This user manual describes all proceedings concerning the operations of this GSK986 series grinding machine 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. And therefore, the proceedings not indicated herein should be considered impractical or unallowable.

PREFACE

Your Excellency:

It's our pleasure for your patronage and purchase of this GSK986 CNC System made by GSK CNC Equipment Co., Ltd.

In order the guarantee the safe, normal and enabled operations, it is very important to carefully read the User Manual before installing and using this product.

SAFETY CAUTION

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

Hot tip: The system power installed on (inside) the cabinet is provided the dedicated power for CNC system manufactured in GSK.

Never attempt to use the power as other purpose; otherwise, the enormous hazard may occur!

STATEMENT!

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

WARNING!

- Please read this user manual and a manual from machine builder completely before installation, programming and operation; do operate the system and machine according to user manuals, otherwise it may damage the system, machine, workpiece and even injure the operator.

CAUTIONS!

- Functions, technical indexes (such as the precision, velocity, etc.) described in this concise user manual are only for the system. Actual functions and technical performance of machine tool with this CNC system are determined by machine builder's design, so refer to its user manual

All specifications and designs herein are subject to change without further notice!

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

PRECAUTIONS

■ Transportation & Storage

- The stacking of product package should be less than 6 layers.
- Don’t climb, stand or place a heavy material on the product package.
- Don’t drag or transport the product by the cable connected with the products.
- Don’t impact and scratch the panel and LCD.
- The product package should be avoided the damp, sunshine and rain.

■ Unpacking Detection

- Check whether it is your purchased product after unpacking the package.
- Check whether the products are damaged during the transportation.
- Check whether the components are complete and being damaged compared with the packing list.
- It is better to touch our company immediately if the inconsistent of the product type, accessory shortage or transportation damage, etc. are generated.

■ Wiring

- The person who attends the wiring and detection should be the professionals with corresponding abilities.
- The product should be grounded stably, and the grounding resistance should be less than 0.1Ω, as well the neutral cable (zero cable) cannot be replaced of the grounding one.
- The wiring should be correct and firm to avoid the product faults or unexpected results.
- The surge absorption diode should be connected based upon the specified direction; otherwise, the product will be damaged.
- It is essential to cut off the product’s power before plugging the plug or opening the cabinet of the product.

■ Overhaul

- It is necessary to cut off the power after overhauling or changing the components.
- The fault should be detected when short-circuit or overload occurs, and then the machine can be tuned on after the fault is eliminated.
- Never attempt to frequently turn on/off the product; if the machine should be turned on again after its power-off, it is necessary to interval 1min. at least.

Security Responsibility

Security responsibility of the manufacturer

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

——Manufacturer should take responsibility for the security of the CNC system 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 CNC system.

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

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

This manual is reserved by final user.

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

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CHAPTER ONE INSTALLATION & CONNECTION

1.1 Precautions for Installation & Connection

1. The operation cabinet of the installation system should have the ventilated and cooling function, in the case of full-closed; we can consider that the system cabinet and main machine can be separately installed.
2. The rated power of system's power is 50W (24V); it is not recommended to supply I/O by using the 24V, and the separated +24V can be used accordingly.
3. Generally, it is recommended that the time-sequence of power on/off is shown below:

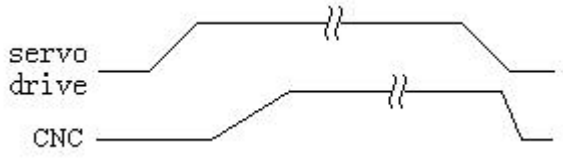


Fig.1-1 Time-sequence of power ON/OFF

4. CNC regards as the microelectronic field, which is more sensitive against the external power environment. If the external strong-current environmental fluctuation exceeds its range, it may affect the stability of system control or damage the CNC equipment; therefore, it is necessary to strictly control the fluctuation range of external power within the controllable range. If the voltage fluctuation is excessive of the external machine tool, it is important to consider using the accessories, such as the voltage-regulator, reactor, etc. to guarantee the stability of the machine tool's power.
5. Requirements of electric cabinet design:
   ① The electric cabinet should be effectively prevented the dust, vapor and organic solution from entering it.
   ② In the design of the electric cabinet, the distance between CNC rear cover and chassis should be more than 20cm. It is important to consider when the temperature inside the electric cabinet rises, the temperature between inside and outside should be less than 10℃.
   ③ In order to guarantee the ventilation and heat radiating of the internal cabinet, generally, install the sealed fan inside the electric cabinet, if the using surroundings are damp, and it is better to install the independent cabinet air conditioner;
   ④ The system display panel, measure apparatus, etc. should be installed where the coolant (with the corrosion liquid) cannot be touched and a place with ventilation;
   ⑤ The components arrangement of electric cabinet are reasonable; The components for easily producing the electric arc, e.g., frequency-convertor, AC contactor, etc., should be departed as far as possible of the servo controller.
   ⑥ It is necessary to consider decreasing the external electric interference as much as possible when designing the electric cabinet; E.g., the grounding of system's strong-current and the weak one (24V grounding, analog voltage grounding, etc.) can not be connected together. The strong cable and signal cable inside the cabinet should be divided as much as possible to prevent the interference from delivering to CNC.
   ⑦ The place of electric cabinet should be apart from other strong-current mechanism as

much as possible, and the thunder-proof and fireproof should be performed within the working range.

6. Cable length. Generally, the standard wiring length is 3 m～5m, up to 10m for individual one. The installation and connection can be guaranteed the stability of the system based upon the above-mentioned requirements, if it exceeds 10m, it is better to negotiate with the manufacturer and check whether the reduction of the signal is within the acceptable range.
7. Cable position. The control and signal cables are belong to weak current; the motor dynamic and power cables are belong to strong current. Note the separation of the strong and weak current when placing the cable and avoid an unnecessary interference.

1.2 Bus Control (Absolute Encoder)

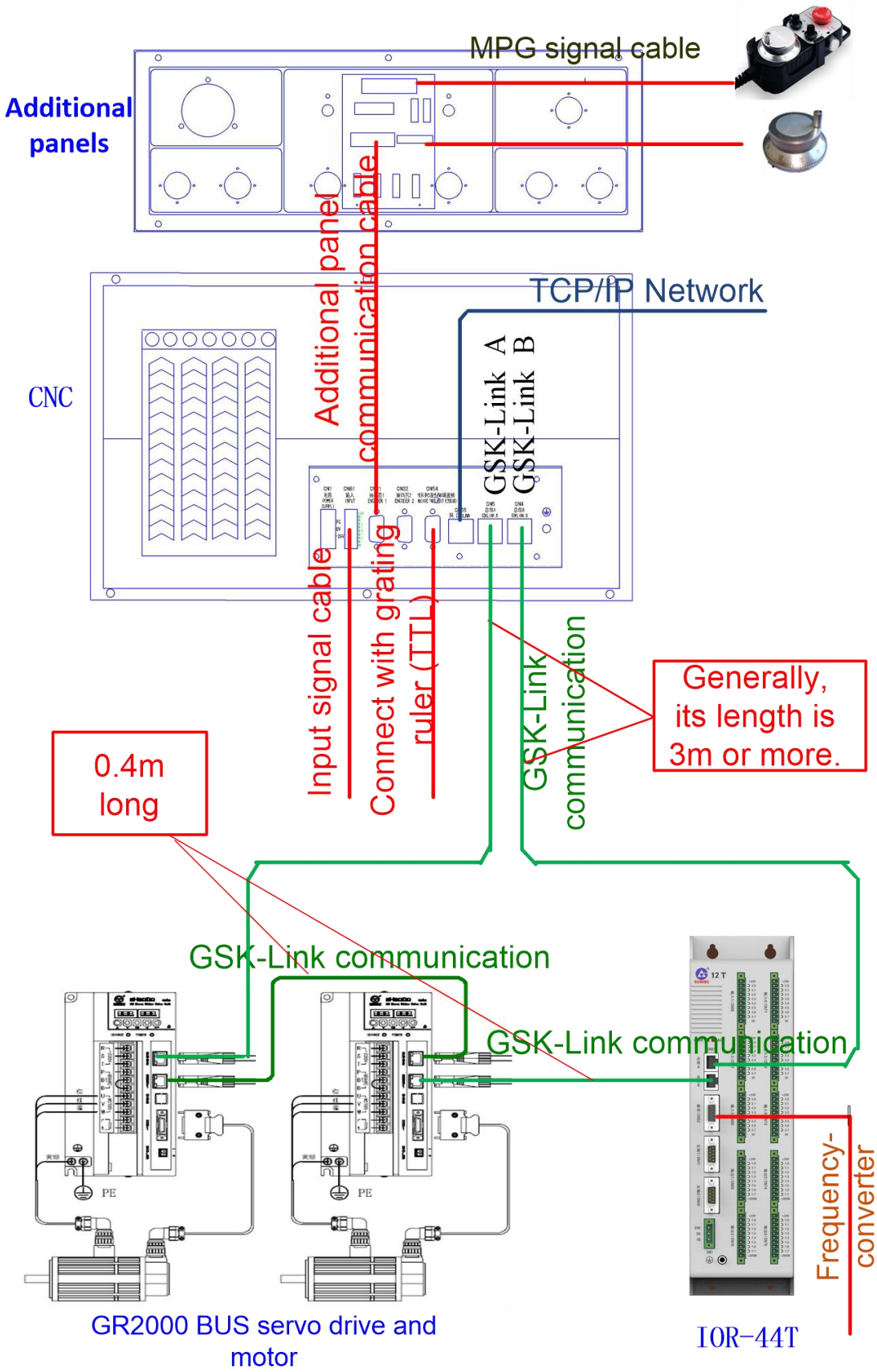


Fig.1-2 BUS controllable connection schematic(GSK986Gs)

1.3 Additional axis control(Incremental Encoder)

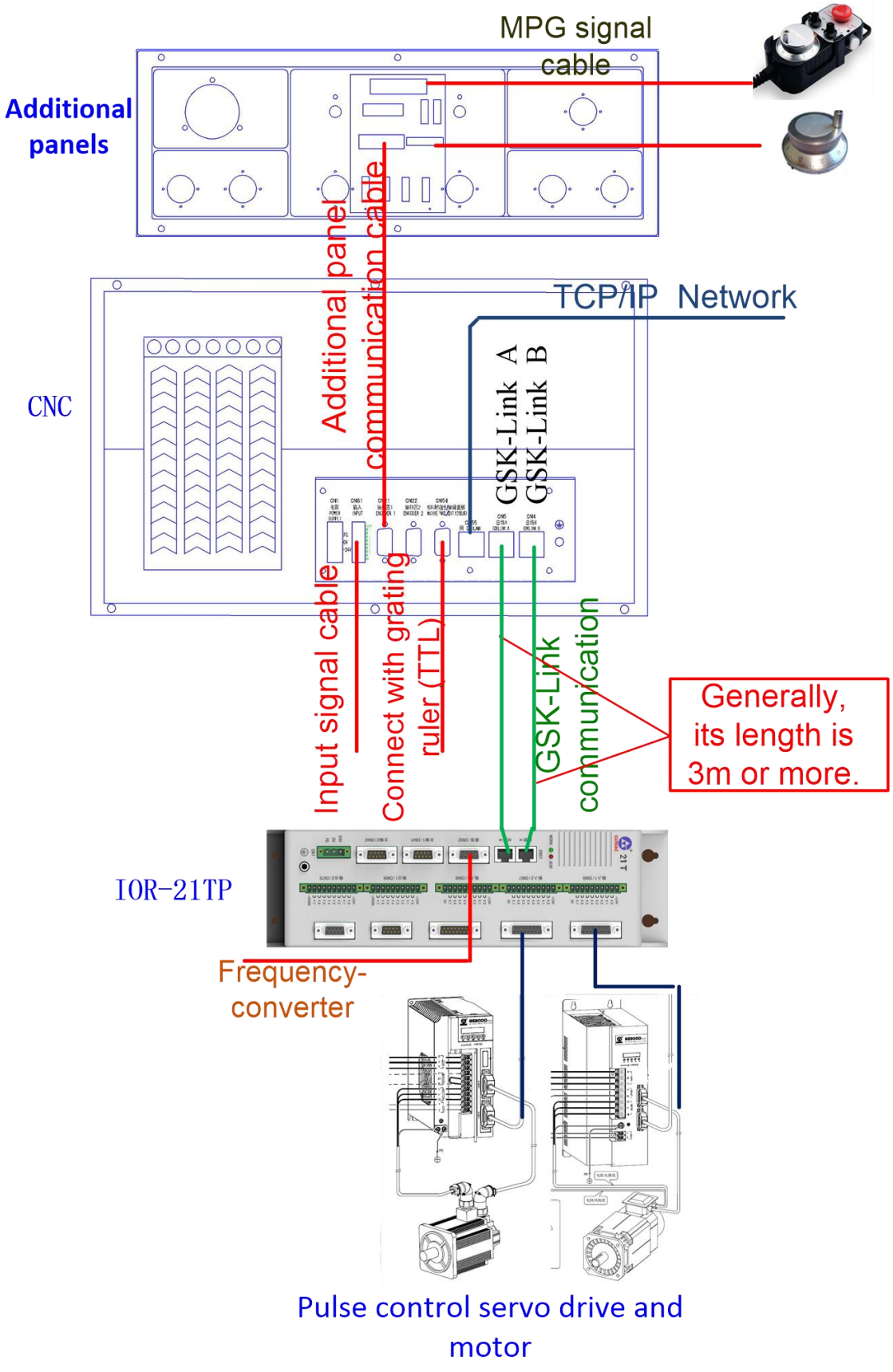


Fig.1-3 Additional axis controllable connection schematic(GSK986Gs)

Illustration:

1. The appearance of I/O unit and system varies according to the evolution of the product. Please refer to the actual object.

2. There is no fixed requirement for the arrangement sequence of I/O unit and servo, and the length of standard wiring shall be followed.

3. When additional axis control is selected, GSK Link bus servo can also be connected. Consult the manufacturer for relevant functions.

4. The servo used for additional axis control is a general servo drive with pulse control mode.

1.4 Installation dimensions

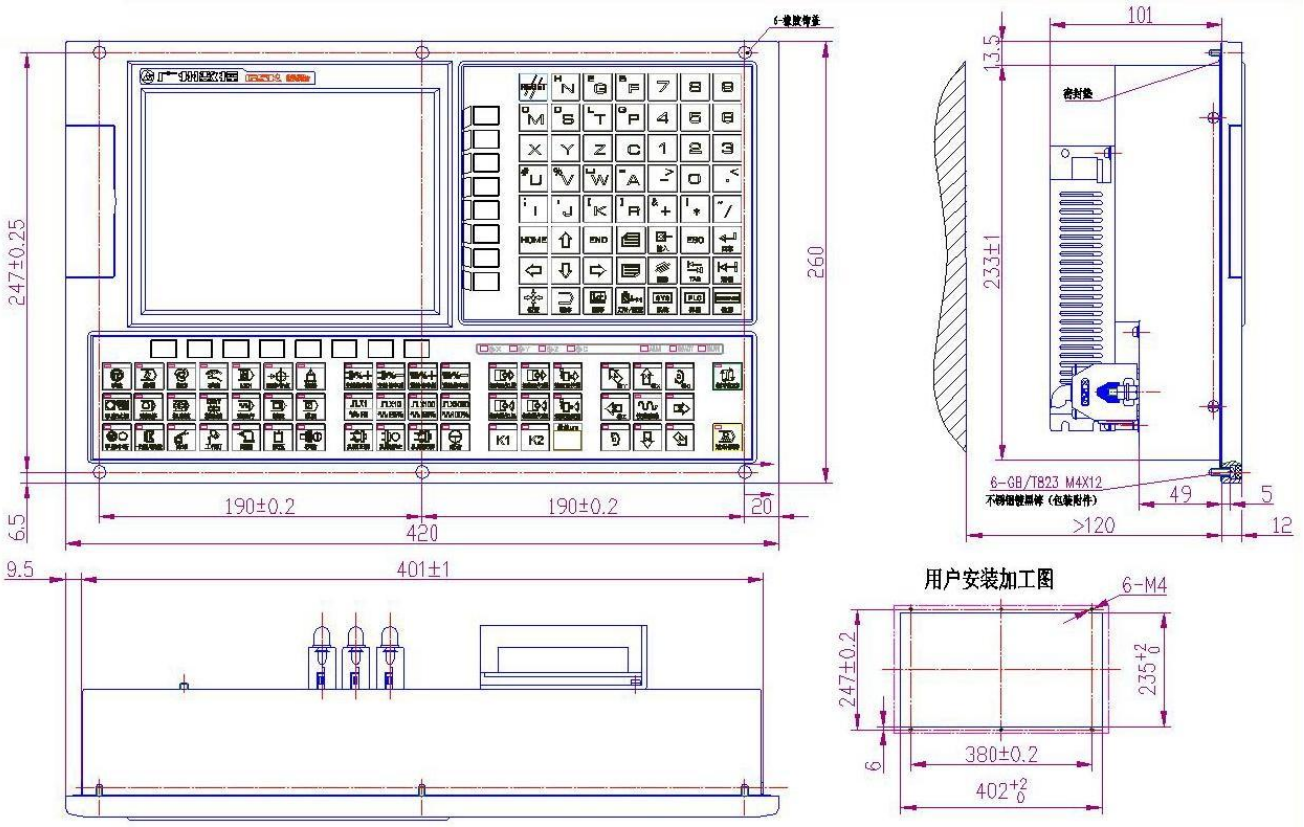


Fig.1-4 Installation dimensions for GSK986Gs

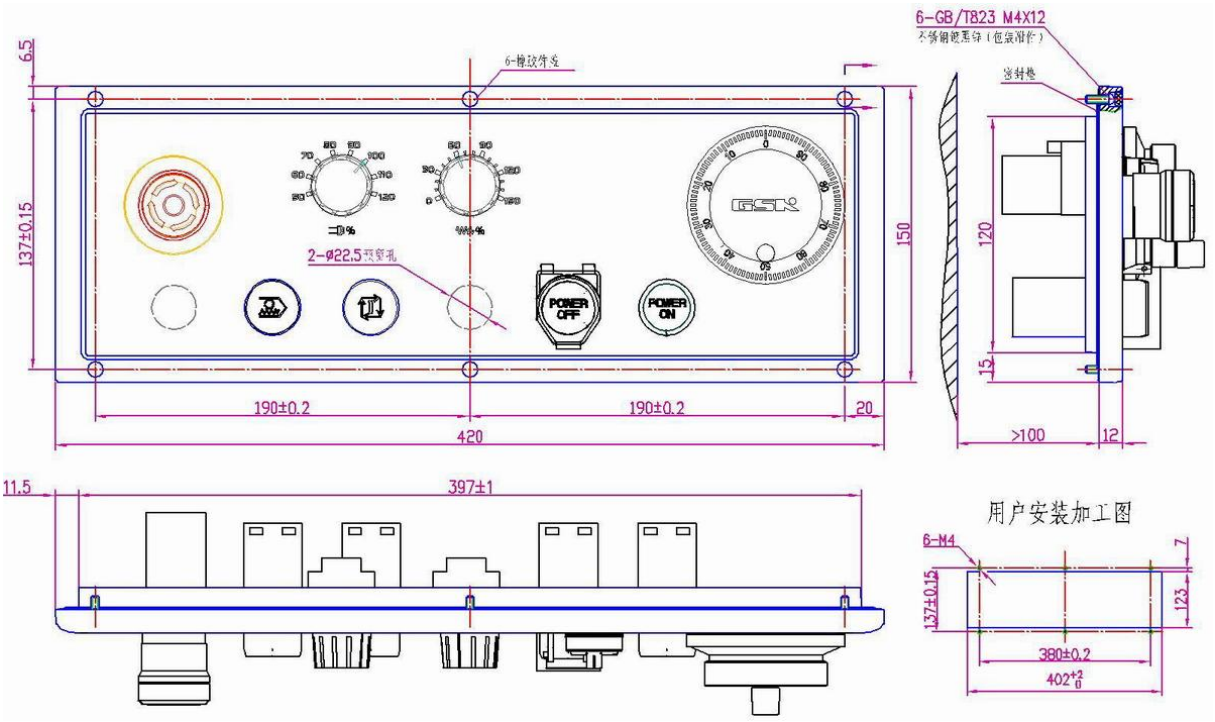


Fig.1-5 Installation dimension of additional panel for AP01AR

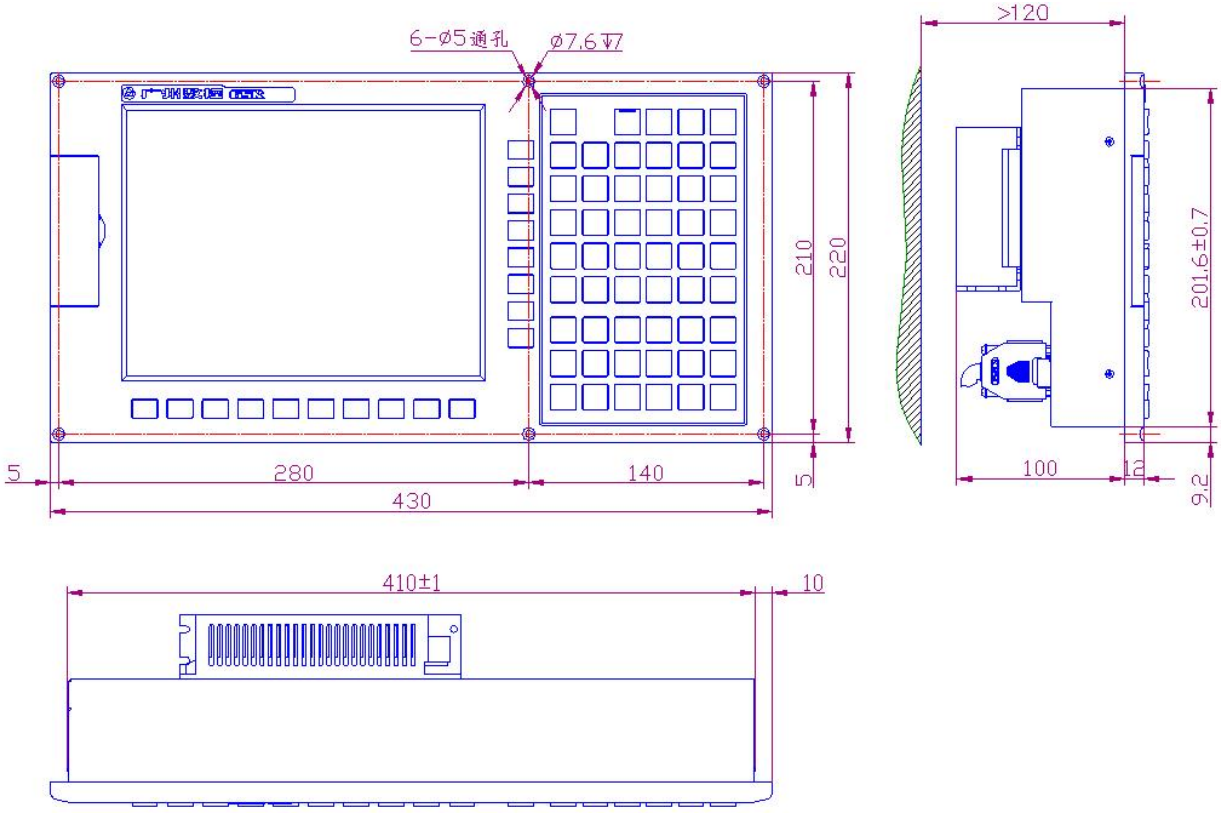


Fig.1-6 Host installation size for GSK986G

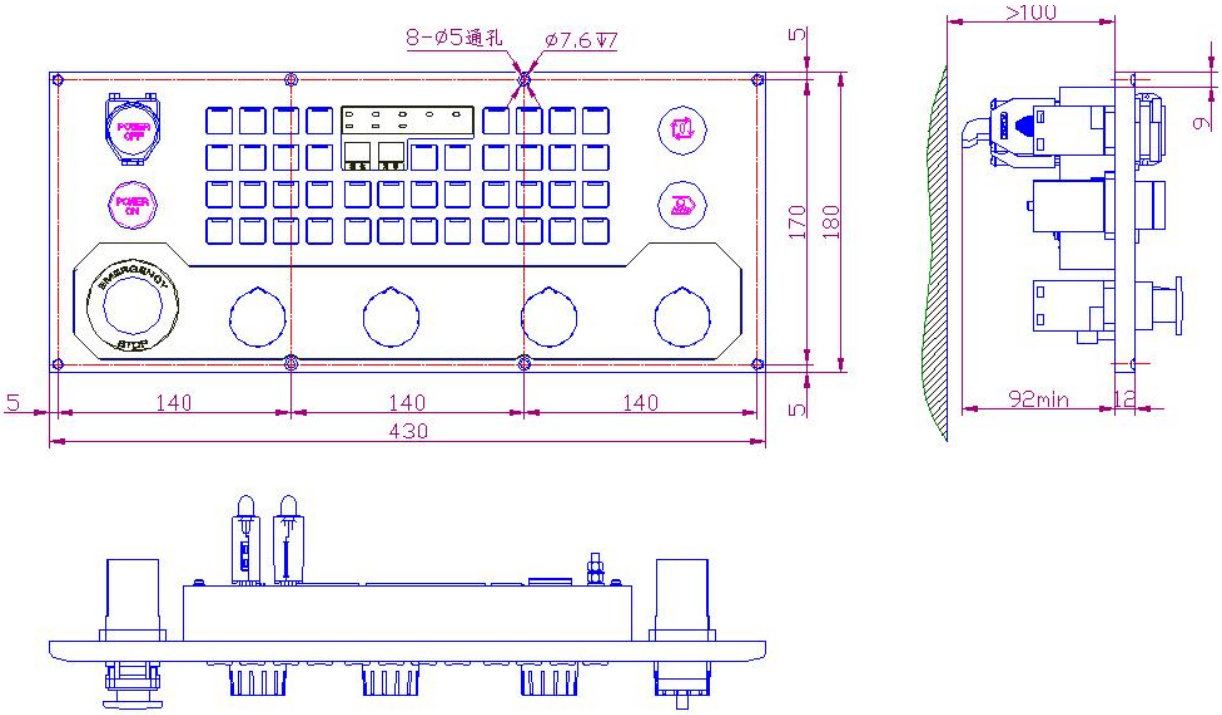


Fig.1-7 Mounting dimensions of machine tool panel for GSK986G

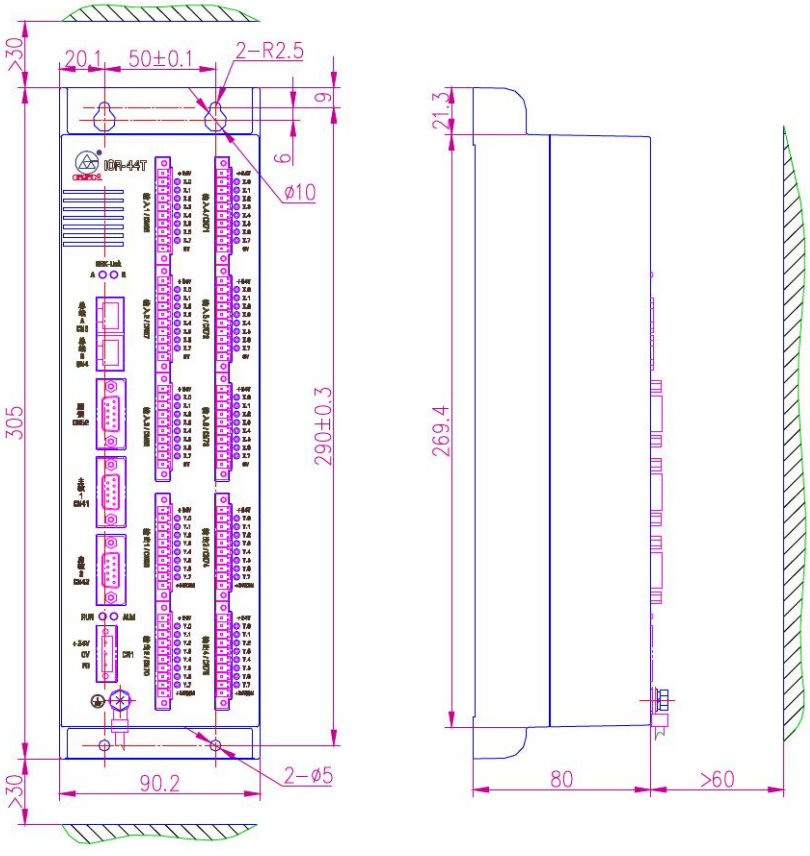


Fig.1-8 Installation dimensions for IOR-44T

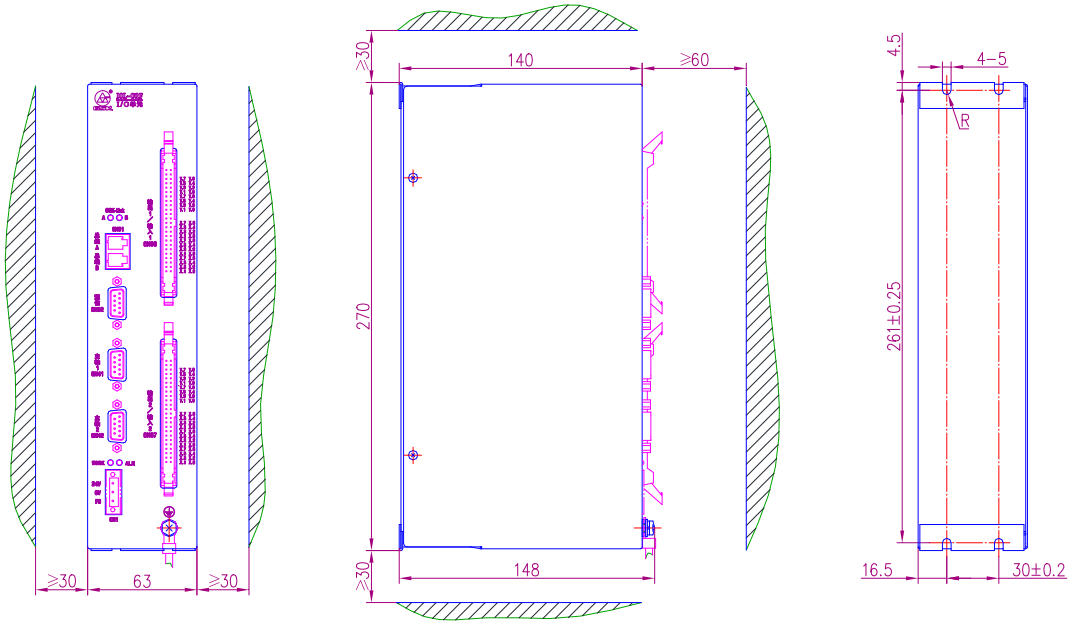


Fig.1-9 Installation dimensions for IOR-44F

1.5 Machine Input/Output (Standard PLC Definition)

1.5.1 Standard factory definition of internal/external grinder

CN	PLC Add.	Definition		CN	PLC Add.	Definition
Input 1	X0.0	Emergency retreat input(Normally Open)		Output 1	Y0.0	Headstock (spindle) positively (M03/M05)
	X0.1	External tailstock control signal (Normally Open)			Y0.1	Headstock (spindle) negatively (M04/M05)
	X0.2	External chuck control (Normally Open)			Y0.2	Headstock (spindle) accurate stop control/braking
	X0.3	Spindle quasi stop signal (Normally Open)			Y0.3	Grinding wheel control 1(M16/M18)
	X0.4	Hydraulic motor overload/ Low liquid level (Normally Open)			Y0.4	Grinding wheel control 2(Star-type)
	X0.5	Head frame (spindle) motor overload (Normally Open)			Y0.5	Grinding wheel control 3(Triangle type)
	X0.6	Cooling motor overload(Normally Open)			Y0.6	Hydraulic pump control (M14/M15)
	X0.7	Grinding wheel motor overload(Normally Open)			Y0.7	Lubrication control (M32/M33)
Input 2	X1.0	X Axis machine tool limit(Normally Closed)		Output 2	Y1.0	Red indicator (Tri-color LED)
	X1.1	Y Axis machine tool limit(Normally Closed)			Y1.1	Yellow indicator (Tri-color LED)

	X1.2	Z Axis machine tool limit(Normally Closed)		**Y1.2**	Green indicator (Tri-color LED)
	X1.3	4th Axis machine tool limit(Normally Closed)		**Y1.3**	Cooling control (M08/M09)
	X1.4	5th Axis machine tool limit(Normally Closed) -RESERVE		**Y1.4**	* Blowing control (M76/M77)
	X1.5	6th Axis machine tool limit(Normally Closed) -RESERVE		**Y1.5**	End-face/Radial measure apparatus display shifting output
	X1.6	7th Axis machine tool limit(Normally Closed) -RESERVE		**Y1.6**	End-face measure apparatus output (M72/M73)
	X1.7	8th Axis machine tool limit(Normally Closed) -RESERVE		**Y1.7**	Radial measure apparatus output (M74/M75)
Input 3	**X2.0**	Tail frame (jacking) in place (Normally Open)	**Output 3**	**Y2.0**	Tailstock (ejector) forward (M10)
	X2.1	Tail frame (ejector) retracted to position (Normally Open)		**Y2.1**	Tailstock (ejector) backward (M11)
	X2.2	Chuck clamped in place (Normally Open)		**Y2.2**	Chuck clamping (M12)
	X2.3	The chuck is loosened in place (Normally Open)		**Y2.3**	Chuck releasing (M13)
	X2.4	End face gauge in place (Normally Open)		**Y2.4**	
	X2.5	Back the end face gauge in place (Normally Open)		**Y2.5**	
	X2.6	Diameter vector meter 1 in place (Normally Open)		**Y2.6**	Custom Output 1(M78/M79)
	X2.7	Retract the diameter vector meter 1 in place (Normally Open)		**Y2.7**	Custom Output 2(M80/M81)
Input 4	**X3.0**		**Output 4**	**Y3.0**	Mist aspirator/magnetic separator/chip conveyor
	X3.1			**Y3.1**	Work lights
	X3.2			**Y3.2**	Finisher(M82/M83)
	X3.3			**Y3.3**	Internal grinding wheel output
	X3.4			**Y3.4**	Protective door(M84/M85)
	X3.5			**Y3.5**	Dynamic and static pressure output of grinding wheel Spindle
	X3.6			**Y3.6**	
	X3.7			**Y3.7**	
p u	**X4.0**				

	X4.1					
	X4.2					
	X4.3					
	X4.4	Finisher in position signal (Normally Open)				
	X4.5	Oil mist and low air pressure detection (Normally Open)				
	X4.6	External input for C/S axis switching (Normally Open)				
	X4.7	**External reset input(Normally Open)**				
Input 6	X5.0	Wheel speed reaches (Normally Open)				
	X5.1	Spindle oil temperature is too high (Normally Open)				
	X5.2	Oil (water) cooling motor of Spindle is overloaded/the liquid level is low/the dynamic and static pressure spindle pressure is low (Normally Closed)				
	X5.3	Internal Grinding wheel motor overload(Normally Open)				
	X5.4	Low lubricating level (Normally Open)				
	X5.5	Lubrication motor overload (Normally Open)				
	X5.6	Magnetic separator/chip conveyor fault (Normally Open)				
	X5.7	Protective door switch detection signal (Normally Closed)				

1.5.2 Standard factory definition of Surface grinder/ Gantry rail grinder

CN	PLC Add.	Definition		CN	PLC Add.	Definition
Input 1	X0.0	Emergency retreat input(Normally Open)		Output 1	Y0.0	Left wheel control(M03/M05,CH1)
	X0.1	Input of worktable travel direction 1(Normally Open)			Y0.1	Left wheel control (Star-type)
	X0.2	Input of worktable travel direction 2(Normally Open)			Y0.2	Left wheel control (Triangle type)
	X0.3	Left limit of workbench (Normally Open)			Y0.3	Right wheel control(M03/M05,CH2)
	X0.4	Right limit of workbench (Normally Open)			Y0.4	Right wheel control (Star-type)

	X0.5	Worktable external left button input (Normally Open)		**Y0.5**	Right wheel control (Triangle type)
	X0.6	Worktable external right button input (Normally Open)		**Y0.6**	Vertical holding brake of left
	X0.7	External cycle button input of workbench (Normally Open)		**Y0.7**	Vertical holding brake of right
Input 2	**X1.0**	Y1 Axis machine tool limit(Normally Closed)	**Output 2**	**Y1.0**	Red indicator (Tri-color LED)
	X1.1	Z1 Axis machine tool limit(Normally Closed)		**Y1.1**	Yellow indicator (Tri-color LED)
	X1.2	Y2 Axis machine tool limit(Normally Closed)		**Y1.2**	Green indicator (Tri-color LED)
	X1.3	Z2 Axis machine tool limit(Normally Closed)		**Y1.3**	Cooling control (M08/M09)
	X1.4			**Y1.4**	Hydraulic refrigerator control
	X1.5			**Y1.5**	Balance oil pump control of left grinding head
	X1.6			**Y1.6**	Trim oil pump control (M82/M83)
	X1.7			**Y1.7**	Bench lubricating oil pump control
Input 3	**X2.0**	Cooling motor overload (Normally Open)	**Output 3**	**Y2.0**	Wheel spindle lubricating motor/static and dynamic pressure system control
	X2.1	Low lubricating level of main shaft/low dynamic and static pressure (Normally Closed)		**Y2.1**	
	X2.2	Balance oil pump overload (Normally Open)		**Y2.2**	Flow direction control of workbench oil circuit 1 (To left)
	X2.3	Lube level low/pressure low input (Normally Open)		**Y2.3**	Flow direction control of workbench oil circuit 2 (To right)
	X2.4	Overload of workbench lubricating pump (Normally Open)		**Y2.4**	Electromagnetic chuck (M12/M13)
	X2.5	Hydraulic motor overload (Normally Open)		**Y2.5**	Hydraulic control (M14/M15)
	X2.6	Hydraulic level low/pressure low input (Normally Open)		**Y2.6**	Hydraulic control (Star-type)
	X2.7	Hydraulic filter core is blocked (Normally Open)		**Y2.7**	Hydraulic control (Triangle type)
Input 4	**X3.0**	Overload of left grinding wheel spindle motor(Normally Open)	**Output 4**	**Y3.0**	Magnetic separator/paper tape filter system control

	X3.1	Oil (water) cooler of the left spindle is overloaded(Normally Open)			**Y3.1**	Work lights
	X3.2	Inspection for balancing oil pressure of left grinding head(Normally Open)			**Y3.2**	
	X3.3	Left grinding wheel spindle temperature is too high(Normally Open)			**Y3.3**	
	X3.4	Overload of right grinding wheel spindle motor(Normally Open)			**Y3.4**	
	X3.5	Oil (water) cooler of the right spindle is overloaded(Normally Open)			**Y3.5**	Balance oil pump control of right grinding head
	X3.6	Inspection for balancing oil pressure of right grinding head(Normally Open)			**Y3.6**	
	X3.7	Right grinding wheel spindle temperature is too high(Normally Open)			**Y3.7**	Protective door
Input 5	**X4.0**	Electromagnetic chuck is under magnetized (Normally Open)				
	X4.1	Reworking oil pump overload (Normally Open)				
	X4.2	Hydraulic refrigerator overload (Normally Open)				
	X4.3					
	X4.4					
	X4.5					
	X4.6	Magnetic separator/paper tape filter system detection input (Normally Open)				
	X4.7	**External reset input(Normally Open)**				
Input 6	**X5.0**	Wheel speed arrival signal				
	X5.1					
	X5.2					
	X5.3					
	X5.4					
	X5.5					
	X5.6					
	X5.7	Protective door				

1.6 I/O unit(Type of IO-R)

1.6.1 Specification

IO unit of IOR series contains of four items, and the specification of each item is as follows:

Type	Signal input	Signal output	Analog value input	Analog value output	Input enabled level	Output enabled level
IOR-04T	48 points	32 points			HIGH	LOW
IOR-44T	48 points	32 points		4-circuit	HIGH	LOW
IOR-44F	48 points	32 points		4-circuit	HIGH	HIGH
IOR-21F	24 points	16 points		2-circuit	HIGH	HIGH

Customized specifications are as follows:

Type	Signal input	Signal output	Analog value input	Analog value output	Input enabled level	Output enabled level	Additional axis control
IOR-21TP	24 points	16 points	4-circuit	4-circuit	HIGH	LOW	2-circuit

1.6.2 Power Interface

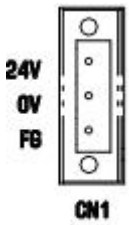


Fig.1-10

Power definition	Description
24V, 0V	IO unit power input, its voltage range is 22V-26V
FG	IO unit shell, it is better to connect with grounding.

In order to ensure the optimal working capacity of IO unit, it is better to share a 24V relay of IO unit and output terminal.

1.6.3 Spindle Interface

Pin definition figure of I/O unit spindle interface:

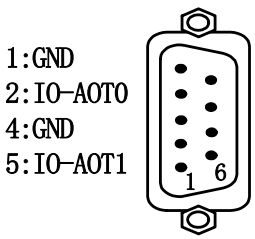


Fig.1-11

Signal definition	Signal explanation
1:GND	Analog voltage output grounding of the 1st circuit
2:IO-AOT0	0~+10V the 1st circuit analog voltage output
4:GND	Analog voltage output grounding of the 2nd circuit
5:IO-AOT1	0~+10V the 2nd circuit analog voltage output

1.6.4 Input Socket

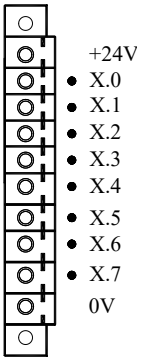


Fig.1-12

Signal definition	Signal explanation
+24V,0V	24V power output, rated 800mA
X.0-X.7	Input the pin, and the inputted valid Level is **HIGH**. The current of the enabled input signal should be more than 4ma, and its voltage should be more than 12V.

Take the IOR-44T e.g. based upon the above-mentioned explanations, and similarly hereinafter.

1.6.5 Output Socket

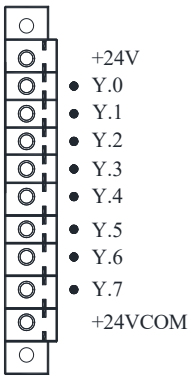


Fig.1-13

Signal definition	Signal explanation
+24V	24V power output, rated 800mA
+24VCOM	Pendent, refer to the 3.5.1
Y.0-Y.7	Output pin, the output enabled Level is **LOW**, and its rated current is 200mA.

1.6.6 Input/Output Electric Schematic

- **Signal input**

There are two methods of external signal input: One is contactor switch input, and its connection graph is shown as Fig.1-14:

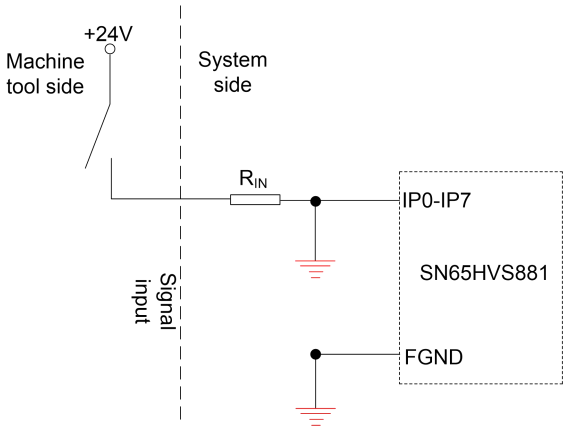


Fig.1-14 Contactor switch input

The other is (transistor) input without contactor switch, and its connection graph is shown as Fig.1-15 and Fig.1-16:

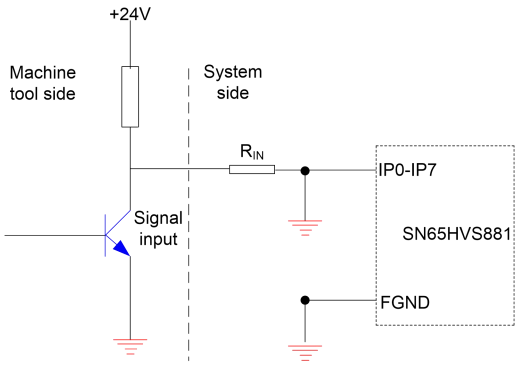


Fig.1-15 NPN connection

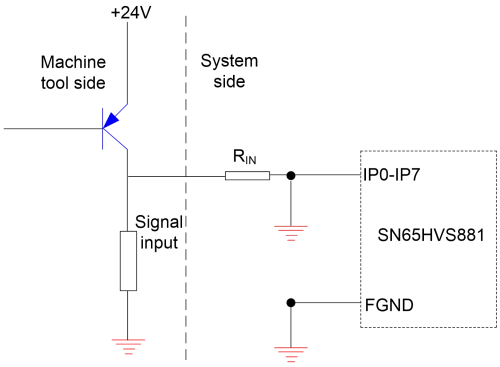


Fig.1-16 PNP connection

- **Signal output**

The enabled Level of the IOR-04T/ IOR-44T output signal is LOW, which is used for driving the side of machine electric circuit or the relay and indicator at the side of the machine panel; the output status of the corresponding Y address is regarded as 1 when its output is enabled, and the output interface potential is 0V. The output status of the corresponding Y address is regarded as 0 when the output is disabled, and the output interface is high-impedance state. The circuit figure is as follows (Fig.1-17).

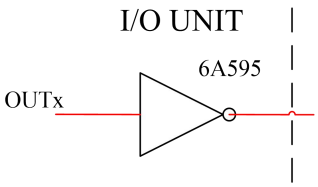


Fig.1-17 Circuit structure figure of internal output signal

Therefore, there are two output states for the output signal: 0V output or high-impendence. The typical applications are shown below:

Drive LED

It is necessary to make a resistance in series for outputting a drive LED, which is restricted the current of flowing LED (Generally, it is regarded as 10mA). Refer to the Fig.1-18.

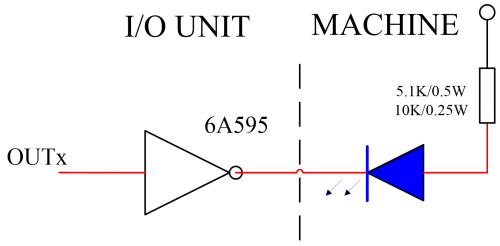


Fig.1-18 Drive LED

Drive filament indicator

It is necessary to connect with a preheating resistance to reduce the current impact by breakover when outputting the drive filament indicator, the value of preheating resistance is regarded as the principle that the indicator does not work, refer to the Fig.1-19:

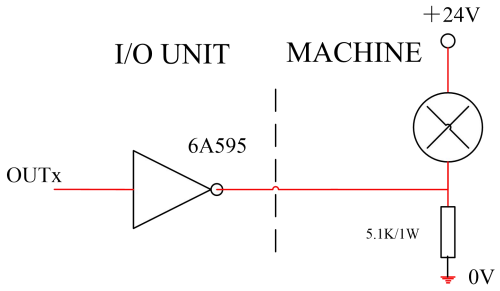


Fig.1-19

Drive inductive loading (e.g., relay)

Output the drive inductive loading, in this case, it is necessary to connect the fly-wheel diode nearby the coil for protecting the output circuit and reducing the interference. Refer to the Fig.1-20.

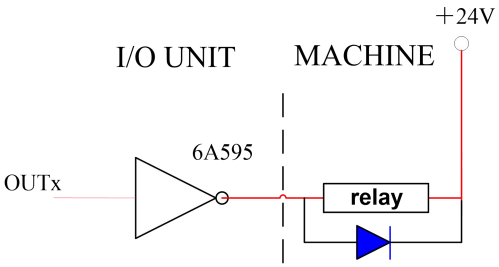
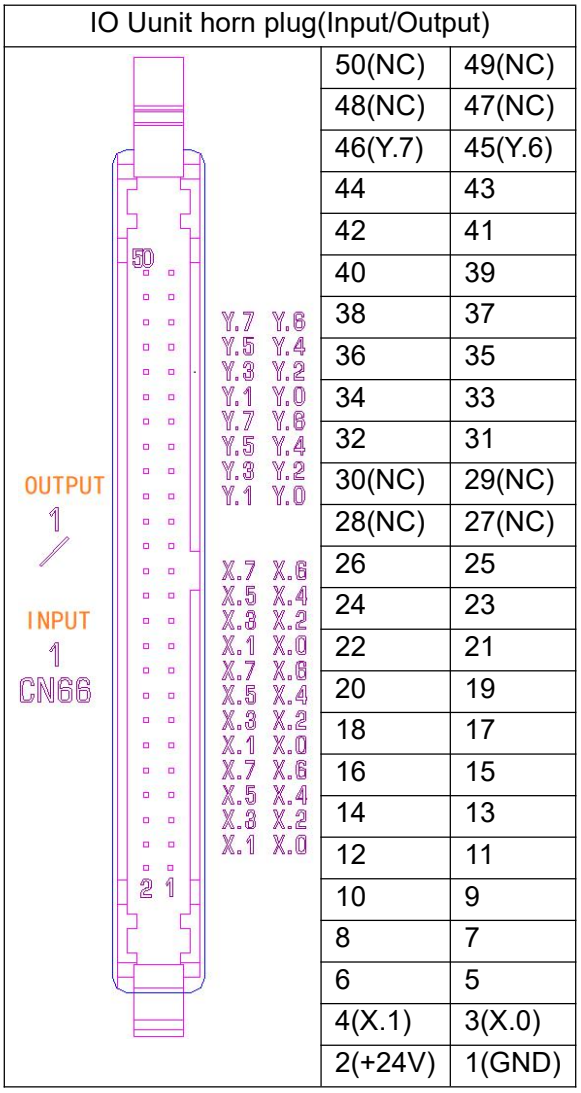


Fig.1-20

- **Output Signal**

COM does not need to connect of the IO unit, suspend. This pin is already connected the 24V with IO inside it, in order to guarantee the optimized capacity of IO unit that ensuring the IO unit shares a 24V with relay of output port.

1.6.7 IOR-44F



50(NC)	49(NC)
48(NC)	47(NC)
46(Y.7)	45(Y.6)
44	43
42	41
40	39
38	37
36	35
34	33
32	31
30(NC)	29(NC)
28(NC)	27(NC)
26	25
24	23
22	21
20	19
18	17
16	15
14	13
12	11
10	9
8	7
6	5
4(X.1)	3(X.0)
2(+24V)	1(GND)

NOTICE

The address distribution of CN67's Output 2/Input 2 is the same as that of CN66's Output 1/Input 1. Adapt to MCT-07 splitter.

1.7 System function interface

1.7.1 Interface identification

- Host interface ID

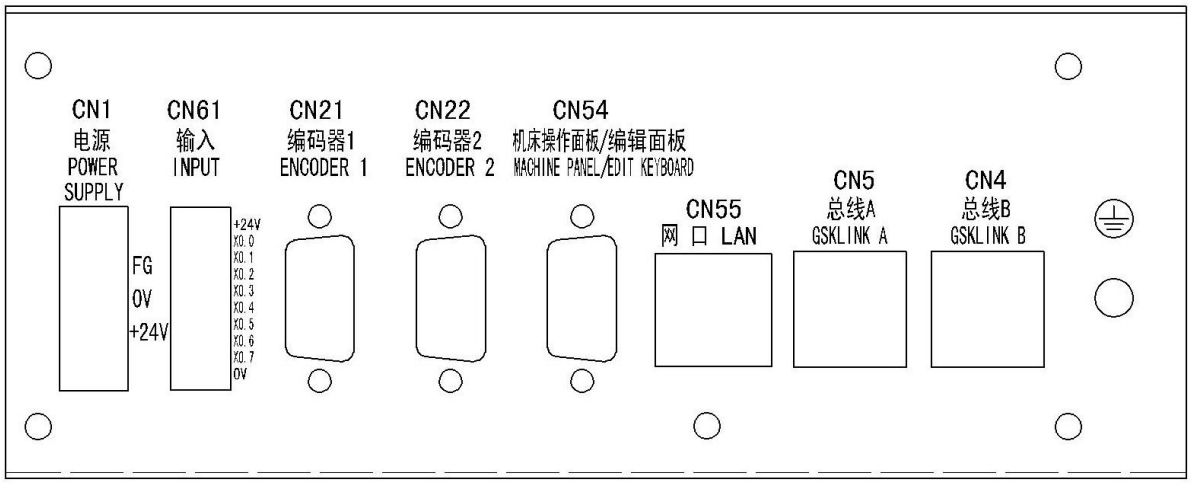


Fig.1-21 Host interface ID

- GSK986Gs additional panel interface identification

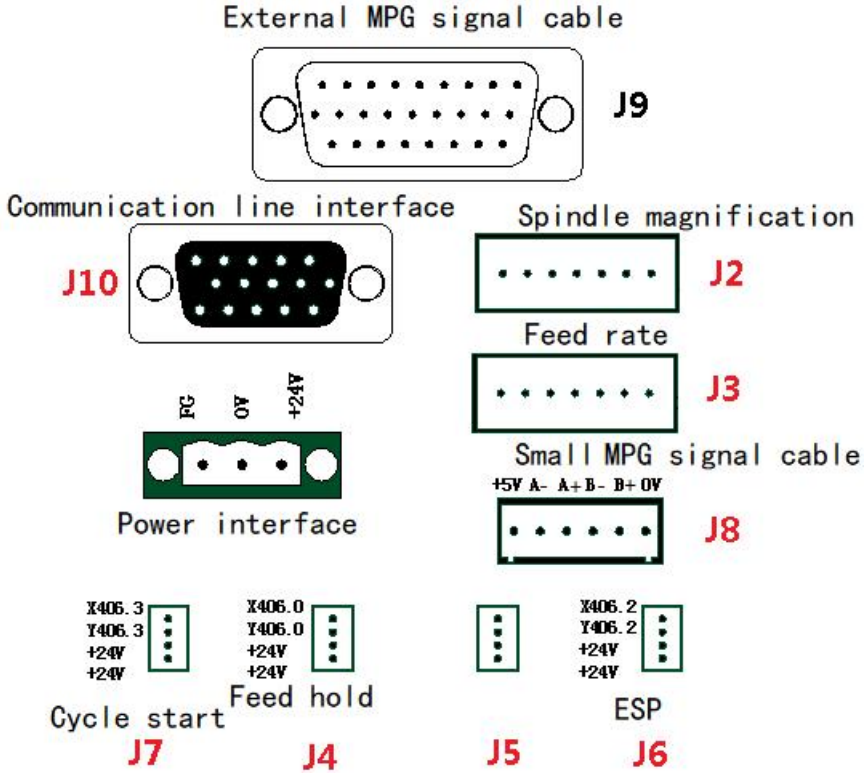


Fig.1-22 Additional panel interface identification

- GSK986G Interface identification of machine tool operation panel

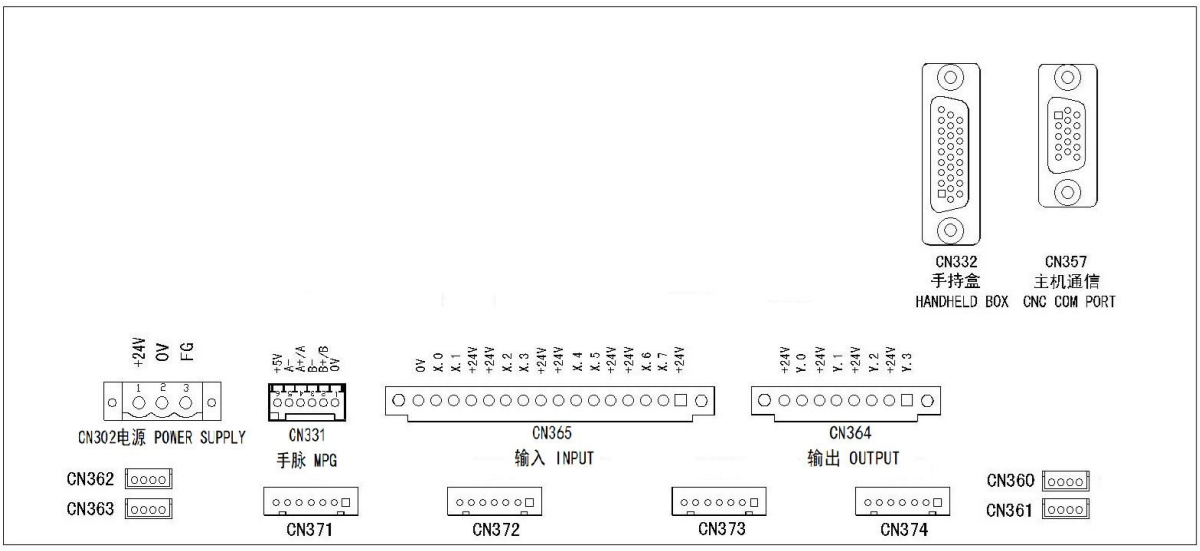


Fig.1-23 Interface identification of machine tool operation panel

1.7.2 Power interface(CN1、CN302)

Power interface This interface provides 24V power for the system, as shown in the following figure:

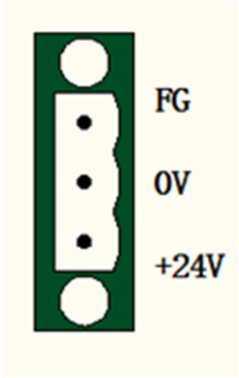


Fig.1-24

The switching power supply of the back cover of the system cannot be used for power supply outside the NC system.

1.7.3 High speed I/O, meter signal(CN61)

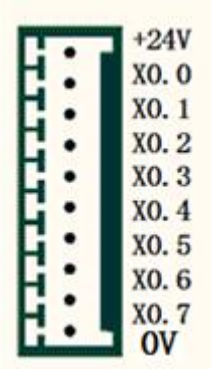


Fig.1-25 Input interface

Interface Definition Table

Pin No	PLC ADD.	EXPLAIN	REMARKS
＋24V		Input common terminal	
X0.0	X20.0	Meter signal P0	For end face gauge
X0.1	X20.1	Meter signal P1	For diameter vector meter 1
X0.2	X20.2	Meter signal P2	For diameter vector meter 1
X0.3	X20.3	Meter signal P3	For diameter vector meter 1
X0.4	X20.4	Meter signal P4	For diameter vector meter 1
X0.5	X20.5	Meter signal P5	For diameter vector meter 2
X0.6	X20.6	Meter signal P6	For diameter vector meter 2
X0.7	X20.7	Meter signal P7	For diameter vector meter 2
0V			

Remarks: This signal is valid at high level.

1.7.4 NormalI/O,Extension meter jump signal(CN73)

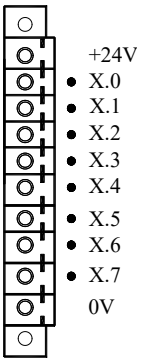


Fig.1-26 Input 6(CN73) interface on 1st IO unit of the extension meter jump signal

Interface Definition Table

Pin No	PLC ADD.	EXPLAIN	REMARKS
＋24V		Input common terminal	
X0.0	X5.0	Meter signal P8	
X0.1	X5.1	Meter signal P9	
X0.2	X5.2	Meter signal P10	
X0.3	X5.3	Meter signal P11	
X0.4	X5.4	Meter signal P12	
X0.5	X5.5	Meter signal P13	
X0.6	X5.6	Meter signal P14	
X0.7	X5.7	Meter signal P15	
0V			

Remarks: This signal is valid at high level.

1.7.5 Encoder(CN21、CN22)

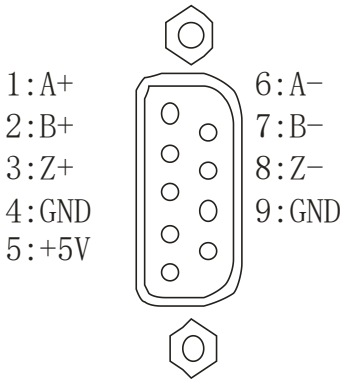


Fig.1-27 9-core D-pin socket

Encoder or grating (TTL) connection signal table

Pin No	Signal definition	explain	Signal direction
1	**A+**	Encoder A+	Grating → CNC
2	**B+**	Encoder B+	Grating → CNC
3	**Z+**	Encoder Z+	Grating → CNC
4	**GND**	5V ground	CNC → Grating
5	**+5V**	5V power	CNC → Grating
6	**A-**	Encoder A-	Grating → CNC
7	**B-**	Encoder B-	Grating → CNC
8	**Z-**	Encoder Z-	Grating → CNC
9	**GND**	5V ground	CNC → Grating

NOTICE

1. 5V ground wire connector is DB 9-hole plug;
2. The signal is TTL level with difference. Please consult the system manufacturer for specific use mode.

1.7.6 Panel small unit (J8)

Pin NO (refer to Figure 1-22)	Signal definition	explain
	+5V	5V power
	A-	**A-**
	A+	**A+**
	B-	**B-**
	B+	**B+**
	0V	5V ground

1.7.7 External handheld unit (J9、CN332)

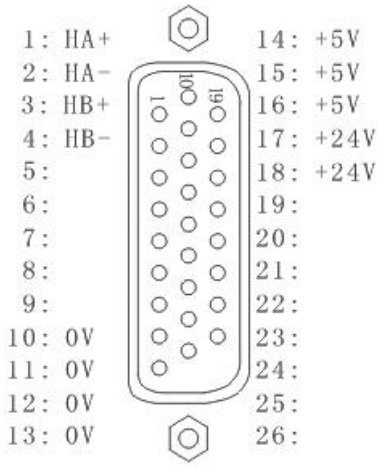


Fig.1-28 External handheld unit 26 core D-pin socket

Pin No	Signal definition	PLC ADD.			remarks
		GSK986Gs	GSK986G	GSK986	
1	HA+				
2	HA-				
3	HB+				
4	HB-				
5	X	X461.0	X467.0	X467.0	
6	Y	X461.1	X467.1	X467.1	
7	5th	X462.1			Short circuit 26 pins
8	Z	X461.2	X467.2	X467.2	
9	X1	X461.3	X467.3	X467.3	
10~13	0V				
14~16	+5V				
17/18	+24V				
19		X462.0			
20		X462.2	X467.4	X468.0	
21		X462.3			
22	X10	X461.4	X467.5	X467.6	
23	X100	X461.5	X467.6	X467.5	
24	X1000	X462.4	X467.7	X467.7	
25	4th	X462.5	X468.0	X467.4	
26	5th		X468.1	X468.1	Short circuit 7 pins

Hand pulse welding wire (GSK-SC10-D):

26 hole DB head			SC10-D Outgoing line	
0V	10	———	black	0V
0V	11	———	White/Black	LED-
+5V	16	———	Red	+5V

+24V	17	Green/Black	LED+
+24V	18	Red/Black	EN
A+	1	Greed	A
A-	2	Purple	A-
B+	3	White	B
B-	4	Purple/Black	B-
X	5	Yellow	X
Y	6	Yellow/Black	Y
5^{TH}	7	Pink	5^{TH}
5^{TH}	26		
Z	8	Brown	Z
X1	9	Grey	X1
X10	22	Grey/Black	X10
X100	23	Orange	X100
X1000	24	Pink/Black	X1000
4^{TH}	25	Brown/black	4^{TH}
Transfer		Blue	ESP1
		Blue/Black	ESP2
Metal housing		Metal housing	

NOTICE

1. Other brands refer to the welding wire of GSK-SC10-D. If the handwheel has no differential signal (i.e. 4-wire handwheel), the "A -", "B -" and "+5V" on the 26 hole DB head need to be shorted during welding;

2. For the handheld unit with emergency stop button, its ESP1 and ESP2 leads are connected in series with the emergency stop button wiring on the panel.

1.7.8 Analog spindle (CN41、CN42)

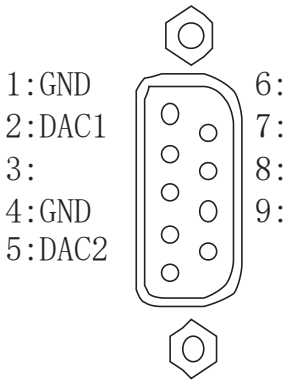


Fig.1-29 9-core D-pin socket of CN41/CN42 on I/O unit

Terminals	spindle	Pin No	Signal definition	PLC ADD.
CN41	SP1	1	AGND	Y400.0~Y401.7
		2	AVI	

	SP2	4	AGND	Y402.0~Y403.7
		5	AVI	
CN42	SP3	1	AGND	Y404.0~Y405.7
		2	AVI	
	SP4	4	AGND	Y406.0~Y407.7
		5	AVI	

1.7.9 Additional Pin Number Definition (CN15、CN16)

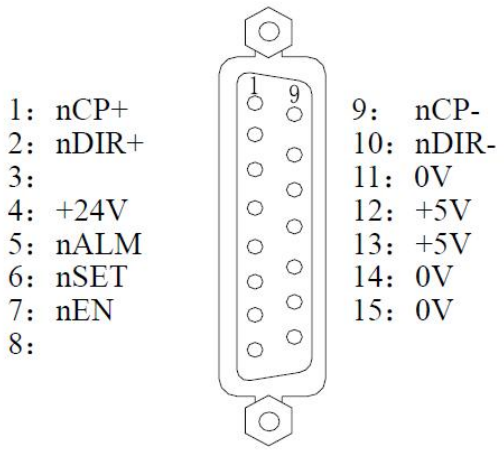


Fig.1-30 15-core D-hole socket of CN15/CN16 on I/O unit

Pin No	Signal definition	explain	PLC ADD.
1	**nCP+**	Command pulse signal +	
2	**nDIR+**	Command direction signal +	
3			
4	**+24V**		
5	**nALM**	ALM	X412.5、X413.5
6	**nSET**	Pulse inhibit signal	Y412.5、Y414.5
7	**nEN**	Axis Enable	Y412.4、Y414.4
8			
9	**nCP-**	Command pulse signal -	
10	**nDIR-**	Command direction signal -	
11	**0V**		
12/13	**+5V**		
14/15	**0V**		

1.7.10 Communication (CN54)

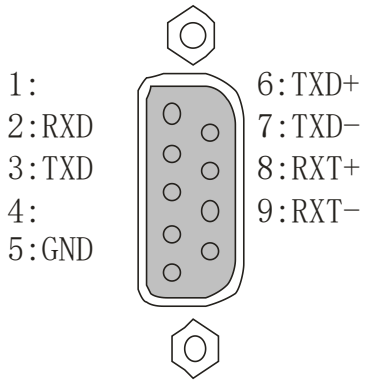


Fig.1-31 9-core D-hole socket at CNC

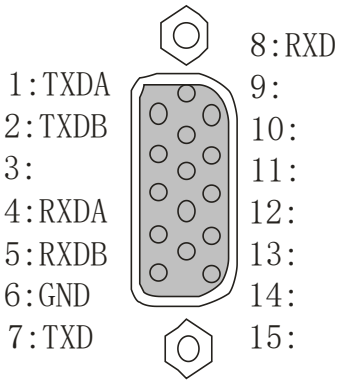


Fig.1-32 15 core D-hole socket at additional panel end

RXD	2	7	TXD
TXD	3	8	RXD
GND	5	6	GND
TXD+	6	4	RXDA
TXD-	7	5	RXDB
RXT+	8	1	TXDA
RXD-	9	2	TXDB
Metal housing		Metal housing	

NOTICE

1. The welding wire connector at CNC end is DB 9-pin plug; The additional panel end is a DB 15 pin plug.

1.7.11 Extended I/O (CN365、CN364)

- Extended Input(CN365)

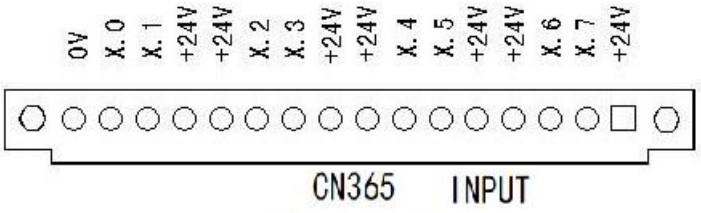


Fig.1-33

Pin No	Signal definition	PLC ADD.
1	0V	
2	X.0	X466.0
3	X.1	X466.1
4/5	+24V	

6	X.2	X466.2
7	X.3	X466.3
8/9	+24V	
10	X.4	X466.4
11	X.5	X466.5
12/13	+24V	
14	X.6	X466.6
15	X.7	X466.7
16	+24V	

- Extended Output (CN364)

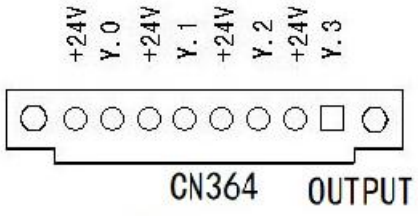


Fig.1-34

Pin No	Signal definition	PLC ADD.
1	+24V	
2	Y.0	Y461.0
3	+24V	
4	Y.1	Y461.1
5	+24V	
6	Y.2	Y461.2
7	+24V	
8	Y.3	Y461.3

CHAPTER TWO MACHINE TOOL DEBUGGING

This chapter introduces the methods and debugging steps of CNC: **Initialization parameter → First Connection → Component configuration → Function selection → Bugging → Precision Setting → Data backup/recovery;** it is better to perform it by the following sequence at 1st time: (This chapter focuses on the system commissioning of external grinder)

2.1 Basic parameters

2.1.1 Initial password

The initial password is “000000” “111111” “222222” “333333” “444444” “555555” from the lowest to the highest, and the initial password is modified according to the actual situation.

Among them, the "machine tool factory" level password is 333333, and the "system" level password is 444444.

- Operation permission, path: 刀补/设置 → CNC SETTING → LEVEL SETTING :

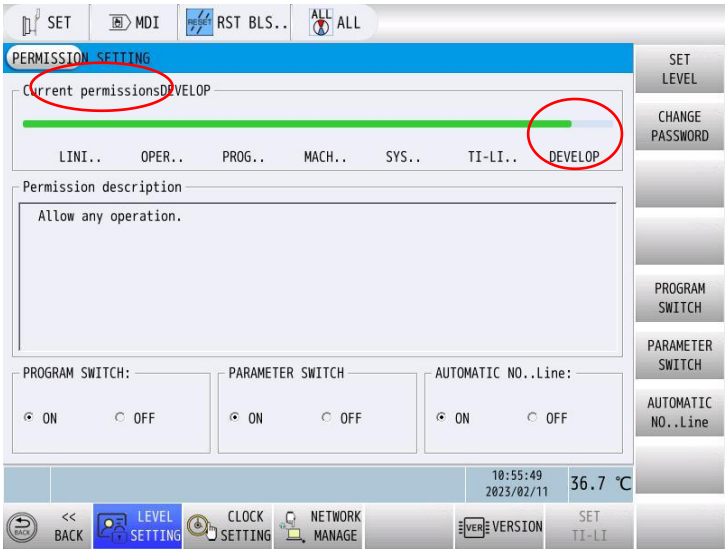


Fig.2-1

2.1.2 Basic configuration

In MDI mode, verify the following basic configuration parameters:

NO.	Definition	Parameters	Remarks
1	Controllable mode	P00001.7~6	00:Not connected;01:GSK-Link;
2	Total number of channels	P00003	
3	Total number of axles	P00004	The sum of all channel feed axes cannot exceed this parameter
4	Total number of spindle	P00005	The sum of all channel spindles cannot exceed this parameter
5	Total number of	P00006	<5;

NO.	Definition	Parameters	Remarks
	I/O unit		
6	Number of current channel axes	P10*04	Number of feed axes controlled by single channel,<9;
7	Current channel spindle number	P10*05	Frequency conversion spindle+servo spindle (including C/S axis),<5;

NOTICE

"*" represents different channel numbers or shaft numbers, the same below.

- Modify under the parameter page, path: SYS 系统 → MAC. PAR. → SYS PAR. or CH. PAR. :

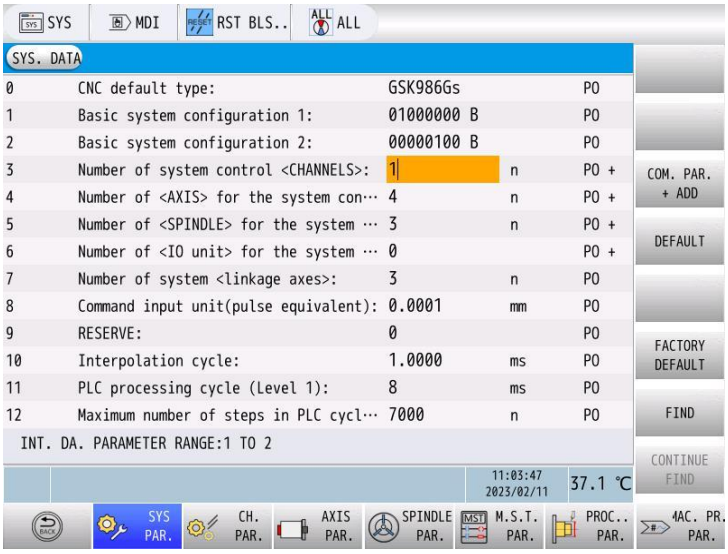


Fig.2-2

- "Debug" page modification, path: 刀补/设置 → DEBUG ,As shown below:

Fig.2-3

Press  ,Position the cursor to "Easy Debugging", Press  or  As shown below:

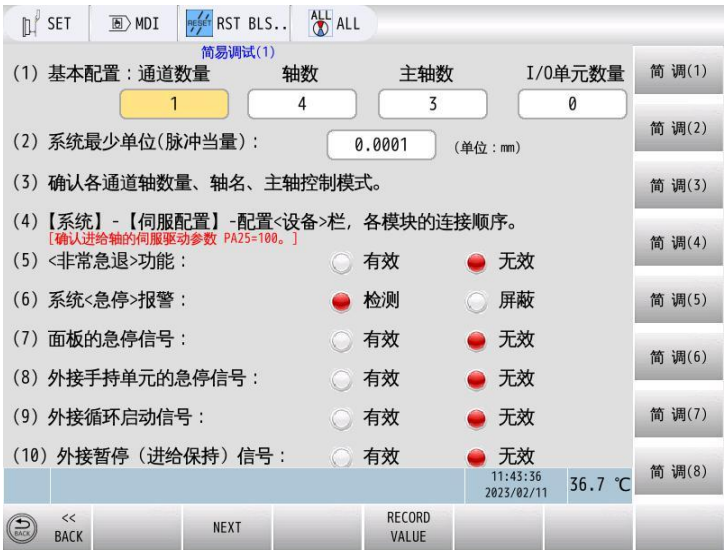


Fig.2-4

2.1.3 Axis control function selection

NO.	Definition	Parameters	Remarks
1	G for command mode	P10*01.0	0-Tybe-B;1-Tybe-A;
2	Number of axes	P00004、P00005	
3	Linear axis	P20*08.6~5	Linear axis as“00”;
4	Rotation axis	P20*08.6~5	Rotation axis for A“01”, Rotation axis for B“10”;
5	Selection of C/S axis	P50*10.0	spindle S is set to "1";
6	Axis name	P20*01	“A B C X Y Z U V W”, Related to command mode
7	Basic Axis Properties	P20*04	Axis attribute definition for arc interpolation;

2.2 SERVO DISPOSE(BUS)

Confirm the basic parameters in chapter 2.1, and the network communication can work normally.

- Network connection shall refer to Section 1.2 to ensure correct connection sequence of all slave stations;
- Press  ,after the machine network is connected correctly, the interface is shown as follows in  .

Fig.2-5

The specific operation of servo configuration is as follows:

- When the new system is debugged for 1st time, it is recommended to delete all.Press CLEAR ALL and CONFIRM or ENTER complete the delete all operation.
- As shown in the figure below, press INPUT to display the slave station name selection list:

Fig.2-6

- Select the name of the corresponding equipment with the cursor ⇩, and then confirm ENTER, as shown in the following figure:

Fig.2-7

- Set other slave stations (feed axis, spindle, I/O unit) by analogy. After all configurations are successful, see the following figure:

Fig.2-8

- Power off and restart the system to complete the network configuration of the servo.

2.3 Simple debugging

2.3.1 Debugging interface

This function can meet the rapid debugging of the machine tool. Without entering the system parameter interface and ladder diagram interface to modify their respective parameters, you can directly modify the relevant function parameters in this interface. The operations are as follows:

→ 

,Enter the system debugging interface, which has seven submenus, as follows:

Debug	Simple debugging (all)	Basic functions of the system	Basic functions of standard ladder diagram	Application related functions	Advanced system functions	Special functions of machine tool	Function monitoring
	Simple settings of the basic functions of the machine tool	Setting of basic system functions	Setting of basic functions of standard ladder	Setting of application functions related to machining and display	Settings of some advanced functions of the system	Setting of some special functions of the machine tool	Monitoring and Diagnosis of Some Functions of Machine Tools

The debugging interface is as follows:

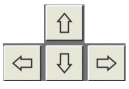
Fig.2-9

It is divided into simple debugging, function monitoring, and classified debugging (basic system functions, basic ladder diagram functions, application related functions, advanced system functions, and special functions for machine tools), as shown in the figure above. Please refer to the system for detailed classification.

NOTICE

The current "Debug" interface does not provide languages other than "Chinese".

2.3.2 Function modification

E.g., modify [Simple Debugging (General)]: Move to [Simple Debugging (General)] used  , move to [Simple Debugging] used  ,and press  again to enter the

debugging interface as follows:

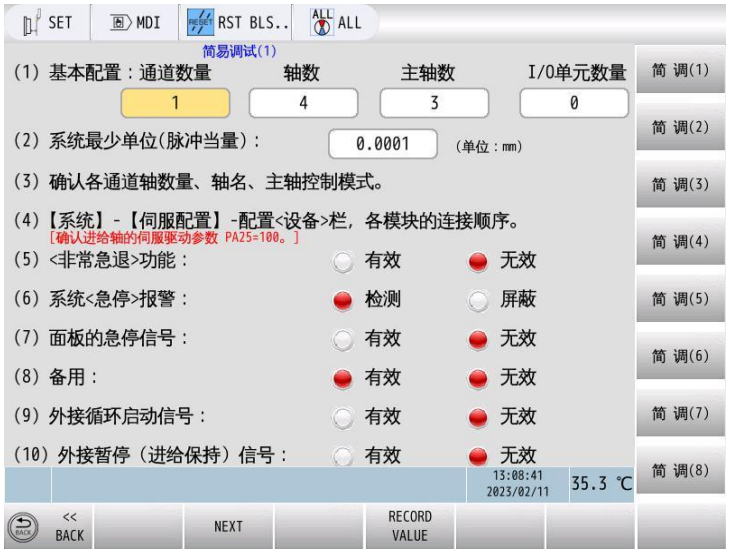
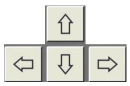
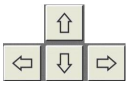


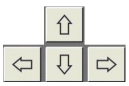
Fig.2-10

Select the function used  , press  to modify the data, press  after entering the value to complete the data modification, and cancel pressing as  ; If it is a function switch, move the cursor to the corresponding function switch and press  The icon turns into a red dot, and the current function switch is modified successfully.

2.3.3 Function monitoring

This function is mainly used to set data, status monitoring and basic parameters under specific functions of the machine tool. The page is as follows:

E.g., "C/S axis monitoring": Move to [4. C/S axis monitoring] used  and press  again to enter the interface as follows:

Select the corresponding used  ,item to modify the main parameters and related status signals.

2.4 PLC function parameters

2.4.1 Standard ladder diagram parameters of internal/external grinder

Remarks: CH0/CH1/CH2/...: total channel/channel 1/channel 2/...

NO.	Function	Channel	PAR.	Definition
1	Keyboard type	CH0	K30.0~2	Keyboard type-000:Integrated panel;001:370 Operation panel;010:430 Operation panel;
2	ESP	CH0	K10.5	External ESP on the panel-0:Invalid 1:Valid
3	ESR	CH1/CH2...	K29.0	Whether the emergency retry is valid-0:Invalid 1:Valid
4	RESET	CH0	K10.0	When reset during operation, the cursor returns to the beginning of the program..-0:EDIT 1:All ways
		CH0	K16.0	Keep cooling output when RESET-0:Hold 1:Don't hold
		CH1	K16.1	1st spindle (Headrest,switch) in RESET-0:Hold 1:Off
		CH1	K16.2	2nd spindle (Grinding,switch) in RESET-0:Hold 1:Off
5	External button	CH0	K10.1	External circulation start-0:Invalid 1:Valid
		CH0	K10.2	External feed and hold-0:Invalid 1:Valid
6	Hand pulse	CH0	K10.6	External Hand pulse-0:Invalid 1:Valid
		CH0	K10.7	Hand pulse/Single step mode ×1000-0:Valid 1:Invalid
7	MODE	CH0	K18.0~2	Mode setting-000:MDI 001:AUTO 010:Pro-Zero 011:EDIT 100:Hand pulse 101:JOG 110:REF 111:Dressing

NO.	Function	Channel	PAR.	Definition
		CH0	K18.3	MODE-0:Power-off memory 1:Power-on designation
8	Hard limit	CH1/CH2...	K20.6	Overtravel detection signal of each axis -0:high level alarm 1:low level alarm
		CH1/CH2...	K20.7	Hard overtravel function of each axis machine tool-0:Invalid 1:Valid
9	Manual key reversal	CH1/CH2...	K23.*	Manual key reversal
10	Return to zero deceleration signal (Incremental encoder)	CH1/CH2...	K24.*	Return to zero deceleration signal-0:Nor_open 1:Nor_closed
11	Servo drive alarm	CH1/CH2...	K25.*	Servo drive alarm-0:No alarm 1:Alarm
12	3rd axis key	CH1/CH2...	K21.7	Is 3rd axis C-axis or Y-axis -0:C-axis 1:Y-axis
13	External magnification	CH0	K19.0	External feed rate -0:no inversion 1:inversion
		CH0	K19.1	External feed rate-0:Invalid 1:Valid
		CH0	K19.3	External Spindle magnification-0:Invalid 1:Valid
		CH0	K19.4	Shared knob for fast rate and feed rate -0:not shared 1:shared
		CH0	K19.5	Multiply adjustment effective mode -0:multiple channels are effective at the same time 1:current channel is effective
14	Spindle	CH1	DT006	S instruction execution time (ms)
		CH1	DC000	Spindle zero speed output range(r/min)
		CH1	DC002	Spindle quasi-stop switch count times
		CH0	K19.7	During operation Hydraulic/Chuck/Tailstock, whether to judge “Spindle analog voltage” or “speed command” - 0:not judge 1:judge
15	2nd spindle (grinding wheel)	CH1	K17.5	2nd Spindle abnormal signal-0:High level alarm 1:Low level alarm
		CH1	K26.1	2nd Spindle-0:No alarm 1:Alarm
		CH0	K31.4	The oil (water) cooling motor of the grinding wheel shaft is faulty/the liquid level is low/the dynamic and static pressure Spindle pressure is low -0:Don’t detect 1:Detect
		CH0	K32.1	Grinding wheel shaft temperature-0:Don’t detect 1:Detect
		CH0	K32.2	Internal grinding wheel motor fault-0:Don’t detect 1:Detect
		CH1	DT025	2nd spindle star start time(ms)
		CH1	DT026	2nd spindle Triangle start time(ms)
16	Hydraulic	CH0	K14.6	“Hydraulic motor not started” alarm-0:Prompt

NO.	Function	Channel	PAR.	Definition
				1:Don't prompt
		CH0	K14.7	Hydraulic control function-0:Invalid 1:Valid
		CH0	K14.0	Pressure detection function-0:Invalid 1:Valid
		CH0	K14.1	Pressure detection signal-0:High level alarm 1:Low level alarm
		CH0	DT002	Hydraulic pressure low alarm detection time(ms)
17	Frist Spindle (Headrest)	CH1	K15.0	Spindle automatic shift function-0:Invalid 1:Valid
		CH1	K15.1	Spindle shift in position signal-0:Don't detect 1:Detect
		CH1	K15.2	Spindle shift in position signal-0:High level effective 1:Low level effective
		CH1	K15.3	Spindle gear power off-0:Don't remember 1:Remember
		CH1	K15.4	Spindle orientation function-0:Invalid 1:Valid
		CH1	K15.5	Y0.2 OUTPUT-0:Brake output valid 1:Directional output valid
		CH1	K15.6	Spindle orientation mode-0:Servo orientation 1:Frequency conversion quasi-stop
		CH1	K15.7	C/S AXIS FUNCTION-0:Invalid 1:Valid
		CH1	K17.0	Spindle key rotation direction of panel-0:Don't reverse 1:Reverse
		CH1	K17.1	Spindle speed arrival detection-0:Invalid 1:Valid
		CH1	K17.2	Spindle jog at-0: Valid under JOG/MPG/REF 1:Valid under all working modes
		CH1	K17.3	Spindle analog voltage or speed command when Spindle stops -0:Don't close 1:Close
		CH1	K17.4	Spindle abnormal signal-0:High level alarm 1:Low level alarm
		CH1/CH2...	K26.0	1st Spindle-0:No alarm 1:Alarm
		CH1	DT000	Time to turn off the original gear when the spindle automatically shifts (ms)
		CH1	DT001	Delay the end time after the automatic shift of the main shaft is in place (ms)
		CH1	DT010	Spindle brake delay output time(ms)
		CH1	DT011	Spindle brake output time(ms)
		CH1	DT012	Spindle jog time(ms)
18	Chuck	CH1	K12.0	Chuck control function -0:Invalid 1:Valid
		CH1	K12.1	Chuck clamping status before Spindle start -0:Detect 1:Don't detect
		CH1	K12.2	Control mode for Chuck-0: Internal 1: External
		CH1	K12.3	Chuck in-position signal-0:Don't detect 1:Detect

NO.	Function	Channel	PAR.	Definition
		CH1	K12.4	External Chuck is controlled in Program operation -0:Invalid 1:Valid
		CH1	DT014	Chuck clamp instruction execution time(ms)
		CH1	DT015	Chuck released instruction execution time(ms)
		CH1	DT018	Chuck pulse output width (ms)
		CH1	DT021	Chuck operation enable delay when Spindle stops (ms)
19	Tailstock	CH1	K13.0	Tailstock control function-0:Invalid 1:Valid
		CH1	K13.1	Spindle rotation and Tailstock forward and backward -0:Interlock 1:No interlock
		CH1	K13.2	External Tailstock is controlled in Program operation -0:Invalid 1:Valid
		CH1	K13.3	Tailstock in-position signal-0:Don't detect 1:Detect
		CH1	DT022	Tailstock action execution time (ms),<400ms
20	Measuring instrument	CH0	K34.0	End face Measuring instrument (M72/M73) in-place signal detection-0:Don't detect 1:Detect
		CH0	K34.1	Radial Measuring instrument1 (M74/M75) in-place signal detection-0:Don't detect 1:Detect
		CH0	K34.2	Radial Measuring instrument2 (M76/M77) in-place signal detection-0:Don't detect 1:Detect
		CH0	K34.3	Whether the measuring instrument is maintained after<ESP> -0:Don't hold 1:Hold
		CH0	K34.4	Whether the measuring instrument is maintained after<RESET> -0:Don't hold 1:Hold
		CH0	DT030	Measuring instrument forward and backward detection time (ms)
21	lubrication	CH0	K16.3	Lubrication with low oil level-0:Don't detect 1:Detect
		CH0	K16.4	Lubrication with low oil level-0:High level alarm 1:Low level alarm
		CH0	K16.5	Relationship between lubrication and Program operation-0:Non-interlock 1:Interlock
		CH0	K16.6	Start when automatic lubrication is effective -0: No lubrication output 1:lubrication output
		CH0	K31.6	Lubrication motor fault-0:Don't detect 1:Detect
		CH0	DT013	Start time of manual lubrication (0: Unlimited lubrication)(ms)
		CH0	DT016	Automatic lubrication interval (ms)
		CH0	DT017	Autolube output time (ms)
22	Protective door	CH0	K14.2	Protective door-0:Invalid 1:Valid
		CH0	K14.3	Protective door detection signal when

NO.	Function	Channel	PAR.	Definition
				protective door is closed -0:Low level 1:High level
		CH0	K14.4	Spindle when the protective door is on-0:Close 1:Don’t close
23	Multi-channel	CH0	K19.5	Multiply adjustment effective mode -0:multiple channels are effective at the same time 1:current channel is effective
		CH0	K30.3	Multi-channel switching-0:Key (K2) 1:Knob (dial switch)
		CH0	K30.6	"Start" signal in Multi-channel parallel mode -0:Multi-channel is valid at the same time 1:CH1 is triggered
		CH0	K30.7	Working mode after entering Multi-channel parallel mode-0:AUTO 1:Hold
24	Program operation	CH0	K16.7	Spindle, cooling off and G command are in the same section, Spindle, before cooling off -0:Wait for the end of G command 1:Don’t wait
		CH1/CH2...	K29.1	Whether the hand pulse test cut function is effective-0:Invalid 1:Valid
		CH1/CH2...	K29.2	Whether the Hand pulse interrupt function is valid-0:Invalid 1:Valid
		CH1/CH2...	K29.3	Whether the Hand pulse interrupt/intervention function remains effective during program operation-0:Invalid 1:Valid
25	Pulse axis control	CH0	K36.7	Pulse axis (IO-R21T) -0:Not connected 1:Connected
26	Others	CH0	K31.0	Cooling motor fault-0:Don’t detect 1:Detect
		CH0	K31.5	Mist suction machine/magnetic separator/chip removal machine fault-0:Don’t detect 1:Detect
		CH0	K31.7	Low oil mist pressure-0:Don’t detect 1:Detect
		CH1	DT032	C-axis clamp timing
		CH0	DT033	Continuous detection time of air pressure and temperature(ms)
		CH0	DT034	Delayed closing output time of mist extractor and magnetic separator(ms)

2.4.2 Standard ladder diagram parameters of plane/gantry grinder

Remarks: CH0/CH1/CH2/...: total channel/channel 1/channel 2/...

NO.	Function	Channel	PAR.	Definition
1	Keyboard type	CH0	K30.0~2	Keyboard type-000:Integrated panel;001:370 Operation panel;010:430 Operation panel;
2	ESP	CH0	K10.5	External ESP on the panel-0:Invalid 1:Valid
3	Emergency	CH1/CH2...	K29.0	Whether the emergency retry is valid-0:Invalid

NO.	Function	Channel	PAR.	Definition
	retreat			1:Valid
4	RESET	CH0	K10.0	When reset during operation, the cursor returns to the beginning of the program..-0:EDIT 1:All ways
		CH0	K16.0	Keep cooling output when RESET-0:Hold 1:Don't hold
		CH1/CH2	K16.1	Spindle (grinding wheel,switch) in RESET-0:Hold 1:Off
5	External button	CH0	K10.1	External circulation start-0:Invalid 1:Valid
		CH0	K10.2	External feed and hold-0:Invalid 1:Valid
6	Hand pulse	CH0	K10.6	External Hand pulse-0:Invalid 1:Valid
		CH0	K10.7	Hand pulse/Single step mode ×1000-0:Valid 1:Invalid
7	MODE	CH0	K18.0~2	Mode setting-000:MDI 001:AUTO 010:Pro-Zero 011:EDIT 100:Hand pulse 101:JOG 110:REF 111:Dressing
		CH0	K18.3	MODE-0:Power-off memory 1:Power-on designation
8	Hard limit	CH1/CH2...	K20.6	Overtravel detection signal of each axis -0:high level alarm 1:low level alarm
		CH1/CH2...	K20.7	Hard overtravel function of each axis machine tool-0:Invalid 1:Valid
9	Manual key reversal	CH1/CH2...	K23.*	Manual key reversal
10	Return to zero deceleration signal (Incremental encoder)	CH1/CH2...	K24.*	Return to zero deceleration signal-0:Nor_open 1:Nor_closed
11	Servo drive alarm	CH1/CH2...	K25.*	Servo drive alarm-0:No alarm 1:Alarm
12	External magnification	CH0	K19.0	External feed rate -0:no inversion 1:inversion
		CH0	K19.1	External feed rate-0:Invalid 1:Valid
		CH0	K19.3	External Spindle magnification-0:Invalid 1:Valid
		CH0	K19.4	Shared knob for fast rate and feed rate -0:not shared 1:shared
		CH0	K19.5	Multiply adjustment effective mode -0:multiple channels are effective at the same time 1:current channel is effective
13	Spindle	CH1	DT006	S instruction execution time (ms)
		CH0	DT065	Star start timing time
		CH0	DT066	Triangle start timing time
		CH0	DT033	Spindle temperature detection frequency of grinding wheel

NO.	Function	Channel	PAR.	Definition
		CH1	DC000	Spindle zero speed output range(r/min)
		CH0	K32.0	Wheel speed reaches-0:Don't detect 1:Detect
		CH1/CH2	K26.0	Spindle alarm of grinding wheel servo-0:Don't detect 1:Detect
		CH1/CH2	K17.4	Wheel frequency conversion Spindle alarm signal -0:Nor_open 1:Nor_closed
14	Hydraulic	CH0	K14.6	"Hydraulic motor not started" alarm-0:Prompt 1:Don't prompt
		CH0	K14.7	Hydraulic control function-0:Invalid 1:Valid
		CH0	K14.0	Pressure detection function-0:Invalid 1:Valid
		CH0	K14.1	Pressure detection signal-0:High level alarm 1:Low level alarm
		CH0	DT002	Hydraulic pressure low alarm detection time(ms)
15	Workbench setting	CH0	K35.0	Machine tool type - 0:Surface grinder (single) 1:Gantry grinder (double)
		CH0	K35.1	Workbench type -0:Hydraulic control 1:Servo control
		CH0	K35.2	Travel signal of hydraulically controlled workbench (1) - 00: left and right reversing switch 01: differential count 10: Encoder feedback 11: reserved
		CH0	K35.3	Travel signal of hydraulically controlled workbench (2) - 00: left and right reversing switch 01: differential count 10: Encoder feedback 11: reserved
		CH0	K35.4	When the program feed is held, whether the workbench stops moving - 0:No pause 1:Pause
		CH0	D010	Current operating speed of workbench (hydraulic proportional valve)(M/min)
		CH0	D011	Maximum operating speed of workbench (hydraulic proportional valve) (M/min)
16	lubrication	CH0	K16.3	Lubrication with low oil level-0:Don't detect 1:Detect
		CH0	K16.4	Lubrication with low oil level-0:High level alarm 1:Low level alarm
		CH0	K16.5	Relationship between lubrication and Program operation-0:Non-interlock 1:Interlock
		CH0	K16.6	Start when automatic lubrication is effective -0: No lubrication output 1:lubrication output
		CH0	K31.1	Workbench's lubrication motor fault-0:Don't detect 1:Detect
		CH0	DT013	Start time of manual lubrication (0: Unlimited lubrication)(ms)
		CH0	DT016	Automatic lubrication interval (ms)

NO.	Function	Channel	PAR.	Definition
		CH0	DT017	Autolube output time (ms)
17	Protective door	CH0	K14.2	Protective door-0:Invalid 1:Valid
		CH0	K14.3	Protective door detection signal when protective door is closed -0:Low level 1:High level
		CH0	K14.4	Spindle when the protective door is on-0:Close 1:Don’t close
18	Multi-channel	CH0	K19.5	Multiply adjustment effective mode -0:multiple channels are effective at the same time 1:current channel is effective
		CH0	K30.3	Multi-channel switching-0:Key (K2) 1:Knob (dial switch)
		CH0	K30.4~5	Multi-channel switching mode-00:Single button cycle 01:Knob (dial switch) 10:One key corresponds to one channel 00:Reserved
		CH0	K30.6	"Start" signal in Multi-channel parallel mode -0:Multi-channel is valid at the same time 1:CH1 is triggered
		CH0	K30.7	Working mode after entering Multi-channel parallel mode-0:AUTO 1:Hold
19	Program operation	CH0	K16.7	Spindle, cooling off and G command are in the same section, Spindle, before cooling off -0:Wait for the end of G command 1:Don’t wait
		CH1/CH2...	K29.1	Whether the hand pulse test cut function is effective-0:Invalid 1:Valid
		CH1/CH2...	K29.2	Whether the Hand pulse interrupt function is valid-0:Invalid 1:Valid
		CH1/CH2...	K29.3	Whether the Hand pulse interrupt/intervention function remains effective during program operation-0:Invalid 1:Valid
20	Pulse axis control	CH0	K36.7	Pulse axis (IO-R21T) -0:Not connected 1:Connected
21	Others	CH0	K31.0	Cooling motor fault-0:Don’t detect 1:Detect
		CH0	K31.2	Balance oil pump overload-0:Don’t detect 1:Detect
		CH0	K31.3	Electromagnetic suction cup under-magnetization alarm-0:Don’t detect 1:Detect
		CH0	K31.4	Dressing oil pump overload-0:Don’t detect 1:Detect
		CH0	K31.5	Mist suction machine/magnetic separator/chip removal machine fault-0:Don’t detect 1:Detect
		CH0	K32.1	Low level or pressure of grinding wheel Spindlelubrication-0:Don’t detect 1:Detect
		CH0	K32.2	(Left) Spindle temperature detection of

NO.	Function	Channel	PAR.	Definition
				grinding wheel -0:Don't detect 1:Detect
		CH0	K32.3	(Right) Spindle temperature detection of grinding wheel -0:Don't detect 1:Detect
		CH0	K32.4	Oil/water cooler of (left) grinding wheel Spindle is overloaded-0:Don't detect 1:Detect
		CH0	K32.5	Oil/water cooler of (right) grinding wheel Spindle is overloaded -0:Don't detect 1:Detect
		CH0	K32.6	(Left)Inspection for balancing oil pressure of grinding head-0:Don't detect 1:Detect
		CH0	K32.7	(Right) Inspection for balancing oil pressure of grinding head-0:Don't detect 1:Detect
		CH0	K33.0	Hydraulic motor fault-0:Don't detect 1:Detect
		CH0	K33.1	Hydraulic refrigerator overload-0:Don't detect 1:Detect
		CH0	K33.2	Hydraulic filter element blockage signal-0:Don't detect 1:Detect
		CH0	DT033	Continuous detection time of air pressure and temperature(ms)
		CH0	DT034	Delayed closing output time of mist extractor and magnetic separator(ms)

2.5 Common function settings

The following parameter settings are mainly based on the configuration of CNC internal/external grinder.

2.5.1 System function

NO.	Definition	PAR.	Remarks
1	Command input unit	P00008	Pulse equivalent,Default 0.0001mm;
2	Language of system	P00023	0:Chinese;1:English;
3	Power down ststus of user rights	P00030.7	0:Save;1:Not save;

2.5.2 Alarm settings

2.5.2.1 ESP alarm

1) system parameter setting

NO.	Definition	PAR.	Remarks
1	ESP alarm	P00026.7	0:Check;1:Shield;

2) PLC parameter setting

CH..	K of data list	Content
CH0	K10.5	External ESP on the panel 0:Invalid 1:Valid;

3) ESP function input definition pin number

NO.	Address	Remarks
1	X460.2	8.4 inch screen, additional panel
2	X464.7	10.4 inch screen, independent key panel
3	X464.7	15 inch touch screen, expansion panel

2.5.2.2 Other alarm switches of the system

NO.	Definition	PAR.	Remarks
1	Servo drive alarm	P00026.6	0:Check;1:Shield;
2	Overtravel/limit alarm	P00026.5	0:Check;1:Shield;
3	Motor-encoder direction	P00026.4	0:Check;1:Shield;
4	Bus<IDN>alarm	P00026.2	0:Check;1:Shield;
5	Follow error range	P00026.1	0:Check;1:Shield;
6	All alarms	P00026.0	0:Check;1:Shield;

2.5.2.3 Ladder common alarm switch

NO.	Definition	PAR.	Remarks
1	Emergency retreat	CH1/CH2..,K29.0	0:Invalid; 1:Valid;
2	Overtravel detection signal of each axis	CH1/CH2..,K20.6	0:High level alarm; 1:Low level alarm;
3	Hard overtravel function of each axis machine tool	CH1/CH2..,K20.7	0:Invalid; 1:Valid;
4	Servo drive alarm	CH1/CH2..,K25.*	0:No alarm; 1:Alarm;
5	2nd Spindle abnormal signal	CH1,K17.5	0:High level alarm; 1:Low level alarm;
6	2nd servo Spindle	CH1,K26.1	0:No alarm; 1:Alarm;
7	“Hydraulic motor not started” alarm	CH0,K14.6	0:Prompt; 1:No prompt;
8	1st Spindle abnormal signal	CH1,K17.4	0:High level alarm; 1:Low level alarm;
9	1st servo Spindle	CH1,K26.0	0:No alarm; 1:Alarm;
10	End face Measuring instrumentin-place signal detection	CH0,K34.0	0:No detection; 1:Detection;
11	Cooling motor fault	CH0,K31.0	0:No detection; 1:Detection;

2.5.3 Basic functions of feed axis

2.5.3.1 Basic configuration of feed axis

NO.	Definition	PAR.	Remarks
1	Axis name in program	P2**01	Axis program name, which can be defined

2	Axis is the current axis in the base coordinate SYS	P2**04	
3	Type of control for axis	P2**08.5、6	00:Linear;01:Rotation(Type-A);10:Rotation (Type-B);
4	Motor type	P2**08.0	0:Rotating motor;1:Direct drive motor;
5	Motor encoder type	P2**08.1	0:Relative;1:Absolute;
6	Maximum speed of motor	P2**74	
7	Number of motor encoder lines	P2**73	A6:8388608;A9:33554432
8	Servo drive alarm	CH1,K25.*	0:No alarm; 1:Alarm;
9	Movement direction of axis motor	P2**08.2、3	00:Forward; 11:Reverse;
10	Axis panel key direction	CH1,K23.*	0:Forward; 1:Reverse;
11	Screw pitch	P2**76	Input the actual value of the machine tool screw into this parameter
12	Gear ratio	P2**77/ P2**78	
13	Machine zero	P2**11.0	0:No;1:Yes;

2.5.3.2 Feed axis speed characteristic

NO.	Definition	PAR.	Remarks
1	Hand pulse maximum feed speed	P2**33	Adaptation principle of system acceleration and deceleration: Medium inertia, each F3000~F4000 corresponds to 100ms acceleration and deceleration time; Medium and high inertia, each F2000~F2500 corresponds to 100ms acceleration and deceleration time; Other inertia shall be modified according to actual needs.
2	Hand pulse feed acceleration and deceleration time	P2**52	
3	Fast moving speed	P2**30	
4	Acceleration and deceleration time of rapid movement	P2**49	
5	Speed at fast magnification F0	P2**31	
6	JOG movement speed	P2**32	
7	Maximum moving speed	P2**29	
8	Cutting feed acceleration/deceleration time	P2**52	
9	Maximum closing speed during cutting	P10*15	
10	Initial closing speed of cutting	P10*14	

2.5.4 Spindle function

2.5.4.1 Spindle basic configuration

NO.	Definition	PAR.	Remarks
1	Spindle speed output mode	P10*06.1	0:Gear; 1:Analog quantity (speed);
2	Control type of Spindle	P5**10.1	0: Analog spindle;1:Bus Spindle;
3	Number of first encoder lines	P5**14	
4	Gear ratio	P5**18/P5**19	
5	Maximum analog voltage of Spindle	P5**20	
6	Spindle motor maximum speed	P5**21	
7	Spindle gear maximum speed	P5**22~P5**25	
8	Acceleration and deceleration time to maximum speed	P5**36	
9	Zero-bias voltage compensation coefficient	P5**16	
10	Spindle start default speed	P5**37	

2.5.4.2 Spindle Common Functions

NO.	Definition	PAR.	Remarks
1	Number of second encoder lines	P5**15	
2	C/S axis control	P5**10.0	0:Not enabled; 1:Enable;
3	PLC switching of C/S axis	CH1,K15.7	0:Invalid; 1:Valid;
4	Analog output after RESET	P00039.1	0:Keep; 1:Clear;
5	Analog output after ESP	P00039.2	0:Keep; 1:Clear;

2.5.5 Hand pulse

NO.	Definition	PAR.	Remarks
1	Step size of Hand pulse	P00061~P00064	

2	Hand pulse direction when coordinates increase	P2**09.2	0:Clockwise; 1:Counterclockwise;
3	Hand pulse pulse signal source	P00032~P00034	1- Small hand pulse on the panel,2- External handheld unit
4	Method of hand pulse cutting rate	P00036.2	0:Multiplier hold;1:Speed of Hand pulse;
5	Reverse of trial cutting control program	P00036.3	0:Allow; 1:Not allowed;
6	Hand pulse's ID of trial cut/interruption	P1*007	1-1st Hand pulse,2-2nd Hand pulse,3-3rd Hand pulse;
7	External handheld unit	CH0,K10.6	0:Invalid; 1:Valid;
8	×1000	CH0,K10.7	0:Invalid; 1:Valid;

2.5.6 Software limit

NO.	Definition	PAR.	Remarks
1	Software travel positive/negative limit	P2**15~ P2**16	
2	Software travel limit 2 detection	P2**12.1	0:Don't check; 1:Inspection;
3	Software travel limit 3 detection	P2**12.2	0:Don't check; 1:Inspection;
4	Storage travel limit detection	P10032.0	0:Detection after powering on and returning to the reference point; 1:Power-on detection;
5	Software travel 2 positive/negative limit	P2**17~ P2**18	
6	Software travel 3 positive/negative limit	P2**19~ P2**20	

2.5.7 Tool compensation

NO.	Definition	PAR.	Remarks
1	NO.0 tool offset coordinate system	P70*00.3	0:Invalid; 1:Valid;
2	Execution mode of geometric compensation	P70*00.0	0:Tool movement; 1:Coordinate offset;
3	Execution mode of wear compensation	P70*00.1	0:Tool movement; 1:Coordinate offset;
4	Maximum tool wear	P60*14	

5	Maximum allowable value of tool wear increment input	P60*15	
6	Tool tip radius compensation function	P70*01.1	0:Invalid; 1:Valid;
7	Transition mode of cutter compensation	P70*01.6	0:Straight transition; 1:Arc transition;

2.5.8 Coordinate system

NO.	Definition	PAR.	Remarks
1	G54~G59 status after RESET	P00044.1	0:No change; 1:Set to G54;
2	G54~G59 power off and restart	P00044.2	0:Memory; 1:No memory, power-on is set to G54;
3	G52 local coordinate system after returning to zero	P00044.4	0:Cancel; 1:Don't cancel;
4	G52 after M30/M02	P00044.5	0:Cancel; 1:Don't cancel;
5	G52 coordinate system after RESET	P00044.6	0:Cancel; 1:Don't cancel;
6	System machine coordinate	P00044.7	0:Motor feedback value; 1:Theoretical value of the system;

2.5.9 Measuring instrument signal

NO.	Definition	PAR.	Remarks
1	Common speed I/O signal source	P00002.6	0:G1054.* of PLC signal; 1.X5.* input by IO unit;
2	Effective level of high-speed I/O	P00037.*	0:High level; 1:Low level;
3	Multi-segment G31, cross-signal detection	P00038.0	0:Invalid; 1:Valid;
4	High speed I/O signal response	P00038.1	0:High and low level independent response; 1:Level edge response;

2.5.10 Oblique axis setting

NO.	Definition	PAR.	Remarks
1	Oblique axis setting	P10*35.0	0:OFF;1:ON;
2	Tilt axis angle	P10*36	
3	Axis number of tilt axis	P10*37	

4	Axis number of orthogonal axis	P10*38	

2.5.11 Page related

NO.	Definition	PAR.	Remarks
1	System power-on default page	P00030.0	0:Location page; 1:Drawing reference page;
2	Page switching when executing small segments	P00030.1	0:Valid; 1:Invalid;
3	Figure parameter page display	P00030.2	0:Display the list of drawing parameters; 1:Directly enter the drawing reference project;
4	Screen Saver File	P00030.4	0:Same as the customized boot file; 1:Independent file;
5	Access mode after screen saver	P00030.5	0:Any key; 1:Password;
6	Screen saver timing	P00013	
7	Cursor position after program execution	P00031.1	0:End; 1:Beginning;
8	After MDI program execution	P00031.0	0:Clear; 1:Don’t clear;
9	Auxiliary coordinate display under position	P00031.7	0:Shield display; 1:Display more than one coordinate system;

2.5.12 Operation related

NO.	Definition	PAR.	Remarks
1	Speed smoothing function	P00047.0	0:OFF;1:ON;
2	Transitional acceleration and deceleration mode	P00047.1	0:Liner; 1:S-type;
3	Maximum error of smooth transition	P00049	
4	Function ATAN, ASIN range	P80*00.7	0:-90.0~90.0;1:90.0~270.0
5	Piece count M code (except M2, M30)	P10*08	
6	Maximum error of arc radius	P10*26	

2.5.13 Rigid parameter

NO.	Definition	PAR.	Remarks
1	Servo position feedforward gain	PA25	Set to 100;
2	Servo position loop parameters	PA19	

2.5.14 C/S axis parameters (take the first Spindle as an example)

NO.	Definition	PAR.	Remarks
1	Spindle control type	P50010.1	Set to 1;
2	C/S axis control function	P50010.0	Set to 1;
3	Axis control type	P2**08.6~5	Set to 0 1: Rotary shaft (type A);
4	Servo axis number	P2**06	Set to -1;
5	C/S axis switching control	CH0,K15.7	Set to 1;
6	Number of encoder lines	P50014	Set to the same;
		P2**72	
7	Gear ratio	P50018:P50019	Set to the same;
		P2**77:P2**78	
8	Motor direction	P50011.1~0	
		P2**08.3~2	

2.6 Machine Zero Setting

2.6.1 Machine Zero of Motor with Absolute Encoder

The CNC connection is successful, and the above functional parameters need to be modified, and the machine tool zero point needs to be reset (take X axis as an example, the same below):

Setting steps:

- P20011.0=0 → move machine tool to the “zero” position=0 → 

→ Press  → 

→ he ”Grid value****” occurs that means the”Zero” is set.
- Alternatively, move the machine to the “zero” position → directly modify the axis parameter P20011.0=1 → system records the machine’s current zero position.

NOTICE

1. If the zero should be set again, set the P20011.0=0, reset it again after the system is turned off.
2. Usually, it is uncessary to install the zero deceleration switch of the machine zero

with an absolute encoder; and the machine that with pitch compensation is needed.

2.6.2 Machine Zero Return of Motor with Incremental Encoder

The relevant parameters based upon the connected enabled Level signal, zero return method, direction adjustment of zero return:

Enabled Level of machine zero return deceleration signal: PLC data K24;

Machine zero return method of each axis: P20011.6~7;

The rapid traverse rate during the deceleration of machine zero return along each axis: P20036;

The low traverse rate during the deceleration of machine zero return along each axis: P20037;

Selection of zero return direction along each axis: P20011.5 (0:positive direction; 1:negative direction)

Only the machine zero can be operated after confirming the machine override limit switch is enabled.

Usually, the machine zero installs approaching the top travel, the enabled stravel of the zero block is above 25mm; it is necessary to guarateen an enough deceleration distance for reducing the speed, so that the zero return and machine safety can be guaranteed. The faster the machine tool zero performs, the longer the zero block is; otherwise, the zero block still does not reduce after the planker is rushing over the planger due to CNC acceleration/deceleration and machine inertia, etc; there is no enough decoration distance accordingly to affect the zero precision.

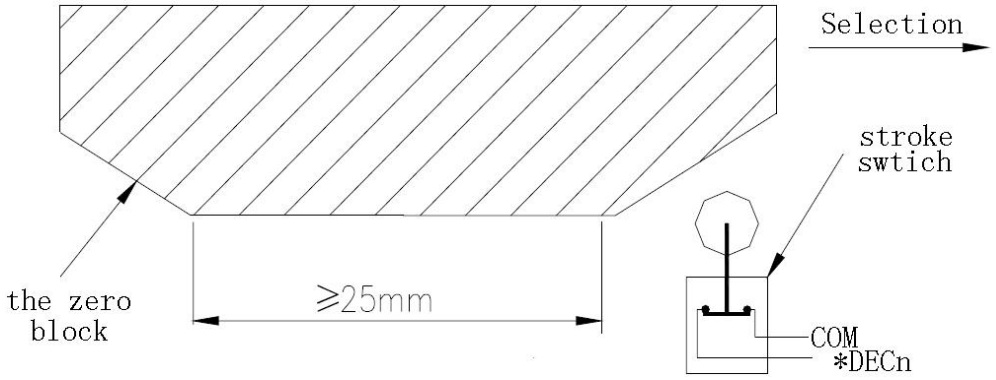


Fig.2-11 The schematic of stroke swtich and one-turn signal of servo motor

Generally, after the deceleration switch is released returning the machine zero when the linear axis is performed zero return. It is better to avoid the critical point position of encoder one-turn signal after the stroke switch is released; and guarantee that the motor reaches to the one-turn signal of encoder after revolving half circle to improve the precision of zero return. The system will be displayed the grid values after the zero return is performed. In the case of the linear connection, it is reseasonable that the grind values are about half of the pitch values.

NOTICE

In the 

mode, the grid values both the current one and previous one will be displayed after the axis zero return is completed; if the bigger grid values are displayed

twice, check whether the zero position is changed or the zero block is loose; alternatively, perform the tool-setting again to avoid the tool-impact accident due to the zero return error.

2.6.3 Machine Zero Offset

Generally, the machine coordinate appears “0.0000” at current after the machine is performed zero return; that is, the zero return position is set to “0”. Alternatively, the current machine coordinate can be set as other values after the zero return is completed; in this case, the zero return operation is also can be called “Zero Return Reference Point”, and then the displayed values are regarded as the offset values of machine reference point (compare to the machine “0” point).

The setting of the offset value is located at the 

page, and the 

sets the position of “reference point 1” at the subpage.

NOTICE

1. Normally, The set “offset value” will not be altered before delivering, it is better to carefully operate it.

2. As for the machine tool coordinate system, the system defaults to the actual position of Encoder, and the value will fluctuate with the motor excitation jitter "0" point, which is a normal phenomenon. Change the parameter P00044.7=1 to display the theoretical value of the machine coordinate.

2.7 Rigid, Interval, Pitch Compensation

2.7.1 Rigid parameters (Velocity Controllable Method)

No.	Definition	Parameter	Remark
1	Velocity proportion coefficient	P2**90	
2	Velocity loop integral coefficient	P2**91	
3	Velocity feedback filtering coefficient	P2**92	
4	Position proportion coefficient	P2**93	
5	Speed feedforward coefficient	P2**95	

2.7.2 Backlash

No.	Definition	Parameter	Remark

1	Compensation value of backlash	P2**12	No.112 parameter of current axis parameter
2	Time of backlash compensation	P2**58	

The backlash compensation value is input by the radius value (actual measurement value), and its unit is the least command output increment. It can be measured by the diagauge, micrometer or laser detector; the precise compensation of backlash compensation can be confirmed the machining accuracy; it is recommended to measure the backlash based upon the following methods:

- Program edit (Z axis is regarded as an example):
  O0001;
  N10 G01 W10 F800 ;
  N20 W15 ;
  N30 W1 ;
  N40 W-1 ;
  N50 M30 .
- It is better to set the backlash error compensation to zero before measuring;
- Single block operation program, find out the measurement basement A after positioning twice, record the current data, and then operation 1mm at the same direction, finally move 1mm to point B at the reverse direction, read the current data accordingly.

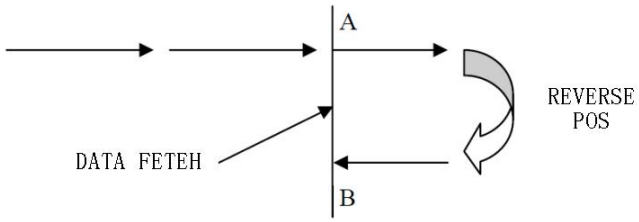


Fig.2-12 Measurement schematic of backlash

- Backlash error compensation value = | Recorded data of point A – Recorded data of point B|; and then the calculated data inputs to the parameter P20112of CNC axis.
  Data A: Read the dialgauge data at the point A;
  Data B: Read the dialgauge data at the point B;

NOTICE

1. In general, it is recommended to enter the reverse clearance compensation value, which is 80%~90% of the measured value.
2. Detect the backlash of the machine tool again after using every 3 months.
3. The backlash compensation value can be evaluated as negative value; in this case, the backlash compensation direction can be altered.

2.7.3 Pitch Compensation

Main parameters of one-way pitch compensation:

No.	Definition	Parameter	Remark

1	Screw pitch error compensation function	P2**09.0	0:OFF;1:ON;(No.109 parameter of current axis parameter)
2	Compensation mode of pitch error	P2**09.2	0:one-way;1:two-way;(No.109 parameter of current axis parameter)
3	Screw pitch error compensation spacing	P2**23	No.123 parameter of current axis parameter
4	Negative farthest end of compensation table	P2**21	No.121 parameter of current axis parameter
5	Reference point of compensation table	P2**20	No.120 parameter of current axis parameter
6	Forward farthest end of compensation meter	P2**22	No.122 parameter of current axis parameter
7	Negative furthest sign of two-way screw compensation	P2**24	No.124 parameter of current axis parameter
8	Reference point reverse movement compensation value	P2**17	No.117 parameter of current axis parameter

- Parameter description:

1) Axis parameter P20120 Axis parameter P20120:pitch error compensation number of reference point of each axis.

Determine the position of the pitch error compensation origin in the compensation table. The number larger than the reference point number represents the compensation point number in the positive direction, and the number smaller than the reference point number represents the compensation point number in the negative direction.

2) Number of axes P20121:the number of the screw pitch error compensation point closest to the negative side of each axis.

The number of the farthest compensation point in the negative direction represents the farthest compensation point in the negative direction. When the distance of the negative coordinate exceeds the number of this compensation point, no pitch compensation is performed, and the compensation values are all 0.

3) Axis parameter P20122: the number of the pitch error compensation point closest to the front side of each axis.

The number of the farthest compensation point in the positive direction represents the farthest compensation point in the positive direction. When the distance of the positive coordinate exceeds the number of this compensation point, no pitch compensation is performed, and the compensation values are all 0;

4) Axis parameter P20123: the number of the pitch error compensation point closest to the front side of each axis.

Set the distance between pitch error compensation points. When this parameter is not 0, pitch error compensation takes effect.

NOTICE

1. All compensation values and compensation interval values are radius values.
2. Power on again after all parameters are modified.

Application examples:

2.7.3.1 Example of negative travel compensation

- Parameters are as follows

PAR. NO.	Setting	Explain
P20109.2	0	Compensation mode of pitch error: 0:one-way;1:two-way;
P20109.0	1	Screw pitch error compensation function: 0:OFF;1:ON;
P20120	10	Pitch error compensation number of reference point of each axis.
P20121	1	The number of the pitch error compensation point closest to the negative side of each axis.
P20122	10	The number of the pitch error compensation point closest to the front side of each axis.
P20123	5.0000	Pitch error compensation point interval of each axis.

- The compensation form is filled in as follows:

Compensation No	1	2	3	4	5	6	7	8	9	10
Compensation Vale	18	-1	7	17	9	-3	4	5	-9	1

Machine coordinate -50 -45 -40 -35 -30 -25 -20 -15 -10 -5 0

2.7.3.2 Example of forward travel compensation

- Parameters are as follows:

PAR. NO.	Setting	Explain
P20109.2	0	Compensation mode of pitch error: 0:one-way;1:two-way;
P20109.0	1	Screw pitch error compensation function: 0:OFF;1:ON;
P20120	0	Pitch error compensation number of reference point of each axis.
P20121	1	The number of the pitch error compensation point closest to the negative side of each axis.
P20122	9	The number of the pitch error compensation point closest to the front side of each axis.
P20123	5.0000	Pitch error compensation point interval of each axis.

- The compensation form is filled in as follows:

Compensation No	0	1	2	3	4	5	6	7	8	9
Compensation Vale	0	-6	7	17	9	-3	4	5	-7	11

Machine coordinate	-5	0	5	10	15	20	25	30	35	40	45

2.7.3.3 Rotation axis pitch compensation

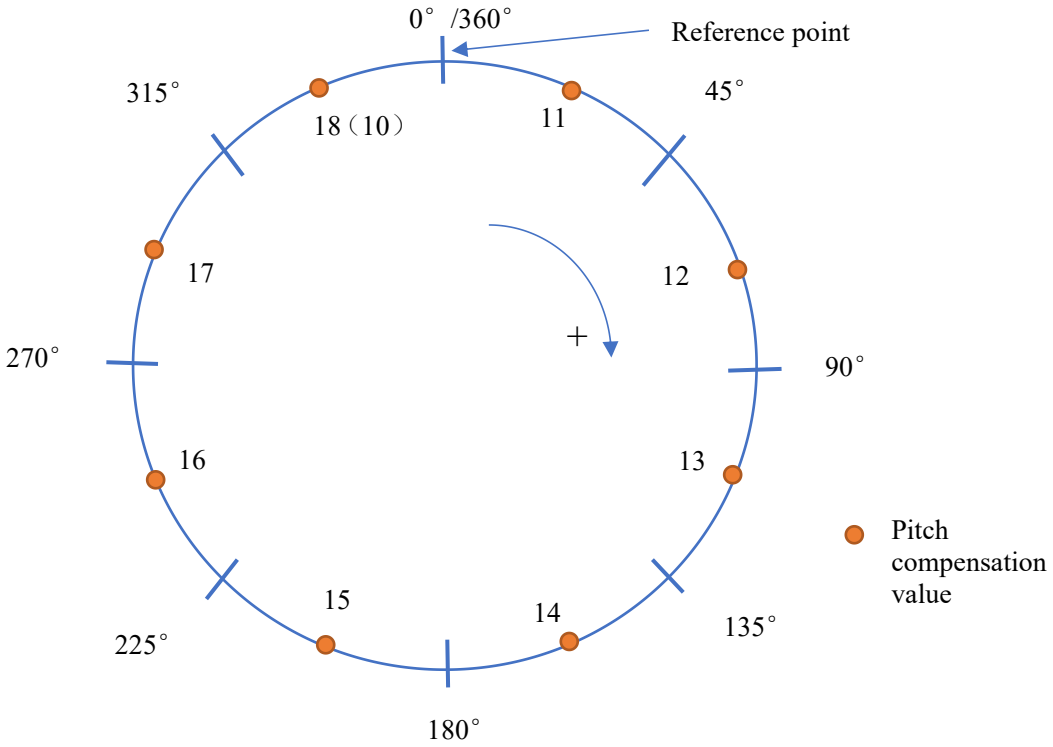


Fig.2-13 Mechanical coordinate diagram of rotating shaft

- The parameters are as follows:

PAR. NO.	Setting	Explain
P20109.2	0	Compensation mode of pitch error: 0:one-way;1:two-way;
P20109.0	1	Screw pitch error compensation function: 0:OFF;1:ON;
P20120	10	Pitch error compensation number of reference point of each axis.
P20121	11	The number of the pitch error compensation point closest to the negative side of each axis.
P20122	18	The number of the pitch error compensation point closest to the front side of each axis.
P20123	45.0000	Pitch error compensation point interval of each axis.

- The compensation form is filled in as follows:

Compensation No	10	11	12	13	14	15	16	17	18	19
Compensation Vale	0	30	-66					70	24	0

Machine coordinate	0	45	90	135	180	225	270	315	360

NOTICE

1. The sum of the compensation amount from 11 to 18 must be 0, otherwise the compensation amount of the pitch error will be accumulated every turn, causing the position offset.

2. The compensation data of the rotating shaft must be set within a range of transferred momentum in the positive direction when designing. If the actual operation is within the range of one transferred momentum in the negative direction, one transferred momentum must be added to convert to the range of one transferred momentum in the positive direction.

E.g.:

When setting the compensation value of - 45 ° position, you should first set - 45 °+360 °=315 °, and then set the compensation value of - 45 ° position on the corresponding compensation serial number of 315 °.

2.7.3.4 Bidirectional pitch compensation

In addition to one-way compensation parameters, the following parameters need to be modified:

PAR. NO.	Setting	Explain
P20109.2	0	Compensation mode of pitch error: 0:one-way;1:two-way;
P20117	1	The compensation value of the pitch error returned to the reference point from the direction opposite to the return direction of the reference point
P20124	10	The closest compensation number of two-way pitch error compensation to the negative measurement

- Parameter interpretation:

1) Axis parameter P20117: pitch error compensation value returned to the reference point from the direction opposite to the return direction of the reference point.

The return direction of the pitch error compensation value of the reference point returned from other positions of the axis is opposite to the return direction of the reference point.

2) Axis parameter P20124: the compensation number closest to the negative measurement for two-way pitch error compensation.

When the two-way pitch error compensation is effective, the compensation number of the starting point of the negative compensation value is shown as follows: the starting point of the compensation table moving in the negative direction always starts from parameter P20124.

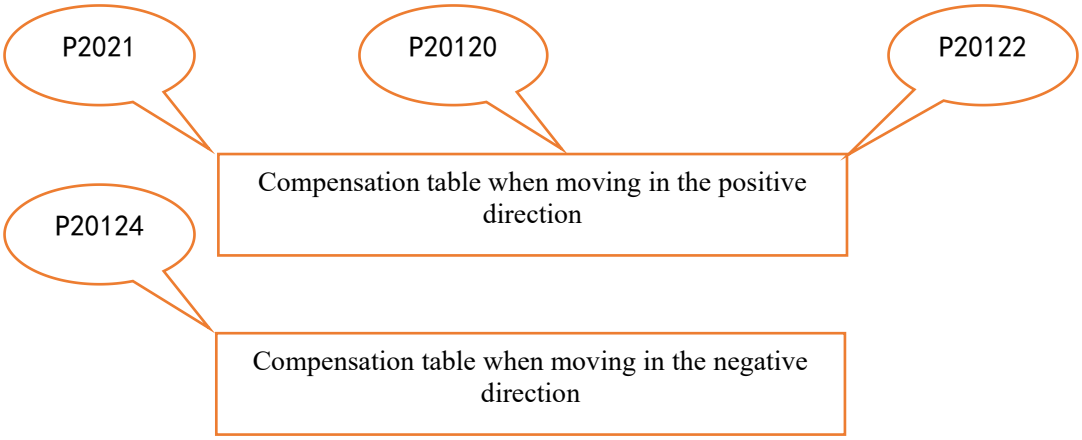


Fig.2-14

- Application examples:

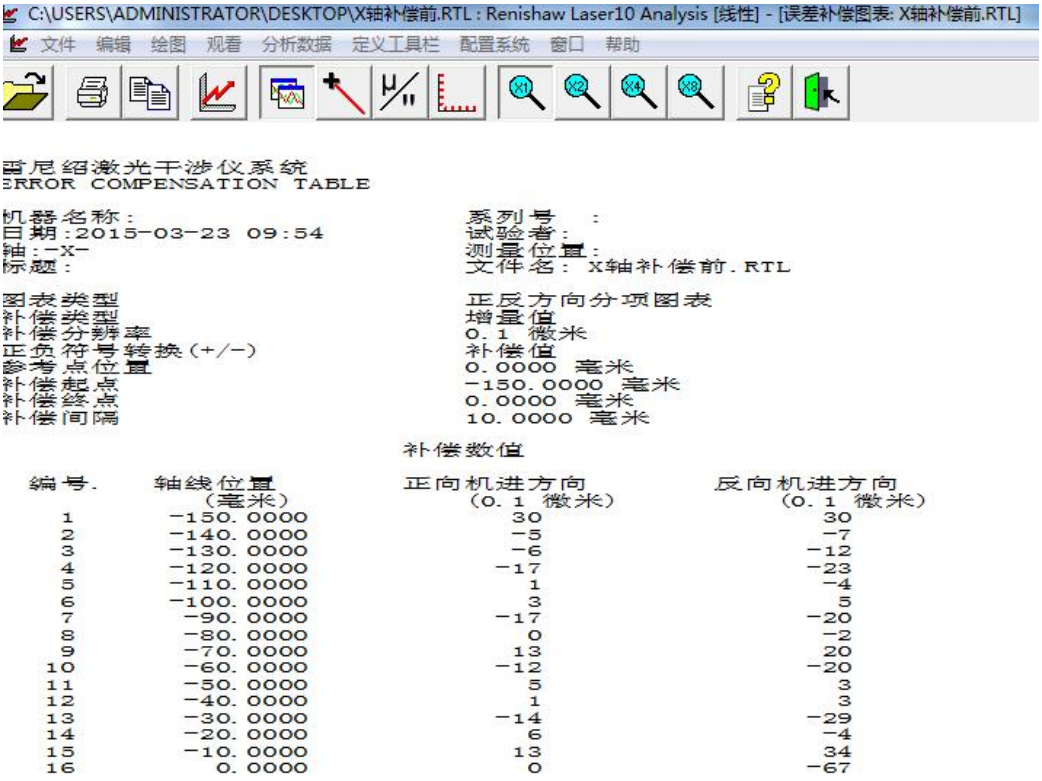


Fig.2-15

The above is the bidirectional pitch error compensation data of Axis X generated by the laser interferometer, so the parameter settings are as follows:

PAR. NO.	Setting	Explain
P20109.2	1	Compensation mode of pitch error: 0:one-way;1:two-way;
P20109.0	1	Screw pitch error compensation function: 0:OFF;1:ON;
P20120	15	Pitch error compensation number of reference point of each axis.
P20121	1	The number of the pitch error compensation point closest to the negative side of each axis.
P20122	15	The number of the pitch error compensation point closest to the

		front side of each axis.
P20123	10.0000	Pitch error compensation point interval of each axis.
P20117	-0.0067	The compensation value of the pitch error returned to the reference point from the direction opposite to the return direction of the reference point
P20124	260	The closest compensation number of two-way pitch error compensation to the negative measurement

Positive compensation value:

Compensation No	0	1	2	...	...	...	...	14	15	16
Compensation Vale	0	30	-5	...	...	...	...	6	13	0

Negative compensation value:

Compensation No	260	261	262	...	...	...	...	274	275	276
Compensation Vale	30	-7	-12	...	...	...	...	-4	34	-67

NOTICE

1. The compensation point number shall meet the following requirements: negative point number<=positive point number, positive point number>=reference point number, negative point number<=(reference point number+1), otherwise the compensation will not work.

2. The speed of pitch error compensation is limited to zero return low speed (parameter P20037).

2.8 Backup/Recovery

→


→


Select "Local Backup/Restore" and "One click Backup/Restore".

Among them, "local backup/recovery" is based on the internal FLASH of the system for backup/recovery operations; One click backup/restore is an operation between the system and the USB flash disk.

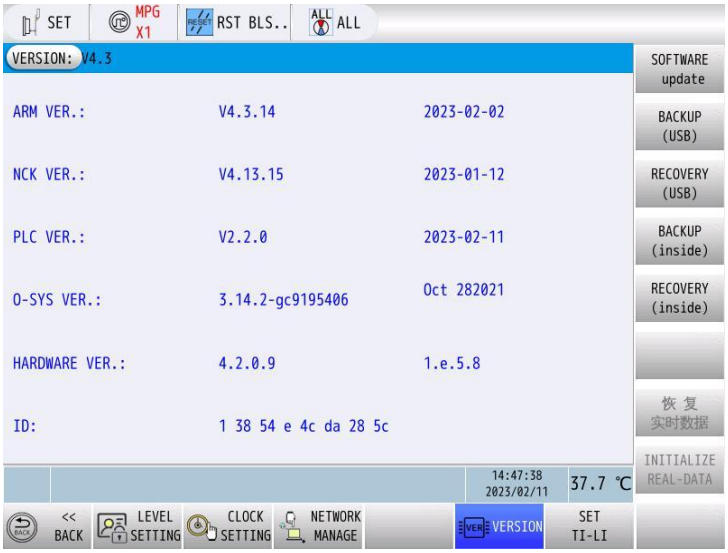


Fig.2-16

2.8.1 Local Backup/Restore (NC< → NC)

After execution BACKUP (inside) RECOVERY (inside) , the system pops up a confirmation box of "Whether to perform local backup/recovery". After confirmation, the operation can be completed after power failure and restart.

2.8.2 One click backup/restore (NC< → USB)

After execution BACKUP (USB) RECOVERY (USB) , the system pops up a confirmation box of "Whether to perform one click backup/recovery". After confirmation, the operation can be completed after power failure and restart.

NOTICE

1. Due to the system kernel, the system does not accept paths with Chinese characters. If there is a copy or backup failure message, please contact the manufacturer for handling.

CHAPTER THREE SYSTEM FUNCTION

3.1 System Function

The functions of different CNC are different, please refer to the relevant Technical Guide or consult the system manufacturer.

3.2 Full-Closed Loop Control (Grating Ruler)

Mostly, the CNC uses the semi-closed loop control for the machine tool; relatively, the adjustment is simple in the mechanical accuracy and environmental allowable range, just consider the stable control of the motor and the adequate torque output. Generally, the basis parameter (It is necessary to adjust the rigid based upon the loading) adjustment can be met the use requirements.

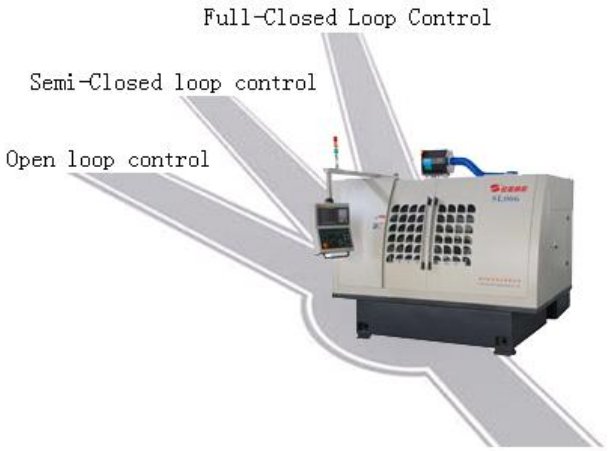


Fig.3-1 Common-use mode of CNC

The promotion of machining accuracy is restricted by some limitations, such as the environment and mechanical precision, etc. More and more machine tools are added the feedback measurement components, e.g., the optical grating and magnetic grating, etc. The CNC should be treated the feedback data in real-time, and adjust the output command to met the various machining requirements. It is recommended that the CNC owns the full-closed loop controllable method to carry out the higher control performance. However, improve the accuracy of machine tool while using the full-closed control, there are different disadvantages caused by various factors, e.g., vibration and interference, etc. are especially obvious in CNC machine tool and the parameter diagnosis in CNC. The common parameter diagnosis methods will be described in the following content.

NOTICE

External feedback measure components are not only restricted on the common grating and magnetic rulers, etc., but also included the temperature data unit, vibration gauge. In order to convenient to describe, the grating ruler will be unified in the following content.

3.2.1 Half-Closed Loop Control

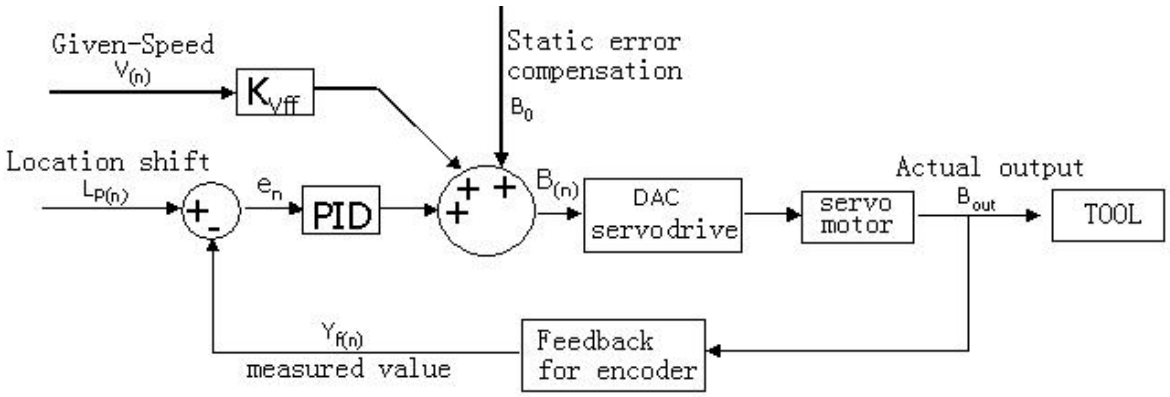


Fig.3-2 Semi-closed loop control

The regular semi-closed loop controllable mode, the parameter diagnosis is subject on the rigid adjustment, mainly adjust PA15~19 of servo parameters. See Servo User Manual for specific operation.

3.2.2 Single Position Loop Control

In the actual application, the full-closed loop control of CNC can be divided into single-position control and dual-position loop control.

In the case of the environment and the allowable mechanical precision, it is suggested to use the single-position loop control; that is, CNC is only adjusted by collecting the grating ruler data (the machine tool's current position), and the data value is less and the parameter diagnosis is simple correspondingly.

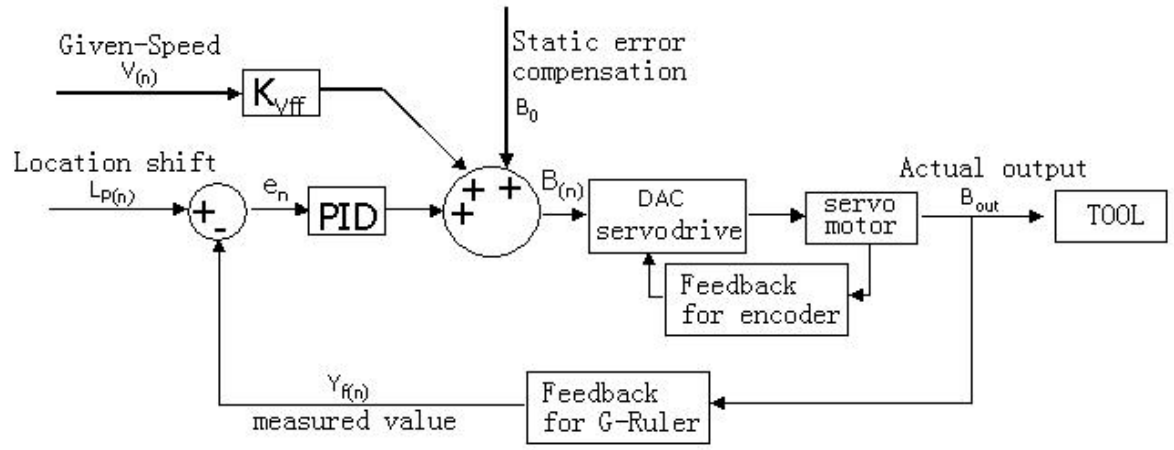


Fig.3-3 Single-position loop control

3.2.3 Dual-Position Loop Control (Grating Ruler)

In the case of the bigger environmental interference and the less of the mechanical precision, the harmonic value of grating ruler feedback signal exceeds the range of the system restriction; in this case, it is suggested to use the dual-position loop control. Simultaneously, the CNC should be read the grating ruler and the motor's real-time data to adjust the command. The data value is bigger and the parameter diagnosis is complicated.

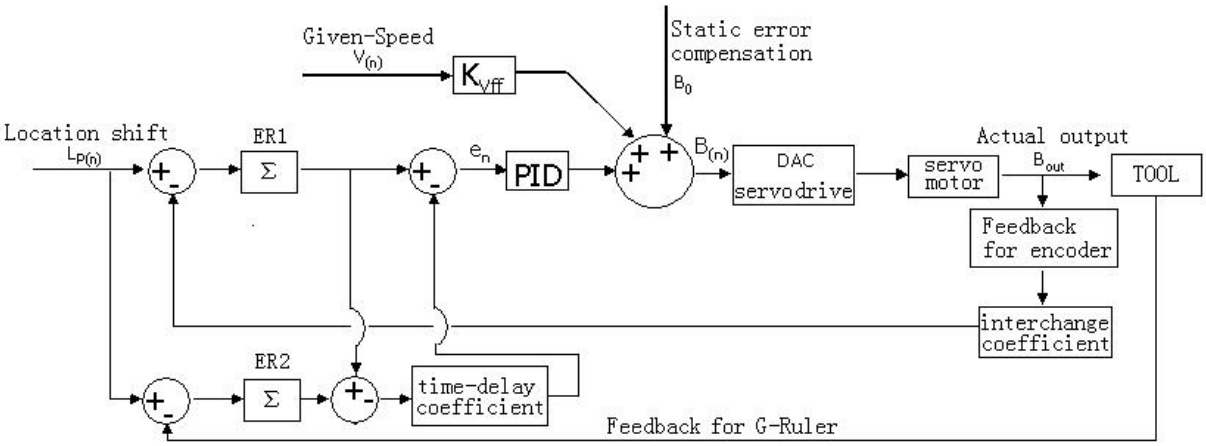


Fig.3-4 Dual-position loop control schematic

3.2.4 Parameter Adjustment

Axis parameter

P	2	*	*	8	9

Dual-pos	fictitious	Coder		direction		type	feedback

Bit0: 0 = Grating ruler feedback is invalid

1 = Grating ruler feedback is effective

Bit1: 0 = Incremental grating ruler

1 = Absolute grating ruler

Bit3: 0 = The grating ruler signal is in the same direction as the motor movement direction

1 = The grating ruler signal is opposite to the motor movement direction

Bit5: 0 = The servo drive uploads two code disks at the same time, which is invalid

1 = The servo drive uploads two code disks at the same time, which is effective

Bit6: 0 = Machine coordinate of virtual axis, pulse function fed back by reading<CN21>is invalid

1 = Machine coordinate of virtual axis, pulse function fed back by reading<CN21>is effective

Bit7: 0 = Dual position ring function is invalid

1 = Dual position ring function is effective

P	2	*	*	9	6	Number of lines of (circular) grating

Number of lines of (circular) grating (Absolute)

P	2	*	*	9	7	Resolution of raster ruler (nm)

Resolution of raster ruler

P	2	*	*	9	8	Maximum value of grating ruler (absolute type) multi-turn

Maximum value of grating ruler (absolute type) multi-turn counting

P	2	*	*	0	0	PID regulation range (mm)

PID regulation range is used to limit mechanical oscillation caused by slight error

P	2	*	*	0	1	Maximum error of double position loop

Maximum allowable error of double position loop

P	2	*	*	0	2	Double position loop adjustment cycle (mm)

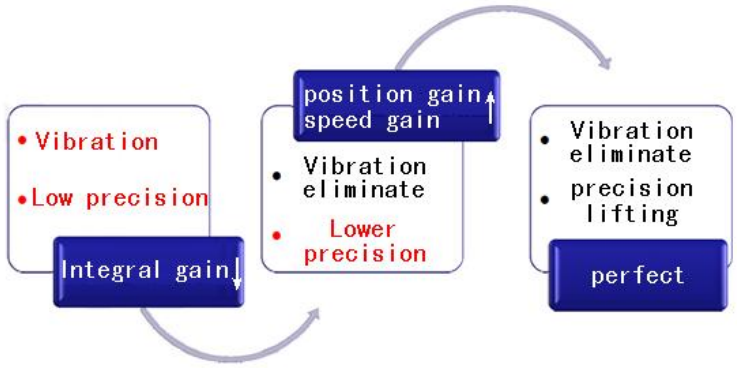
Double position loop adjustment cycle

NOTICE

1. The P2**89.5~6/P2**00/P2**01 are not need to be adjusted when single-position loop is controlled;

2. The adjustment sequence of parameter is “firstly adjust the velocity loop, and then the position loop”. At 1st time, set the parameter other than the above-mentioned P2**00 and P2**01, and then move the measure performance of machine tool; the basis performance

parameter (velocity loop proportional gain of servo motor, velocity loop integral coefficient, velocity feedback filtering coefficient) and direction should be adjusted when the vibration, noisy, creep and weak strength are generated:



3.2.5 Application Example

The screw rod and guide line are wore seriously for the reform of one machine tool, as well the big noise for machine, unsatisfactory machining accuracy and wide tolerance resolution.

Treatment: The X axis is regarded as an example, increase the grating ruler (LC415(30bit,270mm,EnDat2.2) of HEIDENHAIN), the parameter settings are shown below:

➢ Connection

(1) According to the installation requirements of the Grating ruler, install it on the machine tool

(2) The servo uses GR2000T-LA2 and is connected to CN3;

(3) Driving parameters:PA93=10;PA95=500;PA96=51;PA97=0;

(4) CNC parameters:P20089.0=1;P20089.1=1;P20096=30;P20097=10;P20098=65535;

(5) Reset the machine zero point after power off and restart.

➢ Rigid setting

(1) The position proportional gain P20090 is set as the initial value 8;

(2) Servo rigid PA15/PA16 parameters to reduce the relevant value by about 20%;

(3) Set P20112 to 0 (cancel reverse clearance compensation);

Unit set loop control:

(4)P20089.5=0;P20089.7=0;

Double position loop control:

(4)P20089.5=1;P20089.7=1;P00001.0=1;

3.2.6 Precautions

- At present, the grating ruler used by CNC is increment, and the signal is the square-wave signal (TTL Level) with difference. It is better to consult the manufacturer before using the absolute grating ruler.
- The accuracy of grating ruler can not be excessive low when using it; otherwise, the mechanical resonance on the machine tool may easily occur.
- The malfunction of the detection components (grating ruler, encoder, etc.) may be easily caused by the service environment (vapor, oil mist and dust, etc.). Be careful before installing.
- Full-closed loop control asks a high coordination precision for the mechanical driving structure. The servo adjustment vibration may be generated when the excessive interval or error of the machine occurs. It cannot be regularly used when the high-frequency noise on the machine tool occurs and therefore it is recommended to strictly control the mechanical error.

3.3 Other Functions

3.3.1 Emergency Restriction (Protection)

The overall operations of the machine tools are immediately stopped when the grinding machine meets the accidents by using the “ESP” operation, and it probably crowds and kicks off the workpiece due to the inertia of the grinding spindle. Therefore, the grinding wheel should be immediately departed from the workpiece to protect the tool and prevent the workpiece from the fixture.

In the emergency state, the CNC instantly interrupted the current feed state, so that the corresponding axis moves a piece of distance at the rapid traverse rate. If the current CNC, in the axis synchronous state, triggers to stop, and the CNC keeps the current synchronous state, the corresponding axis completes the ESP operations accordingly; the synchronous state (PLC logic implementation) is then cancelled after the emergency stop is completed.

System parameter: P20010.0 (Emergency retraction distance mode), the distance of emergence is performed based upon the increment state when bit0=0; retract to the corresponding coordinate position of machine tool when bit0=1.

P20081 Emergency retraction distance.

K29.0 PLC function is invalid/effective;

X0.0 Input address.

G66.4 PLC signal.

The specific ladder diagram is as follows:

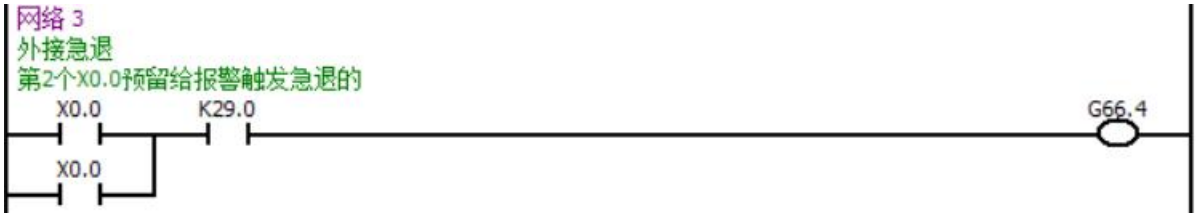


Fig.3-5

3.3.2 Multi spindle output

Number of spindles:P00005.

Spindle speed assignment mode:P00039.3.

IP code of the selected spindle in multi spindle:P50006.

- P00039.3=1:

When there are multiple spindles, the spindle speed output is: “S**** IPn(n=1,2,……)”.

When the number of spindles is 1, the spindle speed output is: “S****”or“S**** IP1”;

When the number of spindles is 2, the speed of 1st spindle is :“S****”or“S**** IP1”; the speed of 2nd spindle is :“S**** IP2”.

- P00039.3=0:

The format of the spindle output is “M3 S****”“M16 S****”. Wherein, M3/M16 specifies "G27.0~2" spindle selection bit in PLC.

NOTICE

1. The axis configuration of the C/S axis is dominated by the spindle configuration, and then select P50010.0 to specify whether to enable the C/S axis;

3.3.3 Multi-core Positioning of Rotation Axis (C/S Axis)

The positioning can be directly specified by “C****” when the C/S axis is specified the positioning by this axis, e.g. the axis C.

If the positioning position exceeds 1 circle and the axis C positioning “****” exceeds ±99999.9999, the method of adding the specified circle numbers: “CC****”; the 1st “C” means circle numbers, the 2nd “C” means the specified axis name of the current C/S axis.

E.g.: Axis A rotates 10000 degree per circle per minute, refer to the following programming:

G1 A10000 F360; Equivalent to G1 CA27 A280 F360;

When a rotation axis is performed a programming and when an absolute command is regarded as end coordinate, its stroke is (-360°~ 360°). When the specified end coordinate exceeds this stroke, the end coordinate will be rounded; e.g., 370° becomes 10°; -400° becomes -40°.

The exceeded stroke (-360°~ 360°) can be specified when using the incremental commands.

E.g.:

G0 C0	Actual movement	completed coordinate
G0 C10	+10	10
G0 C180	+170	180
G0 C370	-170	10
G0 C-500	-150	-140
G0 C360	140	0

E.g.:

G0 H0	Actual movement	completed coordinate
G0 H10	+10	10
G0 H180	+180	190
G0 H370	+370	200
G0 H-500	-500	-300
G0 H360	+360	60

E.g.:

G0 H0	Actual movement	completed coordinate
G0 H10	+10	10
G0 C180	+170	180
G0 H370	+370	190
G0 H-500	-500	-310
G0 C360	+310	0

If the G01 is used, F100, 100 means that the revolving speed of the rotation axis is regarded as 100°/min. The rotation axis can be performed the specified circles by using the appointed characters and commands;

E.g.: G01 CC21 F6000;

Revolving axis C moves 21*360°; that is, positively rotate 21 circles, speed 6000°/min.

G01 CC-13 F5000

Revolving axis C moves -13*360°; that is negatively rotate 13 circles, speed 5000°/min.

3.3.4 MPG Function

The MPG function provided by CNC divides into: MPG insertion and MPG intervention.

- **MPG insertion**

Program performs the MPG intersection command, and block locates at the feed hold state; in this case, the MPG insertion function is enabled, which can be controlled the axis movement by axis selection and override selection to eliminate the null (without cutting value) or tool-setting. At present, the command is performed by pressing the 

again.

Command: M87 (It specifies by PLC)

Command format: Line separately;

Coordinate alteration: Workpiece coordinate system and machine coordinate system are simultaneously altered.

- **MPG intervention**

Program executes the MPG intervention command, the following blocks are consecutively operated. The position of any blocks can be moved the command value by MPG overlapping before receiving the closed MPG intervention command; the overlapped command values are directly reacted at the machine coordinate system, and the workpiece coordinate system does not affect, and the value deviated by machine coordinate system will be compensated to the workpiece coordinate system till the close of the MPG intervention commands are received.

Command: M88_ Open the interference function of MPG (PLC specified, PLC signal G23.0=1,G23.1=0);

M89_ Close the interference function MPG (PLC specified, PLC signal G23.0=0);

Command format: Line separately;

Coordinate alteration: During the intervention of MPG, the shifting value of intervention is overlapped to the machine tool coordinate system, and its workpiece coordinate system does not change; the shifting value of invention will be compensated to the workpiece coordinate system till the MPG intervention function is closed.

NOTICE

It is recommended to use the external Hand Unit for the above-mentioned functions; otherwise, the MPG axis-selectable function on panel can be restricted in CNC state (PLC setting).

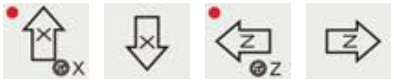
3.3.5 Manual Intervention

Manual intervention, is also called Manual insertion displacement value. Previously set the insertion value in parameter P20147 along each axis.

when the enabling is enabled (G23.0=1,G23.1=1,PLC equals) and the program is performed at any time, and then press the axis movable button, the axis movement state of each axis is valid accordingly. The machine tool position, namely, offset (overlapping) the setting value at the current position, and its overlapped instruction values will be directly reacted on the coordinate system of machine tool; as well, the workpiece coordinate system is unaffected. The deviated value of the coordinate system of the machine tool will be compensated to the workpiece coordinate system until the close intervention enabling (G23.0=0,PLC equals) is received or after the working method is shifted, the value of the deviated by machine coordinate system will be compensated to its workpiece coordinate system.

Parameter: P20147 (Its positive/negative value can be determined by controllable direction of buttons);

Address definition: PLC signal G23.0=1,G23.1=1;

Button operation: The axis movable buttons  in Auto mode;

Coordinate variety: The displacement value of intervention is overlapped to the coordinate system of machine tool during the MPG interference, and the workpiece system is invariable, until the MPG intervention function is closed, and the offset value of intervention will be compensated to the workpiece coordinate system.

3.3.6 Macro Variable Note

CNC provides the macro variable note function, and it is continent to memory and define the variable during using.

Open the file “McroName.txt” provided by CNC on the PC, fill in the variable notes based upon its requirements (Note: the system displays in the form of show left position), refer to the following figure:

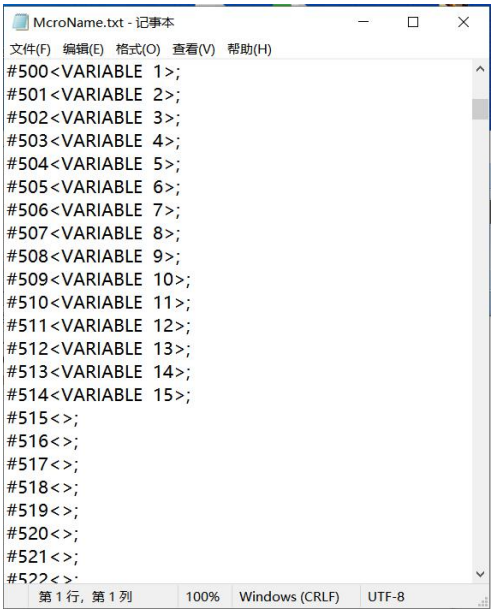


Fig.3-6

In the 

, lead to the root list “SysParameter\Prog” of CNC by U disk, the page is shown below after CNC is restarted.

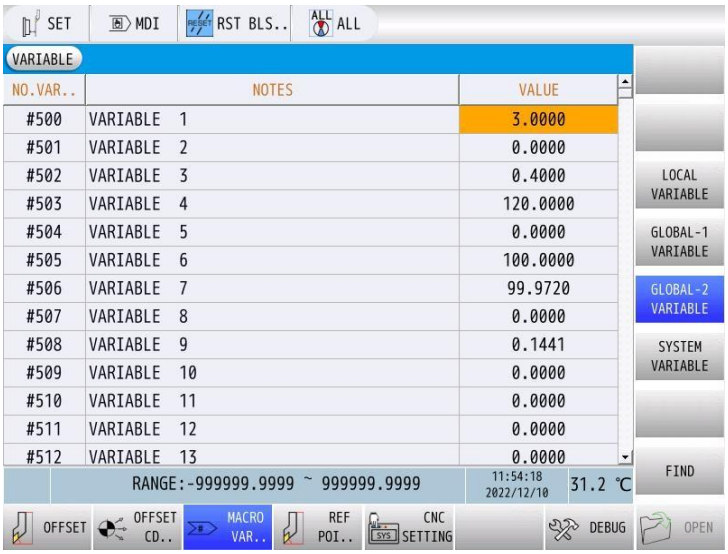


Fig.3-7

3.3.7 Personalized startup page

CNC can choose to customize the personalized background function after the short-lived GSK trademark is displayed on the computer.

- The image is made into a size of 600*800, format of BMP, name of "start.BMP", and imported into the "Other" root directory of CNC through a USB flash drive in 

.

- Effective after restart.

3.3.8 Customize actions/display pages

This function reference《Studio User Guide》.

3.3.9 Oblique-axis Linkage/Non-linkage

3.3.9.1 Oblique-axis concept

When the given axis is not perpendicular to the vertical axis by 90 ° but forms an angle, the axis is called the oblique axis. At this time, the oblique axis control function controls the travel distance of each axis according to the tilt angle. In the oblique axis control function, it is generally defined that X is the oblique axis and Z is the vertical axis.

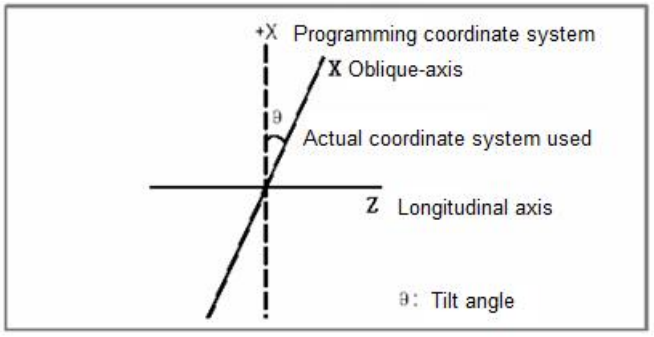


Fig.3-8

When the oblique axis is X axis and the vertical axis is Z axis, the travel distance of each axis is calculated according to the following formula:

The calculation formula of the travel distance along the X axis is:

$$X_a = \frac{X_P}{Cos\theta}$$

The travel distance along the Z axis superimposes the bevel offset of the X axis, and is calculated as follows:

$$Z_a = Z_P - X_P Tan\theta$$

The feed rate component along the X axis is calculated according to the following formula:

$$F_a = \frac{F_P}{Cos\theta}$$

Xa, Za, Fa: actual distance and speed;

Xp, Zp, Fp: distance and speed of programming.

3.3.9.2 Related parameters

The basic axis is X axis and Z axis. At this time, the oblique axis is fixed as X axis and the vertical axis is fixed as Z axis. Set the parameter "P10036 Inclined angle of oblique axis" as the relevant angle. Turn on the oblique axis function P10035.0 and change it to 1. After power failure and restart, the oblique axis function will take effect.

3.3.9.3 Command

- Command Format

  Linkage M90 (PLC address G63.5=1)

  Non-linkage M91 (PLC address G63.5=0)

  Machine coordinate selection G53

- Command Explanation

Linkage: In the state of the obilique axis, x axis moves, and the Z axis machine can be simultaneously moved based upon the relationships of oblique angle, as well the absolute coordinate invariable.

Non-linkage (Cancel the linkage): In the state of the obilique axis, x axis moves but the Z axis machine does not, and its absolute coordinate varies according to the oblique angle.

Machine coordinate selection: Positioning using the machine coordinate system is independent of the absolute coordinates of each axis. See the User Manual for details.

- Linkage and Non-linkage in the program

Linkage in the program (M90), CNC executes the program according to the X/Z axis oblique axis relationship, the corresponding tool setting machine coordinate position, and the machine position remains unchanged;

Non-linkage in the program (M91), CNC executes the program according to the X/Z axis oblique axis relationship, corresponding to the absolute coordinate position of tool setting. The machine tool position changes, and the offset value is $X_P T\mathrm{an}\theta$;

3.3.9.4 **Application Example**

There is an angle α that its X axis is perpendicular to Z axis from one machine tool manufacture; refer to the right-down figure:

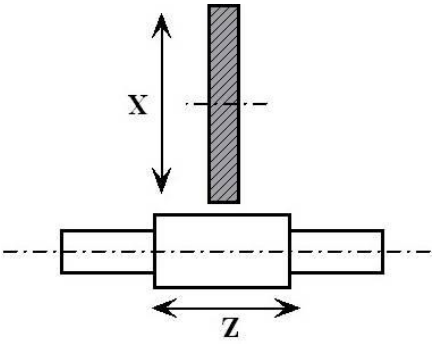


Fig.3-9 Convention grinding schematic

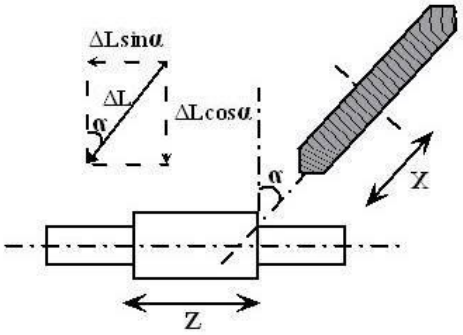


Fig.3-10 Grinding schemetic of oblique axis

➢ Measure the angle, refer to the following steps:

(1) Complete the debugging of the overall machine function and capacity (main motor performance and mechanism accuracy, etc.);

(2) Clear the parameter P10036 to 0 before measuring the angle;

(3) Move the Z axis to the suitable position, place the stand of dial gauge at the Z axis; its indicator is perpendicular to the Z axis and eject one plane of X worktable;

(4) System calls the MPG or single-step, slightly move by controlling X axis; stably moves and indicator clears.

(5) Move a long distance by controlling MPG with unidirection, record the movement value of MPG; simultaneously, record the movement value ΔL of X axis shown by system;

(6) Repeat the stesp (3) ~ (5), if we take 5 ~ 10 points, then calculate: arc cosα=L/ΔL;

(7) Remove a miximum value and a minimum value from the calculated values, average the remaining values from which the gained angle fills into the P10036;

➢ Tool setting (sub coordinate system)

(1) Under the manual pulse state, select the "linkage or non linkage" state, and try to cut the workpiece in the "Settings" page - "Coordinate Settings",chose X or Z ,enter the tool setting size and press ENTER OK;

(2) Switch to the "Linkage" status, MDI or single section execution inspection tool setting position;

NOTICE

1. There are no direct relationships among the reverse interval, pitch error and oblique angle, and it is better to shied the oblique angle before measuring (P10036＝0);

2. Oblique axis programming should be performed based upon the rectangular coordinate system of drawing;

3. It is better to position by using the G53 direct machine coordinate system for ensuring the efficiency (Velocity may relatively reduce when the linkage position is performed) when the oblique axis is positioned, especially, the machine with the end-face apparatus positioning is more convinient (The positioning of machine coordinate system can be reduced the accuracy positioning time due to different size of the error of the horizontal workpiece);

4. The selection of the linkage/non-linkage mainly guarantees the consistence of zero point; note that the offset change regulation of zero should be consistent in conpensating when carrying out the grinding wheel wearing and the trimming compensation by using the cutter compensation, coordinate offset, etc;

5. The input oblique angle can not avoid any error, and therefore, the absolute error may bigger when several workpieces and the workpiece with bigger error in outer dimension are processed; it is note to adjust the machining dimension;

6. It is recommanded to divide the trimming end-face and radial diamond pen when the grinding wheel of oblique axis is trimmed; avoid the error caused by the interference of the nip (The cutter radius compensation can be achieved the single nip, but the effect is not ideal);

7. The principle of linkage/non linkage is to "ensure the consistency of zero point". When tool compensation, coordinate offset and other methods are used to realize grinding wheel wear and dressing compensation, pay attention to the consistency of zero point offset change rule during compensation. That is to say, after the grinding wheel is trimmed, it will be compensated after the longitudinal trimming (X direction). The X direction will be offset according to the conventional offset, and the Z direction offset will be calculated at the same time.

Assume that the oblique axis angle is 30 degrees, the X direction is trimmed by 1mm (diameter), and the Z direction deviation is 0.2887mm.

3.3.10 Meter function

3.3.10.1 System parameter setting

No.	Definition	Parameter	Remark
1	General speed I/O signal source	P00002.6	0:PLC’s G1054.*;1:X5.* of IO unit input;
2	High speed I/O effective level	P00037	0:High level; 1:Low level;
3	Multi segment G31, cross signal detection	P00038.0	0:Invalid; 1:Effective;

4	High speed I/O signal response	P00038.1	0:High and low level independent response; 1:Level edge response;

3.3.10.2 PLC data list K parameter setting

CH..	Date for K	Content
CH0	K34.0	End face gauge in place detection function: 0=invalid;1=valid;
CH0	K34.1	Path vector meter 1 in place detection function: 0=invalid;1=valid;
CH0	K34.2	Path vector meter 2 in place detection function: 0=invalid;1=valid;
CH0	K34.3	Meter signal after ESP:0=Not Hold;1=Hold;
CH0	K34.4	Meter signal after reset:0=Not Hold;1=Hold;
CH0	K34.6	Output Status of Y0.5:0=Output switching of radial 1 and end face gauges;1=Output switching of radial 1 and radial 2 gauges;

3.3.10.3 PLC data list DT parameter setting

CH..	Date for DT	Content
CH0	DT30	Detection time of meter advance and retreat in place, unit: ms

3.3.10.4 Macro variable address of the meter

Meter signal P0~P7 corresponds to PLC signal G57.0~7;

PLC signal G57.0~7 corresponds to variable #1024~#1031.

3.3.11 Connecting PC terminals

The current function description needs to be supplemented.

3.3.12 Servo self diagnosis

The current function description needs to be supplemented.

CHAPTER FOUR BASIS OPERATION

4.1 Page Shift

4.1.1 Main Page Shift

The edit panel of CNC host provides page shift buttons, which can be shifted to and fro among the seven big pages, e.g.: Position, Program, Graph, Setting, System, PLC and Information; refer to the following buttons:

Fig.4-1

4.1.2 Sub-Page Shift

- **Soft Button Shift (Below the Screen)**

The soft buttons on its corresponding page are displayed below the screen, wherein, black means the sub-page shifting, blue means the corresponding operation for this page, and blue background means the current page or operation (reserved), refer to the following figure:

Fig.4-2

4.2 Data Input

- **Programming Input**

Press the key directly once to complete the entry of the current character, press the key again to switch to the upper character, press the key again for 3rd time to confirm the entry and input 1st character again, and so on.

- **Input of Coordinate Setting, Marco Variable, Parameter and PLC Data**

The corresponding input frame is cleared after pressing the INPUT ; confirm the input by the ENTER button after the corresponding characters are input.

- **Offset Setting**

Press the X, Z, Y and C based upon the corresponding axis characters when the absolute value inputs; Press the U, W, V and H in the relative input, and then directly input the corresponding characters after the dialog frame occurs, then confirm it by pressing the ENTER Or press the increment in the upper right corner + INPUT to enter a value.

4.2 Data Searching

Data dialog shows by pressing the FIND , input the completed characters to be searched, that is, it automatically skips to the searched position by pressing the ENTER press the ⇧ or ⇩ if you want to search again.

The FIND function can be searched the character, program, variable, parameter and PLC address, etc.

4.4 Lead-in/Lead-out of File

4.4.1 File Operation

The sub page FILE MANA.. realizes file interaction between CNC and USB flash disk, including copying, data backup and recovery;

程序 PRG → FILE MANA.. Insert USB stick → After identification, refresh the USB flash disk information, as shown below:

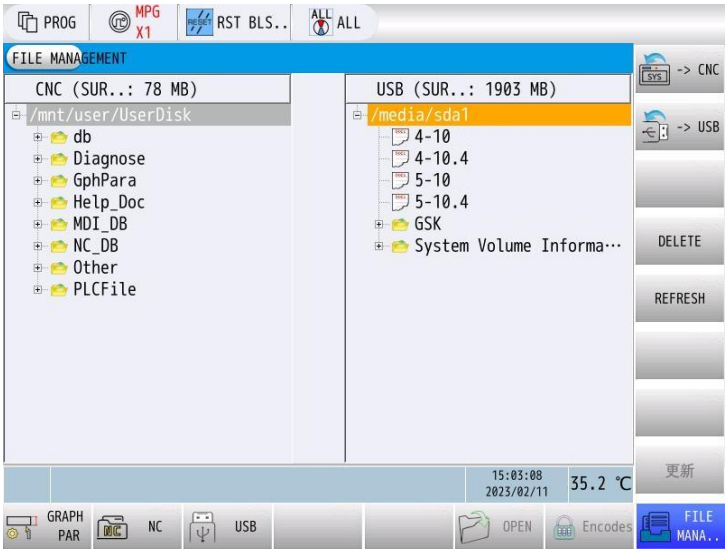


Fig.4-3

E.g., lead in the program 100.CNC from U disk:

1) Move the cursor to select the folder “NC_DB” of the program by ⇩ or ⇧, and then select the folder located at the program;

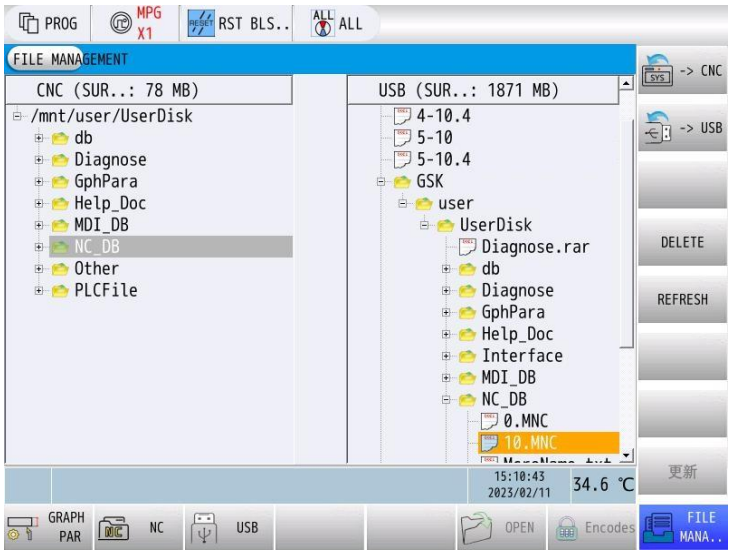


Fig.4-4

2) Move the cursor to “USB” by direction buttons, spread to the next level by pressing the  ; And Press  move the cursor to the target file, i.e. "100. MNC", as shown below:

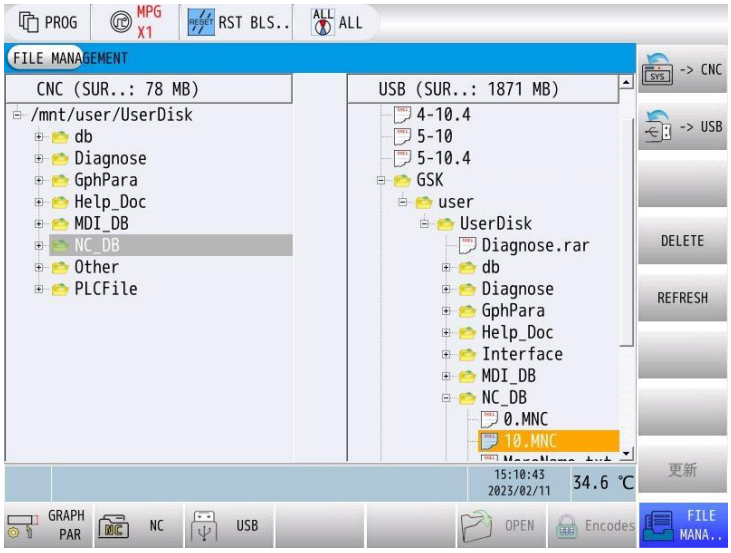


Fig.4-5

3) Press the software key  in the upper right corner, and the system displays copying! As shown in the figure:

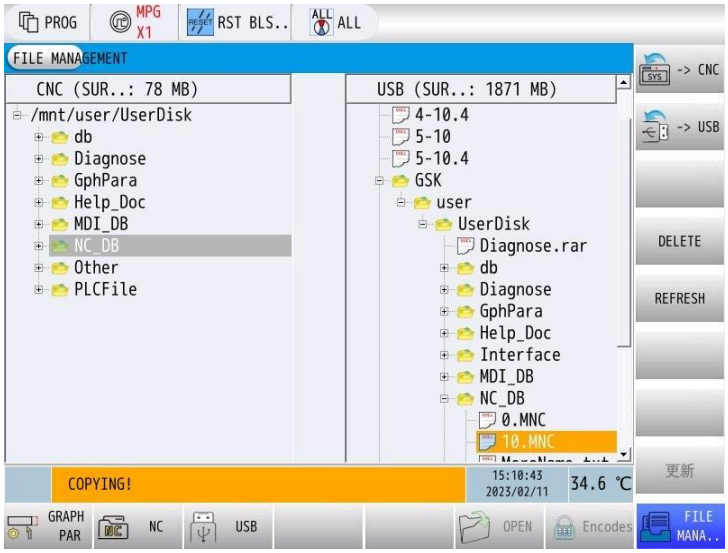


Fig.4-6

4) When the system copy is completed, the system will display that the copy is successful, as shown in the figure:

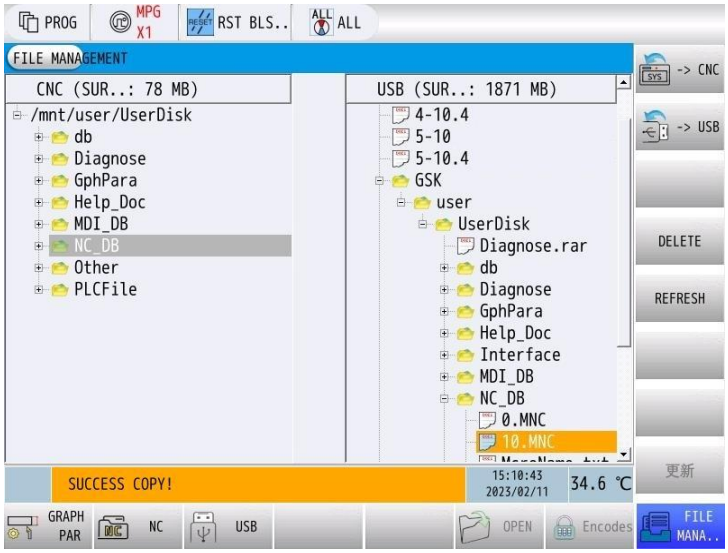


Fig.4-7

5) When the path has the same file name, prompt "... overwrite?..." and ENTER confirm to overwrite; ESC Exit the operation.

Similarly, the import/export operation of other folders, comments and other files is the same as above.

NOTICE

1. CNC supports USB flash drives with a capacity of 8G or less. The disk format must be "FAT32". Consult the manufacturer for other USB flash drives;

2. According to the capacity of the USB flash disk, the time for identification, copy, deletion and other operations varies. During this process, the page stays briefly and you

should operate cautiously.

3. When the copied file or folder contains system files, CNC will prohibit copying and prompt "There are system files in the folder, copying failed!";

4.4.2 Definition of File Name

No.	File Name	Definition	Remark
1	SysData	Data folder	
2	NC_DB	Program folder	
3	Para	Parameter folder	
4	PLC	PLC data folder	Including the execution file and information
5	PLCFile	Ladder diagram project folder	
6	GphPara	Graph parameter list folder	
7	MDI_DB	MDI folder	
8	Alarm	Alarm file	Stored in the db folder
9	McroName.txt	Macro variable note	Stored in the Stored in the db folder folder
	Help_Doc	Help Folder	
10	db	System text content library	
11	Other	Other Folder	Store boot image file and screenshot file

4.5 Parameter modification

1) Enter the data parameters directly and press 

.

2) The way to modify bit parameters is to move the cursor to the position of the parameter and press 

, then press  or  of the cursor to move to the bit parameter to be modified, then enter "0" or "1" and press 

.

3) To enter the parameter interface, press 

, and then press 

to enter the parameter interface as follows:

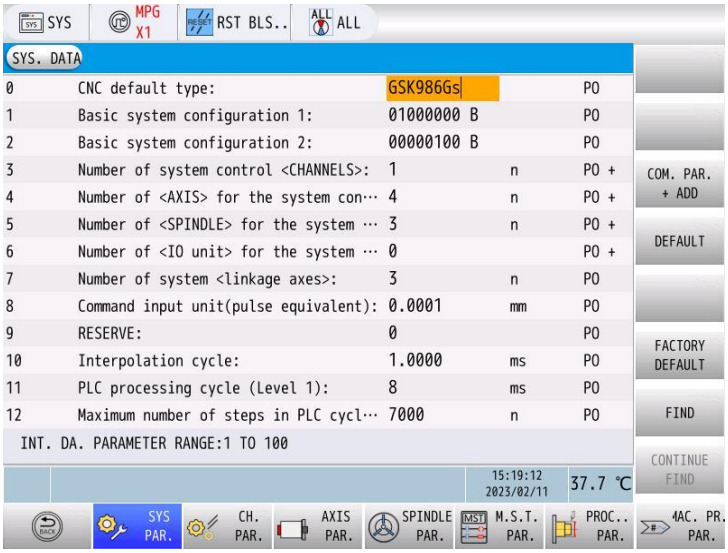

SYS
MPG X1
RST BLS..
ALL
SYS. DATA
0 CNC default type: GSK986Gs PO
1 Basic system configuration 1: 01000000 B PO
2 Basic system configuration 2: 00000100 B PO
3 Number of system control <CHANNELS>: 1 n PO +
4 Number of <AXIS> for the system con··· 4 n PO +
5 Number of <SPINDLE> for the system ··· 3 n PO +
6 Number of <IO unit> for the system ··· 0 PO +
7 Number of system <linkage axes>: 3 n PO
8 Command input unit(pulse equivalent): 0.0001 mm PO
9 RESERVE: 0 PO
10 Interpolation cycle: 1.0000 ms PO
11 PLC processing cycle (Level 1): 8 ms PO
12 Maximum number of steps in PLC cycl··· 7000 n PO
INT. DA. PARAMETER RANGE:1 TO 100
COM. PAR. + ADD
DEFAULT
FACTORY DEFAULT
FIND
CONTINUE FIND
15:19:12 2023/02/11
37.7 ℃
SYS PAR.
CH. PAR.
AXIS PAR.
SPINDLE PAR.
M.S.T. PAR.
PROC.. PAR.
4AC. PR. PAR.

Fig.4-8

CHAPTER FIVE COMMON-USE MACHINING MODUAL

GSK986 system provides a customized interface function of which the manufacturer or end user can set the corresponding parameters of variables in its relative pages based upon the requirements, and then the machining requirements can be executed. Enter to the list by pressing the 程序 PRG in the page of the GRAPH PAR; refer to the following figure:

NOTICE

Enter "GRAPH PAR", can choose to display the drawing list as shown in the above figure (P30.2=0), or can directly open the fixed drawing parameter project (P30.2=1).

5.1 Plane/Plano Grinding Machine

5.1.1 Workpiece type

(1) Surface type (multiple cutting, surface grinding);

(2) Grinding slot (multi slot, rack type);

(3) Rotary slot type (single deep slow feed, with workpiece rotation, common gear (straight));

Fig.5-1

Fig.5-2

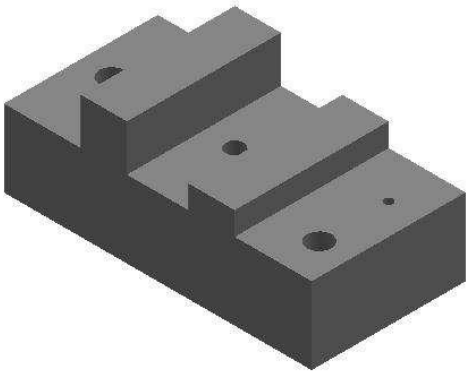


Fig.5-3

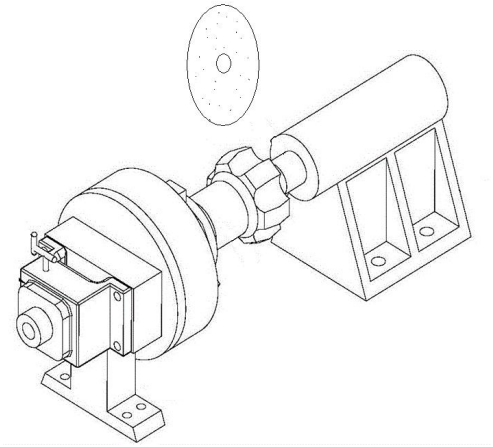


Fig.5-4

5.1.2 Definition of each page

5.1.2.1 Surface

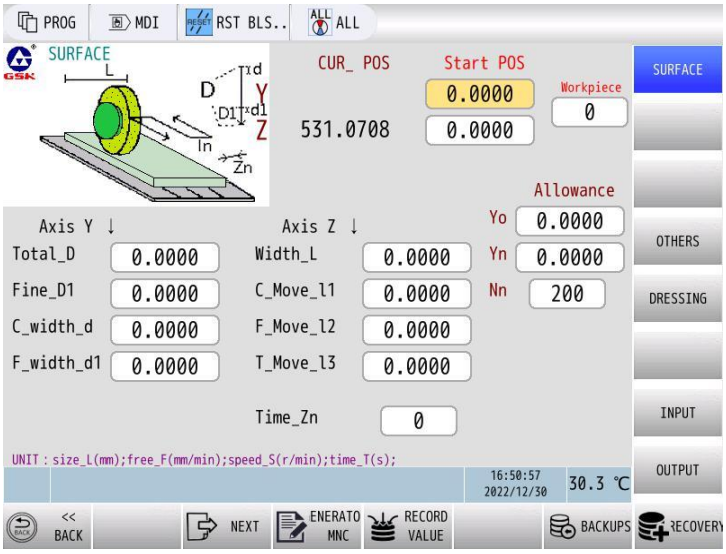


Fig.5-5

Monitoring (data not to be filled in):

CUR_POS(Current coordinate): the current position of the machine tool (absolute position)

Allowance:Yo－Grinding surplus;

Yn－Remaining times of wheel cutting;

Nn－Workpiece count, how many grinding wheels;

Main parameter:

Start POS(Start position): The position of the grinding wheel on the surface of the workpiece during tool setting (starting point)

Workpiece: grinding workpiece type: 0-surface; 1-slot;

Process parameters:

Axis Y(Axis for grinding wheel up and down):

Total_D(Total grinding amount D): Starting from the tool setting position, the total amount of cutting tool in Y axis is divided into rough grinding and fine grinding;

Finish_D1(Total amount of finish grinding D1): The last part of the total grinding amount suitable for small amount of feed is defined as the total amount of fine grinding;

C_Width _d(Coarse grinding component d):For coarse grinding, the amount of each grinding wheel is y-axis;

F_Width _d 1(Finish grinding component d1):For finish grinding, the amount of each grinding wheel is y-axis;

Axis Z(Axis for grinding wheel around):

Width L(Width of workpiece L): The maximum width of longitudinal movement of workpiece;

Moveing_l1(Coarse grinding movement l1): the width of z-axis movement in each cycle during rough grinding;

Moveing_l2(Finish grinding movement l2): the width of z-axis movement in each cycle during finish grinding;

Moveing_l3(Smooth grinding movement l3): the width of z-axis movement in each cycle during smooth grinding;

Times Zn(Polishing times Zn): the number of cycles in Z direction during light grinding (once a time, two times back)

5.1.2.2 SLOT

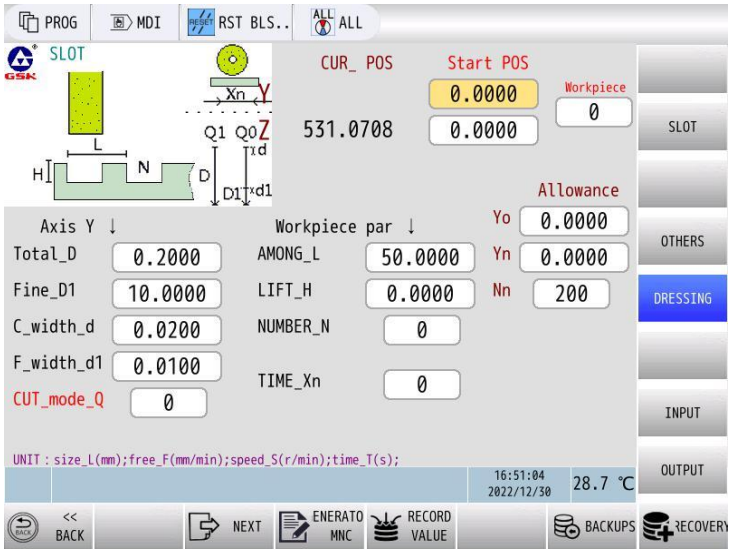


Fig.5-6

Monitoring (data not to be filled in):

CUR_POS(Current coordinate): the current position of the machine tool (absolute position)

Allowance:Yo—Grinding surplus;

Yn—Remaining times of wheel cutting;

Nn—Workpiece count, how many grinding wheels;

Main parameter:

Start POS(Start position): The position of the grinding wheel on the surface of the workpiece during tool setting (starting point)

Workpiece: grinding workpiece type: 0-surface; 1-slot;

Process parameters:

Axis Y(Axis for grinding wheel up and down):

Total_D(Total grinding amount D): Starting from the tool setting position, the total amount of cutting tool in Y axis is divided into rough grinding and fine grinding;

Finish_D1(Total amount of finish grinding D1): The last part of the total grinding amount suitable for small amount of feed is defined as the total amount of fine grinding;

C_Width _d(Coarse grinding component d):For coarse grinding, the amount of each grinding wheel is y-axis;

F_Width _d 1(Finish grinding component d1):For finish grinding, the amount of each grinding wheel is y-axis;

C_mode Q(Cutting mode Q):In slot grinding, the cutting mode of Y axis (grinding wheel) : 0 - Intermittent cutting according to the reversing signal of worktable; 1 - Continuous cutting without connection with

table reversing;

Workpiece Parameter:

AMONG_L(Distance between slots L): The distance between each slot;

LIFT H (Groove height / tool lift H): The lifting height of grinding wheel after grinding;

NUMBER_N(Number of grinding grooves N): Total number of grinding slots;

TIME_Xn(Grinding times Xn): The number of times of worktable reversing when each slot is polished;

5.1.2.3 Grinding wheel dressing(FLAT)

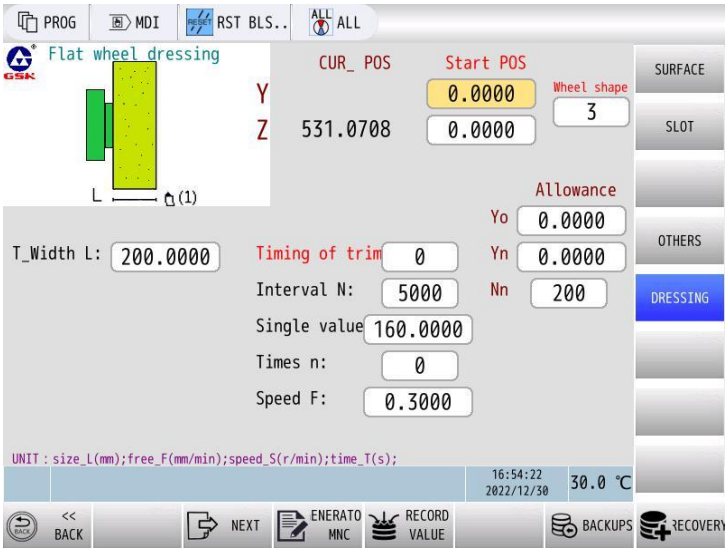


Fig.5-7

Main parameter:

Start POS(Starting position): the position coordinate of the finishing pen on the grinding wheel surface (the starting point of dressing);

Wheel shape(Shape of grinding wheel); shape of grinding surface of grinding wheel;3-Plane grinding wheel; 4-Wheel with step; 5-V type wheel;

Process parameters:

Width_L: dressing width of grinding wheel;

Trim setting:

Timing(When to fix): when to start? 0 - count repair, repair after meeting the set number of processed; 1 - repair immediately;

Interval_N(Dressing interval N): The number of workpieces to be processed or the number of cycles before finishing;

Single _D_d(Single dressing amount d): single dressing feed rate;

Time_N(Repair times N): How many times? ;

Free_F(Dressing speed F): dressing speed;

5.1.2.4 Grinding wheel dressing(STEP)

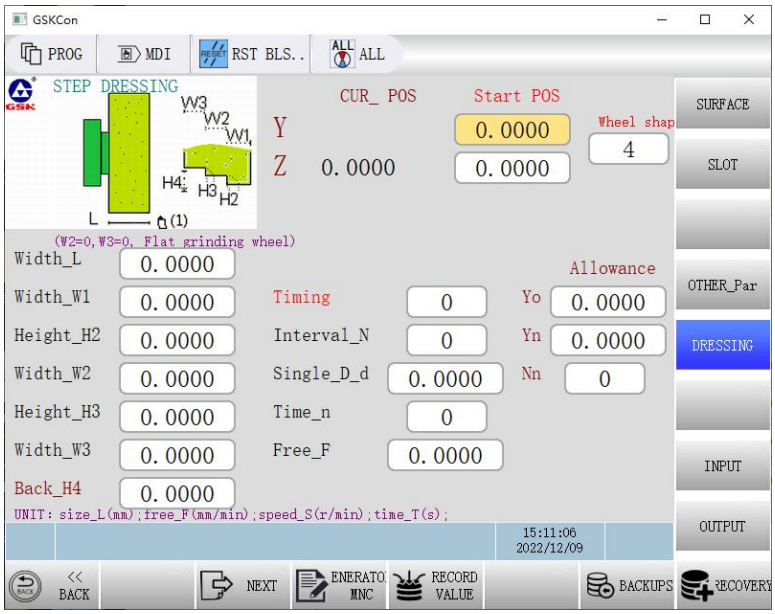


Fig.5-8

Main parameter:

Start POS(Starting position): the position coordinate of the finishing pen on the grinding wheel surface (the starting point of dressing);

Wheel shape(Shape of grinding wheel); shape of grinding surface of grinding wheel;3-Plane grinding wheel; 4-Wheel with step; 5-V type wheel;

Process parameters:

Width_L: dressing width of grinding wheel;

Width W1 ~ W3: width of each segment of step grinding wheel;

Height H2 ~ H3: height of each section of step grinding wheel;

Back_H4(Regression height H4): the retreating height of the last dressing wheel;

Trim setting:

Timing(When to fix): when to start? 0 - count repair, repair after meeting the set number of processed; 1 - repair immediately;

Interval_N(Dressing interval N): The number of workpieces to be processed or the number of cycles before finishing;

Single _D_d(Single dressing amount d): single dressing feed rate;

Time_N(Repair times N): How many times? ;

Free_F(Dressing speed F): dressing speed;

5.1.2.5 Grinding wheel dressing(Type-V)

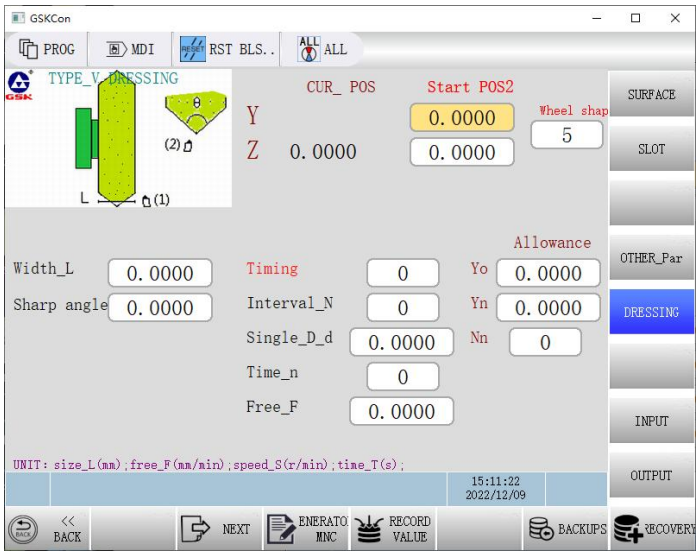


Fig.5-9

Main parameter:

Start POS(Starting position): the position coordinate of the finishing pen on the grinding wheel surface (the starting point of dressing);

Trimmer 1:The position of trimmer 1;

Trimmer 2: The position of trimmer 2; the trimming position in the other direction when shaping (V-shaped, sharp angle);

Wheel shape(Shape of grinding wheel); shape of grinding surface of grinding wheel;3-Plane grinding wheel; 4-Wheel with step; 5-V type wheel;

Trim setting:

Width_L: dressing width of grinding wheel;

Sharp angle Θ: the angle of V-shaped angle;

Trim setting:

Timing(When to fix): when to start? 0 - count repair, repair after meeting the set number of processed; 1 - repair immediately;

Interval_N(Dressing interval N): The number of workpieces to be processed or the number of cycles before finishing;

Single _D_d(Single dressing amount d): single dressing feed rate;

Time_N(Repair times N): How many times? ;

Free_F(Dressing speed F): dressing speed;

5.1.2.6 Other parameters

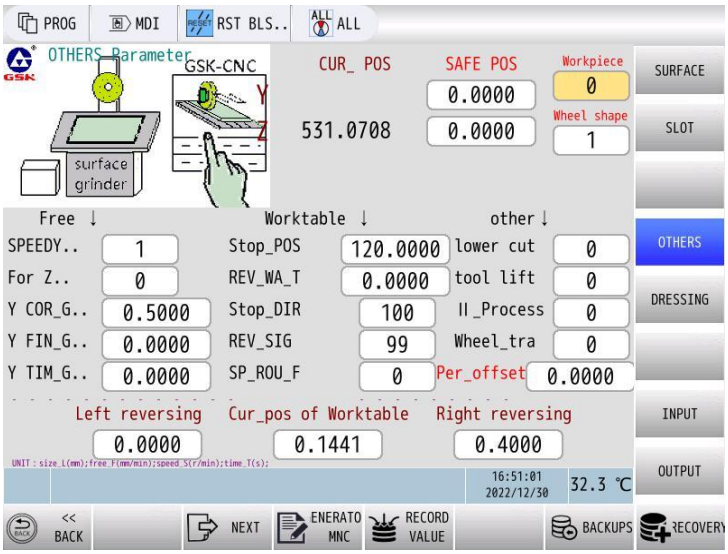


Fig.5-10

Main parameter:

Safe POS(Safe position): stop position after grinding;

Workpiece: grinding workpiece type: 0-surface; 1-slot;

Wheel shape(Shape of grinding wheel); shape of grinding surface of grinding wheel;3-Plane grinding wheel; 4-Wheel with step; 5-V type wheel;

Other parameters:

Free F:

SPEEDY(Fast positioning): the speed of fast moving;

For Z(Z-axis transverse): the speed of z-axis lateral movement during machining;

Y COR_G(Y-axis coarse grinding): the speed of y-axis (grinding wheel) coarse grinding;

Y FIN_G(Y-axis finish grinding): the speed of y-axis (grinding wheel) finish grinding;

Y SMO_G(Y-axis smooth grinding): the speed of y-axis (grinding wheel) smooth grinding;

Workbench (x-axis):

Stop_POS(Stop position of trimming): during trimming, the stop position of worktable: 0 - facing the left side of the operation; 1 - facing the right side of the operation; (when the worktable uses servo motor, the position is the specific coordinate;)

COMM_WA_T(Reversing waiting time): the waiting time before the worktable changes backward and performs the next action;

Stop_DIR(Stop direction): after grinding, stop position of worktable: 0 - face to the left side of the operation; 1 - to the right side of the operation;

COMM_SIG(Commutation signal): 0-single side, the worktable can calculate two times of commutation; 1-two sides, the worktable can calculate one commutation back and forth;

ROU_T_SP(Table round-trip speed): the speed of the table moving back and forth; (when the table uses servo motor, the motor speed;)

Other:

Y Cut_SEL(Selection of Y cutting tool): 0-program automatic cutting; 1-the program does not control Y-axis cutting, and the cutting amount is controlled by hand pulse;

Y Back_off(Y grinding wheel tool lifting): 0-grinding wheel lifting after grinding; 1-grinding wheel staying at the current position after grinding, no tool lifting;

2nd PROC (Secondary processing): grinding wheel \Y axis secondary processing when the starting position: 0:unchanged; 1:the starting position superimposed.

Z Cut_SEL(Z feed mode): 0 - change direction once and feed once according to table reversing signal; 1 - z-axis feed has no connection with worktable reversing, continuous feed;

CYCLE_COMP(Cycle compensation): after the end of each cycle, the system will automatically compensate the set value of grinding wheel (Y direction);

COMM_POS_L: Left end commutation position; Valid after input [Reset].

Workbench_POS: Current position of the workbench; (Read Only)

COMM_POS_R: Left end commutation position; Valid after input [Reset].

5.1.2.7 I0-INPUT/OUTPUT

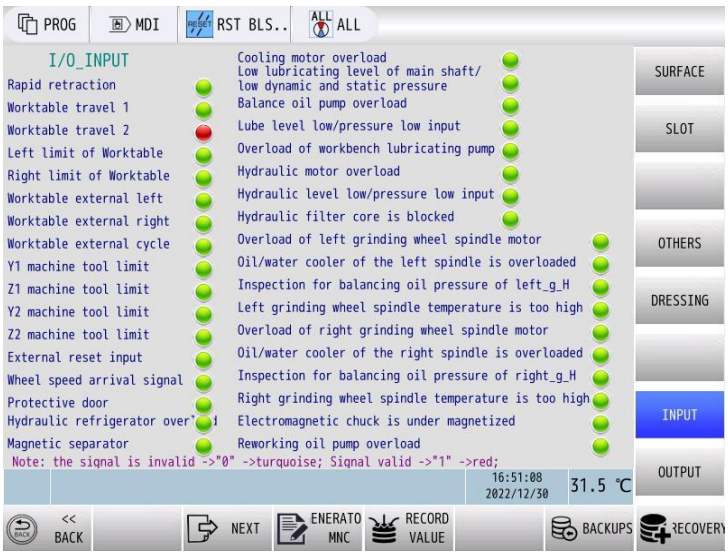


Fig.5-11

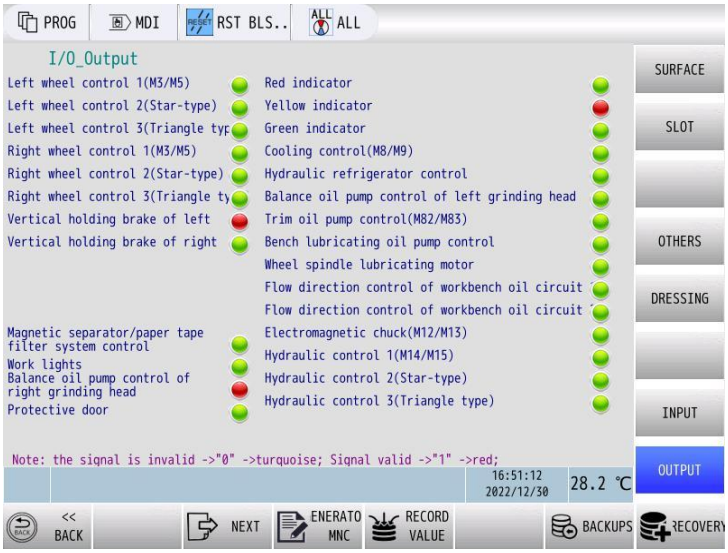


Fig.5-12

5.1.3 Machine tool configuration

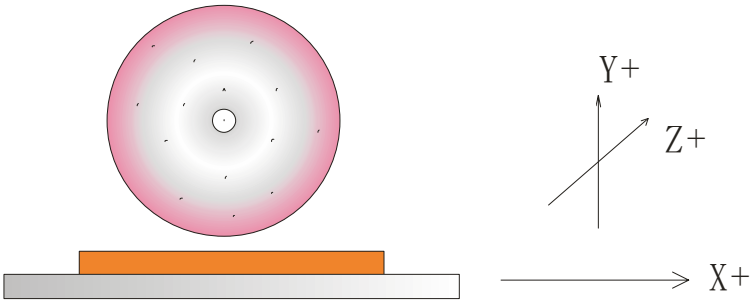


Fig.5-13

5.1.3.1 Axis movement direction:

The forward and backward movement of grinding wheel is z-axis, which is positive far away from the workpiece;

The grinding wheel moves up and down as y axis, and it is positive from bottom to top;

The table moves back and forth as the X axis, which is generally defined as positive to the right.

5.1.3.2 Configuration of worktable (x-axis):

(1) Traditional _ hydraulic control: (table control mode)

- It is input to the PLC of CNC through the travel switch at both ends, and the reversing signal is output;
- Single function and simple operation;
- The speed of worktable can be adjusted conveniently, but the adjustment sensitivity is low;

- The dressing position of grinding wheel is difficult to guarantee;

(2) Improved _ hydraulic control + encoder detection:

- The use of travel switch is reduced, and the feedback position signal of encoder is more stable through structural protection and other measures;
- It is not necessary to manually adjust the switch position for commutation, but only need to input the reversing coordinate on the interface, so the operation is simple;
- The speed of worktable can be adjusted conveniently, and the sensitivity is higher than that of single hydraulic control;
- The dressing position of grinding wheel is not easy to grasp;

(3) All round - servo motor control:

- The electrical design part is simple and saves a lot of input signals such as travel and limit;
- The servo motor is more environmentally friendly and energy-saving than hydraulic;
- The speed of the worktable can be adjusted conveniently and the sensitivity is the highest;
- The dressing position of grinding wheel is accurate and the compensation of grinding wheel is convenient;

5.1.3.3 Attention

- Electromagnetic chuck is used for general surface grinder. The general electromagnetic chuck can be divided into three states: power on and off, magnetization and demagnetization. The magnetic alarm processing is different in different states
- The general surface grinder is 3-axis, and the fourth axis rotation axis is needed when there are rotating workpieces;
- When using "Y knife selection hand pulse", pay attention to turn off hand pulse axis selection when not feeding, so as to avoid accidents caused by manual pulse misoperation;

5.1.3.4 Machine operation mask(8.4')

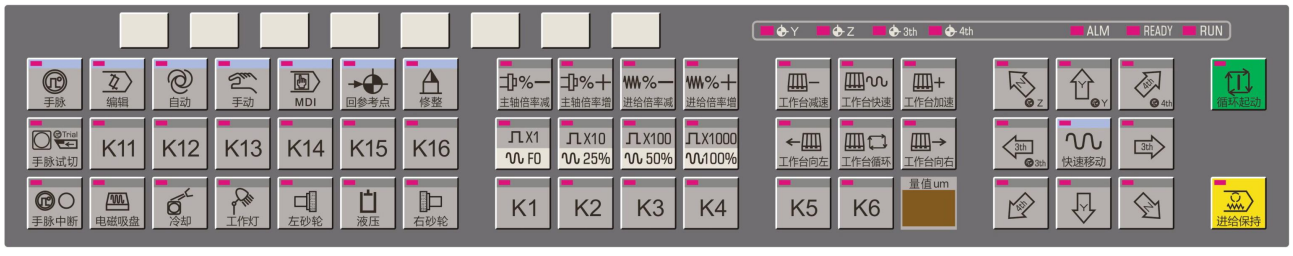


Fig.5-14 Chinese

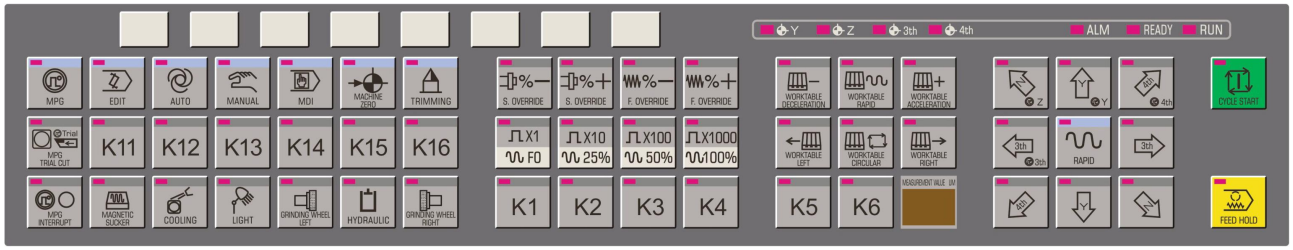
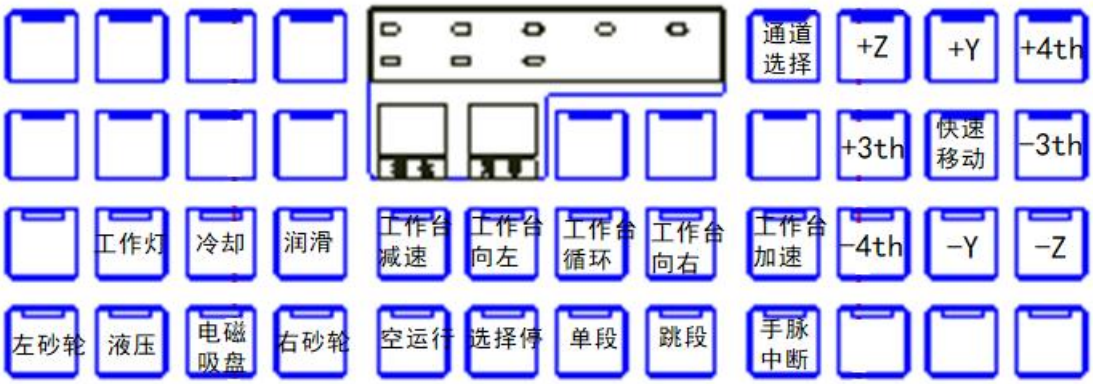


Fig.5-15 English

5.1.3.5 Machine tool operation panel, user-defined panel definition (10')



5.1.4 Operating instructions

5.1.4.1 Power on machine tool and CNC

5.1.4.2 Page and parameter import:

- Ensure that the system has a complete surface grinder processing module (including processing program and operation interface) when it is used for 1st time;
- Appropriate authority → 程序 PRG → FILE MANA.. → Insert the USB flash disk → After identification, refresh the U disk information, as shown below:

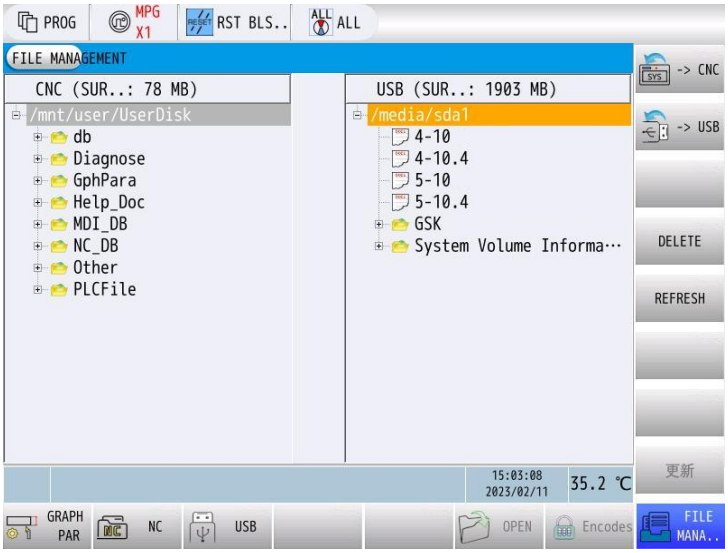


Fig.5-16

- Press ENTER to expand the respective directory, select the "GphPara" folder of CNC, move the cursor to the right, and select the project folder of USB flash disk;
- Press ->CNC key to complete the copy, as shown in the following figure:

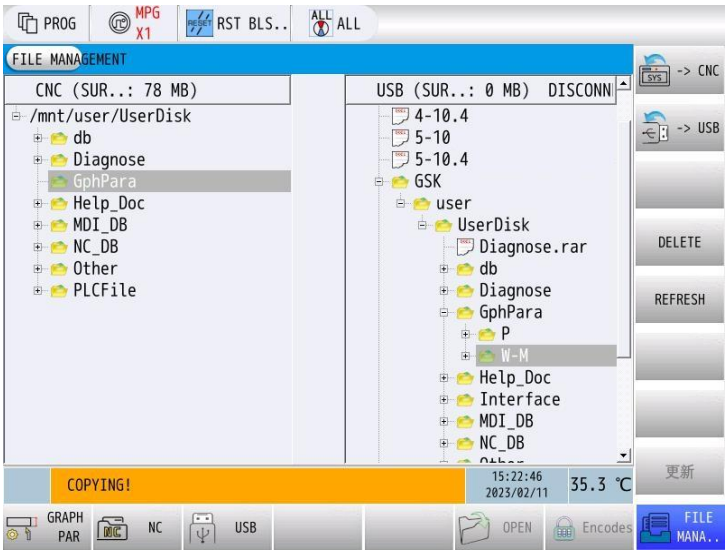


Fig.5-17

- Similarly, copy the "prog" folder or copy it into the "prog" directory of the system one by one.
- Function parameters: bit0 = 1 of P00030, default drawing reference interface when power on; bit2 = 1, directly enter drawing reference engineering

5.1.4.3 Hand pulse test operation

- Relevant parameters:P35: Control magnification of hand pulse cutting

P36.2:Hand pulse test mode:0-mode 0(Multiplier hold),1-mode 1(speed of Hand pulse)

P36.3:Hand pulse test reverse operation of trial cutting control program: 0 -Allowed,1 -Not allowed;

The data parameter K29.1 of the ladder diagram: whether the hand pulse test mode is valid, 0 -Invalid, 1 –Valid;

- Press 

after switching the system to 

mode, and the system will prompt:A22.2 Hand pulse testing.
- Press 

to run the system. When the JOG shakes the Hand pulse, the feed axis will feed, and when it stops, the feed axis will stop.

5.1.4.4 Grinding wheel dressing

- The tool setting operation is basically the same as that of processing tool setting;

5.1.4.5 Worktable cycle under hydraulic control

- Switch on 

under non operation mode;
- Confirm the position of grinding wheel and select 

control table to move left and right;
- After pressing 

, select any one of them 

, and the workbench will automatically move under the set point;

5.1.4.6 Attention

- Safety: In the process of processing, if  is effective, turn  to "off" when not in use;
- The current "slot type" function does not include the plane function inside the tank temporarily;
- When dressing the "flat grinding wheel", Don’t input any value for the step parameters, except for the backoff height;

5.1.5 Program notes

5.1.5.1 Procedure description and precautions

9900.MNC- Main processing program;

9910.MNC- Grinding plane;

9916.MNC- Z-direction cycle subroutine 1;

9917.MNC- Z-direction cycle subroutine 2;

9920.MNC- Main program for Slot class;

9930.MNC- Main program for Rotation class;

9990.MNC- Main program for Dressing;

9991.MNC- Subroutine for Dressing (steps);

9992.MNC- Subroutine for Dressing (V-type);

9993.MNC- Subroutine for Dressing (Other shapes);

Note: The program includes commonly used grinding plane and groove workpieces, as well as Dressing steps and V-shaped grinding wheels. Other parts such as rotating workpieces and other shaped grinding wheels Dressing need to be customized.

5.1.5.2 Order:

G79- Oscillating feed;

G80- Oscillation stopped;

M88- Open hand pulse intervention;

M89- Closed hand pulse intervention;

M64- Switch table to "single side" feed (optional);

M65- Start bench (hydraulic) cycle (optional);

M76- The table stops on the left (optional);

M77- The table stops on the right (optional);

5.1.6 Hydraulic control, encoder feedback virtual axis function

The X-axis of the workbench is controlled by hydraulic, and the encoder feedback data is used as the coordinate display function. The parameters of the virtual axis of the system are set as follows:

5.1.6.1 Relevant parameters are set as follows:

1) X-axis parameter P20008.1 is set as incremental motor;

2) P20009.7 Set to radius programming (1 axis filter overrun alarm may appear when set to diameter programming);

3) P20072 Set the number of encoder lines (the number of encoder lines should be *4 times);

4) P20076 Set the screw pitch of the lead screw (the distance of the coordinate value change after the encoder rotates one circle, subject to the actual measurement);

5) P20077 motor, P20078 screw drive ratio (Default 10:10, can be modified according to actual conditions);

6) P20089.6 Rear cover encoder feedback pulse of the system after virtual axis connection:0=Invalid 1=Valid.CN21 is the encoder or grating ruler feedback machine coordinate;

7) P20149 fluctuation range of target machine tool coordinate value (when the hydraulic control workbench, the data fed back by the encoder converts the machine tool coordinate, when the coordinate

value reaches the detection range near the value set in P20150~P20157);

8) P20150 Current axis target machine coordinate PLC F600.0 (when set to 100, the machine coordinate reaches near 100 (P20149), and the PLC F600.0 output is 1);

9) P20151 Current axis target machine coordinate PLC(F600.1);

10) P20152 Current axis target machine coordinate PLC(F600.2);

11) P20153 Current axis target machine coordinate PLC(F600.3);

12) P20154 Current axis target machine coordinate PLC(F600.4);

13) P20155 Current axis target machine coordinate PLC(F600.5);

14) P20156 Current axis target machine coordinate PLC(F600.6);

15) P20157 Current axis target machine coordinate PLC(F600.7);

16) PLC can write workbench control logic according to the F address set in P20150~P20157.

17) The limit function of X-axis is invalid.The limit can be set in P20150~P20157, and then modified by PLC.

5.2 CNC cylindrical grinder

5.2.1 Workpiece type

This program is mainly for machining shafts, rolls and workpieces with step end faces. Up to 4 steps and 2 end faces can be machined at one time, with two radial gauges and one end face gauge;

Attention:

(1) Procedural principles: The step law is an increasing or decreasing principle;

(2) The maximum expansion is up to 6 steps and 4 end faces, but this needs to be communicated to the manufacturer due to the system memory and speed issues involved;

(3) The radial gauge signal is P1~P4 in order, and the end gauge signal is P0;

(4) If two radial gauges are connected, it is recommended to use relays to put the signals from P1 to P4 together, or directly in parallel;

(5) Grinding process:

The part without the gauge:

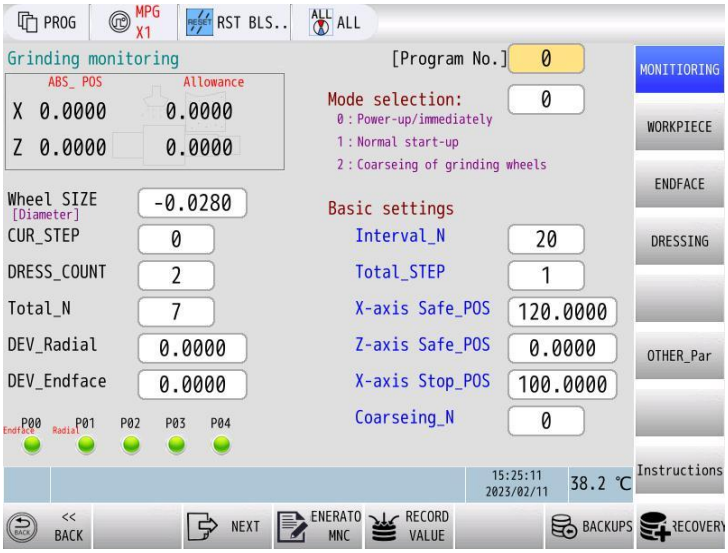
See light section - Rough grinding - Fine grinding - Bright grinding

The part with the gauge:

See light section - Rough grinding - Fine grinding - To size - Bright grinding

5.2.2 Definition of each page

(1) MONITIORING page



Grinding monitoring:

- Wheel SIZE(Grinding wheel size): displays the current grinding wheel size, which can be used to indicate whether to change the grinding wheel;
- CUR_STEP(Grinding steps): shows how many steps are currently in progress.
- DRESS_COUNT (Dressing - workpiece count): displays the current count of workpieces used by the grinding wheel, and goes to the grinding wheel when it arrives;
- Total_N(Total number of completed workpieces): the total number of workpieces that have been processed;
- DEV_Radial(Radial dimension deviation): When [Offset by step 1 dimension] is used, the deviation value of step 1 from the theoretical dimension after using the radial gauge is displayed;
- DEV_Endface(Deviation of end face dimensions): deviation of measurement using end face gauges;

Mode selection:

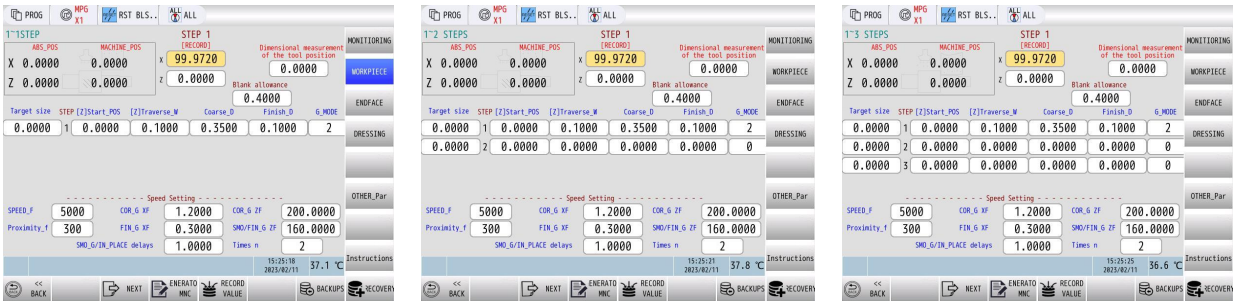
- Power-up/immediate grinding wheel repair;
- Normal start-up;
- Coarsing of grinding wheels (external);

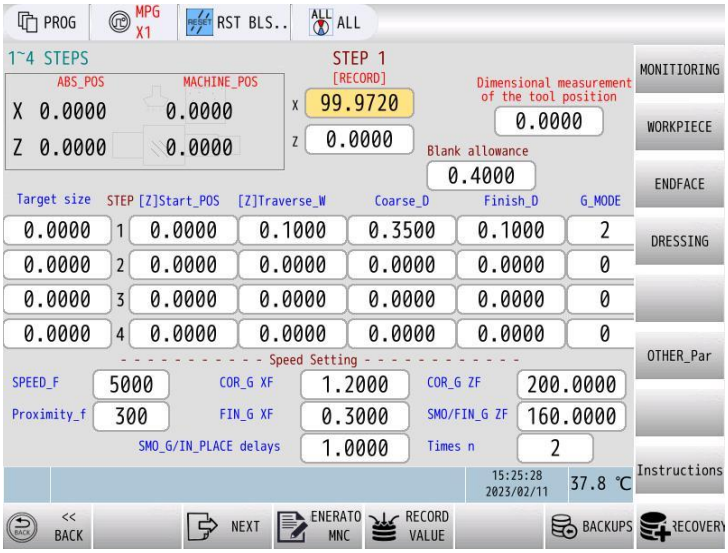
Basic Settings:

- Interval_N{Dressing interval (count)}: set how many workpieces to dress the grinding wheel after machining;

- Total_STEP(Total number of steps): the maximum number of steps to be processed in this procedure;
- X-axis Safe_POS(X-axis safety position [Record]): Press [Record data] to record the position of the grinding wheel safety stop;
- Z-axis Safe_POS(Z-axis safety position [Record]): Press [Record data] to record the position of the workpiece safety stop;
- X-axis Stop_POS(X-axis stop position [Record]): Press [Record data]. Record the position where the X-axis stops and starts again after machining is completed;
- Coarsing_N(Number of grinding wheel roughing): the number of cycles of grinding wheel roughing, used for new grinding wheel dressing, forming grinding wheel roughing, etc..

(2) Processing setting page: 1 to 4 steps





STEP 1(Step 1 tool setting): press [Record Data] to record the position of the grinding wheel trial grinding workpiece;

Dimensional measurement of the tool position: the actual size of the workpiece from the test grinding measurement, generally the diameter value;

Blank margin: the current blank margin of the machined workpiece;

- Steps with gauges: Blank allowance < Coarse_D + Finish_D;

When the blank margin is 0.4mm, the total amount of rough grinding can be set to 0.38mm and the

total amount of fine grinding can be set to 0.1mm;

When the blank margin is 0.05mm, the total amount of rough grinding can be set to 0.05 and the total amount of fine grinding can be set to 0.02;

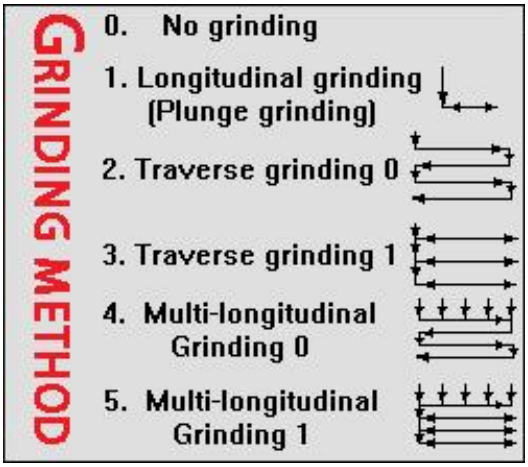
The above settings are related to the range values between the signals of the gauges and are for reference only;

- Steps without gauges: Blank allowance = Coarse_D + Finish_D;

Step parameter setting:

- Target size: the actual size of the step requirement, generally the diameter value;

- [Z]Start_POS ([Z] axis start grinding position): the start grinding position of each step in Z direction;
- [Z]Traverse_W (Transverse [Z] width): the width of the current step Z-axis movement;
- Coarse_D (Total amount of coarse grinding): the total amount of coarse grinding;
- Finish_D (Total amount of fine grinding): the total amount of fine grinding;
- G_MODE (Grinding method): tentatively divided into the following 5 types, as shown below. For detailed descriptions, see Part 4, "Notes on Process Cycles";



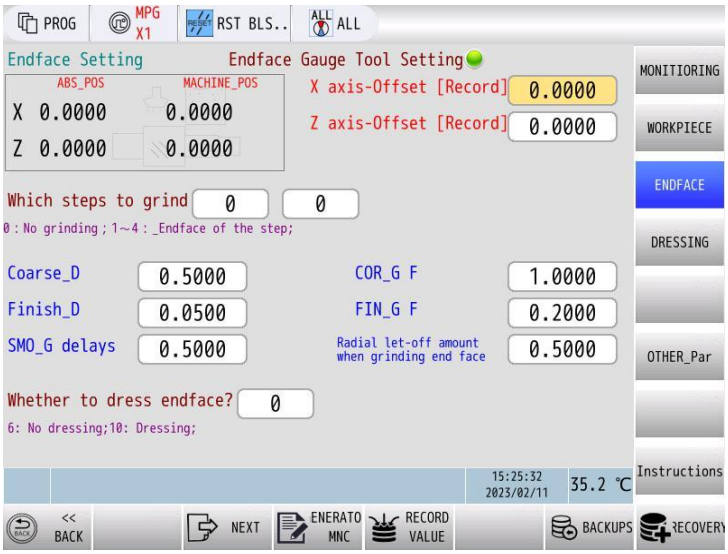
Speed setting.

- SPEED_F (Rapid positioning speed): speed of rapid positioning;
- Proximity_f (Proximity to surface f): the speed at which the grinding wheel is approaching the surface of the workpiece;
- COR_G XF (Coarse grinding speed XF): the speed at which the grinding wheel rough grinds into the tool;
- FIN_G XF (Finish grinding speed XF): the speed at which the grinding wheel is finely ground into the tool;
- COR_G ZF (Coarse grinding speed ZF): table rough grinding lateral movement speed;
- Finish/ smooth grinding speed ZF: Workbench finish/ smooth grinding lateral movement speed;
- Smooth grinding/in-place delay: grinding wheel pause time when smooth grinding or both ends are

in place;

- Number of smooth grinding: the number of times grinding is done in smooth grinding (without feed);

(3) End face setting page:



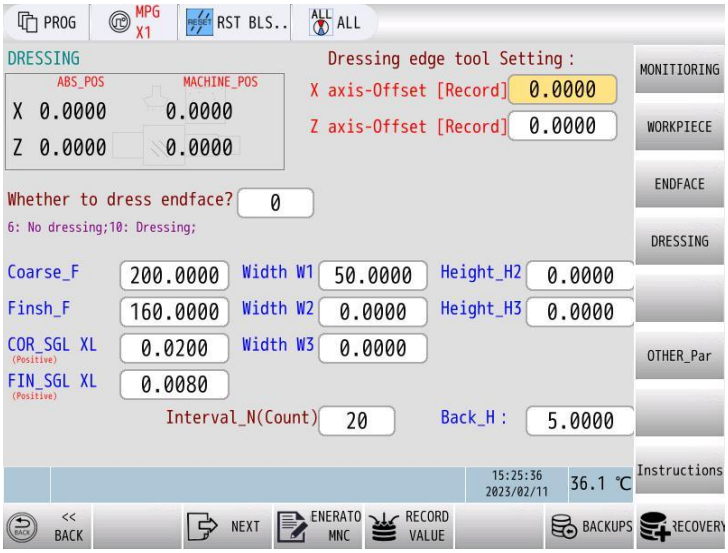
Endface Gauge Tool Setting: press [Record Data] to record the effective position of the face gauge touching the end face of the workpiece;

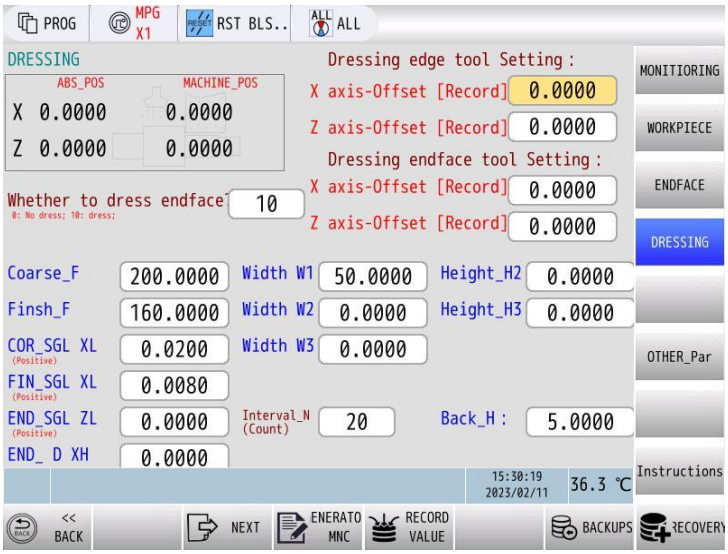
Which steps to grind: select 1st few steps to be ground, fill in 0 if not grinding;

Grinding setting:

- Coarse_D (Total amount of coarse grinding): the total amount of rough grinding at the end position;
- Finish_D (Total amount of finish grinding): the total amount of fine grinding at the end position;
- SMO_G delays (Smooth grinding stop time): The time needed to stop when smooth grinding;
- COR_G F (Coarse grinding speed): the speed at which the end face position is rough ground;
- FIN_G F (Finish grinding speed): the speed at which the end face position is finely ground;
- Radial let-off amount when grinding end face: the distance between the grinding wheel and the radial surface of the workpiece when grinding end faces;

(4) Grinding wheel dressing page:





Dressing external tool Setting: press [Record Data] to record the position of the dressing wheel end to the dressing pen;

Dressing endface tool Setting: press [Record Data] to record the position of the dressing wheel end to the dressing pen;

Whether to dress endface?: 0 - no dress the end face; 10 - dressing the end face;

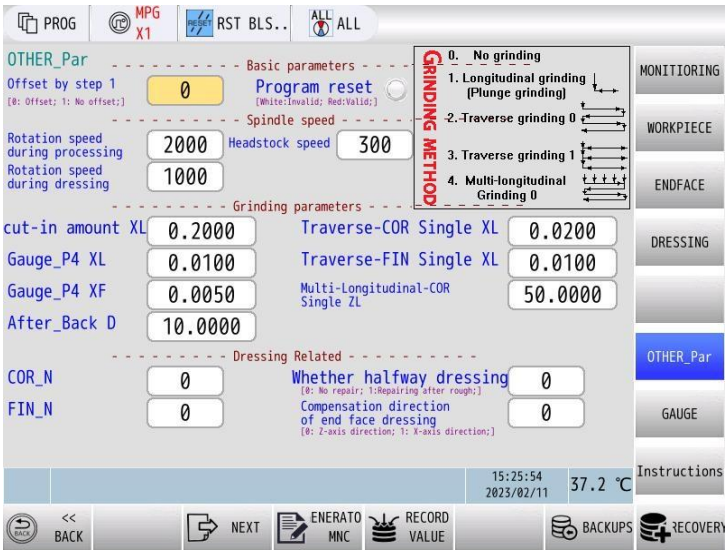
When choosing to dress the end face, first dress the end face and then dress the external;

Dressing parameters:

- Coarse_F (Coarsing wheel F): speed of the roughing wheel;
- Finsh_F (Finishing wheel F): speed of roughing wheel;
- COR_SGL XL (Coarsing sand single feed):Single feed in the X-direction when roughing the grinding wheel;
- FIN_SGL XL (Finishing sand single feed): Single feed in the X direction when finishing the grinding wheel;

- END_SGL ZL(The single feed of dressing grinding wheel end face ZL): The amount of a single feed in the Z direction when dressing end face;
- END_ D XH (The depth of dressing grinding wheel end face XH) : The X direction dressing depth when dressing end face;
- Width W1~3: The width of each segment of the forming (step) grinding wheel;
- Height_H2~3 (Step height H2~3):The height of each segment of the forming (step) grinding wheel;
- Interval_N(Count)(Dressing interval): Setting how many workpieces to dress the grinding wheel after machining.
- Back_H (Setback height H): The distance of the grinding wheel retreat completed in a single dressing pass.

(5) Other parameters page:



Basic parameters:

- Offset by step 1:when using radial gauge in the step, there is a deviation value between the final position and the theoretical position, whether to superimpose this deviation value when machining other steps, the default is 0 when "superimposed";
- Program reset function: Some machine tools choose the program reset function, press the reset button, the program to perform the relevant homing action, the machine back to the initial position, off cooling, off the head frame, etc., see the relevant machine tool factory instructions for details;

Spindle speed:

- Rotation speed during processing:
- Rotation speed during dressing:
- Headstock speed:

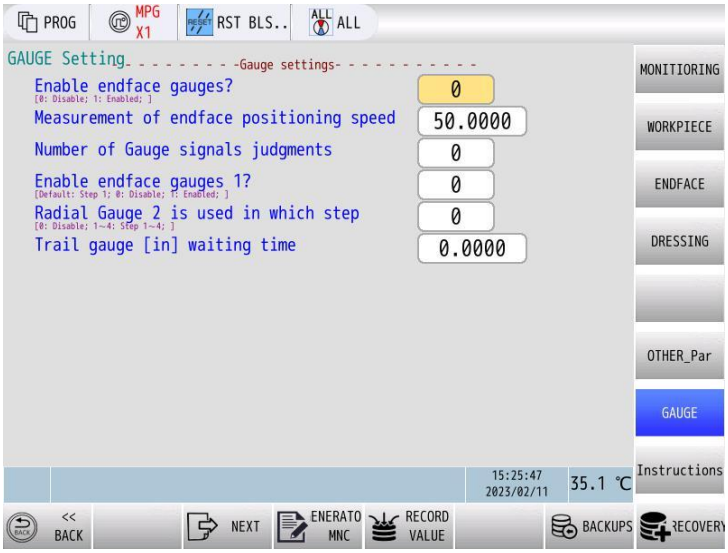
Grinding parameters:

- cut-in amount XL: The grinding wheel is positioned to the blank position, and a cut into the amount of black skin to see the light;
- Gauge_P4 XL (Gauge P4 segment feed XL): When using the gauge, in addition to rough grinding, fine grinding, light grinding, there is a "to size" P4 use, here for the P4 section of the maximum feed, for Traverse-grinding and other segmentation, a single feed program fixed "0.003", according to the need to modify their own procedures The program can be modified as needed;
- Gauge_P4 XF (Gauge P4 segment speed XF): Grinding feed speed of P4 section;
- After_Back D (Distance back after grinding): The retreat distance after each step is ground;
- Traverse-COR Single XL (Traverse grinding - coarsing single feed XL): Single feed for coarsing in the case of Traverse -grinding and other segmentation;
- Traverse-FIN Single XL (Traverse-grinding - finishing grinding single feed XL): The amount of feed for finish grinding in a single pass in the type of segmentation such as traverse grinding;
- Multi-Longitudinal-COR Single ZL (Multi-longitudinal grinding - coarsing grinding single width ZL): Width of the grinding wheel segmented transversely in the multi-longitudinal grinding species;

Dressing Related:

- COR_N (Number of external coarsing): Number of external coarsing;
- FIN_N (Number of external finishing): Number of external finishing;
- Whether halfway dressing (Whether halfway (coarse-finish) dressing): Choose whether to dress the grinding wheel first after the coarse grinding of the workpiece and then finish/smooth grinding of the workpiece; halfway dressing is only for the external end face does not need to consider halfway dressing;
- Compensation direction of end face dressing: according to the different dressers, choose the compensation direction of the dressing amount after end face dressing;

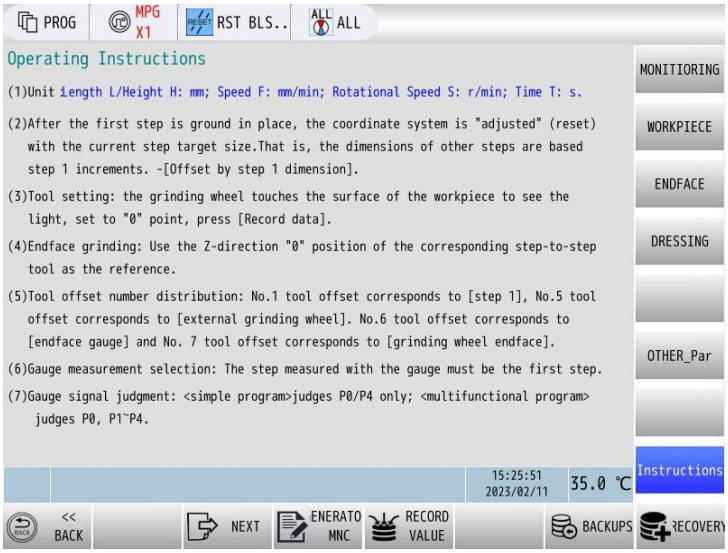
(6) GAUGE Setting Page:



GAUGE Setting:

- Enable endface gauges?: Select whether to enable end gauges;
- Measurement of endface positioning speed: Positioning speed when measuring end faces;
- Number of Gauge signals judgments: Select the number of times whether to judge the gauge signal after the gauge is in place, when it is 0, no judgment, only judge the gauge must control part;
- Enable endface gauges 1? : Whether to enable radial gauge 1 and fix 1st step;
- Radial Gauge 2 is used in which step: Select the radial gauge 2 for 1st few steps;
- Trail gauge [in] waiting time: Waiting time for the radial gauge to be in place after it has gone in;

(7) Instructions page:



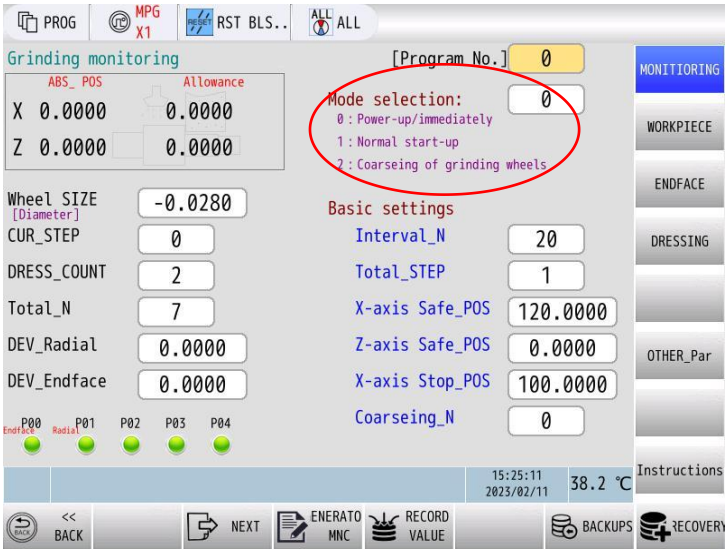
5.2.3 Operating instructions

1) Power on machine tool and CNC;

2) Dressing

- Tool setting:  controls the grinding wheel to move to the corresponding dressing nib, press 

to record the tool setting position ; Note the choice of whether to dress the end face or not.
- Filling in the dressing parameters.
- Dressing the grinding wheel: In general, the grinding wheel needs to be reconditioned for 1st machining or replacement, selecting the mode, 0 or 1, on the following page.

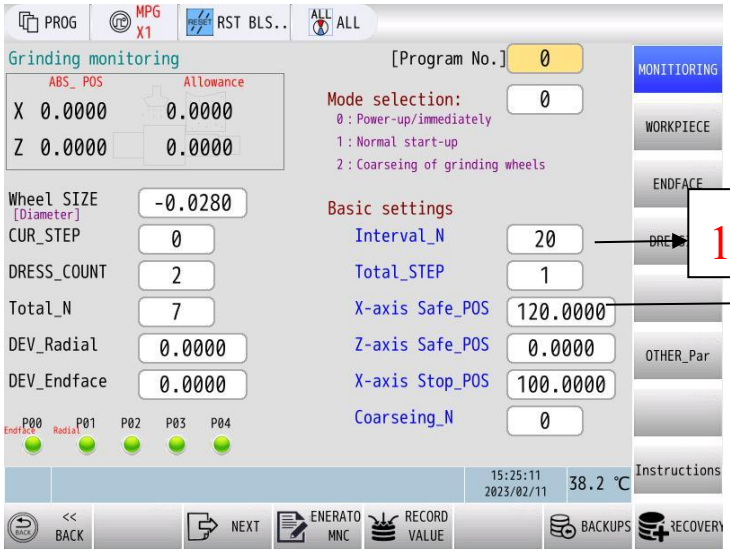


3) Tool setting:

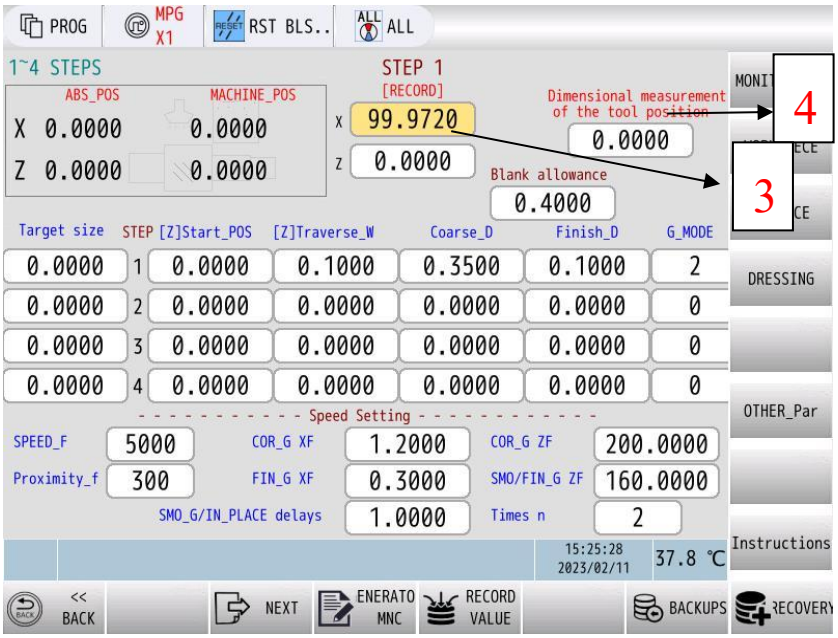
- Clamping workpiece, adjusting tooling;
- Open the CNC page as follows:
- In the "1" position in the figure below - [Total number of steps], enter the number of workpieces 

Changed,showing the "hand pulse" mode, controls each axis to a safe position; in the "2" position in the figure below, press 

to record the safe coordinates.



➢ Control the grinding wheel to move to each axis to the surface of the workpiece, remove the black skin to see the light, as shown in the following figure "3" position, press RECORD VALUE to record the current coordinates.

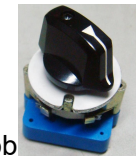


➢ Measuring the size of the workpiece: measuring the actual size of the workpiece at the test cut position, entered at position "4" in the above figure.

➢ Checking other process parameters as needed.

➢ Press CYCLE START to start the automatic grinding. Please reduce the speed or select 单段 the operation for 1st trial machining;

- The grinding can be stopped by press 

or pressing the "feed hold" key when stopping midway;
- Speed ratio knob  or key 

to control speed.

4) Dimensional error compensation:

- In case of deviations in processing data:

  Individual deviation - modification of the [target size] of each step.

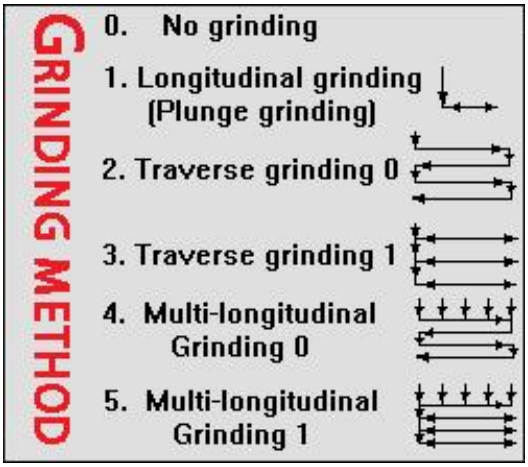
  In the case of the same deviation - you can modify the [measurement size for tool position].

5) Attention:

- Safety: In the process of processing, if  is effective, turn  to "off" when not in use;
- When dressing the "flat grinding wheel", Don't input any value for the step parameters, except for the backoff height;

4. Process cycle considerations

The external grinding process contains the following:



0: No grinding;

1: Longitudinal grinding, also called plunge grinding;

2: Traverse-grinding 0;

3: Traverse-grinding 1;

4: Multi-longitudinal grinding 0;

5: Multi-longitudinal grinding 1;

- Process selection: cross grinding process, the grinding wheel will be out of the gauge probe position, it is not recommended to use cross grinding 0 or multiple longitudinal grinding 0;
- Radial gauge into and out (P1): most manufacturers currently provide radial gauge, Don't provide the gauge into and out of the signal, so in order to insurance, the program uses the gauge signal P1 as the gauge into the judgment, the use of the gauge, into the place at the same time must ensure that the gauge P1 valid, otherwise the program will report "not received the gauge" P1" signal;".
- Seeing light section in the cross grinding: not controlled by the gauge, pay attention to the choice of margin and seeing light section;
- Smooth grinding section in the horizontal grinding: with the gauge, after the "to size" signal P4 is valid, the gauge will automatically exit and then carry out light grinding, at this time need to pay attention to the impact of light grinding on the size;
- Endface grinding: the starting point for grinding endfaces is the starting position of the current step, paying attention to the application of endface gauges and dimensional deviations;

CHATERP SIX COMMANDS

The common grinding functions are described in this chapter, which combines with characters of the GSK986 CNC system and describes the applications of the relevant function command for system; herein, the non-circular grinding function is essentially described.

6.1 Frequently-Used Commands

6.1.1 G00 & G01

Rapid traverse G00 X(U) Z(W)
Cutting feed G01 X(U)_ Z(W)_ F_

E.g.: G00 X100 Z2 ; Position to a safety position at the rapid traverse rate
G01 X82 Z1 F500 ; Close to the workpiece grinding position based upon the velocity of F500
G01 X80.5 Z0.5 F30 ; Enter to the grinding start based upon the velocity of the F30
G01 X80.1 Z0.3 F3 ; Perform the rough-grinding based upon the velocity of F3
G01 X80.005 Z0.05 F0.6 ; Perform the finish-grinding based upon the velocity of the F0.6
G01 X80 Z0 F0.1 ; Grind to its dimension based upon the velocity of the F0.1

6.1.2 G31

Feed skip G31 X(U)_ Z(W)_ F_ P_;

E.g.: G01 X80.5 Z0.5 F30 ; Enter to the grinding start based upon the velocity of F30
G31 X80 Z0.5 F3 P1 ; Rough-milling with F3 speed, wait for P1 during this time; immediately perform the next block if receives the P1 from X80.5 to X80; if does not, the program is continued to perform the next block after the program reaches to X80.
G31 X80 Z0.05 F0.6 P2 ; Rough-milling with F0.6 speed, wait for P2 during this time; immediately perform the next block if receives the P2 in the process of X80; if does not, the program is continued to perform the next block after the program reaches to X80.
G31 X79.99 Z0 F0.1 P3 ; Milling to the dimension with F0.1 speed, wait for P3 during this time; immediately perform the next block if receives the Pe in the process of X79.99; if does not, the program is continued to perform the next block after the program reaches to X79.99.
…

6.1.3 G04

Wait for the skip G04 D_ P_

E.g.: G31 X79.99 Z0 F0.1 P3 ; Finish-milling
G04 D10 P4 ; Polishing, grinding wheel stops at the surface of workpiece, delay 10s, and wait for P4 at the same time; immediately perform the next block if the P4 is received; otherwise, perform the next block after delaying 10s.

6.1.4 G10

6.1.4.1 Programmable data input

Purpose: The workpiece coordinate system envisaged during programming will deviate from the coordinate system actually set with G50 command. Set the desired offset by workpiece coordinate system offset to offset the already set coordinate system.

Format: G10 P0 IP_;

Explain: P0:Workpiece coordinate system offset command.

IP_ : Setting value of axis address and workpiece coordinate system offset

The absolute command is the offset of the original workpiece coordinate system; The increment command is the offset of the current workpiece coordinate system.

6.1.4.2 Setting of workpiece coordinate system offset

Purpose: This function can replace the MDI panel for direct input, and modify the workpiece origin offset and workpiece coordinate system offset values on the coordinate setting page.

Format: G10 L2 Pp IP_;

Explain: p = 0:Specify the offset of the external workpiece origin;

p = 1~6: Specify the workpiece origin offset relative to the workpiece coordinate system G54~G59;

IP_ : Setting of axis address and workpiece origin offset.

The absolute command is the offset of the workpiece origin for each axis. Increment command, this value should be added to the original workpiece origin offset set for each axis (the result is the workpiece origin offset)

6.1.4.3 Setting of tool offset value

Purpose: This function can replace the MDI panel for direct input, and modify the tool wear and all geometric offsets on the tool offset setting page.

Format: G10 P_ X_ Y_ Z_ ;
G10 P_ U_ V_ W_;

Explain:

instructions	describe
P	Command value is offset number P = 1~99 : Tool wear offset value command P = 10001~10099 : Tool geometry offset value command

X	X Offset value (absolute);
Y	Y Offset value (absolute);
Z	Z Offset value (absolute);
U	X Offset value (increment);
V	Y Offset value (increment);
W	Z Offset value (increment);

6.1.4.4 Parameter setting

Purpose: This function can replace the MDI panel for direct input, and modify the tool wear and all geometric offsets on the tool offset setting page.

Format: G10 L52; Set parameter reading and writing mode

N_/K_/D_/DT_/DC_ R(W)_; Read and write programming of system parameters/K/D/DT/DC

N_ P_ R(W)_; Reading and writing programming of shaft type, spindle type or channel type parameters

…

G11; Cancel the parameter read/write mode

Explain: N_ : Parameter No;

K_ : K parameter number of PLC;

D_ : D parameter number of PLC

DT_ : DT parameter number of PLC

DC_ : DC parameter number of PLC

R(W) _: R_ Is the reading address of the parameter, which can only be the macro variable number; W_ Is the written value of the parameter, which can only be a constant or macro variable;

When the read and write parameters are status parameters, their read and write values are binary, and decimal in other cases;

P_ : Shaft No. 1~maximum control shaft No. (1~maximum channel No.), used for reading shaft type parameters, spindle type or channel type parameters;

E.g.:

```
G10  L52
N13  W10.2          // System No.13 parameter is written to 10
N13  R#100          // Read the value of system No.13 parameter into #100

N15  P1  W22.9      // No.15 parameter of 1st axis is written to 22.9, and the P range is 1~the number of current control axes of the channel
N15  P2  W#100      // NO.15 parameter of 2nd axis is written to the value of #100, and the P range is 1~the current number of control axes of the channel
N22  P11  W60       // No.22 parameter of 1st spindle is written to 60, P range 11~1 channels currently control the number of spindles, and P11-P14 for four spindles
N10  P21  W999      // Channel parameter No. 10 parameter is written to 999
N14  P22  R#102     // Auxiliary parameter No. 14 parameter read into #102
N4   P23  W6.6      // Processing parameter No. 4 parameter writing 6.6
N6   P24  W520      // Macro variable parameter No. 6 is written into 520
```

```
K26   W2      // PLC parameter K26 writing 2
D26   R#2       // PLC parameter D26 read into #2
DT8   W#2       // PLC parameter DT8 writes the value of #2
DC8   R#8       // PLC parameter DC8 is read into #8
G11
```

Note: When modifying parameters, parameters that need to be powered on again can not be modified

6.1.5 WHILE

Cycle statement WHILE (Conditional expression) Dom
—Program—
ENDm

E.g.: WHILE (#520 LT 20) DO1 ; Judgment, if #520 is less then 20, U feeds 0.01 based upon the F0.5, and then #520.

```
G01 U0.01 F0.5
#520=#520+1
END1
```

6.1.6 MSG(Information Display Requirement)

In case that the CNC and PLC alarm information can not be edited, and then the CNC provides the NC program information displaying function.

Command format MSG=_____;

Add the format of “MSG= Note Content” in the corresponding block; that is, the block can be displayed the corresponding information when it performs at this block, until the other information is covered; alternatively, clear it by performing the “MSG=” again or cancel the display by 

.

NOTICE

1. Program command is separately lined; the G04 command is added when “MSG=__” and “MSG=” are consecutively used;
2. CNC does not support the on-line Chinese input; therefore, Chinese notes only can be led by PC machine;
3. MSG information does not reserve at the alarm record of CNC;

6.2 Dedicated Commands

6.2.1 Single Pendulum Motion (Vibration)

6.2.1.1 **Purpose: The specified shaft reciprocates.**

Format: G79 IP__ F__ D_ P_**;**

Explain: IP_: The absolute code is the end point coordinate value of tool movement; The incremental code is the tool movement.

F_: See the table below for the feed speed of the tool.

D_: Endpoint delay time.

P_: The specified axis rotates in one direction (P1-P8), effective when the movement exceeds 400 °

6.2.1.2 control flow

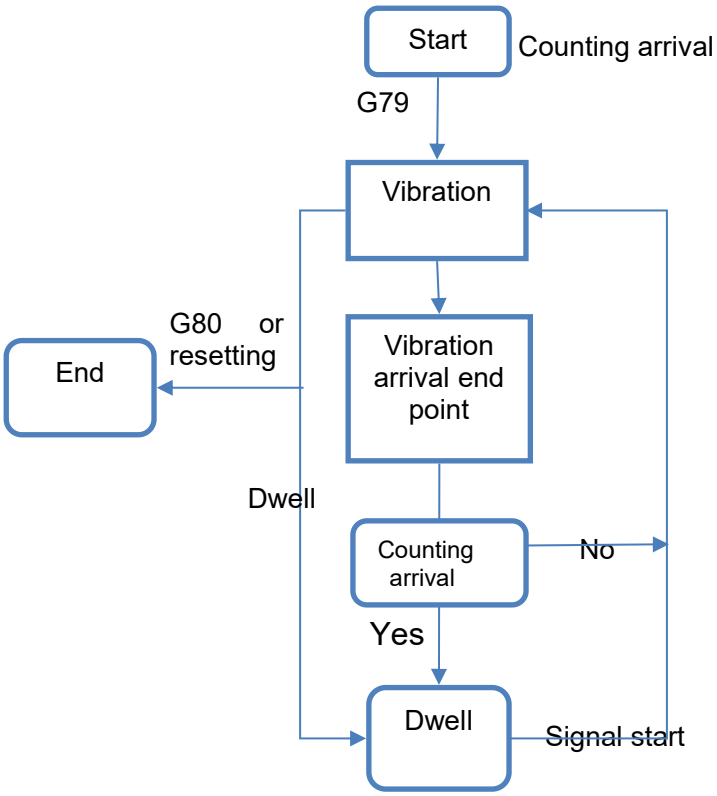


Fig.6-1 Operation flow chart

NOTICE

1. The vibration axis not only can be started and ended by commands, but also can be suspended (G57), started (G59) and stopped by the G signal of PLC;

2. The cancellation of vibration can be performed by G80, 

, ESP, quick retraction and limit;

3. The velocity change during the operation of vibration axis is controlled by override (G151 of PLC), or it can be performed the G79 again;

4. Vibration and other commands can not be specified a same axis at a same time;

5. The operation state of vibration and other feed axes are parallel and not be interfered each other;

6. The status signals of the oscillation state through the PLC: F155 (1 start state, 0 pause state), F156 oscillation state, F157 reaching the end state, F158 reaching the start state;

6.2.1.3 **Relevant Parameter**

- AXIS Parameters

1) Cutting feed acceleration/deceleration time constant after interpolation (axis parameter P20052)

2) Axis attribute setting 3 (axis parameter P20010:BIT7~6), G79 stop mode: 00 start stop; 01 Stop at the end; 10 Immediately decelerate and stop.

3) The maximum speed is limited by the maximum cutting feed speed of each axis (axis parameter P20029)

4) P10032: bit7~5, cancel G79 synchronization in emergency state.

5) G79 Number of oscillations Axis parameter (axis parameter P20138), 0 means infinite oscillations, when the number of oscillations is greater than 0, the axis will enter the suspended state when the number of oscillations is reached, and one round trip means two oscillations.

6) The displacement generated by the oscillation will not be reflected in the workpiece coordinate of the oscillating axis, but only in the machine tool coordinate.

7) Multiplication G151 signal.

8) The axis pointed to by the P field must be the rotation axis type A. When the axis parameter P20010BIT4 is set to one-way movement, only the direction of this parameter can be specified for movement, and when G80 is canceled, it can only decelerate immediately or stop at the end point.

Note 1:When the shaft is running G79 oscillation, the interpolation command (G0, G1, G2) of the shaft can also be run.

e.g.:

```
G0 X0 Z0              // Positioning to X0 Z0 position
G79 X100 F10          // The X-axis oscillates at the position 0-100 (the workpiece coordinate
                         of X-axis is 0 and remains unchanged, and the machine coordinate
                         changes at the position 0-100)
G0 X10                // The X axis moves 10 mm, and the oscillating position of X axis is
                         10-110 (X workpiece coordinate X10)
G1 U20                // The X axis moves 20 mm, and the oscillating position of X axis is
                         30-130 (X workpiece coordinate X30)
G02 X40 Z40 R100 // Perform circular interpolation with a radius of 100 from position
                         point (X30 Z0) to point (X40 Z40). At this time, the oscillating
                         position of X axis is 40-140;
```

Note 2: G80 command cancels vibration of all axes.

Note 3: G80 P2, cancel the vibration of 2nd shaft.

Note 4: G79 X100 Z100 B720 C720 P4, the fourth axis of the system is the B axis, this command specifies the X Z B C axis to oscillate, and the P field value is 4, then the fourth axis B axis is in one-way motion, and X Z C is the back and forth oscillating motion from the starting point to the end point.

Note 5: Class B code used G39.

6.2.1.4 Application examples

E.g.:G0 X10 Z20; Go to the start position

G79 Z30 F4000; Start Z-axis oscillation and oscillate back and forth between 20 and 30 at F4000;

…

G80; Cancel oscillation

…**Relevant Parameter**

- AXIS Parameters

1) Cutting feed acceleration/deceleration time constant after interpolation (axis parameter P20052)

2) Axis attribute setting 3 (axis parameter P20010:BIT7~6), G79 stop mode: 00 start stop; 01 Stop at the end; 10 Immediately decelerate and stop.

3) The maximum speed is limited by the maximum cutting feed speed of each axis (axis parameter P20029)

4) P10032: bit7~5, cancel G79 synchronization in emergency state.

5) G79 Number of oscillations Axis parameter (axis parameter P20138), 0 means infinite oscillations, when the number of oscillations is greater than 0, the axis will enter the suspended state when the number of oscillations is reached, and one round trip means two oscillations.

6) The displacement generated by the oscillation will not be reflected in the workpiece coordinate of the oscillating axis, but only in the machine tool coordinate.

7) Multiplication G151 signal.

8) The axis pointed to by the P field must be the rotation axis type A. When the axis parameter P20010BIT4 is set to one-way movement, only the direction of this parameter can be specified for movement, and when G80 is canceled, it can only decelerate immediately or stop at the end point.

Note 1:When the shaft is running G79 oscillation, the interpolation command (G0, G1, G2) of the shaft can also be run.

e.g.:

```
G0 X0 Z0              // Positioning to X0 Z0 position
G79 X100 F10          // The X-axis oscillates at the position 0-100 (the workpiece coordinate
                         of X-axis is 0 and remains unchanged, and the machine coordinate
                         changes at the position 0-100)
G0 X10                // The X axis moves 10 mm, and the oscillating position of X axis is
                         10-110 (X workpiece coordinate X10)
G1 U20                // The X axis moves 20 mm, and the oscillating position of X axis is
                         30-130 (X workpiece coordinate X30)
G02 X40 Z40 R100 // Perform circular interpolation with a radius of 100 from position
                         point (X30 Z0) to point (X40 Z40). At this time, the oscillating
                         position of X axis is 40-140;
```

Note 2: G80 command cancels vibration of all axes.

Note 3: G80 P2, cancel the vibration of 2nd shaft.

Note 4: G79 X100 Z100 B720 C720 P4, the fourth axis of the system is the B axis, this command specifies the X Z B C axis to oscillate, and the P field value is 4, then the fourth axis B axis is in one-way motion, and X Z C is the back and forth oscillating motion from

the starting point to the end point.

Note 5: Class B code used G39.

6.2.1.4 Application examples

E.g.:G0 X10 Z20; Go to the start position

G79 Z30 F4000; Start Z-axis oscillation and oscillate back and forth between 20 and 30 at F4000;

…

G80; Cancel oscillation

…

6.2.2 Eccentric Axis (Curve Axis)

Eccentric axis workpiece; that is, the grinding cylinder section is standard circle; however, the central axis of the center O' deviates a certain distance I from the generatrix of workpiece O of which this distance is called as eccentricity (refer to the following figure). Commonly, the eccentric axis workpiece has the eccentric axis of decelerator, curve axis of motor, etc.

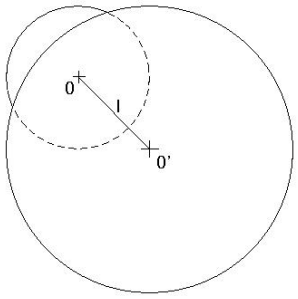


Fig.6-2

At present, the machining of this workpiece is mainly carried out by workpiece of which this method can be guaranteed the roundness of the milling cylinder; however, the requirements, such as the accuracy of the eccenticity, taper for multi-cylinder and coaxiality will not show the excellent machining effects. The following command G87 of the eccentic workpiece is offered based upon the workpiece milling of GSK986. The grinding wheel regardes the milling point path as destination by touching the surface of the workpiece of which where the workpiece axle wire is treated as the reference. The controllable mode is that the workpiece spindle rotation is the main one and the grinding wheel is the slave one. Ensure the machining precision based upon the machine tool and CNC, avoid the low inconsistency of the dimension and the poor precision due to machining method, such as the workpiece and explorator.

6.2.2.1 Format

G87 I_ RI_ RK_ K_ J_F_Q_

6.2.2.2 Format Description

RK: Grinding wheel radius; Value range:>=0

RI: Workpiece radius; Value range:>0

K: Single turn feed; Value range:*>0*

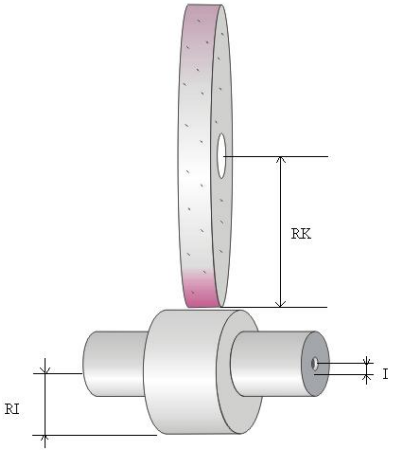
F: Workpiece speed; Value range:(0,300) , When exceeding 300, F=300;

J: Tool retraction; Value range:>=0 (Omitted, equal to 0 by default)

I: Eccentricity,The distance between the center of the circle and the center of the workpiece; Value range: When the value is positive, it means that the workpiece deviates from the positive direction.

P: The P field defaults to 0 by default; When P is not equal to 0, different cutting modes are used. In synchronous mode, K, F, J, RK and Q can be defaulted.

Q: Synchronous tool starting angle (optional, equal to 0 by default).



6.2.2.3 Relevant Parameter

1) P70031 Number of polishing cycles
   Number of rotation cycles of feed rate (smooth grinding).
2) P70033 0 degree (peak) compensation angle
   Output torque compensation range of the grinding wheel from positive to negative.
3) P70034 180 degree (groove) compensation angle
   Output torque compensation range of the grinding wheel from negative to positive.
4) P70036 Horizontal compensation value of non-circular cutting
   Form and position deviation of workpiece in horizontal direction.
5) P70037 Compensation value of non-circular cutting in vertical direction
   Form and position deviation of workpiece in vertical direction.

- Roundness

Workpiece roundness is an important index to measure the machining accuracy, which directly reflects the performance of the machine tool. In addition to the CNC control accuracy listed above, the overall performance of the whole machine should also be considered. In the absence of precision measuring instruments, the roundness of the outer circle processed by the machine tool and the maximum following error (data diagnosis) in the processing process can be used to comprehensively evaluate the processing roundness.

In actual machining, the smaller the following error, the better the roundness; The lower the speed, the better the roundness.

- **Dimension precision of cylinder**

The deminsion precision of cylinder is mainly depended on the workpiece tool-setting accuracy (ignor the accuracy of the machine tool), and the radius/diameter is regarded as the reference at where the tool-setting point (the deviation or error may occur in the other positions due to the value from roundness or taper).

- **Workpiece roundness (taper)**

The milled workpiece taper is different with the excircle milling taper: the excircle milling belongs to the pointed milling; generally, the workpiece taper with different dimensions are basically identified, and the taper adjustment of the machine tool is relatively simple; however, the taper of workpiece is affected by the wave of the whole grinding wheel along with the milling, so that the guide interval and linear accuracy, etc. are easily waved for the milling surface during the follow-up motion. The different taper errors may be generated at the relative position of the distinguished cylinder position.

As the same sylinder, the error of taper will be directly affected the roundness of the workpiece; with regard to the multi-eccentric cylinders for one workpiece, the projection coincidence among cylinders and the comprehensive tappter will directly affected the integrated accuracy of workpiece.

- **Parallel of axle wire**

The parallel is the line between the milling cylinder axle wire and workpiece bus. The error of parallel is referred to centre bore and ejector rotation accuracy regardless of the single eccentric cylinder; however, when the multi-eccentric cylinders are shared with one workpiece, we should strict to the parallel. The error of comprehensive parallal of the cylinder combination at the different phase positions are shown a geometic growth.

- **Surface smooth**

Smooth is another important index for verifying the performance of the grinding machine. Factors affecting the smooth are the linear speed of grinding wheel, workpiece revolving speed, the grininess of grinding wheel's material and polishing time, etc. The milling options (Bit0 of P0104) of the constant linear speed and constant angle speed are offered based upon the characters that the surface smooth of eccentric has differences according to the different parameters of CNC.

In addition, the important effects factors of the smooth are depended on the material and graininess.

- **Machining Efficiency**

Similarly, the machining efficiency is an important embodiment of the machine performance. The referred factors will not be described one by one other than the machining margin. The milling process belongs to the finish-machining, and the milling efficiency may be reduced if the excessive margins are generated; in addition, the massive margin milling and sectional milling are easily caused the tension change on the surface of workpiece, so that the distortion on workpiece and the reduce on hardness may be appeared; strictly control the selection of margins and technology distributions of rough/finish-polishing accordingly.

6.2.2.4 **Application Example**

E.g.: The machining dimension of the eccentric axis is as the follows:

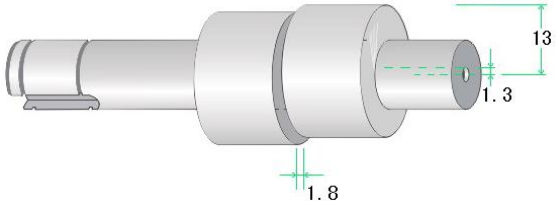
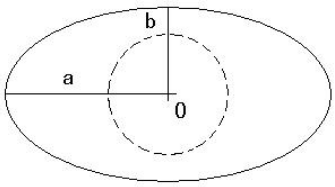


Fig.6-5

O87;
G00 X120; Rapid position to the safety position at the rapd traverse rate
C0; Workpiece rotates to the tool-setting zero
G01 X30 F500; Close to the workpiece at the rapid of F500
M08; Cooling open
N1 G01 X29 F20; Position to the milling start at the speed of the F20
#6128=2; Specify the circle number of the polishing
#6129=60; Specify the workpiece revolving speed when the rough-milling is performed.
G87 I1.3 RI13.05 RK200 K0.02 ; The rough-milling of that the destination diemension is 0.02 based upon the single-circle feed.
#6128=20; Specify the circle number of the polishing
#6129=40; Specify the workpiece's revoving speed of the finish-milling and polishing
G87 I1.3 RI13 RK200 K0.005 ; The rough-milling and polishing of that the destination dimension is 13 based upon the beginingof the single-circle feed 0.005.
N2 G01 X30 F500; Cylindar 1 completion, tool retraction
G00 C180; Workpiece rotates 180°, start the cylindar 2 milling
… Repeatedly perform the blocks between N1～N2
M09; Cooling close
M02; End of program

6.2.3 Oval Grinding

System is designed the oval grinding with the command G88 aiming for the oval workpiece grinding of the its section.



6.2.3.1 Format

Format: G88 A_ B_ RK_ K_J_ F_Q_

Purpose: The workpiece of oval rotates with the C axis, and the X axis operates along with the workpiece's surface based upon the following method.

Explain:

A: the long axis of the oval; Value range:>0

B: the short axis of oval; Value range:>0

RK: the radius of the grinding wheel; Value range:>=0

K: the feed value of single circle; Value range:(0,300) , When exceeding 300, F=300;

F: Workpiece speed; Value range:>0

J: Tool retraction; Value range:>=0 (Omitted, equal to 0 by default)

P: The P field defaults to 0 by default; When P is not equal to 0, different cutting modes are used. In synchronous mode, K, F, J, RK and Q can be defaulted.

Q: Synchronous tool starting angle (optional, equal to 0 by default).

6.2.3.1 Feed path

Refer to Eccentric Shaft Class.

6.2.3.3 Related parameters

1) P70031 Number of polishing cycles

Number of revolutions without feed (smooth grinding).

2) P70033 0 degree (peak) compensation angle

Output torque compensation range of the grinding wheel from positive to negative.

3) P70034 180 degree (groove) compensation angle

Output torque compensation range of the grinding wheel from negative to positive.

6.2.3.4 Relevant indicators

Refer to Eccentric Shaft Class.

6.2.4 Path (Interpolation) Table

GSK986 is machined for the grinding aiming for that the model is enclosed curve workpiece, which is provided the path (interpolation) table function. Generally, the small section machining should be extra treated to the cutter radius; however, such a method may not be adequate when the cutter radius is diminishing for using tool on grinding machine. As for the path table function of the CNC, only, the user offers a contour path of the workpiece. The compensation caused by the change of the cutter radius due to the abrasion can be carried out by system.

6.2.4.1 Format

G200 P_ Q_

P: Contour table format:C_ X_ C represents angle; X represents the distance from the workpiece center to the contour;

Q: Speedometer format: C_ F_ C represents angle; F represents the speed, in revolutions per minute;

Note: Speedometer is only valid for G86 and G86.1 commands

G86 R_ K_ F_ I_ J_H_Q_;

G86.1 R_ K_ F_ I_ J_H_Q_;(With speed smoothing)

R: Grinding wheel radius; Value range: No limit (internal grinding in case of negative value)

K: Single turn feed; Value range:>0

F: Workpiece speed; Value range:(0,300) , When exceeding 300, F=300; It indicates the speed at which the speedometer is used when F defaults,.

I: Eccentricity,The distance between the center of the circle and the center of the workpiece; Value range: When the value is positive, it means that the workpiece deviates from the positive direction.

J: Tool retraction; Value range:>=0 (optional, equal to 0 by default)

H: RESERVE; Value range: No limit,when the value is negative, grind more;(optional, equal to 0 by default)

P: The P field defaults to 0 by default; When P is not equal to 0, different cutting modes are used. In synchronous mode,K、F、R、I、J、H、Q can be defaulted.

Q: Synchronous tool starting angle (optional, equal to 0 by default).

6.2.4.2 Interpolation table format

1) Absolute value input

O****;**** program number

X_ C_; X is the absolute coordinate of the current point;C is the angle of the current point;

……

M99; End character of subprogram

6.2.4.3 **Format of Velocity Table**

The detailed range of the speed command in the velocity table is 1～360 blocks; at 1st block, it is directly regarded as “C0 F1000;”; at the 360 blocks, they are treated as “C0 F1000; C1 F2000……” in turn. Refer to the following format:

O****;**** is program number

C_ F_; C is the angle of current point, F is the velocity of current angle.

……

M99; End character of subprogram

6.2.4.4 **Subdivision Condition of Interpolation Table**

Generally, the more the subdivision sections of the graph’s path is (C/H), the longer the program is, the bigger the desired memory is; however, there are some stored limitations inside the system, and therefore, the line number of the current interpolation table should be less than 40000; if the interpolation table exists, the interpolation table + the line number of the interpolation table should be less than or equals to 40000.

The line number is conversted into angle, namely, the segment number range of the C (H) axis is regarded as 1º~0.01º.

6.2.4.5 **Postion of Start and Tool-Setting**

It is necessary to abide by a principle when the interpolation table is produced:

The tangent of the start whatever the front or rear that can not be existed the interfereced other points for the start.

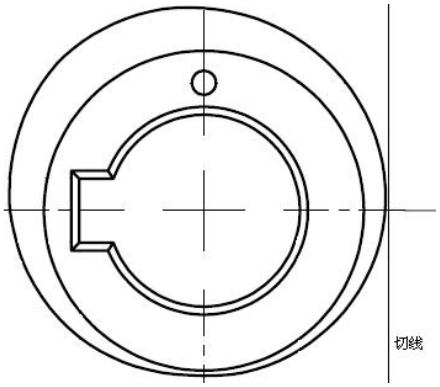


Fig.6-7

The tool-setting position of workpiece machining is the start of workpiece interpolation table.

The other points interfered with the start can not be performed in the front or back of the tangent line of the start point; that is the reason that the system performes the corresponding

smooth treatment in the short section path during the milling; and its principle may cause that the system removes the interference point in the path; so that the start point may different due to the change of the end point at the end of the workpiece processing.

The shape of the whole workpiece will not obviously change based upon the smooth treatment, and its main purpose is to guarantee the acceleration/deceleration stably of two axes during the following machining, and its optimal velocity jump exceeds the point of its range.

Viewing from the format of smooth treatment, the bigger the grinding wheel diameter is, the more severe the condition of the smooth treatment is. The shape of the slot may various due to the smooth. Consequently, the smaller diameter of the grinding wheel will reduce the effect of the interference.

Generally, the start (tool-setting point) is furthest or convex point of a workpiece.

6.2.4.6 **Feed Mehtod**

Similarly, it is used the helical feed method (Refer to the Section 6.2.2.1).

6.2.4.7 **Treatment Method of Velocity**

When the CNC executes the G89, G86, 1st F is regarded as the reference value of the internal speedometer, and the maximum speed increment is 100%/sec. of that of F; it will be calculated with the max. speed increment when it runs up to the top increment.

6.2.4.8 **Relative Parameter**

1) P70031 Number of polishing cycles

Number of revolutions without feed (smooth grinding).

6.2.4.9 **Machining Technology Essentials**

1) Select the suitable grinding wheel

It is easy to view from the velocity smooth treament, it is necessary to select the adequate grinding wheel for machining different workpiece for reducing the effect of grinding wheel smooth treatment. Surely, note the selection of the velocity of grinding wheel when the diameter of grinding wheel is excessive small.

2) Tool-setting principle

Commonly, firstly confirm the position (it is the workpiece's zero at the two tips' position) of the axle cable of the workpiece when the tool-setting is performed, and the tool-setting position can be set by trial milling of excircle.

Generally, the tool-setting can be performed by using the top point; therefore, note the axle wire between two tips, tool-setting point and the axle wire in grinding wheel should be set within a same plane as much as possible.

4) The troubleshooting of that the bigger the base circle is, the bigger the error is

The following performance of axis is directly affected the error and accuracy because the machining of the interpolation table adopts the following milling method; generally, the bigger the base circle is, the bigger the arc corresponding with the unit angle is, simultantously, the bigger the error is in the following situtation. In this case, try to decrease the milling speed to reduce the error range.

5) Disposable milling

It is note that the change of the base circle dimension for the workpiece causes the error of workpiece's shape.

Simultaneously, it is necessary to note the influence of sectional milling to the workpiece

tension.

6.2.5 Oblique-axis Linkage/Non-linkage

6.2.5.1 **Format**

Linkage M90(PLC add. G63.5=1)

Non-linkage M91(PLC add. G63.5=0)

6.2.5.2 **Command Explanation**

Linkage: In the state of the obilique axis, x axis moves, and the Z axis machine can be simultaneously moved based upon the relationships of oblique angle, as well the absolute coordinate invariable.

Non-linkage (Cancel the linkage): In the state of the obilique axis, x axis moves but the Z axis machine does not, and its absolute coordinate varies according to the oblique angle.

6.2.5.3 **Relevant Parameter**

- Channel parameters

P	1	0	0	3	5	Bit0:Whether to enable the control of tilt axis, 0-OFF, 1-ON
P	1	0	0	3	6	Oblique angle of its slope axis
P	1	0	0	3	7	Axis number of tilt axis controlled by tilt axis
P	1	0	0	3	8	Axis number of the orthogonal axis controlled by the tilt axis

6.2.5.4 **Relevant Command**

Machine coordinate system selects G53 (Refer to *USER MANUAL* for format).

6.2.5.5 **Application Example**

There is an angle α that its X axis is perpendicular to Z axis from one machine tool manufacture; refer to the right-down figure:

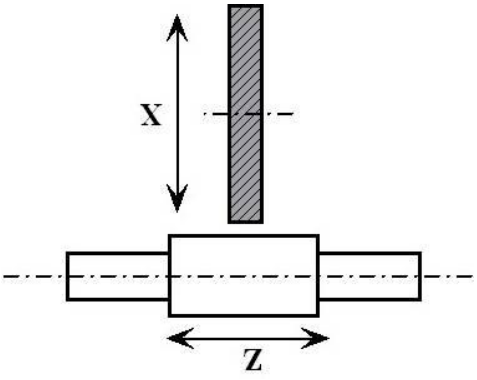


Fig.6-8 Convention grinding schematic

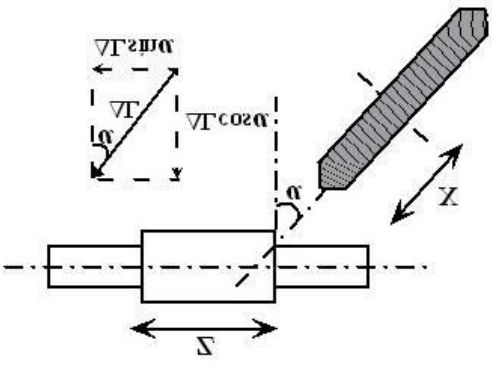


Fig.6-9 Grinding schemetic of oblique axis

Measure the angle, refer to the following steps:

(1) Complete the debugging of the overall machine function and capacity (main motor

performance and mechanism accuracy, etc.);

(2) Clear the parameter P10036 to 0 before measuring the angle;

(3) Move the Z axis to the suitable position, place the stand of dial gauge at the Z axis; its indicator is perpendicular to the Z axis and eject one plane of X worktable;

(4) System calls the MPG or single-step, slightly move by controlling X axis; stably moves and indicator clears.

(5) Move a long distance by controlling MPG with unidirection, record the movement value of MPG; simultaneously, record the movement value ΔL of X axis shown by system;

(6) Repeat the stesp (3) ~ (5), if we take 5 ~ 10 points, then calculate: arc cosα=L/ΔL;

(7) Remove a miximum value and a minimum value from the calculated values, average the remaining values from which the gained angle fills into the P0036;

6.2.5.6 **Precautions**

1) There are no direct relationships among the reverse interval, pitch error and oblique angle, and it is better to shied the oblique angle before measuring (P0017＝0);

2) Oblique axis programming should be performed based upon the rectangular coordinate system of drawing;

3) It is better to position by using the G53 direct machine coordinate system for ensuring the efficiency (Velocity may relatively reduce when the linkage position is performed) when the oblique axis is positioned, especially, the machine with the end-face apparatus positioning is more convinient (The positioning of machine coordinate system can be reduced the accuracy positioning time due to different size of the error of the horizontal workpiece);

4) The selection of the linkage/non-linkage mainly guarantees the consistence of zero point; note that the offset change regulation of zero should be consistent in conpensating when carrying out the grinding wheel wearing and the trimming compensation by using the cutter compensation, coordinate offset, etc;

5) The input oblique angle can not avoid any error, and therefore, the absolute error may bigger when several workpieces and the workpiece with bigger error in outer dimension are processed; it is note to adjust the machining dimension;

6) It is recommanded to divide the trimming end-face and radial diamond pen when the grinding wheel of oblique axis is trimmed; avoid the error caused by the interference of the nip (The cutter radius compensation can be achieved the single nip, but the effect is not ideal);

CHAPTER SEVEN APPLICATION EXAMPLE

7.1 Grinding Wheel Trimming & Compensation

7.1.1 Grinding Trimming of Sub-Coordinate-System

```
O100;                       Grinding wheel trimming
G55;
G00 X#516;                  Trimming start along X axis
G00 Z#517;                  Trimming start along Z axis
M08;                        Cooling open
G01 U-0.02 F10;             Grinding wheel trimming 0.02
G01 W40 F300;               Trimming pen moves horizontally
G01 U-0.02 F10;             Grinding wheel trimming 0.02
G01 W-40 F300;              Trimming pen moves horizontally
M09;                        Cooling close
#5210=#5210-0.04;           G54 coordinate offset (Overlap the trimming value on the offset
                            value) - G10 U-0.04 P10001;
#5220=#5220-0.04;           G55 coordinate offset (Overlap the trimming value on the offset
                            value) - G10 U-0.04 P10002;
G54;G00 U10;                Return to the machining zero
M99;
```

7.1.2 Grinding Trimming of Tool Offset

```
O1; Trimming the main program of grinding wheel
T101;                       Position of trimming head
G1 X-60 F5000 M08 ;
Z0;
X-1;
X0.0 F200;
#121=-0.03;                 Trimming value for single time
#123=-60;                   Horizontal distance
#111=2;                     Trimming times
#109=300;                   Velocity
M98 P9001 L#111;            Call the trimming subprogram
G1 W-60 F260;
X-60 F5000;
M09;
M99;

O9001 ;     Subprogram trimming
N10 G1 U#121 F100 ;         In-feed of trimming head
N20 G1 W#123 F#109 ;        Horizontal travel
```

```
N30 #123=-#123;          Width reversal
#2001=#2001+#121;        Trimming compensation - G10 U#121 P1;
#2002=#2002+#121;        Stage 1 compensation - G10 U#121 P2;
#2003=#2003+#121;        Stage 2 compensation - G10 U#121 P3;
M99;
```

7.2 Repeated Movement improves Roughness

```
O101;    Machining procedure
G54;
G00 X50 Z100;            Positioning to start
M08;                     Cooling open
G79 Z150 F3000;          Repeatedly operate based upon F3000 speed along Z axis
G01 U-0.5 F1;            Grinding wheel performs rough-milling feeding 0.5mm based upon
                         the velocity of F1
G01 U-0.02 F0.2;         Grinding wheel performs finish-milling feeding 0.02mm based upon
                         the velocity of F0.2
G04 D1;                  Polishing waits for 1s
G80;                     Vibration stops
M09;                     Cooling close
M02;
```

7.3 Multi-Stage Milling & Tool-Setting

```
O0 ;                     Main program machining
M98 P100;                Call the sub-program trimming
M98 P2 L20;              Call the main program milling
M30;

O2;                      Main program milling
M00;
T102;                    Tool-setting position of stage 1
M08;
G1 Z0 F1500;
X1;
X0.5 F100 ;              Positioning to the surface of workpiece
X0.2 F4 ;                Roughk-milling
X0.1 F2 ;                Finish-milling
X0.0 F1 ;                Polishing
G1 U1 F1500 ;
T103 ;                   Tool-setting position of stage 2
G1 Z0 F1500;
X1;
X0.5 F100 ;              Positioning to the surface of workpiece
X0.2 F8 ;                Roughk-milling
X0.1 F4 ;                Finish-milling
```

```
X0.0 F2 ;                    Finish-milling
G1 U-10 F1500;
T102 ;                       Return to the position of the 1st stage
G0 X60;                      Return at the rapid traverse rate
M09;
Z0;
M05;
M99;
```

Operations:

(1) The compiled programs are showed as above-mentioned;

(2) Trimming pen tool-setting: Shift to the 

page after the mechanical zero return executes; select the 

and then shift to the method; control the suitable position for the grinding wheel trimming pen by MPG, and the page cursor moves to the 01 column of tool offset, the following page is then appeared by controlling the  :

Fig.7-1

Press the 

to confirm after inputting the 
, similarly, complete the zero operation along Z axis by pressing the 

.

(3) Stage tool-setting: Move to the stage position by the MPG, the trial-milling workpiece is polished accordingly; on the sub-page of the 

; cursor moves to the offset 02, the input page is then displayed by pressing the 
, and then input the maximum margin dimension of the workpiece; for example, the 0.4, confirm it by pressing the 

;subsequently, press the

Z again, press the O to confirm after inputting the ENTER.

Similarly, complete the tool-setting of the 2nd stage.

(4) Amend the dimension: Grinding wheel retreats; measure the dimension of stage 1 after disassembling the workpiece; press the U# if the offset vaue at the tool-offset number 01 column, record the offset and confirm it by ENTER.

Similarly, execute the offset input at the stage 2.

(5) Start the process by controlling the CYCLE START (Prompt: Decelerate the feedrate for machining at 1st time, and detect whether the program is correct by selecting the 单段 mode). Measure the workpiece after the machining is performed, and the error dimension can be amended by U# at its corresponding tool offset number.

7.4 Grinding Command (Macro Command)

G65 A_ B_ C_ D_ I_ J_ K_ H_ Q_ Z_ F_ E_ P9976;

;A=#1; Total amount of X light ("positive" value)

;B=#2; X Total amount of coarse grinding ("positive" value)

;C=#3; X Total amount of fine grinding ("positive" value)

;I=#4; X Rough grinding speed

;J=#5; X Fine grinding speed

;D=#7; Horizontal number of polishing

;K=#6; Starting signal of measuring instrument (P1:allowance detection, P2:rough grinding, P3:fine grinding, P4:smooth grinding, P5:runout)

;H=#11; Measuring instrument detection level (0 does not detect, 1 only detects P4, 2 detects P1 and P4, 3 detects P1~P4, 4 detects P1~P5)

;Q=#17; P5 Number of rotation cycles of workpiece for runout detection, once every 0.01s

;Z=#26; Workpiece cross grinding width

;F=#9; Z direction coarse grinding/fine grinding speed

;E=#8; Z direction "to size"/polishing speed

NOTICE

The program is long, please check in the system or contact the manufacturer.

7.5 End-face Apparatus (Grinding Machien with Oblique Axis)

O123; Oblique axis main program

M90; Linkage state

G55; Shift to the coordinate system used for the apparatus

```
G0 X0;                    Positioning to the start point
Z0;
M72;                      End-face apparatus downwards
G31 U-10 F10 P1;          End-face apparatus measurement
#510=#5021;               Record the end-face error of workpiece
G1 U10 F500;              Tool-retraction
……
G54;                      Shift the coordinate system used for machining
G1 Z20 F500;              End-face location positioning
W#510;                    End-face location offset
……
```

CHAPTER EIGHT COMMON SYSTEM FAULT & TROUBLESHOOTING

8.1 system failure

8.1.1 File save/compile alarm

- Editing and modification of large documents;

Troubleshooting:

(1) The system sets a single file larger than 512KB, which needs to be manually 

pressed before the program can be automatically saved;

(2) For program files over 1M, the system currently prohibits online editing and only allows viewing;

- After 

, the alarm content prompted is not completely consistent with the actual situation;

Troubleshooting:

(1) The compilation error report does not refer to the current program. Find the error report content according to the prompted program number and program segment;

(2) Whether the compiled program segments are complete and whether the function instructions leave parameters;

(3) Whether the newly added alarm file has been updated after the system upgrade;

- After 

, the prompt "****** divisor cannot be equal to 0" will appear;

Troubleshooting:

(1) Check the operation logic;

(2) The corresponding macro variable needs to be assigned;

- After 

,alarm information appears, and some alarm information exceeds the display area;

Troubleshooting:

(1) Press 

to display detailed alarm information and related "help information", or modify the alarm number to display other alarm contents;

8.1.2 Running alarm

- PLC alarm, the content is dark blue "*******";

Troubleshooting:

(1) Whether the pre preparation operation of the machine tool is completed, for example, the machine tool can only be started when the hydraulic pressure is turned on, and automatic

processing can only be operated when the machine tool returns to zero;

(2) Check the corresponding fault source according to the prompts, such as “Cooling motor overload”;

- ESP alarm:

Troubleshooting:

(1) Whether the emergency stop switch on the machine tool operation panel and hand-held unit box is pressed;

(2) Whether the operation panel of the machine tool is disconnected or the circuit of the emergency stop switch is abnormal. If the alarm still exists after the emergency stop signal is shorted, the current interface board (keyboard board) is damaged;

(3) Accidental emergency stop alarm, poor contact of connecting cable, and check the terminal; If the internal spring plate of the emergency stop button is in poor contact or aging, replace the button;

(4) Accidental emergency stop alarm, with network disconnection alarm, I/O alarm caused by abnormal network connection, network problems, network cable plug, etc;

- ESR alarm:

Troubleshooting:

(1) Distinguish the trigger source of the emergency retreat alarm, whether it is triggered by pressing a key or by an overload signal;

(2) Trigger the "emergency retreat" protection, CNC interrupts the current execution state, and sets the axis to move away from the current position at a fast speed;

- Pre limit alarm:

Troubleshooting:

(1) If the command position to be executed exceeds the set soft limit, alarm in advance, check the program or reset the tool;

(2) Is the tool compensation abnormal;

8.1.3 Abnormal screen display

- The screen flashes and stripes appear;

Troubleshooting:

(1) The LCD screen or display board is damaged when it is powered on;

(2) If it occurs during operation, the components of the display board are falsely soldered or the screen connecting line is falsely connected, repair or replace it;

- The screen does not display, or the screen is white or black;

Troubleshooting:

(1) It appears when power is on, but cannot be eliminated when power is on again. The main board, display board and LCD screen have faults and can only be replaced;

(2) Power on occasionally occurs, and it is good to power on again. The system power supply voltage is unstable, resulting in abnormal LCD display. Check for strong current;

- The system displays the interface of returning to startup;

Troubleshooting:

(1) System vulnerability appears after page switching. Please contact the manufacturer for upgrading;

8.1.4 U disk problem

- U disk cannot be identified:

Troubleshooting:

(1) If the new U disk format (FAT32) is abnormal, or the U disk has a virus, reformat the U disk;

(2) The USB flash disk contains hidden partitions, which requires a new low grid USB flash disk. For details, see the relevant instructions;

- Sometimes it can be identified, sometimes it cannot:

Troubleshooting:

(1) U disk quality problem or USB plug aging;

(2) The machine tool is not effectively grounded, and the leakage affects the identification of U disk;

- The U disk cannot be updated, backed up, restored, etc;

Troubleshooting:

(1) If the file path of the U disk or system disk contains Chinese characters or garbled codes, contact the manufacturer for handling;

8.1.5 Parameter abnormal alarm

- The parameters are disordered and lost after the system is powered on:

Troubleshooting:

(1) The mainboard memory is damaged, replace it;

- Commissioning mode appears after power on:

Troubleshooting:

(1) If the PLC and parameters are lost due to normal use and power on again, refer to the above treatment;

(2) If the ladder logic error occurs after the ladder diagram is modified, the PLC cannot start normally, and the ladder diagram is modified;

8.1.6 Disk or storage

- Occasionally, after restart, the page switching is relatively slow, and it will be better after a period of time:

Troubleshooting:

(1) Generally, it is a software problem, memory overflow, and system software upgrade;

- When switching from other modes to automatic mode, the compilation time is long:

Troubleshooting:

(1) The system runs for a long time, with memory fragments, and is restarted after power failure;

(2) There are too many levels of program nesting, or there are nested loops.

- The copy cannot be overwritten, or the copy is successful but the system (application) cannot be started:

Troubleshooting:

(1) The operating system has a problem, and file fragments occur. In serious cases, the application starts abnormally. You can only format and copy again;

8.1.7 Crash or automatic shutdown

- Occasionally, the system operates the page switch without response:

Troubleshooting:

(1) Occasional fixed operations, software problems, software updates;

(2) Frequently, the application program in the system is damaged or infected with viruses. Contact the manufacturer to replace the software;

8.1.8 Machine tool running

- When synchronous control function is used, power on:

Troubleshooting:

(1) Synchronous control axis setting error;

(2) After power failure, one of the shafts was offset, which was caused by readjustment after the system was powered on;

- The shaft with a Grading ruler runs at random;

Troubleshooting:

(1) Whether the Grating ruler signal is normal;

(2) Whether the parameters of double position ring are set reasonably;

(3) Whether the double position loop error protection servo enable function of ladder diagram is enabled;

8.1.9 Encoder alarm, abnormal coordinate value

- Absolute Encoder is used, and the coordinates are abnormal after power failure:

Troubleshooting:

(1) The servo or motor encoder is damaged, replace it;

(2) If the network interface board of CNC fails, replace it and reset the zero point;

(3) When the rotating shaft occurs, the gear ratio causes errors in the calculated position of the rotating shaft, and the manufacturer is contacted for handling;

8.1.10 Tool compensation function

- Tool compensation function is invalid:

Troubleshooting:

(1) Only tool compensation of 1st five axes is supported;

8.1.11 Repetitive positioning accuracy

- Repeated positioning accuracy of the machine tool changes, and the value increases evenly in one direction:

Troubleshooting:

(1) Adjust motor rigidity (restrain current loop jitter);

(2) Mechanical problems: parallelism and tightness of bearings; Accuracy of screw rod installation (side bus, horizontal); Screw rod expansion; Temperature rise, aging, etc;

- Single step positioning and inaccurate step size:

Troubleshooting:

(1) Encoder line number and gear ratio setting;

(2) Screw pitch error and mechanical installation accuracy;

- The actual change of zero point after the system is powered on again:

Troubleshooting:

(1) Mechanical accuracy and temperature rise;

(2) Encoder failed.

8.1.12 Network function (interconnection)

- System online function;

Troubleshooting:

(1) Online failed. Confirm whether the parameters are set normally:

8.1.13 Input/output, common terminal

- Input/output common terminal:

Troubleshooting:

(1) The input/output common terminal of the system host is 24V;

(2) The input/output low level of IOR-44T/IOR-21TP series IO unit is valid; Generally, PNP type proximity switch is used. When NPN type proximity switch is used, pull-up resistance shall be added;

- Analog output:

Troubleshooting:

(1) Check whether the analog output terminal of I/O unit has voltage;

(2) The analog quantity precision output through the I/O unit is divided into 12 bits and 16 bits. See the I/O unit instructions for details;

8.2 Machine failure

8.2.1 Network alarm

- "Network disconnection" alarm and "CP0~CP6 configuration timeout failure" alarm occur when power on:

Troubleshooting:

(1) CP0 means that the hardware connection is not successful, and the wire is generally disconnected or the wiring sequence is wrong;

(2) CP1~CP3 refers to the alarm of unstable hardware connection, which generally means that one of the slave stations is not firmly connected or fails, the hardware connection fails, or whether the network cable plug is normal;

(3) CP4~CP6 are caused by hardware interference, abnormal data, general poor contact and external interference;

(4) Check whether the working indicator of the CNC network interface is on, no, the interface board is faulty, and replace it;

(5) Oxidation of network connection wire connector;

(6) Check whether the slave station has alarm or is damaged and cannot be powered on, and replace it;

- "Network disconnection" during use;

Troubleshooting:

(1) Check whether the connected slave stations are normal and whether the switching power supply of the I/O unit is faulty;

(2) If it still appears, find the interference source near the machine tool;

- I/O board disconnection, etc

Troubleshooting:

(1) Check whether the I/O unit working indicator is normal (flashing);

(2) Check the connection network of I/O unit;

8.2.2 Spindle fault

- No output of spindle

Troubleshooting:

(1) The analog voltage of the spindle output is abnormal, the D/A power supply chip is damaged, or the frequency converter is damaged:

(2) Whether the relevant switching signals (M3/M4/M5 and other signals) are output normally;

- The actual speed of the spindle is inconsistent

Troubleshooting:

(1) Whether the spindle gear ratio is reasonable;

(2) Whether the spindle magnification is 100%;

- The head frame spindle is accidentally misaligned when using C/S axis;

Troubleshooting:

(1) Connection of mechanical transmission parts;
(2) Whether the zero return deceleration switch required by the analog motor is normal;

- Streaks or vibration lines appear during indexing of head frame spindle;

Troubleshooting:
(1) For mechanical reasons and transmission, it is recommended to install reducer;
(2) Rigid parameters of motor, torque motor can be used if conditions permit;

8.2.3 Machining accuracy error

- The actual deviation of the workpiece measured by the measuring instrument is large

Troubleshooting:
(1) Whether the measuring head of the gauge is fixed, whether the rebound of the measuring head of the gauge is sensitive, whether the advance and retreat of the hydraulic cylinder are stable, and whether the measuring host is stable;
(2) Whether the system sets the speed of the response meter in time (parameter P70040);
(3) Measure the leakage current of the machine tool, whether the grounding of the system and measuring instrument is reliable, and whether there is external interference;
(4) Observe whether there is spark or gauge size change through the last polishing, and judge whether there is a problem with the grinding wheel spindle, headstock spindle, tailstock thimble, etc;

- Large step grinding error without gauge

Troubleshooting:
(1) Whether the repeated positioning of the machine tool is stable;
(2) Whether the grinding wheel material and dressing frequency are reasonable;
(3) Check whether the grinding wheel spindle, head frame spindle, tailstock thimble and other conditions are normal;