



广州数控设备有限公司
GSK CNC EQUIPMENT CO., LTD.

Add: No.7, 1st. Street, Luochong North Road, Luochongwei, Guangzhou, 510165, China

[Http://www.gsk.com.cn](http://www.gsk.com.cn) E-mail:sale1@gsk.com.cn

Tel: 86-20-81796410/81797922

Fax: 86-20-81993683

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[HTTP://WWW.GSK.COM.CN](http://www.gsk.com.cn)

[E-MAIL:SALE1@GSK.COM.CN](mailto:SALE1@GSK.COM.CN)

GSK 218MC Series Milling CNC System

Installation and Connection Manual




GUANGZHOU
CHINA


Installation and Connection Manual

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 This user manual describes all proceedings concerning the operations of this CNC system in detail as much as possible. However, it is impractical to give particular descriptions for all unnecessary or unallowable system operations due to the manual text limit, product specific applications and other causes. Therefore, the proceedings not indicated herein should be considered impractical or unallowable.

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Preface

Your Excellency,

It's our pleasure for your patronage and purchase of this GSK218MC Series Machining Center CNC System made by GSK CNC Equipment Co., Ltd.

This manual is the part of the “Installation and Connection”, which is introduced the installation and connection and the PLC programming method of the machining center CNC of the GSK218MC.

In order to guarantee the product is operated with a safe, normal and effective situation, it is necessary to carefully read this manual before installing and using this product.

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

Security Precaution



Accident may occur by improper connection and operation ! This system only can be operated by authorized and qualified personnel. Please carefully read this manual before using !

Especially prompt: The power installed on/inside the main cabinet is a special one offering by our company CNC system.

Never attempt to use for other purposes by this power. Otherwise, huge hazard may occur.

Warning, Notice and Explanation

Statement!

- In this manual we have tried as much as possible to describe all various matters. However, we cannot describe all the matters which must not be done, or which cannot be done, because there are so many possibilities. Therefore, matters which are not especially described as possible in this manual should be regarded as “impossible” .

Warning!

- Before installing, programming and operating the machine, thoroughly read this manual and user manual issued by the machine manufacturer, and rigidly operate the machine based upon the requirement of this manual, otherwise, possibly causing damage to the workpiece and/or machine itself, or injury to the user.

Notice!

- The product functions and technical indexes (such as accuracy, velocity) described in this manual are only for this machine, which installs the CNC system of this product. The actual function configuration and technical capacity are determined by the machine manufacturer, and the function configurations of the CNC machine and technical indexes are subjected on the manual issued by the machine builder.

All specifications and designs are subject to change without notice.

Safety Precautions

■ Transportation and Storage

- Do not pile up the carton over 6 layers.
- Do not climb, stand on the carton, and as well not place the heavy objects on it.
- Do not drag or move the product using the cables connected with the product.
- Do not crash or scratch the panel and display screen.
- Avoid damp, sunshine and raining on the product carton.

■ Open carton to inspect

- Ensure that it is your purchased product after opening the carton.
- Check whether the product is damaged during transporting.
- Confirm whether each part is prepared or damaged based upon the packing list.
- Contact our company immediately if the product type is inconsistent with the packing list, lack of accessories or damage in transportation.

■ Wiring

- The person who attends the wiring and check should have the corresponding professional capacity.
- The product should be reliably grounded, and its resistance should be less than 0.1Ω and can not be used the neutral conductor (zero cable) to replace the ground wire.
- The wiring should be correct and firm, otherwise, possibly causing the malfunction in product or unexpected result.
- The surge absorb diode connected with the product should be linked based upon the described direction, otherwise, it may damage the product.
- Before Inserting/pulling out the plug or opening the main cabinet of the product, it is important to cut off the product's power.

■ Inspection and maintenance

- Cut off the power before inspecting and maintaining or changing the components.
- Check the malfunction when the short-circuit or overloading occurs. The computer can be started after the malfunction is eliminated.
- Do not power ON/OFF frequently for the product, if you want to turn on the power again after power off, its interval time is 1min. at least.

Volume I Programming Description

Introduce the technical specification, product type series and parameter configuration, command code and program format of 218MC series machining center CNC system.

Volume II Function Description

Introduce the main function of the GSK218MC series machining center CNC system.

Volume III Operation Description

Introduce the operations of the GSK218MC series machining center CNC system

Volume IV Installation and Connection

Introduce the installation, connection and setting methods of the GSK218MC series machining center CNC system.

Appendix

Introduce the use explanations of the GSK218MC series machining center CNC system and the appendix

Security Responsibility

Security responsibility of the manufacturer

- Manufacturer should take responsibility for the design and structure danger of the motor and the accessories which have been eliminated and/or controlled.
- Manufacturer should take responsibility for the security of the motor and accessories.
- Manufacturer should take responsibility for the offered information and suggestions for the user.

Security responsibility of the users

- User should know and understand about the contents of security operations by learning and training the security operations of the motor.
- User should take responsibility for the security and danger because of increasing, changing or modifying the original motor or accessory by themselves.
- User should take responsibility for the danger without following the operations, maintenances, installations and storages described in the manual.

This manual is stored by the last user.

Sincerely thanks for your friendly supporting of GSK's products!

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VOIUME I PROGRAMMING

CHAPTER ONE THE COMPILATION SCHEDULE OF SEQUENCE PROGRAMMING

1.1 GSK218MC Series PLC Specification

GSK218MC series PLC specification is shown below:

Table 1-1-1

Specification	GSK218MC Series PLC
Programming language	Ladder
Program level	2
The 1 st level program execution cycle	8ms
Basis code average treatment time	5μs
Programming capacity	4700 steps
Code	Basis code + function code
Internal relay (R)	0~511 (byte)
PLC alarm detection (A)	0~31 (byte)
Nonvolatile memory area	
Timer (T)	0~127 (word)
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)	0~63 (byte)
Signal outputs to the NC side (G)	0~63 (byte)
I/O module (X)	0~63 (byte)
(Y)	0~47 (byte)

1.2 The Concept of the Sequence Programming

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 one)

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 two)

The control operation required by the machine tool can be expressed by the ladder diagram with the on-line compiling of the GSK218MC. 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 stored and converted into the corresponding PLC codes before operating, namely, the so-called instruction list.

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 TWO SEQUENCE PROGRAMMING

The operating principle is different with the common relay, because the PLC sequence controlling is carried out by compiling the on-line diagram. 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).

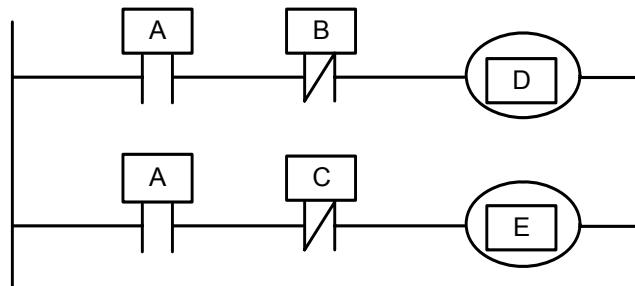


Fig. 2.1 (a) Circuit illustration

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

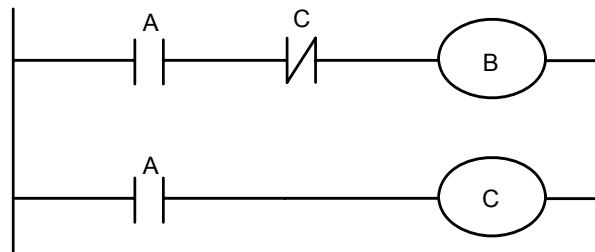


Fig. 2.1 (b)

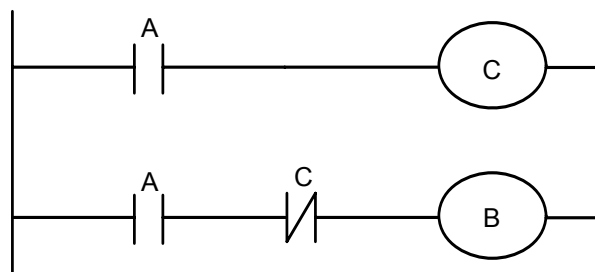


Fig. 2.1 (c)

(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.

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)

GSK218MC PLC program are composed of two parts: the 1st level program and the 2nd level program, which are inconsistent with the performance period.

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

The 2nd program performs once each $8 \times n$ ms. N is the partition value of the 2nd level program. PLC may divide the 2nd level program into N parts when the 2nd level program is executed. It is performed one part for each 8ms.

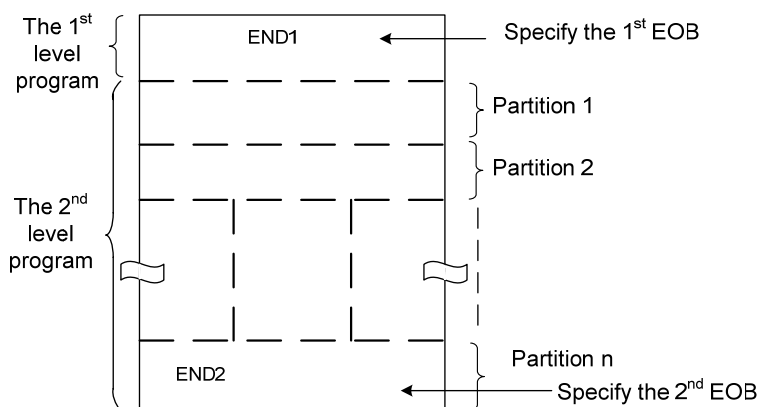


Fig. 2-3-1

PLC in the GSK218MC is separately performed in the PLC-AVR SCM. The 1ms of each 8ms is the communication time for reading the PLC data from the CNC. The 5ms is that the PLC gains the system control signal (F, X), and uploads the control result data (G, Y parameter) external port I/O. PLC is always performed the ladder diagram calculation other than the interruption of the response exchange data.

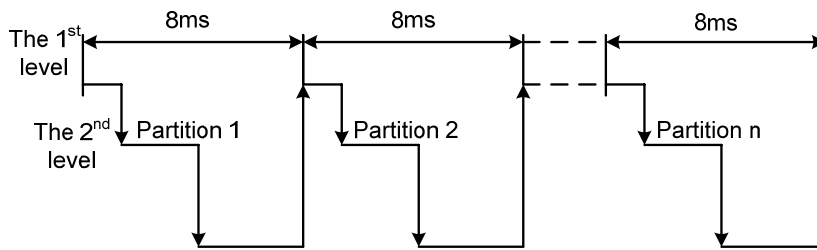


Fig. 2-3-2

When the last partition value of the 2nd level program of the n is performed, the program is then executed from the beginning of the program. In this case, when the partition value is n , the performance time of one cycle is $8 \times n$ ms. The 1st level program performs once each 8ms; the 2nd level program performs once each $8 \times n$ ms. If its steps of the 1st level program is increased, and therefore the steps of the 2nd level program within 8ms should be reduced correspondingly; the partition value may be increased, and the treatment time of the overall program will be longer. So, the compiling of the 1st level program should be shorter.

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.

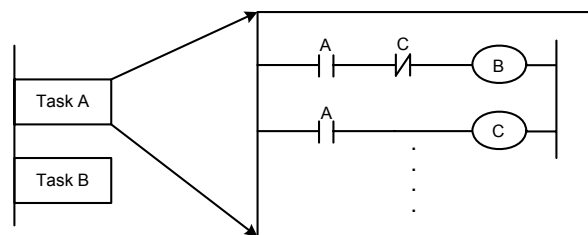


Fig. 2-4-1

2) Nesting

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

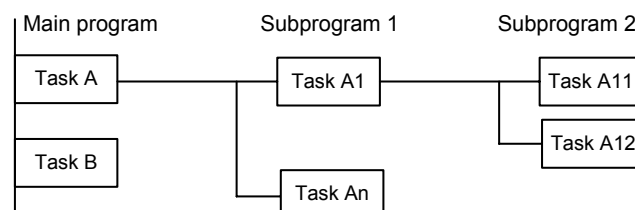


Fig. 2-4-2

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.

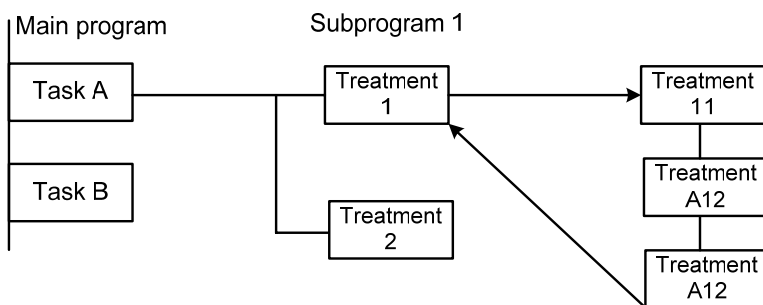


Fig. 2-4-3

2.5 The Treatment of the Input/output Signal

The treatment of the input signal:

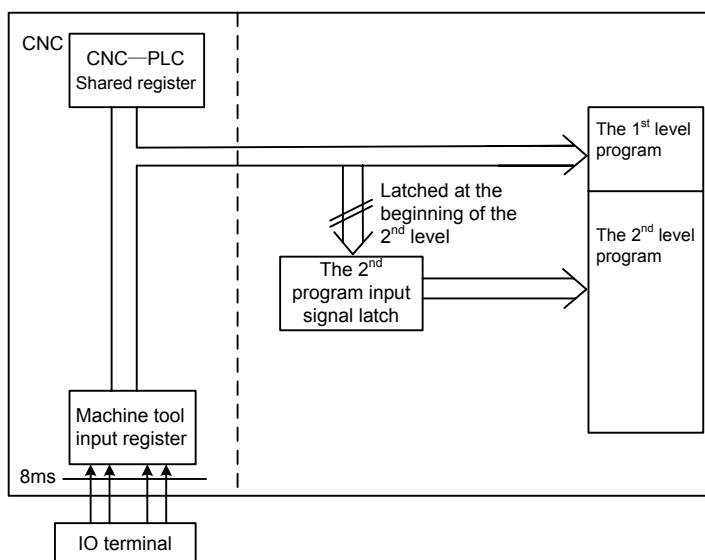


Fig. 2-5-1

The treatment of the output signal:

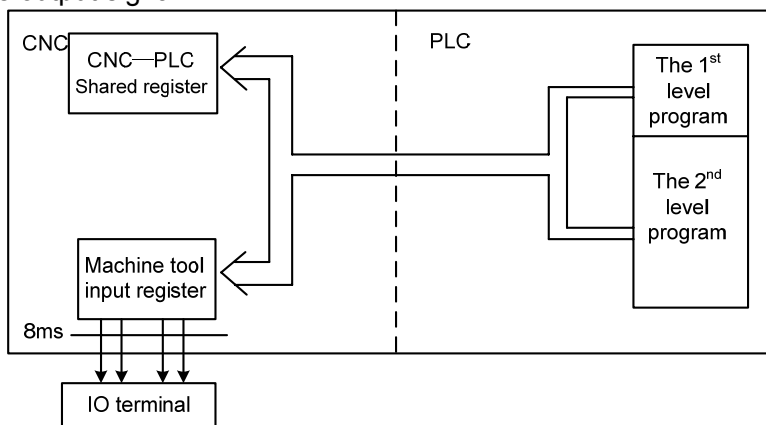


Fig. 2-5-2

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 1st 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 1st level program is also performed the corresponding treatment by using this signals directly.

(3) The 2nd level program input register

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

The signals both in the NC and machine tool input register can be locked to the 2nd level program input latch, as long as the 2nd level program performs. The signal state in this latch keeps invariable during the performance of the 2nd 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 1st and 2nd level programming, that is the reason that different registers are used between two levels programming. Namely, the input signal used with the 2nd level program is the one of the 1st level who is locked. And therefore, the signal in the 2nd level program is later than the 1st level one. At the worst case, one 2nd level program performance cycle can be lagged.

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

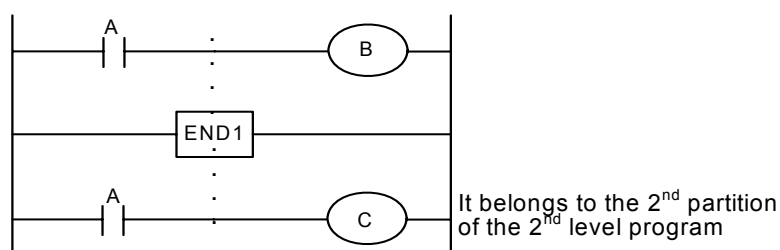


Fig. 2-5-3-1

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

A turns into 0 to perform the 1st level program when the 2nd 8ms is performed, then B=0. And therefore, the 2nd partition of the 2nd 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 THREE 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 GSK218MC PLC is shown below:

Table 3-1

Address	Address explanation	Length
X	Machine → PLC (64 bytes)	INT8U
Y	PLC → machine tool (48 bytes)	INT8U
F	CNC → PLC (64 bytes)	INT8U
G	PLC → CNC (64 bytes)	INT8U
R	Intermediate relay (512 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 GSK218MC PLC composes of two types:

1. The X address is assorted with the three I/O input terminals, namely, XS40, XS41 and XS42.
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

The addresses (48 addresses) are defined as INT8U from X0 to X5, which are distributed on the three I/O input terminals, for example, XS40, XS41 and XS42.

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 the appendix one (GSK218MC CNC system PLC I/O address) and the configuration and definition of the internal software components for the initial definition of the input address.

3.1.2 X Address on the MDI Panel

There are 11 types from the addresses X20 ~ X30 of which these addresses are corresponding 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	X20.0	Rapid Fo	X25.0
Auto	X20.1	Rapid 25%	X25.1
MDI	X20.2	Rapid 50%	X25.2
Zero return	X20.3	Rapid 100%	X25.3
Single step	X20.4	Increment step 0.001	X26.0
Manual	X20.5	Increment step 0.01	X26.1
MPG	X20.6	Increment step 0.1	X26.2
DNC	X20.7	Increment step 1	X26.3
Skip	X21.0	Manual feed shaft +X	X27.0
Single step	X21.1	Manual feed shaft +Y	X27.1
Dry run	X21.2	Manual feed shaft +Z	X27.2
M.S.T Lock	X21.3	Manual feed shaft +Nth	X27.3
Machine tool lock	X21.4	Spindle positive override (218MC-H/-V is N axis +)	X27.4
Selection stop	X21.5	Manual feed shaft -X	X28.0
Program restart	X21.6	Manual feed shaft -Y	X28.1
Working light	X21.7	Manual feed shaft -Z	X28.2
Spindle CCW	X22.0	Manual feed shaft -Nth	X28.3
Spindle stop	X22.1	Spindle negative override (218MC-H/-V is N axis -)	X28.4
Spindle CW	X22.2	Spindle blowing (218MC integration)	X28.7
Spindle negative override (218MC integration)	X22.3	Spindle orientation	X29.0
Spindle override cancellation (218MC integration)	X22.4	Tool magazine zero return	X29.1
Spindle positive override (218MC integration)	X22.5	Tool clamping/releasing	X29.2
Spindle JOG	X22.6	Tool magazine CW	X29.3
Spindle override cancellation (218MC-H/-V is the channel selection)	X22.7	Tool magazine CCW	X29.4
Lubrication	X23.0	Tool pivoting (tool infeed)	X29.5
Cooling	X23.1	Tool back (tool retracting)	X29.6
Chip-removal	X23.2	Tool changer	X29.7
ESP	X23.5	Overtravel release	X30.0
Cycle start	X23.6	Spindle negative override (218MC-H/-V is the spindle override SOV1)	X31.0
Feed hold	X23.7	Spindle override cancellation	X31.1

		(218 MC-H/-V is spindle override SOV2)	
User 1	X24.0	Spindle positive override (218MC-H/-V is spindle override SOV4)	X31.2
User 2	X24.1	Feed negative override (218MC-H/-V is the feed override FOV1)	X31.3
User 3	X24.2	Feed override cancellation (218MC-H/-V is the feed override FOV2)	X31.4
User 4	X24.3	Feed positive override (218MC-H/-V is the feed override FOV4)	X31.5
User 5	X24.4	Feed override FOV8 (218MC-H/-V)	X31.6
Rapid switch	X24.7	Feed override FOV16 (218MC-H/-V)	X31.7

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

The Y address of the GSK218MC PLC composes of two types:

1. The Y address is assorted with the three I/O input terminals, namely, XS43, XS44 and XS45.
2. The Y address is assorted with the indicator on the MDI panel of the system.

3.2.1 Y Address on the I/O Output Port

The addresses (48 addresses) are defined as INT8U from Y0 to Y5, which are distributed on the three I/O input terminals, for example, XS43, XS44 and XS45.

Users can define the signal significance of the Y 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 the appendix one (GSK218MC CNC system PLC I/O address) and the configuration and definition of the internal software components for the initial definition of the input address.

3.2.2 Y Address on the MDI Panel

There are 8 types from the addresses Y12 ~ Y19 of which these addresses are corresponding 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 3-2-2-1

Key-board indicator output	PLC address	Key-board indicator output	PLC address
Edit key indicator	Y12.0	Spindle orientation indicator	Y15.7
Auto key indicator	Y12.1	Tool magazine zero return indicator	Y16.0
MDI key indicator	Y12.2	Tool magazine CW indicator	Y16.1
Zero return key indicator	Y12.3	Tool magazine CCW indicator	Y16.2
Single step key indicator	Y12.4	Tool magazine (tool pivoting) (tool infeed) indicator	Y16.3
Manual key indicator	Y12.5	Tool magazine (tool retraction) indicator	Y16.4
MPG key indicator	Y12.6	Tool magazine clamping/releasing indicator	Y16.5
DNC key indicator	Y12.7	Tool magazine tool changer	Y16.6

		indicator	
Spindle CCW indicator	Y13.0	USER3 indicator	Y16.7
Spindle CW indicator	Y13.1	+X key indicator	Y17.0
Spindle stop indicator	Y13.2	+Y key indicator	Y17.1
Y axis zero return indicator	Y13.3	+Z key indicator	Y17.2
Y axis zero return indicator	Y13.4	+4TH key indicator	Y17.3
Z axis zero return indicator	Y13.5	USER1 key indicator	Y17.4
The 4 th axis zero return indicator	Y13.6	N axis + key indicator	Y17.5
DEF indicator	Y13.7	(218MC integration)	Y17.7
Skip indicator	Y14.0	-X key indicator	Y18.0
Single-step indicator	Y14.1	-Y key indicator	Y18.1
Dry run indicator	Y14.2	-Z key indicator	Y18.2
M.S.T lock indicator	Y14.3	-4TH key indicator	Y18.3
Machine tool lock indicator	Y14.4	USER2 key indicator	Y18.4
Machine tool lighting indicator	Y14.5	N axis - key indicator	Y18.5
Lubrication indicator	Y14.6	Tunnel selection key indicator	Y18.6
Cooling indicator	Y14.7	JOG key indicator	Y18.7
Chip-removal indicator	Y15.0	Overtravel end key indicator	Y19.0
The indicator of feed override cancellation key	Y15.1	Feed dwell key indicator	Y19.1
Rapid switch indicator	Y15.2	Cycle start key indicator	Y19.2
0.001/F0 key indicator	Y15.3	Tool magazine zero point indicator	Y19.3
0.01/25% key indicator	Y15.4	Selection stop indicator	Y19.4
0.1/50% key indicator	Y15.5	Program re-start indicator	Y19.5
1/100% key indicator	Y15.6		

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
Edit mode	G20.0	Feed negative override (218MC integration)	G24.2
Auto mode	G20.1	Rapid switch	G24.7
MDI mode	G20.2	Rapid Fo	G25.0
Zero return mode	G20.3	Rapid 25%	G25.1
Single step mode	G20.4	Rapid 50%	G25.2
Manual mode	G20.5	Rapid 100%	G25.3
MPG mode	G20.6	Increment step length 0.001	G26.0
DNC mode	G20.7	Increment step length 0.01	G26.1
Skip	G21.0	Increment step length 0.1	G26.2
Single block	G21.1	Increment length 1	G26.3
Dry run	G21.2	MPG step length 0.001	G26.4
M.S.T lock	G21.3	MPG step length 0.01	G26.5
Machine lock	G21.4	MPG step length 0.1	G26.6

Selection stop	G21.5	Manual feed axis + X	G27.0
Program re-start	G21.6	Manual feed axis +Y	G27.1
Spindle CCW (positive)	G22.0	Manual feed axis +Z	G27.2
Spindle stop	G22.1	Manual feed axis +4 Th	G27.3
Spindle CW (negative)	G22.2	Manual feed axis -X	G28.0
Spindle negative override (218MC integration)	G22.3	Manual feed axis -Y	G28.1
Spindle override cancellation (218MC integration)	G22.4	Manual feed axis -Z	G28.2
Spindle positive override (218MC integration)	G22.5	Manual feed axis -4 Th	G28.3
Spindle JOG	G22.6	Spindle orientation	G29.0
Tunnel selection signal	G22.7	Tool magazine zero return	G29.1
Lubrication	G23.0	Tool clamping/release	G29.2
Cooling	G23.1	Tool magazine positive	G29.3
Chip removal	G23.2	Tool magazine negative	G29.4
Cycle start	G23.6	Tool pivoting (Tool infeed)	G29.5
Feed hold	G23.7	Tool return (tool retraction)	G29.6
Feed positive override (218MC integration)	G24.0	Tool changer	G29.7
Feed override cancellation (218MC integration)	G24.1	Overtravel release	G30.0

The signal of G63 bytes are used inside the system, the G63.0, G63.1 and G63.2 are the answer signal inside the system separately performed by M, S and T.

3.4 CNC → PLC Address (F)

The addresses from F0 to F63 are defined as: INT9U, totally 64 bytes. Refer to the Chapter Two Function for details.

3.5 Internal Replay Address (R)

The address area is reset when the system is turned on. R510 and R511 are used by the system. Its definition type is: INT8U, totally 512 bytes.

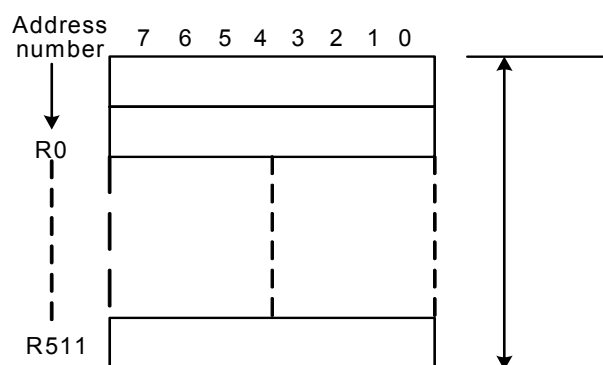


Fig. 3-5-1

System program administration area

R510

The signal of R510.0 address is set to 1 when PLC starts and restarts, which is used the signal set by the initial user. The R510.0 is reset to 0 after the ladder diagram is performed once.

R511 (System timer) The following four signals can be used for system timer:

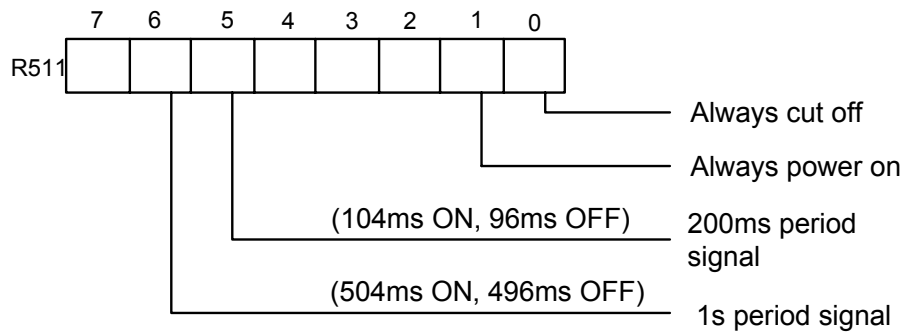


Fig. 3-5-2

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.

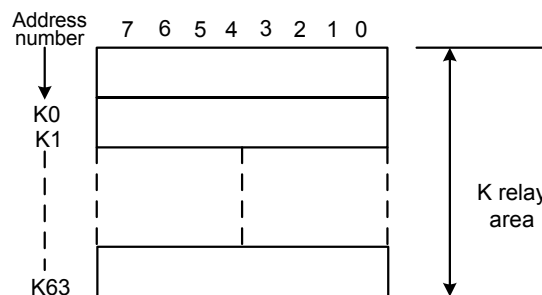


Fig. 3-6-1

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.

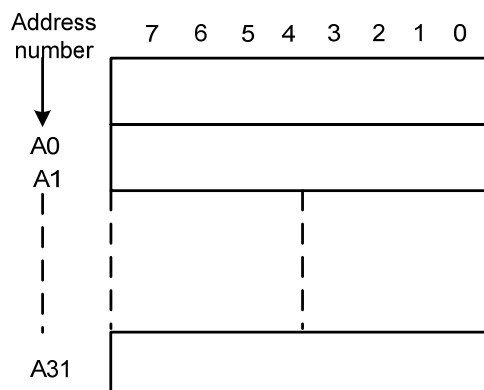


Fig. 3-7-1

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 lose 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. Wherein, D240~247 are used by the system, users can not define by themselves.

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 FOUR PLC BASIS CODE

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 GSK218MC 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 can not output with double coil.

Refer to the following programming:



Fig. 4-1-1

4.2 AND, AND.NOT Codes

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:

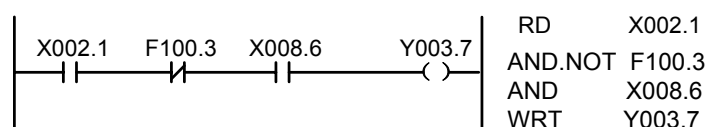


Fig. 4-2-1

4.3 OR, OR.NOT Codes

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:

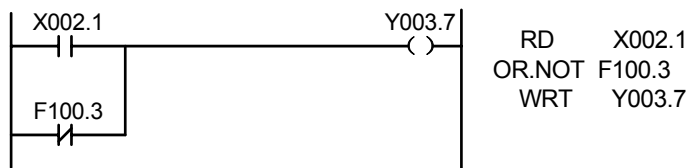


Fig. 4-3-1

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:

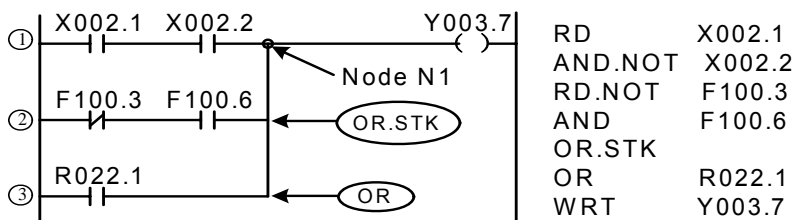


Fig. 4-4-1

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:

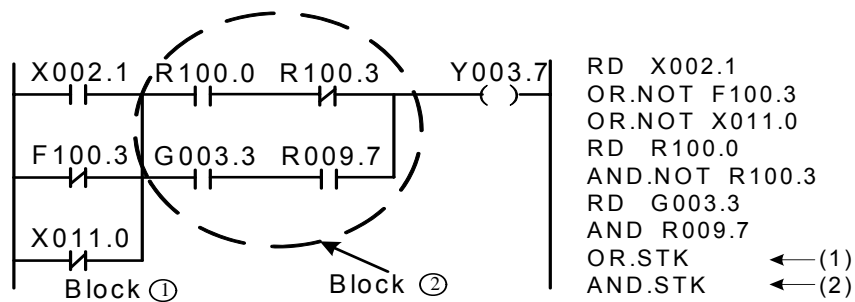


Fig. 4-5-1

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 FIVE PLC FUNCTION CODE

When the basis command code is not easy to compile some operations of the machine tool, the function command codes can be simplified it.

Table 5-1 (218MC PLC function command code)

Serial number	Name	Function	Serial number	Name	Function
1	END1	The 1 st level sequence program end	19	ROT	Binary rotation control
2	END2	The 2 nd level sequence program end	20	SFT	Register shift
3	CALL	Call subprogram	21	DIFU	Rising edge detection
4	CALLU	Call the subprogram without any condition	22	DIFD	Trailing edge detection
5	SP	Subprogram	23	COMP	Binary number comparison
6	SPE	End of subprogram	24	COIN	Consistency comparison
7	SET	Setting	25	MOVN	Data transfer
8	RST	Resetting	26	MOVB	Transfer of one byte
9	JMPB	Sign skip	27	MOVW	Transfer of two bytes
10	LBL	Sign	28	XMOV	Binary indexed data transfer
11	TMR	Timer	29	DSCH	Binary data search
12	TMRB	Regular timer	30	ADD	Binary addition
13	TMRC	Timer	31	SUB	Binary subtraction
14	CTR	Binary counter	32	ANDF	Logic AND
15	DEC	Binary decode	33	ORF	Logic OR
16	COD	Binary code conversion	34	NOT	Logic NOT
17	COM	Control of the concentric line	35	EOR	Exclusive OR/ XOR
18	COME	End of the concentric line control			

5.1 END1 (End of the 1st Level Sequence Program)

Function

This function can be specified once in sequence program at the end of the 1st level program, or it can be performed at the beginning of the 2nd level program when the 1st level program does not execute. The first program can be compiled up to 500 steps.

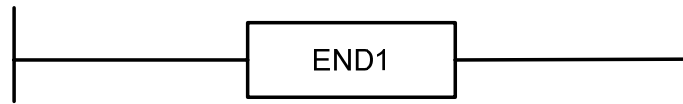
Format

Fig. 5-1-1

5.2 END2 (The End of the 2nd Sequence Program)**Function**

It specifies at the end of the 2nd level program.

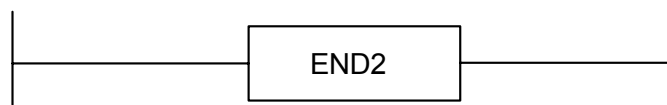
Format

Fig. 5-2-1

5.3 CALL (Call Subprogram)**Function**

Call one specified subprogram

It owns the following characters and limitations:

Subprogram can be nested and called other subprograms up to 18 layers, as for the endless repetition caused by the closure call, the system may alarm. The system allows that the maximum subprogram call number is 100 for controlling the performance data value. The subprogram call can not be performed at the 1st level program. The code or network wrote between END2 AND SP, or after SPE, or before SP, the system can not be performed, and then alarms.

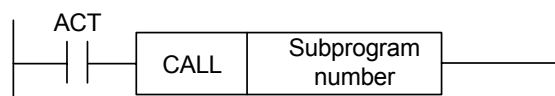
Format

Fig. 5-3-1

Control condition

ACT=0, next code after performing CALL

ACT=1, call subprogram of the specified subprogram number

Parameter

Subprogram number: specify the called subprogram number. The subprogram number is indicated as 0~99.

5.4 CALLU (Call Subprogram Without Condition)**Function**

Call one specified subprogram without any condition

It owns the following characters and limitations:

Subprogram can be nested and called other subprograms up to 18 layers, as for the endless repetition caused by the closure call, the system may alarm. The system allows that the maximum subprogram call number is 100 for controlling the performance data value. The subprogram call can not be performed at the 1st level program. The code or network wrote between END2 AND SP, or after SPE, or before SP, the system can not be performed, and then alarms.

Format

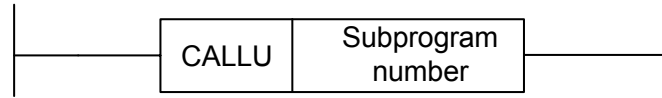


Fig. 5-4-1

Parameter

Subprogram serial number: specify the called subprogram number, its range is 0~99.

5.5 SP (Subprogram)

Function

SP is used to generate a subprogram. The subprogram number is regarded as its name. The range of the subprogram is specified by the SP code and the aftermentioned SPE code together.

Notice

1. The subprogram should be compiled after END2.
2. Another subprogram can not be set inside one subprogram.

Format

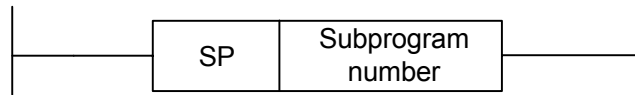


Fig. 5-5-1

Parameter

Subprogram number: specify a called subprogram mark number, its range is 0~99.

5.6 SPE (End of Subprogram)

Function

- * Specify the range of the subprogram when the SPE and SP are used together.
- * The control will return to the main program of the called subprogram when this function code is performed.
- * The subprogram should be compiled after END2.

Figure format

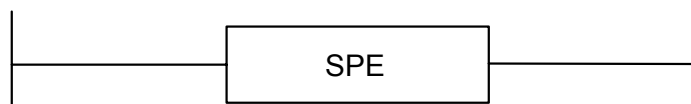


Fig. 5-6-1

For example

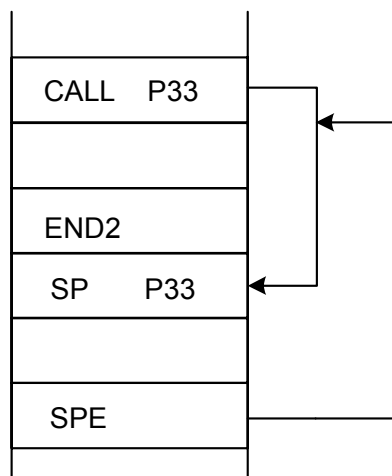


Fig. 5-6-2

5.7 SET (Replacement/Setting)

Function:

Set 1 in the specified address.

Format:

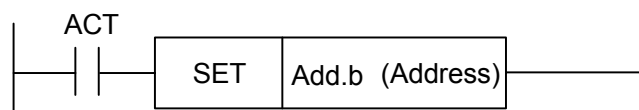


Fig. 5-7-1

Controllable condition

ACT=0, the state of the add.b remains invariable.

ACT=1, the add.b is set to 1.

Parameter

Add.b: setting component address bit can be treated as the output coil, Add = Y, G, R, K and A.

5.8 RST (Resetting)

Function:

Set 0 on the specifying place.

Format:

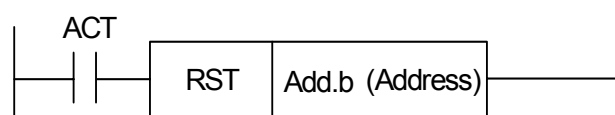


Fig. 5-8-1

Controllable condition

ACT=0, the state of the add.b remains invariable.

ACT=1, add.b is set to 0.

Parameter

Add.b: resetting component address can be treated as output coil, Add = Y, G, R, K and A.

5.9 JMPB (Mark Number Skip)

Function:

JMPB immediately transfers the control to program following with mark number in the ladder diagram programming.

The characters and limitations are shown below:

- * Multiple skip codes can be shared with the same mark number.
- * The skip can not be performed each other between the 1st level and the 2nd level programmes.
- * The skip can not be performed among the subprograms.
- * Rebound is allowable, but users that should hold the endless cycle may be caused by it.
- * The skip can not be performed between main program and subprogram.

Format:

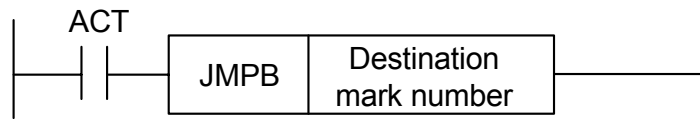


Fig. 5-9-1

Controllable condition

ACT=0, Do not skip, it performs the next code after JMPB.

ACT=1, Perform the next code after the mark number when the skip jumps to the specified mark number.

Parameter

Lx: Specify a skip object mark number. Any value (from 0 to 99) can be specified.

5.10 LBL (Mark Number)

Function

Specify one mark number in the ladder diagram, namely, JMPB specifies a skip object.

It is very important to notice that one mark number with xx only can be specified once using LBL. It may alarm if it uses repeatedly.

Format

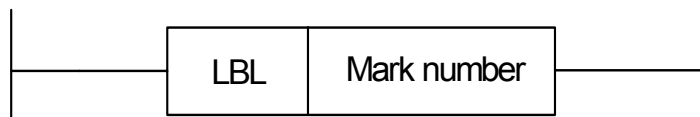


Fig. 5-10-1

Parameter

xx: Specify a skip object mark number, its range is 0~99.

For example

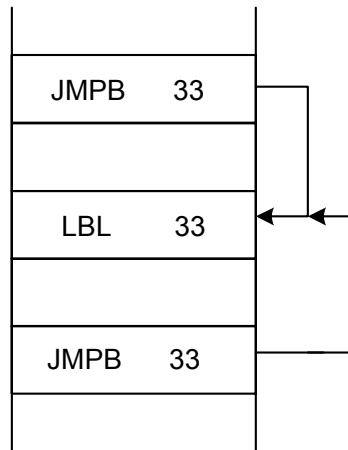


Fig. 5-10-2

5.11 TMR (Timer)

Function

Delay conducting timer.

Format

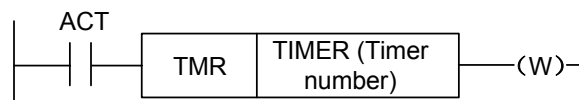


Fig. 5-11-1

Controllable condition

ACT=0, close the timer.

ACT=1, start the timer.

Refer to the following figure for details:

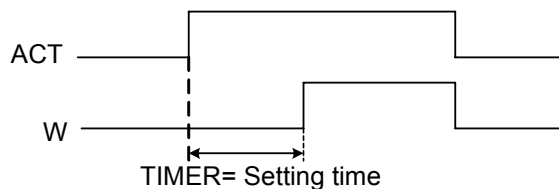


Fig. 5-11-2

Parameter

TIMER: The timer number indicates by xxx (it expresses by numbers from 0 to 127).

Output

W: Output coil. W=1 when it reaches to the resetting value, W=0 means it does not reach to it.

Note: TIMER performs once each 8ms, its setting unit is ms, and 8ms is the performance radix, complete 8ms if it is insufficient. For example: the setting is 54ms, $54=6*8+6$, complete 2ms, the actual performance is 56ms. The time of the timer is set in the [TMR] of the [PLCPAR] under the program-controlled interface. The sequence number of the timer may be detected its range by the system directly. The alarm may occur when the sequence number repeats or exceeds its range.

5.12 TMRB (Fixed Timer)

Function

Delay conducting timer.

Format

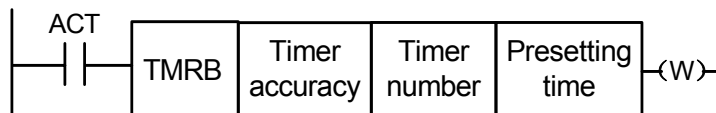


Fig. 5-12-1

Controllable condition

ACT=0, close the timer

ACT=1, start the timer

Refer to the figure for details:

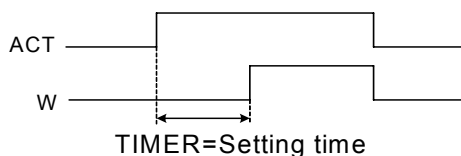


Fig. 5-12-2

Parameter:

TIMER: Fix the timer number, it is indicates by xxx (it expresses by number from 0 to 127).

Table 5-12-1 (Timer accuracy)

Timer accuracy	Setting number	Setting time range	Error range
8ms	0	From 8ms to 524.280s	Scan period from 0 to the 1 st level program
48ms	1	From 48ms to 31.456min	Scan period from 0 to the 1 st level program
1s	2	From 1s to 546 min	Scan period from 0 to the 1 st level program
10s	3	From 10s to 182 h	Scan period from 0 to the 1 st level program
1min	4	From 1min to 1092 h	From 0 to 1s
1ms	5	From 1ms to 65.4s	Scan period from 0 to the 1 st level program

Presetting time

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

Output

W: Output coil. W=1, when it reaches to the presetting. W=0, when it does not reach.

Note: As for the sequence of the timer, the system may check its range automatically, if the repeated sequence or out of the range, the system may alarm. The presetting time in timer is solidified in the ROM along with the ladder diagram, so, the time of the timer only can be changed by modifying the ladder diagram file.

5.13 TMRC (TIMER)

Function

Delay conducting timer

Format

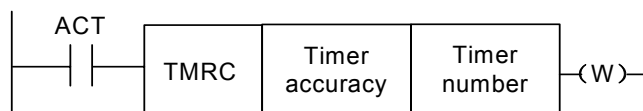


Fig. 5-13-1

Controllable condition

ACT=0, close the timer

ACT=1, start the timer

Refer to the following figure for details:

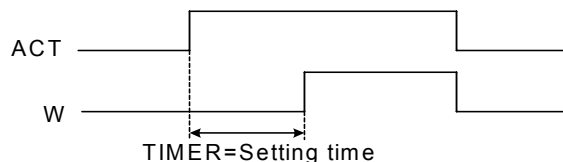


Fig. 5-13-2

Parameter

TIMER: The timer number indicates by xxx (xxx expresses by numbers from 0 to 127).

Table 5-12-1 (Timer accuracy)

Timer accuracy	Setting number	The range of setting time	Error range
8ms	0	From 8ms to 524.280s	Scan period from 0 to the 1 st level program
48ms	1	From 48ms to 31.456 min	Scan period from 0 to the 1 st level program
1s	2	From 1s to 546 min	Scan period from 0 to the 1 st level program
10s	3	From 10s to 182 h	Scan period from 0 to the 1 st level program
1min	4	From 1min to 1092 h	From 0 to 1s
1ms	5	From 1ms to 65.4s	Scan period from 0 to the 1 st level program

Output

W: Output coil. W=1, when it reaches to the presetting, W=0, when it does not reach to it.

Note: The time of the timer is set in the [TMR] in the [PLCPAR] controlling by the program surface. TMRC and TMR timers are shared with a same address, so, the TMRC and TMR timers can not be repeatedly used. The system may automatically check the range of the sequence of the timer. It may alarm when the sequence number is repeated or exceeded its range.

5.14 CRT (Binary Counter)

Function

The data in the counter are binary system, which have the following functions based upon the applications

1) Presetting counter

If the count reaches to the output signal of presetting value, preset the numerical value.

2) Ring-counter

When the counter reaches to the presetting value, it inputs the count signal and resets the initial value and performs the count again.

3) Addition and subtraction counter

This is treated as the forward-backward counter, which can be used both addition and subtraction.

4) The selection of the initial value

The initial value can be regarded as 0 or 1.

Format

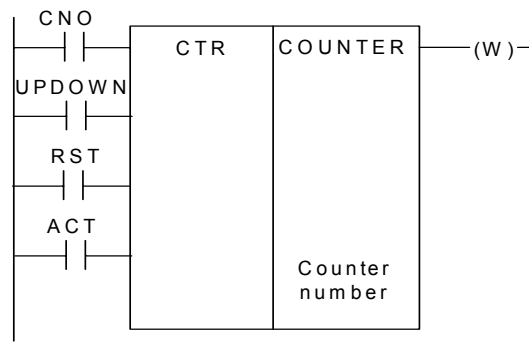


Fig. 5-14-1

Controllable condition

Specify initial value (CN0)

CN0=0, counter begins with 0.

CN0=1, counter begins with 1.

Specify rising or descending counter (UPDOWN):

UPDOWN=1, subtraction counter

UPDOWN=0, addition counter

Reset (RST):

RST=0, release the reset

RST=1, reset: W resets to 0, and the counter value reset to initial value. The RST is set to 1, as long as the reset is required.

ACT=1: Count performs when ACT is at the rising edge.

ACT=0: Counter does not operate, W will not change.

Parameter

COUNTER: Specify the number of the counter, which is indicated by xxx (it expresses by the numbers from 0 to 127).

Output

W: Coil output, W=1, when it reaches to the presetting value.

Note 1: The system may automatically check its range of the sequence number of the timer, it may alarm if the sequence is repeated or exceeded its range.

Note 2: The current value of the timer may automatically reset, after the ladder diagram is converted and downloaded. Reset the counter by the pulse signal before counting for ensuring the reliable of the counter.

5.15 DEC (Binary Decoding)

Function

DEC can be decoded for the binary system code data, one of the consecutive data of the specified 8-bit (1 type) or 16-bit (2 types) is same as the code data. The corresponding output data bit is 1; the output data is 0 without any same number. This code is used for the data decode of M or T function.

Format

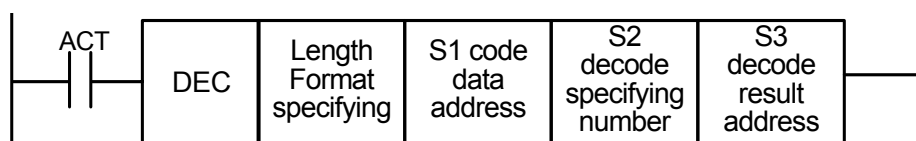


Fig. 5-15-1

Controllable condition

- ACT=0: Reset all of the output bits.
- ACT=1: Perform the data decode; the treatment result is set at the output data address.

Parameter

- Length: Set the dimension of the code data at the 1st bit data of the parameter.
 - 0001: The code data is binary system code data of one byte.
 - 0002: The code data is binary system code data of two bytes.
- S1: Code data address. Supply an address of the storage code data.
- S2: Decoding specifying number. Specify the 1st bit with the consecutive number of the 8-bit to be decoded (1 byte) or 16-bit (two bytes).
- S3: Decode result address. Specify an address output the decoding result. The register area must be output with one byte or two bytes areas.

For example:

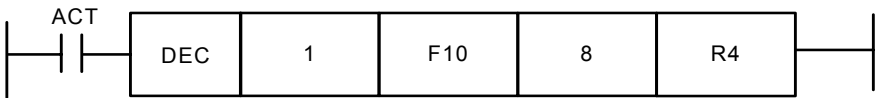


Fig. 5-15-2

- When ACT=1, F10=8, R4=0000,0001;
- When ACT=1, F10=9, R4=0000,0010;
-
- When ACT=1, F10=15, R4=1000,0000;

5.16 COD (Binary System Code Conversion)

Function:

COD code may automatically produce a corresponding table under its function block when it inputs the data capacity, which is used for inputting the conversion table data for the user. 10 grids of each row in this table, it calculates based upon the quotient +1 if it can not be exactly divided, but the capacity data does not change, and then the address of the table number may not display.

Format

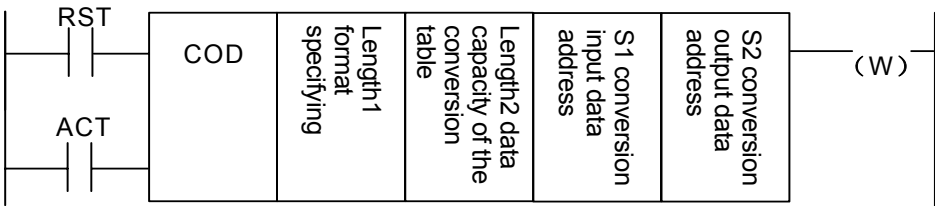


Fig. 5-16-1

Table 5-16-2

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

Controllable condition

Reset (RST):

RST=0, Do not reset.

RST=1, W resets, the error may output.

Working code (ACT):

ACT=0: Do not perform the COD.

ACT=1: Perform the COD. The value of the “conversion input data address (S1)” is regarded as the table number of the conversion table, the corresponding conversion data of the table number is taken out from conversion table to output the “output address to the conversion data (S2)”.

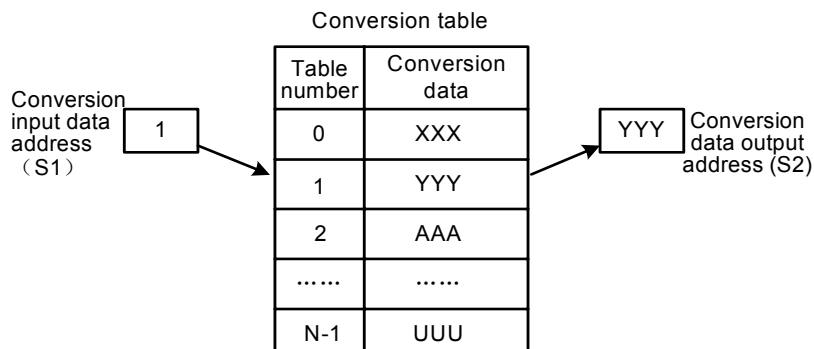


Fig. 5-16-2

Parameter

Length1: Specify the byte number of the binary system data of the conversion data in the conversion table.

1: Binary system of 1 byte.

2: Binary system of 2 bytes.

Length2: The capacity of the conversion table data. Each conversion table capacity can not more than 100, it is 100 bytes when 1 type format is specified; it is 100 bits when 2 bytes format are specified. The total capacity of the entire COD codes conversion table should be less than 512 bytes.

S1: The data in the conversion table can be taken out by the specifying table number, and the address of the specifying table number is regarded as the input address of the conversion data. This address should be supplied a register with one byte.

S2: The output address of the conversion data. Specify the byte numbers of the register in the form specification beginning with the address.

Output

If the abnormal occurs during the COD code performs, W=1, it indicates that the error issues.

Note: The capacity of the conversion data table is up to 100 bytes (bits), this table is compiled between the parameter conversion data output address and error output (W).

5.17 COM (Concentric Line Control)

Function

COM specifies the control until the coil working within the public end code COME range. The system may alarm if the public end code does not specified.

Format

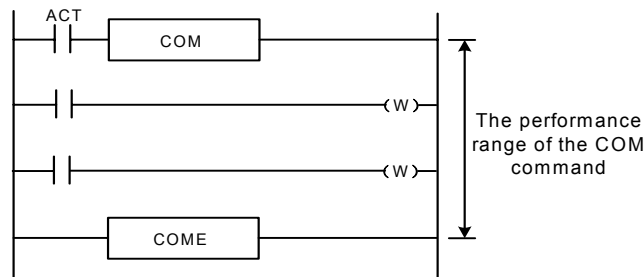


Fig. 5-17-1

Controllable condition

When ACT=0, the coil within the specified range is cut off without any condition (W=0).

When ACT=1, it is same as the COM code that does not perform any operation.

Note 1: Do not specify another COM code within the range of one COM code.

Note 2: When the ACT = 0 of the COM, the coil within the specified range WRT NOT is set to 1 at any time (WRT NOT = 1).

Note 3: The function codes, such as JMPB, END1, END2, CALL, CALLU, LBL, SP, SPE, COM and COME, can not be used between COM and COME, otherwise the system may alarm.

5.18 COME (Concentric Line Control End)

Function

This code is specified the controllable range of the concentric control line code (COM), which can not be used separately; it must be used with COM together.

Format

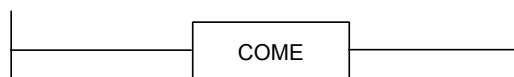


Fig. 5-18-1

5.19 ROT (Binary Rotation Control)

Function

It is used for the revolving control, such as the tool post and rotation workpiece. The code is with some functions, refer to the following:

1. Select the revolving direction with the short path.
2. Count the steps from the current position to the objective one; or count the steps from the previous position of the current one to the previous position of the objective one.
3. Count the position number at the objective previous position or the steps at the objective previous position.

Format

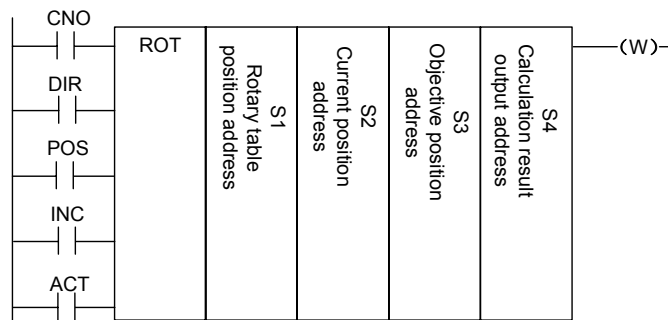


Fig. 5-19-1

Controllable condition

Specify the initial number of the rotary table (CNO):

CNO=0, counter begins with 0.

CNO=1, counter begins with 1.

Check whether the short path can be selected the rotation direction (DIR)

DIR=0, do not select, the selection direction is only positive.

DIR=1, select, the selection direction can be divided into positive or negative.

Specify the operation condition (POS):

POS=0, counting objective position

POS=1 the previous position of the counting object

Specify the position numbers and steps (INC):

INC=0, counting position number. Specify INC=0 and POS=1 if the previous position of the objective one is to be calculated.

INC=1 counting steps. Perform the code (ACT) when the code INC=1 and POS=0, if the distance between the current position and the objective one is to be calculated.

Performance code (ACT):

ACT= 0, do not perform the ROT code. W is without change.

ACT= 1, perform the ROT code. Generally, set the ACT=0, if the operation is to be required, set the ACT=1.

Parameter

S1: Supply the rotary position number.

S2: Supply the address storing the current position.

S3: Specify the address (or code value) storing the objective position. For example, store the address of the T code outputting from the CNC.

S4: The calculation outputs to address, compute the steps to be rotated of the rotary, which reaches to the objective position or the previous position. Always check whether the ACT is 1 when using the calculation result.

Output

W: Rotation direction output. It outputs to the W by the short-circuit rotation direction, its direction is positive (FOR) when W=0; it is the negative direction (REV) when W=1. The definitions of the FOR and REV are shown below, the increase direction of the position number of the revolving table is positive (FOR); it is the negative direction in the decrease state. The address of W can be selected freely, however, if the W results should be used, always check the condition of the ACT=1.

For example: One revolving table is shown below:

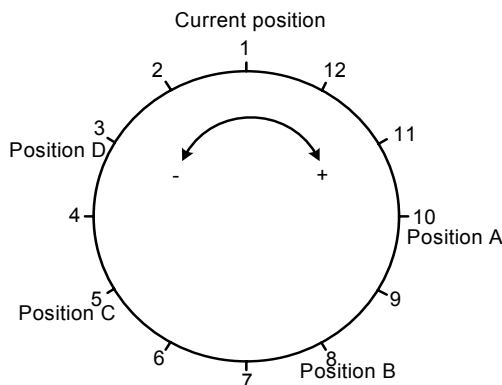


Fig. 5-19-2

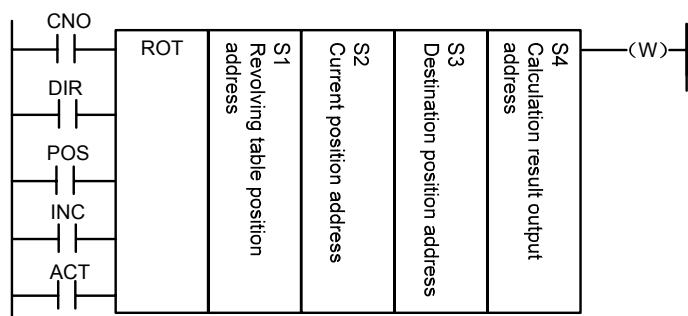


Fig. 5-19-3

The short path rotation is performed, and the numbers of the previous position of the objective one is then calculated.

Current position number S2=1, revolving index position number S1=12, CNO=1, DIR=1, POS=1 and INC=0

Wherein:

S3=10, S4=11, W=1, when the objective position is A in the ACT = 1.

S3=8, S4=9, W=1, when the objective position is B in the ACT = 1.

S3=5, S4=4 and W=0, when the objective position is C in ACT = 1.

S3=3, S4=2 and W=0 when the objective position is D in the ACT = 1.

5.20 SFT (Register Displacement/Shifting)

Function:

This code can be shifted 1 byte (8-bit) based upon the digits specifying by the code parameter each time. The “1” overflown from cycle shifting will be added from the negative direction, for example, the top bit “1” is overflown when shifting to left, the lowest bit supplies “1”, vise versa.

Format:

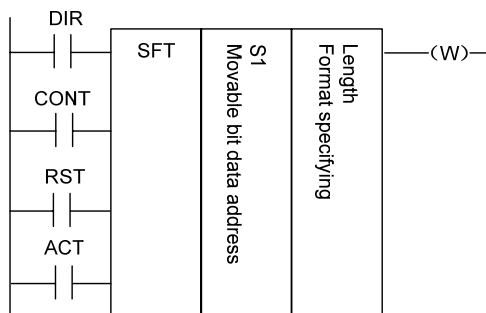


Fig. 5-20-1

Controllable condition

Specify the shifting direction (DIR)

DIR=0, left shift

DIR=1, right shift

State specifying (CONT)

CONT=0, do not perform the cycle shifting

CONT=1, perform the cycle shifting

Reset (RST)

Reset shifting output data (W=1) is (W=0)

RST=0, W does not reset

RST=1, W resets (W=0)

Performance condition (ACT)

ACT=0, do not perform the SFT code.

ACT=1, perform the shifting, set ACT to 0 after the code is performed, if only 1 bit is moved.

Parameter

S1: Set the shifting data address, it composes of one storage area by 1 byte.

Length: it is a 4-digit, which is shown in the following figure:

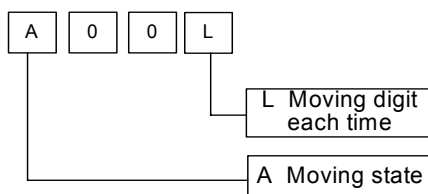


Fig. 5-20-2

L: its range is 0~8

A: it is treated as bit-parameter, it is always shifted when ACT =1 during A =0, and it moves once each period.

ACT is regarded as the pulse signal when A = 1, and when the value turns into 1 from 0, it moves once.

Output

W: "1" state does not move out when the W = 0 shifting operation is performed.

"1" state moves out when the W = 1 shifting operation is performed.

5.21 DIFU (Rising Edge Detection)

Function:

This code is set the output signal to 1 during the scan period of the input signal rising edge.

Format

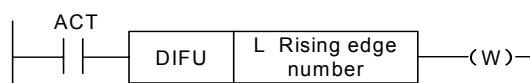


Fig. 5-21-1

Controllable condition

Input signal: The output signal is set to 1 at the rising edge (0→1) of the input signal.

Output signal: The output signal keeps to 1 during one scan period of the ladder diagram when the function code is performed.

Parameter:

L: The range of the rising number is 0~255. The system alarm may occur when another DIFU code or DIFD code is used the same number in the ladder diagram.

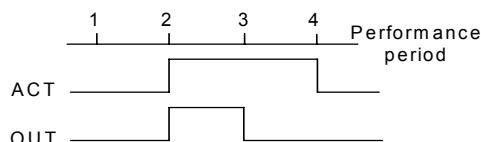
Operation

Fig. 5-21-2

The system may automatically check the range of the series number of the rising edge, as for the repeated series number or the exceeding range, the system alarm may occur.

5.22 DIFD (Descending Edge Detection)**Function:**

This code outputs 1 signal of one scan period when inputting the signal descending edge.

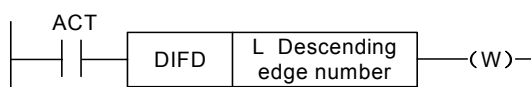
Format

Fig. 5-22-1

Controllable condition:

Input signal: The output signal is set to 1 at the descending edge (1→0) of the input signal.

Output signal: The state in the output signal keeps one scan period of the ladder diagram when this function code is performed.

Parameter:

L: The range of the descending edge number is 0~255. The system alarm may occur when another DIFU code or DIFD code is used the same number in the ladder diagram.

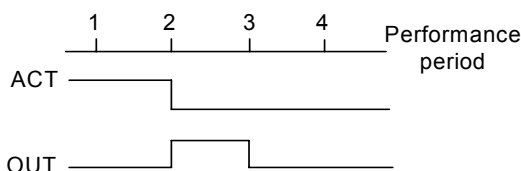
Operation:

Fig. 5-22-2

The system may automatically check the range of the series number of the descending edge, as for the repeated series number or the exceeding range, the system alarm may occur.

5.23 COMP (The Comparison of the Binary Number)

Function:

Compare the dimensions of two binary number data. Specify the enough bytes to store the input data and comparison data in the memory block.

Format:

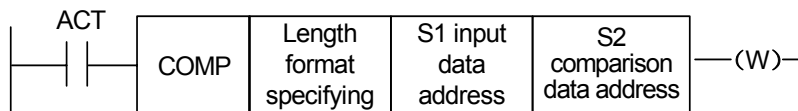


Fig. 5-23-1

Controlled condition

ACT=0, Do not perform the COMP code. W value is invariable

ACT=1, Perform the COMP code

Parameter

Length: Input the specified format (constant or address) and the specified data length (1 byte or 2 bytes) of the data.

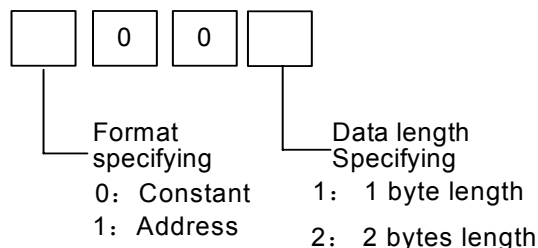


Fig. 5-23-2

S1, S2: The contents both the comparison 1 and comparison 2 can be regarded as constant and address number.

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

Output:

W =0: Inputting data > comparison data

W = 1: Inputting data ≤ comparison data

5.24 COIN (Consistency Comparison)

Function:

This code can be detected whether the input value and comparison value are consistent.

Format:

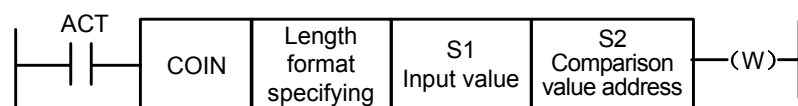


Fig. 5-24-1

Controllable condition:

ACT=0, Do not perform the COIN code. W value is invariable.

ACT=1, Perform the COIN code.

Parameter

Length: Input the specified format (constant or address) and the specified data length (1 byte or 2

bytes) of the data.

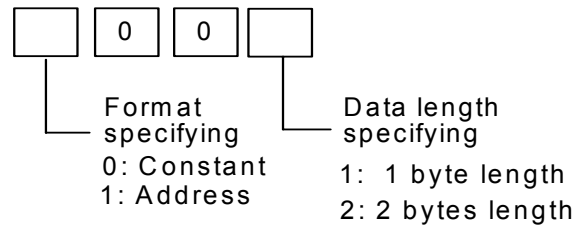


Fig. 5-24-2

S1: The input data can be specified both the constant and storage address.

S2: Compare the storage address of the data.

Output:

W: W = 0: input value \neq comparison value

W = 1: input value = comparison value

5.25 MOVN (Data Transmission)

Function:

The data of the source address or the specified binary data is transferred to the destination address.

Format of the figure:

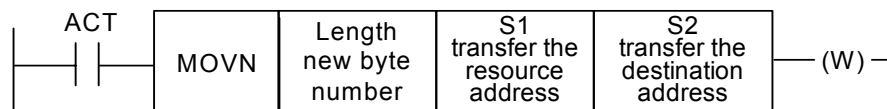


Fig. 5-25-1

Controllable condition

ACT=0, No data.

ACT=1, the byte specified by the quantity is transferred.

Parameter:

Length: the byte numbers or data number to be transferred.

S1: Resource start address or constant.

Select the transfer form based upon the S1:

1. If the S2 is single byte address, S1 is the constant, the resolution of the S1 based upon the byte is copied to the address where it is corresponding Length type at the beginning with S2; the S1 should be evaluated based upon the bit, if S2 is the bit address; the bit address corresponding Length begins with the S2 address.

2. The address type both S1 and S2 will not be considered whether it is matched, which is transferred the data by the byte address.

S2: Destination start address.

For example:

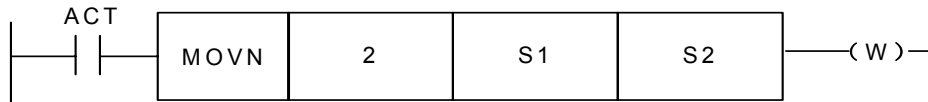


Fig. 5-25-2

1. When S1 is regarded as constant 5, and the S2 is treated as R60, then R60=00000101, R61=00000101.
2. When S1 is regarded as constant 5, and the S2 is treated as D60, then D60=5, D61=5
3. When S1 is address D50, and S2 is treated as D60, then D60=D50.

W=1, the specified quantity bytes are transferred.

W=0 No data transfer

The quantity range that exceeds the parameter type is detected when transferring, the system alarm may occur.

5.26 MOVB (Transmission of 1 Byte)

Function:

The MOVB code transfers the 1 byte data to a specified destination address from a specified resource address.

Figure format:

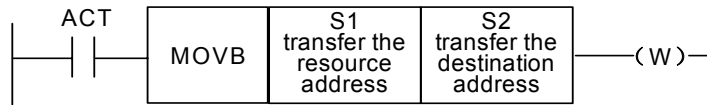


Fig. 5-26-1

Controllable condition:

ACT=0, No data transfers

ACT=1, 1 byte is transferred.

Parameter

S1: Resource address or constant

If the S2 is single byte address, the S1 should be copied to the S2 address based upon the byte value; if S2 is bit address, the S1 should be copied to the S2 lower byte address based upon the byte value.

S2: Destination address

5.27 MOVW (Transmission of Two Bytes)

Function

MOVW code transfers the 2 bytes data to a specified destination address from a specified resource address.

Figure format

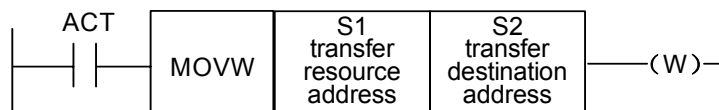


Fig. 5-27-1

Controllable condition

ACT=0, No data transfers.

ACT=1, 1 byte is transferred.

Parameter

S1: Resource address or constant

S2: Destination address

5.28 XMOV (Binary Indexed Data Transmission)**Function**

This function code is used to read or write the data from the data table. The data number (table capacity) in this table can be specified by address; the data table can be operated by PLC based upon the user's setting during operating.

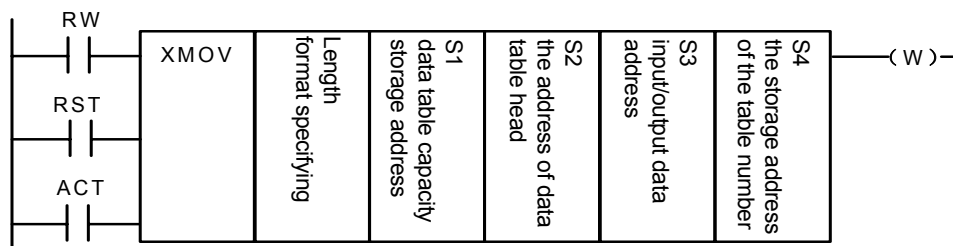
Format:

Fig. 5-28-1

Controllable condition

Specify the operation (read or write) (RW)

RW=0: Read the data from the data table.

RW=1: Write the data to the data table.

Reset (RST)

RST=0: Release the reset

RST=1: Reset W=0.

Perform the code (ACT)

ACT=0: Do not perform the XMOV code, W keeps invariable.

ACT=1: Perform XMOV code.

Parameter

Length: The format specifies the length of the transmission data.

1: 1 byte length.

2: 2 bytes length.

S1: The data capacity storage address of the data table is used to store the data capacity of the data table; the occupied byte number should be suitable for the specified length of the Length. The valid range of the data is determined by the specified byte length of the Length 1 format.

1 byte length: from 1 to 512.

2 byte length: from 1 to 256, that is, $256 \times 2 = 512$ bytes, which is the capacity of the PLC data table.

S2: Set the address of the data table head. The storage area of the data table = byte length \times data number of its table. The address of the table head should be the value in which is set inside the data table.

S3: Input/output address. Set and place the address from the reading when the data is read. Set and place the address from writing when the data is write. Its byte numbers should be suitable from the

setting of the Length format. This address is defined as D register.

S4: Storage address of the table number. It is used to store the table number to be read or write. It occupied bytes should be suitable for the specifying in the Length. If the setting of the table number is more than the data registered in the S1, it outputs W=1 in a wrong way.

Actual transmission address = head address + table number, the table number is 0 (S1-1); The actual transmission address can not be exceeded the data list.

Output:

When the value in the table number exceeds the S1, W=1, the read or write of the data table does not perform.

W=0, without error

W=1, with error

5.29 DSCH (Binary Data Index)

Function:

This function code can be use for indexing the binary data in the data table. The data number (table capacity) in the data table can be specified by address. In this case, the table capacity still can be changed even if the program is written into ROM.

Format

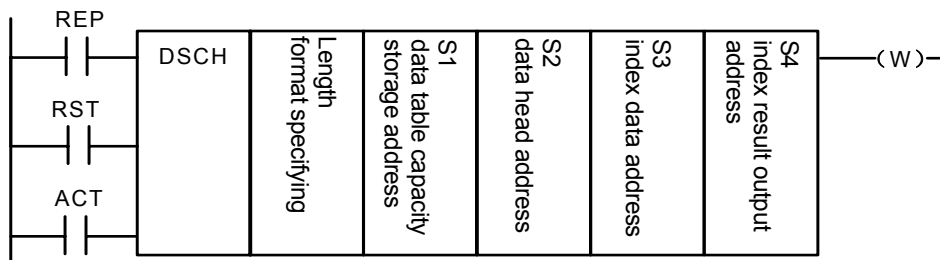


Fig. 5-29-1

Controllable condition

Detection repetition (REP)

REP=0: Perform DSCH code, start to search it from the first address of the data table, it will not consider the destination data may generate repeatedly; it may stop the search outputting its address when detecting the destination data at the first time. W=1, if the indexed data does not find.

REP=1: Perform DSCH code. If the indexed data does not find or it has two or above data, W=1.

Reset (RST)

RST=0, Release the reset.

RST=1: Reset W=0.

Performance code (ACT)

ACT=0: Do not perform DSCH code, W keeps invariable.

ACT=1: Perform DSCH code. Output its table number if the indexed data is found; if it is not found or it has two more above data, W=1.

Parameter

Length: Format specifies the length of the index data.

1: 1 byte length

2: 2 bytes length

S1: Data number storage address of the data table. The byte length specified by this address is distributed the storage area for the requirement of the byte. The data number of the data table is n+1 (table head is 0, the end of the table is n).

S2: Set the data table head address.

S3: Set the input address of the index address.

S4: The address output of the index result. Actual address = head address + table number, table number is 0~(S1-1), the actual address can not exceed the data table. After indexing: output its number from the list if the index data is found. The table number is outputted to the index result output address of which the required storage byte number should be suitable for the specified format.

Output

W=0, Find the indexed data.

W=1, Do not find the indexed data.

5.30 ADD (Binary Addition)

Function:

This function code is used for the add operation of the 1 byte or 2 bytes binary data. The addend data and the add operation output the data should be set the storage address with the corresponding byte length.

Format

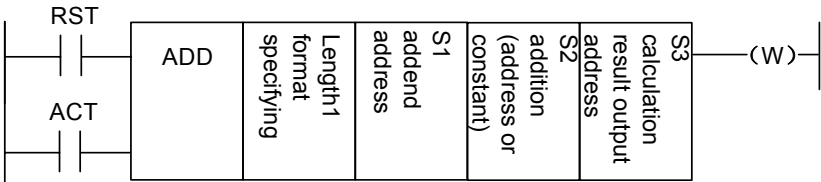


Fig. 5-30-1

Controllable condition

Reset (RST):

RST=0: Release the reset.

RST=1: Reset W=0.

Performance code (ACT)

ACT=0: Do not perform ADD code, W keeps invariable.

ACT=1: Perform ADD code.

Parameter:

Length: Specify the data length (1 byte or 2 bytes) and the specifying method of the addend (constant or address).

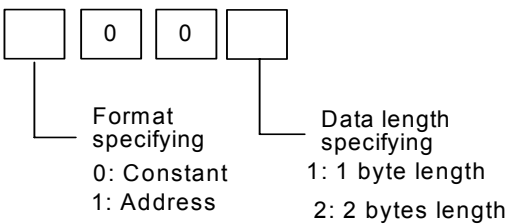


Fig. 5-30-2

S1: Specify the storage addend address.

S2: The specifying method of the addend is determined by the specification of the Length.

S3: Specify the output operation address.

Output

W=0: Operation is normal.

W=1: Operation is abnormal.

When the add operation result exceeds the specified data length, W=1

5.31 SUB (Binary Subtraction)

Function

This function code is used for the subtraction of the 1 byte or 2 bytes binary data. The minuend data and the subtraction output data should be set the storage address with the corresponding byte length.

Format

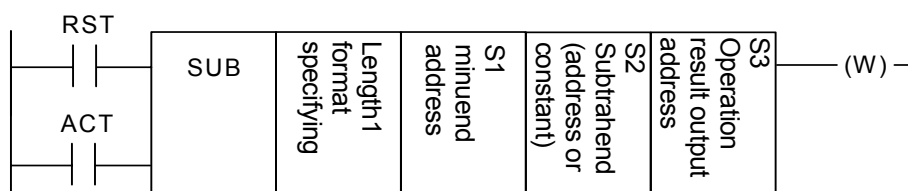


Fig. 5-31-1

Controllable condition

Reset (RST):

RST=0: Release the resetting.

RST=1: Reset W=0.

Performance code (ACT):

ACT=0: Do not perform the SUB code, W keeps invariable.

ACT=1: Perform the SUB code.

Parameter:

Length: Data length specified (1 or 2 bytes) and the addend specifying method (constant or address).

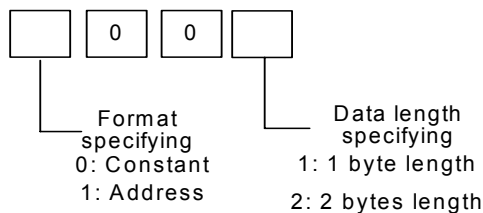


Fig. 5-31-2

S1: Specify and store the minuend address.

S2: The specifying method of the subtrahend is determined by Length.

S3: Specify and output the address of the operation result.

Output

W=0: Normal operation.

W=1: Abnormal operation.

The subtraction result exceeds the specified data length, W=1

5.32 ANDF (Bit-by-bit AND)

Function

This code is performed the AND with a constant (or the content from the address B) from the content of the address A, and its result is stored to address C.

Format

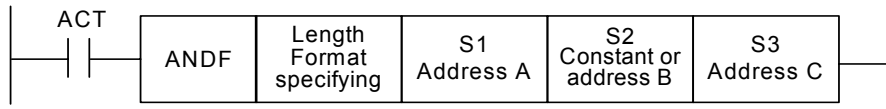


Fig. 5-32-1

Controllable condition

ACT=0: Do not perform ANDF code.

ACT=1: Perform the ANDF code.

Parameter

Length: Specify the data length (1 byte or 2 bytes), input the data format (constant or address).

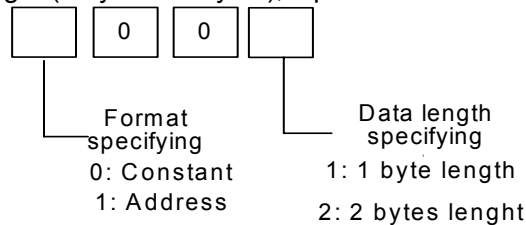


Fig. 5-32-2

S1: Specify the input data that will to be performed by AND. The address is then begins and the data length is consistent with the Length.

S2: The input data is performed with the one of the AND. When the format specifying is selected the address, the address is then started, and the data length is consistent with the length.

S3: It is used for storing the address of ANDF operational result. The result from the ANDF is stored from this address, and the data length is consistent with the one of the Length.

For example: When the address A and B have the following data, which are shown below:

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

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

The operational result of the ANDF is shown below:

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

5.33 ORF (Bit-by-bit OR)

Function

This code is performed the OR with a constant (or the content from the address B) from the content of the address A, and its result is stored to address C.

Format

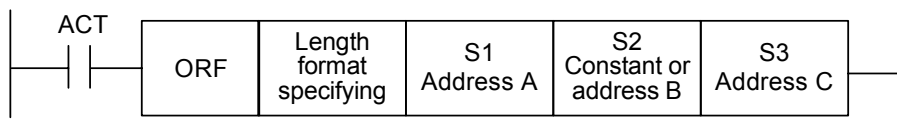


Fig. 5-33-1

Controllable condition

ACT=0: Do not perform the ORF code.

ACT=1: Perform the ORF code.

Parameter

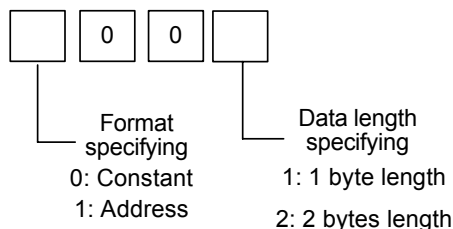


Fig. 5-33-2

Length: Specify the data length (1 byte or 2 bytes), input the data format (constant or address).

S1: Specify the input data that will to be performed by NOT. The address is then begins and the data length is consistent with the length.

S2: The input data is performed with the one of the OR. When the format specifying is selected the address, the address is then started, and the data length is consistent with the length.

S3: It is used for storing the address of ORF operational result. The result from the ORF is stored from this address, and the data length is consistent with the one of the length..

For example: When the address A and B have the following data, which are shown below:

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

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

The operational result of the ORF is shown below:

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

5.34 NOT (Bit-by-bit NOT)

Function: This code is reversed to each content in address A, and store the result to the address B.

Format:

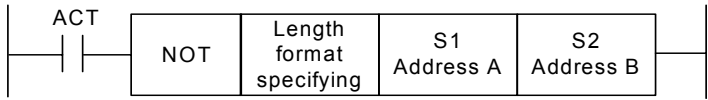


Fig. 5-34-1

Controllable condition

ACT=0, Do not perform the NOT code.

ACT=1, Perform the NOT code.

Parameter

Length: Specify the data length (1 byte or 2 bytes)

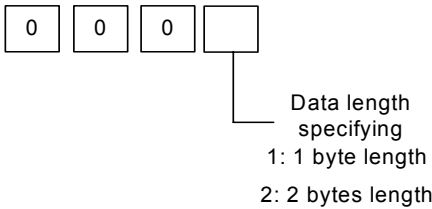


Fig. 5-34-2

S1: The input data is reversed bit-by-bit. The address is started and the data length is consistent with the length.

S2: It is used for outputting NOT operational result. The result of the NOT operation starts to store from this address, and the length of the data is consistent with the one of the length.

For example:

When the address A and B have the following data, which are shown below:

Address A

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

The operation result of the NOT is shown below:

Address B

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

5.35 EOR (Exclusive OR)

Function:

This code is performed the Exclusive OR with a constant (or the content from the address B) from the content of the address A, and its result is stored to address C

Format

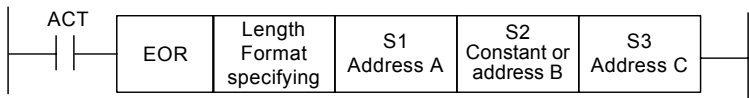


Fig. 5-35-1

Controllable condition

ACT=0: Do not perform the EOR code.

ACT=1: Perform the EOR code.

Parameter

Length: Specify the data length (1 byte or 2 bytes), input the data format (constant or address).

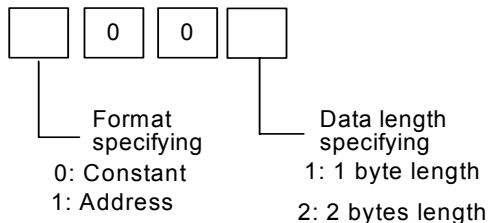


Fig. 5-35-2

S1: Specify the input data that will to be performed by Exclusive OR. The address is then begins and the data length is consistent with the length.

S2: The input data is performed with the one of the Exclusive OR. When the format specifying is selected the address, the address is then started, and the data length is consistent with the length.

S3: It is used for storing the address of EOR operational result. The result from the EOR is stored from this address, and the data length is consistent with the one of the length

For example: When the address A and B have the following data, which are shown below:

Address A

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

Address B

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

The operational result of the EOR is shown below

Address C

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

CHAPTER SIX THE COMPILATION LIMIT OF THE LADDER DIAGRAM

1. The program should with the codes END1 and END2, which is regarded as the end symbol of the 1st level and 2nd level program, and the END1 should be performed before END2.
2. The parallel output is only output instead of multi-level output.
3. The result output address in the overall basis code, output function code can not be set to the following address:
 - 1) Counter presetting address DC, timer presetting address DT.
 - 2) The address systems from K0 to K5 are used, user can not define it.
 - 3) The address systems among the GA63, R510 and R511 are used, user can not define it.
 - 4) X address and F address on the I/O input port.
4. The vertical hovering, the node point does not connect to the following node and the parallel conducting line is performed the parallel connection to the node network, will generate the node or network, which can not be performed. So, the system alarm occurs.
5. The start network does not connect directly between different vertical lines in the same row; one of row does not consecutively connect to the vertical line. As for this case, the system can not be treated, and therefore the system alarm occurs.
6. The upper embossment can not be accepted inside the network, that is, the parallel network generates on several nodes on one certain row, and any row of it can not be connected to this parallel network. The system alarm may issue.

This is regarded as syntax error, and the system alarm may occur, which is as follow:

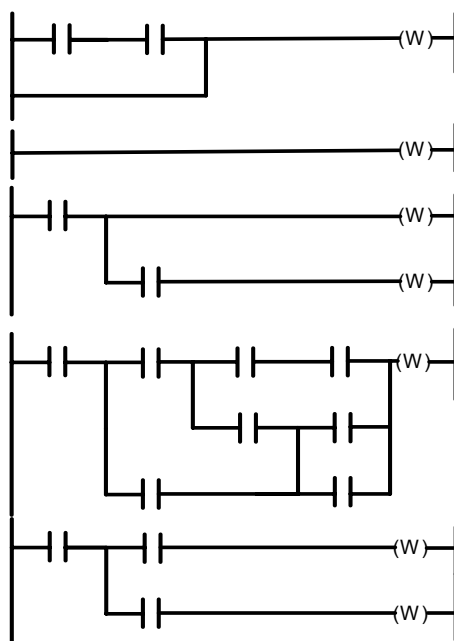


Fig. 6.1

VOLUME II FUNCTION EXPLANATION

CHAPTER ONE CONTROLLABLE AXIS

1.1 The output of the axis movement

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

Signal **Axis movement signal**

MV1~MV4 (F017#0~F017#3)

[Type] Output signal

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

MV1: X axis is being moved.

MV2: Y axis is being moved.

MV3: Z axis is being moved.

MV4: A axis is being moved.

[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.

The signal of the axis movement direction

MVD1~MVD4 (F019#0~F019#3)

[Type] Output signal

[Function] These signals are indicated as the movement direction of one controllable axis.

MVD1: The movement direction of X axis

MVD2: The movement direction of Y axis

MVD3: The movement direction of Z axis

MVD4: The movement direction of A axis

[Output condition] "0" indicates the corresponding axis moves along with the negative direction, "1" indicates the corresponding axis moves along with the positive direction.

Note:

These signals are kept invariable during stopping, which indicates the axis movement direction before stopping.

Signal address

	#7	#6	#5	#4	#3	#2	#1	#0
F017					MV4	MV3	MV2	MV1
F019					MVD4	MVD3	MVD2	MVD1

1.2 Servo Ready Signal

Signal Servo ready signal
SA (F000#6)

[Type] Output signal

[Function] SA signal turns into 1 after the servo is ready. As for the axis that with brake, the brake is released when the signal is outputted. It is braked when this signal does not output.

Signal address

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

CHAPTER TWO READY FOR OPERATION

2.1 ESP

Brief: The machine immediately stops by pressing the ESP button on the operation panel of the machine tool.

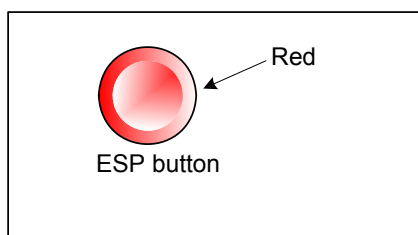


Fig. 2-1

The button is locked after pressing; the releasing methods are differing from the manufactures. Usually, the button can be released by left-rotation.

Signal ESP Signal

ESP (G001.0)

[Type] Input signal

[Function] The machine immediately stops after inputting the ESP signal.

[Function] The CNC is reset and in the ESP state when the ESP signal becomes 1.

Signal address

G001								ESP
------	--	--	--	--	--	--	--	-----

2.2 CNC Overtravel Signal

Brief: The limit switch operates, and the tool decelerates and stops when the tool movement exceeds the stroke end set by the machine tool limit switch, the overtravel alarm is then displayed.

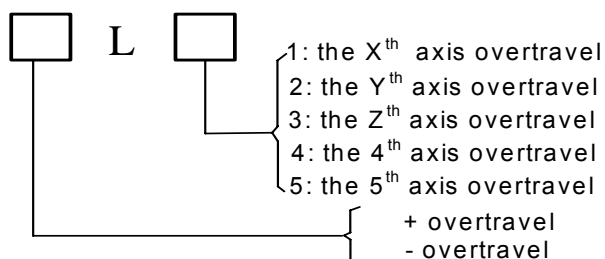
Signal Overtravel signal

+L1~+L5(G012#0~G012#4)

−L1~−L5(G013#0~G013#4)

[Type] Input signal

[Function] It indicates the controllable axis has been reached to the stroke limit. Each direction of each controllable axis has this signal. The + and − are expressed the direction of the signal name, the digit is corresponding with the controllable axis.



[Operation] When the signal is "0", the operations of the controllable unit are shown below:

- * All of the axes are decelerated in the automatic operation, even if only the overtravel signal of one axis turns into 1, the alarm occurs and stops.
- * The axis with movement signal 1 is decelerated and stopped in the manual operation, the axis after stopping can be moved along with the negative direction.
- * The movement direction of the axis is memorized once its overtravel signal turns into 1.

Before eliminating the alarm, this signal axis can not moved along with this direction, even if the signal becomes 0.

Signal address

G012				+L5	+L4	+L3	+L2	+L1
G013				-L5	-L4	-L3	-L2	-L1

2.3 Alarm Signal

Brief: When the alarm occurs in the CNC, which displays on the screen, and its alarm signal is set to 1.

Signal Alarm signal
AL (F001#0)

[Type] Output signal

[Function] The alarm signal indicates that the following alarms are displayed when the CNC is in the alarm state:

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

[Output condition] The alarm signal is 1 in the following conditions:

—— CNC is in the alarm state

The alarm signal is 0 in the following situation:

—— Clear the alarm by the CNC resetting

Signal address

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

2.4 Selection of the Operation Method

Signal Detection signal in the operation method
F003#0~F003#7

[Type] Output signal

[Function] It indicates the selected operation method.

Signal address

	#7	#6	#5	#4	#3	#2	#1	#0
F003	MZRO	MEDT	MMEM	MRMT	MMDI	MJ	MH	MINC

2.5 State Output Signal

Cutting feed signal

CUT (F002#6)

[Type] Output signal

[Function] This signal indicates that it is being performed the automatic cutting feed.

[Output condition] The signal is set to 1 in the following conditions:

In the automatic cutting feed (linear interpolation, arc interpolation, helical interpolation, thread cutting, skip cutting or cutting in the canned cycle)

Notice:

1. This signal does not output when the feed is in the dwell state.
2. This signal can be outputted during interlocking or the federate is 0.

Signal address

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

CHAPTER THREE MANUAL OPERATION

3.1 JOG Feed/Incremental Feed

Brief

JOG feed The feed axis and direction selection signal on the operation panel is set to 1 in the JOG mode. The machine is consecutively moved along the selected axis in its direction.

Incremental feed The feed axis and direction selection signal on the operation panel is set to 1 in the incremental feed mode. The machine moves one step along the selected axis in its direction; the least distance of the machine movement is the least input increment, each step has the least input increment with 10, 100 or 1000 folds.

JOG feed and incremental feed are absolutely same, other than the feed distance selection method. In JOG feed, the machine can be consecutively feed when the feed axis (+J1, -J1, +J2, -J2, +J3 and -J3) and direction selection signal are set to 1. In incremental feed, the machine is single step feed. The JOG feedrate can be adjusted by its override disk.

The single-step distance can be selected by the incremental step **G026 #0~G026 #3**.

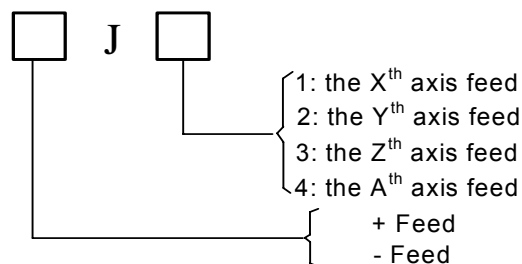
Signal Feed axis and direction selection

+J1~+J4 (G27 #0~G27 #3)

-J1~-J4 (G28 #0~G28 #3)

[Type] Input signal

[Function] Select the required feed axis and direction in the JOG feed or incremental feed. The + and - in the signal name are indicated as feed direction, the digit is corresponding with the controllable axis.



[Operation] When the signal is set to 1, the controllable unit is shown below:

* The controllable unit can be moved the specified axis along the specified direction when the JOG feed or incremental feed is enabled.

In JOG feed, the controllable unit consecutively moves the controllable axis when the signal is set to 1.

* In the incremental feed, the controllable unit makes that the specified axis feeds based upon the specified step distance, and then it stops. The controllable unit may not stop feeding even if this signal is set to 0 during the axis feed. Move the axis again, and the signal will be set to 0 then to 1.

Manual rapid feed selection signal

RT (G024 #7)

[Type] Input signal

[Function] Select the rapid traverse rate of the JOG feed or increment feed.

When the signal turns into 1, the operation of the controllable unit is shown below:

- The controllable unit performs the JOG feed or increment feed at the rapid traverse rate. The rapid traverse override is enabled.
- The signal shifts to 0 from 1 or is reverse, and its feedrate decreases to 0 during the JOG feed or increment feed. The feed axis and the direction selection signal can be kept to 1 during the acceleration or deceleration.

Signal address

	# 7	# 6	# 5	# 4	# 3	# 2	# 1	# 0
G024	RT							
G027					+J4	+J3	+J2	+J1
G028					−J4	−J3	−J2	−J1

3.2 MPG (Manual Pulse Generator) / Single Step Feed

Brief In the MPG/single step feed mode, the machine tool can be slightly moved by rotating the MPG or single-stop operation. The machine tool movement axis can be selected by the MPG feed axis signal or axis movement signal.

Signal **Single-step feed amount signal selection**
(G026 # 0~G026 # 3)

[Type] Input signal

[Function] The move distance from the pulse is generated by pressing the axis movement key once during this signal is selected the single-step feed.

Signal **MPG feed amount signal selection**
(G026 # 4~G026 # 6)

[Type] Input signal

[Function] The move distance from a pulse is generated by rotating each unit from the MPG.

CHAPTER FOUR REFERENCE POSITION RETURN

4.1 Manual Reference Position Return

Brief The machine tool moves along with the specified direction and returns to the reference position by setting the parameter No. 7#3~#7 in the mode of the manual reference position return. The selected axis from the panel buttons is only indicated the one of the specified zero return and it is regardless of the axis move.

The following signals are related with the manual reference position return:

Table 4-1-1

	Manual reference position return
Deceleration signal of reference position return	DECX、DECY、DECZ、DECA
End signal of reference position return	ZP1、ZP2、ZP3、ZP4

Signal

End signal of reference position return

ZP1~ZP4(F016 # 0~F016 # 3)

[Type] Output signal

[Function] This signal shows that the machine tool has been held in the reference position of the controllable axis. These signals are one-to-one corresponding with the axes.

Table 4-1-2

ZP1	End signal of reference position return along with X axis
ZP2	End signal of reference position return along with Y axis
ZP3	End signal of reference position return along with Z axis
ZP4	End signal of reference position return along with A axis

[Output condition] The signal becomes 1 when the following states are displayed:

- The manual reference position return has been completed, and its current position is performed in the in-position area.
- The automatical reference position return (G28) has been completed, and its current position is performed in the in-position area.
- The detection of the reference position return has been completed, and its current position is performed in the in-position area.

The signal becomes 0 when the following states are displayed:

- When the machine tool moves from the reference position.
- When the ESP signal occurs
- When the servo alarm generates.

Return to the zero deceleration signal detection

DECX (G017#0) DECY (G017#1) DECZ (G017#2) DECA (G017#3)

[Type] Input signal

[Function] These signal decreases the move speed of the manual reference position return, so that it approximates to the reference position at the low speed.

4.2 Return to the Reference Position Detection Signal

The detection allowance signal of the 1st reference position

PREF10---PREF13 (G056#0---#3)

The detection allowance signal of the 2nd reference position

PREF20---PREF23 (G057#0---#3)

The detection allowance signal of the 3rd reference position

PREF30---PREF33 (G058#0---#3)

The detection allowance signal of the 4th reference position

PREF40---PREF43 (G059#0---#3)

[Type] Input signal

[Function] When this signal is set to 1, the end signal (F42, F43 and F44) of the reference position return is enabled.

These signals are one-to-one corresponding with the axes.

Table 4-2-1

PREF*0	Allowance signal of reference position detection along with X axis
PREF*1	Allowance signal of reference position detection along with Y axis
PREF*2	Allowance signal of reference position detection along with Z axis
PREF*3	Allowance signal of reference position detection along with A axis

End signal of the 1st reference position return

ZP11---ZP14 (F041#0---#3)

End signal of the 2nd reference position return

ZP21---ZP24 (F042#0---#3)

End signal of the 3rd reference position return

ZP31---ZP34 (F043#0---#3)

End signal of the 4th reference position return

ZP41---ZP44 (F044#0---#3)

[Type] Output signal

[Function] This signal shows that the machine tool has been held in the reference position of the controllable axis.

These signals are one-to-one corresponding with the axes.

Table 4-2-2

ZP*1	End signal of reference position return along with X axis
ZP*2	End signal of reference position return along with Y axis
ZP*3	End signal of reference position return along with Z axis
ZP*4	End signal of reference position return along with A axis

[Output condition] This signal is enabled when the detection allowance signal (G57, G58 and G59) of the reference position is set to 1. The signal becomes 1 when the following states are displayed.

- The manual reference position return has been completed, and its current position is performed in the in-position area.

- The automatic reference position return (G30) has been completed, and its current position is performed in the in-position area
- The detection of the reference position return has been completed, and its current position is performed in the in-position area.

The signal becomes 0 when the following states are displayed:

- The detection allowance signal (G57, G58 and G59) of the reference position is set to 0
- The machine tool moves from the reference position.
- The ESP signal occurs
- The servo alarm generates.

4.3 Area Detection Signal

Area detection signal

AQ1—AQ3 (F045#0---#2)

[Type] Output signal

[Function] This signal shows that the machine tool has been held in the area range of the controllable axis

These signals are one-to-one corresponding with the axes.

Table 4-3-1

AQ1	Detection signal of the 2 nd reference position area along with Z axis
AQ2	Detection signal of the 3 rd reference position area along with Z axis
AQ3	Detection signal of the 4 th reference position area along with Z axis

[Output condition]

When the machine tool position is within the area of the stored stroke check 1 (Data parameter **P66~P75** is set the boundary), and without the area of the stored stroke check 2 (Data parameter **P76~P85** or program code can be set this boundary), the signal is then turned into 1; otherwise, it turns into 0.

Signal address

	#7	#6	#5	#4	#3	#2	#1	#0
F016					ZP4	ZP3	ZP2	ZP1
F041					ZP14	ZP13	ZP12	ZP11
F042					ZP24	ZP23	ZP22	ZP21
F043					ZP34	ZP33	ZP32	ZP31
F044					ZP44	ZP43	ZP42	ZP41
F045						AQ3	AQ2	AQ1
G017					DECA	DECZ	DECY	DECX

G057					PREF23	PREF22	PREF21	PREF20
G058					PREF33	PREF32	PREF31	PREF30
G059					PREF43	PREF42	PREF41	PREF40

CHAPTER FIVE AUTOMATICAL OPERATION

5.1 Cycle Start/ Feed Hold

Brief Start the automatic operation (Cycle start): In the storage mode, the automatic operation start signal ST is set to 1 during the DNC or MDI mode; the CNC enters into the automatic operation start state, then operates.

Signal ST is ignored in the following conditions:

1. The ST signal is ignored other than the mode of the Auto, DNC and MDI
2. The ST signal is ignored when the feed dwell signal (SP) is set to 1.
3. The ST signal is ignored when the ESP signal (ESP) is set to 1.
4. The ST signal is ignored when the <RESET> key on the MDI is pressed.
5. The ST signal is ignored when the CNC is in the alarm state.
6. The ST signal is ignored when the automatic operation has been started.
7. The ST signal is ignored when the program restart signal is set to 1.
8. The ST signal is ignored when the CNC is being searched a sequence number.

In the automatic operation, the CNC enters into the feed hold state and stops in the following states:

1. When the feed hold signal (SP) is set to 1.
2. Single block code is ended during the single block operates.
3. MDI operation has been completed.
4. The alarm occurs in the CNC.
5. The single block code has been completed after it becomes the other automatic operations or edit mode.

In the automatic operation, the CNC enters into the reset state and stops in the following states.

1. When the ESP signal is set to 1.
2. Press the <RESET> key on the MDI.

Automatic operation interruption: The feed hold signal SP is set to 1 during the automatic operation, the CNC enters into the dwell state and stops. At the same time, the cycle start light STL is cleared to 0, and the feed hold indicator SPL is set to 1. The automatic operation will not restart even if the SP signal is cleared to 0 again. If the restart automatic operation should be performed again, the SP signal should be cleared to 0, and then the ST signal is set to 1, then clears to 0.

Signal Cycle start signal

ST (G023#6)

[Type] Input signal

[Type] Start the automatic operation

[Operation] ST is set to 1 in DNC or MDI mode during the automatic operation, the CNC then enters into the cycle start state and starts to operate,

Feed hold signal

SP (G023#7)

[Type] Input signal

[Function] Automatic operation interruption

[Operation] SP signal is set to 1, and CNC enters into the feed hold state and stops during the automatic operation. When the SP signal is set to 0, the automatic operation can not be started.

Cycle start indicator signal

STL (F000 #5)

[Type] Output signal
 [Function] The PLC is entered into the automatic operation start already.
 [Output condition] The signal can be set to 1 or 0, which is determined by CNC state, refer to the Fig. 5.1.

Feed hold indicator signal

SPL (F000 #4)

[Type] Output signal
 [Function] The PLC is entered into the feed hold state already.
 [Output condition] The signal can be set to 1 or 0, which is determined by CNC state, refer to the Fig. 5.1.

Automatic operation signal

OP (F000 #7)

[Type] Output signal
 [Function] The PLC automatic operation is being performed.
 [Output condition] This signal can be set to 1 or 0, which is determined by CNC state, refer to the Fig. 5.1.

Table 5-1

	Cycle start LED STL	Feed hold LED SPL	Auto operation LED OP
Cycle start state	1	0	1
Feed hold state	0	1	1
Auto operation stop state	0	0	0
Reset state	0	0	0

Signal address

	#7	#6	#5	#4	#3	#2	#1	#0
G023	SP	ST						
F000	OP		STL	SPL				

5.2 Reset

Brief: The CNC is reset and entered into the reset state in the following conditions:

1. The ESP signal is set to 1.
2. Press the <RESET> key on MDI

The reset signal RST outputs to PLC when CNC is reset. After the abovementioned conditions are released, the reset signal RST is set to 0 when it outputs the time set by parameter No.203.

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

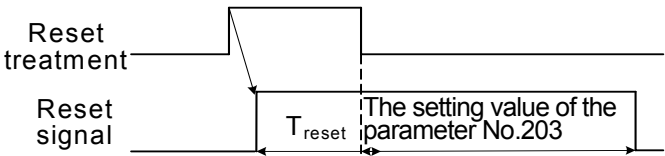


Fig. 5-2

In the automatic operation, the automatic operation stops when CNC is reset, and the operation axis

decelerates then stops.

The CNC is reset during performing the M, S, T function, the MF, SF and TF signals are set to 0 within 16ms.

RST (F001 #1)

[Type] Output signal

[Function] PLC and CNC is already reset, this signal is used for treating the PLC reset.

[Output condition] This signal is set to 1 based upon the following conditions:

1. ESP signal is set to 1.
2. Press the <RESET> key on MDI.

This signal is set to 0 in the following case:

After the abovementioned conditions are released, and then the CNC is reset. The reset signal output time set by parameter No.203 has been ended.

Signal address

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

5.3 Program test

Brief: The automatic operation detection should be firstly performed before machining, which is tested whether the generated program is correct. When the machine does not operate, the detection is performed by the change viewing the position display or the actual operation machine tool.

5.3.1 Machine Tool Lock

Brief: Do not move the change of the machine tool monitoring position display.

When all axes of the machine tool lock signal MMLK is set to 1, stop to output pulse to the servo motor during manual or Auto operation, but the code distribution is still performed, and the absolute and relative coordinates are also renovated. So, the operator can check whether the code compilation is correct viewing the change of the monitor position.

The machine tool lock detection signal of all axes

MMLK (F004 #1)

[Type] Output signal

[Function] The machine lock signal state of all axes of the PLC

[Output condition] When the signal is set to 1, the machine tool lock signal of all axes is set to 1.

When the signal is set to 0, the machine tool lock signal of all axes is set to 0.

Signal address

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

5.3.2 Dry Run

Brief: The dry run is only enabled to the automatic operation. The machine operates with the constant feedrate instead of performing the one defined in the program. The feedrate is set by data parameter P86.

This function is used for checking the move of the machine tool when the machine tool does not install the workpiece.

Signal Dry run signal

DRN (G021 #2)

[Type] Input signal

[Function] Dry run enables.

[Operation] when this signal is set to 1, the machine tool moves based upon feedrate set by dry run. The machine tool moves normally when the signal is set to 0.

Note:

The dry run signal becomes 1 from 0 during the machine operation, and the machine tool operation speed is the one of the dry run, which is accelerated or decelerated by programming specified speed; when the dry run signal becomes 0 from 1, the machine tool operation speed is accelerated or decelerated to the programming specified speed by the dry run speed.

Signal address

	#7	#6	#5	#4	#3	#2	#1	#0
G021						DRN		

5.3.3 Single Block

Brief: The signal block operation is only enabled to the automatic operation.

When the single block signal (SBK) is set to 1 during the automatic operation; the CNC enters into the automatic operation and stops after the current block is executed. In the sequence automatic operation, the CNC enters into the automatic operation and stops after each block in the program is performed. The automatic operation is performed again when the single block signal (SBK) is set to 0.

Signal: Single block signal

SBK (G021 #1)

[Type] Input signal

[Function] Single block enables.

[Operation] Perform the single block operation when this signal is set to 1.
Perform the normal operation when this signal is set to 0.

Single block detection signal

MSBK (F004 #3)

[Type] Output signal

[Function] PLC single block signal state

[Motion] The signal is set to 1 in the following condition:
—— When the single block signal SBK is set to 1.
The signal is set to 0 in the following condition:
—— When the single block signal SBK is set to 0.

Note:

1. The operation in the thread cutting

The SBK signal becomes 1 during the thread cutting, the operation is stopped after the thread cutting code is performed before the 1st non-thread cutting block.

2. The operation in the canned cycle

The SBK (when it is set to 1) signal is stopped during the canned cycle instead of the EOB when the positioning approaches to the drilling and tool-retraction each time. SPL signal becomes 1 when it is set to 0, which means that it is not performed to the EOB. STL and SPL signals are became 0 and stopped when a block is performed.

Signal address

	# 7	# 6	# 5	# 4	# 3	# 2	# 1	# 0
G021							SBK	
F004					MSBK			

5.4 Skip Optional Block

Brief: In the Auto operation, when a slash is specified at the beginning of the block, and when the skip optional block signal BDT is set to 1, this block is then ignored.

Signal: The signal of skip optional block

BDT (G021#0)

[Type] Input signal

[Function] Select whether the block with “/” is ignored.

[Motion] In the Auto operation, the block with “/” is ignored when BDT is set to 1; the program is performed normally when BDT is set to 0.

The detection signal of skip optional block

MBDT (F004#0)

[Type] Output signal

[Function] The state of PLC skip optional block BDT

Signal address

	# 7	# 6	# 5	# 4	# 3	# 2	# 1	# 0
G021								BDT
F004								MBDT

5.5 Program Restart

Brief: The program can be restarted the block from the specified sequence number, after the tool is damaged or had a rest then stopped. This function also can be used for the rapid program detection function.

Signal: The signal of program restart

SRN<G021#6>

[Type] Input signal

[Function] Selection program restarts

[Operation] When the program restart signal is set to “1” for searching the sequence number of the restart block; the CRT screen shifts to the program restart screen. When the program restart signal is set to “0”, and the automatic operation is enabled, the machine tool moves to the machining restart point with the dry run speed in turn based upon the setting of the axis sequence. The machining restarts after the machine tool moves to the restart point.

The signal in the program restart

SRNMV<F002#4>

[Type] Output signal

[Function] It means that the program is being started.

[Output condition] This signal becomes 1:

- When the G21 #6 is set to 1 in the Auto state, the program restart signal is set to 1.

When this signal becomes 0:

- Program restart sequence end (all of the controllable axis from the machine are moved to the restart point)

Signal address

	# 7	# 6	# 5	# 4	# 3	# 2	# 1	# 0
G021		SNR						
F002				SRNM				

CHAPTER SIX FEEDRATE CONTROL

6.1 Rapid Traverse Rate

Brief: 4-gear override (F0, 25%, 50% and 100%) can be used for the rapid traverse rate.

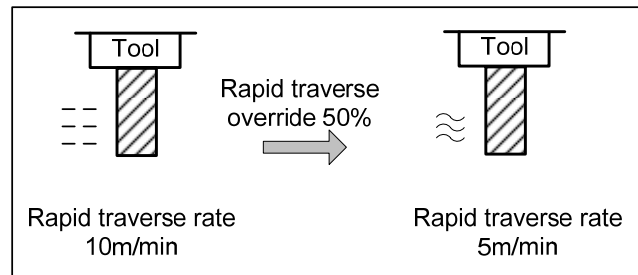


Fig. 6-1

Feedrate: The actual move speed is gained from which the setting value of the parameter P088~092 multiplies the override value, regardless in the Auto or manual operation (it consists of the manual reference position return and program zero return).

F0 speed: It is determined by parameter P093

Signal: The signal of the rapid traverse rate

Rapid F0 (G025#0)

Rapid F25% (G025#1)

Rapid F50% (G025#2)

Rapid F100% (G025#3)

[Type] Input signal

[Function] It is the rapid traverse override signal.

The code detection signal of the rapid traverse override (G11#0~G11#1)

[Type] Input signal

[Function] It is the code detection signal of the rapid traverse override

[Operation] The code signal corresponding with the following override

Code signal at the rapid traverse rate

RV1	RV2	Override value
0	0	100%
0	1	50%
1	0	25%
1	1	0%

6.2 Feedrate Override

Brief: The override disk can be selected to increase or decrease the programming feedrate by the percentage. This character is used for the programming detection. For example, when the specified feedrate in the program is 100mm/min, the override is set to 50%, the machine is then moves at the speed of 50mm/min.

Signal GSK218MC integration CNC system:

- Feedrate FOV1 (X31.3)
- Feedrate FOV2 (X31.4)
- Feedrate FOV4 (X31.5)
- Feedrate FOV8 (X31.6)
- Feedrate FOV16 (X31.7)

[Type] Input signal
[Function] Cutting feedrate override signal. Totally 21 gear from 0% to 200%.
[Motion] In the Auto operation, the specified speed by the cutting feed multiplies the override value selected by this signal, which gains the actual feedrate.

GSK 218MC-H and GSK 218MC-V CNC system:

Code detection signal of the feedrate override (G011#3~G011#7)

[Type] Input signal
[Function] The cutting feedrate rate signal has five binary system code signals corresponding with its override:
So, the override can be selected based upon the unit of the 10% within the range of the 0~200%.
Note: The feedrate both 218MC-H and 218MC-V are controlled by the feed brand switch.

6.3 Override Cancellation

Brief: The feedrate override is fixed on 100% by the override cancellation signal.

Signal Override cancellation signal

OVC (G024#1)

[Type] Input signal
[Function] The feedrate override is fixed on 100%.
[Operation] The CNC operation is shown below when the signal is set to 1:
The feedrate override is fixed on 100% regardless of the feedrate override signal.
No affection in the rapid traverse override and spindle speed override.

Signal address

	#7	#6	#5	#4	#3	#2	#1	#0
G024							OVC	

CHAPTER SEVEN MISCELLANEOUS FUNCTION

7.1 M Code Miscellaneous Function

Brief: M code miscellaneous function When the registered M code is operated, the register signal (F026.0~F033.7) and the strobe signal are sent to the PLC, PLC is started or cut off its relative functions by these signals.

Basis processing

These signals are used for the following functions:

Table 7-1-1

Function	Program address	Output signal		Response signal	End signal
		Register signal	Strobe signal		
M code miscellaneous function	M**	M** (F026#0~F033#7)	MF (F007 # 0)	MRESP (G063#0)	FIN(G000#0) MFIN(G000#1)

(1) It is supposed that the MXX is specified in the program (Suppose the register signal is FYYY.Y) As for the MXX, if the user does not register it, the alarm may occur. User specify a unique F signal registering this M code to the system, that is, the code signal from F26 to F33.

(2) If the non M, S and T codes, such as the movement and dwell, are specified with the miscellaneous function at the same time, the miscellaneous function is then simultaneously performed. Multiple codes of the miscellaneous function are specified in a block, its codes may perform in sequence.

(3) When the MXX is performed, the register signal FYY.Y and the strobe signal F007#0 are set to 1, simultaneously, ensuring the PLC sets the response signal RESP(G063#0) to 0.

(4) PLC is set the end signal MFIN (G000#1) and FIN (G000#0) to 1 when the operation is performed. If these functions, namely, the M, S and T code miscellaneous functions are performed simultaneously, the end signal FIN(G000#0) can be set to 1 till all of these functions are executed.

(5) When the MXX is completed, ensuring the PLC is set the response signal MRESP (G63#0) to 1.

(6) M, S and T codes may be performed simultaneously in a block. The CNC can be performed next block after affirming the end signal FIN is set to 1.

7.2 S Code Miscellaneous Function

Brief: When the S code is performed, the I/O point or analog value control can be set by the bit 2 of the bit parameter No: 1

The basis processing of the spindle S code I/O point control:

Table 7-2-1

Function	Program address	Output signal		Response signal	End signal
		F address signal	Strobe signal		
S code miscellaneous function	S*	S* (F22)	TF (F007 # 2)	SRESP (G63#1)	FIN(G00#0) SFIN(G00#4)

S code miscellaneous function explanations are shown below:

(1) It is supposed that SX is specified in the program:

The range of the X is 1~8, the system may alarm if it exceeds its range. S1~S8 separately corresponds to the F address signal F22#0~#7. (For example, S1 corresponds to the F address signal F22#0).

(2) If the non M, S and T codes, such as the movement and dwell, are specified with the miscellaneous function at the same time, the miscellaneous function is then simultaneously performed.

(3) When the S1 is performed, the F address signal F22#1 and the strobe signal F007#2 are set to 1, simultaneously, ensuring the PLC sets the response signal RESP(G063#1) to 0.

(4) PLC is set the end signal SFIN (G00#4) and FIN (G00#0) to 1 when the operation is performed. If these code miscellaneous functions, namely, M, S and T, are performed simultaneously, the end signal FIN (G00#0) can be set to 1 till all of these functions are executed.

(5) When the S1 is completed, ensuring the PLC is set the response signal SRESP (G63#1) to 1.

(6) M, S and T codes may be performed simultaneously in a block. The CNC can be performed next block after affirming the end signal FIN is set to 1.

The basic processing of the spindle S code analog value:

Table 7-2-1

Function	Program address	Output signal		The signal completion of the shift	Response signal	End signal
		F address signal	Strobe signal			
S code miscellaneous function	S****	S** (F034#0~#2)	TF (F007 # 2)	GRAR (G002#4)	SRESP (G063#1)	FIN(G000#0) SFIN(G000#4)

The S code miscellaneous function explanations are shown below:

(1) It is supposed that the SXXXX is specified in program: (The state of F34#0~#2 is determined by parameter P246~248, and PLC can be performed the processing of the gear step change by this signal, for example, the parameter P246 is set to 1000, and S500 executes).

(2) If the non M, S and T codes, such as the movement and dwell, are specified with the miscellaneous function at the same time, the miscellaneous function is then simultaneously performed.

(3) When the S500 is performed, the F address signal F34#0 and the strobe signal F007#2 are set to 1, simultaneously, ensuring the PLC sets the response signal SRESP(G063#1) to 0

(4) The PLC is set the gear shift signal GRAR (G002#4) is set to 1 when the gear shift is completed.

(5) PLC is set the end signal SFIN (G000#4) and FIN (G000#0) to 1 when the S code miscellaneous function is performed. If these code miscellaneous functions, namely, M, S and T, are performed simultaneously, the end signal FIN (G000#0) can be set to 1 till all of these functions are executed

(6) When the S500 is completed, ensuring the PLC is set the response signal SRESP (G063#1) to 1.

(7) M, S and T codes may be performed simultaneously in a block. The CNC can be performed next block after affirming the end signal FIN is set to 1.

7.3 T Code Miscellaneous Function

Brief: T code miscellaneous function: T code should be used with the M code together, for example: T06M06;

When the T code is performed, the data address (D241) and the strobe signal are sent to PLC, and PLC starts or cut off its relative functions using these signals.

Basis process

These signals are used for the following functions

Table 7-3-1

Function	Program address	Output signal		Response signal	End signal
		Data address	Strobe signal		
T code miscellaneous function	T**	T** (D241)	BF (F007 # 3)	SRESP (G63#2)	FIN(G00#0) TFIN(G00#5)

- (1) It is supposed that the TXX (XX is sent to the data address D241) is specified in the program:
- (2) If the non M, S and T codes, such as the movement and dwell, are specified with the miscellaneous function at the same time, the miscellaneous function is then simultaneously performed. Multiple codes of the miscellaneous function are specified in a block, its code will be performed in sequence.
- (3) The strobe signal F007#3 is set to 1 when performing TXX.
- (4) The end signal TFIN (G000#5) and FIN (G000#0) are set to 1 by PLC when the operation is completed. If these functions, namely, the M, S and T code miscellaneous functions are performed simultaneously, the end signal FIN(G000#0) can be set to 1 till all of these functions are executed.
- (5) M, S and T codes may be performed simultaneously in a block. The CNC can be performed next block after affirming the end signal FIN is set to 1.

Signal It is the register signal of the M code miscellaneous function

M00~M99 (F026~F033)

The strobe signal of M code miscellaneous function

MFEFD (F007 # 0)

[Type] Output signal

[Function] These signals are specified the miscellaneous function of the PLC.

[Output condition] Refer to explanation of the “M code miscellaneous function in Section 7.1” for the output condition and execution process.

Note 1: The following miscellaneous function can be treated in the CNC: they can not be outputted even if they are specified in the program:

- * M98, M99
- * The M code for calling subprogram
- * The M code for calling the user macro program

Note 2: The encoding signal also can be outputted other than the code signal and strobe signal in the following miscellaneous function.

M00, M01, M02, M30

Note 3: The M codes from the M00 to M39 can be supplied based upon the binary encoding.

For example: M5 is corresponding to the 00000101

M encoding signal

DM00 (F009#7)

DM01 (F009#6)

DM02 (F009#5)

DM30 (F009#4)

[Type] Output signal

[Function] These signals are shown that the miscellaneous function has been specified actually. The corresponding table between miscellaneous function and output signal in the program code are shown below:

Table 7-3-2

Program code	Output signal
M00	DM00
M01	DM01
M02	DM02
M30	DM30

[Output condition] The M encoding signal is set to 1 when the following conditions are described.

- Specify the corresponding miscellaneous function, and any specified move command and dwell code is completed at the same block. However, when the end signal of the miscellaneous function returns before the move code and dwell code, these signals are then not outputted.

The M encoding signal bit is 0 when the following conditions are performed:

- FIN signal bit is 1.
- When it is reset.

The end signal of M code miscellaneous function

MFIN<G000#1>

Response signal of M code miscellaneous function

MRESP<G063#0>

[Type] Input signal

[Function] It means that the M code miscellaneous function is completed.

[Operation] Refer to the “M code miscellaneous function in Section 7.1” for the treatment and process in the control unit.

The strobe signal of S code miscellaneous function

TF (F007#2)

[Type] Output signal

[Function] These signals are shown that the spindle speed function has been specified actually.

[Output condition] Refer to the “S code miscellaneous function in Section 7.2” for the output condition and performance process.

The end signal of S code miscellaneous function

SFIN<G000#4>

The response signal of S code miscellaneous function

SRESP<G063#1>

[Type] Input signal

[Function] It means that the S code miscellaneous function is completed.

[Operation] Refer to the “S code miscellaneous function in the Section 7.2” for the treatment and

performance process of the unit.

Tool function strobe signal

BF (F007 #3)

[Type] Output signal

[Function] These signals are shown that the tool function has been specified actually.

[Output condition] Refer to the "T code miscellaneous function in Section 7.3" for the output condition and performance process.

Tool function end signal

TFIN<G000#5>

[Type] Input signal

[Function] It means that T code miscellaneous function is completed.

[Operation] Refer to the "T code miscellaneous function in Section 7.3" for the treatment and performance of the control unit.

Miscellaneous function end signal

FIN (G000 #0)

[Type] Input signal

[Function] This signal shows the end of the M, S and T code miscellaneous functions.

[Operation] When this signal is 1, refer to the explanations in Section 7.1, 7.2 and 7.3 for the operation and treatment of the control unit.

Caution

All of these functions abovementioned are shared with one end signal FIN (G000#0); this signal should be set to 1 after the overall functions are completed.

Signal address

	#7	#6	#5	#4	#3	#2	#1	#0
G000			TFIN	SFIN			MFIN	FIN
G063							SRESP	MRESP
F007					BF	TF		MF
F009	DM00	DM01	DM02	DM30				

7.4 Miscellaneous Function Lock

Brief: It is forbidden to perform the specified M, S and T functions. This function is used for detecting the program even if the code signal and strobe signal are not output.

Signal: Miscellaneous function lock signal

AFL (G021 #3)

[Type] Input signal

[Function] This signal selects the miscellaneous function lock. That is, this signal is not permitted to perform the specified S, T and partition M functions.

[Motion] When the signal is set to 1, the functions of the control unit are shown below:

1. As for the Auto, DNC and MDI operations, the control unit does not perform the specified M, S and T functions, namely, the code and strobe signals are not output.
2. This signal is set to 1 after the code signal is output, normally, perform the output operation till it ends. (to the manual FIN signal, and the strobe signal is set to 1.)
3. The miscellaneous functions, for example, M00, M01, M02 and M03 can be performed, even if this signal is set to 1. The overall code, strobe and encoding signals are output based upon the normal method.
4. The miscellaneous functions M98 and M99 can be performed based upon the normal method, even if this signal is set to 1, however, the performance result does not output in the control unit.

Caution: The spindle analog output is still performed even if this signal is set to 1.

The detection signal of miscellaneous function

MAFL (F004#4)

[Type] Output signal

[Function] This signal indicates the state of the miscellaneous function lock signal.

[Output condition] The miscellaneous function lock signal AFL is 1 when this signal is set to 1.
The miscellaneous function lock signal AFL is 0 when this signal is set to 0.

Signal address

	# 7	# 6	# 5	# 4	# 3	# 2	# 1	# 0
G021					AFL			
F004				MAFL				

CHAPTER EIGHT SPINDLE SPEED FUNCTION

8.1 Spindle Speed Control Method

Brief: GSK218MC divides the spindle into gear spindle and analog spindle based upon the control method.

1. In the gear spindle, the CNC controls the spindle speed by which the S code turns into switch value and then outputs to the spindle.
2. In the analog spindle, the CNC controls the spindle speed by which the S code turns into analog value and then outputs to the spindle.

The I/O point or analog value control can be set by bit 2 of bit parameter No.1.

8.1.1 Gear Spindle

Brief: The gear spindle means that the spindle S code is controlled by I/O.

Signal

Spindle speed strobe signal

TF (F007#2)

Gear spindle address signal

F22#0~F22#7

[Type] Output signal

[Function] These signals have been indicated that the specified spindle speed function has been performed actually.

[Output condition] Refer to the "S code miscellaneous function in Section for spindle S code I/O point control" for the output condition and performance process.

Note: S code range: S1~S8, the alarm may occur if it exceeds its range, S1~S8 are separately corresponding with the F address signal F022#0~#7. User can refer to three gears (S1, S2 and S3) of the configured ladder diagram from the system. So, S4~S8 can not be used, the corresponding ladder diagram should be added if the user needs.

8.1.2 Analog Spindle

Brief: Analog spindle is that the spindle speed is controlled by the analog voltage value of the CNC. CNC can be controlled the spindle speed of which the S code turns into the analog voltage value outputting to the machine's spindle.

Actual output analog voltage value = spindle controlled S value x spindle override.

Signal GSK218MC integration CNC system:

Spindle override SOV1 (X31.0)

Spindle override SOV2 (X31.1)

Spindle override SOV4 (X31.2)

[Type] Input signal

[Function] This signal specifies that the spindle controls the override change of the S value.

GSK 218MC-H and GSK 218MC-V CNC system:**Spindle override code detection signal (G019#0~G019#2)**

[Input] Input signal

[Function] It is the spindle override code detection signal

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%.

Notice: The spindle speed override function in the tapping cycle and thread cutting is disabled.

Gear shift treatment

Although the S code is spindle speed, its actual controlled member is spindle motor, and therefore, the CNC should be affirmed the corresponding relations between spindle motor speed and gear. The CNC selects the gear shift based upon the defined speed range of each gear shift in advance, as it is directly selected by S code. The PLC can be selected the corresponding gear shift using its selection signal (GR3, GR2 and GR1). Simultaneously, the CNC outputs the spindle motor speed based upon the selected gear shift. Specify the S0~S99999 and CNC output corresponding codes with the spindle speed in the MDI operation. Two or three speed gear shifts (GR1, GR2 and GR3) can be set by parameter No.246~248, and then the gear shift selection signal can be output at the same time. When the gear shift selection signal changes, the SF signal is simultaneously output.

The meaning of the gear shift signal is shown below:

Table 8-1-2-1

	the 2 nd gear	the 3 rd gear	Remark
GR1	Low	Low	Low: Low speed gear
GR2	High	Middle	Middle: intermediate speed gear
GR3		High	High: high speed gear

- When the code voltage is 10V, spindle speed A at low speed shift (Parameter No246) (min^{-1})
- When the code voltage is 10V, spindle speed B at the high speed shift (Parameter No.247) (min^{-1}) (Medium speed gear at the 3rd gear).
- When the code voltage is 10V, spindle speed C at the high speed shift (Parameter No.248) (min^{-1}) (the 3rd gear).

S code command is performed with the spindle motor speed code voltage (0~10V) and the gear shift selection signal.

The relationships among the GR1, GR2 and GR3 are shown above:

Signal: Gear shift selection signal**GR1,GR2,GR3****<F034#0~#2>**

[Type] Input signal

[Function] These signals are informed the gear shift selected by PLC.

[Output condition] Refer to the gear shift method for the explanation of these signals.

Gear shift selection signal (Input)**GR1,GR2,GR3<G002#0~#2>**

[Type] Input signal

[Function] These signals are informed the current selected gear shift of the CNC.

[Output condition] Refer to the gear shift method for the explanation of these signals.

Gear shift in-position signal

GEAR<G002#4>

[Type] Input signal

[Function] These signals that are informed the current selected gear shift of the CNC has been performed its in-position.

[Output condition] Refer to the gear shift method for the explanation of these signals.

Signal address

	#7	#6	#5	#4	#3	#2	#1	#0
G002				GEAR		GR3	GR2	GR1
G022			SPOV	OVC	SMOV			
F007						TF		
F034						GR3	GR2	GR1

8.2 Rigid Tapping

Brief: The rigid tapping is synchronized the tapping axis and spindle axis in the common tapping canned cycle.

The CNC needs to detect the rotation direction signal of the spindle ensuring the direction and processing of the cutting feed during the rigid tapping (during performing G74 and G84).

Performance processing:

Spindle rotates → Z axis feed tapping → sending the M05 stop code to spindle → after the spindle is absolutely stopped → sending a reverse code → Z axis retracts to the start → spindle stops

The corresponding ladder diagram should be compiled for carrying out the rigid tapping; inform the rotation direction of the CNC external spindle.

Signal: Rigid tapping signal

RGTAP (G003#1)

[Type] Output signal

[Function] That this signal informs PLC has been in the mode of the rigid tapping.

[Output condition] RGTAP 1: It is rigid tapping mode at present.
0: It does not tapping mode at present.

Signal address

	#7	#6	#5	#4	#3	#2	#1	#0
G003							RGTAP	

CHAPTER NINE PROGRAMMING CODE

9.1 User Macro Program

Brief: It is very essential to perform the same operation repeatedly for the subprogram, but the variable, arithmetic, calculation, logic operation and condition branch can be used for the user macro program function, which is very easy to develop the current program. The machining program can be called the user macro program by a simple code, as the calling of the subprogram.

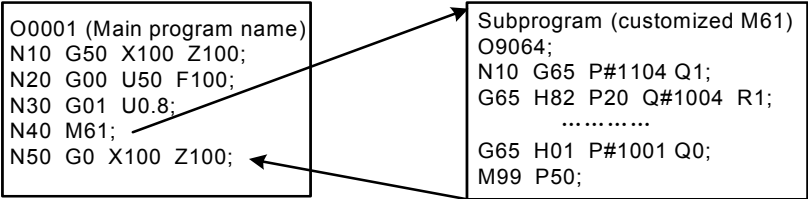


Fig. 9-1-1

It means that one function is programmed by the user macro, which becomes the general function. Namely, the data variable (changeable and undefinition data) can be compiled the program. For example, the user macro program can be used for the composed technology.

Signal: User macro program input signal

UI000~UI015 (G054, G055)

[Type] Input signal

[Function] Do not offer any function to the controllable unit. These signals are regarded as one of the system variable, which is read by the macro program, and it is used for the interface signal between macro program and PLC.

The corresponding system variables of these signals are shown below:

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 the variable of the 16-bit, which is composed 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

User macro program output signal

UO000~UO015

(F054~F055)

UO100~UO131

(F056~F059)

[Type] Output signal

[Function] Do not offer any function to the controllable unit. These signals are regarded as a kind of variable which is read or written by the user macro program, and it is used for the interface signal between macro program and PLC.

The corresponding system variables of these signals are shown below:

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 the variable of the 16-bit, which is composed 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

9.2 Canned Cycle

Brief: Canned cycles can be simplified the program. With a canned cycle, a frequently-used machining operation can be specified in a single block with a G function; without canned cycles, normally more than one block is required. In addition, the use of canned cycles can shorten the program to save memory.

Explanations: A canned cycle consists of a sequence of 6 operations:

Operation 1 Positioning a hole position

Operation 2 Rapid traverse up to Point R level

Operation 3 Hole machining

Operation 4 Operation at the bottom of a hole

Operation 5 Retraction to point R level

Operation 6 Rapid traverse up to the initial point

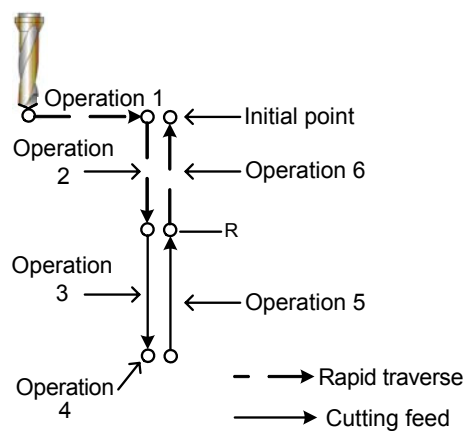


Fig. 9-2-1 Canned cycle operation sequence

Spindle control: Output the spindle code of the reverse rotation in some canned cycle.

The following canned cycles are required the spindle control:

Reverse tapping cycle G74 Fine boring cycle G76

Tapping cycle G84 Boring cycle G86

Counter boring cycle G87 Boring cycle G88

Using the frequently-used miscellaneous functions for the spindle control:

Refer to the miscellaneous function explanations.

M03: Spindle positive

M04: Spindle negative

M05: Spindle stop

M19: Spindle orientation

Tapping signal: Output the tapping signal during the tapping cycle. The tapping signal also can be output when tapping cycle G code is enabled.

Override: The cutting feed override is always set to 100% during tapping.

Feed hold: The move may not stop immediately during tapping when pressing the feed hold key. The move stops when the tool returns to the R panel.

Dry run: Whether the dry run is enabled during the TDR (bit 5 of parameter No.12) defines tapping.

Signal: Tapping signal

TAP<F001 # 5>

[Type] Output signal

[Function] It informs that the system is in the tapping mode.

[Output condition] This signal is 1:

- When the system is in the tapping cycle mode G74 and G84
- When the system is in the tapping mode G63.

This signal is 0:

- When the system is neither in the tapping cycle mode nor in the tapping mode
- When the reset or ESP signal is input

Signal address

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

CHAPTER TEN DISPLAY/SETTING

10.1 Clock Function

Brief: The Year, Month and Day are displayed on the setting screen.
The system variable of the user macro program can be read the time.
Read and write can be performed for the time information.

10.2 Display the Operation Record

Brief: This function can be displayed the current error. Operator performs the history records to the MDI key and signal when the alarm occurs.

10.3 Help Function

Brief: The CNC alarm and the details of the CNC operation can be displayed on the screen using the help function.

Detailed information of alarm: The help screen displays the generated alarm and that how to release the alarm information. However, the information from the P/S alarm is displayed, which is easy to be distorted or misunderstood.

CHAPTER ELEVEN MEASURING

11.1 Skip Function

Brief: Linear interpolation can be commanded by specifying axial move following the G31, like G01. If an external signal is input during the execution of this command, execution of the command is interrupted and the next block is executed.

The skip function is used when the end of measuring is not programmed but specified with a signal from the machine, for example, in 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 in a custom macro because they are stored in the custom macro system variable #5016~#5019, as follows:

- #5016 X axis position of EOB
- #5017 Y axis position of EOB
- #5018 Z axis position of EOB
- #5019 4th axis position of EOB

Signal: Special signal

SKIPP <G001#1>

[Type] Input signal

[Function] This signal completes the skip cutting. Namely, the position of skip signal turns into "1", which is stored in the user macro variable, simultaneously, the move code of the block is ended.

[Operation] The controllable equipments are shown in the following when the skip signal turns into "1":

- When the block consists of the skip machining code G31, the current position of the code axis when the control equipment is read and stored the signal that it is set to 1. The control equipment stops the move of the axis, and then, clear the remaindering move distance of this block code axis.
- The state of the skip signal is monitored instead of its rising edge. In this case, if the skip signal is still "1", it is regarded as the skip condition is met immediately when next skip cutting is commanded.

Note: The requirement of the skip signal width is at least 10ms.

Signal address

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

CHAPTER TWELVE PANEL LOCK SETTING

Signal: Program edit locking signal

LEDT (G016#6)

[Type] Input signal

[Function] This signal locks the edit function of the program.

[Operation] The program edit function is enabled when signal is set to 1.
 The program edit function is disabled (The program can not be compiled) when the signal is set to 0.

The operation panel lock signal

LSYS (G016#7)

[Type] Input signal

[Function] This signal locks the button on machine’s operation panel.

[Operation] The overall button on the machine’s operation panel is locked and disabled when the signal is set to 1.
The machine operation button is enabled when the signal is set to 0.

Signal address

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

APPENDIX ONE ADDRESS BETWEEN PLC and CNC

1: CNC → PLC addresses: F000 ----- F064

Appendix list -1

Signal	Symbol	Address
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	SAR	F001#3
Spindle enabling signal	ENB	F001#4
Tapping signal	TAP	F001#5
Rigid performance signal	DTAP	F001#6
G63 tapping signal	MTAP	F001#7
Thread cutting signal	THRD	F002#3
Program start signal	SRNMV	F002#4
Cutting feed signal	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 manual data input	MMDI	F003#3
Affirmance signal of DNC operational selection	MRMT	F003#4
Detection signal of Auto operational selection	MMEM	F003#5
Detection signal of register Edit selection	MEDT	F003#6
Detection signal of mechanical zero return selection	MZRO	F003#7
Detection signal of skip optional block	MBDT	F004#0
Detection signal of overall axes machine lock	MMLK	F004#1
Detection signal of single block	MSBK	F004#3
Auxiliary function lock signal	MAFL	F004#4
Detection of manual reference position return	MREF	F004#5
Detection signal of feed override cancellation	CFORD	F005#0
Detection signal of spindle override cancellation	CSORD	F005#1
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
External operation panel lock	LOPT	F008#0
Hard limit ignorance	LALM	F008#1
ESP signal ignorance	EALM	F008#2
Tool change in performing	RCT	F009#0
System type selection signal	CNCS	F010#0

(0:218MC-H/-V, 1:218MC integration)		
Performance signal of syntactic detection	SCHK	F010#1
Spindle speed arrival signal	SAR	F011#0
Spindle speed detection signal	ZSP	F011#1
The completion signal of spindle orientation	COIN	F011#2
The completion signal of speed/position shift	VPO	F011#3
End signal of axis zero point return	ZP1 --- ZP5	F016#0 --- #4
Axis movement signal	MV1 --- MV5	F017#0 --- #4
System controllable number 1	AXIS1	F018#0
System controllable number 2	AXIS2	F018#1
System controllable number 4	AXIS4	F018#2
System controllable number 8	AXIS8	F018#3
Axis movement direction signal	MVD1 --- MVD5	F019#0 --- #4
The 4 th axis index worktable releasing signal	BUCLP	F020#0
The 4 th axis index worktable clamping signal	BCLP	F020#1
Limit overtravel alarm along -X axis	AL-X	F021#0
Limit overtravel alarm along + X axis	AL+X	F021#1
Limit overtravel alarm along - Y axis	AL-Y	F021#2
Limit overtravel alarm along + Y axis	AL+Y	F021#3
Limit overtravel alarm along - Z axis	AL-Z	F021#4
Limit overtravel alarm along + Z axis	AL+Z	F021#5
Limit overtravel alarm along - 4 th axis	AL-4	F021#6
Limit overtravel alarm along + 4 th axis	AL+4	F021#7
Gear controllable signal of spindle I/O point	SCODE1---SCODE5	F022
Register signal of M code M.S.T function	M**	F026 --- F033 (The address can be registered in M register table, refer to the Section 3.5 in the <i>Chapter Three Operation</i>)
The signal of spindle analog value control gear selection	GR1, GR2, GR3	F034#0 --- #2
End signal of axis returning to the 1 st reference position	ZP11---ZP14	F041#0 --- #3
End signal of axis returning to the 2 nd reference position	ZP21---ZP24	F042#0 --- #3
End signal of axis returning to the 3 rd reference position	ZP31---ZP34	F043#0 --- #3
End signal of axis returning to the 4 th reference position	ZP41---ZP44	F044#0 --- #3
The detection signal in the 2 nd reference position along Z axis	AQ1	F045#0
The detection signal in the 3 rd reference position along Z axis	AQ2	F045#1
The detection signal in the 4 th reference position along Z axis	AQ3	F045#2
User macro program output signal	UO000 --- UO015 U100 --- U131	F054,F055 F056 --- F059
The established reference position signal	ZRF1 ---- ZRF5	F060#0 --- #4
The arrival signal of the required component	ESEND	F061#1
The performance signal of axis returning to the reference position	ZRFJ1 ---- ZRFJ5	F061#2 --- #6

The following parameters are performed at the high speed and in the accuracy mode:		
High speed card scan counter		F300
Pulse accumulation along the 1 st axis of high speed card		F301
Pulse accumulation along the 2 nd axis of high speed card		F302
Pulse accumulation along the 3 rd axis of the high speed card		F303
Pulse accumulation along the 4 th axis of the high speed card		F304
Pulse accumulation along the 5 th axis of the high speed card		F305
Pulse accumulation spindle of high speed card		F306
Error alarm		F307
Error alarm		F308
Buffer area dimension of interpolation point		F309
Numbers of fitting point		F310
Numbers of controllable point		F311
Times of the completion of the task		F312
Buffer area dimension of the ARM control		F313
Symbol of task completion		F314
Signal catch		F315
Signal catch		F316
DSP alarm information		F317

APPENDIX TWO The ADDRESS of PLC→CNC: G000 ----- G064

Appendix list -2

Signal	Symbol	Address
Miscellaneous function end signal	FIN	G000#0
End signal of M code miscellaneous function	MFIN	G000#1
End signal of S code miscellaneous function	SFIN	G000#4
End signal of T code miscellaneous function	TFIN	G000#5
ESP signal	ESP	G001#0
Skip signal	SKIPP	G001#1
Gear selection signal (input)	GR1,GR2, GR3	G002#0 --- #2
Gear shift in-position signal of spindle analog value control	GEAR	G002#4
Rigid tapping signal	RGTAP	G003#1
Interruption signal of user macro program	UINT	G009#1
Encode signal of rapid override	RV0 --- RV1	G011#0 --- #1
Rapid override encode signal 1, 2, 4, 8 and 16	FV1, FV2, FV4, FV8, FV16	G011#3 --- #7
Overtravel signal	*+L1 --- *+L5 *-L1 ---- *-L5	G012#0 ---- #4 G013#0 ---- #4
Editing lock signal	LEDT	G016#6
Operation panel lock signal	LSYS	G016#7
Detection signal of zero return deceleration		G017#0 ---- #4
Additional axis selection	AXIS1, AXIS2, AXIS4, AXIS8	G018#0 ---- #4
Detection signal of spindle override encode	SV1, SV2, SV4, SV8	G019#0 ---- #3
Edit mode		G020#0
Auto mode		G020#1
MDI mode		G020#2
Zero return mode		G020#3
Single step mode		G020#4
Manual mode		G020#5
MPG mode		G020#6
DNC mode		G020#7
Skip		G021#0
Single block		G021#1
Dry run		G021#2
M.S.T lock		G021#3
Machine lock		G021#4
Selection stop		G021#5
Program restart		G021#6
Spindle positive		G022#0
Spindle stop		G022#1
Spindle negative		G022#2
Spindle – override (218MC all-in-one machine)		G022#3
Spindle override cancellation		G022#4
Spindle + override (218MC all-in-on machine)		G022#5
Spindle JOG		G022#6
Tunnel selection signal		G022#7
Lubrication		G023#0
Cooling		G023#1
Chip-removal		G023#2
Cycle start		G023#6
Feed hold		G023#7
Feed + override (218MC all-in-one machine)		G024#0
Feed override cancellation		G024#1


Feed – override (218MC all-in-one machine)		G024#2
Rapid switch		G024#7
Rapid Fo		G025#0
Rapid 25%		G025#1
Rapid 50%		G025#2
Rapid 100%		G025#3
Increment step length 0.001		G026#0
Increment step length 0.01		G026#1
Increment step length 0.01		G026#2
Increment step length 1		G026#3
MPG step length 0.001		G026#4
MPG step length 0.01		G026#5
MPG step length 0.1		G026#6
Manual feed axis +X		G027#0
Manual feed axis +Y		G027#1
Manual feed axis +Z		G027#2
Manual feed axis +4 th		G027#3
Manual feed axis -X		G028#0
Manual feed axis -Y		G028#1
Manual feed axis -Z		G028#2
Manual feed axis -4 th		G028#3
Spindle orientation		G029#0
Tool magazine zero return		G029#1
Tool clamping/releasing		G029#2
Tool magazine positive		G029#3
Tool magazine negative		G029#4
Tool magazine pivoting		G029#5
Tool magazine retraction		G029#6
Tool changer		G029#7
Overtravel release		G030#0
Interruption signal of user macro program	UINT	G031#1
Spindle stop signal	*SSTP	G032#7
Polarity selection signal of spindle speed command output	SGN	G033#5
Polarity selection signal of spindle speed command	SSIN	G033#6
The completion signal of index working table releasing	BEUCL	G038#6
The completion signal of index working table clamping	BECLP	G038#7
The allowance signal of the 1 st reference position detection		G056#0 ----- #3
The allowance signal of the 2 nd reference position detection	PREF20----PREF23	G057#0 ----- #3
The allowance signal of the 3 rd reference position detection	PREF30----PREF33	G058#0 ----- #3
The allowance signal of the 4 th reference position detection	PREF40----PREF43	G059#0 ----- #3

VOLUME III OPERATION EXPLANATION

CHAPTER ONE PLC INTERFACE DISPLAY

1.1 GSK218MC The Automatic Operation in PLC ON

PLC operates when the system is turned on: the 1st period may use the R510.0 to conduct a period of its network cables, the value of the R510.0 is then reset to “0”; the user can not output this value. The value of the nonvolatile relay is the one of the last output before PLC stops.

Note: The keys inside the < > in the following explanations are panel buttons; the keys inside the 【 】 is the soft button under the screen; 【 】 is the interface corresponding with the current soft key;  means that it includes submenu; all of the PLC operations are performed in the MDI mode, other methods only can be viewed and searched.

1.2 Programmable Interface Display

1.2.1 INFO Interface

1. Enter the programmable page by pressing the <program-controlled> key; enter the INFO interface pressing the **[INFO]** soft key, refer to the fig. 1-2-1-1. Also, it can be set under the PLC interface defining the bit parameter No: 26#6=1, and then enter the INFO interface pressing the <program-controlled> key again. This interface offers some relative information of this system, such as the version number, modification data.

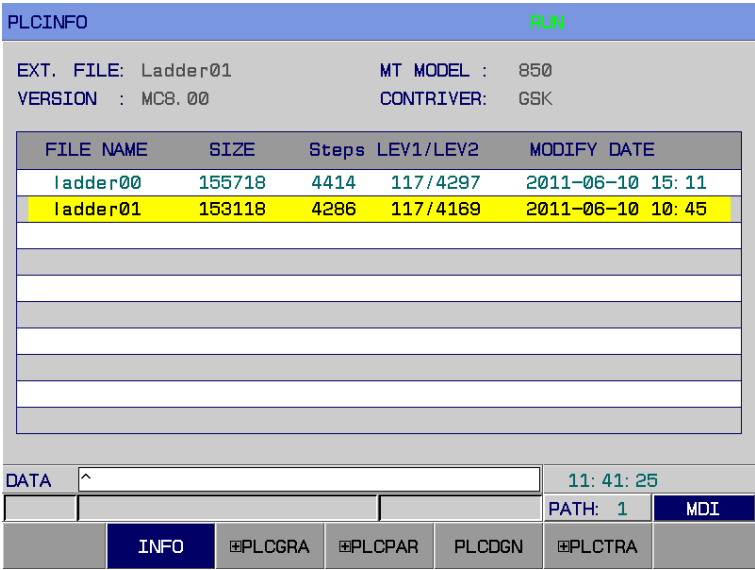


Fig. 1-2-1-1

- (1) The ladder diagram name of current operation is supplied in the interface. The ladder diagram divides into three types: the only one ladder diagram in operating, the rest of 15 ladder diagrams other than the operation of the ladder diagram 0—15 and the other ladder diagrams for compiling and reference (any two numbers can be identified or named other than 0-15).
- (2) The value of the system is set by bit parameter 53#0~#3 when the power is turned on initialization, which is the composed parameter of binary system; the No. 0 ladder diagram is used when this value is set to 0; when this value is set to 1~15, the No. 1~15 ladder diagrams are then used. The ladder diagram file for loading some one number is called operation file

(this operation may cause hazard; it is enabled after restarting when the power is turned off). This file may be deleted to rebuild if the format is incorrect. So, the user should carefully specify the file name of the ladder diagram. The overall file names of the ladder diagram must be "ladderXX.grp" (XX is serial number), otherwise, the files may not be identified by the system. The file format is described by the system, the user can not modify it without the system, otherwise, it may be deleted or can not be identified.

- (3) M6 is separately called the macro program from O91000 to O91015 when the 0~15 ladder diagrams are used.
- (4) The selection of the ladder diagram. The file name can be specified by moving the cursor or inputting the "LX"/"LXX" (X/XX is number). The system may detect whether the X"/"XX is the known file name by pressing the "input" key. If it does not detect, the ladder diagram file should be set up based upon the file name "ladder0X.grp" or "ladderXX.grp". The system may automatically generate two function blocks "END1" and "END2" when the new file is set up, so that the user can consecutively operate this ladder diagram file (The command table remains null if it is converted after opening the file). User can copy or cut the ladder diagram from the normal file (it can not exceeds 100 rows, otherwise, only the previous 100 rows can be performed) pasting to other file, then copy the function (without modification), and then set up a new file. For safety's sake, after the ladder diagram is compiled, the current file may automatically stored when another file is opened; the ladder diagram syntactic may be detected before storing of which it may give up if the incorrect syntax is found.
- (5) The file head includes the basis information of the file such as the line number and step number, wherein, the step information occurs as long as it is converted, otherwise, it always keeps the opening information. User can delete the unopened and unoperated ladder diagram file; this operation is the irreversible operation, so user should be careful. The system may stop the renewal of the ladder diagram network after the user open the unoperated ladder diagram, in order to avoid the misguidance. The operating ladder diagram can only be stored and copied, so that user can copy this information to others ladder diagram files. It is better to stop the operation before compiling the current ladder diagram. When the cursor stops at the background compiling file, user can open the Info information to modify the compiling file background (including the ladder diagram version number, suitable machine and ladder diagram maintainer) by the "modification" key.

1.2.2 PLCGRA Interface

Enter **PLCGRA** interface pressing the **[PLCGRA]** soft key, it also can be set under the PLC interface defining the bit parameter **N0: 26#6=1**, and press the <programmable> key to shift the screen entering the **PLCGRA** interface. Refer to the Fig. 1-2-1:

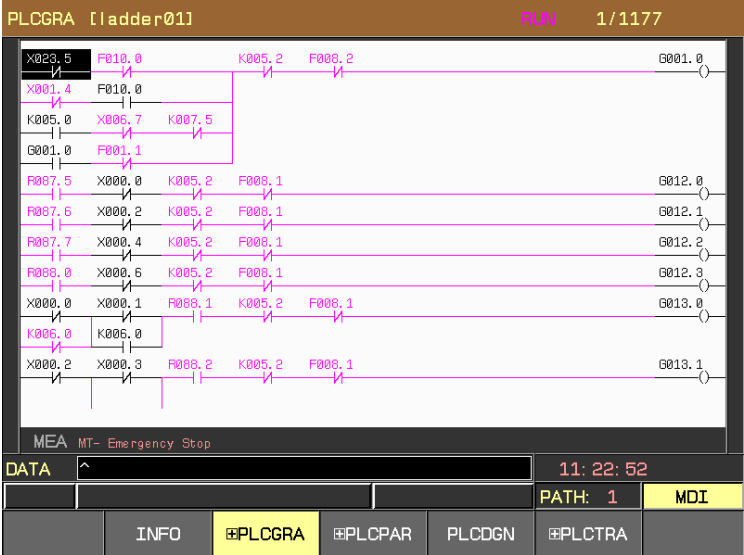


Fig. 1-2-2-1


The content and operation of the PLCGRA interface:

PLCGRA [ladder01]: Operate the current ladder diagram name.

001/1193: It means that the cursor specified place is at the ladder diagram.

Run: Ladder diagram operation state. The operation stage of the ladder diagram includes RUN, STOP and DEBUG.

Figure area: Ladder diagram program

Input: Display the input data. The input data can be enquired pressing the  on the panel.

MEA: The note of cursor positioning node

MDI mode: Current working method (The ladder diagram can be modified only in the MDI mode). The searching and positioning can be performed by the pageup, pagedown and other direction keys, the components then can be viewed and modified.

1.2.3 PLCPAR Interface

Enter **PLCGRA** interface pressing the **[+PLCGRA]** soft key, it also can be set under the PLC interface defining the bit parameter **N0: 26#6=1**, and press the <programmable> key to shift the screen entering the **PLCGRA** interface. Refer to the Fig. 1-2-3-1:

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	^	11:41:06
		PATH: 1 MDI
INFO	PLCGRA	PLCPAR
PLCDGN	PLCTRA	

Fig. 1-2-3-1

The content and operation of the **PLCPAR** interface:

RUN: Operation state of the ladder diagram

ADDR: Nonvolatile/keep relay address

Bit0~Bit7: Bit number state of the nonvolatile relay address

1: It means that this address remains the original state (before the power off);

0: It means that the address is rest to default state after the power is turned off.

Input: Display the input data.

MDI: Current working method. (**Note:** The relative parameters of the **PLCPAR** can be modified as long as in the MID mode.)

The searching and positioning can be performed by the pageup, pagedown and other direction keys, the corresponding address then can be viewed and modified.

1.2.4 PLCDGN Interface

Enter **PLCGRA** interface pressing the **[PLCGRA]** soft key, it also can be set under the PLC interface defining the bit parameter **N0: 26#6=1**, and press the <programmable> key to shift the screen entering the **PLCDGN** interface. Refer to the Fig. 1-2-4-1

PLCDGN					RUN				
ADDR	Bit7	Bit6	Bit5	Bit4	Bit3	Bit2	Bit1	Bit0	
F000	0	1	0	0	0	0	0	0	
F001	0	0	0	0	1	0	0	0	
F002	0	0	0	0	0	0	0	0	
F003	0	0	0	0	0	0	0	0	
F004	0	0	0	0	0	0	0	0	
F005	0	0	0	0	0	0	1	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	

DATA

^

11: 45: 22

PATH: 1

MDI

INFO

PLCGRA

PLCPAR

PLCDGN

PLCTRA

1.2.5 PLCTRA Interface

PLCTRA interface compose of two “setting” and “trace”. Enter the PLCTRA “setting” interface by pressing the [PLCTRA] soft key under the screen. Refer to the figure 1-2-5-1:

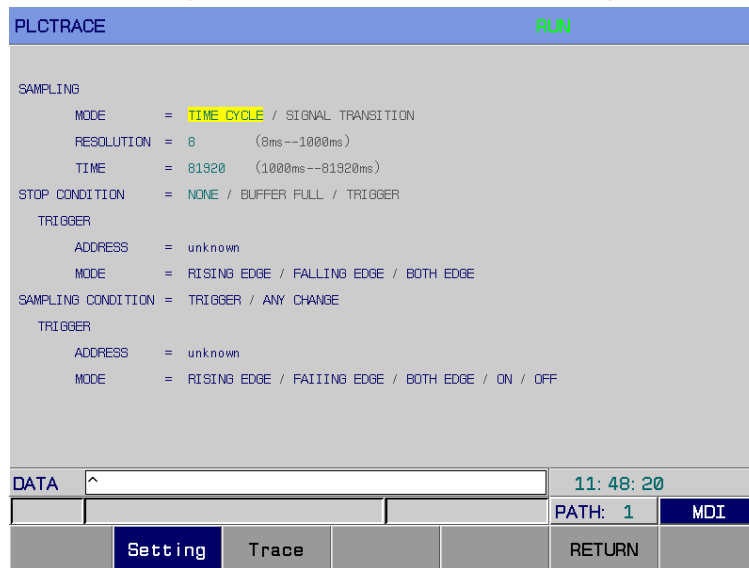


Fig. 1-2-5-1

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.

CHAPTER TWO PLC PROGRAMMING OPERATION

2.1 Brief

The PLC operations of the GSK218MC serial are completed corresponding interface in the system. The overall modification of the ladder diagram should be performed after the limitation higher than the debugging is gained.

GSK218MC series operations can be performed within two interfaces.

1. Enter PLCGRA classification interface pressing [PLCGRA] twice, refer to the fig. 2-1-1: The PLCGRA interface consists of basis code, function code, command table and edit command.

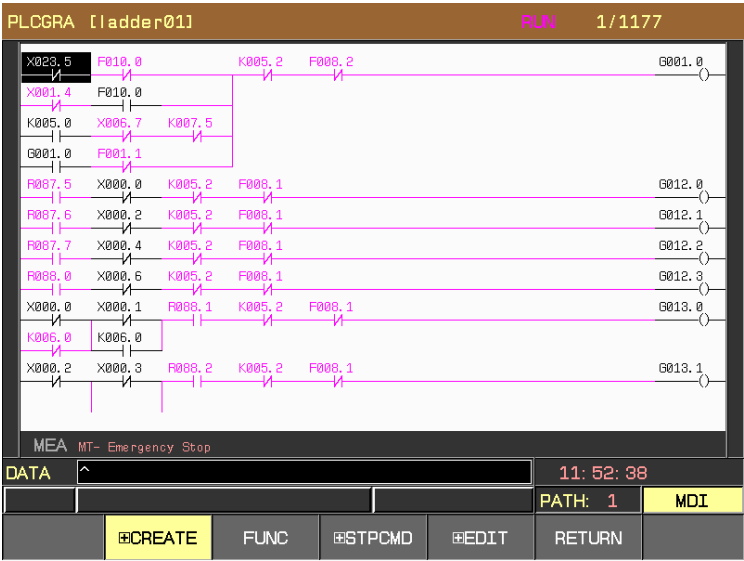


Fig. 2-1-1

2. **PLCPAR** interface includes CRT, TMR, DATA, KPAR and MDEC.

Enter PLCRAR interface pressing the [PLCPAR] soft key, refer to Fig. 1-2-3-1. Enter the PLCPAR classification operation interface by controlling [PLCPAR] again, refer to the Fig. 2-1-2. The parameter modification, PLC operation state control and entering the I/O debugging mode should be performed after the limitation above the debugging is gained. Refer to the Chapter Three for details.

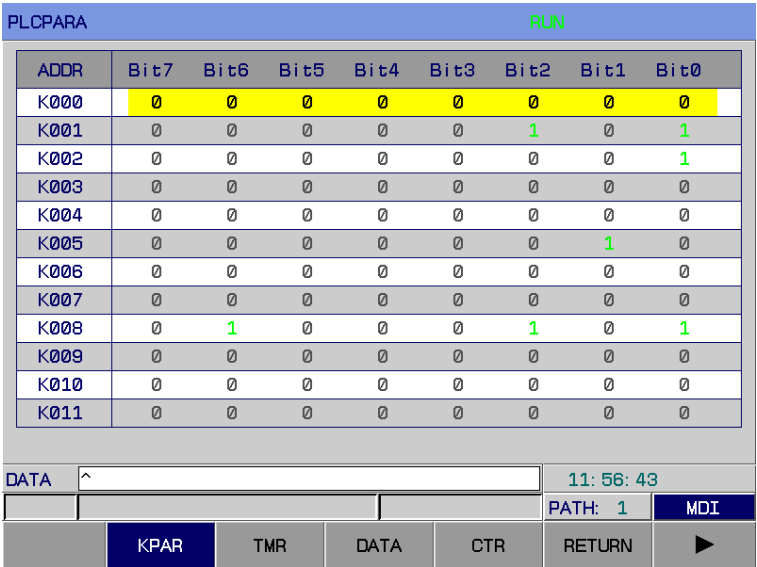


Fig. 2-1-2

2.2 Basis Code

Enter the basis command operation interface pressing the [Basis command] soft key in the Fig. 2-1-1. Refer to the Fig. 2-2-1.

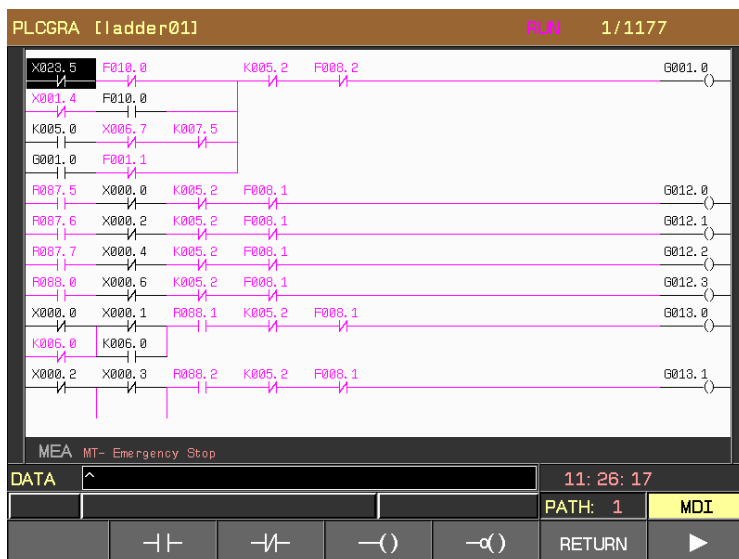


Fig. 2-2-1

Display other basis codes pressing the [▶] key. Refer to Fig. 2-2-2.



Fig. 2-2-2

The basis codes are displayed as follows:

- [—|—]: Normally opened contact
- [—|/—]: Normally closed contact
- [—()]: Output coil
- [—○()]: Output coil reverse
- [—]: Horizontal breakover cable
- [—]: Vertical breakover cable
- [✕]: Delet the vertical breakover cable

Miscellaneous soft keys:

- [▶]: Pagedown
- [◀]: Pageup

[Return]: Return to the last menu

2.3 The Operation Explanation of the Ladder Diagram

- Add component: positioning the cursor to the place where the component is needed to be added, input the component name in according to the corresponding menu, the display is then appeared after the data; the corresponding components can be added pressing the

INPUT

key on the panel. If the component has been positioned at the current place, the new one may replace the old one.

- Insertion component: Positioning the cursor to the place where is required to insert the

INSERT

component; a vacancy is inserted in this place pressing the key, and then add the new component pressing the steps of the add component. The cursor can be inserted in turn.

SHIFT




(Note: Ensuring the indicator above the is lighted on when inserting the node.)

DELETE

- Component Deletion: Delete the current component pressing the key on the panel.

SHIFT

(Note: Ensuring the indicator above the is lighted on when deleting the current component.)

- Add the vertical breakover cable: Add a vertical breakover cable at the lower right corner of the current cursor by pressing the [] soft key.
- Delete the vertical breakover cable: The vertical breakover at the lower right corner of the current cursor can be deleted by pressing the [] soft key.
- Insert the horizontal breakover cable: a horizontal breakover cable can be inserted at the current cursor place by pressing the [] soft key; the horizontal breakover cable may replace the component which has been performed at the current position.

SHIFT

- Row insertion: The cursor is positioned at any destination row, press the on the

SHIFT

INSERT

panel till the indicator above the is lighted up, then press the key, and therefore a new row is inserted above the specified row of the cursor. The followings rows are moved down in turn.

SHIFT

- Row deletion: The cursor is positioned at the destination row, press the on the


SHIFT

DELETE



panel till the indicator above the is lighted up, then press the key, the


current row is then deleted, the following rows are moved up in return.

- Block deletion: The cursor is positioned as the start position where to be deleted, then input

the address of the output coil of the desired deletion block, and then press the  key on the panel.

- Search: Directly input the component name what you want to reach, it will display at the data


column on screen, upward or downward search by pressing the  or  after inputting.


- Save: The modified ladder diagram is saved by pressing the  key.


Illustrations of the ladder diagram programming:


1. The cursor is positioned as the start place of the programming position, a normally opened contact symbol occurs at the cursor's positioning, directly input the component name X1.4,


affirm it by pressing the  key, the component X001.4 appears on the current cursor position.


2. Rightward one place of the cursor, press the [] soft key, a symbol of the normally closed contact occurs at the cursor positioning, directly input component name X2.1, affirm it by pressing


the  key, and then the X002.1 appears at the current cursor position.


3. The cursor is positioned at the next start position, press the [] soft key, a symbol of the normally opened contact occurs at the cursor positioning, direct input the component name

X2.4, affirm it by pressing the  , the component then appears at the current cursor position.

4. Rightward one place of the cursor, press the [] soft key, draw a horizontal breakover line at the current cursor position;

5. Upward one place of the cursor, press the [] soft key, draw a vertical breakover line at the lower right corner of the cursor.

6. Press the [] soft key, the output coil is automatically generated (the required horizontal breakover line), and then the output coil is produced at the right side of the ladder diagram.

Directly input the component name G1.0, affirm it by pressing the  , the component G001.0 occurs at the current cursor position.

The compiled ladder diagram is shown in the Fig. 2-3-1:

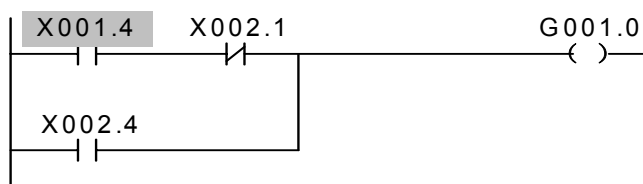


Fig. 2-3-1 Ladder diagram illustration

Explanation: The green component indicates connection state in the ladder diagram regardless of the normally opened, normally closed or output coil, and the white one means disconnected state. (The dark color is disconnection state, the light color is connected state based on the publish)

2.4 Function Code

Press the [Function command] soft key in the Fig. 2-1-1, then enter the function code operation interface, refer to the Fig. 2-4-1.

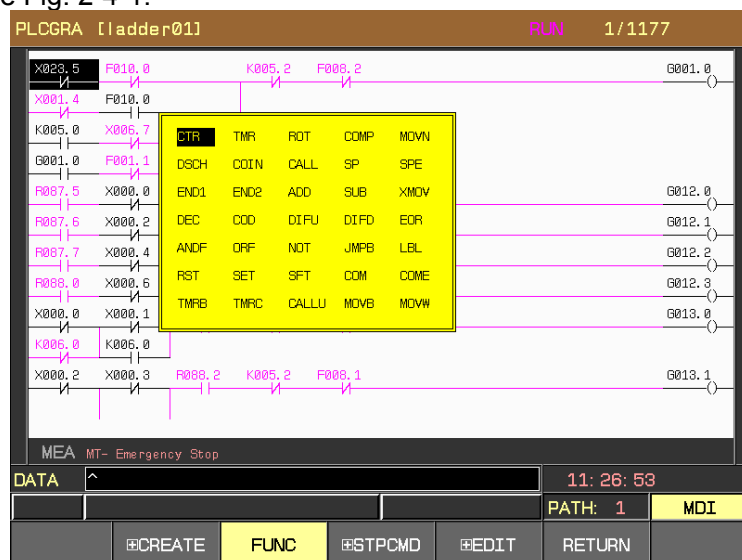


Fig. 2-4-1

There are 35 PLC function codes are listed in the function code. Refer to the Chapter Two Programming for function code format and usage, the compilation of the function code is consistent with the ladder diagram operation in the Section 2.3.

2.5 Command Table

In the PLCGRA interface, as the Fig. 2-1-1. Press the [Command table] soft key again, and then enter the command table classification operation interface, refer to the Fig. 2-5-1.

PLCREPER		RUN	1/3620																																																					
<table><tr><th colspan="2">NO.</th><th colspan="2">REPER</th></tr><tr><td>0001</td><td>RD. NOT</td><td>X023. 5</td><td></td></tr><tr><td>0002</td><td>AND. NOT</td><td>F010. 0</td><td></td></tr><tr><td>0003</td><td>RD. NOT</td><td>X001. 4</td><td></td></tr><tr><td>0004</td><td>AND</td><td>F010. 0</td><td></td></tr><tr><td>0005</td><td>OR. STK</td><td></td><td></td></tr><tr><td>0006</td><td>RD</td><td>K005. 0</td><td></td></tr><tr><td>0007</td><td>AND. NOT</td><td>X006. 7</td><td></td></tr><tr><td>0008</td><td>AND. NOT</td><td>K007. 5</td><td></td></tr><tr><td>0009</td><td>OR. STK</td><td></td><td></td></tr><tr><td>0010</td><td>RD</td><td>G001. 0</td><td></td></tr><tr><td>0011</td><td>AND. NOT</td><td>F001. 1</td><td></td></tr><tr><td>0012</td><td>OR. STK</td><td></td><td></td></tr></table>					NO.		REPER		0001	RD. NOT	X023. 5		0002	AND. NOT	F010. 0		0003	RD. NOT	X001. 4		0004	AND	F010. 0		0005	OR. STK			0006	RD	K005. 0		0007	AND. NOT	X006. 7		0008	AND. NOT	K007. 5		0009	OR. STK			0010	RD	G001. 0		0011	AND. NOT	F001. 1		0012	OR. STK		
NO.		REPER																																																						
0001	RD. NOT	X023. 5																																																						
0002	AND. NOT	F010. 0																																																						
0003	RD. NOT	X001. 4																																																						
0004	AND	F010. 0																																																						
0005	OR. STK																																																							
0006	RD	K005. 0																																																						
0007	AND. NOT	X006. 7																																																						
0008	AND. NOT	K007. 5																																																						
0009	OR. STK																																																							
0010	RD	G001. 0																																																						
0011	AND. NOT	F001. 1																																																						
0012	OR. STK																																																							
DATA ^				11: 27: 08																																																				
			PATH: 1	MDI																																																				
CONVERT		DOWN	STOP	RETURN																																																				

Fig. 2-5-1

The content and operation of the command list:

1/3652: Offer the steps and totally steps information of in the current operation of the ladder diagram.

RUN: the operation state of the ladder diagram

Input: Display the input data.

MDI mode: current working method.

[Conversion]: Ladder diagram converts to the command list.

[Download]: Download the command list to the CNC, automatically operate the PLC ladder diagram.

[Stop]: Stop the operation of the ladder diagram.

[Return]: Return to the previous menu.

The positioning can be performed by the pageup, downpage and four direction keys, and then check the command list.

interface, the ladder diagram of current operation is stopped. (This step can be ignored if the current ladder diagram does not modify).

4. The modification of the PLC program compilation is completed by the [Basis command], [Function command] and [compilation command] in the [PLCGRA] interface. Press the <Store> key, the data column prompts: "Ladder diagram stores successfully!" means that the storage is performed. When some incorrect compilation occurs in the PLC, the corresponding alarm may display during storing, check the PLC program.

5. The data column may display: "the ladder diagram is converting..." by pressing the [Command list] soft key in the [PLCGRA] interface, then control the [Conversion] soft key. "Successfully convert" displays after converting.

6. The data column may display: "the command list is downloading" by pressing the [Command list] soft key in the [PLCGRA] interface, then press the [Download] soft key. "Successfully download!" displays after the downloading is performed. The ladder diagram is converted into the command list downloading to the CNC and then it operates automatically.

CHAPTER THREE PLC ADDRESS AND 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. 3-1, 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. 3-1

3.1 Nonvolatile/Hold Relay

Press the [KPAR] soft key in the Fig. 3-1, then enter the checking and setting interfaces of the nonvolatile replay, refer to the Fig. 3-1-1.

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. 3-1-1

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.

[▶]: Enter next page.

The set value can be downloaded to the CNC operation pressing the <Save> key after modifying. “KPAR downloading successful” displays after the save is performed; the system displays: “downloading fail” when the save is incorrect; the “illegal downloading parameter” displays without downloading conditions.

(**Note:** It can be saved and operated by pressing the <Save> after modifying. K000~~K005 are used by the system. Refer to the Appendix One and Three for details)

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.

3.2 Timer

Press the [TMR] soft key in the Fig. 3-1, then enter the checking and setting interfaces of the timer, refer to the Fig. 3-2-1.

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	08000	08000	STANDBY		
010	T010	08000	08000	STANDBY		
011	T011	00000	00500	STANDBY		
DATA ^					11:28:41	
					PATH: 1 MDI	
KPAR		TMR	DATA	CTR	RETURN	▶

Fig. 3-2-1

The content and operation of the timer:

RUN: Operation state of ladder diagram.

N0.: Timer serial number; Do no 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 K000.0 (PLC parameter allows to be modified) is set 1 in the MDI mode.

Input: Input data display

MDI mode: Current working mode

[Return]: Return to the previous menu

►: Enter to the next page.

The set value can be downloaded to the CNC operation pressing the <Save> key after modifying. “TMR downloading successful” displays after the save is performed; 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 address can be performed.

3.3 Data List

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

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	^	11: 28: 51
		PATH: 1 MDI
KPAR	TMR	DATA CTR RETURN ►

Fig. 3-3-1

The content and operation of the data list:

RUN: The operation state of the ladder diagram.

N0.: Serial number of the data list; Do not change.

ADDR.: Data list address; Do not change.

DATA: Data list setting value; it can be changed after the K000.0 (PLC parameter allows modification) is set to 1 in the MDI mode.

Input: Input data display.

MDI mode: Current working mode.

[Return]: Return to the previous menu.

[▶]: Enter to the next page.

The set value can be downloaded to the CNC operation pressing the <Save> key after modifying. “TMR downloading successful” displays after the save is performed; the system displays: “downloading fail” when the save is incorrect; the “illegal downloading parameter” displays without downloading conditions.

Note: It only can be saved and operated by pressing the [Save] key after modifying.

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 address can be performed.

3.4 Counter

Press the [CTR] soft key in the Fig. 3-1, then enter the checking and setting interface of the counter, refer to the Fig. 3-4-1.

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
KPAR	TMR	DATA
	CTR	RETURN
		▶

Fig. 3-4-1

The content and operation of the counter:

RUN: The operation state of the ladder diagram

NO.: Serial number of the counter; Do not change

ADDR.: Counter address; Do not change

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

SET: Counter setting value; it can be changed after the K000.0 (PLC parameter allows modification) is set to 1 in the MDI mode

Input: Input data display.

MDI mode: Current working mode.

[Return]: Return to the previous menu.

[▶]: Enter to the next page.

The set value can be downloaded to the CNC operation pressing the <Save> key after modifying. “CTR downloading successful” displays after the save is performed; the system displays: “downloading fail” when the save is incorrect; the “illegal downloading parameter” displays without downloading conditions.

Note: It only can be saved and operated by pressing the [Save] key after modifying

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

3.5 M function corresponding to the F address

Press the [▶] soft key in the Fig. 3-1 entering the next page; press the [MDEC] soft key entering the checking and setting interfaces of the M function corresponding to the F address, refer to the Fig. 3-5-1.

MCodeDEC		RUN	
MCODE	ADDR	REMARK	
M00	F031. 7	Program Stop	
M01	F030. 4	Optional Stop	
M02	F030. 5	End of Program	
M03	F030. 0	Spindle forward	
M04	F030. 1	Spindle backward	
M05	F030. 2	Spindle stop	
M06	F030. 3	Auto change tool	
M07	F***. *	STANDBY	
M08	F031. 0	Coolant on	
M09	F031. 1	Coolant off	
M10	F031. 2	A axis Clamp	
M11	F031. 3	A axis Release	

DATA	^	11: 29: 30
		PATH: 1 MDI
◀	MDEC	RETURN

Fig. 3-5-1

The content and operation of the M function corresponding to the F address:

MCodeDEC: It indicates MDEC interface.

RUN: The operation state of the ladder diagram.

MCODE: M function number.

ADDR: F address setting; Input the password higher than the terminal user, which can be modified in the MDI mode; the system should be restarted again after modifying.

MEANING: M function explanation.

Input: Input data display

MDI mode: Current working mode.

[Return]: Return to the previous menu.

[◀]: Enter to the previous page.

This interface is used for registering and deleting of the M code. F signal is set to the one unique corresponding M code; the M code that does not set by the F signal is disabled.

The corresponding F strobe signal may be sent based upon this list when M code is performed, then start the corresponding ladder diagram network. The system alarm occurs after modifying, the prompt content is “Cut off the power”, and its setting is enabled after the system is restarted. The setting of the M function in PLC program, its corresponding M code is desired to be used after the corresponding address is modified, the ladder diagram is then modified. It is necessary to operate carefully, so that the machine may be damaged or the injury accident may occur.

The search and positioning can be performed by the pageup, pagedown and four direction keys on the panel; the M function corresponding to the F address can be checked or modified.

Note 1: M00, M03, M04 and M05 can not be changed because they are occupied by the system.

Note 2: The file numbers of the ladder diagram and configuration should be consistent when the system is performed the ladder and configuration files. The data after modifying are stored to the configuration file of corresponding current ladder diagram file number. User should compile its significance of the signal in this configuration file, so that the system can be correctly displayed the modified information from the user. The Chinese note name of the configuration is “LadChixx”, and the English note name is “LadEngxx”.

CHAPTER FOUR THE USER EXPLANATION OF THE LADDER DIAGRAM SOFTWARE EDIT

4.1 Brief

At present, the GSK218MC 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 GSK218MC and machine center CNC, which mainly offers the functions such as the edit, conversion, debugging and printing of the GSK218MC series ladder diagram. This software can be used in the Windows 98, Windows Me, Windows 2000, Windows XP and Windows 2003.

4.2 Software Introduction

4.2.1 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.mea) 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 Ladder01 ladder diagram in the LadFile folder is opened in the software, the interface is shown below:

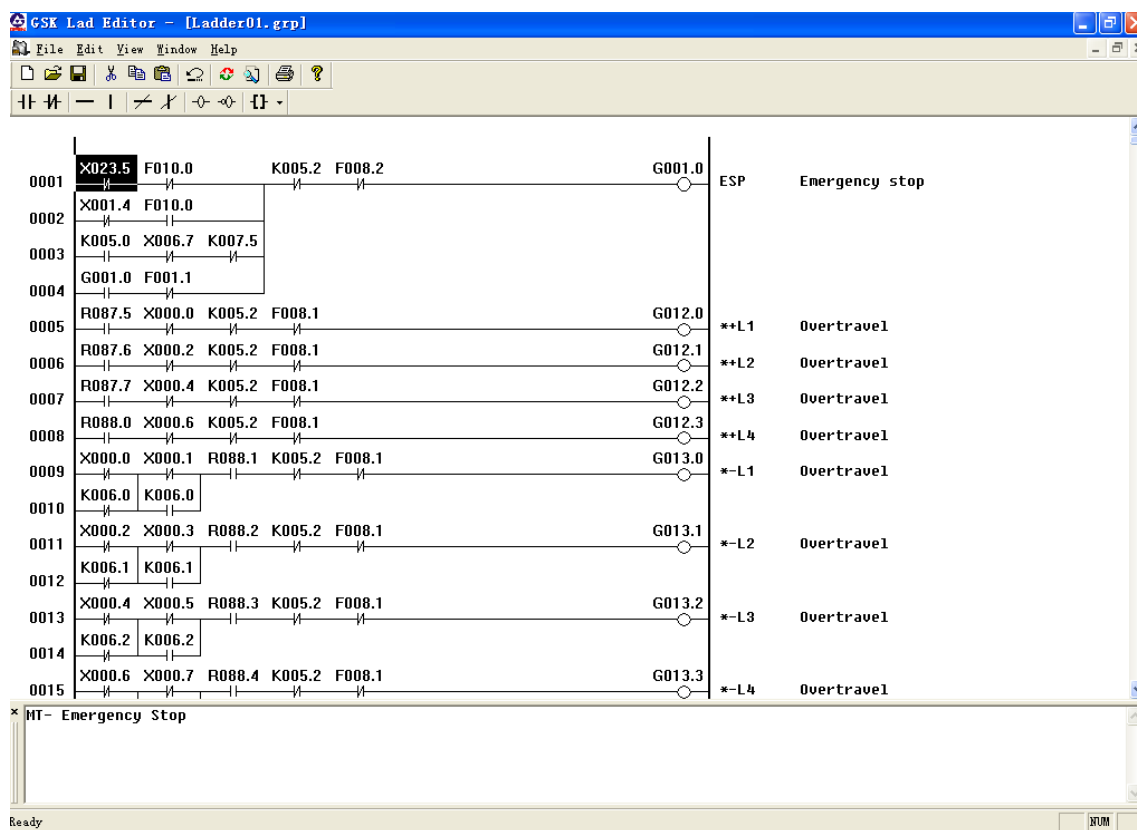


Fig. 4-2-1-1

4.2.2 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

4.3 Software Operation

4.3.1 Toolbar

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

4.3.1.1 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

4.3.1.2 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. Spring the drawing menu pressing the mini arrow at the right once, and then select the function codes.

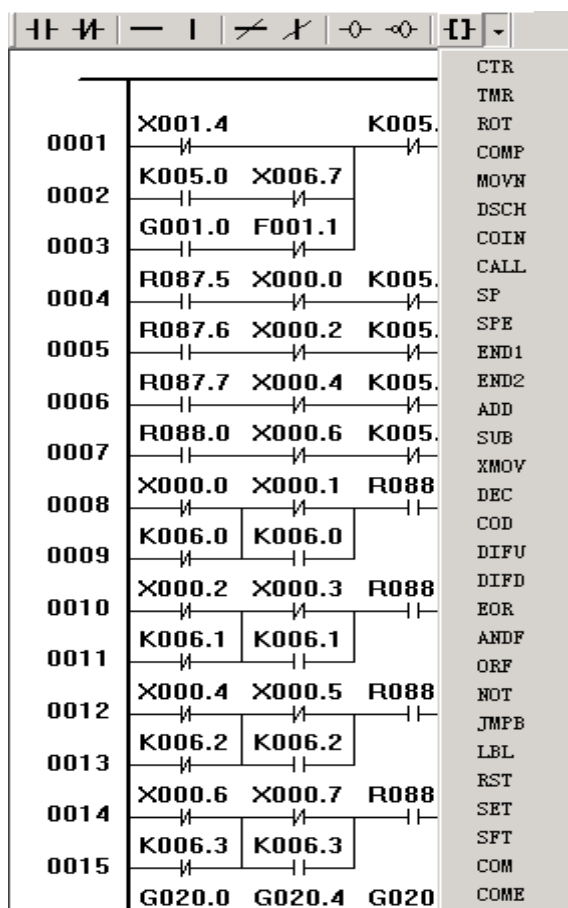


Fig. 4-3-1-2-1

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

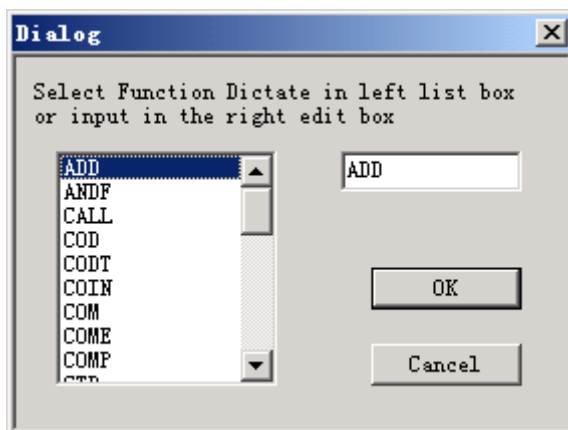


Fig. 4-3-1-2-2

4.3.2 The Selection of the 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.

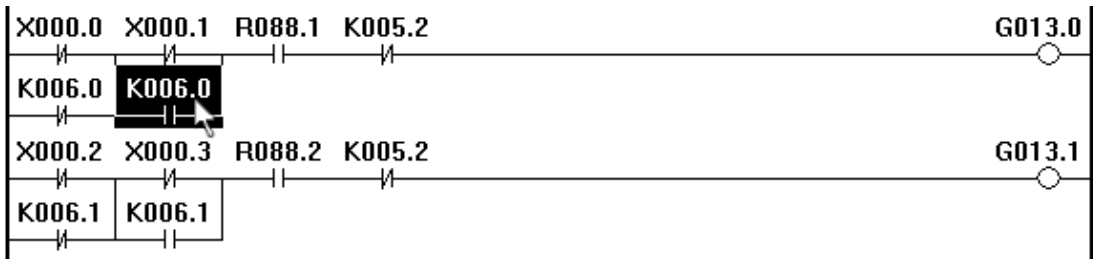


Fig. 4-3-2-1

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.

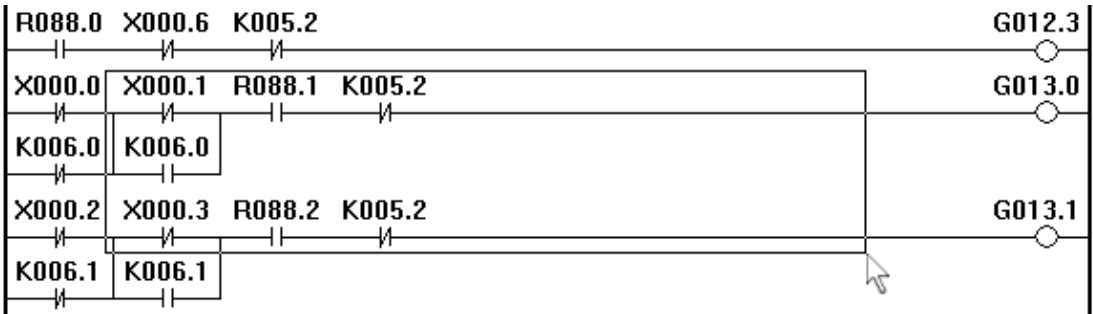


Fig. 4-3-2-2

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.

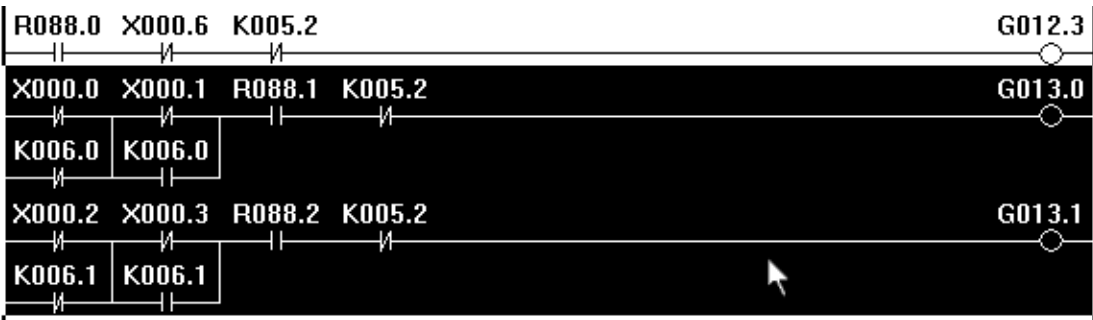


Fig. 4-3-2-3

4.3.3 The Editing of the Figure

4.3.3.1 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.

4.3.3.2 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.

4.3.3.3 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].

4.3.3.4 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];

4.3.3.5 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];

4.3.3.6 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];

4.3.3.7 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];

4.3.4 Ladder Diagram Note

4.3.4.1 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.

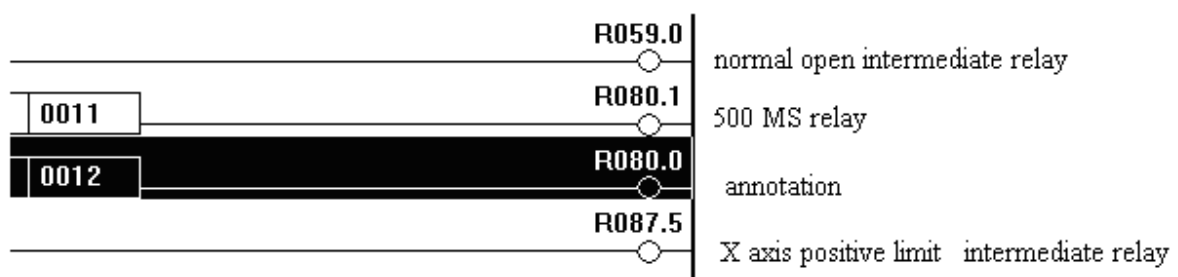


Fig. 4-3-4-1-1

4.3.4.2 Component Note of the Ladder Diagram

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;

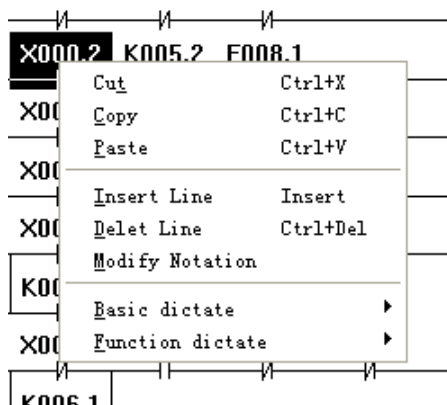


Fig. 4-3-4-2-1

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

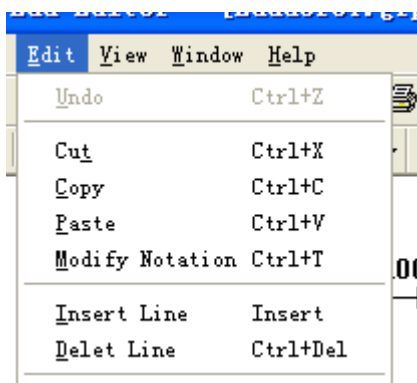


Fig. 4-3-4-2-2

3. Shortcut key [Ctrl+T].

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

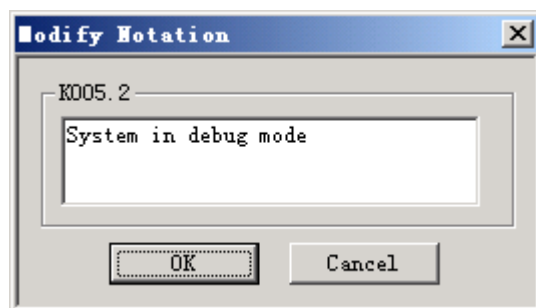


Fig. 4-3-4-2-3

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

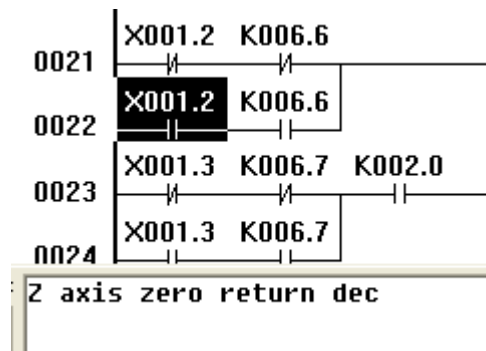


Fig. 4-3-4-2-4

4.3.5 Leading-out

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 Eleven **System Communication** in the Volume Three of the **218MC Programming and Operation 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 Milling machine and machining center of the GSK218MC series.

The configuration format of the ladder diagram is shown in the Appendix Two.

VOLUME IV

INSTALLATION AND CONNCETION

CHAPTER ONE THE SYSTEM CONFIGURATION AND INSTALLATION

1.1 Composition of the System

GSK218MC CNC system is composed of the following units, and the composition of the system is shown as figure 1-1.

- (1) GSK218MC CNC system
- (2) Additional operation panel (optional parts)
- (3) CNC AC servo drive unit (step drive unit)
- (4) Servo motor (step motor)
- (5) AC transformer

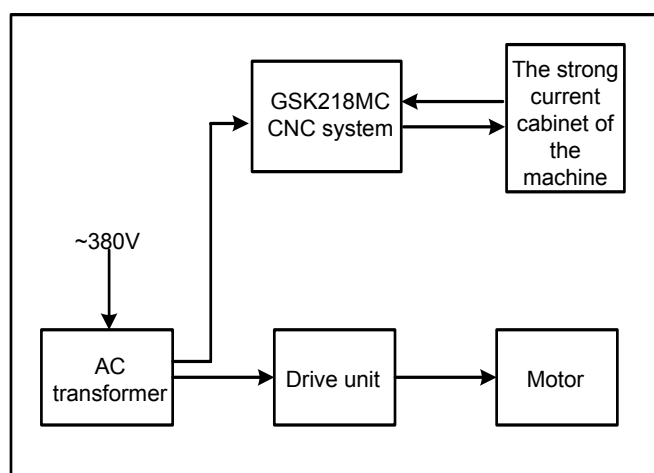


Fig. 1-1

1.2 The System Installation and Connection

Firstly, check whether the parts, such as CNC system, the drive unit, the motor and the photoelectric encoder, etc, to be installed are all complete, in good condition and matched with each other.

The installation of CNC system must be fixed, and some space should be reserved around CNC system, so the heat of the system can be sent out. CNC system should be installed the place in which is each to operate, avoiding the scrap iron and coolant.

The strong and weak currents should be separated, and the power supply of CNC system and the drive unit should be provided by the isolation transformer, and the power supply should be parted with

the strong current of the machine. The various cables should keep far away from AC contractor to reduce the interference. It would be best that the photoelectric encoder, the limit signal and the emergency stop signal should be connected with CNC system directly rather than come through the strong current cabinet. The power supply must be connected with the earth properly.

Various sockets should be connected and the screw should be fixed tightly, and the joints of cables are not allowed to plug and pull after power on.

During installing CNC system, the panel should not be scratched by the hard object and the edge iron; CNC system should be taken off during painting to keep the panel clean.

Around CNC system, it should be free of the strong current, the ferromagnetic interference source, and keep far away from the inflammable, the explosives and the various dangerous objects.

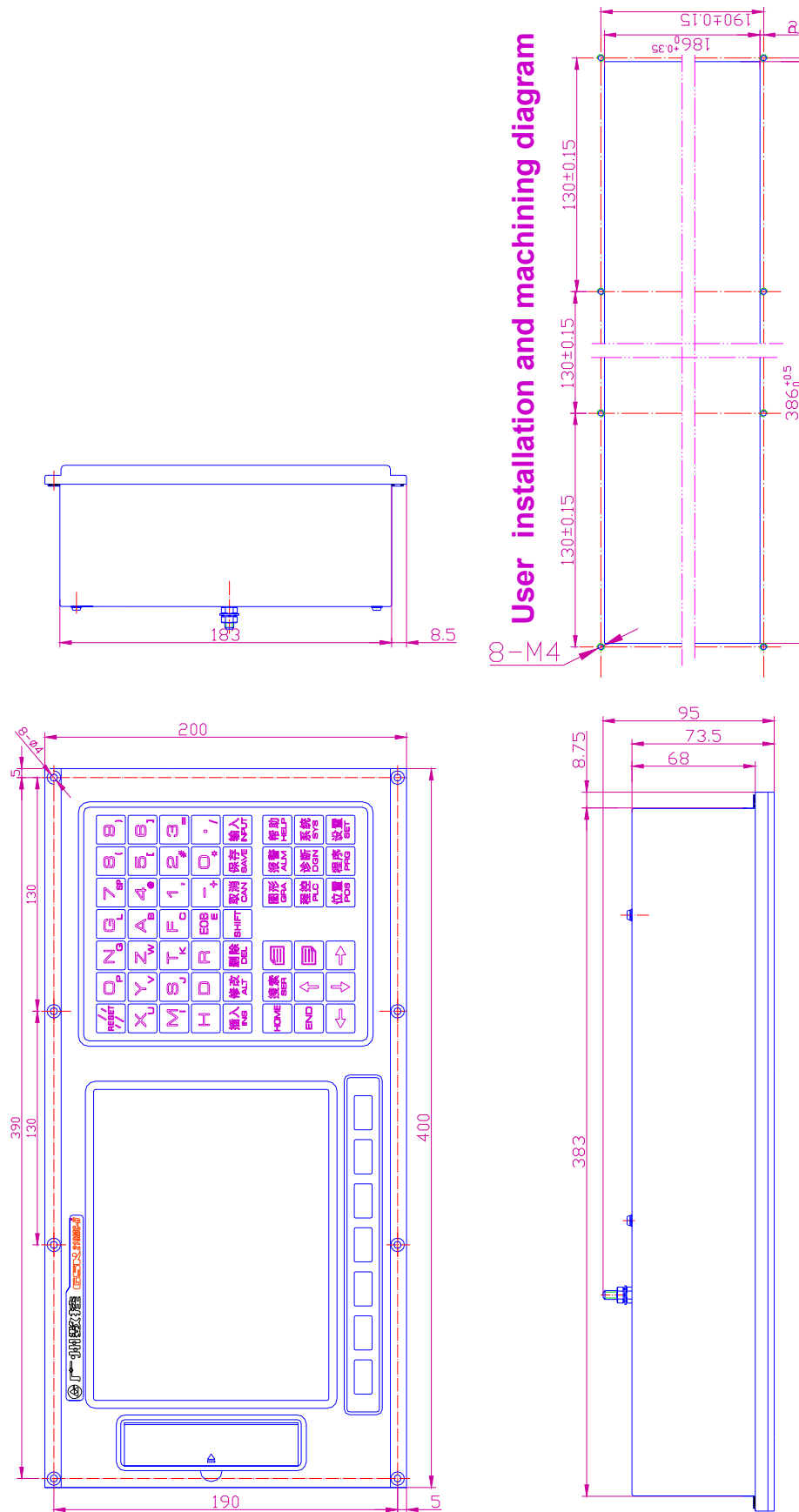


Fig.1-3-2 Installation dimension figure of GSK2-8MC-H editing panel

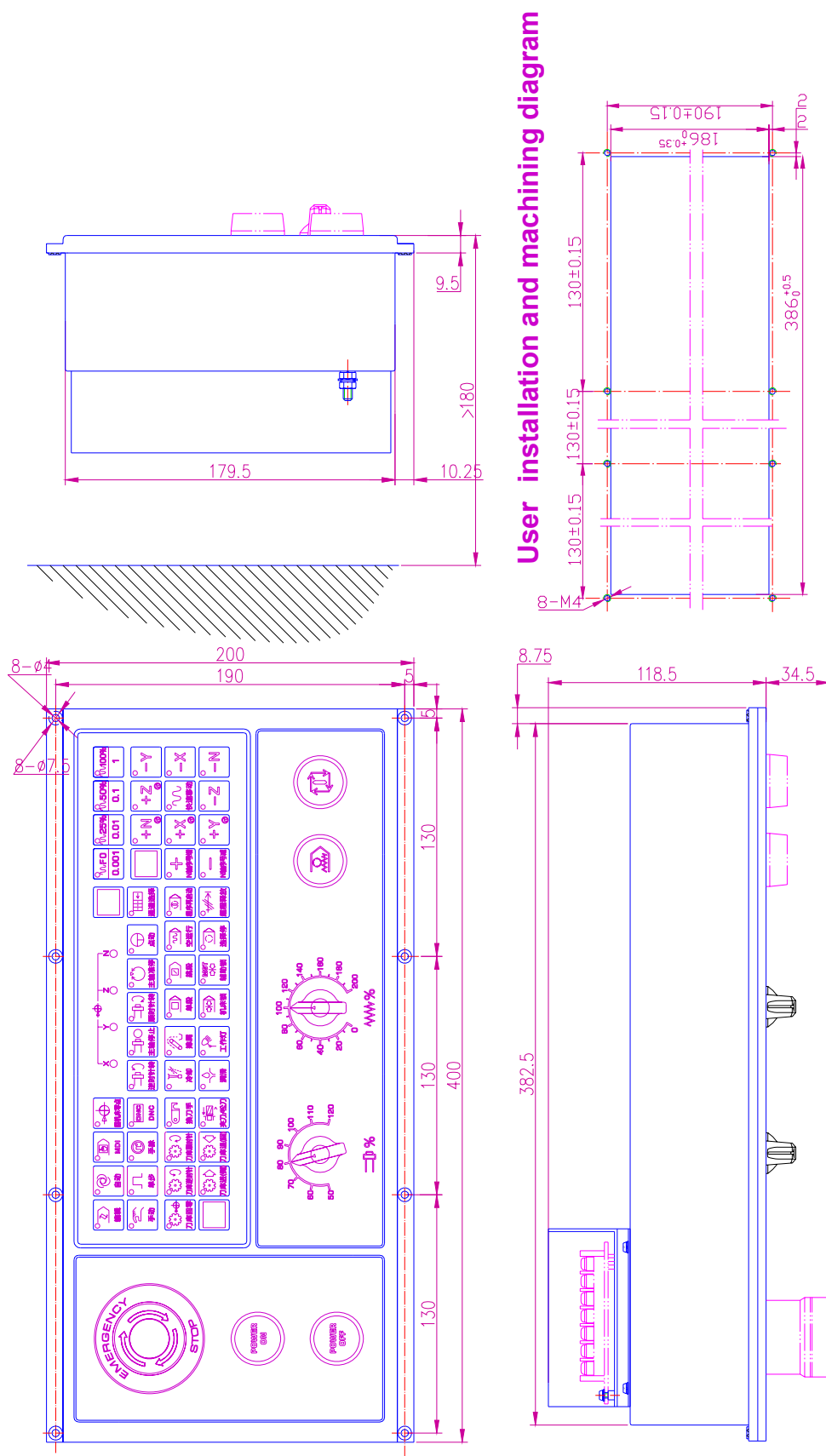


Fig.1-3-3 Installation dimension figure of GSK218MC-H operation panel

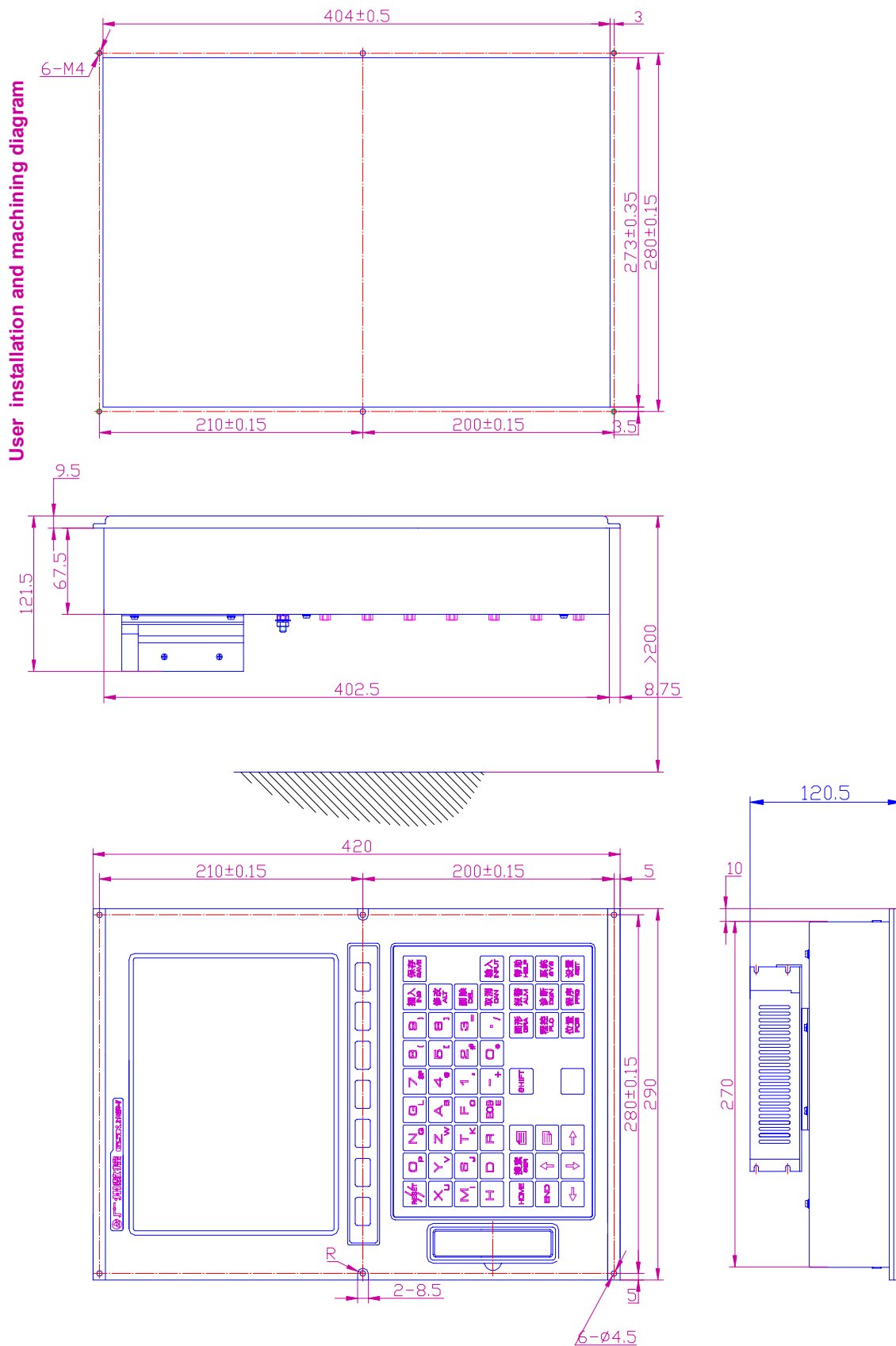


Fig. 1-3-4 Installation dimension figure of GSK218MC-V editing panel

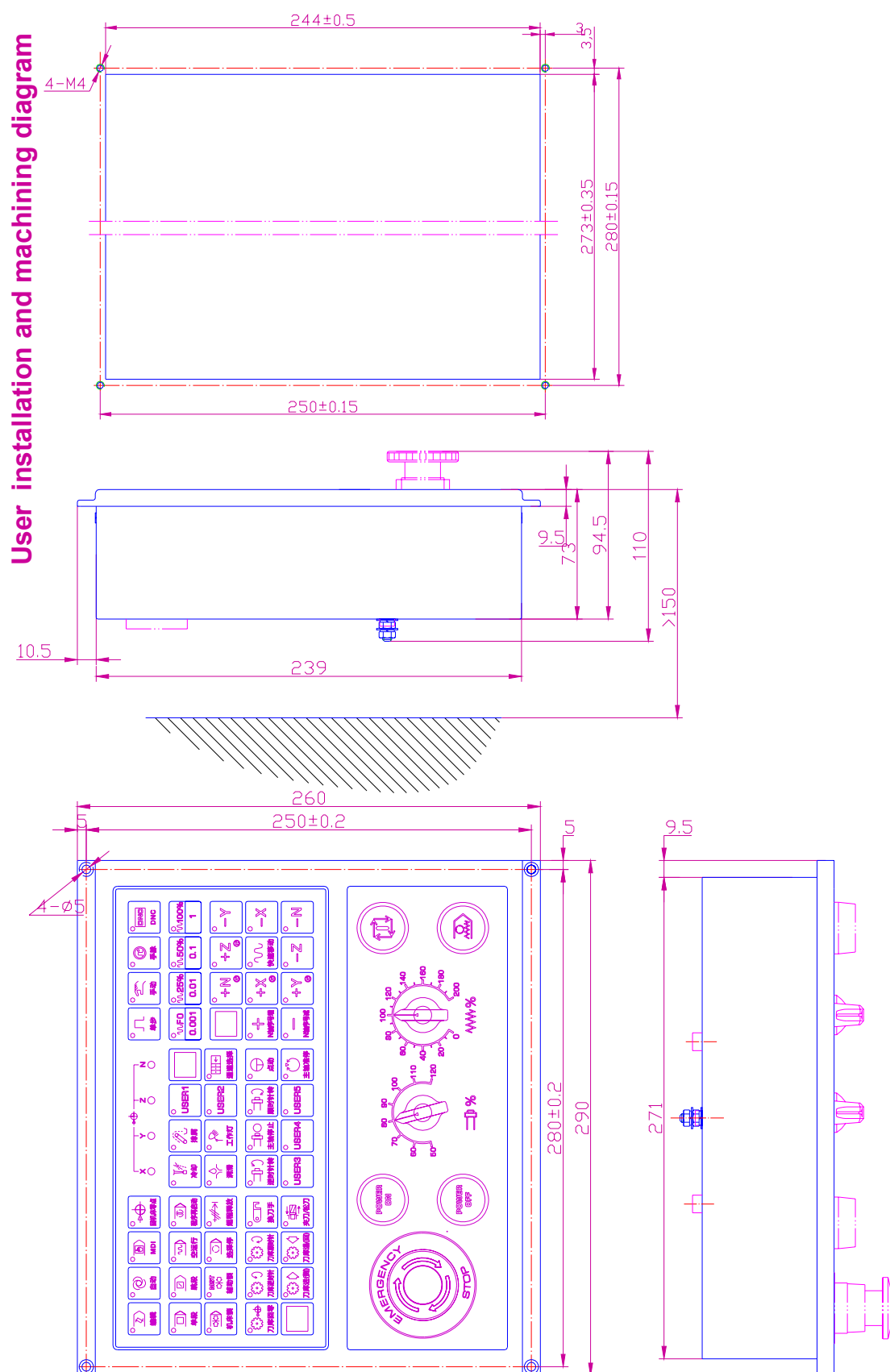


Fig. 1-3-5 Installation dimension figure of GSK218MC-V operation panel

1.4 The Additional Panel Figure

The additional panel of GSK218MC integration system is selected by the customers. The extension holes on the panel are user-defined, such as the emergency stop, the program lock, the system power on and off, feed hold, cycle start and MPG, etc. The following are optional parts of GSK218MC integration system:

MPG: Changchun LGF-001-100;

Additional panel: Aluminum 460mm×130mm, which can be assembled under the panel;

Emergency stop button: LAY3-02ZS/1

Unself-lock button: KH-516-B11 (green or red)

Self-lock button: KH-516-B21 (green or red)

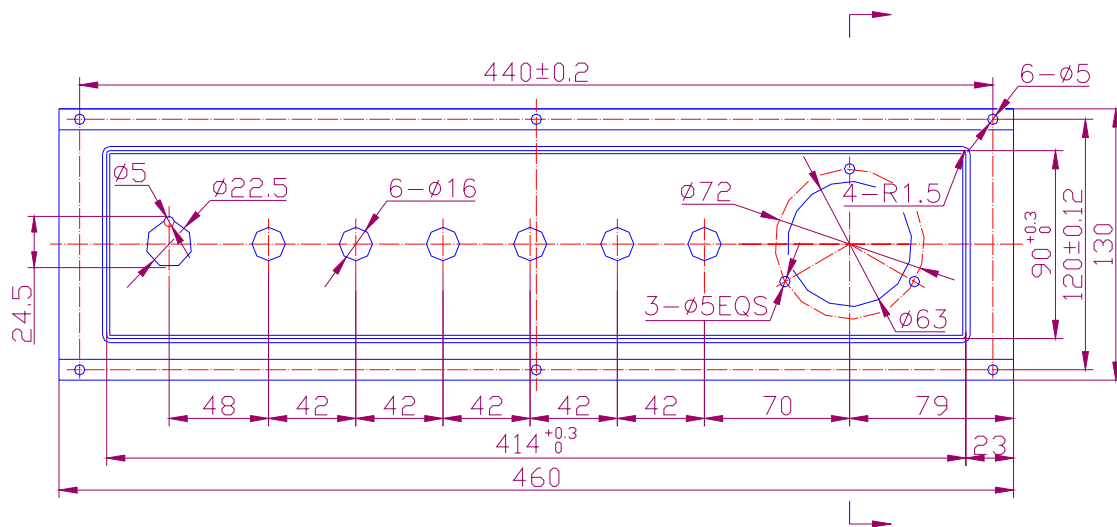


Fig.1-4-1

CHAPTER TWO CONNECTION BETWEEN EQUIPMENTS

2.1 Connection Diagram of the External System

2.1.1 The Layout of Interface Position

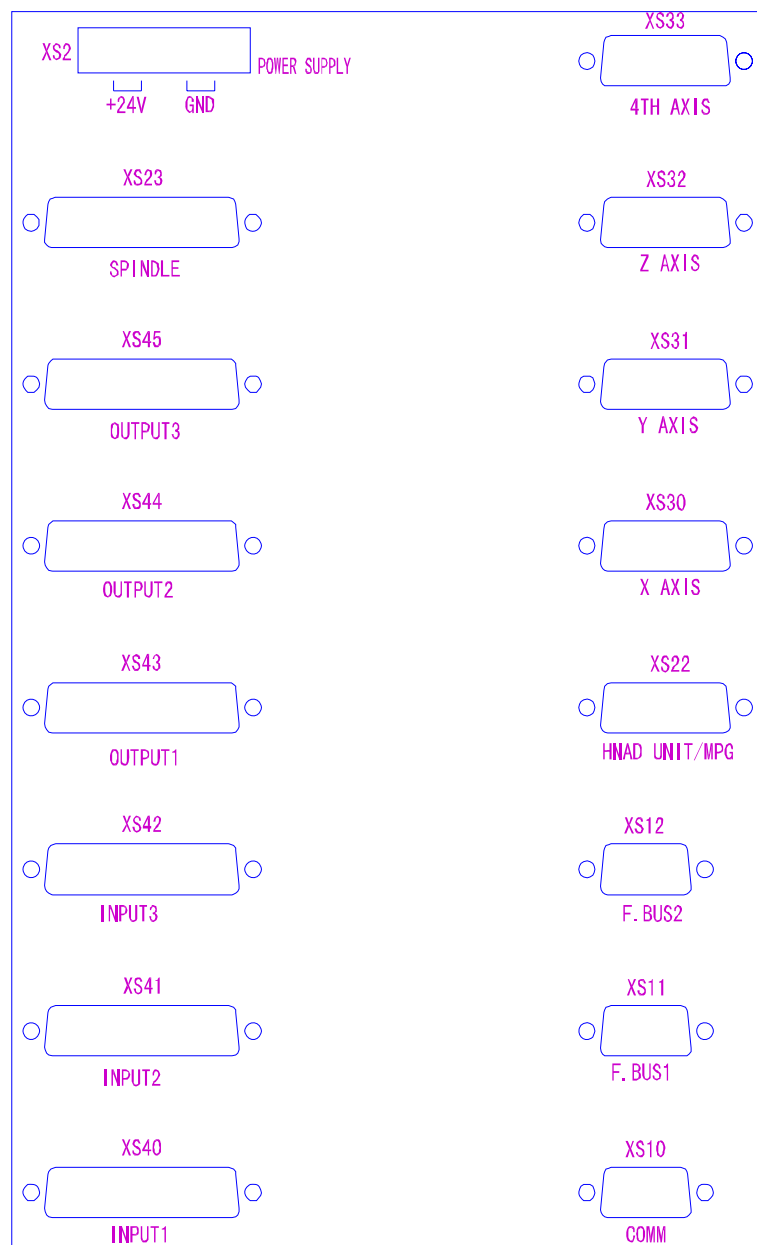


Fig. 2-1-1-1 GSK218MC interface figure

2.1.2 The Connection Diagram

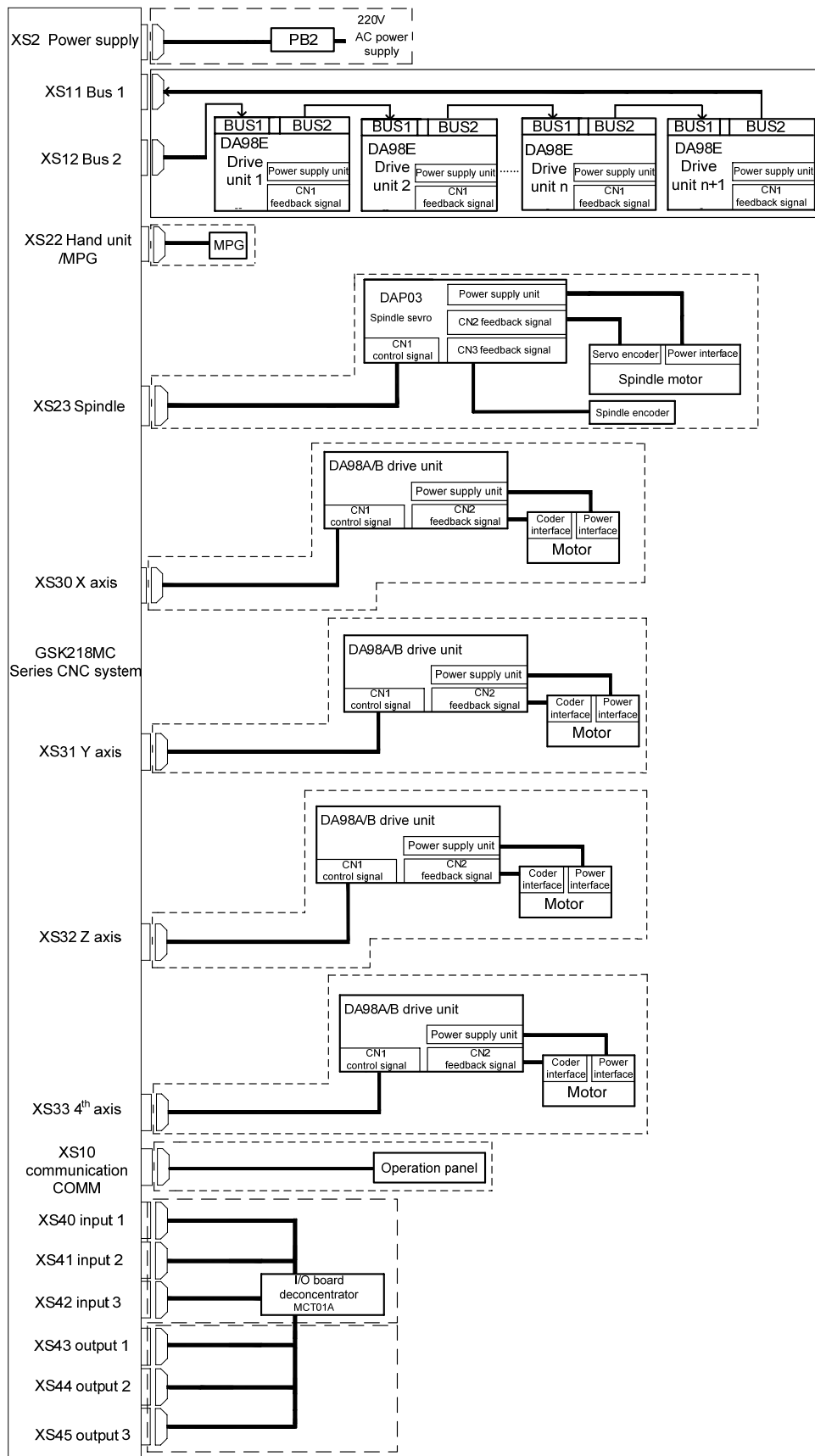


Fig. 2-1-2-1

2.2 Connection between the System and the Drive Unit

The interfaces with the drive unit include XS30 (X axis) , XS31 (Y axis) , XS32 (Z axis) and XS33 (the 4th axis) .

2.2.1 The System Interface Figure

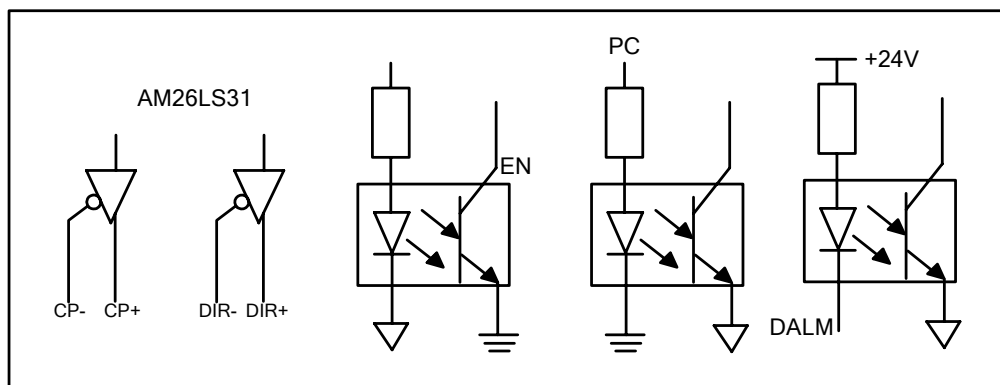


Fig. 2-2-1-1

2.2.2 The Interface Signal List

XS30: DB15 female (X axis)

1	XCP+	9	XCP-
2	XDIR+	10	XDIR-
3	XPC	11	0V
4	+24V	12	+5V
5	XDALM	13	+5V
6		14	0V
7	XEN	15	0V
8	0V		

XS31: DB15 female (Y axis)

1	YCP+	9	YCP-
2	YDIR+	10	YDIR-
3	YPC	11	0V
4	+24V	12	+5V
5	YDALM	13	+5V
6		14	0V
7	YEN	15	0V
8	0V		

XS32: DB15 female (Z axis)

1	ZCP+	9	ZCP-
2	ZDIR+	10	ZDIR-
3	ZPC	11	0V
4	+24V	12	+5V
5	ZDALM	13	+5V
6		14	0V
7	ZEN	15	0V
8	0V		

XS33: DB15 female (4TH axis)

1	4CP+	9	4CP-
2	4DIR+	10	4DIR-
3	4PC	11	0V
4	+24V	12	+5V
5	4DALM	13	+5V
6		14	0V
7	4EN	15	0V
8	0V		

Fig. 2-2-2-1

2.2.3 Introduction of Signals

1. The pulse movement code signals

XCP+, XCP-, YCP+, YCP-, ZCP+, ZCP-, 4CP+ and 4CP- are code pulse signals, XDIR+, XDIR-, YDIR+, YDIR-, ZDIR+, ZDIR-, 4DIR+ and 4DIR- are movement direction signal, and the signals of two groups are difference output.

The circuit diagram is shown as below:

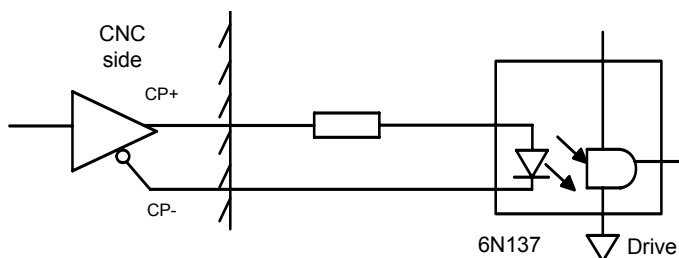


Fig. 2-2-3-1

2. The drive unit alarm signal ALM (input)

The mode of signal received on the system side is shown as below. Whether the high level or the low level is valid can be set by the bit parameter #19 (The high or the low level should comply with the drive unit.)

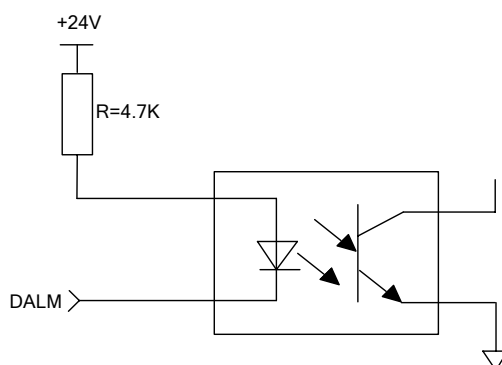


Fig. 2-2-3-2

3. Ready signal EN of CNC system (contact output)

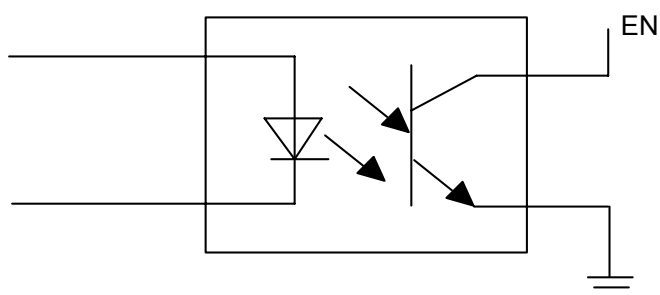


Fig. 2-2-3-3

4. Signal PC of reference point return

The system supports +24V zero return and +5V zero return, the receiving circuit of signals on the system side is shown as below:

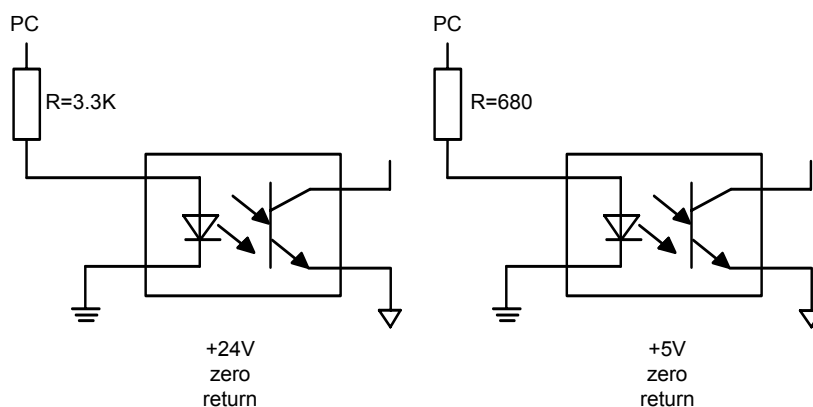


Fig. 2-2-3-4

The wave of PC signals provided by the user is shown as the following figure:

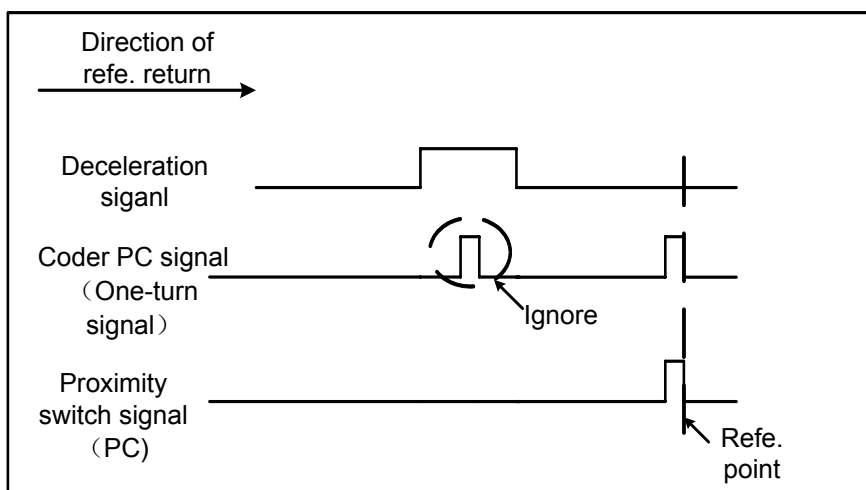


Fig. 2-2-3-5

2.2.4 The Cable Connection Diagram

1. The cables of GSK218MC with DY3 series drive unit

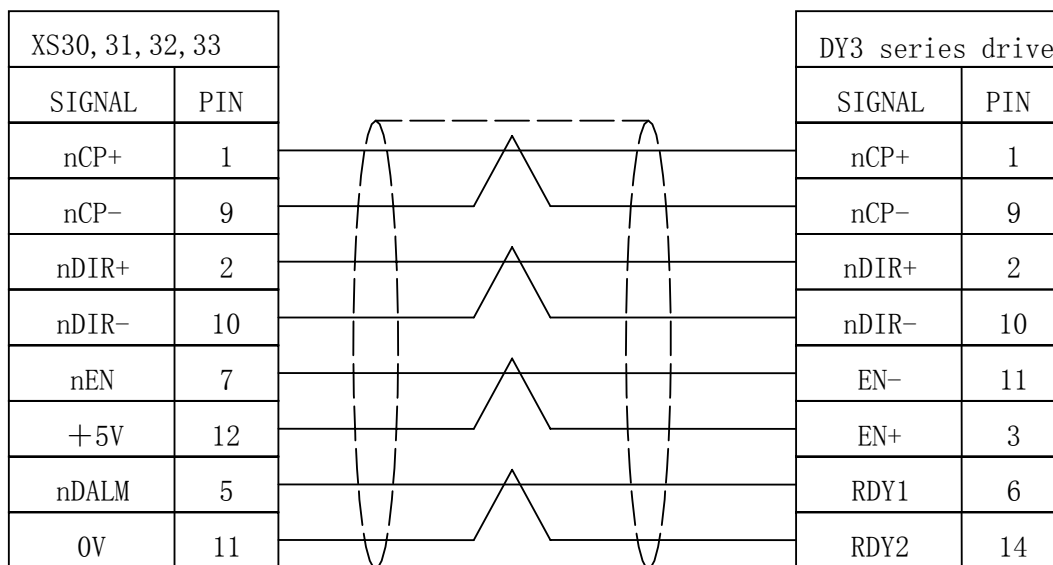


Fig. 2-2-4-1

2. The cables of GSK218MC with DA98 series servo drive unit

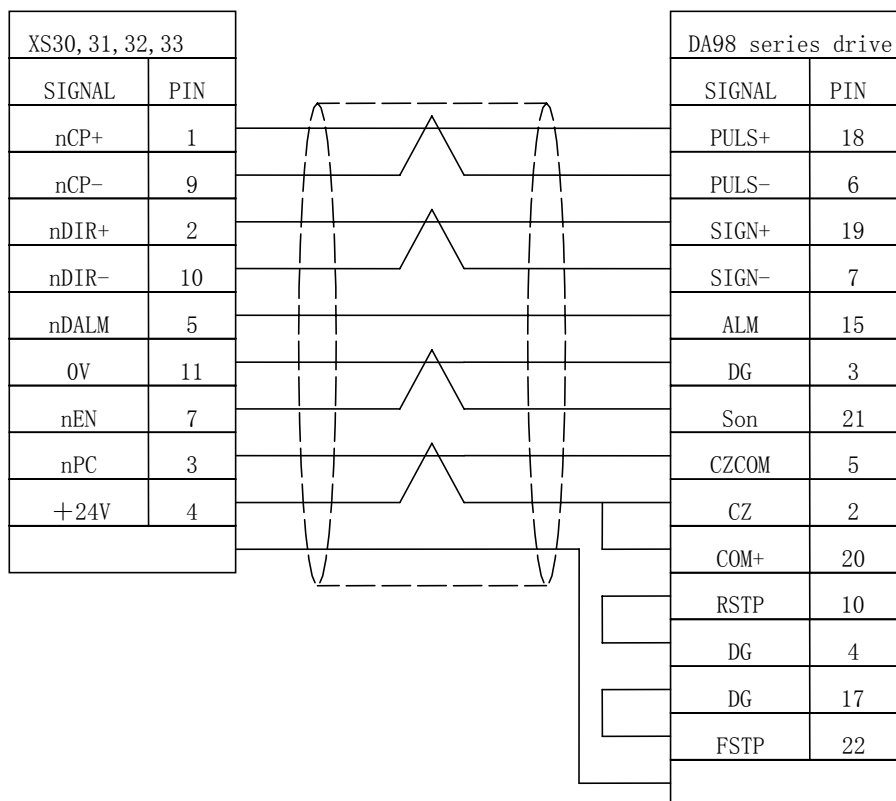


Fig. 2-2-4-2

3. The cables of GSK218MC with DA98B series drive unit:

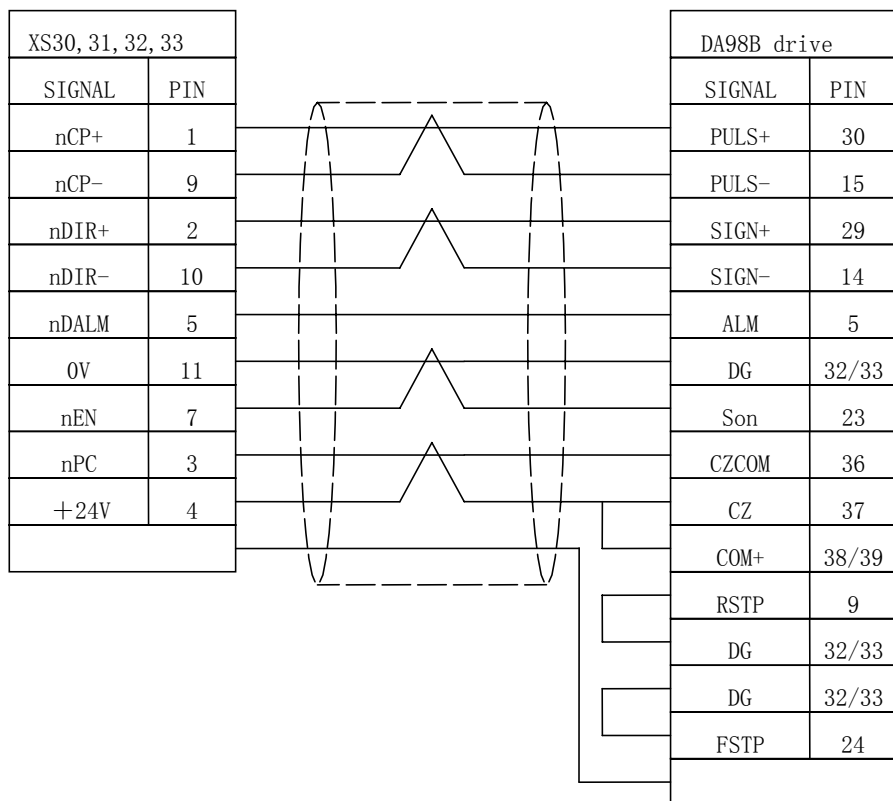


Fig. 2-2-4-3

2.3 RS232 Standard Series Interfaces

GSK218MC CNC system can communicate with PC through RS232-C series interface. (GSK218MC communication software must be equipped.) And the connection diagram is shown as below:

The connection diagram of cables is shown as below:

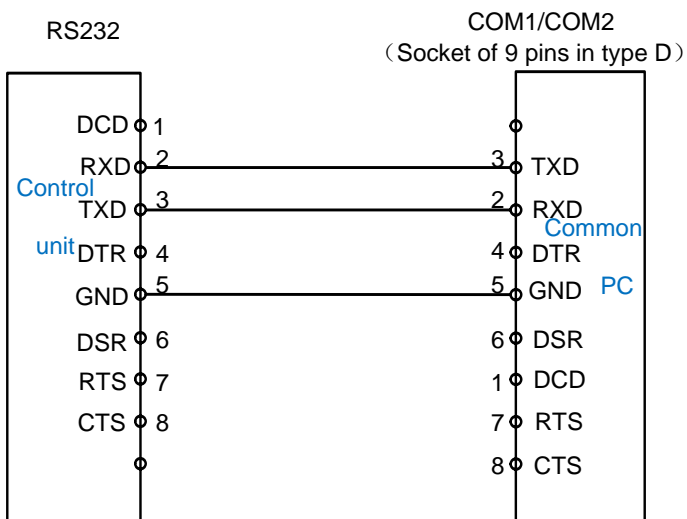


Fig. 2-3-1

2.4 Connection between MPG and Handhold Unit

2.4.1 Interface Signal Diagram

218MC system can be equipped with MPG or handhold unit in difference type or non-difference, the interface signal is shown as below:

XS22: (DB26 female plug)

1	HB+	10	GND	19	LED
2	HB-	11		20	
3	HA+	12		21	VCOM
4	HA-	13		22	ESP2
5	HX	14		23	HY
6	HZ	15		24	HU
7	H ₋	16	VDD5	25	H*1
8	H*10	17		26	H*100
9	ESP1	18			

Fig. 2-4-1-1

2.4.2 Introduction of Interface Signals

HA+, HA−, HB+ and HB−: with MPG in different type or handheld unit pulse signal (with MPG of non-difference type or handheld unit, HA+, HB+ with +5V; HA- with MPG A; HB- with MPG B);

ESP1 and ESP2: Emergency stop signal of handheld unit;

HX, HY, HZ and HU: They are respectively the axis selection signals of X, Y, Z and 4th;

H*1, H*10 and H*100: They are respectively the override signals of MPG pulse equivalent;

VCOM: Common port of handheld unit.

The connection diagram of 218MC with the internal MPG is shown as below:

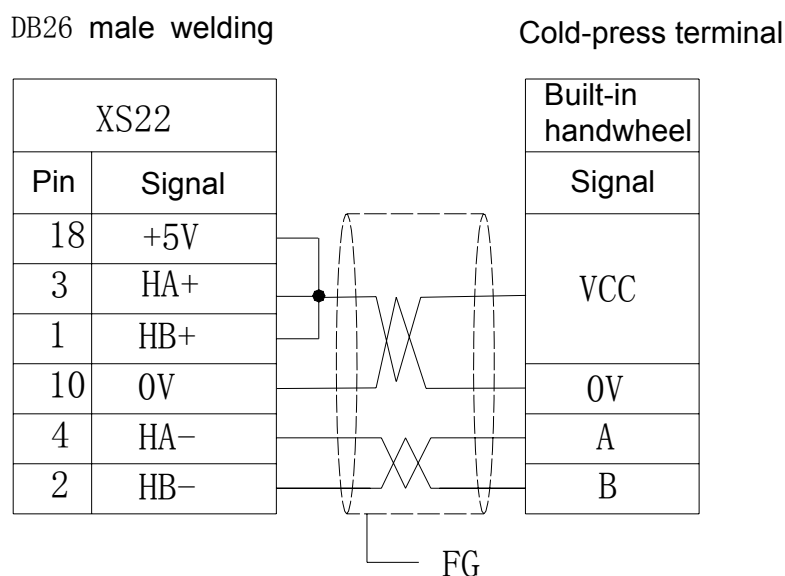


Fig. 2-4-2-1

Connection diagram of GSK218MC with handheld unit in difference type (L) :

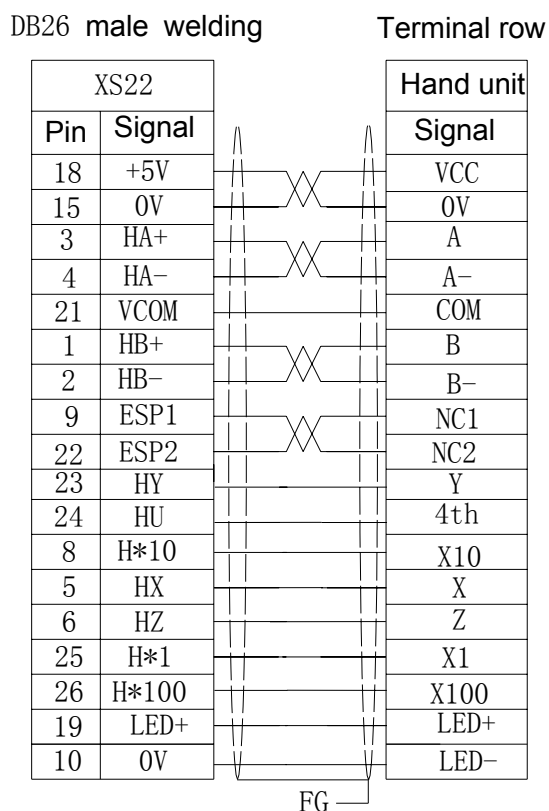


Fig. 2-4-2-2

Connection diagram of GSK218MC with handheld unit in voltage type (E) :

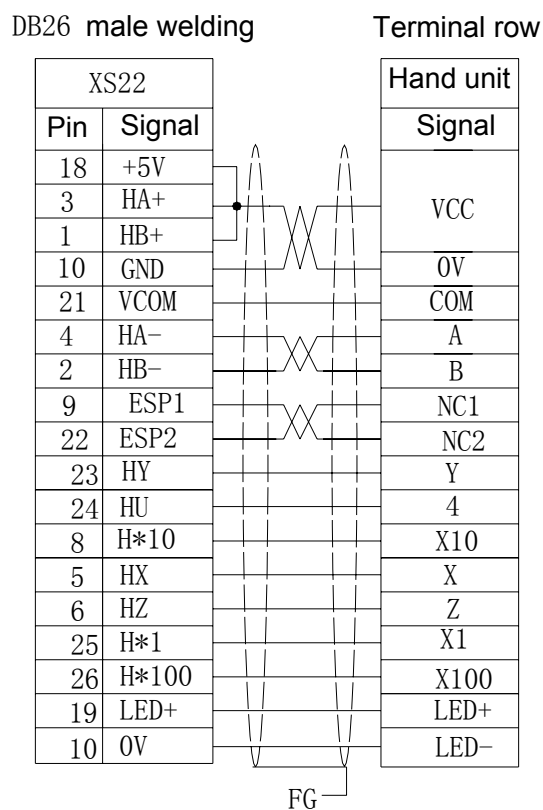


Fig. 2-4-2-3

2.5 Connection of the Spindle Units

2.5.1 List of the Interface Signals

The system interface is DB44 pin socket, and its pin definitions are shown as below:

XS23: (DB44 female plug)

1	PA-	16	PA+	31	GND
2	PB-	17	PB+	32	GND
3	PZ-	18	PZ+	33	SIGN+
4	ZOUT-	19	ZOUT+	34	SIGN-
5	SAR/PAR	20	ZSP	35	COM-
6	SECT	21	COIN	36	COM-
7	ALM	22	RDY	37	COM+
8	ARST	23	COM-	38	COM+
9	SFR	24	SON	39	COM+
10	SPO	25	SRV	40	SP1
11	STAO	26	SP2	41	SECO
12	VP	27	ZSL	42	PURS+
13	GE0	28	PULS-	43	GE1
14	VCMD+	29	AGND	44	VPO
15	VCMD-	30	AGND		

Fig. 2-5-1-1

2.5.2 Introduction of the Interface Signals

- 1) VCMD+ and VCMD-: The analog command input 0~10V;
- 2) The spindle servo input signals: SON drive enable, SFR CW rotation, SRV CCW rotation, STAO position start, SECO position direction option, SPO position option 0, SP1 position option 1, SP2 position option 2, SL clamp at zero speed, ARST alarm reset and switch between VP speed/position;
- 3) The spindle servo output signal: PAR/SAR speed/position reach, RDY ready, ZSP output at zero speed, COIN position finish, ALM alarm output and VPO speed/position state output;
- 4) PA+, PA-, PB+, PB-, PZ+ and PZ-: The motor coder/the spindle coder pulse A, B and Z phases difference output (The spindle servo output signal);
- 5) COM+ and COM-: DC15V~24V power supplied from the external;
- 6) ZOUT+ and ZOUT-: Z axis feedback output of the motor/the spindle coder(the spindle servo output signals) ;
- 7) SECT: Backup;
- 8) PULS+ and PULS-: The pulse command input in position mode;
- 9) SIGN+ and SIGN-: The direction command input in position mode;

2.5.3 The Connection Circuit of DAP03 Interfaces

GSK218MC is equipped with the interface connection circuit of DAP03 control circuit:

DB44 male welding

DB44 female welding

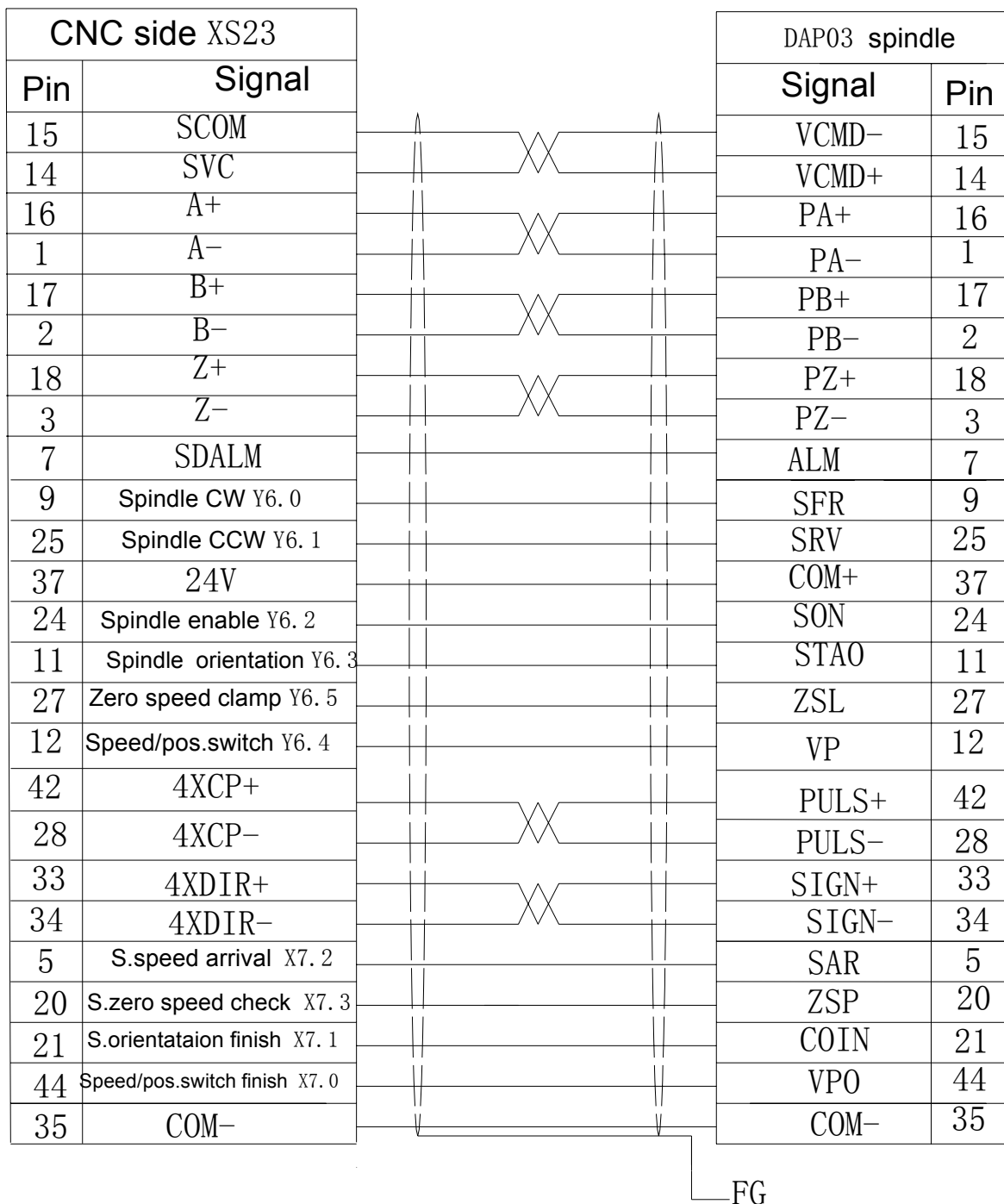


Fig. 2-5-4-1

2.6 The System Power Supply Interface

The input voltage of the system is +24V. And the power supply interface is as below:

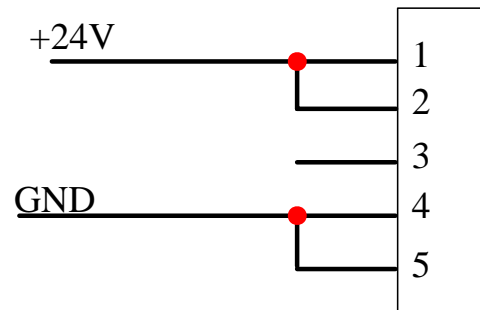


Fig. 2-6-1

2.7 The Control Interface of the External Power Supply

The control interface diagram of the external power supply of the system operation panel is shown as below:

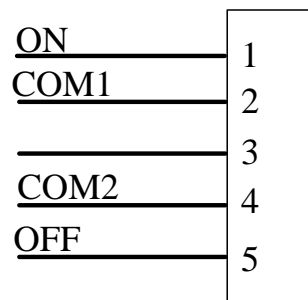


Fig. 2-7-1

CHAPTER THREE THE MACHINE CONTROL I/O INTERFACE

3.1 The Interface Signal List

XS40(input 1): DB25 male plug

1	IN00	14	IN01
2	IN02	15	IN03
3	COM	16	COM
4	+24V	17	IN04
5	IN05	18	IN06
6	IN07	19	COM
7	COM	20	+24V
8	IN08	21	IN09
9	IN10	22	IN11
10	COM	23	COM
11	+24V	24	IN12
12	IN13	25	IN14
13	IN15		

XS41(input 2): DB25 male plug

1	IN16	14	IN17
2	IN18	15	IN19
3	COM	16	COM
4	+24V	17	IN20
5	IN21	18	IN22
6	IN23	19	COM
7	COM	20	+24V
8	IN24	21	IN25
9	IN26	22	IN27
10	COM	23	COM
11	+24V	24	IN28
12	IN29	25	IN30
13	IN31		

XS42(input 3): DB25 male plug

1	IN32	14	IN33
2	IN34	15	IN35
3	COM	16	COM
4	+24V	17	IN36
5	IN37	18	IN38
6	IN39	19	COM
7	COM	20	+24V
8	IN40	21	IN41
9	IN42	22	IN43
10	COM	23	COM
11	+24V	24	IN44
12	IN45	25	IN46
13	IN47		

XS43: output 1 DB25 female plug

1	D000	14	D001
2	D002	15	D003
3	COM	16	+24V
4	+24V	17	D004
5	D005	18	D006
6	D007	19	COM
7	+24V	20	+24V
8	D008	21	D009
9	D010	22	D011
10	COM	23	+24V
11	+24V	24	D012
12	D013	25	D014
13	D015		

XS44: output 2 DB25 female plug

1	D016	14	D017
2	D018	15	D019
3	COM	16	+24V
4	+24V	17	D020
5	D021	18	D022
6	D023	19	COM
7	+24V	20	+24V
8	D024	21	D025
9	D026	22	D027
10	COM	23	+24V
11	+24V	24	D028
12	D029	25	D030
13	D031		

XS45: output 3 DB25 female plug

1	D032	14	D033
2	D034	15	D035
3	COM	16	+24V
4	+24V	17	D036
5	D037	18	D038
6	D039	19	COM
7	+24V	20	+24V
8	D040	21	D041
9	D042	22	D043
10	COM	23	+24V
11	+24V	24	D044
12	D045	25	D046
13	D047		

Fig. 3-1

Among them, XS40, XS41 and XS42 are input interfaces (DB25 pins), and XS43, XS44 and XS45 are output interface (DB25 hole).

3.2 The Input Interfaces

3.2.1 The Circuit Principle of the Input Interface

DC input signals from machine to CNC come from the buttons of the machine side, the limit switch and the contacts of the relay, etc.

a) The contacts of the machine side should satisfy the following conditions:

Contact capacity: DC30V, above 16mA.

The leakage current of contacts during the open-circuit: below 1mA (voltage 26.4V).

The voltage drop of contacts during the closed-circuit: below 2V (current 8.5mA, including the voltage drop of the cable).

b) The return circuit of the signals is shown as fig.3-2-1-1:

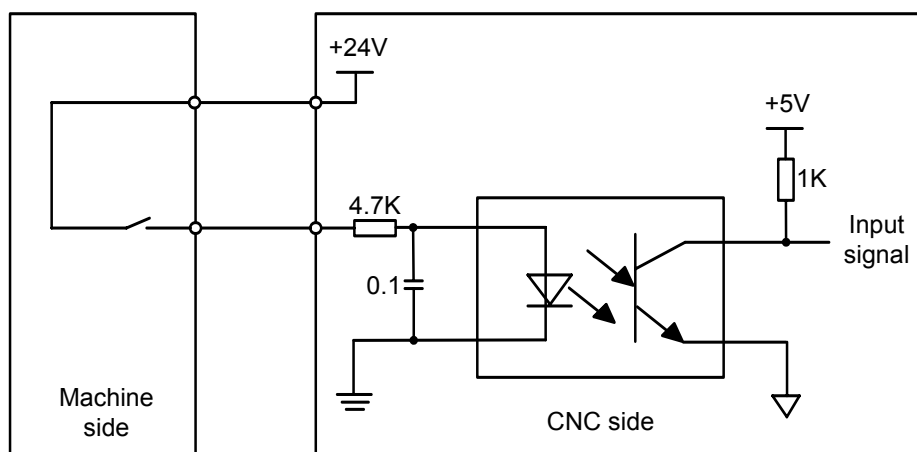


Fig. 3-2-1-1

3.2.2 The Interface Definition of the Input Signals

The definitions of each pin of the input interfaces are show as the following list:

List 3-2-2-1

ADDRESS	SIGNAL INTERFACE	INTERFACE PIN NO.	DEFINITION	CONTACTS
X000.0	XS40	1	The limit signal of X axis in positive direction	NC contact
X000.1	XS40	14	The limit signal of X axis in negative direction	NC contact
X000.2	XS40	2	The limit signal of Y axis in positive direction	NC contact
X000.3	XS40	15	The limit signal of Y axis in negative direction	NC contact
X000.4	XS40	17	The limit signal of Z axis in positive direction	NC contact
X000.5	XS40	5	The limit signal of Z axis in negative direction	NC contact
X000.6	XS40	18	The limit signal of the 4 th axis in positive direction	NC contact
X000.7	XS40	6	The limit signal of the 4 th axis in negative direction	NC contact
X001.0	XS40	8	X axis zero return deceleration signal	NC contact
X001.1	XS40	21	Y axis zero return deceleration signal	NC contact
X001.2	XS40	9	Z axis zero return deceleration signal	NC contact
X001.3	XS40	22	The 4 th axis zero return deceleration signal	NC contact
X001.4	XS40	24	The emergency stop switch (218MC integration)	NC contact
X001.5	XS40	12	The external cycle start	Normally open contact
X001.6	XS40	25	The external feed hold	Normally open contact
X001.7	XS40	13	The lubrication pressure or the oil level detection	Normally open contact
X002.0	XS41	1	Detecting the air supply pressure	Normally open contact
X002.1	XS41	14	Jumping signal	Normally open contact
X002.2	XS41	2	Detection of the index table	NC contact

ADDRESS	SIGNAL INTERFACE	INTERFACE PIN NO.	DEFINITION	CONTACTS
			releasing	
X002.3	XS41	15	Detection of the index table clamping	NC contact
X002.4	XS41	17	The external clamping/releasing tool control	Normally open contact
X002.5	XS41	5	The tool releasing detection	Normally open contact
X002.6	XS41	18	The tool clamping detection	Normally open contact
X002.7	XS41	6	The detection switch of the spindle tool	Set by parameters
X003.0	XS41	8	The editing lock	Normally open contact
X003.1	XS41	21	The operation lock	Normally open contact
X003.2	XS41	9	Undefined	
X003.3	XS41	22	Undefined	
X003.4	XS41	24	Undefined	
X003.5	XS41	12	Undefined	
X003.6	XS41	25	Undefined	
X003.7	XS41	13	Undefined	
X004.0	XS42	1	The handhold unit enable	Normally open contact
X004.1	XS42	14	The spindle gear 1 in-position	Normally open contact
X004.2	XS42	2	The spindle gear 2 in-position	Normally open contact
X004.3	XS42	15	The spindle gear 3 in-position	Normally open contact
X004.4	XS42	17	Undefined	
X004.5	XS42	5	Detecting the safety door switch	Normally open contact
X004.6	XS42	18	Undefined	
X004.7	XS42	6	Undefined	
X005.0	XS42	8	Undefined	
X005.1	XS42	21	The magazine advance in-position	Set by parameters
X005.2	XS42	9	The magazine retraction in-position	Set by parameters
X005.3	XS42	22	The magazine CW /CCW rotation in-position	Set by parameters

ADDRESS	SIGNAL INTERFACE	INTERFACE PIN NO.	DEFINITION	CONTACTS
X005.4	XS42	24	The magazine zero return in-position	Set by parameters
X005.5	XS42	12	The detection switch of the present tool in the toolpot	Set by parameters
X005.6	XS42	25	Undefined	
X005.7	XS42	13	Undefined	
X006.0	XS22	5	The external MPG X axis selection	Normally open contact
X006.1	XS22	23	The external MPG Y axis selection	Normally open contact
X006.2	XS22	6	The external MPG Z axis selection	Normally open contact
X006.3	XS22	24	The external MPG A axis selection	Normally open contact
X006.4	XS22	25	The external MPG step width 0.001	Normally open contact
X006.5	XS22	8	The external MPG step width 0. 01	Normally open contact
X006.6	XS22	26	The external MPG step width 0. 1	Normally open contact
X006.7	XS22	ESP (9, 22)	The external emergency stop	NC contact
X007.0	XS23	44	Completing to switch between the speed/position mode	Set by parameters
X007.1	XS23	21	Completing the spindle orientation	Set by parameters
X007.2	XS23	5	The spindle speed reach	Set by parameters
X007.3	XS23	20	The spindle zero-speed detection	NC contact

3.3 The Output Interface

3.3.1 The Circuit Principle of the Output Interface

a) The specification of the transistor for output:

- ① When the output is ON, the maximum load current includes the instant current below 200mA.
- ② When the output is ON, the maximum saturation voltage is 1.6V during 200mA, and its typical value is 1V.

③ When the output is OFF, the voltage resistance includes the instant voltage below 24+20%.

④ When the output is OFF, the leakage current is below 100 μ A.

b) The output return circuit:

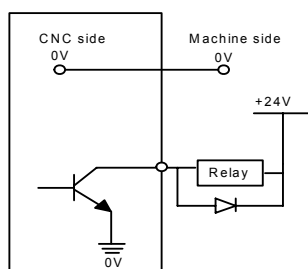


Fig. 3-3-1-1

All the output signals of the system are provided by Darlington tube, and when the output is valid, the corresponding Darlington tube is conducted. Except TL-, TL+ and SPZD are the pulse signals (Not hold output), the other outputs are the level signals (output hold), and the common port of the signal is +24V.

3.3.2 The Definitions of the Output Signal Interfaces

List 3-3-2-1

ADDRESS	SIGNAL INTERFACE	INTERFACE PIN NO.	DEFINITION
Y000.0	XS43	1	Z axis band-type brake
Y000.1	XS43	14	Cooling
Y000.2	XS43	2	The tool releasing/ clamping
Y000.3	XS43	15	Undefined
Y000.4	XS43	17	The spindle brake
Y000.5	XS43	5	Undefined
Y000.6	XS43	18	The red alarm lamp
Y000.7	XS43	6	The yellow alarm lamp
Y001.0	XS43	8	The green alarm lamp
GY001.1	XS43	21	Chip removal control
Y001.2	XS43	9	Lubricating
Y001.3	XS43	22	The machine lighting control
Y001.4	XS43	24	Hydraulic pressure starting
Y001.5	XS43	12	Blowing the spindle
Y001.6	XS43	25	The index table releasing
Y001.7	XS43	13	The index table clamping
Y002.0	XS44	1	Undefined
Y002.1	XS44	14	Undefined
Y002.2	XS44	2	Undefined
Y002.3	XS44	15	Undefined

ADDRESS	SIGNAL INTERFACE	INTERFACE PIN NO.	DEFINITION
Y002.4	XS44	17	The handheld unit lamp
Y002.5	XS44	5	Undefined
Y002.6	XS44	18	Hydrovalve output
Y002.7	XS44	6	Switching between the spindle/speed mode
Y003.0	XS44	8	The magazine CW rotation
Y003.1	XS44	21	The magazine CCW rotation
Y003.2	XS44	9	The magazine advance
Y003.3	XS44	22	The magazine retraction
Y003.4	XS44	24	The spindle gear 1(frequency conversion/IO point control)
Y003.5	XS44	12	The spindle gear 2(frequency conversion/IO point control)
Y003.6	XS44	25	The spindle gear 3(frequency conversion/IO point control)
Y003.7	XS44	13	Undefined
Y004.0	XS45	1	Undefined
Y004.1	XS45	14	Undefined
Y004.2	XS45	2	Undefined
Y004.3	XS45	15	Undefined
Y004.4	XS45	17	Undefined
Y004.5	XS45	5	Undefined
Y004.6	XS45	18	Undefined
Y004.7	XS45	6	Undefined
Y005.0	XS45	8	Undefined
Y005.1	XS45	21	Undefined
Y005.2	XS45	9	Undefined
Y005.3	XS45	22	Undefined
Y005.4	XS45	24	Undefined
Y005.5	XS45	12	Undefined
Y005.6	XS45	25	Undefined
Y005.7	XS45	13	Undefined
Y006.0	XS23	9	The spindle CW rotation
Y006.1	XS23	25	The spindle CCW rotation
Y006.2	XS23	24	The spindle enable
Y006.3	XS23	11	The spindle orientation
Y006.4	XS23	12	Switching between speed/position mode
Y006.5	XS23	27	Clamping at zero speed

CHAPTER FOUR MACHINE DEBUGGING

This chapter introduces some methods and steps of installing, debugging and trial running GSK218MC system. After the following debugging steps are completed, the machine can be operated correspondingly.

4.1 Debugging Ready

Debugging **GSK218MC** can be operated as 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 **GSK218MC**:

- 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 **GSK218MC** 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 **218MC** integration system, the user can monitor and check the state of the emergency stop input signal through checking NO: 1#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. As to 218MC-H/ 218MC-V, check NO:23#5 (MT-emergency stop).

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

218MC parameter diagnosis (The input state on the system side)

State address				X1.4				
Pin NO.				XS40.24				

218MC-H/-V parameter diagnosis (the input state on the system side)

State address			X23.5					
Pin NO.								

Remark: The situations occur in the system: 0251:the emergency stop alarm, please check whether the state of X1.4 is 1 in 218MC system; while check X23.5 in 218MC-H/-V system. However, it's not allowed to ignore the emergency stop alarm by the bit parameter NO:61#5, which may result some functions can't be used normally, such as M3 and M4. 218MC is with the external emergency stop button, while 218MC-H/-V is with the internal emergency stop button,

and the allocation is on the system operation panel.

It's required to correctly display the alarm "some axis (X, Y or Z) 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, GSK218MC 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:

List 4-3-1

ADDRESS	SIGNAL INTERFACE	INTERFACE PIN NO.	DEFINITION	CONTACT
X000.0	XS40	1	Limit signal of X axis in positive direction	NC contact
X000.1	XS40	14	Limit signal of X axis in negative direction	NC contact
X000.2	XS40	2	Limit signal of Y axis in positive direction	NC contact
X000.3	XS40	15	Limit signal of Y axis in negative direction	NC contact
X000.4	XS40	17	Limit signal of Z axis in positive direction	NC contact
X000.5	XS40	5	Limit signal of Z axis in negative direction	NC contact
X000.6	XS40	18	Limit signal of the 4 th axis in positive direction	NC contact
X000.7	XS40	6	Limit signal of the 4 th axis in negative direction	NC contact

2. Rewriting the following parameters:

List 4-3-2

ADDRES S	DEFINITION	STATE 0	STATE 1	SETTING VALUE
K006.0	Selecting limit switch of X axis	2 switches	1 switch	0
K006.1	Selecting limit switch of Y axis	2 switches	1 switch	0
K006.2	Selecting limit switch of Z axis	2 switches	1 switch	0

K006.3	Selecting limit switch of the 4 th axis	2 switches	1 switch	0
--------	--	------------	----------	---

B. The situation of one limit switch:

(The only switch is used for some switch in positive and negative directions)

1. Please strictly connect as the following list:

List 4-3-3

ADDRESS	SIGNAL INTERFACE	INTERFACE PIN NO.	DEFINITION	
X000.0	XS40	1	Limit signal of X axis	NC contact
X000.2	XS40	2	Limit signal of Y axis	NC contact
X000.4	XS40	17	Limit signal of Z axis	NC contact
X000.6	XS40	18	Limit signal of the 4 th axis	NC contact

2. Rewriting the following parameters:

List 4-3-4

ADDRESS	Definition	STATE 0	STATE 1	SETTING VALUE
K006.0	Selecting limit switch of X axis	2 switches	1 switch	1
K006.1	Selecting limit switch of Y axis	2 switches	1 switch	1
K006.2	Selecting limit switch of Z axis	2 switches	1 switch	1
K006.3	Selecting limit switch of the 4 th axis	2 switches	1 switch	1

List 4-3-5

ADDRESS	DEFINITION	STATE 0	STATE 1	SETTING VALUE
K007.0	Take the direction opposite with X axis limit alarm one			
K007.1	Take the direction opposite with Y axis limit alarm one			
K007.2	Take the direction opposite with Z axis limit alarm one			
K007.3	Take the direction opposite with the 4 th axis limit alarm one			

State parameters

0	1	1	BFA	LZR						
---	---	---	-----	-----	--	--	--	--	--	--

LZR =1: Detect the limit after power on before the manual reference point return.

=0: Not detect the limit after power on before the manual reference point return.

BFA =1: When the overrun command occurs, the system alarms after overtravel.

=0: When the overrun command occurs, the system alarms before overtravel.

The system parameter numbers:

0	3	1			G13					
---	---	---	--	--	-----	--	--	--	--	--

G13 =1: It is set as G13 mode during power-on or clearing the state.

=0: It is set as G12 mode during power-on or clearing the state.

The system parameter numbers:

0	6	1		LALM						
---	---	---	--	------	--	--	--	--	--	--

LALM =1:Ignore the limit alarm.

=0: Not ignore the 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~P163** and **P165~P168** 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 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, the linear of GSK motor encoder is C=2500.

Z_M : The number of gear teeth at the end of the screw.

} With the change gear

Z_D : The number of gear teeth at the end of the motor.

System side:

Frequency of the numerator: NO.160, NO.161, NO.162 and NO.163 of the system parameters (the code frequency multiplication coefficient).

Frequency of the denominator: NO.165, NO.166, NO.167 and NO.168 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.

If the step drive is required, try to select the drive unit with the step subdivision function, select the mechanical transmission ratio properly, and try to set the system electrical gear ratio as 1:1, so the big difference between the numerator and the denominator of the electrical gear ratio can be avoided.

【Example 2】 The formular of the gear ratio of the rotation axis:

$$G = \frac{N \times C \times 4}{P} = \frac{1 \times 2500 \times 4}{360 \times 1000 \times \text{reduction ratio (driving/passive tooth)}}$$

4.5 Backlash Compensation

The dialgauge, 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 G91 X1 F800 ;

N20 X1 ;

N30 X1 ;
 N40 X-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.

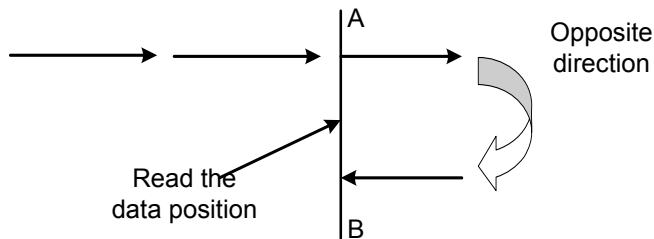


Fig. 4-5-1 (Measuring method of the backlash)

- 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.

Remark 1: The backlash compensation amount of each axis is set by data parameters P190~P193.

Remark 2: The mode of backlash compensation amount and the compensation frequency are set by data parameters P195~P198.

Remark 3: To guarantee the machine precision, the backlash can be detected again after the machine is unused for three months.

The system parameter number

0	1	8	RVCS							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.

RVCS =1: The compensation mode of the backlash: up and down speed.

=0: The compensation mode of the backlash: the fixed frequency.

4.6 Setting the Drive Unit

If the machine traverse direction isn't compliance with that required by the position movement code, the position parameter NO: 3#1~ NO: 3#5 can be rewritten.

System parameter numbers:

0	0	3				DIR4	DIRZ	DIRY	DIRX	
---	---	---	--	--	--	------	------	------	------	--

DIRX =1:X axis feeding direction.

=0: Taking the direction opposite with X axis feeding one.

DIRY =1: Y axis feeding direction.

=0: Taking the direction opposite with Y axis feeding one.

DIRZ =1: Z axis feeding direction.

=0: Taking the direction opposite with Z axis feeding one.

DIR4 =1: The 4th axis feeding direction.

=0: Taking the direction opposite with the 4th axis feeding one.

After power on, if the system displays the alarm of X, Y, Z 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#4** 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#4** 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#4** 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.

The system parameter number

0	1	9			ALMS	ALM5	ALM4	ALMZ	ALMY	ALMX
---	---	---	--	--	------	------	------	------	------	------

ALMX =1: X axis drive alarm high level is valid.

=0: X axis drive alarm low level is valid.

ALMY =1: Y axis drive alarm high level is valid.

=0: Y axis drive alarm low level is valid.

ALMZ =1: Z axis drive alarm high level is valid.

=0: Z axis drive alarm low level is valid.

ALM4 =1: The 4th axis drive alarm high level is valid.

=0: The 4th axis drive alarm low level is valid.

ALM5 =1: The 5th axis drive alarm high level is valid.

=0: The 5th axis drive alarm low level is valid.

ALMS =1: The spindle drive unit alarm high level is valid.

=0: The spindle drive unit alarm low level is valid.

The system parameter number

0	6	1	FALM			SALM				
---	---	---	-------------	--	--	-------------	--	--	--	--

SALM =1:Ignore the spindle drive unit alarm.

=0:Not ignore the spindle drive unit alarm.

FALM =1: Ignore the feeding axis drive unit alarm.

=0: Not ignore the feeding axis drive unit 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, 127) is set by the mechanical errors of intervals N and N-1.
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. The point number to be compensated: each 256 points in each axis.
5. The range of compensation amount: each compensation point (-999 pulse equivalent~+999 pulse equivalent) x the compensation override.
6. The setting method is same as the input method of the system parameters; about it, refer to *Operation*.

● Points of attention for setting the compensation amount:

1. Whether the screw pitch is compensated is set by bit parameter **NO:37#0**.
2. Data parameters **P216~P220**: The screw pitch error compensation number of each axis reference point (setting the compensation zero point).
3. Data parameters **P221~P225**: Compensation point number of each axis screw pitch error.
4. Data parameters **P226~P230**: Compensation interval of each axis screw pitch error. If the positive compensation interval is input, compensation is executed based on the value. If the negative interval is input and displayed by the absolute value, compensation is executed based on the absolute value.
5. The system parameters **P231~P235**: Each axis screw pitch error compensation override, and the system defaults 0.001.

6.If the input compensation interval is 0, it doesn't require to compensate.

7. After setting the relative parameters about the screw pitch error, the parameters become valid after returning to the mechanical zero point and power on again.

● **Setting the compensation parameters in one direction, taking X axis as an example**

The zero return screw pitch compensation is set in positive direction, and the mechanical zero point is taken as the reference point of the error compensation, so the screw pitch error compensation can only be executed on the machine coordinate system.

List 4-7-1

PARAMETER	SETTING VALUE
P216: The compensation number of X reference point	255
P221: The compensation point number of X axis screw pitch error	256
P226: The compensation interval of X axis screw pitch error	10
P231: The compensation override of X axis screw pitch error	0.001

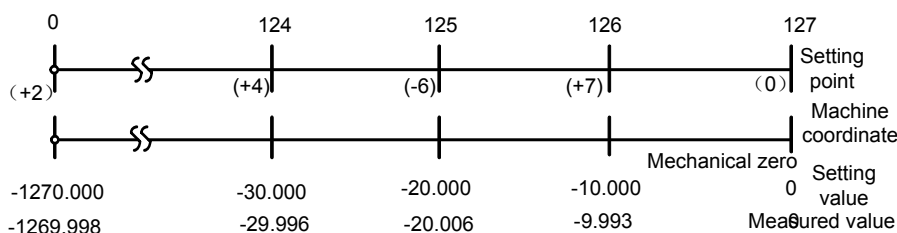


Fig. 4-7-1

The compensation value is set in 【screw pitch compensation X】 in offset.

List 4-7-2

NUMBER	0	.....	.....	124	125	126	127
COMPENSATION AMOUNT	+2	.....	.....	+4	-6	+7	0

The zero return screw pitch compensation is set in negative direction, and the mechanical zero point is taken as the reference point of the error compensation, so the screw pitch error compensation can only be executed on the machine coordinate system.

List 4-7-3

PARAMETER	SETTING VALUE
P216: The compensation number of X reference point.	0
P221: The compensation point number of X axis screw pitch error	256

P226: The compensation interval of X axis screw pitch error	10
P231: The compensation override of X axis screw pitch error	0.001

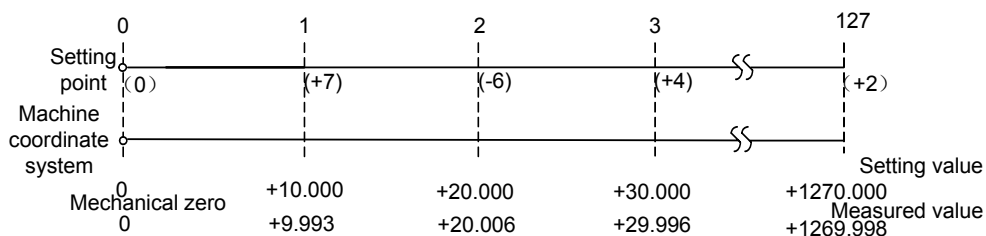


Fig. 4-7-2

Set the compensation value in 【screw pitch error X】 in offset.

List 4-7-4

NUMBER	0	1	2	3	.....	.....	127
COMPENSATION AMOUNT	0	+7	-6	+4	.....	.....	+2

The setting method of Y and Z axes are same as above.

4.8 Mechanical Zero Return (Machine Zero Return)

1. 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 and Z 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. 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**.

Zero return type using stepper motor with no encoder: A

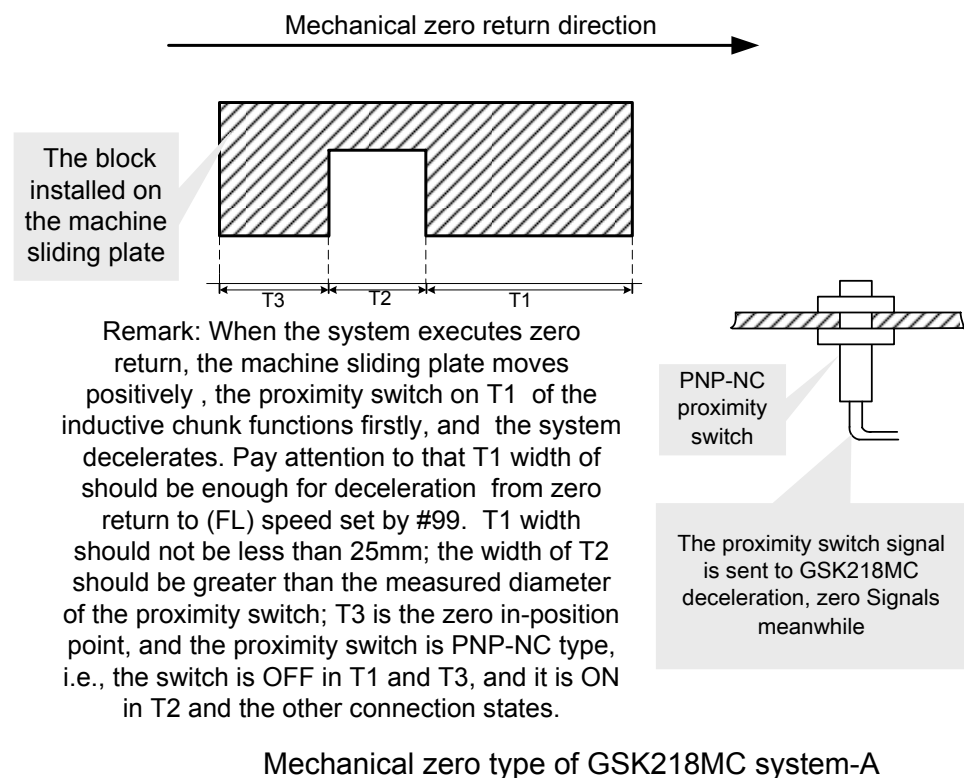


Fig. 4-8-1

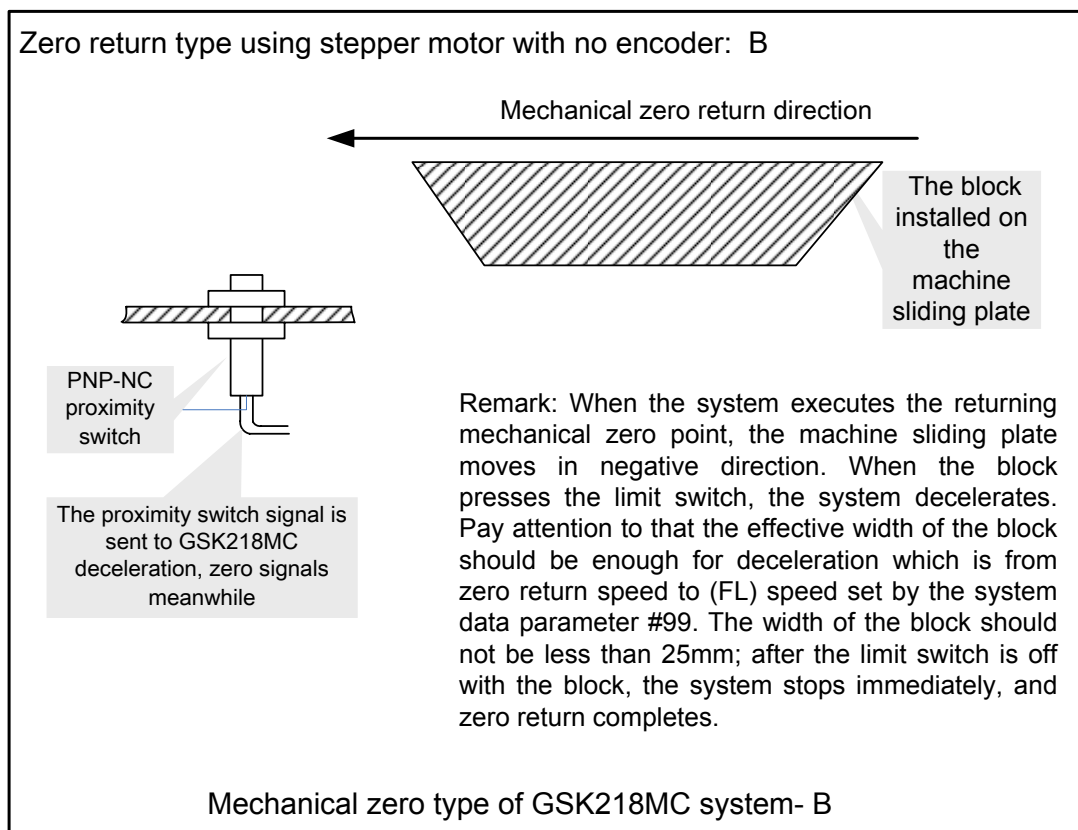


Fig. 4-8-2

2. Operation steps of mechanical zero return:



(1) Press **MACHINE ZERO** 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 or Z axis for mechanical zero return, and zero return direction is set by bit parameters **N0:7#3~N0:7#5**.

(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~P103**. After touching the deceleration switch, the machine traverses to the mechanical zero point (the reference point) at FL speed set by data parameter **P099**. During returning the mechanical zero point, the coordinate axis stops moving, the zero return indicator is ON.

3. Operation steps of the mechanical zero return with the program codes

After the bit parameter **N0:4#3** is set as 0, zero return can be operated by G28 because detecting the limit block is equivalent to the mechanical zero return in JOG mode,

Remark 1: If there isn't the mechanical zero point in your CNC machine, please don't use the mechanical zero return operation.

Remark 2: After the mechanical zero point completes, the indicator of the corresponding axis is ON.

Remark 3: When the operator uses some axis taking from the mechanical zero point, the indicator is OFF.

Remark 4: About the mechanical zero point (the reference point) direction, please refer to the manual of the machine manufactory.

● Relative signals

DECX: Deceleration signal in X direction;

DECY: Deceleration signal in Y direction;

DECZ: Deceleration signal in Z direction;

DEC4: Deceleration signal in the 4th axis.

The parameter diagnosis (the input state on the machine side)

STATE ADDRESS					X1.3	X1.2	X1.1	X1.0
PIN NO.					XS40.22	XS40.09	XS40.21	XS40.08

State parameters No.001

0	0	1	SJZ						
---	---	---	-----	--	--	--	--	--	--

SJZ =1: The reference point memory: memory.

=0: The reference point memory: not memory.

The system parameter number

0	0	6	MAOB	ZPLS					
---	---	---	------	------	--	--	--	--	--

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.

The system parameter number

0	0	7		ZMI4	ZMIz	ZMIy	ZMIx		
---	---	---	--	------	------	------	------	--	--

ZMIx =1: Setting X axis reference point return direction: negative.

=0: Setting X axis reference point return direction: positive.

ZMIy =1: Setting Y axis reference point return direction: negative.

=0: Setting Y axis reference point return direction: positive.

ZMIz =1: Setting Z axis reference point return direction: negative.

=0: Setting Z axis reference point return direction: positive.

ZMI4 =1: Setting the 4th axis reference point return direction: negative.

=0: Setting the 4th axis reference point return direction: positive.

Data parameter No.099

0	9	9	ZRNFL
---	---	---	-------

ZRNFL: The low speed of X, Y, Z and the 4th axis return to the reference point, which are common to all axes.

Data parameters No.100~No.103

1	0	0	Speed of X axis returning to the reference point
1	0	1	Speed of Y axis returning to the reference point
1	0	2	Speed of Z axis returning to the reference point
1	0	3	Speed of the 4 th axis returning to the reference point

4.9 Controlling the Input and Output Signals during the Spindle CW and CCW Rotation

- Relative signal
 - 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

Parameter diagnosis (output state on the system side)

STATE ADDRESS							Y6.1	Y6.0
PIN NO.							XS23.25	XS23.09

Y6.0= the spindle CW signal output; Y6.1= the spindle CCW signal output.

STATE ADDRESS						Y6.2		
PIN NO.						XS23.24		

Y6.2= The spindle enable.

The parameter diagnosis (the output state on the machine side)

STATE ADDRESS					X7.3	X7.2		
PIN NO.					XS23.20	XS23.05		

X7.2= the spindle speed/position reach signal input; X7.3=the spindle zero speed detection signal input.

STATE							X7.1	
ADDRESS								
PIN NO.							XS23.21	

X7.1= the spindle orientation finish signal.

Data parameters No.257

2	5	7	
---	---	---	--

The spindle maximum speed during tapping cycle

Data parameters No.258

2	5	8	
---	---	---	--

The spindle maximum speed.

● Movement time sequence

The spindle movement time sequence is shown as the following figure 4-9-1:

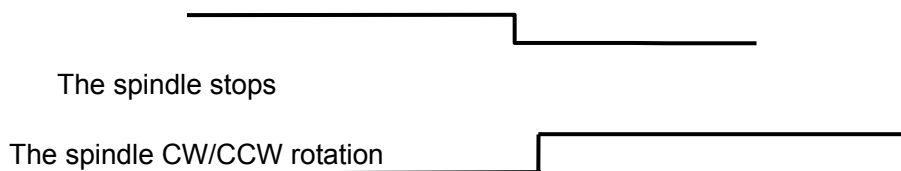


Fig.4-9-1 The spindle CCW rotation time sequence

● Control logic

- ① When the system is ON, the spindle stops, M05 signal output is hold;
- ② After executing M3/M4 code, M3/M4 is valid and hold, M05 signal doesn't output.

4.10 The Spindle Automatic Gear Change Control

● Relative signals

Y3.4~Y3.6: The spindle automatic gear change output signal.

X4.1~X4.3: 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 in three gears and the gear change in-position detection function in three gears.

● The signal diagnosis

The parameter diagnosis (the output state on the system side)

STATE		Y3.6	Y3.5	Y3.4				
ADDRESS								
PIN NO.		XS44.25	XS44.12	XS44.24				

Y3.4=the spindle gear I output; Y3.5= the spindle gear II output; Y3.6= The spindle gear III output.

The parameter diagnosis (the input state on the machine side)

STATE					X4.3	X4.2	X4.1	
ADDRESS								
PIN NO.					XS42.15	XS42.02	XS42.14	

X4.1= the spindle gear I in-position; X4.2= the spindle gear II in-position; X4.3= the spindle gear III in-position.

- The control parameters

State parameters

0	0	1						SPT		
---	---	---	--	--	--	--	--	-----	--	--

SPT =1: The spindle control type: I/O point control.

=0: The spindle control type: frequency conversion or other mode.

Data parameters No.246

2	4	6	
---	---	---	--

The maximum speed corresponding to gear 1 (When the spindle is in gear I , the maximum speed is the spindle one when the transducer is corresponding to 10V voltage.)

Data parameters No.247

2	4	7	
---	---	---	--

The maximum speed corresponding to gear 2 (When the spindle is in gear II , the maximum speed is the spindle one when the transducer is corresponding to 10V voltage.)

Data parameters No.248

2	4	8	
---	---	---	--

The maximum speed corresponding to gear 3 (When the spindle is in gear III, the maximum speed is the spindle one when the transducer is corresponding to 10V voltage.)

Data parameters No.250

2	5	0	
---	---	---	--

The maximum speed of the motor during the spindle gear change (The maximum speed is the motor one when the transducer is corresponding to 10V voltage.)

Data parameters No.251

2	5	1	
---	---	---	--

The motor speed during the spindle gear change (relative to the speed of data parameter 251).

Remark: 1. When the machine is with the automatic gear change device, K8.4 is set as 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, K9.3 should be set as 1; otherwise, 0.

3. When the spindle is I/O point control, K4.0 should be set as 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

The parameter diagnosis (the input state on the system side)

STATE ADDRESS		X1.6	X1.5					
---------------	--	------	------	--	--	--	--	--

PIN NO.		XS40.25	XS40.12					
---------	--	----------------	----------------	--	--	--	--	--

X1.5=The external cycle start; X1.6=The external feed hold.

- The signal internal connection

About *SP/ST signal internal circuit, refer to the following figure 4-11-1:

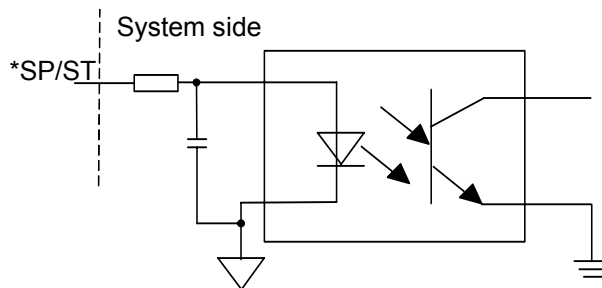


Fig. 4-11-1

- The external circuit

About the connection between *SP and ST signals, refer to the following figure 4-11-2.

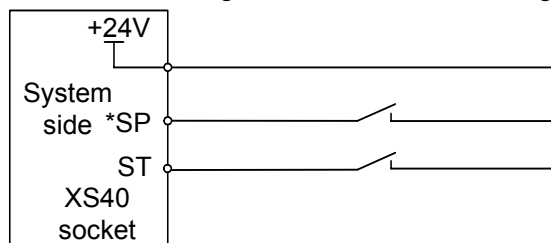


Fig. 4-11-2

- Rewriting the following parameters:

ADDRESS	DEFINITION	STATE 0	STATE 1	SETTING VALUE
K005.1	Whether the machine is with the external cycle start	NO	YES	1

4.12 The External Editing Lock and the External Operation Panel Lock

- The relative signals

LEDT: The external editing lock signal. When the signal is 1, the program can be edited, and it is same as the function of the program switch on the system.

LSYS: The external operation panel lock signal. When the signal is 1, all the operation keys on the machine are locked.

Signal address

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

Parameter diagnosis (the input state on the system side)

STATE ADDRESS							X3.1	X3.0
PIN NO.							XS41.21	XS41.8

X3.0= the external editing lock; X3.1= the external operation panel lock.

The system parameter number

0	5	9		LEDT	LOPT				
----------	----------	----------	--	-------------	-------------	--	--	--	--

LOPT =1: Use the external operation panel lock.

=0: Not use the external operation panel lock.

LEDT =1:Use the external editing lock.

=0: Not use the external editing lock.

4.13 Cooling, Lubricating and Chip Removal Control

- Relative signals

M08: Coolant is ON.

M35: The chip removal function is ON.

- Signal diagnosis

Parameter diagnosis (The output state on the machine side)

STATE ADDRESS							Y0.1	
PIN NO.							XS43.14	

Y0.1= the cooling switch control.

Parameter diagnosis (the machine side output state)

STATE ADDRESS							Y1.1	
PIN NO.							XS43.21	

Y1.1= the chip removal switch control.

- About the internal circuit, refer to the following figure 4-13-1:

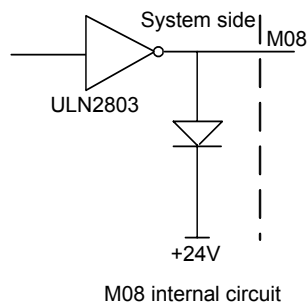


Fig. 4-13-1

4.14 Setting the Relative Feedrate

The system parameter number

0	1	2	FDR	RDR	TDR	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.

TDR =1: During tapping, dry run is valid.

=0: During tapping, dry run is invalid.

RDR =1: During cutting feed, dry run is valid.

=0: During cutting feed, dry run is invalid.

FDR =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 at power-on	300
------	----------------------------------	-----

Setting range: 0~9999 (mm/min)

0088	G0 rapid speed of X axis	5000
------	--------------------------	------

Setting range: 0~9999 (mm/min)

0089	G0 rapid speed of Y axis	5000
------	--------------------------	------

Setting range: 0~9999 (mm/min)

0090	G0 rapid speed of Z axis	5000
------	--------------------------	------

Setting range: 0~9999 (mm/min)

0091	G0 rapid speed of the 4 th axis	5000
------	--	------

Setting range: 0~9999 (mm/min)

0093	Fo speed of rapid override of each axis (common to all axes)	30
------	--	----

Setting range: 0~1000 (mm/min)

0094	Maximum feedrate during rapid positioning (common to all axes)	8000
------	--	------

Setting range: 0~9999 (mm/min)

0095	The lowest feedrate during rapid positioning (common to all axes)	0
------	---	---

Setting range: 0~500 (mm/min)

0096	The maximum control speed during cutting feed (common to all axes)	6000
------	--	------

Setting range: 0~9999 (mm/min)

0097	The lowest control speed during cutting feed (common to all axes)	0
------	---	---

Setting range: 0~500 (mm/min)

0098	Feedrate during continuous feeding of each axis is JOG mode	2000
------	---	------

Setting range: 0~5000 (mm/min)

0099	Reference point return speed (FL) (common to all axes)	40
------	--	----

Setting range: 0~500 (mm/min)

0100	Reference point return speed of X axis	4000
------	--	------

Setting range: 0~9999 (mm/min)

0101	Reference point return speed of Y axis	4000
------	--	------

Setting range: 0~9999 (mm/min)

0102	Reference point return speed of Z axis	4000
------	--	------

Setting range: 0~9999 (mm/min)

0103	Reference point return speed of the 4 th axis	4000
------	--	------

Setting range: 0~9999 (mm/min)

0170	Speed of rapid positioning of X axis in JOG mode	5000
------	--	------

Setting range: 0~30000 (mm/min)

0171	Speed of rapid positioning of Y axis in JOG mode	5000
------	--	------

Setting range: 0~30000 (mm/min)

0172	Speed of rapid positioning of Z axis in JOG mode	5000
------	--	------

Setting range: 0~30000 (mm/min)

0173	Speed of rapid positioning of the 4 th axis in JOG mode	5000
------	--	------

Setting range: 0~30000 (mm/min)

4.15 Setting the Relative Tapping Parameters

Positioning parameter number

0	4	4			PCP	DOV			VGR	
---	---	---	--	--	-----	-----	--	--	-----	--

VGR =1: The gear ratio of the spindle and the position encoder can be random.

=0: The gear ratio of the spindle and the position encoder can be random.

DOV =1: The override is valid during the rapid tapping retraction.

=0: The override is invalid during the rapid tapping retraction.

PCP =1: It is the tapping cycle of the deep hole at high speed during the flexibility tapping.

=0: It is the tapping cycle of the standard deep hole during the flexibility tapping.

System parameter number

0	4	5				OVS	OVU	TDR		NIZ
---	---	---	--	--	--	-----	-----	-----	--	-----

NIZ =1: The smooth processing is operated during rigid tapping.

=0: The smooth processing is not operated during rigid tapping.

TDR =1: During the rigid tapping feeding, the same time constant is used during tool retraction.

=0: During the rigid tapping feeding, the same time constant is not used during tool retraction.

OVU =1: The tool retraction override is 10% during rigid tapping.

=0: The tool retraction override is 1% during rigid tapping.

OVS =1: The feedrate override selection and the override cancel signal are valid during rigid tapping.

=0: The feedrate override selection and the override cancel signal are invalid during rigid tapping.

System parameter number

0	4	6			ORI				SSOG	
---	---	---	--	--	-----	--	--	--	------	--

SSOG =1: The spindle control mode is servo when the tapping starts.

=0: The spindle control mode is following when the tapping starts.

ORI =1: The spindle exact stops when the tapping starts.

=0: The spindle doesn't exact stop when the tapping starts.

Parameter number K

0	0	7	PAP							
---	---	---	-----	--	--	--	--	--	--	--

DGN =1: Use the spindle position mode.

=0: Not use the spindle position mode.

It is set as 1 during the rigid tapping, and it is set as 0 during the flexibility tapping.

Appendix: The setting method of rigid and flexibility tapping when GSK218MC system with DAP03 spindle servo drive unit

Points of attention:

- (1) During rigid tapping, 218MC is with DAP03 spindle servo drive unit.
- (2) During rigid tapping, 218MC must be connected with DAP03 spindle servo drive unit properly.

Setting steps:

A. Setting rigid tapping: The system adopts the default parameters, and only the following parameters can be rewritten:

1. Bit parameter: **NO:46#1** is rewritten into 1 (servo mode).
2. PLC parameter: **K7#7** is rewritten into 1 (the spindle position mode).
3. Data parameter: The tapping maximum speed set by **P257** parameter is set to comply with the maximum speed of the spindle.
4. Data parameter: The gear 1 speed set by parameter **P294** corresponding to tapping is set to comply with the maximum speed of tapping.
5. **PA4** is set as 5 in DAP03 parameter (speed and position modes).
6. During executing the rigid tapping command, if the rotation direction of the spindle doesn't comply with the command direction, set DAP03 parameter **PA15** as 1.
7. Data parameter: The linear acceleration and deceleration time constant of the spindle and tapping axis set by **P298** is rewritten to 300.
8. Data parameter: During tool retraction, the time constant of the spindle and tapping axis set by **P302** is rewritten to 300.
9. After switching into the position mode, when the spindle speed doesn't comply with the command speed, the data parameters **P323** and **P326** can be rewritten, or DAP03 parameters **PA12** and **PA13** can be rewritten by the formula $P \cdot G = N \cdot C \cdot 4$ to obtain the electrical gear ratio.
 P: The pulse number of input codes; G: The electrical gear ratio; N: The number of the motor revolution; C: The photoelectric encoder pulse.

10. When the gear ratio of the spindle and the motor isn't 1;1, the corresponding gear ratio should be calculated and input into **PA35** and **PA36** parameters of DAP03.
11. The spindle CW and CCW rotation should comply with each other during rigid tapping. And the fluctuation of revolution speed should not be too much, it's better to keep in three revolutions.
12. About cutting some soft material, such as the aluminum alloy and the copper, etc, it's better to use the tapping in spiral type, with the dedicated coolant to get better effect.

B. Setting the flexibility tapping: The system default parameter can be used, and only the following parameters should be rewritten.

During the flexibility tapping, only the bit parameter **NO:46#1** is rewritten into 0 (in the following mode), **K7#7** is changed into 0, and the code M29 is also used, and the dwell time from 1s to 2s of the codes is with the better effect.

Remark: The above corresponds the setting method of the machine without the gear change.

APPENDIX

APPENDIX ONE THE USAGE GUIDE OF THE LADDER DIAGRAM OF GSK218MC WITH THE TURRET MAGAZINE

1. Points for Attention during Using the Ladder Diagram when GSK218MC with the Turret Magazine

1. During using the ladder diagram, the circuit should be connected strictly based on the requirements.
2. During using the ladder diagram, PLC parameters should be correctly set, and the ladder diagram should comply with the allocation of the machine.
3. If the machine has the special control requirements, the program should be added in the ladder diagram, which requires the technicians have the electrical and PLC knowledge and learn the ladder diagram very well.
4. The ladder diagram is only suitable for CNC milling machine or the machining center with the turret magazine. If the machine is in the other type, it may cause the accident.
5. The ladder diagram is only taken as the reference, and the ladder diagram varies as the different machine type.

2. The Allocation and Definitions of I/O Address and Internal Software Components in CNC PLC of GSK218MC

List I Definition of the input signal interfaces

ADDRESS	SIGNAL INTERFACE	INTERFACE PIN NO.	DEFINITION	CONTACT SELECTION
X000.0	XS40	1	X axis positive limit signal	NC contact
X000.1	XS40	14	X axis negative limit signal	NC contact
X000.2	XS40	2	Y axis positive limit signal	NC contact
X000.3	XS40	15	Y axis negative limit signal	NC contact
X000.4	XS40	17	Z axis positive limit signal	NC contact
X000.5	XS40	5	Z axis negative limit signal	NC contact
X000.6	XS40	18	The 4 th axis positive limit signal	NC contact
X000.7	XS40	6	The 4 th axis negative limit signal	NC contact

ADDRESS	SIGNAL INTERFACE	INTERFACE PIN NO.	DEFINITION	CONTACT SELECTION
X001.0	XS40	8	X axis zero return deceleration signal	NC contact
X001.1	XS40	21	Y axis zero return deceleration signal	NC contact
X001.2	XS40	9	Z axis zero return deceleration signal	NC contact
X001.3	XS40	22	The 4 th axis zero return deceleration signal	NC contact
X001.4	XS40	24	The emergency stop switch (218MC integration)	NC contact
X001.5	XS40	12	The external cycle start	Normally open contact
X001.6	XS40	25	The external feed hold	Normally open contact
X001.7	XS40	13	The lubrication pressure or the oil level detection	Normally open contact
X002.0	XS41	1	The air supply pressure detection	Normally open contact
X002.1	XS41	14	The jumping signal	Normally open contact
X002.2	XS41	2	The index worktable releasing detection	Normally open contact
X002.3	XS41	15	The index worktable clamping detection	Normally open contact
X002.4	XS41	17	The external clamping/releasing tool control	Normally open contact
X002.5	XS41	5	The tool releasing detection	Normally open contact
X002.6	XS41	18	The tool clamping detection	Normally open contact
X002.7	XS41	6	The spindle tool detection switch	Set by parameters
X003.0	XS41	8	Editing lock	Normally open contact
X003.1	XS41	21	Operation lock	Normally open contact
X003.2	XS41	9	Undefined	
X003.3	XS41	22	Undefined	
X003.4	XS41	24	Undefined	
X003.5	XS41	12	Undefined	
X003.6	XS41	25	Undefined	

ADDRESS	SIGNAL INTERFACE	INTERFACE PIN NO.	DEFINITION	CONTACT SELECTION
X003.7	XS41	13	Undefined	
X004.0	XS42	1	The handhold unit enable	Normally open contact
X004.1	XS42	14	The spindle gear I in-position	Normally open contact
X004.2	XS42	2	The spindle gear II in-position	Normally open contact
X004.3	XS42	15	The spindle gear III in-position	Normally open contact
X004.4	XS42	17	Undefined	
X004.5	XS42	5	The safety door switch detection	Normally open contact
X004.6	XS42	18	Undefined	
X004.7	XS42	6	Undefined	
X005.0	XS42	8	Undefined	
X005.1	XS42	21	The magazine advance in-position	Set by parameters
X005.2	XS42	9	The magazine retraction in-position	Set by parameters
X005.3	XS42	22	The magazine CW /CCW rotation in-position	Set by parameters
X005.4	XS42	24	The magazine zero return in-position	Set by parameters
X005.5	XS42	12	The current toolpot tool detection switch	Set by parameters
X005.6	XS42	25	Undefined	
X005.7	XS42	13	Undefined	
X006.0	XS22	5	The external MPG X axis selection	Normally open contact
X006.1	XS22	23	The external MPG Y axis selection	Normally open contact
X006.2	XS22	6	The external MPG Z axis selection	Normally open contact
X006.3	XS22	24	The external MPG A axis selection	Normally open contact
X006.4	XS22	25	The external MPG width 0.001	Normally open contact
X006.5	XS22	8	The external MPG width 0.01	Normally open contact
X006.6	XS22	26	The external MPG width 0.1	Normally open contact
X006.7	XS22	ESP (9, 22)	The external emergency	NC contact

ADDRESS	SIGNAL INTERFACE	INTERFACE PIN NO.	DEFINITION	CONTACT SELECTION
			stop	
X007.0	XS23	44	Completing to switch between speed/position mode	Set by parameters
X007.1	XS23	21	The spindle orientation finish	Set by parameters
X007.2	XS23	5	The spindle speed reach	Set by parameters
X007.3	XS23	20	The spindle zero speed detection	NC contact

Points of attention:

1. About the connection method and points of attention of PLC input part (X), refer to chapter IV.
2. The contacts are classified into the four types: Normally open contact, NC contact, whether the contact is normally open or NC is set by the parameters. Among them, the input points are connected with normally open or NC contact are set by KAPA parameter in PLC. About the details, refer to KAPA parameter introduction.
3. When use the ladder diagram, the users can add the new function into the undefined input part, but pay attention to that if the undefined part is used, the ladder diagram should be rewritten.
4. Operation panel

The function of USER1 button:

K11.1=0: The switch of the water hydrovalve

K11.1=1: Z axis returns to the 1st reference position in JOG mode.

The function of USER2 button: Z axis returns to the 2nd reference position in JOG mode.

The function of USER3 button: The switch of starting blowing the spindle.

List II The interface definitions of the output signals

ADDRESS	SIGNAL INTERFACE	INTERFACE PIN NO.	DEFINITION
Y000.0	XS43	1	Z axis band-type brake
Y000.1	XS43	14	Cooling
Y000.2	XS43	2	The tool releasing/clamping
Y000.3	XS43	15	Undefined
Y000.4	XS43	17	The spindle brake
Y000.5	XS43	5	Undefined

ADDRESS	SIGNAL INTERFACE	INTERFACE PIN NO.	DEFINITION
Y000.6	XS43	18	Red lamp
Y000.7	XS43	6	Yellow lamp
Y001.0	XS43	8	Green lamp
Y001.1	XS43	21	Chip removal control
Y001.2	XS43	9	Lubrication control
Y001.3	XS43	22	Machine lighting control
Y001.4	XS43	24	Starting hydraulic pressure
Y001.5	XS43	12	Blowing the spindle
Y001.6	XS43	25	The index worktable releasing
Y001.7	XS43	13	The index worktable clamping
Y002.0	XS44	1	Undefined
Y002.1	XS44	14	Undefined
Y002.2	XS44	2	Undefined
Y002.3	XS44	15	Undefined
Y002.4	XS44	17	Handhold unit lamp
Y002.5	XS44	5	Undefined
Y002.6	XS44	18	The flushing hydrovalve output
Y002.7	XS44	6	Switching between spindle/speed mode
Y003.0	XS44	8	The magazine CW rotation
Y003.1	XS44	21	The magazine CCW rotation
Y003.2	XS44	9	The magazine advance
Y003.3	XS44	22	The magazine retraction
Y003.4	XS44	24	The spindle gear I (frequency conversion / IO point control)
Y003.5	XS44	12	The spindle gear II (frequency conversion / IO point control)
Y003.6	XS44	25	The spindle gear III (frequency conversion / IO point control)
Y003.7	XS44	13	Undefined
Y004.0	XS45	1	Undefined
Y004.1	XS45	14	Undefined
Y004.2	XS45	2	Undefined
Y004.3	XS45	15	Undefined
Y004.4	XS45	17	Undefined
Y004.5	XS45	5	Undefined

ADDRESS	SIGNAL INTERFACE	INTERFACE PIN NO.	DEFINITION
Y004.6	XS45	18	Undefined
Y004.7	XS45	6	Undefined
Y005.0	XS45	8	Undefined
Y005.1	XS45	21	Undefined
Y005.2	XS45	9	Undefined
Y005.3	XS45	22	Undefined
Y005.4	XS45	24	Undefined
Y005.5	XS45	12	Undefined
Y005.6	XS45	25	Undefined
Y005.7	XS45	13	Undefined
Y006.0	XS23	9	The spindle CW rotation
Y006.1	XS23	25	The spindle CCW rotation
Y006.2	XS23	24	The spindle enable
Y006.3	XS23	11	The spindle orientation
Y006.4	XS23	12	Switching between speed/position mode
Y006.5	XS23	27	Zero speed clamp

Points for attention:

1. About the connection method and points of attention of PLC input part (Y), refer to chapter IV.
2. When use the ladder diagram, the users can add the new function into the undefined input part, but pay attention to that if the undefined part is used, the ladder diagram should be rewritten.

List 3 KAPA address definitions

ADDRESS	DEFINITION	STATE 0	STATE 1
K000.0	Whether allow to rewrite PLC parameters	NO	YES
K000.1	Whether allow to debug PLC signal	NO	YES
K000.2	Whether all Y signals are clear when PLC enters debugging mode	NO	YES
K000.3	Whether allow to edit the information of address A	NO	YES
K000.4	Whether allow to edit the information of address K	NO	YES
K000.5	Whether allow to edit the information of address X	NO	YES
K000.6	Whether allow to edit the information of address Y	NO	YES
K000.7	Whether allow to operate the command list	NO	YES
K001.0	Whether allow to use the magazine	NO	YES
K001.1	Whether automatically download during running the ladder diagram	NO	YES
K001.2	The level selection of the input signal of the	+24v valid	0v valid

ADDRESS	DEFINITION	STATE 0	STATE 1
	spindle interface		
K002.0	Whether use the 4 th axis	NO	YES
K004.0	Whether the spindle uses the gear control (I/O point)	NO	YES
K004.1	Whether the manual reference point can only control one axis	Many axes	One axis
K005.0	Whether the machine is with the external MPG	NO	YES
K005.1	Whether the machine is with the external cycle start	NO	YES
K005.2	Whether the system enters the debugging mode	NO	YES
K006.0	The switch selection of X axis limit	2 switches	1 switch
K006.1	The switch selection of Y axis limit	2 switches	1 switch
K006.2	The switch selection of Z axis limit	2 switches	1 switch
K006.3	The switch selection of the 4 th axis limit	2 switches	1 switch
K006.4	Whether select the normally open type for X axis zero return switch	NO	YES
K006.5	Whether select the normally open type for Y axis zero return switch	NO	YES
K006.6	Whether select the normally open type for Z axis zero return switch	NO	YES
K006.7	Whether select the normally open type for the 4 th axis zero return switch	NO	YES
K007.4	Whether cancel the 4 th hardware limit	NO	YES
K007.5	Whether cancel the external emergency stop	NO	YES
K007.6	Whether the spindle output analog voltage +10V~-10V	NO	YES
K007.7	Whether use the spindle position mode	NO	YES
K008.0	Whether the spindle positioning detection is the normally open type	NC type	Normally open type
K008.1	The tool clamping/releasing control selection	External button	Panel button
K008.2	Whether use the tool clamping/releasing device or not	YES	NO
K008.3	Whether use the safety door detection device	NO	YES
K008.4	Whether the spindle is with the gear change device	NO	YES
K008.5	Check whether the reach detection is NC type during the spindle speed (speed	NC type	Normally open

ADDRESS	DEFINITION	STATE 0	STATE 1
	mode)/position (position mode)		type
K008.6	In the spindle speed mode, whether the detection switch is ON (the position mode is OFF).	ON	OFF
K008.7	Whether there is the detection signal in spindle position/speed mode	YES	NO
K009.0	Whether there is the detection signal for the spindle position reach signal	YES	NO
K009.1	Whether the lubrication pressure or the oil level detection is valid	NO	YES
K009.2	Whether detect the air pressure	NO	YES
K009.3	Whether there is the detection switch for the spindle level detection	YES	NO
K010.1	Whether there is zero return switch in the magazine	NO	YES
K010.2	Whether select NC type for the magazine zero return switch	Normally open type	NC type
K010.3	Whether select NC type for the magazine tool advance switch	Normally open type	NC type
K010.4	Whether select NC type for the magazine retraction switch	Normally open type	NC type
K010.5	Whether select NC type for the magazine counting switch	Normally open type	NC type
K010.6	Whether setting the magazine origin is valid in JOG mode	NO	YES
K010.7	Whether the magazine enters the adjusting mode	NO	YES
K011.0	Whether the spindle tool number doesn't display during clamping or releasing the tool in JOG mode	YES	NO
K011.1	Whether allow to return to the tool-change position in JOG mode	NO	YES
K011.2	Whether the output is OFF after the magazine advance in-position	NO	YES
K011.4	Whether the output is OFF after the spindle positioning finish	NO	YES
K011.5	Whether output CW rotation signal during the spindle orientation	NO	YES
K012.0	Whether detect the spindle with a tool is valid or not	NO	YES
K012.1	Whether the spindle tool detection switch is NC type	NO	YES
K012.2	Whether detect the current magazine toolpot with a tool is valid or not	NO	YES

ADDRESS	DEFINITION	STATE 0	STATE 1
K012.3	Whether the toolpot detection switch is NC type	NO	YES
K012.4	Whether use the index worktable clamping/releasing device	NO	YES
K012.5	Whether the index worktable clamps or releases automatically	NO	YES
K012.6	Whether the index worktable enters the debugging mode	NO	YES
K013.4	Whether X axis uses the zero return switch	YES	NO
K013.5	Whether Y axis uses the zero return switch	YES	NO
K013.6	Whether Z axis uses the zero return switch	YES	NO
K013.7	Whether the 4 th axis uses the zero return switch	YES	NO
K015.0	Whether it is the operation panel B	NO	YES
K015.6	Whether the keypad combined magazine control button is valid	NO	YES
K015.7	Whether the external magazine control button is valid	NO	YES

Points for attention:

- When the system is running normally, please make sure the states of K000.0, K000.1, K000.2, K000.3, K000.4, K000.5, K000.6, K000.7, K005.2 and K010.7 are 0; otherwise, the accident may happen.
- After rewriting K001.0 parameter, the parameter becomes valid until the system restarts. When K001.0=0 (the magazine isn't used), K010.1, K010.2, K010.3, K010.4, K010.5, K010.6, K010.7, K011.0, K011.1 and K011.2 are set to invalid.
- When K001.0=1(the magazine is used and valid), K008.2 setting is invalid.
- When K008.2=0 (the tool clamping/releasing device isn't used), K008.1 setting is invalid.
- Points of attention for setting K006.0:
When two limit switches of X axis are installed, the positive limit switch is connected with X0.0, the negative with X0.1, K006.0 is set as 0 and becomes valid.
When one limit switch of X axis is installed, which must be connected with X0.0, and K006.0 is set to 1 and becomes valid. And the setting of K006.1 of Y axis, K006.2 of Z axis, K006.3 of the 4th axis are same as that of X axis.
- When K005.2=1,all the alarm interlock is released, and the system enters the debugging mode, which is only used during the system testing. When the system is normally used, the parameter should be set as 0; otherwise, the accident may happen.
- About the relative parameters K010.1, K010.2, K010.3, K010.4, K010.5, K010.6, K010.7, K011.0, K011.1 and K011.2 with the magazine, please refer to part III: the usage and maintenance of the magazine.

8. When K004.0=1 (whether the spindle uses I/O point control), K008.4 (whether the spindle is with the gear change device) is set to invalid, that is to say, the spindle is without the gear change device.
9. When K015.0=0, the operation panel of GSK218MC is used; K015.0=1, the operation panel of GSK990MA is used.

List IV The definitions of PLC external alarm

PLC alarm number	A ADDRESS	INFORMATION
1200	A000.0	The air pressure detection abnormal
1201	A000.1	The lubrication oil detection abnormal
1202	A000.2	The lubrication motor detection abnormal
1203	A000.3	The cooling motor detection abnormal
1204	A000.4	The chip removal motor detection abnormal
1205	A000.5	The pressure oil pump motor detection abnormal
1206	A000.6	The spindle cooling unit detection abnormal
1207	A000.7	The machine lamp detection abnormal
1208	A001.0	The machine control box temperature detection abnormal
1209	A001.1	The machine bed temperature detection abnormal
1210	A001.2	The machine vibration frequency detection abnormal
1211	A001.3	The pressure oil temperature detection abnormal
1212	A001.4	The oil pressure too low
1213	A001.5	The machine not ready
1214	A001.6	The spindle gear abnormal and can't revolve
1215	A001.7	Executing T code before M06 code
1216	A002.0	The spindle can't revolve when the tool is released
1217	A002.1	The tool can't release during the spindle revolving
1218	A002.2	Confirm the tool number again after the magazine stops due to the abnormal
1219	A002.3	The spindle can't revolve in the magazine tool advance position
1220	A002.4	The spindle tool clamping detection abnormal
1221	A002.5	The spindle tool releasing detection abnormal
1222	A002.6	The spindle unit temperature detection abnormal
1223	A002.7	The spindle speed detection abnormal
1224	A003.0	The spindle motor enable detection abnormal
1225	A003.1	The spindle orientation in-position detection abnormal
1226	A003.2	The spindle gear abnormal

Appendix One The Usage Guide of the Ladder Diagram

PLC alarm number	A ADDRESS	INFORMATION
1227	A003.3	The magazine can't revolve not in the origin position
1228	A003.4	The cycle start can't be executed when the magazine is in the tool advance position
1229	A003.5	Please set the spindle tool number
1230	A003.6	The tool can't be changed during the spindle tool release
1231	A003.7	The tool can't be changed when the magazine isn't in the tool retraction position
1232	A004.0	The magazine rotation in-position detection abnormal
1233	A004.1	The magazine rotation motor detection abnormal
1234	A004.2	The program stops running when the magazine is in the tool advance position
1235	A004.3	The magazine traverses in-position detection abnormal
1236	A004.4	The magazine zero return detection abnormal
1237	A004.5	The magazine origin position lost, and zero return should be executed again.
1238	A004.6	The tool advance in-position detection abnormal
1239	A004.7	The tool retraction in-position detection abnormal
1240	A005.0	The magazine is abnormal and zero return should be executed again
1241	A005.1	The magazine tool advance detection abnormal
1242	A005.2	The magazine tool retraction detection abnormal
1243	A005.3	The magazine zero position setting is valid
1244	A005.4	For the magazine safety, the tool change stops due to the abnormal
1245	A005.5	There isn't the code tool number or the number is repeatedly in the tool list
1246	A005.6	The tool advance can't be executed in the magazine because the tool isn't in the tool-change position
1247	A005.7	The tool advance can't be executed in the magazine because the spindle doesn't position
1248	A006.0	The tool retraction can't be executed in the magazine when the tool is released
1249	A006.1	The tool advance can't be executed because the spindle is with a tool
1250	A006.2	Feeding can't be executed because the spindle doesn't comply with the current tool number in the magazine
1251	A006.3	Switch off the power supply
1252	A006.4	Z axis can't move during the tool clamping

PLC alarm number	A ADDRESS	INFORMATION
1253	A006.5	Caution to operate the magazine adjusting mode
1254	A006.6	The cycle start can't be executed in the magazine adjusting mode
1255	A006.7	The tool can't return to the origin
1256	A007.0	The tool change position can't be returned because the tool is clamped
1257	A007.1	The tool change position can't be returned because the spindle doesn't position
1258	A007.2	The tool change position can't be returned because the magazine is abnormal
1259	A007.3	The tool can't be changed due to T code tool number abnormal
1260	A007.4	The cycle start can't be executed during returning to the tool change position in JOG mode
1261	A007.5	The tool retraction can't be executed when the tool isn't in the origin
1262	A007.6	Excess the safety position
1263	A007.7	M06 can't be executed because the magazine isn't used
1264	A008.0	Switching the spindle speed mode into the position one is abnormal
1265	A008.1	Switching the spindle position mode into the speed one is abnormal
1266	A008.2	The gear change can't be executed during the spindle revolution
1267	A008.3	The magazine advance and retraction detection abnormal
1268	A008.4	The signal detection is abnormal during the spindle releasing and clamping tool
1269	A008.5	The spindle orientation time sequence detection abnormal
1270	A008.6	The tool change can't be executed because Z axis doesn't return to the mechanical zero point
1271	A008.7	The magazine revolution is abnormal, so it is compelled to stop
1272	A009.0	The spindle tool number detection abnormal
1273	A009.1	The magazine can't advance because the toolpot is with a tool of the current tool number
1274	A009.2	The magazine can't advance because the toolpot isn't in-position
1288	A011.0	The index worktable releasing detection abnormal
1289	A011.1	The index worktable clamping detection abnormal

PLC alarm number	A ADDRESS	INFORMATION
1290	A011. 2	The index worktable clamping device doesn't start
1291	A011. 3	The index worktable can't revolve because it doesn't release
1292	A011. 4	The index worktable can't move because it doesn't clamp
1293	A011. 5	The cycle start can't be executed because the safety door isn't closed
1294	A011. 6	The index worktable can't start because it doesn't clamp
1360	A020. 0	The lubrication pressure low or the oil level low

The alarms of A0.0~A19.7 are the system red ones. After the alarm, the system stops running.
A20.0~A31.7 are the customer self-defined blue alarms. After the alarm, the system continues to run, which doesn't affect the normal running.

The details of PLC alarm diagnosis information:

Alarm information: 1200 The air pressure is detected abnormal.

Reason:

Trouble shooting: Detect the state of X002.0.

Alarm information: 1201 The lubrication oil is detected abnormal.

Reason: User-defined

Trouble shooting:

Alarm information: 1202 The lubrication motor is detected abnormal.

Reason: User-defined

Trouble shooting:

Alarm information: 1203 The cooling motor is detected abnormal.

Reason: User-defined

Trouble shooting:

Alarm information: 1204 The chip cleaner motor is detected abnormal.

Reason: User-defined

Trouble shooting:

Alarm information: 1205 The pressure oil pump motor is detected abnormal.

Reason: User-defined

Trouble shooting:

Alarm information: 1206 The spindle cooling unit is detected abnormal.

Reason: User-defined

Trouble shooting:

Alarm information: 1207 The machine lamp is detected abnormal.

Reason: User-defined

Trouble shooting:

Alarm information: 1208 The machine control cabinet temperature is detected abnormal.

Reason: User-defined

Trouble shooting:

Alarm information: 1209 The machine bed temperature is detected abnormal.

Reason: User-defined

Trouble shooting:

Alarm information: 1210 The machine vibration frequency is detected abnormal.

Reason: User-defined

Trouble shooting:

Alarm information:1211 The pressure oil temperature is detected abnormal.

Reason: User-defined

Trouble shooting:

Alarm information:1212 The oil pressure is too low.

Reason: User-defined

Trouble shooting:

Alarm information:1213 The machine is not ready.

Reason: User-defined

Trouble shooting:

Alarm information:1214 The spindle revolution can't be operated due to the spindle gear abnormal.
Reason: The spindle gear abnormal is detected during the revolution code of the spindle is executed.
Trouble shooting: When the spindle is in gear I (Y3.4=1) in the time set by T0021, if the gear I in-position detection switch (X4.1) is OFF, adjust the time of T0021 or check whether X4.1 is ON or not; When the spindle is in gear II (Y3.5=1) in the time set by T0022, if the gear II in-position detection switch (X4.2) is OFF, adjust the time of T0022 or check whether X4.2 is ON or not; When the spindle is in gear III(Y3.6=1) in the time set by T0023, if the gear III in-position detection switch (X4.3) is OFF, adjust the time of T0023 or check whether X4.3 is ON or not.

Alarm informationin:1215 Execute M06 code after executing T codes.
Reason: When M06 code is executed, the valid T codes are not executed.
Trouble shooting: After executing the valid T codes, M06 code is executed.

Alarm information:1216 When the tool is released, the spindle can't revolve.
Reason: When the tool is released, the code of the spindle revolution is executed. For example: In the JOG mode, press the spindle CW, CCW rotation, inch or positioning, or in the auto mode, press M03, M04 or M19, the spindle gets revolved.
Trouble shooting: In JOG mode, press clamp/release button, the tool is clamped (Y0.2=0); Check whether the tool clamp detection switch (X2.6) is 1, when the state is 1, the alarm doesn't occur during the spindle revolution.

Alarm information:1217 The tool can't be released during the spindle revolving.
Reason: When the spindle is revolving, the code of the tool release is executed.
Trouble shooting: When the spindle stops, the tool release code can be executed to avoid the alarm.

Alarm information:1218 When the magazine is abnormal and stops, the tool number should be confirmed, again.
Reason: When M6 code is being executed and the magazine is revolving, the alarm occurs; or press "reset" key, the alarm occurs.
Trouble shooting: 1. The magazine zero return is operated, again.

2. Reset the spindle tool number and the magazine tool number.

(About the detailed operation, please refer to *Chapter III: The usage method and maintenance of GSK218MC CNC system with the turret magazine*)

Alarm information: 1219 The spindle can't revolve in the magazine tool advance position.
Reason: The spindle revolution is operated when the magazine doesn't retract in-position.
Trouble shooting: The magazine returns to the tool retraction position. (detect whether the magazine is in the tool retraction position by checking the state of X5.2.)

Alarm information: 1220 The spindle tool clamping is detected abnormal.

Reason: When the tool is clamped ($Y0.2=0$) in the time set by T010, the tool clamping detection switch (X2.6) is OFF.

Trouble shooting: 1. Detect whether the magazine clamping detection switch is normal or not.
2. Detect whether Y0.2 is output or not.
3. Adjust the time of T010, again.

Alarm information: 1221 The spindle tool releasing is detected abnormal.

Reason: When the tool is released ($Y0.2=1$) in the time set by T009, the magazine release detection switch (X2.5) is OFF.

Trouble shooting: 1. Detect the magazine releasing detection switch is normal or not.
2. Detect whether Y0.2 is output or not.
3. Adjust the time of T009, again.

Alarm information: 1222 The spindle unit temperature is detected abnormal.

Reason: User-defined

Trouble shooting:

Alarm information: 1223 The spindle speed is detected abnormal.

Reason: User-defined

Trouble shooting:

Alarm information: 1224 The spindle motor enable is detected abnormal.

Reason: User-defined

Trouble shooting: Without

Alarm information: 1225 The spindle orientation in-position is detected abnormal.

Reason: When the spindle executes the movement of in-position ($Y2.1=1$) in the time set by T013, the spindle position detection switch (X7.1) is ON.

Trouble shooting: 1. The spindle drive unit or the spindle encoder is abnormal.
2. Detect whether Y6.3 is output.
3. Adjust the time of T013, again.

Alarm information: 1226 The spindle gear is abnormal.

Reason: Detect the spindle gear abnormal.

Trouble shooting: When the spindle is in gear I ($Y3.4=1$) in the time set by T0021, if the gear I in-position detection switch (X4.1) is OFF, adjust the time of T0021 or check whether X4.1 is

ON or not; When the spindle is in gear II (Y3.5=1) in the time set by T0022, if the gear II in-position detection switch (X4.2) is OFF, adjust the time of T0022 or check whether X4.2 is ON or not; When the spindle is in gear III (Y3.6=1) in the time set by T0023, if the gear III in-position detection switch (X4.3) is OFF, adjust the time of T0023 or check whether X4.3 is ON or not.

Alarm information: 1227 The magazine can't revolve because it isn't in the origin.

Reason: The magazine isn't in the tool retraction position and Z axis isn't in the origin; "magazine CW" or "magazine CCW" in the JOG mode is pressed, the alarm occurs.

Trouble shooting: The magazine returns to the retraction position or Z axis returns to the origin.

Alarm information: 1228 The cycle start can't be operated when the magazine is in the tool advance position.

Reason: When the magazine isn't in the tool retraction position, "start" is pressed in AUTO, MDI or DNC mode, the alarm occurs.

Trouble shooting: The magazine returns to the tool retraction position.

Alarm information: 1229 Set the spindle tool number.

Reason: When the spindle tool number is 0, press "clamp/release", the alarm occurs.

Trouble shooting: The alarm only reminds when the spindle tool number is 0, the spindle can't be loaded the tool, and the alarm can be shielded by rewriting the parameter K011.0.

Alarm information: 1230 When the spindle tool is released, the tool can't be changed.

Reason: The spindle tool is released (Y2.0=1), M06 or M50 code is executed.

Trouble shooting: The spindle tool is in the clamp state (Y2.0=0).

Alarm information: 1231 The tool can't be changed when the magazine isn't in the tool retraction position.

Reason: When the magazine isn't in tool retraction position, M06 or M50 code is executed.

Trouble shooting: The magazine is in the tool retraction position.

Alarm information: 1232 The magazine revolves in-position and is detected abnormal.

Reason: User-defined

Trouble shooting

Alarm information: 1233 The magazine rotation motor is detected abnormal.

Reason: User-defined

Trouble shooting:

Alarm information: 1234 The program stops running when the magazine is in the tool advance position.

Reason: The alarm occurs when the program is running while the magazine isn't in the tool retraction position.

Trouble shooting: The magazine should return to the tool retraction position before executing the program.

Alarm information: 1235 The magazine moves in-position and is detected abnormal.

Reason: User-defined

Trouble shooting:

Alarm information: 1236 The magazine zero return is detected abnormal.

Reason: User-defined.

Trouble shooting:

Alarm information: 1237 The magazine origin position is missed, so zero return should be operated, again.

Reason: When the magazine returns zero point, the abnormal occurs; zero return stops, and the alarm occurs.

Trouble shooting: The magazine returns zero point, again. (About the detailed operation, please refer to *Chapter III: The usage method and maintenance of GSK218MC CNC system with the turret magazine.*)

Alarm information: 1238 The tool advance in-position is detected abnormal.

Reason: User-defined

Trouble shooting:

Alarm information: 1239 The tool retraction in-position is detected abnormal.

Reason: User-defined

Trouble shooting:

Alarm information: 1240 The magazine is abnormal, zero return should be operated.

Reason: 1. When the magazine stops for the time set by T102, the magazine counting switch (X3.5) is detected abnormal, the pulse signal occurs.

2. When the magazine is rotating, the magazine counting switch is 0 or 1, which exceeds the time set by T103.

Trouble shooting: 1. The output of the magazine CW or CCW rotation (Y3.0 and Y3.1) is abnormal.

2. The magazine counting switch is abnormal.

3. Reset the values of T102 and T103.

(About the detailed operation, please refer to *Chapter III: The usage method and maintenance of*

GSK218MC CNC system with the turret magazine.)

Alarm information: 1241 The magazine tool advance is detected abnormal.

Reason: When the magazine is executed the tool advance movement (Y3.2=1) in the time set by T104, the magazine tool advance detection switch (X5.1) isn't operated.

Trouble shooting: 1. Detect whether the magazine tool advance detection switch is normal or not.
2. Detect whether Y3.2 is output.
3. Adjust the time set by T104, again.

Alarm information: 1242 The magazine tool retraction is detected abnormal.

Reason: When the magazine is executed the tool retraction movement (Y3.3=1) in the time set by T105, the magazine tool advance detection switch (X5.2) doesn't operate.

Trouble shooting: 1. Detect whether the magazine tool advance detection switch is normal or not.
2. Detect whether Y3.3 is output or not.
3. Adjust the time of T105, again.

Alarm information: 1243 Set the magazine zero position as valid.

Reason: When the magazine is not with the zero return switch (K010.1=0), the alarm occurs when K010.6=1, which reminds the magazine zero position setting is valid.

Trouble shooting: Set K010.6 as 0. (About the detailed operation, please refer to *Chapter III: The usage method and maintenance of GSK218MC CNC system with the turret magazine.*)

Alarm information: 1244 For the magazine safety, tool changing stops due to the abnormal.

Reason: When the magazine changes the tool automatically, the tool changing stops or the magazine is detected that it is not in the tool retraction position due to the abnormal, the alarm occurs. The alarm only reminds the operator that the magazine and the tool number of the spindle are in disorder; even the alarm is cleared, it doesn't mean the magazine is normal, the magazine and the tool number of the spindle should be reset. (About the detailed operation, please refer to *Chapter III: The usage method and maintenance of GSK218MC CNC system with the turret magazine.*)

Trouble shooting: 1. Press "reset" key to clear the alarm;
2. Readjust the magazine and confirm whether the tool number of the spindle comply with the magazine, including the magazine returning to the retraction position, the spindle in the tool clamp state, whether the current tool case number complies with the current value of CTR100, whether the tool number of the spindle complies with the value of D245, and the spindle can not be with the tool when the value of D245 is 0.

Alarm information: 1245 There isn't any code of the tool number in the tool list or the code of the tool

number is repeated.

Reason: There isn't any tool number specified by T code in the tool list(D001-D099) or the tool number specified by T code is repeated.

Trouble shooting: Rewrite the tool number value of the tool list.

Alarm information: 1246 The tool advance can't be operated because the magazine isn't in the tool change position.

Reason: Z axis isn't in the tool change position, but the tool advance in the magazine is operated.

Trouble shooting: After executing G91, G30 and Z0 codes, Z axis returns to the position of tool change.

Alarm information: 1247 The spindle doesn't position, the tool advance in the magazine can't be operated.

Reason: The spindle doesn't position, but the tool advance in the magazine is operated.

Trouble shooting: The spindle positioning is executed.

Alarm information: 1248 The tool retraction in the magazine can't be operated in the tool releasing state.

Reason: The spindle tool is released, but the tool retraction is operated.

Trouble shooting: The tool retraction is operated after clamping the spindle tool.

Alarm information: 1249 The tool advance can't be operated because the spindle is with tools.

Reason: The tool advance in the magazine is executed when Z axis is in the origin and the spindle is with tools (D245 isn't 0.) .

Trouble shooting: Unload the tool on the spindle, and set D245 as 0.

Alarm information: 1250 The tool advance can't be operated because the spindle tool number doesn't comply with the current tool number in the magazine.

Reason: The tool advance in the magazine is operated when Z axis is in the tool change position, the tool number of the spindle and that of the current tool case in the magazine are different.

Trouble shooting: The tool number of the current tool case in the magazine is the same as the spindle tool number by rotating the magazine.

Alarm information: 1251 Please switch off the power supply.

Reason: After rewriting, the parameter can become valid until the system is restarted.

Trouble shooting: Restart the system.

Alarm information: 1252 Z axis can't move when the tool is clamped.

Reason: Z axis is moved when the magazine is in the tool advance position and the tool is clamped.

Trouble shooting: 1. The magazine is in the tool retraction position.

2. The spindle tool is released.

Alarm information: 1253 Caution to operate the magazine debugging mode.

Reason: When K010.7 is set as 1, the alarm occurs. The alarm only reminds the magazine enters the debugging mode, and the alarm and the interlock signal relative with the magazine are released completely. Therefore, caution to operate; otherwise, the abnormal causes the mechanical damage.

Trouble shooting: Press “reset” key to clear the alarm. (Remark: Clearing the alarm doesn’t mean the system isn’t in the magazine debugging mode, while exiting the magazine debugging mode should be set K010.7 as 0.)

Alarm information: 1254 The cycle start can’t be operated in the magazine debugging mode.

Reason: The alarm occurs when K010.7=1 and press “start” button in AUTO, MDI or DNC mode.

Trouble shooting: Set K0107 as 0.

Alarm information: 1255 The tool can’t return the origin because it is clamped.

Reason: Z axis returns to the origin when the magazine is in the tool advance position and the spindle tool is clamped.

Trouble shooting: 1. The magazine is in the tool retraction position.

2. The spindle tool is released.

Alarm information: 1256 The tool can’t return to the tool change position when the tool is clamped.

Reason: Z axis returns to the tool change position when the magazine is in the tool advance position and the spindle tool is clamped.

Trouble shooting: 1. The magazine is in the tool retraction position.

2. The spindle tool is released.

Alarm information: 1257 The spindle doesn’t position, so the tool can’t return to the tool change position.

Reason: Z axis returns to the tool change position when the magazine is in the tool advance position and the spindle doesn’t position.

Trouble shooting: 1. The magazine is in the tool retraction position.

2. The spindle doesn’t position.

Alarm information: 1258 The tool can’t return to the tool change position due to the magazine abnormal.

Reason: User-defined.

Trouble shooting:

Alarm information: 1259 The tool can't be changed because T code tool number is abnormal.

Reason: Before executing M06 code, the wrong T code is executed. The wrong T code is: In the tool list (D001-D099), there isn't the tool number specified by T code or the number specified by T code is repeated.)

Trouble shooting: After executing the correct T code, M06 code is executed.

Alarm information: 1260 The cycle start can't be operated during the tool change in JOG mode.

Reason: The alarm occurs when K011.1=1 (the tool change is valid in JOG mode) and press "start" button in AUTO, MDI or DNC mode.

Trouble shooting: Set K011.1 as 0.

Alarm information: 1261 The tool retraction can't be operated in the origin.

Reason: The tool retraction in the magazine is executed when the magazine is in the tool advance position and Z axis isn't in the origin.

Trouble shooting: Z axis returns to the origin and then the tool is retracted.

Alarm information: 1262 The tool exceeds the safety position.

Reason: During moving Z axis, Z axis exceeds the position of the tool change when the magazine is in the tool advance position.

Trouble shooting: Z axis is moved and Z axis coordinate is set between the tool change position and the origin position.

Alarm information: 1263 M06 can't be executed because the magazine hasn't been used.

Reason: User-defined

Trouble shooting:

Alarm information: 1264 The abnormal occurs during switching the spindle position mode.

Reason: When M29 code is executed, the spindle position mode finish signal doesn't receive in the time set by T24.

Trouble shooting: Adjust the time set by T24 or check whether the spindle position mode finish signal is output or not.

Alarm information: 1265 The abnormal occurs during switching spindle speed mode.

Reason: When M28 code is executed, the spindle speed mode finish signal doesn't receive in the time set by T28.

Trouble shooting: Adjust the time set by T28 or check whether the spindle speed mode finish signal is output or not.

Alarm information: 1266 The gear change can't be operated during the spindle revolving.

Reason:

Trouble shooting:

Alarm information: 1267 The magazine advance and retraction are detected abnormal.

Reason: The system detects the signal of the magazine advance in-position and the magazine

retraction in-position signal meanwhile.

Trouble shooting: Detect whether the signals of X5.1 and X5.2 are normal or not and the switch type is correct or not.

Alarm information: 1268 The spindle tool releasing and clamping are detected abnormal.

Reason: The system detects the tool releasing and clamping signals at the same time.

Trouble shooting: Detect whether the signals of X2.5 and X2.6 are normal or not and the switch type is correct or not.

Alarm information: 1269 The spindle orientation time sequence is detected abnormal.

Reason: Before executing the spindle orientation, the system has already detected the spindle orientation finish signal.

Trouble shooting: Detect whether X5.0 signal is normal or not, and the switch type is right or not.

Alarm information: 1270 The tool change can't be operated because Z axis doesn't return to the mechanical zero point.

Reason: After the system powers on or the emergency stop, M06 or M50 code is executed before Z axis returns to the mechanical zero return.

Trouble shooting: Firstly execute Z axis zero return operation, and then the tool change.

Alarm information: 1271 The magazine stops revolving due to the abnormal.

Reason: 1. After the magazine sends the rotation command, the pulse signal isn't detected in the time set by T109, which is sent by the magazine counting switch (X5.3) .

2. During the magazine rotating, it exceeds the time set by T103 when the magazine counting switch is 0 or 1.

Trouble shooting: 1. The output of the magazine CW or CCW rotation (Y3.0 and Y3.1) is abnormal.

2. The magazine counting switch is abnormal.

3. Reset the values of T109 and T103.

(About the detailed operation, please refer to *Chapter III: The usage method and maintenance of GSK218MC CNC system with the turret magazine.*)

Alarm information: 1272 The spindle tool number is detected abnormal.

Reason: When the spindle is loaded the tool detection device and K12.0 is set as 1 and the spindle tool is clamped and the spindle tool number is 0, M06 or M50 code is executed while the system detects that the spindle is with the tool.

Trouble shooting: Check whether the signal of X2.7 is normal or not, unload the spindle tool and execute M06 tool change code.

Alarm information: 1273 The tool advance can't be operated because the current tool number of the toolpot is with a tool.

Reason: When the magazine is with the tool detection advice and K12.1 is 1, the spindle is with a tool, while the system detects that the magazine is with a tool when the magazine advance is operated.

Trouble shooting: 1. Check whether the signal of X5.5 is normal or not.

2. Check whether the tool number of the magazine is complied with that of the spindle, including the magazine returning to the tool retraction position, the spindle is in the tool clamping state, whether the current tool case number is complied with the current value of CTR100, whether the tool number of the spindle is complied with the value of D245, and the spindle can't load any tool if the value of D245 is 0; otherwise, the magazine zero return is executed.

(About the detailed operation, please refer to *Chapter III: The usage method and maintenance of GSK218MC CNC system with the turret magazine.*)

Alarm information: 1274 The magazine can't advance because the toolpot isn't in-position.

Reason:

Trouble shooting:

Alarm information: 1288 The index worktable is released and detected abnormal.

Reason: When the worktable is executed the releasing movement (Y1.6=1), the worktable is released in-position in the time set by T38 while the detection switch (X2.2) doesn't operate.

Trouble shooting: 1. Check whether the switch is normal when the table is released in-position.

2. Check whether Y1.6 is output or not.
3. Adjust the time set by T38.

Alarm information: 1289 The index worktable clamping is detected abnormal.

Reason: When the worktable is executed the clamping movement (Y1.7=1) in the time set by T39; the worktable is clamped in-position while the detection switch (X2.3) doesn't operate.

Trouble shooting: 1. Check whether the switch is normal when the worktable is clamped in-position.

2. Check whether Y1.7 is output or not.
3. Adjust the time set by T39.

Alarm information: 1290 The index worktable doesn't start the clamping device.

Reason: When the index worktable clamping device doesn't start (K12.4=0), the index worktable releasing or clamping command is executed.

Trouble shooting: After setting K12.4 as 1, the index worktable releasing or clamping command is executed.

Alarm information: 1291 The index worktable can't be rotated because it doesn't release.

Reason: When the index worktable is released, the index worktable rotation is executed.

Trouble shooting: Firstly, the index worktable clamping is executed, and the worktable is rotated, or the index worktable is adjusted into the debugging mode (k12.6 is set as 1), finally the rotation of the index table is executed.

Alarm information: 1292 The index worktable can't move because it doesn't clamp.

Reason: When the index worktable is released, the feeding axis is executed the movement.

Trouble shooting: Firstly, the index worktable clamping is executed, and the feeding axis is executed movement, or the index worktable is adjusted into the debugging mode (K12.6 is set as 1), finally the feeding axis is executed the movement.

Alarm information: 1293 The cycle start can't be operated because the safety door is open.

Reason: When the safety door detection device is started (K8.3=1), the cycle start button is pressed when the safety door is not closed (X4.5=0).

Trouble shooting: The cycle start is executed after the safety door is closed.

Alarm information: 1294 The index worktable can't start because it doesn't clamp.

Reason: When the index worktable is released, the cycle start button is pressed.

Trouble shooting: Firstly the index worktable is clamped, and then the cycle start is executed.

Alarm information: 1360 The lubrication pressure is low or the oil level is low.

Reason:

Trouble shooting: Detect the state of X001.7.

Points for attention:

About the alarms of "user-defined" as the reasons, there isn't any alarms in the ladder diagram, so the ladder diagram should be rewritten by the user.

List V The definitions of TMR parameters

ADDRESS	NOTE	INITIAL VALUE(ms)	USER SETTING VALUE (ms)
T0001	The time delay unit of the spindle CW rotation finish	500	
T0002	The time delay unit of the spindle CCW rotation finish	500	
T0003	The time delay unit of the spindle gear change finish	500	
T0004	The time delay unit of the spindle orientation finish	0	
T0005	The time delay unit of the miscellaneous function finish	0	
T0006	The spindle gear change time delay unit	500	
T0007	The time delay unit of the spindle tool releasing finish	0	
T0008	The time delay unit of the spindle tool clamping finish	0	
T0009	Setting the detection time of the spindle tool releasing	8000	
T0010	Setting the detection time of the spindle tool clamping	8000	

ADDRESS	NOTE	INITIAL VALUE(ms)	USER SETTING VALUE (ms)
T0011	The time of the pulse signal 1: one second	50	
T0012	The time of the pulse signal 2: one second	50	
T0013	Setting the spindle positioning detection time	8000	
T0014	Setting the spindle CW detection time	500	
T0015	Setting the spindle CCW detection time	500	
T0016	Setting the lubricating OFF time (unit:min)	30	
T0017	Setting the lubricating ON time (unit:sec)	10	
T0018	Setting the spindle positioning delay detection time	2000	
T0019	The spindle inch time delay unit	500	
T0020	The time delay unit of the program restarting	10	
T0021	The time delay unit of the spindle gear I	10000	
T0022	The time delay unit of the spindle gear II	10000	
T0023	The time delay unit of the spindle gear III	10000	
T0024	The detection time of switching between the spindle speed/position mode	10000	
T0025	M29 executing finish time (it is valid without the detection signal)	4000	
T0026	The positioning finish time in the spindle position mode (it is valid without the detection signal)	2000	
T0027	M28 executing the finish time (It is valid without the detection signal.)	2000	
T0028	The detection time of switching between the spindle speed/position mode	10000	
T0029	The spindle brake time	1000	
T0030	Spindle gear 1: The delay	3000	

ADDRESS	NOTE	INITIAL VALUE(ms)	USER SETTING VALUE (ms)
	time of gear change without the detection switch		
T0031	Spindle gear 2: The delay time of gear change without the detection switch	3000	
T0032	Spindle gear 3: The delay time of gear change without the detection switch	3000	
T0033	Canceling the delay finish time in the spindle gear control without the detection unit	3000	
T0034	M5 finish delay time	500	
T0035	Disconnecting in the delay time after the spindle gear change finish	800	
T0036	The delay time after the index worktable releasing finish	500	
T0037	The delay time after the index worktable clamping finish	500	
T0038	The delay time after the index worktable releasing detection	5000	
T0039	The delay time after the index worktable clamping detection	5000	
T0040	The delay time after the index worktable releasing finish	4000	
T0041	The delay time after the index worktable clamping finish	4000	
T0100	The turret magazine rotation delay time 1 in the JOG mode	2000	
T0101	The turret magazine rotation delay time 2 in the JOG mode	2000	
T0102	Setting the delay detection time of the turret magazine dwell	2000	
T0103	Setting the delay detection time of the turret magazine rotation	3000	
T0104	Setting the delay detection time of the turret magazine tool advance	5000	
T0105	Setting the delay detection time of the turret magazine retraction	5000	
T0106	The time delay unit of the turret magazine advance finish	0	

ADDRESS	NOTE	INITIAL VALUE(ms)	USER SETTING VALUE (ms)
T0107	The time delay unit of the turret magazine tool retraction finish	0	
T0108	Setting the delay detection time of the turret magazine rotation 2	3000	
T0109	Setting the time for compelling to stop when the magazine rotation abnormal occurs	5000	

List VI Definitions of DATA parameters

DEFINITION	NOTE	USER SETTING VALUE
D000	Display the spindle tool number	No setting
D001	Tool number 1	
D002	Tool number 2	
⋮	⋮	
D098	Tool number 98	
D099	Tool number 99	
D100	The magazine capacity	
D241	The tool number of T code	No setting
D243	The current tool case number	No setting
D245	The spindle tool number	

Points for attention:

1. The setting value of D100 is less than 100, and the setting value is same as that of CTR100; otherwise, the abnormal occurs.

For example: When D100=16, the data list D001-D016 are valid.

When D100=24, the data list D001-D024 are valid.

2. D000 only displays the spindle tool number, and the spindle tool number can't be rewritten in D000, and the spindle tool number should be rewritten in D245.

3. The value of D241 should be rewritten.

4. D240~D247 is only used by the system, so the customers can't use the parameters as the user-defined.

5. About the details, please refer to chapter III.

List VII Definitions of CTR parameters

ADDRESS	NOTE	INITIAL VALUE	USER SETTING VALUE
C100	Setting the magazine capacity	16	

Points for attention:

1. The setting value of CTR100 should be less than 100, and same as that of D100; otherwise, the abnormal occurs.

For example: When CTR100=16, the toolcase number of the magazine is 16.

When CTR100=24, the toolcase number of the magazine is 24.

List VIII Definition of M codes

M CODE	F SIGNAL	FUNCTION	REMARK
M00	F031.7	Program dwell	
M01	F030.4	Optional stop	
M02	F030.5	Program end	
M03	F030.0	Spindle CW rotation	
M04	F030.1	Spindle CCW rotation	
M05	F030.2	Spindle stop	
M06	F030.3	Automatic tool change	
M08	F031.0	Cooling fluid ON	
M09	F031.1	Cooling fluid OFF	
M10	F031.2	A axis clamping	
M11	F031.3	A axis releasing	
M16	F026.0	Spindle tool releasing code	
M17	F026.1	Spindle tool clamping code	
M18	F028.3	Canceling the spindle exact stop	
M19	F026.2	The spindle exact stop code	
M20	F032.5	The spindle neutral gear command	
M21	F026.3	The tool searching code in the tool returning	
M22	F026.4	The tool searching code in holding a new tool	
M23	F026.5	The spindle bit code in the magazine swaying direction	
M24	F026.6	The code of the magazine returning to the origin	
M26	F027.5	Starting the chip removal hydrovalve	
M27	F027.6	Turning off the chip removal hydrovalve	
M28	F032.3	Canceling the rigid tapping code	

M CODE	F SIGNAL	FUNCTION	REMARK
M29	F032.2	Rigid tapping code	
M30	F028.0	Program end	
M32	F031.4	Lubricating ON	Reserved
M33	F031.5	Lubricating OFF	Reserved
M35	F028.1	Starting the spiral chip removal conveyer	
M36	F028.2	Turning off the spiral chip removal conveyer	
M44	F026.7	Starting to blow the spindle	
M45	F027.0	Stopping blowing the spindle	
M50	F027.1	Starting automatic tool change	
M51	F027.2	Automatic tool change end	
M53	F027.3	Detect whether the tool is correct after the tool change	Reserved
M55	F027.4	Detect whether the spindle is with a tool or not	Reserved

Points for attention:

1. "F***.*)" and M codes with "Reserved" in F signal table cannot be used.
2. M16, M17, M21, M22, M23 and M24 are valid when the tool change is being executed, and they cannot run separately.

3. Usage and Maintenance of GSK218MC CNC System with the Turret Magazine

1. The tool magazine installation and setting related PLC parameters

Operation aim: Ensure the ladder diagram fit to the allocation of the magazine

A. Requirements of the machine when the ladder diagram is matched with the turret magazine:

1. The machine has the spindle tool automatically clamping/releasing device which has the normally open in-position check switch.
2. The spindle has the positioning function and its positioning angle can be regulated.
3. The tool magazine capacity must be less than 100.
4. The tool magazine can execute CCW/CW.
5. The tool magazine has the count switch, forward in-position check switch, and retraction in-position check switch.
6. The tool magazine has zero return switch (optional).

B. The connection of circuits relative with the magazine:

- 1). Input

ADDRESS	NOT E	REMARK
X002.2	The detection of the index worktable releasing	Normally open contact
X002.3	The detection of the index worktable clamping	Normal open contact
X002.4	The external clamping/releasing tool control	Optional
X002.5	The tool releasing detection	Normally open contact
X002.6	The tool clamping detection	Normally open contact
X005.1	The magazine advance in-position	Normally open or NC
X005.2	The magazine retraction in-position	Normally open or NC
X005.3	The magazine counting switch	Normally open or NC
X005.4	The magazine zero return in-position	Optional
X005.5	The current toolpot tool check switch	Optional
X007.1	The spindle orientation in-position	NC contact

2). Output

Address	NOTE	REMARK
Y000.2	The tool clamping/releasing	
Y001.6	The index worktable releasing	
Y001.7	The index worktable clamping	
Y003.0	The magazine CW rotation	
Y003.1	The magazine CCW rotation	
Y003.2	The magazine advance	
Y003.3	The magazine retraction	
Y006.2	The spindle enable	
Y006.3	The spindle orientation	

C. Selecting the magazine switch type

The magazine without the zero return switch	Setting K010.1 as 0
The magazine with the zero return switch	Setting K010.1 as 1
The magazine zero return switch is normally open type	Setting K010.2 as 0
The magazine zero return switch is NC type	Setting K010.2 as 1
The magazine tool advance switch is normally open type	Setting K010.3 as 0
The magazine tool advance switch is NC type	Setting K010.3 as 1
The magazine tool retraction switch is normally open type	Setting K010.4 as 0
The magazine tool retraction switch is NC type	Setting K010.4 as 1

The magazine counting switch is normally open type

Setting K010.5 as 0

The magazine counting switch is NC type

Setting K010.5 as 1

For example: The magazine isn't with the zero return switch, each detection switch is the normally open type, the parameter should be set as:

K010.1=0 K010.2=0 K010.3=0 K010.4=0 K010.5=0

D. Setting the magazine capacity:

Input the magazine capacity in DATA100 and CTR100.

Points for attention:

1. The magazine capacity is the number of toolcase in the magazine.
2. The setting value of DATA100 and CTR100 is less than 100.

For example: When the magazine capacity is 16, DATA100 and CTR100 are set as 16.

E. Setting the tool number in the magazine:

The data list D001--D099 respectively corresponds to the toolcase NO.1 --NO.99 of the magazine, the setting value of the data list D001--D099 respectively corresponds to the tool number NO.1 --NO.99 of the toolcase, D245 is the tool number of the spindle.

Points for attention:

1. The same tool number (except for 0) can't be set in D001--D099; otherwise, during the tool change, the alarm occurs.
2. The setting range of the tool number should satisfy the requirement set by data parameter 0206; otherwise, during executing T code, the system alarms.

For example: If the magazine capacity is 16 and 1-16 is set in D1--D16 in order, #8 toolcase is rotated into the tool change position and change the tool during executing T8 M6;

If 10, 20, 30.....160 are set in D1--D16 in turn, during executing T80 M6, #8 tool case is rotated into the tool change position and the tool is changed;

If D1 and D2 are also set as 8, the system alarms during executing T8 M6.

F. Setting the time parameters relative with the magazine:

ADDRESS	NOTE	SETTING RANGE	INITIAL VALUE(ms)
T0004	The time delay unit of the spindle positioning finish	Greater or equal to 0	0
T0007	The time delay unit of the spindle tool releasing finish	Greater or equal to 0	0
T0008	The time delay unit of the spindle tool clamping finish	Greater or equal to 0	0
T0009	Setting the detection time of the spindle tool releasing	Greater than the tool releasing time	8000
T0010	Setting the detection time of the spindle tool clamping	Greater than the tool clamping time	8000
T0013	Setting the detection time of the spindle positioning	Greater than the positioning time	8000
T0018	Setting the delay time of the spindle positioning detection	Greater than the positioning width	2000
T0036	The delay time of the index worktable releasing finish	Greater than or equal to 0	500
T0037	The delay time of the index worktable clamping finish	Greater than or equal to 0	500
T0038	The delay time of the index worktable releasing detection	Greater than or equal to 0	5000
T0039	The delay time of the index worktable clamping detection	Greater than or equal to 0	5000
T0040	The delay time of the index worktable releasing	Greater than or equal to 0	4000
T0041	The delay time of the index worktable clamping	Greater than or equal to 0	4000
T0100	Delay time 1 of the turret magazine rotation in the JOG mode	Greater than the time of rotating one tool post	2000
T0101	Delay time 2 of the turret magazine rotation in the JOG mode	Greater than the time of rotating one tool post	2000
T0102	The delay detection time of the turret magazine stopping	Greater than the time of rotating one tool post	2000
T0103	The delay time of the turret magazine rotation detection	Greater than the time of rotating one tool post	3000
T0104	The delay time of the tool advance detection in the turret magazine	Greater than the tool advance time	5000
T0105	The delay time of the tool retraction detection in the turret magazine	Greater than the tool retraction time	5000
T0106	The time delay unit of the tool advance finish in the turret	Greater than or equal to 0	0

ADDRESS	NOTE	SETTING RANGE	INITIAL VALUE(ms)
	magazine		
T0107	The time delay unit of the tool retraction finish in the turret magazine	Greater than or equal to 0	0
T0108	Setting the delay time 2 of the turret magazine rotation detection	Greater than the time of rotating one tool post	3000
T0109	Setting the time of compelling to stop the magazine rotation due to the abnormal	Greater than the time of rotating one tool post	5000

Points for attention:

1. The above parameter (TMR) is related to the magazine type, about the magazine speed and other performances, please refer to the magazine performance for properly setting the parameters.

2. When the above parameter (TMR) setting is not proper, the system alarms and the tool change can not be executed normally.

The ladder diagram matches with the magazine after the above A-F steps are operated, but the magazine cannot normally run, the magazine is executed CCW, CW, infeed and retraction in JOG mode to check whether each operation of magazine is normal through the following *chapter II The magazine manual and zero return operation*.

2. The magazine manual and zero return operation

Operation aim: Check whether each operation of the magazine is normal.

The detailed operation as below:

A. The magazine usage is valid.

1. The following bit parameters should be set because the magazine type is the turret one:

Bit parameter 53. 0=1 bit parameter 53. 1=0 bit parameter 53. 2=0 bit parameter 53. 3=0

2. In PLC, KAPA parameter K001.0 is set as 1.

B. Confirming the magazine rotation direction:

In JOG mode, press "MAG. CW" and the magazine rotates according to the prescribed negative direction of the machine; press "MAG. CCW" and the magazine rotates according to the prescribed positive direction of the machine; otherwise, the tool magazine count will be disorder to cause that the tool change is executed wrongly, which can be resolved by regulating the phase sequence of the motor.

C. The magazine zero return:


The magazine zero return operation is divided into zero return switch and without zero return switch:

1. The magazine is with the zero return switch: press “MAG. ZERO” in ZERO RETURN mode, and the zero return is completed when the indicator is ON. (the indicator flashing means the magazine is executing zero return.)
2. The magazine is without the zero return switch:
 - a. In JOG mode, press “CCW” or “CW” to make No. 1 toolcase in the magazine rotate to the tool change position.
 - b. In MDI mode, set K010.6 as 1.
 - c. Press “MAG. ZERO” in ZERO RETURN mode until its indicator is ON.
 - d. Set K010.6 as 0.



3. The spindle positioning angle and tool change coordinate position regulation

A. About the spindle positioning angle regulation, please refer to the manual of the spindle drive unit.


Regulating steps of the spindle positioning angle (example):

1. Input the system debugging password. Continuously press  on MDI keypad to enter the password interface; in MDI mode, input the system debugging password: 888888, and then press

 key, “PASSWORD CORRECT” is shown on the left bottom corner on the screen.

2. Press “PROGRAM CONTROL” key on MDI keypad; on  interface, press  softkey, the system enters the check and setting interface of the relay in keep type, press four direction keys on the keypad and the cursor can position whether K010.7 magazine enters the



debugging mode. Press the numerical “1”, the enter key, and then , the data column reminds: “KPAR download is done!”, which means saving is successful, and the magazine debugging mode becomes valid (the advance and retraction of the magazine can be operated without any condition.). Then, the system reminds: 1253 caution to operate the magazine debugging mode, and pressing the reset key to cancel the alarm.

3. Prepare one knife handle to pull the pop-rivet.
4. In ZERO RETURN mode, Z axis zero return is executed.
5. In JOG mode, press “tool advance” key, the magazine is in the advance position.
6. Load the knife handle without the pop-rivet on the magazine and adjust it.
7. In MPG mode, Z axis can be moved upward and downward, which should be caution to operate. Then, the motor rotor or the spindle connecting the motor rotor is directly twisted for one more circle,

and the spindle position is adjusted in JOG mode until the key on the spindle key enters the magazine slot. (About the spindle positioning angle regulation, please refer to the manual of the spindle drive unit.)

B. Regulating the tool change coordinate position

1. According to the above method, after the orientation regulation completes, the spindle orientation is executed in the JOG mode, and then the tool releasing movement is operated, the pop-rivet of the knife handle is installed (the magazine is still in the tool advance position.). In MPG mode, Z axis can be moved upward or downward to adjust the tool change coordinate position (Please make sure the tool is released.), and record the machine coordinate of Z axis (such as -120.000).
2. Firstly execute the tool clamping movement, and then press "tool retraction" key on the keypad, and the magazine returns to the tool retraction position. (Please make sure the tool is clamped.)
3. In MDI mode, set K010.7 to 0 as the above method.
4. The previously recorded Z axis machine coordinate is set in the data parameter 0052, and the parameter should be set correctly; otherwise, the accident may happen to cause the mechanical damage.

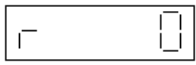

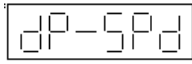


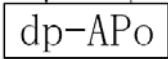

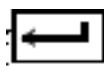

Through the operation of the three steps, the correct tool change can be executed, the operation of T code and M code is operated as below:

TxxM6; and Txx; M6; The executed effect is same.

T0M6; The tool on the spindle is returned to the magazine.

WARNING: When the spindle tool number is 0, the spindle can't be with any tools; otherwise, the accident may happen during tool change and causes the mechanical damage!

Appendix: The setting method of DAP03 positioning angle:

1. Power on the control device, default to display on LED: .
 2. Press  key to enter the monitoring mode, the system displays: .
 3. There are 25 display states in Monitor mode, and select the state to look by pressing  and .
- Find  (The motor coded disc is the positioning disc, and the spindle coded disc is taken as the positioning disc,  can be found); press , the system displays  or other numerical values.
4. To realize the spindle positioning function, the motor rotor should be rotated at least one circle to find the position. When the motor is OFF, directly twist the motor rotor or the spindle connecting the motor rotor for one more circle; it is suggested that the user directly twist for the convenient operation.
 5. Adopt the above method to twist the motor for one more circle, and adjust gradually, the motor

(spindle) rotor can position on the positioning point. After the operation, the absolute position of the rotor can be observed. E. 0 or other numerical value is displayed on the monitoring window. The value is recorded in the parameter PA58 and saved, that is the position. (For example: If E 213 is displayed on the monitor window, the numerical value “213” is input into the parameter PA58.)

4. The right method of handling the emergency stop, power off, resetting and alarm during the magazine running

1. In MDI mode, the tool change is commanded, or it is operated in Auto mode. When the magazine is in the advance limit position, the spindle comes downward the tool hold position. After clamping the tool, if the emergency stop, power off, alarm or resetting occurs when the magazine is going to retract, press “tool retraction” on the system to exit the magazine in JOG mode, then the tool takes off the current magazine chuck, the machine can be used. (Points for attention: If the spindle is released, Z axis is lifted and the magazine is exited, the magazine corresponding to the current spindle is loaded the tool, then hitting tool may happen during the tool change in the next time.)

2. In MDI mode, the tool change is commanded, or it is operated in Auto mode. When the magazine is in the advance limit position, the spindle has already released the tool. If the emergency stop, power off, alarm or resetting occurs, Z axis is going to be lifted, or the toolpot doesn't rotate after Z axis is lifted, press “tool release” button on the spindle in JOG mode, and then the tool is released, Z axis is lifted to reach the safe position in JOG or MPG mode, press “tool retraction” key on the system to exit the magazine, the operation can be executed normally. (Remark: The magazine chuck corresponding to the current spindle is loaded the tool, if the spindle is without the tool, the system should display “T0000”.)

3. In MDI mode, the tool change is commanded, or it is operated in Auto mode. When the magazine is in the advance limit position, Z axis is lifted to the 1st reference position. When the tool is rotating, the current tool number may not comply with the actual one if the emergency stop, power off, alarm or resetting occurs, and the system alarms: “1218 The magazine stops and confirm the tool number again due to the abnormal.” Or “1244 To guarantee the magazine safety, the tool change stops due to the abnormal”, etc. If the operation continues, press “tool retraction” key on the system to exit the magazine in JOG mode, after the magazine returns zero, again and the spindle tool number and the magazine tool number can be reset, the operation can be executed normally. (About the details, please refer to: *Chapter III: The usage method and maintenance of GSK218MC CNC system with the turret magazine.*)

4. Note of GSK218MC CNC System with the Turret Magazine Macro Program

O91001;	(Program name)
G65 H81 P50 Q#1003 R1;	(Miscellaneous lock machine lock transfer to N50 when spindle tool number=T code program end)
M50;	(The tool change begins, and detect whether the condition of tool change is satisfied or not; otherwise, the system alarms)
G69 G50 G15 G80 G40;	(Canceling the relative modes)
G65 H81 P20 Q#1000 R1;	(The spindle tool NO.=0 that is to say, the spindle doesn't load the tool, transfer to N20 and the tool return code isn't executed)
M19 G91 G49 G30 Z0;	(Spindle positioning, return to the tool change coordinate point)
M21;	(Tool return->magazine rotation magazine advance spindle releasing tool)
N20 M19 G91 G49 G28 Z0;	(Return to the mechanical origin)
G65 H81 P30 Q#1002 R1;	(T code tool number=0, transfer to N30 and the tool searching code isn't executed)
M22;	(Tool searching->tool rotation tool advance spindle tool releasing)
G91 G49 G30 Z0;	(Return to the tool change coordinate point)
N30 M17;	(The spindle clamping tool)
M24;	(The magazine retraction)
M51;	(The tool change end)
N50 M99;	(Program end)
%	

APPENDIX TWO THE USAGE GUIDE OF LADDER DIAGRAM OF GSK218MC WITH THE DISC MAGAZINE

1. Points for Attention of Using the Disc Magazine:

- 1) During the tool change, every operation must be confirmed and then the next operation can be executed.
- 2) Before the magazine positioning sensor confirming, the tool advance can't be operated.
- 3) During the tool advance and before completing, the magazine motor can't be started and the toolpot can't be rotated.
- 4) Before confirming the tool advance, the tool change can't be operated.
- 5) Before the machine spindle reaches the tool change position, the tool change can't be operated.
- 6) Before the spindle positioning completes, the tool change can't be operated.
- 7) The spindle head can't be moved before the tool change completes and the tool arm returns to the origin.
- 8) When the motor voltage is too high, the overload relay should trip firstly to avoid the motor burnt.
- 9) The tool change is firstly executed in JOG mode, and then confirm the operations are correct, such as the toolcase advance, the tool change by the mechanical part and the spindle clamping and releasing the tool, finally the operation is controlled by CNC in sequence.
- 10) During debugging, only the input and output signals (X and Y addresses) in the ladder diagram program can be rewritten, then the debugging requirements can be completed. However, to avoid the accident, it's better not to rewrite the other addresses if the operator can't guarantee the safety.

2. The Allocation and Definition of PMC, I/O Address and the Internal Software Components in GSK218MC CNC System

List I The definitions of the input signal interfaces

ADDRESS	SIGNAL INTERFACE	INTERFACE PIN NO.	DEFINITION	CONTACT
X000.0	XS40	1	X axis positive limit signal	NC contact
X000.1	XS40	14	X axis negative limit signal	NC contact
X000.2	XS40	2	Y axis positive limit signal	NC contact
X000.3	XS40	15	Y axis negative limit signal	NC contact
X000.4	XS40	17	Z axis positive limit signal	NC contact
X000.5	XS40	5	Z axis negative limit signal	NC contact
X000.6	XS40	18	The 4 th axis positive limit signal	NC contact
X000.7	XS40	6	The 4 th axis negative limit signal	NC contact
X001.0	XS40	8	X axis zero return deceleration signal	NC contact
X001.1	XS40	21	Y axis zero return deceleration signal	NC contact
X001.2	XS40	9	Z axis zero return deceleration signal	NC contact
X001.3	XS40	22	The 4 th axis zero return deceleration signal	NC contact
X001.4	XS40	24	Emergency stop (218MC integration)	NC contact
X001.5	XS40	12	External cycle start	Normally open contact
X001.6	XS40	25	External feed hold	Normally open contact
X001.7	XS40	13	Detecting the lubrication pressure or the oil level	Normally open contact
X002.0	XS41	1	Detecting the air pressure	Normally open contact
X002.1	XS41	14	Jumping signal	Normally open contact
X002.2	XS41	2	Detecting the index worktable releasing	Normally open contact
X002.3	XS41	15	Detecting the index	Normally

ADDRESS	SIGNAL INTERFACE	INTERFACE PIN NO.	DEFINITION	CONTACT
			worktable clamping	open contact
X002.4	XS41	17	External clamping/releasing tool	Normally open contact
X002.5	XS41	5	Detecting the tool releasing	Normally open contact
X002.6	XS41	18	Detecting the tool clamping	Normally open contact
X002.7	XS41	6	Without definition	
X003.0	XS41	8	Editing lock	Normally open contact
X003.1	XS41	21	Operation lock	Normally open contact
X003.2	XS41	9	The manipulator braking signal	Set by parameters
X003.3	XS41	22	Detection signal of the manipulator tool-hold	Set by parameters
X003.4	XS41	24	Detection signal of the manipulator zero speed	Set by parameters
X003.5	XS41	12	The magazine rotation motor overload	NC contact
X003.6	XS41	25	The manipulator arm motor overload	NC contact
X003.7	XS41	13	The cooling motor overload	NC contact
X004.0	XS42	1	External magazine CW rotation	Normally open contact
X004.1	XS42	14	External magazine CCW rotation	Normally open contact
X004.2	XS42	2	External toolcase vertical	Normally open contact
X004.3	XS42	15	External toolcase level	Normally open contact
X004.4	XS42	17	Without definition	
X004.5	XS42	5	Without definition	
X004.6	XS42	18	Without definition	
X004.7	XS42	6	Without definition	
X005.0	XS42	8	Without definition	
X005.1	XS42	21	The toolcase vertical detection	Set by parameters
X005.2	XS42	9	The toolcase level detection	Set by parameters
X005.3	XS42	22	The magazine counting	Normally

ADDRESS	SIGNAL INTERFACE	INTERFACE PIN NO.	DEFINITION	CONTACT
			(normal 0)	open contact
X005.4	XS42	24	The magazine CW/CCW in-position (normal 1)	Normally open contact
X005.5	XS42	12	The magazine zero return in-position	Optional
X005.6	XS42	25	External magazine zero return	Normally open contact
X005.7	XS42	13	External manipulator movement	Normally open contact
X006.0	XS22	6	External MPG X axis selection	Normally open contact
X006.1	XS22	2	External MPG Y axis selection	Normally open contact
X006.2	XS22	7	External MPG Z axis selection	Normally open contact
X006.3	XS22	3	External MPG A axis selection	Normally open contact
X006.4	XS22	8	External MPG step width 0.001	Normally open contact
X006.5	XS22	4	External MPG step width 0.01	Normally open contact
X006.6	XS22	9	External MPG step width 0.1	Normally open contact
X006.7	XS22	ESP (9, 22)	External emergency stop	NC contact
X007.0	XS23	44	Completing to switch between speed/position mode	Set by parameters
X007.1	XS23	21	The spindle orientation finish	Set by parameters
X007.2	XS23	5	The spindle speed reach	Set by parameters
X007.3	XS23	20	The spindle zero speed detection	NC contact

Points for attention:

1. About the connection method and points for attention of PLC input (X address), please refer to chapter IV.
2. The contacts are divided as: Normally open contact, NC contact and the contact set by parameters.
3. During using the ladder diagram, the user can add the new function into the undefined input, but it requires to rewrite the ladder diagram, so be caution to operate.
4. Operation panel USER1 function of button: K11.1=0: The switch of chip removal hydrovalve.

K11.1=1: Z axis returns to the 1st reference position in JOG mode.

Function of USER2 button: Z axis is returned to the 2nd reference position in JOG mode.

Function of USER3 button: Start the switch of blowing the spindle.

List II The definitions of the output signal interface

ADDRESS	SIGNAL INTERFACE	INTERFACE PIN NO.	DEFINITION
Y000.0	XS43	1	Z axis band-type brake
Y000.1	XS43	14	Cooling
Y000.2	XS43	2	The tool releasing/clamping
Y000.3	XS43	15	Without definition
Y000.4	XS43	17	The spindle brake
Y000.5	XS43	5	Without definition
Y000.6	XS43	18	The red alarm lamp (ON when the system alarms)
Y000.7	XS43	6	The yellow lamp (ON when the system doesn't alarm and doesn't run)
Y001.0	XS43	8	The green lamp (ON when the program is running)
Y001.1	XS43	21	Chip removal control
Y001.2	XS43	9	Lubricating control
Y001.3	XS43	22	Machine lighting control
Y001.4	XS43	24	Hydraulic pressure start
Y001.5	XS43	12	Blowing the spindle
Y001.6	XS43	25	The index worktable releasing
Y001.7	XS43	13	The index worktable clamping
Y002.0	XS44	1	Without definition
Y002.1	XS44	14	Without definition
Y002.2	XS44	2	Without definition
Y002.3	XS44	15	Without definition
Y002.4	XS44	17	The handheld unit lamp
Y002.5	XS44	5	The manipulator running
Y002.6	XS44	18	The chip removal hydrovalve output
Y002.7	XS44	6	The spindle position/speed mode
Y003.0	XS44	8	The magazine CW rotation
Y003.1	XS44	21	The magazine CCW rotation
Y003.2	XS44	9	The tool case vertical
Y003.3	XS44	22	The tool case level
Y003.4	XS44	24	The spindle gear I (frequency conversion/IO point control)
Y003.5	XS44	12	The spindle gear II (frequency conversion/IO point control)

ADDRESS	SIGNAL INTERFACE	INTERFACE PIN NO.	DEFINITION
Y003.6	XS44	25	The spindle gearⅢ(frequency conversion/IO point control)
Y003.7	XS44	13	Without definition
Y004.0	XS45	1	Without definition
Y004.1	XS45	14	Without definition
Y004.2	XS45	2	Without definition
Y004.3	XS45	15	Without definition
Y004.4	XS45	17	Without definition
Y004.5	XS45	5	Without definition
Y004.6	XS45	18	Without definition
Y004.7	XS45	6	Without definition
Y005.0	XS45	8	Without definition
Y005.1	XS45	21	Without definition
Y005.2	XS45	9	Without definition
Y005.3	XS45	22	Without definition
Y005.4	XS45	24	Without definition
Y005.5	XS45	12	Without definition
Y005.6	XS45	25	Without definition
Y005.7	XS45	13	Without definition
Y006.0	XS23	9	The spindle CW rotation
Y006.1	XS23	25	The spindle CCW rotation
Y006.2	XS23	24	The spindle enable
Y006.3	XS23	11	The spindle orientation
Y006.4	XS23	12	Switching between speed/position mode
Y006.5	XS23	27	Zero speed clamping

Points for attention:

1. About the connection method and points for attention of PLC output (Y address), please refer to chapter IV.
2. During using the ladder diagram, the user can add the new function into the undefined input, but it requires to rewrite the ladder diagram, so be caution to operate.

List III The address definition of KAPA

ADDRESS	DEFINITION	STATE 0	STATE 1	USER SETTING VALUE
K000.0	Whether allow to rewrite PLC parameters	NO	YES	
K000.1	Whether allow to debug PLC signals	NO	YES	
K000.2	Whether clear all Y signals when PLC enters the debugging mode	NO	YES	

ADDRESS	DEFINITION	STATE 0	STATE 1	USER SETTING VALUE
K000.3	Whether allow to edit A address information	NO	YES	
K000.4	Whether allow to edit K address information	NO	YES	
K000.5	Whether allow to edit X address information	NO	YES	
K000.6	Whether allow to edit Y address information	NO	YES	
K000.7	Whether allow to operate the command list	NO	YES	
K001.0	Whether allow to use the magazine	NO	YES	
K001.1	Whether automatically download during switching the ladder diagram	NO	YES	
K001.2	Selecting the spindle interface input signal level	+24v valid	0v valid	
K002.0	Whether use the 4 th axis	NO	YES	
K004.0	Whether use the gear control (I/O point) for spindle	NO	YES	
K004.1	Whether only one axis is controlled in the reference point in JOG mode	Many axes	One axis	
K005.0	Whether the machine is with the external MPG	NO	YES	
K005.1	Whether the machine is with the external cycle start	NO	YES	
K005.2	Whether the system enters the debugging mode	NO	YES	
K006.0	X axis limit switch selection	2 switches	1 switch	
K006.1	Y axis limit switch selection	2 switches	1 switch	
K006.2	Z axis limit switch selection	2 switches	1 switch	
K006.3	The 4 th axis limit switch selection	2 switches	1 switch	
K006.4	Whether X axis zero return switch is normally open type	NO	YES	
K006.5	Whether Y axis zero return switch is normally open type	NO	YES	
K006.6	Whether Z axis zero return switch is normally open type	NO	YES	
K006.7	Whether the 4 th axis zero return switch is normally open type	NO	YES	
K007.4	Whether cancel the 4 th hardware limit	NO	YES	
K007.5	Whether cancel	NO	YES	

ADDRESS	DEFINITION	STATE 0	STATE 1	USER SETTING VALUE
	the external emergency stop			
K007.6	Whether the spindle output +10V~-10V analog voltage	NO	YES	
K007.7	Whether use the spindle position mode	NO	YES	
K008.0	Whether the spindle positioning detection is normally open type	NC type	Normally open type	
K008.1	Whether the tool clamping or releasing is controlled by the panel button	External button	Panel button	
K008.2	Whether use the tool clamping/releasing device	YES	NO	
K008.4	Whether the spindle is with the gear change device	NO	YES	
K008.5	The spindle speed (speed mode)/position(position mode) reaching detection switch is NC type	NC type	Normally open type	
K008.6	In the spindle speed mode, whether the detection switch is ON. (It's OFF in the position mode.)	ON	OFF	
K008.7	Whether there is a detection signal during switching between the spindle position/speed mode	YES	NO	
K009.0	Whether there is a detection signal for the spindle position reaching	YES	NO	
K009.1	Whether detect the lubrication pressure or oil level	NO	YES	
K009.2	Whether detect the air pressure	NO	YES	
K009.3	Whether there is a detection switch during detecting the spindle gear			
K009.4	Whether detect the magazine rotation motor overload	NO	YES	
K009.5	Whether detect the manipulator arm motor overload	NO	YES	
K009.6	Whether detect the cooling motor overload	NO	YES	
K010.1	Whether the magazine is with the zero return switch	NO	YES	
K010.2	Selecting the magazine zero return switch contact	Normally open type	NC type	
K010.3	Selecting the magazine tool	Normally	NC type	

ADDRESS	DEFINITION	STATE 0	STATE 1	USER SETTING VALUE
	advance detection switch contact	open type		
K010.4	Selecting the magazine tool retraction detection switch contact	Normally open type	NC type	
K010.6	Whether setting the magazine origin in JOG mode is valid or not	Invalid	Valid	
K010.7	Whether the magazine enters the debugging mode	NO	YES	
K011.0	Whether remind the spindle tool number during clamping or releasing the tool in JOG mode	YES	NO	
K011.1	Whether allow to return to the tool change position in JOG mode	NO	YES	
K011.4	Whether cut off and output after the spindle positioning finish	NO	YES	
K011.5	Whether output CW rotation signal during the spindle positioning	NO	YES	
K012.0	Whether the manipulator braking signal is NC type	Normally open type	NC type	
K012.1	Whether the manipulator tool hold signal is NC type	Normally open type	NC type	
K012.2	Whether the manipulator zero signal is NC type	Normally open type	NC type	
K012.3	Whether the toolpot detection switch is NC type	NO	YES	
K012.4	Whether use the index worktable clamping or releasing device	NO	YES	
K012.5	Whether the index worktable automatically clamps or releases	NO	YES	
K012.6	Whether the index worktable enters the working mode	NO	YES	
K012.7	Whether the manipulator enters the debugging mode	NO	YES	
K013.4	Whether X axis uses the zero return switch	YES	NO	
K013.5	Whether Y axis uses the zero return switch	YES	NO	
K013.6	Whether Z axis uses the zero return switch	YES	NO	
K013.7	Whether the 4 th axis uses the zero return switch	YES	NO	
K015.0	Whether it is the operation panel B	NO	YES	
K015.6	Whether the keypad combined	NO	YES	

ADDRESS	DEFINITION	STATE 0	STATE 1	USER SETTING VALUE
	magazine control button is valid or not			
K015.7	Whether the external magazine control button is valid or not	NO	YES	

Points for attention:

1. When the system is normally running, please make sure K000.0, K000.1, K000.2, K000.3, K000.4, K000.5, K000.6, K000.7, K005.2, K010.7 and K012.7 are 0; otherwise, the accident may happen.
2. After rewriting K001.0 parameter, it becomes valid after restarting the system. When K001.0=0 (i.e: the magazine is not used), setting K010.0, K010.1, K010.2, K010.3, K010.4, K010.5, K010.6, K010.7, K011.0, K011.1, K011.2 and K011.3 are invalid.
3. When K001.0=1 (i.e The magazine usage is valid), setting K008.2 is invalid.
4. When K008.2=0(i.e The tool clamping/releasing device is not used), setting K008.1 is invalid.
5. Points for attention of setting K006.0:
When X axis is installed two limit switches (the positive is connected with X0.0, the negative is connected with X0.1.), setting K006.0 as 0 is valid.
When X axis is installed one limit switch connected with X0.0, setting K006.0 as 1 is valid.
Setting K006.1 of Y axis, K006.2 of Z axis, and K006.3 of the 4th axis is same as that of X axis.
6. When K005.2=1, all the alarm interlock is released, the system enters the debugging mode, which is only used for system testing. The parameter should be set as 0 during the normally usage; otherwise, the accident may happen.
7. About the parameters of K010.1, K010.2, K010.3, K010.4, K010.6, K010.7, K011.0, K011.1 and K012.7, which are relative to the magazine, please refer to *Chapter III: the usage and maintenance of the magazine*.
8. When K004.0=1 (Whether the spindle uses I/O point control), K008.4 (the spindle is with the gear change device or not) setting is invalid, that is to say, the spindle is without the gear change device.
9. When K012.7=1, the manipulator is running without any condition. Firstly Z axis returns to the machine zero position, and the manipulator can't load the tool; otherwise, unload the tool in JOG mode. The mode only applies to the debugging the manipulator position. However, the data can't be changed, so be caution to use.
10. When K015.0=0, use the operation panel of GSK218MC; K015.0=1, use the operation panel of GSK990MA.

List IV Definition of PLC external alarm

PMC ALARM NUMBER	A ADDRESS	ALARM CONTENT
1200	A000.0	The air pressure detected abnormal
1201	A000.1	The lubrication oil detected abnormal
1202	A000.2	The lubricating motor detected abnormal
1203	A000.3	The cooling motor overload
1204	A000.4	The chip removal motor detected abnormal
1205	A000.5	The pressure oil pump motor detected abnormal
1206	A000.6	The spindle cooling unit detected abnormal
1207	A000.7	The machine lamp detected abnormal
1208	A001.0	The machine control box temperature detected abnormal
1209	A001.1	The machine bed temperature detected abnormal
1210	A001.2	The machine vibration frequency detected abnormal
1211	A001.3	The pressure oil temperature detected abnormal
1212	A001.4	The oil pressure too low
1213	A001.5	The machine isn't ready
1214	A001.6	The spindle can't revolve due to the gear abnormal
1215	A001.7	T code should be executed before executing M06 code
1216	A002.0	The spindle can't rotate in the tool releasing state
1217	A002.1	The tool can't release during the spindle rotating
1218	A002.2	The magazine stops due to the abnormal and confirm the tool number again
1219	A002.3	The manipulator isn't in the origin and the spindle can't revolve
1220	A002.4	The spindle tool clamping detected abnormal
1221	A002.5	The spindle tool releasing detected abnormal
1222	A002.6	The spindle temperature detected abnormal
1223	A002.7	The spindle speed detected abnormal
1224	A003.0	The spindle motor enable detected abnormal

PMC ALARM NUMBER	A ADDRESS	ALARM CONTENT
1225	A003.1	The spindle orientation in-position detected abnormal
1226	A003.2	The spindle gear abnormal
1227	A003.3	The cycle start can't be executed if the manipulator isn't in the origin
1228	A003.4	The cycle start can't be executed because the toolcase is in the vertical position
1229	A003.5	The mechanical zero return should be executed before executing M06 code
1230	A003.6	The tool change can't be executed in the spindle tool releasing state
1231	A003.7	The tool change can't be executed because the toolcase isn't in the level position
1232	A004.0	The magazine rotation in-position detected abnormal
1233	A004.1	The magazine rotation motor overload
1234	A004.2	The mechanical manipulator arm motor overload
1235	A004.3	The magazine traverse in-position detected abnormal
1236	A004.4	The magazine zero return detected abnormal
1237	A004.5	Zero return should be operated again due to the magazine origin lost
1238	A004.6	The toolcase level and vertical detected abnormal
1239	A004.7	The spindle can't be rotated if the toolcase isn't in the level position
1240	A005.0	Zero return should be operated again due to the magazine abnormal
1241	A005.1	The toolcase vertical direction detected abnormal
1242	A005.2	The toolcase level direction detected abnormal
1243	A005.3	Setting the magazine zero position valid
1244	A005.4	For magazine safety, the tool change stops due to the abnormal
1245	A005.5	Without the tool number code or the repeated number in the tool list
1246	A005.6	The spindle releasing/clamping tool detection abnormal

PMC ALARM NUMBER	A ADDRESS	ALARM CONTENT
1247	A005.7	The spindle orientation time sequence detected abnormal
1248	A006.0	Condition of executing T code tool number not enough
1249	A006.1	Tool advance can't be operated due to the spindle with a tool
1250	A006.2	The tool advance can't be executed because the spindle is not same as the current tool number in the magazine
1251	A006.3	Switch off power supply
1252	A006.4	Z axis can't be moved in the tool clamping state
1253	A006.5	Caution to operate the magazine adjusting mode
1254	A006.6	Cycle start can't be executed in the magazine debugging mode
1255	A006.7	The origin can't be returned during tool clamping
1256	A007.0	The tool change position can't be returned during tool clamping
1257	A007.1	The tool change position can't be returned because the spindle doesn't position
1258	A007.2	The tool change position can't be returned due to the magazine abnormal
1259	A007.3	The tool change can't be operated due to T code tool number abnormal
1260	A007.4	Cycle start can't be executed during returning to tool change position in JOG mode
1261	A007.5	Tool retraction can't be operated because the tool isn't in the origin
1262	A007.6	Excess the safety position
1263	A007.7	Caution to operate the manipulator debugging mode
1264	A008.0	Switching spindle speed into position mode is abnormal
1265	A008.1	Switching spindle position into speed mode is abnormal
1266	A008.2	The gear change can't be operated during the spindle rotating
1267	A008.3	The manipulator can't be operated because the toolcase isn't vertical

PMC ALARM NUMBER	A ADDRESS	ALARM CONTENT
1268	A008.4	The manipulator can't be operated because it isn't in the origin
1269	A008.5	The manipulator stops due to the operation abnormal
1270	A008.6	The manipulator tool holding detected abnormal
1271	A008.7	The manipulator can't be operated because the spindle doesn't orientate
1272	A009.0	The manipulator can't be operated because the spindle tool doesn't release
1273	A009.1	The manipulator can't be operated because the spindle tool doesn't clamp
1274	A009.2	Tool advance can't be operated because the manipulator isn't in the origin
1275	A009.3	The tool retraction can't be operated because the manipulator isn't in the origin
1276	A009.4	The toolpot can't rotate because the manipulator isn't in the origin
1277	A009.5	The toolpot can't rotate because the toolcase isn't in the level position
1278	A009.6	The manipulator can't be operated because Z axis doesn't return to the 2 nd reference position
1279	A009.7	The manipulator origin position detected abnormal
1280	A010.0	Compel to stop magazine rotating due to the abnormal
1288	A011.0	The index worktable releasing detected abnormal
1289	A011.1	The index worktable clamping detected abnormal
1290	A011.2	The index worktable clamping device doesn't start
1291	A011.3	The index worktable can't rotate because it doesn't release
1292	A011.4	The index worktable can't be moved because it doesn't clamp
1293	A011.5	Cycle start can't be executed because the safety door isn't closed
1294	A011.6	The index worktable can't start because it doesn't clamp
1360	A020.0	The lubrication pressure low or the oil level

PMC ALARM NUMBER	A ADDRESS	ALARM CONTENT
		low

A0.0~A19.7 are the system red alarms, after the alarm, the system stops running. A20.0~A31.7 are user-defined blue alarms. After the alarm, the system continues to run without affecting the normal usage.

Details of some PMC alarm diagnosis information:

Alarm information: 1200 The air pressure is detected abnormal.

Reason:

Trouble shooting: Detect the state of X002.0.

Alarm information: 1201 The lubrication oil is detected abnormal.

Reason: User-defined

Trouble shooting:

Alarm information: 1202 The lubricating motor is detected abnormal.

Reason: User-defined

Trouble shooting:

Alarm information: 1203 The cooling motor is overload.

Reason: The cooling motor overload

Trouble shooting: Detect whether the cooling motor is normal or not, after confirming, switch on the overload protection switch.

Alarm information: 1204 The chip removal motor is detected abnormal.

Reason: User-defined

Trouble shooting:

Alarm information: 1205 The pressure oil pump motor is detected abnormal.

Reason: User-defined

Trouble shooting:

Alarm information: 1206 The spindle cooling unit is detected abnormal.

Reason: User-defined

Trouble shooting:

Alarm information: 1207 The machine lamp is detected abnormal.

Reason: User-defined

Trouble shooting:

Alarm information: 1208 The machine control box temperature is detected abnormal.

Reason: User-defined

Trouble shooting:

Alarm information: 1209 The machine bed temperature is detected abnormal.

Reason: User-defined

Trouble shooting:

Alarm information: 1210 The machine vibration frequency is detected abnormal.

Reason: User-defined

Trouble shooting:

Alarm information: 1211 The pressure oil temperature is detected abnormal.

Reason: User-defined

Trouble shooting:

Alarm information: 1212 The oil pressure is too low.

Reason: User-defined

Trouble shooting:

Alarm information: 1213 The machine is not ready.

Reason: User-defined

Trouble shooting:

Alarm information: 1214 The spindle revolution can't be operated due to the gear abnormal.

Reason: When the spindle is executing the revolving codes, the spindle gear is detected abnormal.

Trouble shooting: When the spindle is in gear I (Y3.4=1), the gear I in-position detection switch (X004.1) is OFF in the time set by T0021, adjust the time of T0021 or check whether X004.1 is ON or not; When the spindle is in gear II (Y3.5=1), the gear II in-position detection switch (X004.2) is OFF in the time set by T0022, adjust the time of T0022 or check whether X004.2 is ON or not; When the spindle is in gear III (Y3.6=1), the gear III in-position detection switch (X004.3) is OFF in the time set by T0023, adjust the time of T0023 or check whether X004.3 is ON or not.

Alarm information: 1215 M06 code should be executed after T code.

Reason: After executing M06 code, the valid T code isn't executed.

Trouble shooting: After executing the valid T codes, M06 code is executed.

Alarm information: 1216 The spindle can't be rotated in the tool releasing state.

Reason: The spindle rotation codes are executed when the tool is released. For example: spindle CW, CCW rotation, inch or positioning is executed in JOG mode or M03,M04 or M19 is executed in AUTO mode, which causes the spindle rotation.

Trouble shooting: In JOG mode, press "clamp/release" button to make the tool clamped (Y0.2=10) , and detect whether the tool clamping detection switch (X2.6) is 1 or not; when the state is 1, the system doesn't alarm during the spindle rotating.

Alarm information: 1217 The tool can't be released during the spindle rotating.

Reason: When the spindle is rotating, the code of tool releasing is executed.

Trouble shooting: The alarm can be avoided when the tool releasing code is executed during the spindle stopping.

Alarm information: 1218 The magazine stops due to the abnormal and then the tool number should be confirmed again.

Reason: Txx code is executed during the magazine rotating, the system alarms; or "reset" key is pressed, the alarm occurs.

Trouble shooting: 1. The magazine zero return can be operated, again.

2. Reset the spindle tool number and the magazine tool number.

(About the details, refer to *chapter III: The usage method and maintenance of GSK218MC CNC system with the disc magazine.*)

Alarm information: 1219 The spindle rotation can't be operated because the manipulator isn't in the origin.

Reason: The spindle revolution is executed while the manipulator isn't in the origin.

Trouble shooting: 1. The manipulator returns to the origin. (whether the manipulator is in the origin or not is detected by the state of X3.4.)

2. The diagnosis can be conveniently operated when the abnormal occurs during the manipulator running. The manipulator can operate positioning in the mechanical zero position; when the manipulator isn't in the origin, the mechanical zero return should be operated before positioning.

(About the details, refer to *chapter III: The usage method and maintenance of GSK218MC CNC system with the disc magazine.*)

Alarm information: 1220 The spindle tool clamping is detected abnormal.

Reason: When the tool is clamped (Y2.0=0), the magazine clamping detection switch (X2.6) is still OFF in the time set by T010.

Trouble shooting: 1. Detect whether the magazine clamping detection switch is normal or not.
2. Detect whether Y0.2 is output or not.
3. Readjust the time of T010.

Alarm information: 1221 The spindle tool releasing is detected abnormal.

Reason: When the tool is released (Y2.0=1), the magazine releasing detection switch (X2.5) is still OFF in the time set by T009.

Trouble shooting: 1. Detect whether the magazine releasing detection switch is normal or not.
2. Detect whether Y0.2 is output or not.
3. Readjust the time of T009.

Alarm information: 1222 The spindle unit temperature is detected abnormal.

Reason: User-defined

Trouble shooting:

Alarm information: 1223 The spindle speed is detected abnormal.

Reason: User-defined

Trouble shooting:

Alarm information: 1224 The spindle motor enable is detected abnormal.

Reason: User-defined

Trouble shooting: Without

Alarm information: 1225 The spindle orientation in-position is detected abnormal.

Reason: When the spindle is executed positioning (Y2.1=1), the spindle positioning detection switch (X7.1) is still connected in the time set by T013.

Trouble shooting: 1. The spindle drive unit or the spindle encoder is abnormal.
2. Detect whether Y6.3 is output or not.
3. Readjust the time of T013.

Alarm information: 1226 The spindle gear is abnormal.

Reason: The spindle gear is detected abnormal.

Trouble shooting: When the spindle is in gear I (Y3.4=1), the gear I in-position detection switch (X004.1) is still OFF in the time set by T0021, adjust the time of T0021 or check whether X004.1 is

ON or not; When the spindle is in gear II (Y3.5=1), the gear II in-position detection switch (X004.2) is still OFF in the time set by T0022, adjust the time of T0022 or check whether X004.2 is ON or not; When the spindle is in gear III (Y3.6=1), the gear III in-position detection switch (X004.3) is still OFF in the time set by T0023, adjust the time of T0023 or check whether X004.3 is ON or not;

Alarm information: 1227 The cycle start can't be operated because the manipulator isn't in the origin.

Reason: When the manipulator isn't in the origin, pressing "start" button in Auto, MDI or DNC mode causes the alarm.

Trouble shooting: The manipulator returns to the origin.

Alarm information: 1228 The cycle start can't be operated because the toolcase is in the vertical position.

Reason: When the toolcase is in the vertical position, pressing "start" button in Auto, MDI or DNC mode causes the alarm.

Trouble shooting: The toolcase is returned to the level position.

Alarm information: 1229 M06 code should be executed after the mechanical zero return.

Reason: Without executing the mechanical zero return, M06 or M50 code is executed.

Trouble shooting: The mechanical zero return should be executed, firstly.

Alarm information: 1230 The tool change can't be operated during the spindle tool releasing.

Reason: When the spindle is released (Y0.2=1), M06 or M50 code is executed.

Trouble shooting: The spindle tool is clamped (Y2.0=0).

Alarm information: 1231 The tool change can't be operated because the toolcase isn't in the level position.

Reason: When the toolcase isn't in the level position, M06 or M50 code is executed.

Trouble shooting: The toolcase is returned to the level position.

Alarm information: 1232 The magazine rotating in-position is detected abnormal.

Reason: User-defined

Trouble shooting:

Alarm information: 1233 The magazine rotation motor is overload.

Reason: The motor overload occurs because the mechanical part gets stuck during the magazine

rotation motor running or the current is too much.

Trouble shooting: Check whether the mechanical part of the magazine rotation motor is normal or not; after checking, the overload protection switch of the mechanical magazine rotation motor is turned on, again.

Alarm information: 1234 The manipulator motor is overload.

Reason: The motor overload occurs because the mechanical part of the manipulator arm gets stuck during running or the current is too much.

Trouble shooting: Check whether the mechanical part of the manipulator is normal or not; after checking, the overload protection switch of the manipulator arm motor is turned on, again.

Alarm information: 1235 The magazine traverse in-position is detected abnormal.

Reason: User-defined

Trouble shooting:

Alarm information: 1236 The magazine zero return is detected abnormal.

Reason: User-defined

Trouble shooting:

Alarm information: 1237 Zero return should be operated because the magazine origin is lost.

Reason: During the magazine zero return, it stops and the alarm occurs due to the abnormal.

Trouble shooting: The magazine is returned to the zero position, again.

(About the details, refer to *chapter III: The usage method and maintenance of GSK218MC CNC system with the disc magazine.*)

Alarm information: 1238 The toolcase level and vertical positions are detected abnormal.

Reason: The toolcase is neither in the level position nor in the vertical.

Trouble shooting: Detect whether the detection signals of X5.1 and X5.2 are normal or not.

Alarm information: 1239 The spindle can't be rotated because the toolcase isn't in the level position.

Reason: The spindle rotation is executed when the toolcase isn't in the level position.

Trouble shooting: The toolcase is returned to the level position, which can be detected by the stated of X5.2, and then the spindle rotation is executed.

Alarm information: 1240 Zero return should be operated, again, due to the magazine abnormal.

Reason: 1. The magazine stops rotating in the time set by T102, and the pulse signal occurs because

the magazine counting switch (X3.5) is detected.

2. Detecting the magazine counting switch as 0 or 1 exceeds the time set by T103 during the magazine rotating.

Trouble shooting: 1. The output (Y3.0 and Y3.1) of the magazine CW or CCW rotation is abnormal.

2. The magazine counting switch is abnormal.

3. Reset the values of T102 and T103.

(About the details, refer to *chapter III: The usage method and maintenance of GSK218MC CNC system with the disc magazine.*)

Alarm information: 1241 The toolcase vertical direction is detected abnormal.

Reason: When the toolcase vertical movement (Y3.2=1) is executed, the toolcase vertical direction detection switch (X5.1) doesn't operate in the time set by T104.

Trouble shooting: 1. Detect whether the toolcase vertical direction detection switch is normal or not.

2. Detect whether Y3.2 is output or not.

3. Readjust the time of T104.

Alarm information: 1242 The toolcase level direction is detected abnormal.

Reason: When the toolcase level movement (Y3.3=1) is executed, the toolcase level direction detection switch (X5.2) doesn't operate in the time set by T105.

Trouble shooting: 1. Detect whether the toolcase level direction detection switch is normal or not.

2. Detect whether Y303 is output or not.

3. Readjust the time of T105.

Alarm information: 1243 The magazine zero position setting is valid.

Reason: When the magazine is without zero return switch (K010.1=0), the system alarms when K010.6=1 and reminds setting the magazine zero position is valid.

Trouble shooting: Set K010.6 as 0.

(About the details, refer to *chapter III: The usage method and maintenance of GSK218MC CNC system with the disc magazine.*)

Alarm information: 1244 To guarantee the magazine safety, the tool change stops due to the abnormal.

Reason: When the tool change is executed automatically in the magazine, the tool change stops due to the abnormal or the manipulator isn't in the origin during starting the system, which causes the alarm. The alarm only reminds the operator that the tool number of the magazine and that of the

spindle may be in disorder, even clearing the alarm doesn't mean the magazine is normal, so the tool numbers of the magazine and the spindle should be reset.

(About the details, refer to *chapter III: The usage method and maintenance of GSK218MC CNC system with the disc magazine.*)

Trouble shooting: Readjust the magazine and confirm whether the tool number of the magazine is complied with that of the spindle, including whether the manipulator is in the origin, the toolcase returns to the level position, the spindle is clamped or not, whether the current toolcase number complies with the current value of CTR100, whether the tool number of the spindle complies with the value of D245.

Alarm information: 1245 There isn't the tool number code in the tool list or the tool number code is repeated.

Reason: The tool number isn't specified by T code in the tool list (D000-D099) or the tool code specified by T code is repeated in the tool list.

Trouble shooting: The tool number value is rewritten in the tool list.

Alarm information: 1246 The spindle tool releasing or clamping is detected abnormal.

Reason: The spindle tool is neither in the releasing position nor the clamping position.

Trouble shooting: Detect whether X2.5 and X2.6 is normal or not.

Alarm information: 1247 The spindle orientation time sequence is detected abnormal.

Reason: Before the spindle orientation, the finish signal is done.

Trouble shooting: Check whether the signal of X5.0 is normal or not.

Alarm information: 1248 Executing T code tool number condition is not satisfied.

Reason: Before the 1st T code tool number isn't completed, the 2nd T code is executed.

Trouble shooting: After completing to execute the 1st T code tool number, the 2nd T code is executed.

Alarm information: 1249 The tool advance can't be operated because the spindle is with a tool.

Reason: When Z axis is in the origin and the spindle is with a tool (D245 is not 0), the tool advance in the magazine is executed.

Trouble shooting: Unload the spindle tool ,and set D245 as 0.

Alarm information: 1250 The tool advance can't be operated because the tool number of the spindle is different with the current one of the magazine.

Reason: The tool advance in the magazine is executed when Z axis is in the tool change position and the tool number of the spindle is different with that of the current toolcase in the magazine.

Trouble shooting: Rotating the magazine to make the tool number of the current toolcase in the magazine same as that of the spindle.

Alarm information: 1251 Please switch off power supply.

Reason: The parameter becomes valid after restarting the system.

Trouble shooting: Restart the system.

Alarm information: 1252 Z axis can't be moved during the tool clamping.

Reason: Z axis traverse is executed when the manipulator is in the tool hold and the tool is clamped.

Trouble shooting: 1. The manipulator is in the origin.

2. The spindle tool is released.

Alarm information: 1253 Caution to operate the magazine debugging mode.

Reason: When K010.7 is set as 1, the alarm occurs. The alarm only reminds the magazine enters the debugging mode, the alarms and interlock signals relative with the magazine are released completely, so be caution to operate; otherwise, the abnormal may cause the mechanical part damage.

Trouble shooting: Press "reset" key to clear the alarm. (Remark: Clearing the alarm doesn't mean the system isn't in the magazine debugging mode, K010.7 is 0 to exit the magazine debugging mode)

Alarm information: 1254 Cycle start can't be executed in the magazine debugging mode.

Reason: Set K010.7 as 1, pressing "start" button in Auto, MDI or DNC mode causes the alarm.

Trouble shooting: Set K010.7 as 0.

Alarm information: 1255 The origin can't be returned during the tool clamping.

Reason: Z axis is returned to the origin when the magazine is in the tool advance position and the spindle tool is clamped.

Trouble shooting: 1. The magazine is in the tool retraction position.

2. The spindle tool is released.

Alarm information: 1256 The tool can't be returned to the tool change when the tool is clamped.

Reason: Z axis is returned to the tool change position when the magazine is in the tool advance position and the spindle tool is in the clamping state.

Trouble shooting: 1. The magazine is in the tool retraction position.

2. The spindle tool is released.

Alarm information: 1257 The tool change position can't be returned because the spindle doesn't position.

Reason: Z axis returns to the tool change position when the magazine is in the tool advance position and the spindle doesn't position.

Trouble shooting: 1. The magazine is in the tool retraction position.
2. The spindle is positioned.

Alarm information: 1258 The tool change position can't be returned due to the magazine abnormal.

Reason: User-defined

Trouble shooting:

Alarm information: 1259 The tool change can't be operated due to T code tool number abnormal.

Reason: The wrong T code is executed before executing M06 code. (The wrong T codes are: The tool numbers not specified by T code exist in the tool list (D001-D099) or the tool number specified by T code is repeated.)

Trouble shooting: After executing the correct T codes, M06 code is executed.

Alarm information: 1260 Cycle start can't be operated during returning tool change position in JOG mode.

Reason: When K011.1=1 (Returning tool change position is valid in JOG mode), pressing "start" button in AUTO, MDI or DNC mode causes the alarm.

Trouble shooting: Set K011.1 as 0.

Alarm information: 1261 The tool retraction can't be operated because Z axis isn't in the origin.

Reason: The magazine tool retraction is executed when the magazine is in the tool advance position and Z axis isn't in the origin.

Trouble shooting: After Z axis is returned to the origin, the tool retraction is operated.

Alarm information: 1262 Exceed the safety position

Reason: Z axis exceeds the tool change position when Z axis is moved and the manipulator is in the tool hold position.

Trouble shooting: Move Z axis and make Z axis coordinate is between the tool change position and the origin.

Alarm information: 1263 Caution to operate the manipulator adjusting mode.

Reason: The system alarms when K012.7 is set as 1, and the alarm reminds the manipulator enters the debugging mode, the alarm and the interlock signals relative with the magazine is

released completely, so caution to operate; Otherwise, the abnormal may damage the mechanical part.

Trouble shooting: Setting K012.7 as 0 to exit the manipulator debugging mode.

Alarm information: 1264 Switching into the spindle position mode is abnormal.

Reason: During executing M29 code, the spindle position mode finish signal isn't received in the time set by T24.

Trouble shooting: Adjust the time set by T24 or check whether the spindle position mode finish signal is output or not.

Alarm information: 1265 The spindle speed mode switching is abnormal.

Reason: During executing M28 code, the spindle speed mode finish signal isn't received in the time set by T28.

Trouble shooting: Adjust the time set by T28 or check whether the spindle speed mode finish signal is output or not.

Alarm information: 1266 The gear change can't be operated during the spindle rotating.

Reason:

Trouble shooting:

Alarm information: 1267 The manipulator can't be operated when the toolcase isn't vertical.

Reason: The manipulator movement is executed when the toolcase is vertical.

Trouble shooting: The toolcase should be executed the vertical movement firstly.

Alarm information: 1268 The manipulator can't be operated because it isn't in the origin.

Reason: The manipulator is operated when it isn't in the origin.

Trouble shooting: Set K12.7 as 1, that is to say, the manipulator enters the debugging mode, and the manipulator is returned to the origin in JOG mode.

Alarm information: 1269 The manipulator operation stops due to the abnormal.

Reason: Emergency stop is pressed during the manipulator running, and the manipulator operation stops by resetting due to the abnormal.

Trouble shooting: Set K10.7 as 1, that is to say, the magazine enters the debugging mode, and the manipulator is returned to the origin in JOG mode.

Alarm information: 1270 The manipulator tool hold is detected abnormal.

Reason: The manipulator is executed the tool hold operation, but it can't reach the tool hold position in the time set by T110; Or the manipulator is fallen downward for rotating 180°, but it can't reach the tool hold position in the time set by T111.

Trouble shooting: Check whether the output of Y2.5 is normal or not; Check whether the input of X3.3 is normal or not.

Alarm information: 1271 The manipulator can't be operated because the spindle doesn't orientate.

Reason: The manipulator operation is executed before the spindle orientating.

Trouble shooting: The spindle orientation should be executed firstly.

Alarm information: 1272 The manipulator can't be operated when the spindle tool isn't released.

Reason: When the spindle doesn't release the tool, the manipulator is fallen downward for rotating 180°.

Trouble shooting: Check whether the output of Y0.2 is normal or not; check whether the input of X2.5 is normal or not.

Alarm information: 1273 The manipulator can't be operated when the spindle tool isn't clamped.

Reason: When the spindle doesn't clamp the tool, the manipulator tool hold is executed or the manipulator is returned to the origin.

Trouble shooting: Check whether the output of Y0.2 is normal or not; Check whether the input of X2.6 is normal or not.

Alarm information: 1274 The tool advance can't be operated because the manipulator isn't in the origin.

Reason: The tool post retraction is executed because the manipulator isn't in the origin.

Trouble shooting: The manipulator is returned to the origin.

Alarm information: 1275 The tool retraction can't be operated because the manipulator isn't in the origin.

Reason: The tool post retraction is executed when the manipulator isn't in the origin.

Trouble shooting: The manipulator is returned to the origin.

Alarm information: 1276 The manipulator can't be rotated because it isn't in the origin.

Reason: The toolpot rotation movement is executed when the manipulator isn't in the origin.

Trouble shooting: The manipulator is returned to the origin.

Alarm information: 1277 The toolpot can't be rotated because the tool case isn't in the level position.

Reason: The toolpot rotation movement is executed when the toolcase isn't in the level position.

Trouble shooting: The toolcase is returned to the level position; Check whether the input of X5.2 is normal or not.

Alarm information: 1278 The manipulator can't be operated when Z axis doesn't return to the 2nd reference position.

Reason: The manipulator is executed while Z axis hasn't returned to the 2nd reference position.

Trouble shooting: 1. G30 G91 Z0 is executed to return to the 2nd reference position;

2. When the manipulator isn't in the origin and returning to the 2nd reference position by G30 G91 Z0 in AUTO mode isn't allowed to be executed, the 2nd reference position can be returned in JOG mode. Firstly, Z axis is returned to the mechanical zero position in ZERO RETURN mode, and set K11.1 as 1 (returning to the tool change position in JOG mode), pressing "USER2" key to execute returning to the 2nd reference position in JOG mode.

Alarm information: 1279 The manipulator origin position is detected abnormal.

Reason: When the system is powered on, the system detects that the manipulator isn't in the origin;

or X3.4 signal isn't received in the time set by T110 after the system commands the manipulator to be returned to the origin.

Trouble shooting: 1. The manipulator is returned to the origin in the debugging mode.
2. Adjust the time set by T110.

Alarm information: 1280 Compel to stop the magazine rotating due to the abnormal.

Reason: 1. After the magazine sending the rotation command, the pulse signal sent by the magazine counting switch (X5.3, X5.4) isn't received in the time set by T108.

2. During the magazine rotating, the system detects that the magazine counting switch state is 0 or 1, which exceeds the time set by T103.

Trouble shooting: 1. The output (Y3.0 and Y3.1) of the magazine CW or CCW rotation is abnormal.
2. The magazine counting switch is abnormal.
3. Reset the values of T108 and T103.

(About the details, refer to *chapter III: The usage method and maintenance of GSK218MC CNC system with the disc magazine.*)

Alarm information: 1288 The index worktable releasing is detected abnormal.

Reason: When the worktable is executed the releasing movement (Y1.6=1), the worktable releasing in-position detection switch (X2.2) doesn't operate in the time set by T38.

Trouble shooting: 1. Check whether the worktable releasing in-position detection switch is normal.
2. Check whether Y1.6 is output or not.
3. Adjust the time set by T38.

Alarm information: 1289 The index worktable clamping is detected abnormal.

Reason: When the worktable is executed the clamping movement (Y1.7=1), the worktable clamping in-position detection switch (X2.3) doesn't operate in the time set by T39.

Trouble shooting: 1. Check whether the worktable clamping in-position detection switch is normal.
2. Check Y1.7 is output or not.
3. Adjust the time set by T39.

Alarm information: 1290 The index worktable clamping device doesn't start.

Reason: When the index worktable clamping device doesn't start (K12.4=0), the index worktable releasing or clamping command is executed.

Trouble shooting: Firstly set K12.4 as 1, the index worktable releasing or the clamping command is executed.

Alarm information: 1291 The index worktable can't be rotated because it isn't released.

Reason: When the index worktable is released, the index worktable rotation movement is executed.

Trouble shooting: Firstly, the index worktable clamping movement is executed, and the index worktable rotation movement is operated; or the index worktable is adjusted into the debugging mode (K12.6 is set as 1), and then the index worktable rotation movement is executed.

Alarm information: 1292 The index worktable can't be moved because it isn't clamped.

Reason: When the index worktable is released, the feeding axis is executed the movement.

Trouble shooting: After executing the index worktable clamping, and then the feeding axis is executed the movement; Or the index worktable is adjusted to the debugging mode (K12.6 is set as 1), and feeding axis movement is operated.

Alarm information: 1293 Cycle start can't be operated because the safety door isn't closed.

Reason: The cycle start button is pressed when the safety door detection switch (K8.3=1) is started and the safety door isn't closed (X4.5=0) .

Trouble shooting: Executing cycle start is after closing the safety door.

Alarm information: 1294 Cycle start can't be executed because the index worktable isn't clamped.

Reason: The cycle start button is pressed when the index worktable is released.

Trouble shooting: Cycle start is executed after executing the index worktable clamping.

Alarm information: 1360 The lubrication pressure low or the oil level low.

Reason:

Trouble shooting: Detect the state of X001.7.

Points for attention: About "user-defined" reason, this kind of alarms aren't designed in the ladder diagram in which the user should rewrite the ladder diagram to add.

List V The definitions of TMR parameters

ADDRESS	NOTE	INITIAL VALUE (ms)	USER SETTING VALUE
T0001	The time delay unit of the spindle CW rotation finish	500	
T0002	The time delay unit of the spindle CCW rotation finish	500	
T0003	The time delay unit of the spindle gear change finish	500	
T0004	The time delay unit of the spindle positioning finish	0	
T0005	The time delay unit of the miscellaneous function finish	0	
T0006	The time delay unit of the spindle gear change	500	
T0007	The time delay unit of the spindle tool releasing finish	0	
T0008	The time delay unit of the spindle tool clamping finish	0	
T0009	Setting the detection time of the spindle tool releasing	8000	
T0010	Setting the detection time of the spindle tool clamping	8000	
T0011	M code miscellaneous	50	

ADDRESS	NOTE	INITIAL VALUE (ms)	USER SETTING VALUE
	function time delay finish		
T0012	Time delay of T code miscellaneous function finish	50	
T0013	Setting the detection time of the spindle positioning	8000	
T0014	Setting the detection time of the spindle CW rotation	500	
T0015	Setting the detection time of the spindle CCW rotation	500	
T0016	Setting the time of lubrication OFF (Unit: min)	30	
T0017	Setting the time of lubrication ON (Unit: sec)	10	
T0018	Setting the detection time delay for the spindle positioning	2000	
T0019	The spindle inch time delay unit	2000	
T0020	The program restarting time delay unit	10	
T0021	The time delay detector of the spindle gear I	10000	
T0022	The time delay detector of the spindle gear II	10000	
T0023	The time delay detector of the spindle gear III	10000	
T0024	The detection time of switching between the spindle speed/position mode	10000	
T0025	Time of completing executing M29 (valid without the detection signal)	4000	
T0026	Time of completing positioning in the spindle position mode (valid without the detection signal)	1500	
T0027	The time of completing executing M28 (valid without the detection signal)	2000	
T0028	The detection time of switching between the spindle position/speed mode	10000	
T0029	The spindle brake time	5000	
T0030	The spindle gear 1--the delay	2000	

ADDRESS	NOTE	INITIAL VALUE (ms)	USER SETTING VALUE
	time of gear change without the detection switch		
T0031	The spindle gear 2—The delay time of gear change without the detection switch	2000	
T0032	The spindle gear 3—The delay time of gear change without the detection switch	2000	
T0033	When the spindle gear is in-position without the detection switch, cancel the delay time of completing gear change in-position.	2000	
T0034	The delay time of M5 finish	500	
T0036	The delay time of the index worktable releasing	500	
T0037	The delay time of the index worktable clamping	500	
T0038	The delay time of the index worktable releasing	5000	
T0039	The detection delay time of the index worktable clamping	5000	
T0040	The delay time of the index worktable releasing finish	4000	
T0041	The delay time of the index worktable clamping finish	4000	
T0100	The delay time 1 of the magazine rotating in JOG mode	2000	
T0101	The delay time 2 of the magazine rotating in JOG mode	2000	
T0102	Setting the detection delay time of the magazine stopping	2000	
T0103	Setting the detection delay time 1 of the magazine rotation	3000	
T0104	Setting the detection delay time of the toolcase vertical	5000	
T0105	Setting the detection delay time of the toolcase level	5000	
T0106	The time delay unit of the toolcase vertical finish	0	
T0107	The time delay unit of the toolcase level finish	0	

ADDRESS	NOTE	INITIAL VALUE (ms)	USER SETTING VALUE
T0108	Setting the detection delay time 2 of the magazine rotation	3000	
T0109	Setting the time of compelling to stop the magazine rotation due to the abnormal	5000	
T0110	The detection delay time of the manipulator tool hold and origin return	2000	
T0111	The detection delay time of the manipulator falling downward for tool change	4000	

List VI Definitions of DATA parameters

(The magazine capacity is 24)

ADDRESS	NAME	PRESET VALUE
D001	#1 tool case number	1 (The number of the tool in the tool case)
D002	#2 tool case number	2 (The number of the tool in the tool case)
D003	#3 tool case number	3 (The number of the tool in the tool case)
D004	#4 tool case number	4 (The number of the tool in the tool case)
D005	#5 tool case number	5 (The number of the tool in the tool case)
D006	#6 tool case number	6 (The number of the tool in the tool case)
D007	#7 tool case number	7 (The number of the tool in the tool case)
D008	#8 tool case number	8 (The number of the tool in the tool case)
D009	#9 tool case number	9 (The number of the tool in the tool case)
D010	#10 tool case number	10 (The number of the tool in the tool case)
D011	#11 tool case number	11 (The number of the tool in the tool case)
D012	#12 tool case number	12 (The number of the tool in the tool case)
D013	#13 tool case number	13 (The number of the tool in the tool case)
D014	#14 tool case number	14 (The number of the tool in the tool case)
D015	#15 tool case number	15 (The number of the tool in the tool case)
D016	#16 tool case number	16 (The number of the tool in the tool case)
D017	#17 tool case number	17 (The number of the tool in the tool case)
D018	#18 tool case number	18 (The number of the tool in the tool case)
D019	#19 tool case number	19 (The number of the tool in the tool case)

ADDRESS	NAME	PRESET VALUE
D020	#20 tool case number	20 (The number of the tool in the tool case)
D021	#21 tool case number	21 (The number of the tool in the tool case)
D022	#22 tool case number	22 (The number of the tool in the tool case)
D023	#23 tool case number	23 (The number of the tool in the tool case)
D024	#24 tool case number	24 (The number of the tool in the tool case)
D100	The magazine capacity	24
D241	The tool number of T code	It can't be set.
D243	The current tool post number	It can't be set.
D245	The spindle tool number	

Points for attention:

1. The setting value of D100 must be less than 100, and its setting value must be same as that of CTR100; otherwise, the abnormal occurs.
For example: When D100=16, D001-D016 in the data list are valid.
When D100=24, D001-D024 in the data list are valid.
2. D000 only displays the spindle tool number, and the spindle tool number can't be rewritten in D000; the spindle tool number should be rewritten in D245.
3. The value of D241 can't be rewritten.
4. D240~D247 are used by the system, and they are not user-defined.
5. About the detailed introduction, please refer to part 3.

List VII Definitions of CTR parameters

ADDRESS	PRESET VALUE	CURRENT VALUE	FUNCTION
C50	3	The current steps of the manipulator operation	The manipulator operation counting in JOG mode
C100	24	The current tool case number	The magazine counter (24TOOL)

Points for attention:

1. Setting value of CTR100 must be less than 100, and its setting value is same as that of D100; otherwise, the abnormal occurs.

For example: CTR100=16, the tool case number of the magazine is 16.

CTR100=24, the tool case number of the magazine is 24.

List VIII Definitions of M codes

M CODE	F SIGNAL	FUNCTION	REMARK
M00	F031.7	Program dwell	
M01	F030.4	Option stop	
M02	F030.5	Program end	
M03	F030.0	Spindle CW	
M04	F030.1	Spindle CCW	
M05	F030.2	Spindle stop	
M06	F030.3	Automatic tool change	
M08	F031.0	Coolant ON	
M09	F031.1	Coolant OFF	
M10	F031.2	A axis clamping	
M11	F031.3	A axis releasing	
M16	F026.0	Spindle tool releasing code	
M17	F026.1	Spindle tool clamping code	
M18	F028.3	Canceling spindle exact stop	
M19	F026.2	Spindle exact stop code	
M20	F032.5	Spindle neutral gear (Gear control is valid without the gear change switch)	
M22	F026.4	Manipulator operation beginning	
M23	F026.5	Tool case vertical command	Reserved
M24	F026.6	Tool case level command	Reserved
M26	F027.5	Turning on chip removal hydrovalve	
M27	F027.6	Turning off chip removal hydrovalve	
M28	F032.3	Canceling the rigid tapping code	
M29	F032.2	Rigid tapping code	
M30	F028.0	Program end	
M32	F031.4	Lubricating ON	Reserved
M33	F031.5	Lubricating OFF	Reserved
M35	F028.1	Starting the spiral chip removal transmitter	
M36	F028.2	Switching off the spiral chip removal transmitter	
M44	F026.7	Starting blowing the spindle	
M45	F027.0	Stopping blowing the spindle	
M50	F027.1	Automatic tool change beginning	
M51	F027.2	Automatic tool change end	
M53	F027.3	Whether the tool is correct or not after tool change	Reserved

M CODE	F SIGNAL	FUNCTION	REMARK
M55	F027.4	Whether the spindle is with a tool or not	Reserved
M56	F029.0	The manipulator reaching the tool hold position	Reserved
M57	F029.1	The manipulator falling downward for rotating 180°and lifting	Reserved
M58	F029.2	The manipulator returning to the origin	Reserved

Points for attention:

1. "F***. *" and M codes with "Reserved" in F signal table cannot be used.
2. M22, M50 and M51 are only valid when the tool change is being executed, which can't run separately; while they can run independently in MDI mode during the magazine debugging mode.

3. Usage and Maintenance of GSK218MC CNC SYSTEM with the Disc Magazine

1. The magazine installation and setting the related PLC parameters:

Operation aim: Ensure the ladder diagram fit to the allocation of the magazine.

- A. The requirements for the machine when the ladder diagram with the disc magazine:

- 1). The machine has the spindle tool automatically clamping/releasing device which has the normally open in-position check switch.
- 2). The spindle has the positioning function and its positioning angle can be regulated.
- 3). The tool magazine capacity must be less than 100.
- 4). The tool magazine can execute CCW/CW.
- 5). The tool magazine has the count switch, forward in-position check switch, and retraction in-position check switch.
- 6). The tool magazine has zero return switch (optional).

2. The connection of circuits relative with the magazine

1). Input

PIN POSITION	SIGNAL INTERFACE	ADDRESS	INTRODUCTION	REMARK
17	XS41	X002.4	The external clamping/releasing tool control	Optional
5	XS41	X002.5	The tool releasing detection	Normally open contact
18	XS41	X002.6	The tool clamping	Normally open contact

			detection	
9	XS41	X003.2	The manipulator brake signal	Normally open or NC
22	XS41	X003.3	The manipulator tool hold detection signal	Normally open or NC
24	XS41	X003.4	The manipulator zero position detection signal	Normally open or NC
21	XS42	X005.1	The tool case vertical detection	Normally open or NC
9	XS42	X005.2	The tool case level detection	Normally open or NC
22	XS42	X005.3	The magazine counting (normal 0)	Normally open contact
24	XS42	X005.4	The magazine CW/CCW in-position (normal 1)	Normally open contact
12	XS42	X005.5	The toolpot zero return in-position detection	Optional
21	XS23	X007.1	The spindle orientation in-position	Normally open or NC

2). Output

PIN POSITION	SIGNAL INTERFACE	SYMBOL NO.	INTRODUCTION
2	XS43	Y000.2	The tool releasing/clamping
5	XS44	Y002.5	The manipulator running
8	XS44	Y003.0	The magazine CW rotation
21	XS44	Y003.1	The magazine CCW rotation
9	XS44	Y003.2	The toolcase vertical
22	XS44	Y003.3	The toolcase level
11	XS23	Y006.3	The spindle orientation

C. Selecting the magazine switch type

The magazine is without the zero return switch: Set K010.1 as 0.

The magazine is with the zero return switch: Set K010.1 as 1.

The magazine zero return switch is normally open type: Set K010.2 as 0.

The magazine zero return switch is NC type: Set K010.2 as 1.

The magazine zero return switch is NC type: Set K010.3 as 0.

The tool case vertical detection switch is NC type: Set K010.3 as 1.

The tool case level detection switch is normally open type: Set K010.4 as 0.

The tool case level detection switch is NC type: Set K010.4 as 1.

The magazine counting switch is normally open type. (When the magazine is normal, it is 0.)

The magazine CW/CCW rotation in-position is normally open type. (When the magazine is normal, it is 1.)

For example: The magazine is without the zero return switch, each detection switch is normally open type, the parameters should be set as:

K010.1=0 K010.2=0 K010.3=0 K010.4=0 K010.5=0

D. Setting the magazine capacity

Input the magazine capacity in DATA100 and CTR100.

Points for attention:

1. The magazine capacity is the toolcase number of the magazine.
2. The setting value of DATA100 and CTR100 must be less than 100.

For example: When the magazine capacity is 24, set DATA100 as 24, CTR100 as 24.

E. Setting the tool number in the magazine:

The data list D001--D099 respectively correspond to the tool case NO. 1~99 in the magazine, and the setting value D001--D099 in the data list respectively correspond to NO.1~99 tool number in the tool case.

Points for attention:

1. Same tool number (except for 0) can't be set in D001--D099; otherwise, the system alarms during the tool change.
2. The setting range of tool number should satisfy the requirement set by data parameter 0206; otherwise, the system alarms during executing T code.

For example: When the magazine capacity is 24, if 1-24 is set in D1—D24 in turn, #8 tool case is rotated into the tool change position and then the tool is changed during executing T8M6; If 10 20, 30... 240 are executed in order in D1—D24, #8 tool case is rotated into the tool change position and then the tool is changed during executing T80M6; If D1 and D2 both are set as 8, the system alarms during executing T8M6.

F. Setting the time parameter (TMR) relative with the magazine:

ADDRESS	NOTE	SETTING RANGE	INITIAL VALUE (ms)
T0004	The time delay unit of the spindle positioning finish	Greater or equal to 0	0
T0007	The time delay unit of the spindle tool releasing finish	Greater or equal to 0	0
T0008	The time delay unit of the spindle tool clamping finish	Greater or equal to 0	0
T0009	Setting the detection time of the spindle tool releasing	Greater than the time of tool releasing	8000
T0010	Setting the detection time of the spindle tool clamping	Greater than the time of tool clamping	8000
T0013	Setting the detection time of the spindle positioning	Greater than the positioning time	8000
T0018	Setting detection delay time for the spindle positioning	Relative with the positioning width	2000
T0036	The delay time of the index worktable releasing finish	Greater or equal to 0	500
T0037	The delay time of the index worktable clamping finish	Greater or equal to 0	500
T0038	The detection delay time for the index worktable releasing	Greater or equal to 0	5000
T0039	The detection delay time for the index worktable clamping	Greater or equal to 0	5000
T0040	The delay time of the index worktable releasing finish	Greater or equal to 0	4000
T0041	The delay time of the index worktable clamping finish	Greater or equal to 0	4000
T0100	The delay time 1 of the magazine rotation in JOG mode	Greater than rotating one tool post time	2000
T0101	The delay time 2 of the magazine rotation in JOG mode	Greater than rotating one tool post time	2000
T0102	The detection delay time of the magazine stopping	Greater than rotating one tool post time	2000
T0103	The detection delay time of the magazine rotation	Greater than rotating one tool post time	3000
T0104	Setting the detection delay time of the tool case vertical	Greater than the tool case vertical time	5000
T0105	Setting the detection delay time of the tool case level	Greater than the tool case level time	5000

ADDRESS	NOTE	SETTING RANGE	INITIAL VALUE (ms)
T0106	The time delay unit of the toolcase vertical finish	Greater or equal to 0	0
T0107	The time delay unit of the toolcase level finish	Greater or equal to 0	0
T0108	The detection time delay 2 of the magazine rotation	Greater than rotating one tool post time	3000
T0109	The time of compelling to stop the magazine rotation due to the abnormal	Greater than rotating one tool post time	5000
T0110	Detection delay time of the manipulator tool hold and origin return	Greater than the time of the manipulator from the origin to the tool hold point	2000
T0111	Detection delay time of the manipulator falling downward for tool change	Greater than the time of the manipulator falling downward for rotating 180° and lifting upward	4000

Points for attention:

1. The above parameters (TMR) is relative with the magazine performance, such as the type and the rotation speed, etc, please properly set according to the magazine performance index.
2. If the above parameters (TMR) are set improperly, the alarm occurs, which may cause the abnormal tool change.

Through the basic steps of A-F, the ladder diagram is matched with the magazine allocation. If the magazine can't normal run yet, CW, CCW rotation, the tool advance and the tool retraction in JOG mode can be set and operated in the following section, and each operation of the magazine can be checked normal or not.

2. Magazine manual and zero return operation

Operation aim: Check each operation of the magazine is normal or not.

The detailed steps are as below:

A. The magazine usage valid

1. Because the magazine type is the disc, the following bit parameters should be set:

Bit parameter 53.0=0. Bit parameter 53.1=0, Bit parameter 53.2=0, Bit parameter 53.3=0.

2. KAPA parameter of PMC K001.0 is set as 1.

B. The magazine entering debugging mode

1. The magazine debugging PMC parameter can be set for the magazine holding tool chuck, the spindle concentric degree and Z axis tool hold position. When K012.7 is set as 1, the condition limit of the manipulator running can be cancelled and the magazine debugging state is entered.

After debugging, set K12.7 as 0 , and the data can't be exchanged.

2. Steps of manipulator running in JOG mode in the normal situation

Z axis returns to the tool change point. (In MDI mode, G30G91Z0 is recorded, and Z axis is returned to the manipulator tool change point.)

Set K10.7 as 1.

Spindle orientation. (Press “ spindle orientation” in JOG mode, the orientation completes.)

Toolcase vertical. (In JOG mode, press “tool advance” button, the tool case is vertical in-position.)

The manipulator is hold the tool in JOG mode. (In JOG mode, press “ tool change manipulator” button, the manipulator operation 1 completes.)

The tool releasing. (In JOG mode, press clamp/release, the tool is released in-position.)

The manipulator tool change in JOG mode. (Press “tool change manipulator” button again, and the manipulator operation 2 completes.)

The tool clamping (Press “tool clamping/releasing” again, the tool is clamped in-position.)

The manipulator is returned to the manipulator origin in JOG mode. (Press “tool change manipulator” button at the 3rd time, the manipulator operation 3 completes.)

The manipulator operation in JOG mode completes.

In the normal situation, the conditions of running the manipulator in JOG mode:

The spindle orientation complete, the tool case vertical in-position, Z axis is returned to the tool change point.

C. Confirming the magazine rotation direction

In JOG mode, press “MAG. CW” and the magazine is rotated according to the prescribed negative direction of the machine; press “MAG. CCW” and the magazine is rotated according to the prescribed positive direction of the machine; otherwise, the magazine counting will be disorder to cause that the tool change is executed wrongly, which can be resolved by regulating the phase sequence of the motor.

D. Magazine zero return operation





The magazine zero return operation is divided into zero return switch and without zero return switch:

1. The magazine is with the zero return switch: press "MAG. ZERO" in "ZERO RETURN" mode, and the zero return is completed when the indicator is ON. (the indicator flashing means the magazine is executing zero return.)
2. The magazine is without the zero return switch:
 - a. In JOG mode, press "CCW" or "CW" to make the No. 1 toolcase in the magazine rotate to the tool change position.
 - b. In MDI mode, set K010.6 as 1.
 - c. In zero return mode, press "MAG. ZERO RETURN" button until "MAG. ZERO RETURN" indicator is on.
 - d. Set K010.6 as 0.

3. The spindle positioning angle and tool change coordinate position regulation

About the spindle positioning angle regulation, please refer to the manual of the spindle drive unit.

Appendix: The setting method of DAP01 positioning angle:

- 1) Power on the control device, default to display on LED: r 0;
 - 2) Press  key to enter the monitoring mode, the system displays: dp-SPd;
 - 3) There are 25 display states in Monitor mode, and select the state to look by pressing  .
- Find dp-APo (The motor encoder is the positioning one, and the spindle encoder is taken as the positioning one, dp-SPo can be found); press , the system displays E. 0 or other numerical values.
- 4) To realize the spindle positioning function, the motor rotor should be rotated at least one circle to find the position. When the motor is OFF, directly twist the motor rotor or the spindle connecting the motor rotor for one more circle; it is suggested that the user directly twist for the convenient operation.
 - 5) Adopt the above method to twist the motor for one more circle, and adjust gradually, the motor (spindle) rotor can position on the positioning point. After the operation, the absolute position of the rotor can be observed. E. 0 or other numerical value is displayed on the monitoring window. The value is recorded in the parameter PA58 and saved, that is the position.

(For example: If

E	213
---	-----

 is displayed on the monitor window, the numerical value “213” is input into the parameter PA58.)

The magazine tool change position coordinate is set in the system data parameter 0052, the parameter must be set correctly; otherwise, the accident may happen causing the mechanical part damage.

Through the above operation of three steps, the tool change can be executed correctly, and the operation of executing T and M codes is described as below:

Program 1: TXXM6; Program 2: TXX;

G54 G90;	}	Machining program
X100, Y100;		
.....		
.....		
M6;		

The tool change effect of above two programs are same.


The following program format is wrong:


T1;
T2;
M6;

4. Adjusting in JOG mode after the magazine stopping due to the abnormal

During the manipulator running, power off occurs or the emergency stop or the resetting button is pressed, the manipulator should return to zero position. Firstly, set K010.7=1, the magazine is entered the debugging state, the manipulator is returned to zero position in JOG mode according to the above steps; if the problem can't be resolved, set K012.7=1, and the manipulator is entered the debugging state, and then all the limit conditions of running manipulator are released, so be caution to operate it. After the manipulator zero return, set K010.7=0 and K012.7=0, the manipulator can run normally.

The introduction of setting KAPA parameters of PMC:

1. Input the system debugging password. Continuously press  to enter the password screen;

- in MDI mode, input the system debugging password, and then press  key, “PASSWORD CORRECT” is shown at the left bottom corner on the screen.
2. Press “PROGRAM CONTROL” key on MDI keypad; on **【PLCPAR】** interface, press **【KPAR】**

softkey, the system enters the check and setting interface of the relay in keep type, press four direction keys on the keypad and the cursor can position whether K010.7 magazine is entered the

SAVE

debugging mode. Press the numerical “1”, and the enter key, finally , the data column reminds: “KPAR download is done!”, which means saving is successful, and the magazine debugging mode becomes valid. Set K010.7 as 0 to exit the magazine debugging mode.

4. Note of GSK218MC CNC System with the Disc Magazine Macro Program

O91000;	(Program name)
G65 H81 P10 Q#1000 R1;	(Miscellaneous lock machine lock transfer to N10 when spindle tool number=T code program end)
G69 G50 G15 G80G40;	
M50;	(Tool change begins, and detect whether the condition of tool change is satisfied or not; otherwise, the system alarms)
M19 G00 G91 G49 G30 Z0;	(Spindle positioning, return to the tool change coordinate point)
M22;	(The manipulator operation begins)
N10 M51;	(Tool change end)
M99;	(Program end)
%	

APPENDIX THREE THE ALLOCATED FILE FORMAT OF THE LADDER DIAGRAM

The following information is saved in the form of signals in sequence in the ladder diagram allocated file **LadChixx.txt**. (“xx” corresponding to the running ladder diagram file number set by the system.)

1. M Code M00—Meaning of F Signal in M99

Format: Mxx+space+Fyyyy+space+Chinese note+line break (Enter)

Such as: “M00 F0317 program dwell”

Among them: “xx” is **00, 01, 02.....99**, from top to bottom, totally 100 digits, and the sequence can’t be changed.

“Space” normally is one space, the other words can’t be added.

“yyyy” means the value of F signal corresponding to M code, for example “**F0317** means **F31.7**”, from **0260** to **0337** can be set (from signal **26.0** to **33.7**), if it is set as “**-001**”, it means it can’t be registered, and the system doesn’t identify this M code. In “Chinese note”, there are maximum **32** words, which can be combined by **16** Chinese characters or the Chinese characters + words in the equal amount. The followings are same.

“Line bread” means the end of this line, the following words can’t be identified. The followings are same.

2. “%” in a Single Line Meaning Saving M Code Information End

3. X signal X0.0---The Code and Meaning of X6.7

Format: Xxxxx+space+Chinese note+line break(Enter)

Such as “ X0000 X axis positive limit signal”

Among them, “xxxx” means the value of X signal, for example: “0000” means 0.0”, “0067 means 6.7”, from top to bottom are from 0000 to 0067 (X signal is from 0.0 to 6.7), and the sequence can’t be changed.

“Space” normally is 5 spaces, the other words can’t be added, the followings are same.

4. Y Signal Y0.0—The Code and Meaning of Y5.7

Format: Yxxxx+space+Chinese note+line break (Enter)

Such as: “Y0000 Z axis band-type break”

Among them: “xxxx” means the value of Y signal, for example “0000 means 0.0”, “0057 means 5.7”, from top to bottom is from 0000 to 0057, that is to say, Y signal is from 0.0 to 5.7, the sequence can’t be changed.

5. K signal K6.0---The Code and Meaning of K63.7

Format: Kxxxx+space+Chinese note+line break (Enter)

Such as: "K0060 Whether X axis only use one limit switch"

Among them: "xxxx" signal means the value of K signal, for example: "0060 means 63.7", "0637 means 63.7", from top to bottom is from 0060 to 0637, that is to say, K signal is from 6.0 to 63.7, the sequence can't be changed.

"Space" is normally 5 spaces, the other words can't be added.

6. A signal A0.0---The Code and Meaning of A31.7

Format: Axxxx+space+Chinese note+line break (Enter)

Such as: "A0000 Air pressure is detected abnormal."

Among them: "xxxx" means the value of A signal, for example "0000 means 0.0" "0317 means 31.7", from top to bottom is from 0000 to 0317, that is to say, A signal from 0.0 to 31.7, the sequence can't be changed.

"Space" is normally 5 spaces, the other words can't be added.

7. End// End Symbol

Remark: The above information must be rewritten to the top, about the details, please refer to LadChixx.txt---the internal file in the system. The only difference in the corresponding English file LadEng01.txt is that Chinese note is changed into 32 English words or characters.