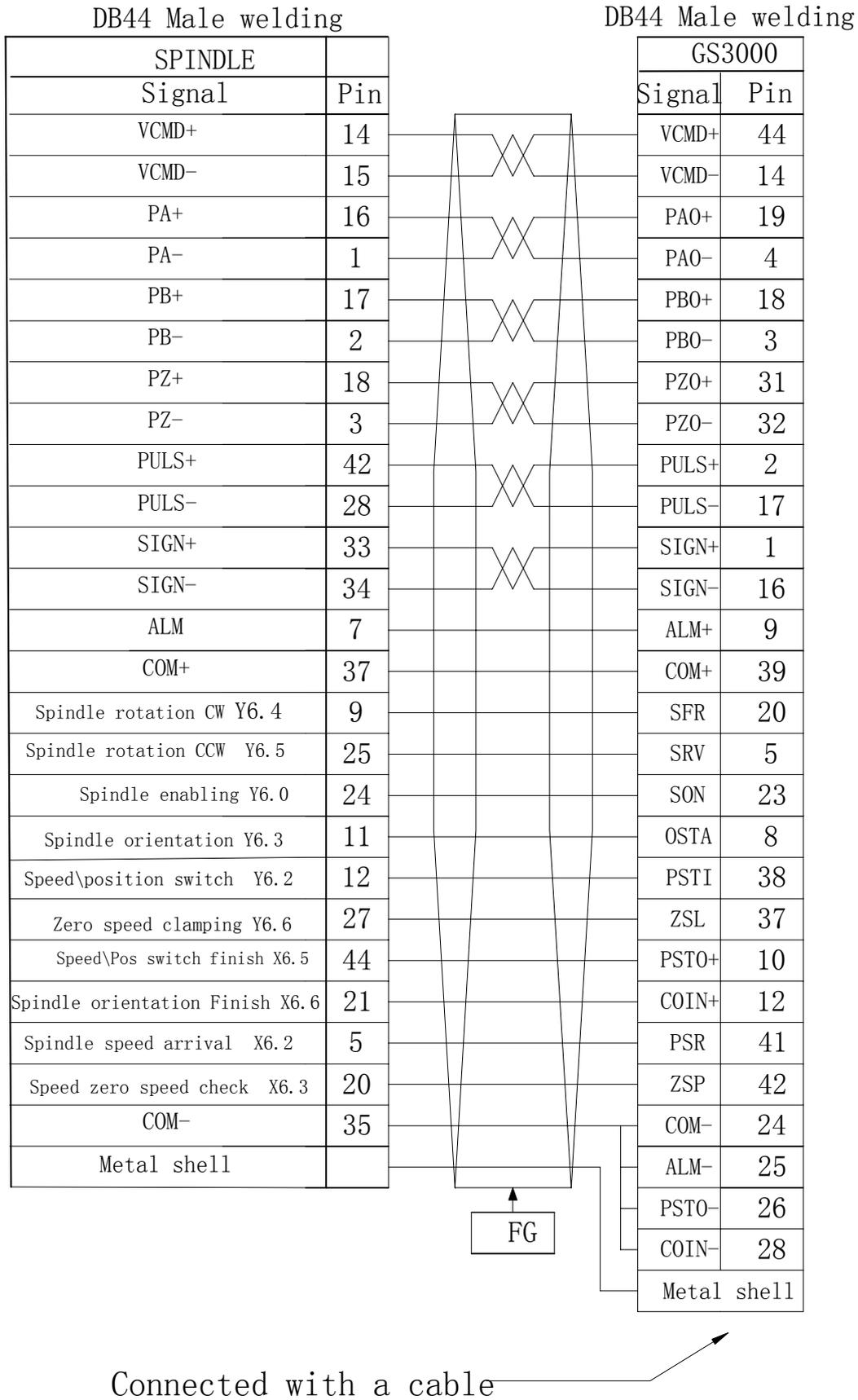


Fig. 2-8-3-2

## Chapter 3 Machine Control I/O Interface

### 3.1 Interface Signal Diagram

XS40 input signal interface (male)

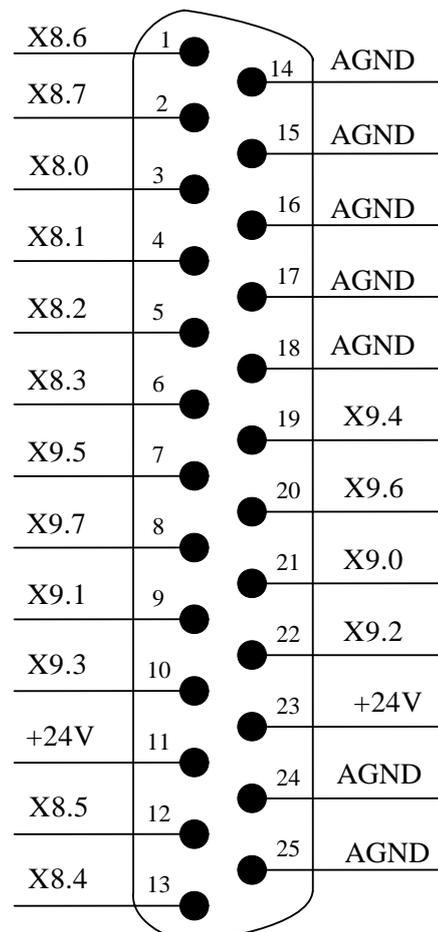


Fig. 3-1-1

Input X address' pin definition is shown below:

Table 3-1-1

Address	Signal interface	Interface pin	Definition	Contact selection
X8.0	XS40	3	Program lock	Normally open contact
X8.1	XS40	4	Feed's permissive signal	Normally open contact
X8.2	XS40	5	Spindle rotation's permissive signal	Normally open contact
X8.3	XS40	6	External feedrate override coding (Gray code)	---
X8.4	XS40	13	External feedrate override coding (Gray code)	--
X8.5	XS40	12	External feedrate override coding	--

			( Gray code )	
X8.6	XS40	1	External feedrate override coding ( Gray code )	--
X8.7	XS40	2	External feedrate override coding ( Gray code )	--
X9.0	XS40	21	External spindle override coding ( Gray code )	--
X9.1	XS40	9	External spindle override coding ( Gray code )	--
X9.2	XS40	22	External spindle override coding ( Gray code )	--
X9.3	XS40	10	External chuck control signal	--
X9.4	XS40	19	Emergency stop signal	Normally closed contact
X9.5	XS40	7	External cycle start signal	Normally open contact
X9.6	XS40	20	External feed hold signal	Normally closed contact
X9.7	XS40	8	G31 high-speed skip signal	--

## Chapter 4 Machine Debugging

The chapter introduces the trial operation methods and steps after GSK980TC3 system is turned on firstly, and the corresponding machine operation can be performed after the following steps are done.

### 4.1 Debug Preparation

Debugging GSK980TC3 can be operated based on the following steps:

- Connection of the system: The correct connection is the base of the system debugging;
- PLC debugging: Make the system safety function (such as the emergency stop and hardware limit, etc) and the operation function effective;
- Setting the drive unit parameters: Set the parameters of the motor type and the control mode, etc.
- Setting the system parameters: Set the control and the speed parameters, etc.
- Data backup: After the system debugging, the data, such as the parameter, compensation data and PLC program, should be backup.

Pay attention to the following matters before debugging and running GSK980TC3:

- Check the fly-wheel diode polar of the relay and the solenoid valve to guarantee all the cables connected correctly.
- Check the connection phase sequence of strong current cables of the motor.
- Check the corresponding relations between the position control cable, the coded wheel feedback cable and the motor strong current cable of AC servo feed unit.
- Confirm the type of the analog voltage code received by the spindle.
- Confirm all the earth wires are connected properly.
- Confirm the usefulness of the emergency stop button and the emergency stop return circuit. Make sure that the power supply of the drive device and that of the spindle drive device are OFF after pressing the emergency stop button or disconnecting the emergency return circuit.
- Confirm the voltage of each circuit power supply is correct and the polar is connected right.
- Confirm the power supply specification in each circuit is correct.
- Confirm each transformer specification and in-out direction in the circuit is correct.
- Confirm the power supply in-out circuit direction of each breaker is correct.

### 4.2 System Power-on

- Press the emergency stop button and make sure all the air switches are OFF.
- Switch on the air switch of the main power supply in the cabinet.
- Connect the air switch controlling DC24V or the fuse and check whether DC24V power supply is normal or not.
- Check whether the power supply of the other parts is normal or not.
- Electrify GSK980TC3 CNC device.

### 4.3 Emergency Stop and Limit

The system is with the software limit function. For safety, the hardware limit measure should be adopted meanwhile, and the limit switches of each axis in positive and negative directions should be installed.

About GSK980TC3 integration system, the user can monitor and check the state of the emergency stop input signal through checking NO: 009#4 (^ESP) on 【X signal】 software interface of the <diagnosis> interface. After pressing the emergency stop button, all the air switches of the system must be OFF.

In JOG or MPG mode, each coordinate axis is moved slowly to testify the validity of each axis overrun limit switch, the overrun release button and the correctness of alarm display. The system alarms when the overrun occurs or the emergency stop button is pressed; while press the overrun release button and the axis moves oppositely, the system can release the alarm.

- The emergency stop signal

GSK980TC3 parameter diagnosis (The input state on the system side)

State address				<b>X9.4</b>				
Pin NO.				<b>XS40.19</b>				

**Note: the system prompts:** 0251: emergency stop alarm, 980TC3 system checks X9.4.

It's required to correctly display the alarm "some axis (the 1<sup>st</sup> axis or the 2<sup>nd</sup> or the 3<sup>rd</sup> axis) in some direction (positive or negative) when the servo axis overruns. And it guarantees that after the overrun is released, the axis can't move in the overtravel direction when some axis overruns and the alarm occurs. Therefore, GSK980TC3 system provides two connection methods of overrun limit switches to satisfy the customers' requirements.

**A. The situations of two limit switches:**

(One limit switch of some axis in the positive direction, the other is in the negative)

1. Please strictly connect as the following list:

Table 4-3-1

Address	Signal interface	Interface pin	Definition	Contact
X0.0	GL200 (X0)	0	Limit signal of the 1 <sup>st</sup> axis stroke	Normally closed contact
X0.2	GL200 (X0)	2	Limit signal of the 3 <sup>rd</sup> axis stroke	Normally closed contact
X4.0	GL200 (X4)	0	Limit signal of the 2 <sup>nd</sup> axis stroke	Normally closed contact
X4.2	GL200 (X4)	2	Limit signal of the 4 <sup>th</sup> axis stroke	Normally closed contact
X4.4	GL200 (X4)	4	Limit signal of the 5 <sup>th</sup> axis stroke	Normally closed contact

2. Rewriting the following parameters:

Table 4-3-2

Address	Definition	State 0	State 1	Setting value
K006.0	Whether to use one limit switch or not	2 PCS	1PC	1PC

**B. With two stroke limit switches:** (I/O needs to be expanded)

(the two stroke limit switches are defined that some axis's positive limit uses a stroke switch, and the negative limit uses another stroke switch.)

1. Please strictly connect as the following list:

Table 4-3-3

Address	Signal interface	Interface pin	Definition	Contact
X0.0	GL200 (X0)	0	The 1 <sup>st</sup> axis' positive stroke limit signal	Normally closed contact
X0.1	GL200 (X0)	1	The 1 <sup>st</sup> axis' negative stroke limit signal	Normally closed contact
X0.2	GL200 (X0)	2	The 3 <sup>rd</sup> axis' positive stroke limit signal	Normally closed contact
X0.3	GL200 (X0)	4	The 3 <sup>rd</sup> axis' negative stroke limit signal	Normally closed contact
X4.0	GL200 (X4)	0	The 2 <sup>nd</sup> axis' positive stroke limit signal	Normally closed contact
X4.1	GL200 (X4)	4	The 2 <sup>nd</sup> axis' negative stroke limit signal	Normally closed contact
X4.2	GL200 (X4)	2	The 4 <sup>th</sup> axis' positive stroke limit signal	Normally closed contact
X4.3	GL200 (X4)	3	The 4 <sup>th</sup> axis' negative stroke limit signal	Normally closed contact
X4.4	GL200 (X4)	4	The 5 <sup>th</sup> axis' positive stroke limit signal	Normally closed contact
X4.5	GL200 (X4)	5	The 5 <sup>th</sup> axis' negative stroke limit signal	Normally closed contact

2. Rewriting the following parameters:

Table 4-3-4

Address	Definition	State 0	State 1	Setting value
K006.0	Whether to use one limit switch or not	2 PCS	1PC	1PC

System parameter number

6	1		LALM					
---	---	--	------	--	--	--	--	--

**LALM** =1: ignore the hard limit alarm.

=0: do not ignore the hard limit alarm.

## 4.4 Changing the Gear Ratio

When the machine traverse distance doesn't comply with the movement distance displayed on the system coordinate, the system parameters P160~P164 and P165~P169 can be rewritten to change the electrical gear ratio, and then, the different mechanical transmission ratios can be applied.

The fractional frequency and frequency multiplication( the electrical gear) of the position code pulse should be set.

In the Position control mode, the various pulse sources can be matched conveniently by setting the parameters; therefore, the ideal controlled resolution ratio (angle/pulse) required by the customer can be reached.

Formula:

$$G = \frac{\text{Numerator}}{\text{Denominator}} = \frac{4C}{L/\zeta} \times \frac{Z_M}{Z_D}$$

G: Electrical gear ratio;

L: Screw lead;

ζ :The minimum output code unit of the system(mm/pulse);

C: The linear/revolution of the photoelectric encoder.

Z<sub>M</sub>: The number of gear teeth at the end of the screw.

Z<sub>D</sub>: The number of gear teeth at the end of the motor.

} With the change gear

System side:

Frequency of the numerator: NO.160, NO.161, NO.162, NO.163, NO.164 of the system parameters (the code frequency multiplication coefficient).

Frequency of the denominator: NO.165, NO.166, NO.167, NO.168, NO.169 of the system parameters ( the code fractional frequency coefficient).

Digit servo side:

Frequency of the numerator: Parameter PA12 (The code frequency multiplication coefficient).

Frequency of the denominator: Parameter PA13 (The code fractional frequency coefficient).

【Example 1】 If the screw lead is 8mm, the minimum output code unit of the system is 0.001mm, and the motor coder linear number is 2500, so:

$$G = \frac{4C}{L/\zeta} \times \frac{Z_M}{Z_D} = \frac{4 \times 2500}{8/0.001} \times \frac{1}{1} = \frac{5}{4}$$

Then, the data parameters NO. 160 (CMRX) =5, NO.165 (CMDX) =4;

The parameter setting of the system gear ratio is same as that of the digit servo gear ratio. If it is equipped with the digit servo with the electrical gear ratio function, the electrical gear ratio of the system is set as 1:1, and the calculated electrical gear ratio is set into the digit servo.

【Example 2】 The formular of the gear ratio of the rotation axis:

$$G = \frac{N \times C \times 4}{P} = \frac{1 \times 2500 \times 4}{360 \times 1000 \times \text{reduction ratio (driving/passive tooth)}}$$

Note: the motor's optical encoder lines C=2500.

## 4.5 Backlash Compensation

The dial gauge, the micrometer gauge or the laser can be used to measure; the backlash compensation should be compensated to improve the machining precision. Therefore, measuring the

lead screw backlash in MPG or single step mode is not recommended, and the following method is suggested:

- Editing a program:

```
O0001;
N10 G01 U1 F800 ;
N20 U1 ;
N30 U1 ;
N40 U-1 ;
N50 M30 ;
```

- The backlash error compensation value is set as 0 before measuring;
- In the running program of a single block, find the measuring datum A after positioning two times, record the current data, run 1mm in the same direction, and then run 1mm to point B in opposite direction, finally read the current data.

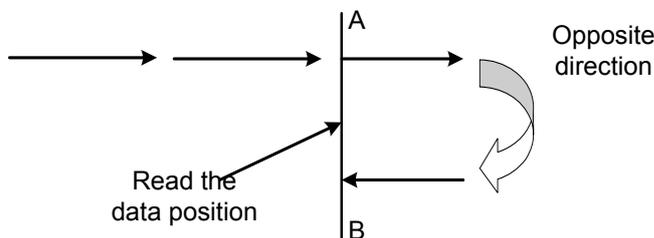


Fig. 4-5-1 (Measuring method of the backlash)

- The backlash error compensation value = | The data recorded by point A - the data recorded by point B |; The calculated data are input into the corresponding system parameters.  
 Data A: The data of dial gauge in Point A;  
 Data B: The data of dial gauge in Point B;  
 Pulse equivalent: 1 micrometer.

- Note 1:** The backlash compensation amount of each axis is set by data parameters P190~P194.
- Note 2:** The mode of backlash compensation amount and the compensation frequency are set by data parameters P195~P199.
- Note 3:** To guarantee the machine precision, the backlash can be detected again after the machine is unused for three months.

System parameter number

0	1	8	RVCS	RBK						RVIT
---	---	---	------	-----	--	--	--	--	--	------

- RVIT** =1: When the backlash is greater than the gap allowance value, the next block is executed after the compensation is completed.  
 =0: When the backlash is greater than the gap allowance value, the next block is executed before the compensation is completed.
- RBK** =1: Cutting/rapid traverse separately executes backlash compensation.  
 =0: Cutting/rapid traverse does not separately execute backlash

compensation.

- RVCS** =1: The compensation mode of the backlash: up and down speed.  
 =0: The compensation mode of the backlash: the fixed frequency.

## 4.6 Settings relevant to the Drive Unit

If the machine traverse direction isn't compliance with that required by the position movement code, the position parameter NO: 3#0~ NO: 3#4 can be rewritten.

System parameter numbers:

0	0	3				<b>DIR5</b>	<b>DIR4</b>	<b>DIR3</b>	<b>DIR2</b>	<b>DIR1</b>
---	---	---	--	--	--	-------------	-------------	-------------	-------------	-------------

- DIR1** =1: the 1<sup>st</sup> feed direction NOT(negation).  
 =0: the 1<sup>st</sup> feed direction is NOT(negation).  
**DIR2** =1: the 2<sup>nd</sup> feed direction NOT(negation).  
 =0: the 2<sup>nd</sup> feed direction is NOT(negation).  
**DIR3** =1: the 3<sup>rd</sup> feed direction NOT(negation).  
 =0: the 3<sup>rd</sup> feed direction is NOT(negation).  
**DIR4** =1: the 4<sup>th</sup> feed direction NOT(negation).  
 =0: the 4<sup>th</sup> feed direction is NOT(negation).  
**DIR5** =1: the 5<sup>th</sup> feed direction NOT(negation).  
 =0: the 5<sup>th</sup> feed direction is NOT(negation).

After power on, if the system displays the alarm of the 1<sup>st</sup>, 2<sup>nd</sup>, 3<sup>rd</sup>, 4<sup>th</sup>, 5<sup>th</sup> axis or the spindle drive unit, firstly, check whether the drive unit alarms and the drive unit is connected or not. If there aren't above situations, the level set by the system alarm parameters should not match the alarm level of the drive unit, and the bit parameters NO:19#0 ~ NO:19#5 can be rewritten to set the high level valid or the low valid. If the customer also uses GSK drive unit, the bit parameters NO:19#0~NO:19#5 are set as 0. After rewriting the parameters, press <RESET> key to cancel the system alarm, and for safety, the parameter switch of the system should be set as "OFF".

If the drive unit doesn't provide the drive alarm signal, the signal can't be connected, and the state parameters NO: 19#0 ~ NO: 19#5 should be set as 1 meanwhile. When the system displays the drive unit alarm, the operator should judge the fault on the system side or on the drive unit side.

System parameter number

0	1	9			<b>ALS1</b>	<b>ALM5</b>	<b>ALM4</b>	<b>ALM3</b>	<b>ALM2</b>	<b>ALM1</b>
---	---	---	--	--	-------------	-------------	-------------	-------------	-------------	-------------

- ALM1** =1: alarm when the 1<sup>st</sup> axis driver's alarm number is 1.  
 =0: alarm when the 1<sup>st</sup> axis driver's alarm number is 0.  
**ALM2** =1: alarm when the 2<sup>nd</sup> axis driver's alarm number is 1.  
 =0: alarm when the 2<sup>nd</sup> axis driver's alarm number is 0.  
**ALM3** =1: alarm when the 3<sup>rd</sup> axis driver's alarm number is 1.

- =0: alarm when the 3<sup>rd</sup> axis driver's alarm number is 0.
- ALM4** =1: alarm when the 4<sup>th</sup> axis driver's alarm number is 1.  
=0: alarm when the 4<sup>th</sup> axis driver's alarm number is 0.
- ALM5** =1: alarm when the 5<sup>th</sup> axis driver's alarm number is 1.  
=0: alarm when the 5<sup>th</sup> axis driver's alarm number is 0.
- ALS1** =1: alarm when the 1<sup>st</sup> spindle driver's alarm number is 1.  
=0: alarm when the 1<sup>st</sup> spindle driver's alarm number is 0.

System parameter number

<b>0</b>	<b>6</b>	<b>1</b>	<b>FALM</b>	<b>LALM</b>	<b>EALM</b>	<b>SALM</b>	<b>AALM</b>			<b>SSC</b>
----------	----------	----------	-------------	-------------	-------------	-------------	-------------	--	--	------------

- SSC** =1: use the constant surface speed control.  
=0: do not use the constant surface speed control.
- AALM** =1: ignore the external user alarm.  
=0: do not ignore the external user alarm.
- SALM** =1: ignore the spindle drive unit alarm.  
=0: do not ignore the spindle drive unit alarm.
- EALM** =1: ignore the emergency stop alarm.  
=0: do not ignore the emergency stop alarm.
- LALM** =1: ignore the hard limit alarm.  
=0: do not ignore the hard limit alarm.
- FALM** =1: ignore the feed axis driver alarm.  
=0: do not ignore the feed axis driver alarm.

## 4.7 The Machine Screw Pitch Compensation

### ● Setting the compensation amount

1. The set compensation amount is relative with the position relation between the zero point and the compensation point, the mechanical traverse direction and the compensation interval, etc.
2. The compensation amount of the compensation point N(N=0, 1, 2, 3, ..... 255) is set by the mechanical errors of intervals N and N-1. the set compensation point quantity of each is 256.
3. The mechanical zero point is taken as the compensation origin, and the compensation amount set by each axis is taken as the parameter value.
4. The axes to be compensated: X, Y, Z and 4th.
5. The range of compensation amount: each compensation point (-999 pulse equivalent~+999 pulse equivalent) x the compensation override. (metric:0.001mm, inch: 0.0001inch) .
6. When the pitch error compensation interval is set to 0, the system does not execute the compensation. (the system executes the pitch error compensation at nearby of the middle point of compensation area).
7. After the relevant parameters with the pitch error compensation is set, the system is turned off and then turned on, it is valid after the machine zero is performed.
8. After the pitch compensation is executed, the machine zero is not changed. Because the

machine zero is changed, position of the pitch compensation point is not consistent with the actual machine compensation position, which causes the machine precision decreasing, at the moment, the system check again the pitch error compensation data.

9. Setting the pitch error compensation data can execute each axis' pitch error compensation, which improves the machine precision, its compensation value's unit is a detection unit. For different machines, their pitch errors are different, so their compensation data are different, the pitch compensation data is set according to the machine characteristics of the machine connected to the CNC. After the pitch error compensation data is set, the final user cannot change these data because these changed data reduces the machine precision.

● **Pitch error compensation setting relevant parameters**

1. Whether the pitch compensation function set by NO:37#0 is valid; (0: No, 1: Yes)
2. The data parameter P226~230 sets each pitch error compensation interval;
3. The data parameter P216~220 sets pitch error numbers of each axis' reference point;

Pitch compensation number of each axis' reference point is set below:

- ① Big or small of each compensation point's pitch compensation number corresponds to big or small of the machine coordinate value, i.e., the bigger the compensation of the machine coordinate value is, the bigger the corresponding compensation number.
- ② When the pitch error compensation is set in some area of the machine, the compensation number of the machine coordinate system' least compensation point in the area is 0, the reference point's pitch compensation number is confirmed by the position relationship between the reference point and No. 0 compensation point.
- ③ Example: assume that the machine stroke is 100mm, the pitch error' compensation interval is 10mm, and the compensation number is 1-10. So the reference point's pitch compensation number judges below:
  - A. The machine's zero return direction is positive. The machine coordinate system's least value in the area is -100, the compensation number of -100 point is No. 0, the position relationship between the reference point and No. 0 compensation point is No. 0, which is shown in Fig. 4-7-1:

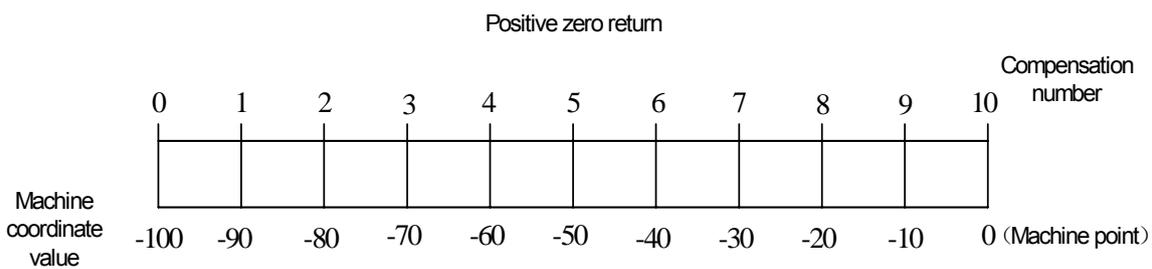


Fig. 4-7-1

- B. The machine's zero return direction is negative. The machine coordinate system's least value in the area is 0, the compensation number of 0 point is No. 0, which is shown in Fig. 4-7-2):

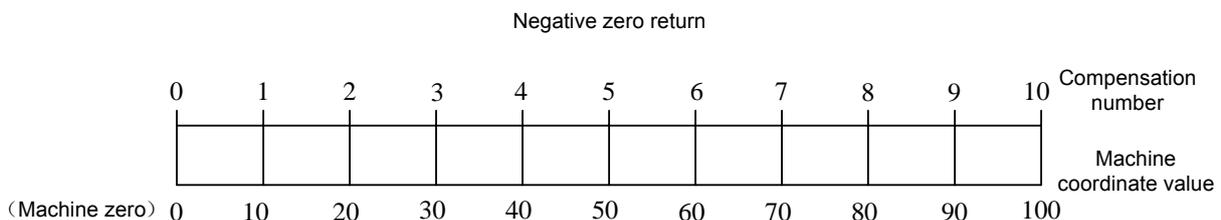


Fig. 4-7-2

C. The machine's reference point is at the machine's middle point, which occurs when an absolute encoder is allocated. The machine coordinate system's least value in the area is -100, the compensation number of -50 point is No. 0, the position relationship between the reference point and No. 0 compensation point is No. 5, which is shown in Fig. 4-7-3:

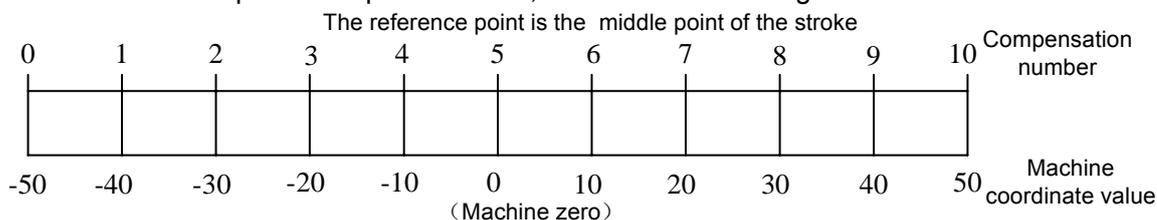


Fig. 4-7-3

**Note:** Relevant parameters with each pitch error are set according to the actual condition when the pitch error is checked. If the setting is mistaken, the machine precision is reduced.

● **Corresponding relationship between the pitch error compensation amount and reference point's compensation sequence number**

Corresponding relationship between the pitch error compensation amount and the compensation number is shown in Fig. 4-7-4:

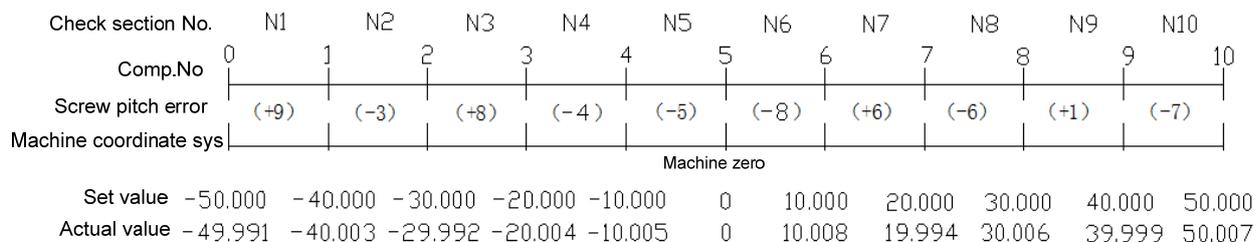


Fig.4-7-4

Corresponding relationship between the pitch error compensation amount and compensation number is shown in Table 4-7-1:

Table 4-7-1

Compensation number	0	1	2	3	4	5	6	7	8	9	10
Compensation amount	0	+9	-3	+8	-4	-5	-8	+6	-6	+1	-7

Distance between the least value and the max value of the machine worktable's moving stroke is divided into N blocks, the pitch error of each block's interval is fixed, which is not influenced by the worktable's moving direction. The error value in N1 area is input into the corresponding sequence number "1", the system can correctly call N1 area' pitch error compensation amount as Fig. 4-7-4, the error value in N6 area is input into the corresponding compensation sequence number "6", so, the system can correctly call N6 area's pitch error compensation amount. So, the relationship is each area's pitch error value corresponding to the relative area' end point of the positive moving.

● **Pitch error compensation set's example**

The linear axis pitch error compensation example, the linear axis takes X as example, and other axes' setting methods are the same.

A. Positive zero return, the error compensation is checked by taking the machine zero as the reference point.

Assume the actual condition is: the pitch error compensation interval is 10mm, X axis travel is 100mm, the compensation point quantity is 11, the reference point's compensation number is 10, and the relevant data parameter setting is shown in Table 4-7-2:

Table 4-7-2

Parameter	Default setting	Actual setting
P216: compensation number of the 1 <sup>st</sup> axis' reference point	0	5
P226: the 1 <sup>st</sup> axis pitch error compensation interval	5	10

The actual measured value is shown in Fig. 4-7-5:

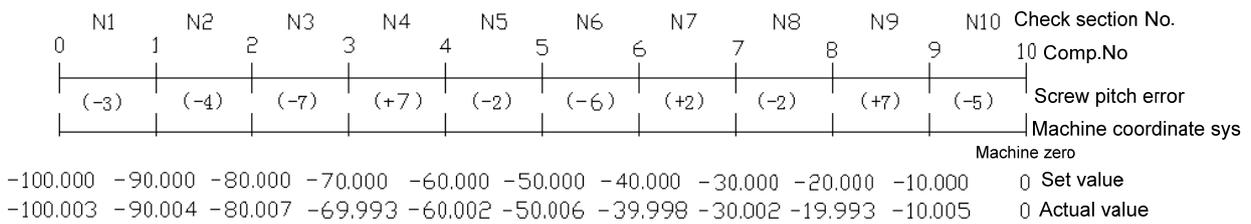


Fig.4-7-5

This moment, X pitch error compensation value is set in Table 4-7-3:

Table 4-7-3

Compensation number	0	1	2	3	4	5	6	7	8	9	10
Compensation value	0	-3	-4	-7	+7	-2	-6	+2	-2	+7	-5

B. Negative zero return, the error compensation is checked by taking the machine zero as the reference point.

Assume the actual condition is: the pitch error compensation interval is 10mm, X axis travel is 100mm, and the relevant data parameter setting is shown in Table 4-7-4:

Table 4-7-4

Parameter	Default setting	Actual setting
P216: compensation number of the 1 <sup>st</sup> axis' reference point	0	5
P226: the 1 <sup>st</sup> axis pitch error compensation interval	5	10

The actual measured value is shown in Fig. 4-7-6:

Check section No.	N1	N2	N3	N4	N5	N6	N7	N8	N9	N10	
Comp.No	0	1	2	3	4	5	6	7	8	9	10
Screw pitch error	(-3)	(+8)	(-5)	(+9)	(-9)	(+2)	(-4)	(-6)	(+1)	(-7)	
Machine coordinate sys											
Set value	0	10.000	20.000	30.000	40.000	50.000	60.000	70.000	80.000	90.000	100.000
Actual value	0	10.003	19.992	30.005	39.991	50.009	59.998	70.004	80.006	89.999	100.007

Fig.4-7-6

This moment, X pitch error compensation value is set in Table 4-7-5:

Table 4-7-5

Compensation number	0	1	2	3	4	5	6	7	8	9	10
Compensation value	0	-3	+8	-5	+9	-9	+2	-4	-6	+1	-7

C. The machine zero in the middle of travel and the error compensation is checked by taking the machine zero as the reference point.

Assume the actual condition is: the pitch error compensation interval is 10mm, X axis travel is 100mm, the limit value from the negative to the positive is -50 ~+50, and the relevant data parameter setting is shown in Table 4-7-6:

Table 4-7-6

Parameter	Default setting	Actual setting
P216: compensation number of the 1 <sup>st</sup> axis' reference point	0	5
P226: the 1 <sup>st</sup> axis pitch error compensation interval	5	10

The actual measured value is shown in Fig. 4-7-7 :

Check section No.	N1	N2	N3	N4	N5	N6	N7	N8	N9	N10	
Comp.No	0	1	2	3	4	5	6	7	8	9	10
Screw pitch error	<b>(+9)</b>	<b>(-3)</b>	<b>(+8)</b>	<b>(-4)</b>	<b>(-5)</b>	<b>(-8)</b>	<b>(+6)</b>	<b>(-6)</b>	<b>(+1)</b>	<b>(-7)</b>	
Machine coordinate sys						Machine zero					
Set value	-50.000	-40.000	-30.000	-20.000	-10.000	0	10.000	20.000	30.000	40.000	50.000
Actual value	-49.991	-40.003	-29.992	-20.004	-10.005	0	10.008	19.994	30.006	39.999	50.007

Fig. 4-7-7

Set X pitch error compensation value in Table 4-7-7:

Table 4-7-7

Compensation number	0	1	2	3	4	5	6	7	8	9	10
Compensation value	0	+9	-3	+8	-4	-5	-8	+6	-6	+1	-7

## 4.8 Mechanical Zero Return (Machine Zero Return)

The concept of mechanical zero point(machine zero point)

The machine coordinate system is the fixed one on the machine. And the origin of the machine coordinate system is called as the mechanical zero point (or the machine zero point). In this manual, it is also called as the reference point, and always installed in the maximum limit of X,Y 4<sup>TH</sup> and 5<sup>TH</sup> axes. After the machine is designed, manufactured and adjusted, the machine is set up and fixed. However, after CNC power on, there isn't the mechanical zero point, and the zero point is obtained in AUTO or JOG mode.

There are two types of zero return:1. after a block; 2. before a block, which are set by bit parameter N0: 6#1.

There are two types of zero return:1. with one-turn signal; 2. without one-turn signal, which are set by bit parameter N0: 6#6.

During zero return, if there isn't one-turn signal in the motor, zero mode type is classified as type A or B, which are set by bit parameter N0:6#7.

### 4.8.1 Bus Servo Zero Return Function Setting

When the system is allocated with a bus servo, there are two kind of zero return mode: incremental zero return and absolute setting zero, which is introduced as follows:

#### 1. Incremental zero return

Set to select the incremental in 【BUS】's encoder type or set the bit parameter No: 20#4=0. The system executes zero return according to the common zero return mode, i.e., select one-rotation signal or no one-rotation signal zero return mode, which mode is used in the system allocated with GE2000 series incremental mode's version. Zero return' each axis in zero return mode is valid.

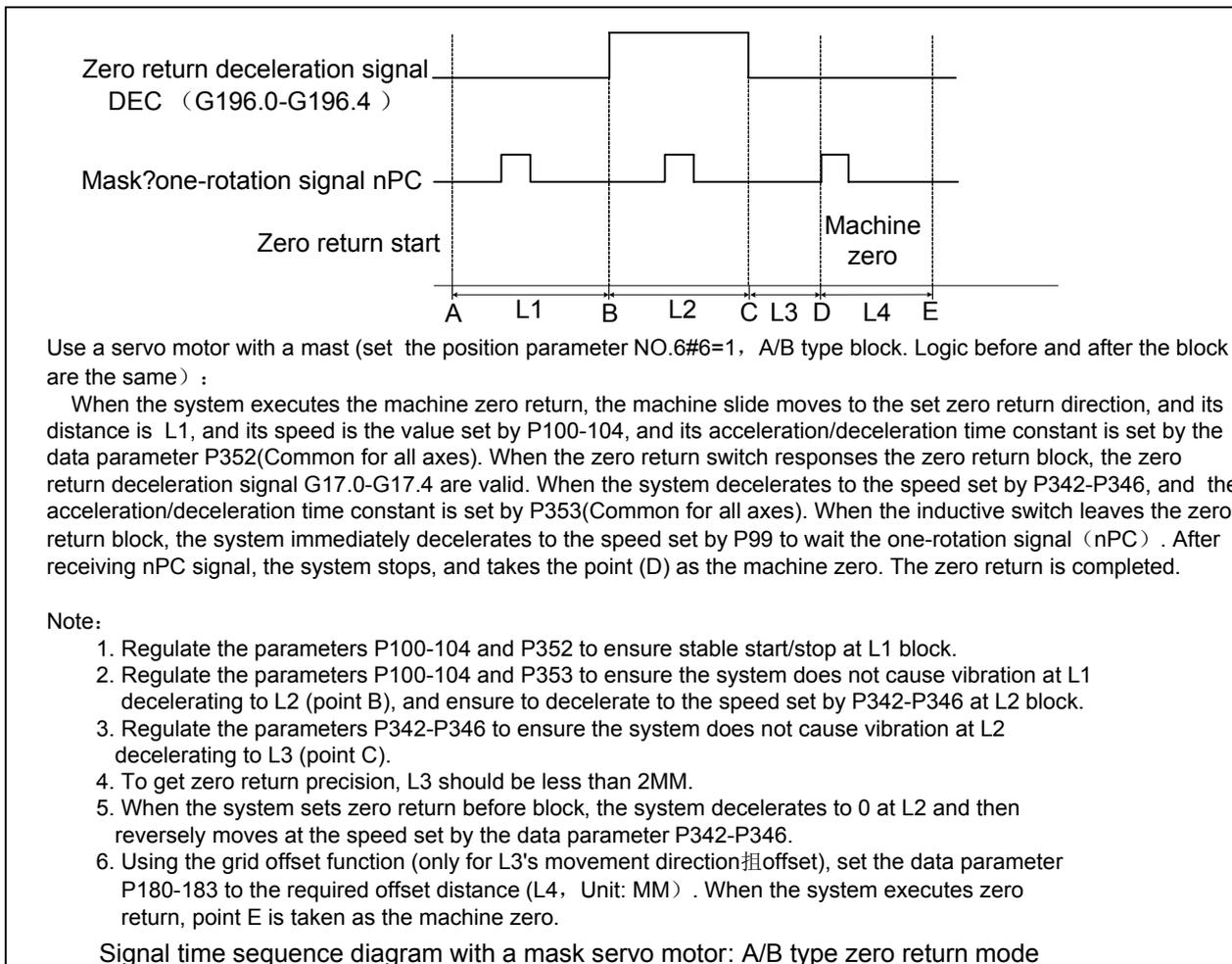


Fig. 4-8-1-1

Operation steps of bus incremental servo's mechanical zero return:



(1) Press  to enter the mechanical zero return mode, and then “mechanical zero return” is displayed at the bottom right corner on LED screen.

(2) Select X, Y, 4<sup>TH</sup> or 5<sup>TH</sup> axis for mechanical zero return, and zero return direction is set by bit parameters N0:7#3~N0:7#4.

(3) The machine moves along the mechanical zero point, before the deceleration point, the machine traverses rapidly, and the traverse speed is set by the data parameters **P100~P104**. After touching the deceleration switch, each axis returns to the mechanical zero point (the reference point) at the speed set by P342~P346. After separating from the block, move the machine zero at the speed FL (data parameter P099). During returning the mechanical zero point, the coordinate axis stops moving, the zero return indicator is ON.

Example:

Taking an example of the 1st axis' common incremental zero return, the 1st axis strikes the block at the speed F4000 (the data parameter P100 is set to 4000), it passes the block after encountering the deceleration switch at F500 (the data parameter P342 is set to 500) . After it leaves the block, the 1st axis searches one-rotation Z pulse signal at the speed F40 (the data parameter P99 is set to 40) , and it stops after it receives the signal, which is shown in Fig. 4-8-1-2.

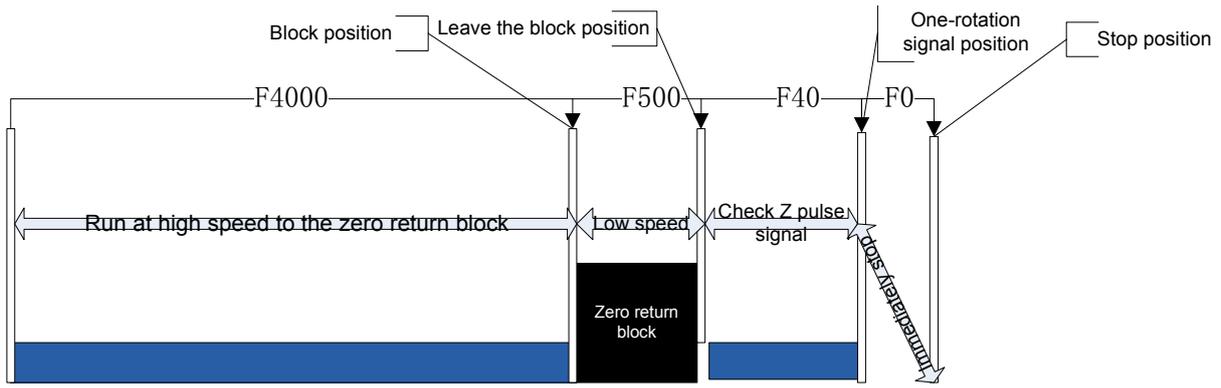


Fig. 4-8-1-2

2. Using the program code machine zero's operation steps

After NO: 6#3 is set to 0, using the program code G28 executes the zero return because checking the stroke block equals to the manual machine zero return.

3. Absolute zero setting and zero return

Zero setting method:



Pressing **SYSTEM** can enter the system page, and then to switch the display **【+BUS】** by corresponding soft key, which is shown in Fig. 4-8-1-3:

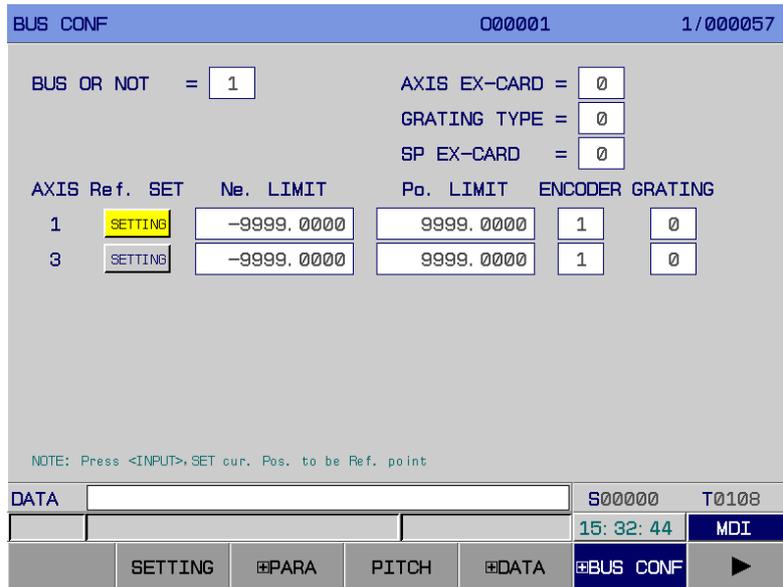


Fig. 4-8-1-3

- a) Firstly, set the system terminal's gear ratio, feed axis' direction and zero return direction, and turn off and turn on the system.
- b) In MDI mode, "Bus Yes or No" in the bus allocation page is set to 1 , the "Encoder Classification" is set to 1 , manually moving each axis sets the machine zero position.
- c) Move the cursor to **SET**, press <Input>key twice, the zero return indicator is ON, the absolute position record of each axis' motor is taken as the machine zero. The negative border and positive border can be manually set according to the actual machine's max. stroke, which makes the machine coordinates move forward/backward one value, No.61#6 is set to 1, the positive/negative limit is valid. Setting range: -99999.9999~99999.9999.

d) Whether the system is allocated with a grating. Each axis separately set to whether to allocate with a grating, 0: be not allocated with a grating, 1: be allocated with a grating.



e) Press **INPUT** to confirm it.

**Note 1:** After the machine zero is set, when each axis' referent point direction, feed axis moving direction, servo and system gear ratio cause zero be lost, the machine zero must be set again.

**Note 2:** After the machine zero is set again, it influences other reference points, for example, the 2<sup>nd</sup>, 3<sup>rd</sup> reference point should be set again.

**Example:**

The absolute encoder setting a zero can set a zero position according to the motor feedbacking absolute position, which is shown in Fig. 4-8-2-4.

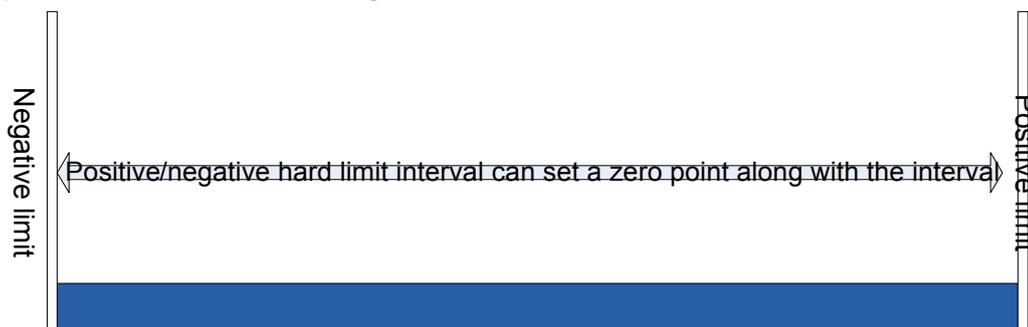


Fig. 4-8-1-4 absolute encoder zero setting

**Note 1:** When the machine is not installed with a zero return deceleration switch or the machine zero is not set, the machine zero return operation is not performed.

**Note 2:** When the machine zero return ends, the corresponding axis' indicator lights.

**Note 3:** When the corresponding axis is not on the machine zero, the zero return indicator is OFF.

**Note 4:** About the machine zero (i.e., the reference point), refer to the machine manufacturer' user manual .

**Note 5:** After the machine zero is set, each axis' zero return direction, the feed axis direction, and the gear ratio must not be changed.

● **Relevant signals**

- DECX: X deceleration signal;
- DECY: Y deceleration signal
- DECZ: Z deceleration signal;
- DEC4: the 4<sup>th</sup> deceleration signal;
- DEC5: the 5<sup>th</sup> deceleration signal.

System diagnosis (input state at side of the machine)

<b>State address</b>		<b>X0.6</b>	<b>X0.5</b>	<b>X0.4</b>				
<b>Pin</b>		<b>GL200X0.6</b>	<b>GL200X0.5</b>	<b>GL200X0.4</b>				

<b>State address</b>	<b>X4.7</b>	<b>X4.6</b>						
<b>Pin</b>	<b>GL200X4.7</b>	<b>GL200X4.6</b>						

System parameter number

<b>0</b>	<b>0</b>	<b>6</b>	<b>MAOB</b>	<b>ZPLS</b>		<b>SJZ</b>			<b>ZMOD</b>	
----------	----------	----------	-------------	-------------	--	------------	--	--	-------------	--

- ZMOD** =1: the zero return mode: before the block.  
=0: the zero return mode: after the block.
- SJZ** =1: The reference point memory: memory.  
=0: The reference point memory: not memory.
- ZPLS** =1: Zero return mode selection: with one-turn signal.  
=0: Zero return mode selection: without one-turn signal.
- MAOB** =1: Zero return mode without one-turn signal: Mode B;  
=0: Zero return mode without one-turn signal: Mode A.

System parameter number

0	0	7				<b>ZMI5</b>	<b>ZMI4</b>	<b>ZMI3</b>	<b>ZMI2</b>	<b>ZMI1</b>
---	---	---	--	--	--	-------------	-------------	-------------	-------------	-------------

- ZMI1** =1: Setting the 1<sup>st</sup> axis reference point return direction: negative.  
=0: Setting the 1<sup>st</sup> axis reference point return direction: positive
- ZMI2** =1: Setting the 2<sup>nd</sup> axis reference point return direction: negative.  
=0: Setting the 2<sup>nd</sup> axis reference point return direction: positive
- ZMI3** =1: Setting the 3<sup>rd</sup> axis reference point return direction: negative.  
=0: Setting the 3<sup>rd</sup> axis reference point return direction: positive
- ZMI4** =1: Setting the 4<sup>th</sup> axis reference point return direction: negative.  
=0: Setting the 4<sup>th</sup> axis reference point return direction: positive
- ZMI5** =1: Setting the 5<sup>th</sup> axis reference point return direction: negative.  
=0: Setting the 5<sup>th</sup> axis reference point return direction: positive

System parameter number

0	2	0	<b>UHSM</b>	<b>APC</b>						
---	---	---	-------------	------------	--	--	--	--	--	--

- APC** =1: use an absolute encoder.  
=0: do not use an absolute encoder.
- UHSM** =1: can use the manual to directly set the machine zero.  
=0: cannot use the manual to directly set the machine zero.

Data parameterNo.099

0	9	9	Gain Z pulse signal's (FL) speed(for all axes)
---	---	---	--

Data parameterNo.100~No.104

1	0	0	The 1 <sup>st</sup> axis reference point return's speed
1	0	1	The 2 <sup>nd</sup> axis reference point return's speed
1	0	2	The 3 <sup>rd</sup> axis reference point return's speed
1	0	3	The 4 <sup>th</sup> axis reference point return's speed
1	0	4	The 5 <sup>th</sup> axis reference point return's speed

Data parameterNo.342~No.346

3	4	2	Speed when the 1 <sup>st</sup> axis zero return with low-speed
3	4	3	Speed when the 2 <sup>nd</sup> axis zero return with low-speed
3	4	4	Speed when the 3 <sup>rd</sup> axis zero return with low-speed
3	4	5	Speed when the 4 <sup>th</sup> axis zero return with low-speed

3	4	6	Speed when the 5 <sup>th</sup> axis zero return with low-speed
---	---	---	--

Data parameterNo.352~No.353

3	5	2	Acceleration/deceleration time constant of zero return with high-speed
3	5	3	Acceleration/deceleration time constant of zero return with low-speed

Data parameterNo.354

3	5	4	Speed of zero return deceleration stop to return to the machine zero with low speed
---	---	---	---

Data parameterNo.180~No.184

1	8	0	Grid offset amount or reference point offset amount of the 1 <sup>st</sup> axis
1	8	1	Grid offset amount or reference point offset amount of the 2 <sup>nd</sup> axis
1	8	2	Grid offset amount or reference point offset amount of the 3 <sup>rd</sup> axis
1	8	3	Grid offset amount or reference point offset amount of the 4 <sup>th</sup> axis
1	8	4	Grid offset amount or reference point offset amount of the 5 <sup>th</sup> axis

## 4.9 The Spindle Rotation (CW/CCW) Input/Output Signal Control

- Relevant signals
  - M03: The spindle CW rotation
  - M04: The spindle CCW rotation
  - M05: The spindle stops
  - SON: The spindle enable
  - SAR/PAR: The spindle speed reach
  - ZSP: The spindle zero speed detection
  - COIN: The spindle orientation in-position

System diagnosis (output state at side of the system)

State address						Y1.2	Y1.1	Y1.0
Pin						GL200 (Y1.2)	GL200 (Y1.1)	GL200(Y1.0)

Y1.0=the spindle rotation CW (double-spindle is the spindle 2 rotation CW); Y1.1= the spindle stop (double-spindle is the spindle 2 stop);

Y1.2= the spindle rotation CCW (double-spindle is the spindle 2 rotation CCW).

State address								Y6.0
Pin								GL200(SPINDL4 female).24

Y6.0= The spindle enable.

System diagnosis (input state at side of the machine)

State address						X6.2		
Pin						GL200 (SPINDL4 female).24		

X6.2=the spindle speed arrival signal.

State address		X6.6	X6.5		X6.3			
Pin		GL200 (SPINDL4 female).24 1	GL200 (SPINDL4 female).24 4		GL200 (SPINDL4 female).24 0			

X6.3=the spindle zero-speed check signal; X6.5=speed/position switch completion; X6.6=the spindle orientation completion.

Data parameter No.258

2	5	8	The spindle speed upper limit
---	---	---	-------------------------------

Data parameter No.286~No.288

2	8	6	Gear's tooth quantity at the side of the spindle (No. 1 gear)
2	8	7	Gear's tooth quantity at the side of the spindle (No. 2 gear)
2	8	8	Gear's tooth quantity at the side of the spindle (No. 3 gear)

Data parameter No.290~No.292

2	9	0	Gear's tooth quantity at the side of the position encoder (No. 1 gear)
2	9	1	Gear's tooth quantity at the side of the position encoder (No. 2 gear)
2	9	2	Gear's tooth quantity at the side of the position encoder (No. 3 gear)

● Operation sequence

The spindle operation sequence is shown in Fig.4-9-1:

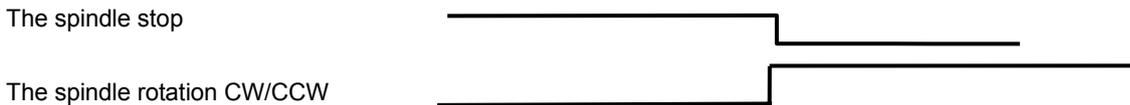


Fig. 4-9-1 Sequence of the spindle rotation CCW

● Control logic

- ① When the system is turned on, the spindle stops, M05 signal output remains;
- ② After M3/M4 is executed, M3/M4 is valid and remains and M05 signal closes output;

### 4.10 The Spindle Gear Change Control

● Relative signals

X2.0~X2.1: The spindle gear change in-position signal.

When the spindle frequency conversion (0~10V analog voltage output) controls, the system can support the spindle automatic gear change control with three gears and the gear change in-position detection function with three gears.

● Signal diagnosis

System diagnosis (input state at side of the machine)

<b>State address</b>					<b>X2.4</b>	<b>X2.3</b>	<b>X2.1</b>	<b>X2.0</b>
<b>Pin</b>					<b>GL200 (X2.3)</b>	<b>GL200 (X2.2)</b>	<b>GL200 (X2.1)</b>	<b>GL200 (X2.0)</b>

X2.0=the spindle No. 1 gear in-position; X2.1= the spindle No. 2 gear in-position; X2.2= the spindle No. 3 gear in-position; X2.3= the spindle No. 4 gear in-position.

● Control parameters

State parameter

0	0	1					<b>SPT</b>		
---	---	---	--	--	--	--	------------	--	--

- SPT** =1: The spindle control type: I/O point control.
- =0: The spindle control type: frequency conversion or other mode.

Data parameterNo.246

2	4	6	The maximum speed corresponding to gear 1
---	---	---	---

When the spindle is in No. 1 gear, the maximum speed is the spindle one when the transducer is corresponding to 10V voltage.

Data parameterNo.247

2	4	7	The maximum speed corresponding to gear 2
---	---	---	---

When the spindle is in No. 2 gear, the maximum speed is the spindle one when the transducer is corresponding to 10V voltage.

Data parameterNo.248

2	4	8	The maximum speed corresponding to gear 3
---	---	---	---

When the spindle is in No. 1 gear, the maximum speed is the spindle one when the transducer is corresponding to 10V voltage.

Data parameterNo.250

2	5	0	Motor speed when the spindle gear performs gear change
---	---	---	--

The speed relative to the data parameter No.251.

Data parameterNo.251

2	5	1	The maximum speed when the spindle gear performs gear change
---	---	---	--

The motor's speed when the transducer corresponds to 10V.

Note:

1. When the machine is with the automatic gear change device, K8.4 is set to 1; otherwise, 0. When the automatic gear change is invalid, the maximum speed of gear 1 is defaulted and 246≥247≥248.
2. When the spindle gear detection isn't with the detection switch, K7.3 should be set to 1; otherwise, 0.
3. When the spindle is I/O point control, K4.0 should be set to 1.

## 4.11 The External Cycle Start and Feed Hold

- Relative signals

ST: The external automatic cycle start signal, and it is same as the function of the automatic cycle start key on the machine panel.

\*SP: Feed hold signal, and it is same as the function of the feed hold key on the machine panel.

- Signal diagnosis

System diagnosis (input state at side of the system)

State address		X9.6	X9.5				
Pin		XS40.20	XS40.7				

X9.5= The external cycle start X9.6= The external feed hold

- The signal's internal connection

\*SP/ST signal internal circuit is referred to the following Fig. 4-11-1:

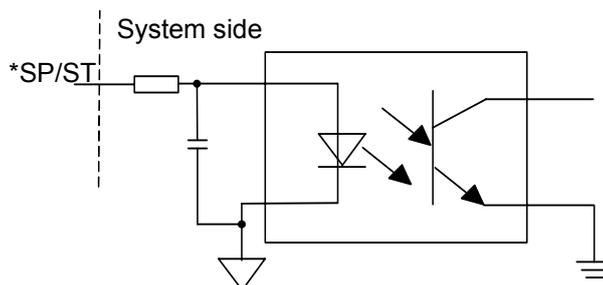


Fig.4-11-1

- The external circuit

The connection between \*SP and ST signals is referred to the following Fig. 4-11-2.

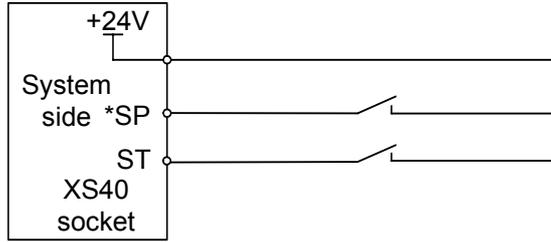


Fig. 4-11-2

- Modifying the following parameter

Address	Definition	State 0	State 1	Setting value
K005.1	Whether the machine is with the external cycle start	No	Yes	1

## 4.12 Cooling, Lubricating Control

- Relative M codes

M08: cooling ON

M09: cooling OFF

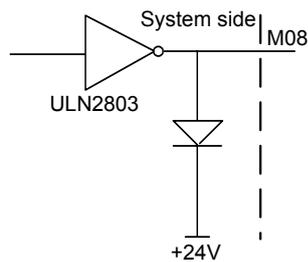
- Signal diagnosis

System diagnosis (output state at side of the system)

State address					Y03		Y0.1	
Pin					GL200(Y0.3)		GL200(Y0.1)	

Y0.1=cooling; Y0.3=lubricating

- The internal circuit is referred to the following Fig. 4-12-1:



M08 internal circuit

Fig. 4-12-1

## 4.13 Setting the Relative Feedrate

System parameter number

0	1	2	RDR	FDR		RFO			LRP	RPD
---	---	---	-----	-----	--	-----	--	--	-----	-----

**RPD** =1: Before connecting the power supply and the reference point return, the rapid in JOG mode is valid.

=0: Before connecting the power supply and the reference point return, the rapid in JOG mode is invalid.

**LRP** =1: Positioning (G00) interpolation type is linear.

=0: Positioning (G00) interpolation type is non-linear.

**RFO** =1: Rapid feeding, when the feed override is Fo, the feeding stops.

=0: Rapid feeding, when the feed override is Fo, the feeding doesn't stop.

**FDR** =1: During cutting feed, dry run is valid.

=0: During cutting feed, dry run is invalid.

**RDR** =1: During rapid positioning, dry run is valid.

=0: During rapid positioning, dry run is invalid.

0086	Dry run speed	5000
------	---------------	------

Setting range: 0~9999 (mm/min)

0087	The cutting feedrate when power-on	300
------	------------------------------------	-----

Setting range: 0~9999 (mm/min)

0088	G0 rapid positioning speed of the 1 <sup>st</sup> axis	5000
------	--	------

Setting range: 0~30000 (mm/min)

0089	G0 rapid positioning speed of the 2 <sup>nd</sup> axis	5000
------	--	------

Setting range: 0~30000(mm/min)

0090	G0 rapid positioning speed of the 3 <sup>rd</sup> axis	5000
------	--	------

Setting range: 0~30000 (mm/min)

0091	G0 rapid positioning speed of the 4 <sup>th</sup> axis	5000
------	--	------

Setting range: 0~30000 (mm/min)

0092	G0 rapid positioning speed of the 5 <sup>th</sup> axis	5000
------	--	------

Setting range: 0~30000(mm/min)

0093	Fo speed of rapid override of each axis (for all axes)	30
------	--	----

Setting range: 0~1000 (mm/min)

0094	Maximum feedrate during rapid positioning (for all axes)	8000
------	--	------

Setting range: 300~30000 (mm/min)

0095	The lowest feedrate during rapid positioning (for all axes)	0
------	---	---

Setting range: 0~300 (mm/min)

0096	The maximum control speed during cutting feed (for all axes)	6000
------	--	------

Setting range: 300~30000 (mm/min)

0097	The lowest control speed during cutting feed (for all axes)	0
------	---	---

Setting range: 0~300 (mm/min)

0098	Feedrate during continuous feeding of each axis is JOG mode	2000
------	---	------

Setting range: 0~30000 (mm/min)

0099	Speed (FL) when gaining Z pulse signal (for all axes)	40
------	---	----

Setting range: 1~60 (mm/min)

0100	Reference point return speed of the 1 <sup>st</sup> axis	4000
------	--	------

Setting range: 0~9999 (mm/min)

0101	Reference point return speed of the 2 <sup>nd</sup> axis	4000
------	--	------

Setting range: 0~9999 (mm/min)

0102	Reference point return speed of the 3 <sup>rd</sup> axis	4000
------	--	------

Setting range: 0~9999 (mm/min)

0103	Reference point return speed of the 4 <sup>th</sup> axis	4000
------	--	------

Setting range: 0~9999 (mm/min)

0104	Reference point return speed of the 5 <sup>th</sup> axis	4000
------	--	------

Setting range: 0~9999 (mm/min)

0170	Speed of rapid positioning of 1 <sup>st</sup> axis in JOG mode	5000
------	--	------

Setting range: 0~30000 (mm/min)

0171	Speed of rapid positioning of 2 <sup>nd</sup> axis in JOG mode	5000
------	--	------

Setting range: 0~30000 (mm/min)

0172	Speed of rapid positioning of 3 <sup>rd</sup> axis in JOG mode	5000
------	--	------

Setting range: 0~30000 (mm/min)

0173	Speed of rapid positioning of 4 <sup>th</sup> axis in JOG mode	5000
------	--	------

Setting range: 0~30000 (mm/min)

0174	Speed of rapid positioning of 5 <sup>th</sup> axis in JOG mode	5000
------	--	------

Setting range: 0~30000 (mm/min)

## 4.14 Chuck Control

### 1. Address definition

Y2								DOQPS	DOQPJ
----	--	--	--	--	--	--	--	-------	-------

Y2.0 : outside chuck clamping output/inside chuck releasing output

Y2.1: outside chuck releasing output/inside chuck clamping output

X1						NQPF	WQPJ	DIQP
----	--	--	--	--	--	------	------	------

X1.0: chuck releasing control signal (DIQP)

X1.1: outside chuck clamping in-position/inside chuck releasing in-position (WQPJ)

X1.2: outside chuck releasing in-position/inside chuck clamping in-position (NQPJ)

**2. Control parameter**

K011			BIT5	BIT4	BIT3	BIT2	BIT1	BIT0
------	--	--	------	------	------	------	------	------

K11.0 = 1: use the chuck;

=0: do not use the chuck.

The following K11.1 definition negation (NOT):

K11.1 =1: outside chuck mode, WQPJ is a outside clamping signal and NQPJ is a outside chuck releasing signal;

=0: inside chuck mode, NQPJ is a outside clamping signal and WQPJ is a outside chuck releasing signal.

K11.2 =1: the chuck releasing has no check switch;

=0: the chuck releasing has a check switch.

K11.3 = 1: the chuck releasing switch is a normally closed type;

=0: the chuck releasing switch is a normally open type.

K11.4 = 1: after power on, the chuck automatically outputs the state at which is before power-off;

=0: after power on, the chuck does not automatically output any states.

K11.5 = 1: the chuck releasing/clamping is not relevant with the chuck operation;

=0: forbid the spindle rotation when the chuck releases/clamps, and forbid the chuck releasing/clamping when the spindle rotates.

T021	Chuck clamping in-position check time ms
T022	Chuck releasing in-position check time ms

**3. Control logic**

Signals in outside chuck mode	Chuck clamping	WQPJ (X1.1): chuck clamping in-position signal
		DOQPJ (Y2.0): chuck clamping output signal
	Chuck releasing	NQPJ (X1.2): chuck releasing in-position signal
		DOQPS (Y2.1): chuck releasing output signal
Signals in inside chuck mode	Chuck clamping	NQPJ (X1.2): chuck clamping in-position signal
		DOQPS (Y2.1): chuck clamping output signal
	Chuck releasing	WQPJ (X1.1): chuck releasing in-position signal
		DOQPJ (Y2.0): chuck releasing output signal

When the system is turned on, DOQPJ (outside chuck clamping/inside chuck releasing) and DOQPS (outside chuck releasing/inside chuck clamping) remain the previous state when power of; namely, DOQPJ and DOQPS have power failure memory function.

When the chuck control input(DIQP) is valid, the chuck clamping/ chuck releasing signal is valid, i.e., when the chuck control input signal is valid, the output state changes.

DOQPJ, DOQPS output states remain unchanged when reset, emergency stop state.

#### 4. Time sequence

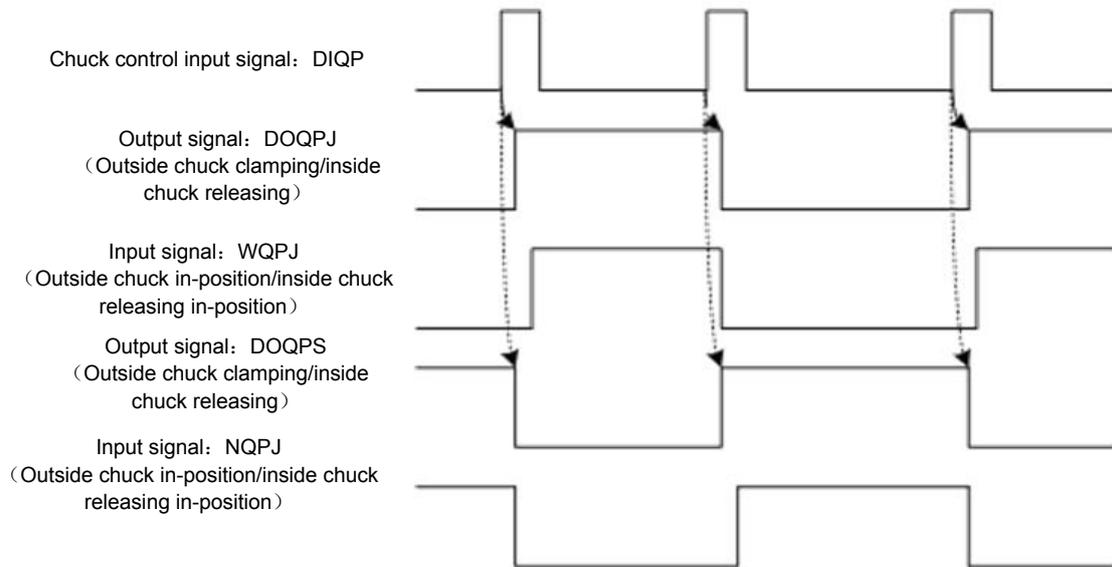


Fig.4-14-1

### 4.15 Tool Change Control

The standard ladder diagram supports two kind of tool post control logic; setting K parameter's corresponding control bit can select the adaptive tool post. Select it by Bit0 and Bit1.

K0002								BIT1	BIT0
-------	--	--	--	--	--	--	--	------	------

K2.0=0, K2.1=0: standard electric tool post(adaptive Changzhou tool post)

K2.0=1, K2.1=0: servo tool post (adaptive to Taida tool post servo, see Appendix 1)

K2.0=0, K2.1=1: hydraulic tool post

D0000	Total cutter spacing quantity of tool post								
-------	--	--	--	--	--	--	--	--	--

**General electric tool post : K2.0=0, K2.1=0, (adaptive Changzhou tool post)**

#### 1) Control parameters

K0012	BIT3							
K0013	BIT0							

K12.3 1: check the cutter spacing signal after tool change ends

0: do not check the cutter spacing signal after tool change ends

K13.0 1: the electric tool post's general cutter spacing signal is normally open

0: the electric tool post's general cutter spacing signal is normally closed

T036	Total time of tool change (0-65535ms)
T037	Tool post reversal locking time (0-65535ms)
TMRB09	Delay time from the tool post's rotation CW stop to reverse output (0-65536ms)

#### 2) Signal address:

X0003	T8	T7	T6	T5	T4	T3	T2	T1
-------	----	----	----	----	----	----	----	----



### 3) Tool change process

- ① After the tool change is performed, the system outputs the tool post rotation CW signal TL+, and start to check the cutter spacing signal. After the system has checked the cutter spacing signal, it closes TL+ output, delays the time set by the PLC parameter TMRB09, it outputs the tool post rotation CCW signal TL-. After it delays set by the PLC parameter DT37, it closes the tool post rotation CCW signal TL-. When the system has not checked the target cutter spacing signal within the time set by DT36, it closes the tool post rotation CW signal (TL+), an alarm occurs.
- ② When K0012 Bit3 is set to 1 (after tool change ends, the system checks the cutter spacing signal). After the tool post rotation CCW time ends, the system confirms whether the current cutter spacing input signal is consistent with the current tool number or not, otherwise, an alarm occurs.
- ③ the tool change process ends.

### 4) Tool change flow

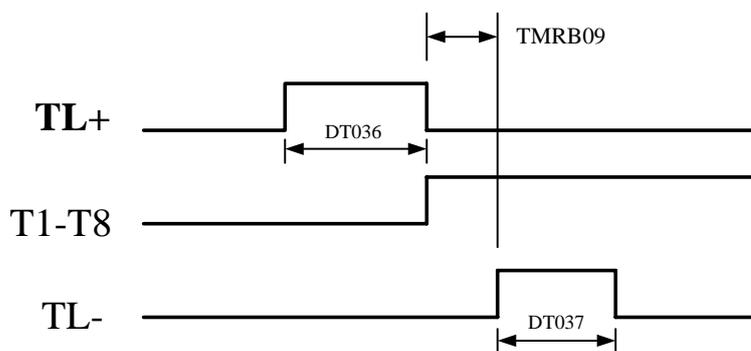


Fig. 4-15-1 tool change time sequence

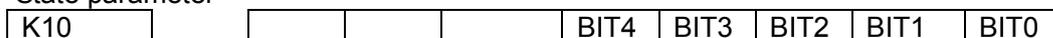
## 4.16 Tailstock Control

- Relative signal  
 DOTWJ: tailstock forward output signal  
 DOTWS: tailstock backward output signal  
 DITW: tailstock control input signal

- Signal diagnosis

Signal	DITW	DOTWJ	DOTWS
<b>Diagnosis address</b>	X1.3	Y2.2	Y2.3
<b>Interface pin</b>	GL200(X1.3)	GL200(Y2.2)	GL200(Y2.3)

- Control parameter  
 State parameter



- BIT0    =1: use the automatic tailstock  
 =0: do use the automatic tailstock

- BIT1 =1: the spindle rotation permits the tailstock forward/backward  
=0: the spindle rotation does not permit the tailstock forward/backward
- BIT2 =1: the tailstock forward checks in-position switch  
=0: the tailstock forward does not check in-position switch
- BIT3 =1: the tailstock forward output's use time delays OFF, and the timer is TMR25  
=0: the tailstock forward output remains
- BIT4 =1: the tailstock's backward output's use time delays OFF, and the timer is TMR26  
=0: the tailstock backward output remains

● Time sequence of operation

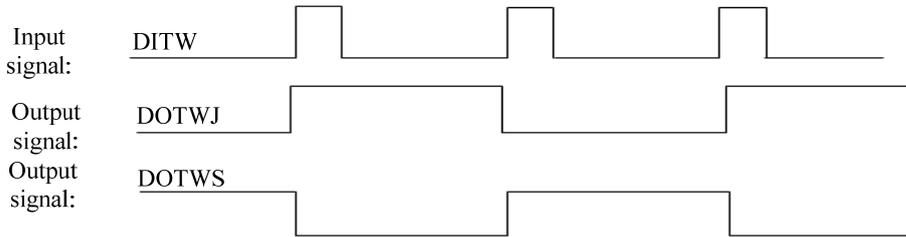


Fig. 4-16-1 time sequence of tailstock control

When the system is turned on, the tailstock forward (DOTWJ) and the tailstock backward (DOTWS) are invalid; when the 1st tailstock control input (DITW) is valid, the tailstock forward is valid; when the 2nd tailstock control input is valid, the tailstock backward is valid. The tailstock forward/backward signal interlock alternately outputs, i.e., when the tailstock control input signal is valid, the output state changes. After M10 is executed, DOTWJ (GL200Y3.2) inputs 0V, and the tailstock forward is performed; after M11 is performed, DOTWS (GL200Y3.3) outputs 0V, and the tailstock backward is performed.

## 4.17 C/S Axis Control

### 1. Address definition

X018			BIT5					
Y018			BIT5					

X18.5: C/S key

Y18.5: C/S key indicator light

### 2. Control parameter

K07	BIT7							BIT0
NO037	SCS							

K7.0 =1: use the spindle contour control

=0: do not use the spindle contour control

K7.7 =1: use the spindle position mode

=0: use the spindle speed mode

NO37.6 =1: perform Cs contour control in each spindle

=0: do not perform Cs contour control in each spindle

NO37.7 =1: use the spindle contour control

=0: do not use the spindle contour control

T address	Definition	Default
T011	M29 execution completion time(no check switch)	4000ms
T013	M28 execution completion time(no check switch)	4000ms

T011: the spindle is switched from the speed mode to the contour control mode to check delay

T013: the spindle is switched from the contour mode to the speed control mode to check delay

### 3. Function description

GSK980TC3 standard PLC programs supports the 1<sup>st</sup> spindle Cs contour control.

When the system parameters and PLC parameters are simultaneously set, the function is valid.

In Auto mode, executing M14 can switch the spindle from the speed mode to the contour control mode, and executing M15 can switch it from the contour mode to the contour control mode.

In JOG, MPG, Step mode, using “C/S” key on the panel can switch the spindle control mode. Press it to switch to the spindle control mode. When the spindle is the contour control mode, “C/S” light is ON. When the spindle is switched to the contour control mode, “C/S” key light flashes. When it the speed control mode, the key light is OFF.

When reset or unsuccessful switch is performed in the course of switch, the system returns to the previous control mode.

When the spindle is the contour control mode, the spindle operation cannot be performed, such as spindle rotation CW/CCW/stop.

## 4.18 Setting Related to the 4<sup>th</sup> Axis

GSK 980TC3 series owns 4-axis 4-link function.

When the data parameter P5 is set to 4, and after the system is turned off and then turned on, the 4<sup>th</sup> axis function is valid.

Related bit parameters:

System parameter number

0	0	9								<b>A4TP</b>	<b>RAB</b>
---	---	---	--	--	--	--	--	--	--	-------------	------------

**RAB** =1: rotate nearby when each axis is taken as a rotary axis

=0: do not rotate nearby when each axis is taken as a rotary axis

**A4TP** =1: set to the 4-axis link system

=0: do not set to the 4-axis link system

System parameter number

0	0	8								<b>AXS4</b>			
---	---	---	--	--	--	--	--	--	--	-------------	--	--	--

**AXS4** =1: the 4<sup>th</sup> axis is set to the rotary axis

=0: the 4<sup>th</sup> axis is set to the linear axis

System parameter number

0	5	0		<b>SIM</b>						<b>REL</b>	
---	---	---	--	------------	--	--	--	--	--	------------	--

- REL** =1: relative position display setting of indexing table: within 360°.  
 =0: relative position display setting of indexing table: beyond 360°.
- SIM** =1: an alarm occurs when indexing code and other control axis code are in the same block.  
 =0: no alarm when indexing code and other control axis code are in the same block.

Relative data parameter:

Table 4-16-1

No.	Default value	Setting range	Parameter meaning
0005	3	3~5	CNC controllable axis quantity
0178	4	0~5	The 4 <sup>th</sup> axis' program name (0~5:X, Y, Z, A, B, C)

## 4.19 Relevant Bus Servo Setting

System parameter number

0	0	0		<b>SVCD</b>	<b>SEQ</b>	<b>MSP</b>		<b>INI</b>	<b>INM</b>	
---	---	---	--	-------------	------------	------------	--	------------	------------	--

- INM** =1: least command increment of linear axis (inch)  
 =0: least command increment of linear axis (metric)
- INI** =1: input unit (inch)  
 =0: input unit (metric)
- MSP** =1: use the double spindle control  
 =0: do not use the double spindle control
- SEQ** =1: automatically insert a sequence number  
 =0: do not insert a sequence number
- SVCD** =1: use the bus servo card  
 =0: do not use the bus servo card

System parameter number

0	0	1					<b>SPT</b>	<b>SBUS</b>	<b>RASA</b>
---	---	---	--	--	--	--	------------	-------------	-------------

- RASA** =1: use the absolute grating ruler  
 =0: do not use the absolute grating ruler
- SBUS** =1: the spindle driver is the bus control mode  
 =0: the spindle driver is not the bus control mode
- SPT** =1: the spindle control type (I/O control)  
 =0: the spindle control type (frequency conversion or others)

System parameter number

0	0	5					<b>ISC</b>	
---	---	---	--	--	--	--	------------	--

- ISC** =1: least command unit: metric 0.0001 (mm&deg), inch 0.00001 (inch)  
 =0: least command unit: metric 0.001 (mm&deg), inch 0.0001 (inch)

System parameter number

0	2	0	UHSM	APC		USNO				ITL
---	---	---	------	-----	--	------	--	--	--	-----

- ITL** =1: all axes interlock are valid  
 =0: all axes interlock are invalid
- USNO** =1: the bus servo's older version  
 =0: the bus servo's new version
- APC** =1: use the absolute encoder  
 =0: do not use the absolute encoder
- UHSM** =1: use the manual to directly set the machine zero  
 =0: do not use the manual to directly set the machine zero

Data parameter

0008	Ethernet bus slave station MDT data package size	16
------	--	----

Setting range: 2, 4, 6, 8, 10, 12, 14, 16, 20

**Note: the parameter can be modified by our developers.**

0009	Max. retransmission times of Ethernet bus	10
------	---	----

Setting range: 0~30

**Note: the parameter can be modified by our developers.**

0380	Set an axis which is synchronous with the 4 <sup>th</sup> axis: 0: not synchronous with any axes 1:X 2:Y 3:Z	0
------	---	---

Setting range: 0~3

0381	Max. permissive error between synchronous axes	200
------	--	-----

Setting range: 0~10000

0392	Move distance when the servo optimizes	50
------	--	----

Setting range: 0~100

0393	Move speed rate when the servo optimizes	2000
------	--	------

Setting range: 0~5000

0444	To be extended	50
------	----------------	----

Setting range: 0~500

0445	The 1 <sup>st</sup> axis allocated with grating precision	0.0010
------	---	--------

Setting range: 0~10

0446	The 2 <sup>nd</sup> axis allocated with grating precision	0.0010
------	---	--------

Setting range: 0~10

0447	The 3 <sup>rd</sup> axis allocated with grating precision	0.0010
------	---	--------

Setting range: 0~10

0448	The 4 <sup>th</sup> axis allocated with grating precision	0.0010
------	---	--------

Setting range: 0~10

0449	The 5 <sup>th</sup> axis allocated with grating precision	0.0010
------	---	--------

Setting range: 0~10

## Appendix



## Appendix 1 Servo Tool Post Explanation

### 1. Software Version Information

1. Software design: GSK CNC Equipment Co., Ltd. Project Group
2. PLC software version: standard version
3. Software remark: (taking example of servo tool post, Taida drive)

### 2. Relevant Signal Parameter to the CNC System

#### 1. Input signals

Input interface	Pin	Signal name	Function	Remark(Taida drive, different for different drive signals)
GL200(X3)	0	X03.0/T1	Tool number's position signal	Corresponding to the servo driver CN1 interface's pin 6, 7 DO1 signal
	1	X03.1/T2	Tool number's position signal	Corresponding to the servo driver CN1 interface's pin 4, 5 DO2 signal
	2	X03.2/T3	Tool number's position signal	Corresponding to the servo driver CN1 interface's pin 2, 3 DO3 signal
	3	X03.3/T4	Tool number's position signal	Corresponding to the servo driver CN1 interface's pin 1, 26 DO4 signal
	4	X03.4/T5	Tool number's position signal	Corresponding to the servo driver CN1 interface's pin 27, 28 DO5 signal
	+24V	+24V	DC24V	Corresponding to the servo driver CN1 interface's pin 11 COM+
	AGND	AGND	DC0V	Corresponding to the servo driver CN1 interface's pin 45, 47, 49 COM-
GL200(X2)	6	X2.6/TC P	Servo tool post lock check respond signal	Machine side appromixity switch S8 input signal. When there is only one switch (K12.1=1), the point is used (refer to the machine tool's instructions)
	5	X02.7	Servo tool post release check signal	Tool post release check input signal

#### ③ Output signal

Output interface	Pin	Signal name	Function	Remark
GL200(Y2)	7	Y2.7	Servo start	Corresponding to the servo driver CN1 interface's pin 32 D16 signal

GL200(Y3)	0	Y3.0	NC signal output s the driver DI1	Corresponding to the servo driver CN1 interface's pin 9 tool number selection
	1	Y3.1	NC signal output s the driver DI2	Corresponding to the servo driver CN1 interface's pin 10 tool number selection
	2	Y3.2	NC signal output s the driver DI3	Corresponding to the servo driver CN1 interface's pin 34 tool number selection
	3	Y3.3	NC signal output s the driver DI4	Corresponding to the servo driver CN1 interface's pin 8 tool number selection
	4	Y3.4	The tool post locking signal	Tool post lock output signal
	5	Y3.5	The tool post releasing signal	Tool post release output signal
	6	Y3.6	Mode switch input MD0	Corresponding to the servo driver CN1 interface's pin 31 D17 signal
	7	Y3.7	Mode switch input MD1	Corresponding to the servo driver CN1 interface's pin 30 D18 signal

④ The ladder's relevant parameters

No.	Setting value	Definition	Remark
K01.0	1	Whether to use the tool post	
K2.0/1	K2.0=1 K2.1=0	Tool post selection	Select the servo tool post
K09.0	1	Whether to use the hydraulic device	980TC3 simultaneously sets K9.1 to 1, and directly starts the hydraulic instead of opening the parameter
K12.0	0	Whether the tool post releasing/clamping signal switch is normally closed	Set it according to the tool post switch state
K12.1	0	The tool releasing/clamping uses one input interface	Set it according to the tool post switch state
T038	5000	The tool post clamping delay check	The system has not received X2.6 in-position signal in the range after the clamping signal sends, A5.2 alarm occurs
T039	5000	The tool post releasing delay check	The system has not received X2.6/X3.5 in-position signal in the range after the releasing signal sends, A5.3 alarm occurs
T040	10000	The servo is ready to delay the check time	The system has not checked the servo ready signal and A5.0 alarm occurs
T041	10000	The tool post zero return to delay the check time	The zero return is not completed in the range, and A5.4 alarm occurs
T042	10000	Tool selection controls the delay check	The tool change is not completed in the range set by the parameter, and A5.4 alarm occurs
T043	100	The tool post clamps the delay completion	Delay to execute the next step after the servo receives the locking signal
T044	100	The tool post releases the delay completion	Delay to execute the next step after the servo receives the releasing signal
T045	1000	Delay the tool post servo alarm	An alarm A6.0 occurs when the servo alarm signal length exceeds the range

Appendix

<b>D000</b>	4	The tool post' total tool quantity	Set it according to the adaptive tool post
<b>D001</b>	0000	The servo alarm coded value	According to DO01-05 corresponding to the driver's manual: status's binary system into coded-decimal code
<b>D002</b>	0001	The servo ready OK coded value	According to DO01-05 corresponding to the driver's manual: status's binary system into coded-decimal code
<b>D003</b>	0002	Coded value in the servo zero return	According to DO01-05 corresponding to the driver's manual: status's binary system into coded-decimal code
<b>D004</b>	0005	The servo zero return completion coded value	According to DO01-05 corresponding to the driver's manual: status's binary system into coded-decimal code
<b>D005</b>	0004	Coded value in servo rotating	According to DO01-05 corresponding to the driver's manual: status's binary system into coded-decimal code
<b>D006</b>	0004	Tool number display reduction	According to DO01-05 corresponding to the driver's manual: status's binary system into coded-decimal code

⑤ Relevant alarms

No.	Content	Treatment
A5.0/1240	The tool post ready is not OK	Check whether PLC-TMR040 parameter setting is too small Check whether the servo drive is normal, DO1-DO5 circuit is broken, and the input signal is normal Check whether Y2.7, S8(X2.6) signal, the circuit of turret's oil pressure are normal
A5.1/1241	After the tool post servo is ready OK, the tool post zero return is executed after reset	Execute the turret zero return
A5.2/1242	The tool post locking check is abnormal	Check whether PLC-TMR038 parameter setting is too small Check whether Y3.4, S8(X2.6) signal, the circuit of turret's oil pressure are normal
A5.3/1243	The tool post releasing check is abnormal	Check whether PLC-TMR039 parameter setting is too small Check whether Y3.5, S8(X2.7) signal, the circuit of turret's oil pressure are normal
A5.4/1244	The tool post zero return completion signal checks abnormality	Check whether PLC-TMR041 parameter setting is too small Check whether Y3.4, S8(X2.6) signal, the circuit of turret's oil pressure are normal Check whether PLD-D4 is correct
A5.5/1245	The tool post signal is abnormal. Execute zero return again	Execute the zero return again
A5.6/1246	The servo tool post searching a tool is overtime	Check whether PLC-TMR042 parameter setting is too small Check whether the servo drive is normal, DO1-DO5 circuit is broken, and the input signal is normal
A6.0/1248	The tool post's servo driver alarms. Restart	Check whether the servo driver alarms Restart the machine and check whether the alarm still exists

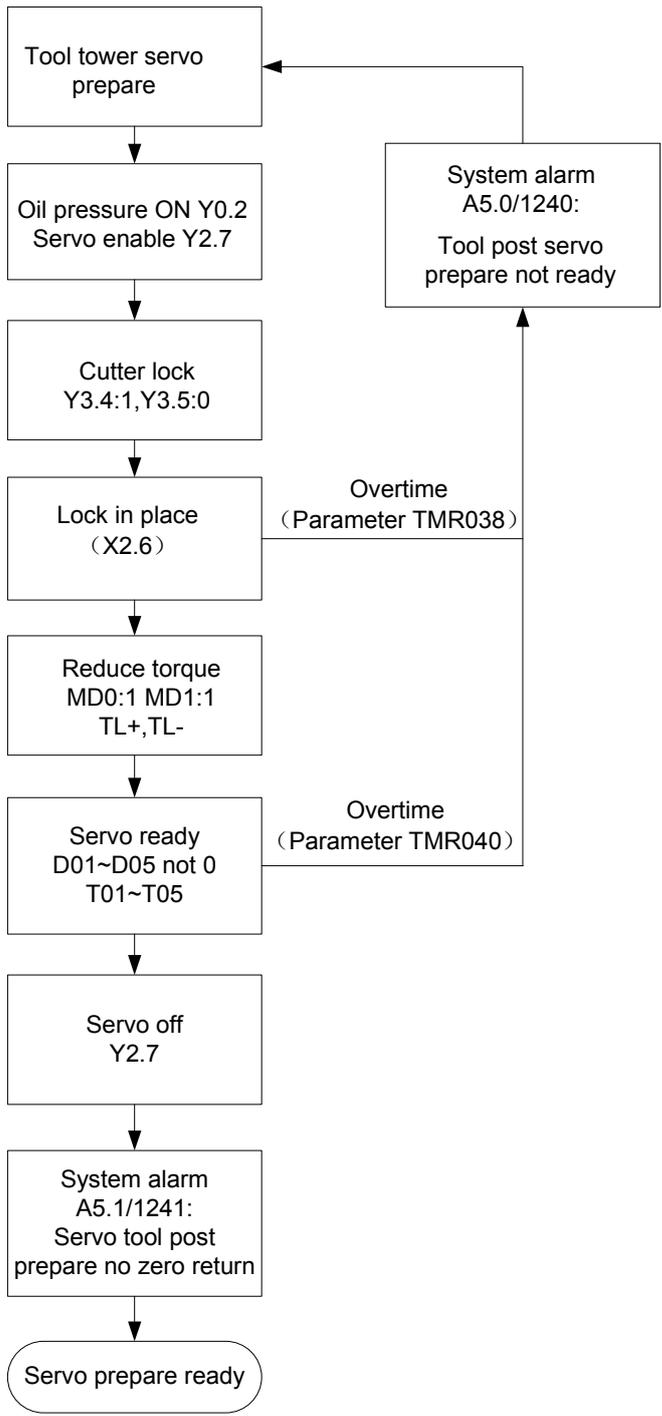
		View the driver's manual to trouble shooting
--	--	--

### 3. Functional description

- ⑥ The system is turned on, i.e., the turret servo ready flow. After the ready is OK, A5.1/1241 alarm occurs to prompt the servo turret does not return to zero.
- ⑦ Reset to clear A5.1/1241 alarm.
- ⑧ Select "Machine zero return" mode, press the key "Select a tool CW" or "Select a tool CCW" to execute the turret zero return.
- ⑨ Execute T code in "Auto mode" and "MDI mode", or press the key "Select a tool CW" or "Select a tool CCW" in "Manual mode" or "MPG mode" to execute the tool change flow.
- ⑩ Before tool change, the system automatically check whether the turret executes the tool post zero return. When the turret does not execute the zero return, the turret zero return is executed firstly and then the tool change is done.
- Before the tool post returns to zero, the operator checks whether the turret is ready. When the servo in PLC-TMR040 setting value is not ready OK, A5.0/1240 overtime alarm occurs. In the course of the servo zero return and tool change, when the logic time sequence is abnormal, A5.4/1244 or A5.5/1245 alarm occurs.  
Before the servo zero return and tool change, check whether the oil pressure is started.

### 4. Flow chart and I/O input/output control

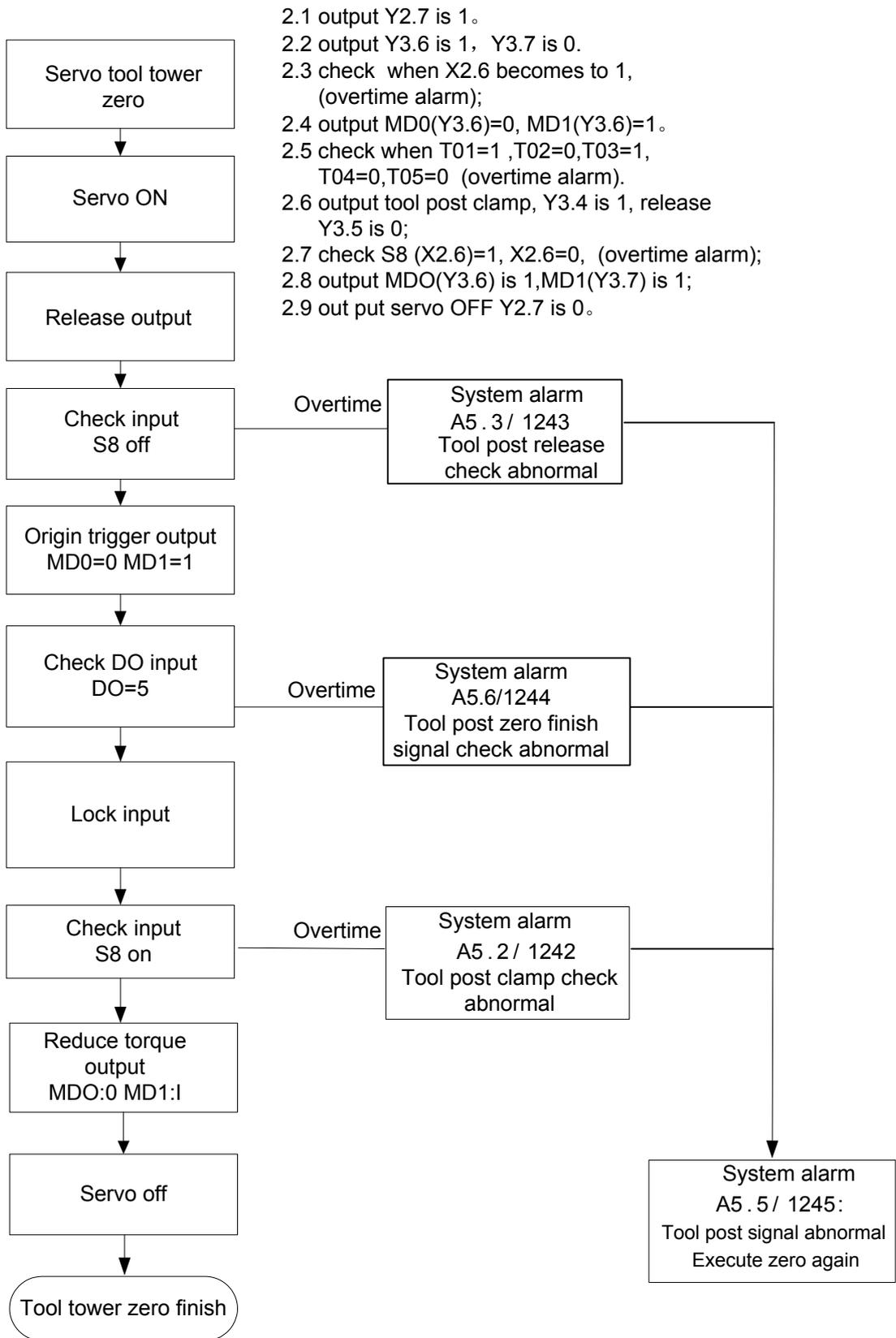
1. Servo ready OK



- 1.1 output Y0.2 is 1.
- 1.2 output Y2.7 is 1.
- 1.3 output Y3.6 is 1, Y3.7 is 0.
- 1.4 check when X2.6 becomes to 1, (overtime alarm);
- 1.5 output TL+ is 1, TL- is 1.
- 1.6 check when T01\T02\T03\T04\T05 input any non-zero(overtime alarm).
- 1.7 out put Y2.7 is 0.

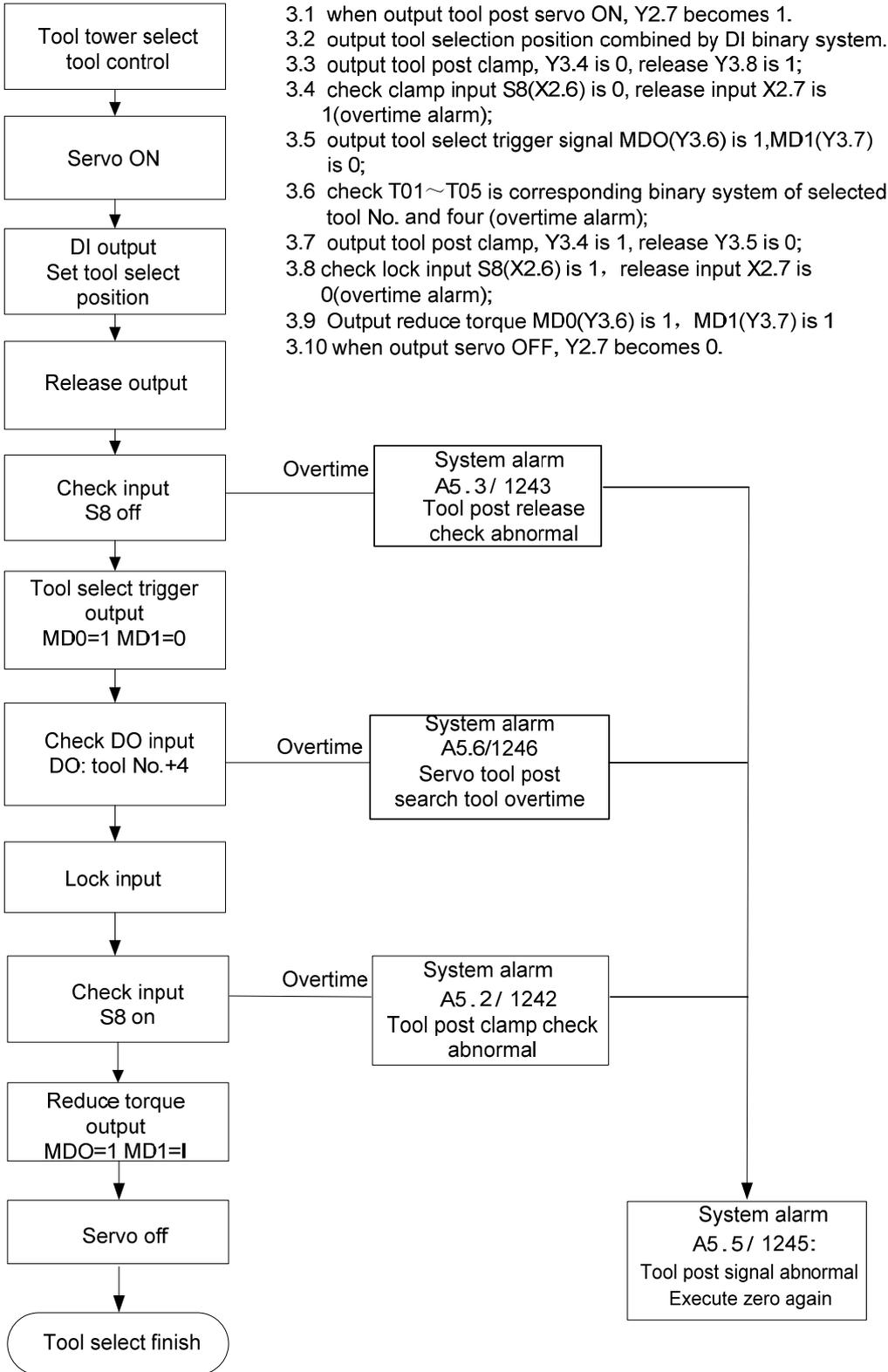
Appendix

2. Turrent origin return



Appendix

### 3. Tool selection control



Appendix

## Appendix 2 Taiwan Liuxin Tool Post Wire Table

GSK980TC3 is matched with Taiwan Liuxin Tool Post, modify K1.0 into 1, K2.0 into 1, K2.1 into 0.

GL200 (X3)	+ 24V		+ 24V
	0	T1	Sensor A
	1	T2	Sensor B
	2	T3	Sensor C
	3	T4	Sensor D
GL200 (X2)	4	T5	Sensor E
	6	TCP	Sensor F
GL200 (Y3)	4	TLCOK	Tool pot pushing out the electromagnetic valve
	6	TL +	Tool pot rotating CW the valve
	7	TL -	Tool pot rotating CCW the valve
	+ 24V		+ 24V
	AGND		0V



## Appendix 3 Ladder Configuration File Format

The signal in configuration file LadChixx.txt of ladder (“xx” corresponds to the running ladder file number set by the system) stores the following information by fixed sequence.

### 1. F Signals and Meanings of M Code M00---M99

Format: MXX + space + Fyyy + space + Chinese notes + EOB symbol(enter)

Example: “M00 F0317 program pause”

Thereinto: “xx” from up to down is 00, 01, 02.. till to 99, it totals 100. and its sequence cannot be altered.

Generally, “Space” is one space, which cannot be adulterated by any other characters.

“yyy” means the M code corresponds to F signal value, i.e. **F0317** represents **F31.7**. it may set from 0260 to 0337 (i.e. F signal from 26.0 to 33.7). if it is set to “-001” , it means no registration is allowed and it cannot be identified by system.

“Chinese remark” contains up to 32 characters, it may has 16 Chinese characters or equivalent Chinese characters + characters. The following is same as this.

“EOB symbol” means the end of the line and the characters following will not be identified. The following is same as this.

### 2. “%” that Occupies a Line Exclusively Means the End of M Code Information Storage.

### 3. The Codes and Meanings of X Signal X0.0-X6.7

Format: Xxxxx + space + Chinese remark + EOB symbol (enter)

Example: “X0000 the 1st axis limit signal (positive direction with double-switch)”

Thereinto: “xxxx” means the value of X signal, i.e. “0000 for 0.0”, “0067 for 6.7”. and it is from 0000 to 0067 from up to down(i.e. X signal from 0.0 to 6.7), its sequence can’t be altered.

“Space” generally includes 5 spaces, which cannot be adulterated by any other characters. The following is same as this.

### 4. The Codes and Meaning of Y Signal Y0.0---Y5.7

Format: Yxxxx + space + Chinese notes + EOB symbol(enter)

Example: “Y0000 lubricating output ”

Thereinto: “xxxx” means the value of Y signal, i.e. “0000 for 0.0”, “0057 for 5.7”. and it is from 0000 to 0057 from up to down(i.e. Y signal from 0.0 to 5.7), its sequence can’t be altered

### 5. The Codes and Meanings of K Signal Y6.0---Y63.7

Format: Kxxxx + space + Chinese remark + EOB symbol(enter)

Example: “K0060 Whether one limit switch is used or not”

Thereinto : “xxxx” means the value of K signal, i.e. “0060 for 6.0”, “0637 for 63.7”. and it is from 0060 to 0637 from up to down(i.e. K signal from 6.0 to 63.7), its sequence can’t be altered.

“Space” generally includes 5 spaces, which cannot be adulterated by any other characters.

## 6. The Codes and Meanings of A Signal A0.0-A31.7A

Format: Axxxx + space + Chinese notes + EOB symbol(enter)

Example: "A0000 air pressure detection abnormality"

Thereinto: "xxxx" means the value of A signal, i.e. "0000 for 0.0", "0317 for 31.7". and it is from 0000 to 0317 from up to down(i.e. A signal from 0.0 to 31.7), its sequence can't be altered.

"Space" generally includes 5 spaces, which cannot be adulterated by any other characters.

## 7. End // End Sign

**Note:** Every line of above information should be written in a set form, refer to system embedded file LadChixx.txt for details. The English file LadEngxx.tx contains 32 English characters or words.

## Appendix 4 Common Debugging Method

### 1.1 Zero Return Method and Common Parameter Setting

Press , and then press the soft key **【CNC SETTING】** in  page to enter the CNC setting page:

- a) When the parameter switch input is 1, the parameter switch is ON, and when it is 0, the switch is OFF.
- b) Move the cursor to the authority setting area to select the machine factory's password, input the initial password. The password can be modified.

**Note: The password is not always digits, and it also contains “Input key”.**

- c) After modification, inputting a mistaken password again or the previous password after power off is invalid, the password after modified is input again, unless the system is initialized to return to the initial password “111111”, otherwise, the password is defaulted to the last modified password.

- d) After the above item a, b are correctly performed, values in the 6 display pages **【BITPAR】**, **【DATAPAR】**, **【MARCOVAR】**, **【OFFSET】**, **【BUS】** and **【LADDERPAR】**.

- e) Absolute zero return: setting zero in the bus allocation is shown in the following figure. Firstly move the cursor to the axis number 1 “Setting”, then press the input key twice, and X zero return light is ON on the system panel; move the cursor to the axis number 3 “Setting”, then press the input key twice, and Z zero return light is ON on the system panel; input the positive/negative border according to the machine's actual position.

**Note: The positive/negative border is set according to the actual machine coordinates by manually moving the machine's each axis. Setting a safety border is to prevent the programming personnel from big data, from impacting the machine, and other axes are set based on the above operations.**

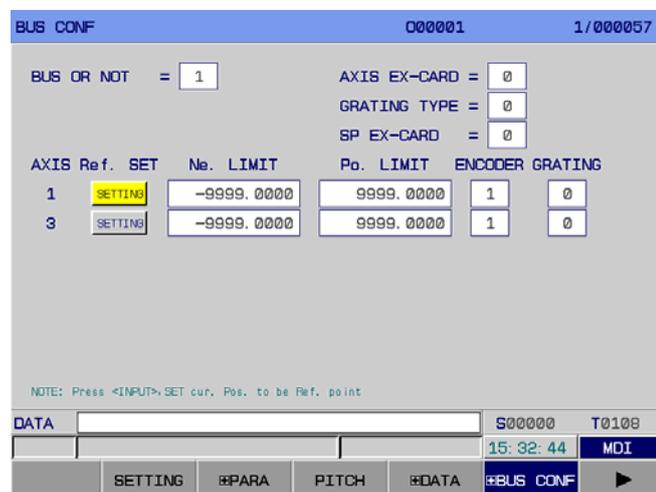


Fig. 1-1-1



System parameter number

0	1	9			ALS1			ALM3		ALM1
---	---	---	--	--	------	--	--	------	--	------

- ALM1** =1: an alarm when the 1<sup>st</sup> axis' driver alarm signal is 1  
 =0: an alarm when the 1<sup>st</sup> axis' driver alarm signal is 0
- ALM3** =1: an alarm when the 3<sup>rd</sup> axis' driver alarm signal is 1  
 =0: an alarm when the 3<sup>rd</sup> axis' driver alarm signal is 0
- ALS1** =1: an alarm when the 1<sup>st</sup> spindle' driver alarm signal is 1  
 =0: an alarm when the 1<sup>st</sup> spindle' driver alarm signal is 0

System parameter number

0	6	1	FALM	LALM	EALM	SALM	AALM			SSC
---	---	---	------	------	------	------	------	--	--	-----

- SSC** =1: use the constant surface speed control  
 =0: do not use the constant surface speed control
- AALM** =1: ignore the external user alarm  
 =0: do not ignore the external user alarm
- SALM** =1: ignore the spindle driver alarm  
 =0: do not ignore the spindle driver alarm
- EALM** =1: ignore the emergency stop alarm  
 =0: do not ignore the emergency stop alarm
- LALM** =1: ignore the hard limit alarm  
 =0: do not ignore the hard limit alarm
- FALM** =1: ignore the feed axis' driver alarm  
 =0: do not ignore the feed axis' driver alarm

System K parameter

0	1	6				Bit4	Bit3	Bit2	Bit1	Bit0
---	---	---	--	--	--	------	------	------	------	------

- Bit0** =1: X axis key direction NOT (negation)  
 =0: X axis key direction is NOT
- Bit1** =1: Y axis key direction NOT  
 =0: Y axis key direction is NOT
- Bit2** =1: Z axis key direction NOT  
 =0: Z axis key direction is NOT
- Bit3** =1: the 4<sup>th</sup> axis key direction NOT  
 =0: the 4<sup>th</sup> axis key direction is NOT
- Bit4** =1: C axis key direction NOT  
 =0: C axis key direction is NOT

● Multi-spindle setting

Data parameterNo.005

0	0	5	CNC controllable axis quantity
---	---	---	--------------------------------

Note: 5 is input into the data parameter 0005, the CNC controllable axis quantity is 5. Modify the parameter, and the system prompt to power off and then power on.

### ● Setting of gear ratio

Data parameterNo.160

1	6	0	The 1 <sup>st</sup> axis command multiplier factor (CMR)
---	---	---	--

Data parameterNo.161

1	6	1	The 2 <sup>nd</sup> axis command multiplier factor (CMR)
---	---	---	--

Data parameterNo.162

1	6	2	The 3 <sup>rd</sup> axis command multiplier factor (CMR)
---	---	---	--

Data parameterNo.163

1	6	3	The 4 <sup>th</sup> axis command multiplier factor (CMR)
---	---	---	--

Data parameterNo.164

1	6	4	The 5 <sup>th</sup> axis command multiplier factor (CMR)
---	---	---	--

Data parameterNo.165

1	6	5	The 1 <sup>st</sup> axis command division factor (CMD)
---	---	---	--

Data parameterNo.166

1	6	6	The 2 <sup>nd</sup> axis command division factor (CMD)
---	---	---	--

Data parameterNo.167

1	6	7	The 3 <sup>rd</sup> axis command division factor (CMD)
---	---	---	--

Data parameterNo.168

1	6	8	The 4 <sup>th</sup> axis command division factor (CMD)
---	---	---	--

Data parameterNo.169

1	6	9	The 5 <sup>th</sup> axis command division factor (CMD)
---	---	---	--

Besides the above method, the system gear ratio can be set by each axis' PA12, PA13 in the servo page of **【+ BUS SETTING】**. (adaptive to GE2000 driver)

### ● Setting of tool post

Opening K parameter page can select the following tool post types

K1.0=0 row-tool tool post

K1.0=1, K2.0=0, K2.1=0: standard electric square tool post

K1.0=1, K2.0=1, K2.1=0: servo tool post (adaptive Taida servo tool post)

K1.0=1, K2.0=0, K2.1=1: (adaptive to Changzhou tool post)

## 1.2 Chuck Control

For relevant K parameters, press PLC to enter **【PLCPAR】** soft key page

K11.0=1 (use the chuck)

K11.1 (if the chuck is insider)

K11.2 (the chuck releasing/clamping has no check switch)

### 1.3 Tailstock Control

For relevant K parameters, press PLC to enter 【LADDERPAR】 soft key page  
K10.0=1 (use the automatic tailstock)

### 1.4 Hydraulic Start

For relevant K parameters, press PLC to enter 【LADDERPAR】 soft key page  
K9.0=1 (use the hydraulic device)  
K9.1=1 (use USER1 as the hydraulic control)

### 1.5 Cs Axis Setting

#### Cs use steps:

1. the system bit parameter NO37, Bit7=1 (use Cs contour control function)
2. the ladder K parameter K7.0=1 (use the spindle contour control), K7.7=1 (use the spindle position mode)
3. Open CS direct manual mode, press CS axis system on the panel to switch the speed mode into the position mode, also input M14, press CS axis on the panel or input M15 to close CS axis.

**Note:** the above parameters are set according to the machine or the system's actual conditions. Refer to the Chapter 4 Machine Debugging.

