RichAuto-B5X Series Motion Control System

User's Manual

北京锐志天宏科技股份有限公司

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Thank you for choosing RichAuto products!

This manual helps you be familiar with the company's products, and get information

about systems' components、 configuration etc.

This manual contains detailed knowledge of the system characteristics 、 operating procedures, installation &commissioning, and safety precautions. Please read this manual carefully before using the system and machine, which will help you to use it better.

Cautions:

1. It's strictly prohibited in the strong interference and strong magnetic field environment. Operating ambient temperature：0-70 ℃；Environment humidity： 0-90% (Non-condensing).

2. Insert U disk in the correct direction. Do not pull out or insert 50-pin signal transmission cable when system is powered on.

3. During the perform processing in U disk file, do not pull out the U disk to prevent the interruption of data transmission.

4. Strictly prohibited metal, dust, and other conductive substances drop into the handheld controller shell.

5. The machine casing shall be well grounded to ensure work safety and prevent interference.

6. Unauthorized removal is strictly prohibited, no internal user repairable parts.

7. For long time not using, please power off and keep it properly.

8. Be careful to prevent it from water, dust, fire when using.

9. Do not use the corrosive chemical solvents to clean the device.

10. Spindle motor bearing life and its speed is inversely proportional.

11. Graver is very sharp. Do not touch when it is running, in order to avoid injury；Do not use handkerchiefs, scarves to approach it to prevent embroiled damage.

Important statement:

The Company shall not be responsible for any loss caused by improper using or failure to comply with the rules of operation.

Beijing RichAuto S&T Co., Ltd owns final interpretation of this manual, we reserves the rights to revise all information in this manual, including data, technical details, etc.

CONTENT

➢ **Forward**

1) **System introductin**

RichAuto CNC motion control systems are independently developed by Beijing RichAuto S&T Co., Ltd. It can be widely applied to machinery, advertisement, woodworking, Jade carving, mold engraving machines, laser, flame, plasma cutting machines, woodworking lathe, dispensing machine and so on in the industry machine control field.

RichAuto makes DSP as the core control system, High-speed processing operation which the microcontroller and PLC systems can't compare with; Embedded structure, high degree of integration, Strong stability, easy to installation and operation; support U disk, removable storage card reader, with USB interface, high speed transfer，plug and play . Fully offline work.

2) **Performance characteristics**

a) System standard configuration is X, Y, Z axis motion control method, and supports the rotation axis（C axis）control which enables the switch between rotary machining and plane processing . Can be extended to X, Y, Z, C four-axis motion control to realize 4 axes linkages control.

b) Multiple I/O ports control. Standard equipped with I/O signal node stepper board which has 16 inputs and 8 output signals, servo board has 16 inputs and 16 outputs.

c) Support the standard G code, PLT format instructions; support domestic and international mainstream CAM software, such as: Type3, Artcam, UG, Pro/E, MasterCAM, Cimatron, Ucancam etc.

d) Provide with power failed protection. System automatically save the current processing information in the moment of sudden power down (file name, current line number, work speed, spindle state)；After powered up and returned HOME position, the system automatically prompts the user to restore the processing before power down which makes processing operations become more humanity.

e) Support breakpoint memory & file line No. selection processing. It can save up to 8 different breakpoints processing information.

f) Multi-coordinate memory function. Provide 9 working coordinate systems. The User can switch among the 9 coordinates; each coordinate system saves 1 work origin.

g) Support adjusting spindle operating frequency (or spindle rotate speed). The spindle frequency is divided into 8 shifts. During processing, user can adjust shifts directly by keys, and no need suspend processing.

h) Support 0-10V analog output, accurately controls the spindle speed.

i) Support network communication which realizes files loading, machine operation controlling; or just reads files in U disk/card reader directly, plug and play.

j) Support adjust speed ratio during operation. To adjust the speed ratio so as to change the processing speed and travel speed, speed ratio values from 0.1-1. Increasing or decreasing 0.1 per time.

k) Simple manual operate mode. In manual mode, the system provides 3 kinds of move modes, including continuous, step (crawl), distance, become more simple and convenient.

l) Identifies M code, F code and other extended instructions, and it can also open a special code based on user's needs.

m) Built-in 1 G memory and 5 inches color screen to achieve 1:1 simulation of processing job.

n) Self-detection function. The system comes with I/O ports signal detection function for easy remote maintenance.

o) High speed and stable machining characteristics, support high subdivision, ensure high precision, high speed processing.

p) Standard English and Chinese double display interfaces. Supports simplify Chinese, traditional Chinese, English, Russian, French languages etc. which can be customized as needed.

q) System support automatic dynamic upgrade, more convenient remote operation and remote maintenance.

3) Product parameters

Model No.	RichAuto-B5X		
CPU	DSP	Power down protection	Support
Built in memory	1GB	Breakpoint processing	limitless
Display screen	5″ color screen	External supply voltage	DC 24V
Communication port	U disk、network	Manual mode	Continuous, step, distance
Linkage axis No.	3-4 axis	Interpolate method	Straight line, arc, spline curve
Control signal	Differential signal	Soft / hard limit	Support
Driving system	Step / servo motor	Maximum pulse frequency	10MHz
Minimum input unit	0.001mm	Password protection	Support
Languages	Simplified Chinese, English, traditional Chinese, other languages can be customized		
Standard layout	Handheld controller 1 pc; HDMI data transmission cable 1 pc; I/O board 1 pc.		

4) Model list

	Model No.	Model Name
B5X series motion control system	B51	Three axis linkages motion control system
	B55	Multi-process motion control system
	B57	ATC motion control system
	B58	Four axis linkages motion control system

1 RichAuto system introduction

1.1 System structure

RichAuto control system contains the following parts: Handheld controller 1pc, I/O board1pc, 19-pin HDMI data transmission cable 1pc.
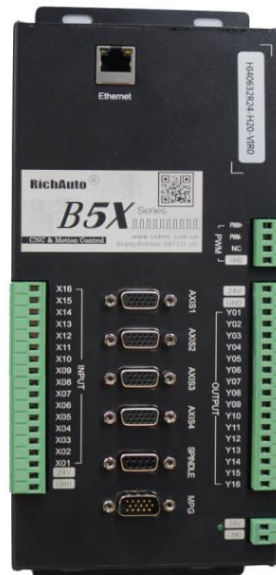
HANDHELD CONTROL

H19-PIN HDMI CABLE

STEPPER I/O BOARD

SERVO I/O BOARD

1.2 System startup method

RichAuto–B5X motion control system covers 2 modes—Normal start & Emergency start：

Normal start: Supply power to the system as usual. The system will access into "HOME Type at Start" control interface after starting up.

Emergency start: User can emergency start the system if the system doesn't show any words or can't access into the "manual control user interface".

Power off at first, then hold down" 归零 REF 确认 OK "key without release it, supply power to the controller, release

" 归零 REF 确认 OK " button after 3-4 seconds past. The system will show "Emergency State", and then user could select "system update", "inner format" or "date initial" according to the situation. Or do nothing, just power off and restart it normally.

1.3 Components description

1) LCD display screen: 5 inches liquid crystal display which is used to show the machine motion and system settings

information etc.

2) Keypad: 24 buttons to be used to input system parameters and control machine motion etc.

3) U flash disk interface：U disk or other external memory port. The external memory system format is FAT16/32.

4) 19-pin HDMI cable socket：To be used to connect between controller and I/O board, to transmit the output signal come from the controller to machine actuator.

## 1.4 Wiring board mounting dimensions

Stepper board
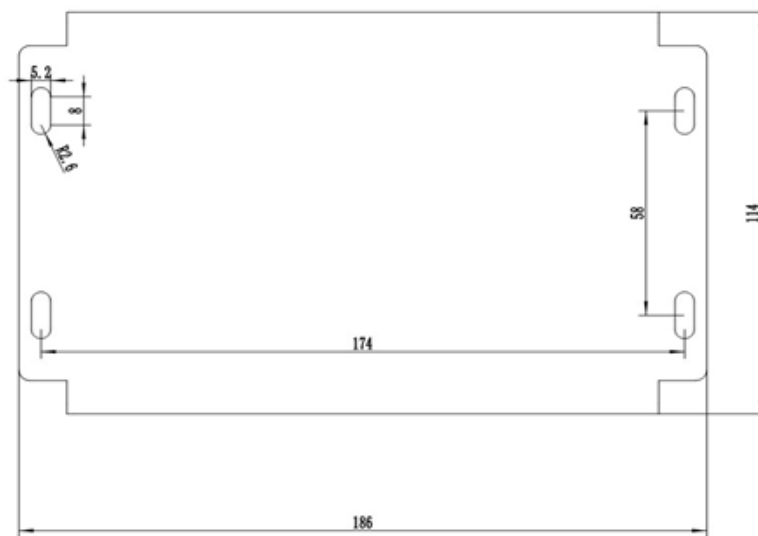
Servo board

2 Handheld controller buttons introduction

2.1 Buttons description

RichAuto–B5X motion control system has defined 24 operation buttons, realize all operations of the machine actuator by using single key or combination keys, each key or combination keys provides one or more functions under different working conditions:
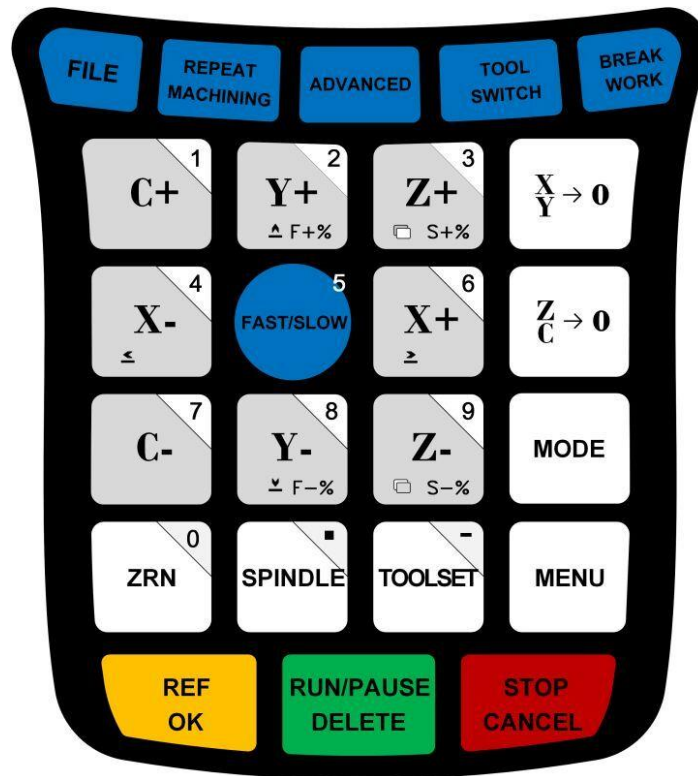
Photograph of pressing keys

2.2 Using methods

　　RichAuto control system has 2 kinds of pressing keys operation methods. Single key operation & Combination keys operation.

　　Single key： Press one key on the keypad is executing the single key operation.

　　Combination keys： Press two keys at the same time to achieve a certain function is executing combination keys operation；The operation steps: push down the first main function key do not release it, meanwhile press the second auxiliary function key, after that release both of the two keys at the same time to realize the combination keys operation. For instance, the system upgrade combination keys are " [菜单 MENU] " + " [归零 REF 确认 OK] ". When operation, user
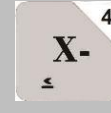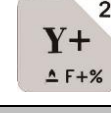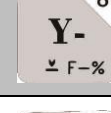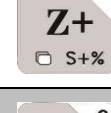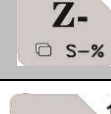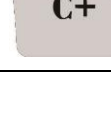
should push down the main function key "菜单 MENU" first but not release it, and then push the second auxiliary function key "归零 REF 确认 OK", and release them together.
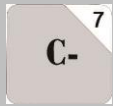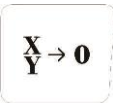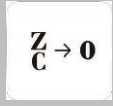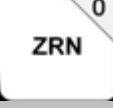
Commonly used combination keys:

	Combination Keys	**Functions**
1	"菜单 MENU"+"**0—9**"numeric key	Coordinates systems switching keys **0** is mechanical coordinate system **1-9**are working coordinate system
2	"菜单 MENU"+"归零 REF 确认 OK"	System upgrade
3	"轴启/轴停 SPINDLE"+"5 高速/低速 FAST/SLOW"	Switching spindle shifts in manual mode

2.3 Keys specification

Key Name	Function
X+	X+ axis direction move/ digit 6 input/ menu left move selection
X-	X- axis direction move/ digit 4 input/ menu right move selection
Y+	Y+ axis direction move/ increase speed ratio in auto processing mode/ digit 2 input/ menu move up selection
Y-	Y- axis direction move/ reduce speed ratio in auto processing mode/ digit 8 input/ menu move down selection
Z+	Z+ axis direction move/ digit 3 input/ increase spindle speed in auto processing mode
Z-	Z- axis direction move/ digit 9 input/ reduce spindle speed in auto processing mode
C+	C+ axis direction move/ digit 1 input

	C- axis direction move/ digit 7 input
	Set X axis and Y axis work origin
	Set Z axis and C axis work origin
	Start Z axis automatic tool setting / minus sign input
	Return to ZERO point(Mechanical origin) in manual mode/ digit 0 input
	High/low speed switching in manual mode/ digit 5 input
	Control spindle ON/OFF in manual mode/ decimal point input
	Enter MENU settings/ machine tool states display switching during auto processing
	Return reference point operation/ OK key of all selection, text inputs and operations
	Manual motion states/ switching of continuous, step, distance 3 modes
	Loading files from U disk or inner storage space
	Repeat previous file machining
	Start advance processing function， such as 'Array work', 'mirror work'
	Tool change among T1,T2,T3 and T4
	Start breakpoint resume function
	RUN/ PAUSE processing file; DELETE the input data;

	Selection of different attribute in MENU
停止 STOP 取消 CANCEL	Motion parameter adjustment in manual mode; processing termination; Cancellation of various options, inputs and operations during processing

3 Wiring description

3.1 Wiring board terminals

3.1.1 Stepper wiring board

3.1.1.1 Stepper type
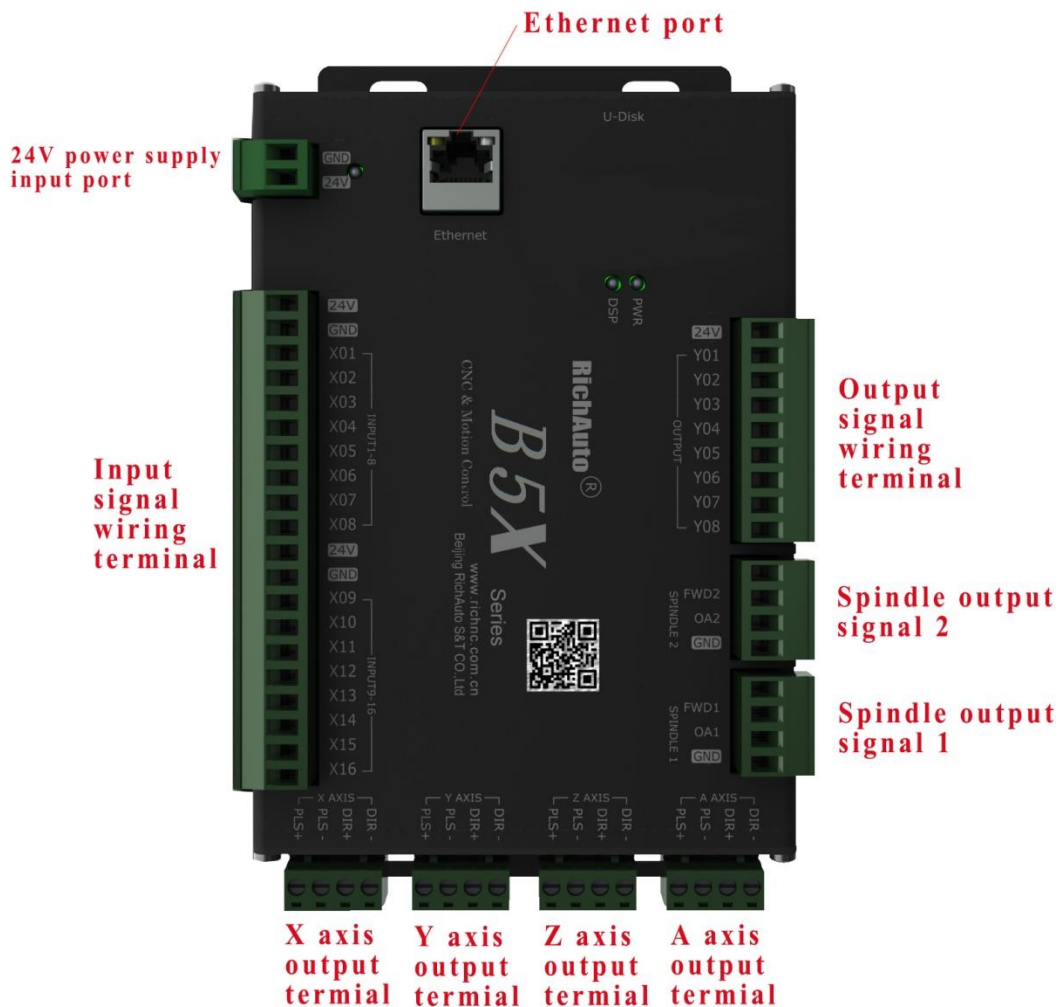
3.1.1.2　　I/O ports of stepper board

Terminal	Name	Pin definition	Pin functions and parameters
DC24V	24V+	Input power supply+	To provide 24V operating voltage after power on, recommend to use DC 24V (current≥3A) power supply
	24V-	Input power supply-	
X_AXIS	P+	X axis pulse+ differential signal	P+ and P- for pulse differential pair signals, using twisted pair will improve its anti-interference ability
	P-	X axis pulse- differential signal	
	D+	X axis direction+ differential signal	D+ and D- for directional differential pair signals, using twisted pair will improve its anti-interference ability
	D-	X axis direction- differential signal	
Y_AXIS	P+	Y axis pulse+ differential signal	P+ and P- for pulse differential pair signals, using twisted pair will improve its anti-interference ability
	P-	Y axis pulse- differential signal	
	D+	Y axis direction+ differential signal	D+ and D- for directional differential pair signals, using twisted pair will improve its anti-interference ability
	D-	Y axis direction- differential signal	
Z_AXIS	P+	Z axis pulse+ differential signal	P+ and P- for pulse differential pair signals, using twisted pair will improve its anti-interference ability
	P-	Z axis pulse- differential signal	
	D+	Z axis direction+ differential signal	D+ and D- for directional differential pair signals, using twisted pair will improve its anti-interference ability
	D-	Z axis direction- differential signal	

C_AXIS	P+	C axis pulse+ differential signal	P+ and P- for pulse differential pair signals, using twisted pair will improve its anti-interference ability
	P-	C axis pulse- differential signal	
	D+	C axis direction+ differential signal	D+ and D- for directional differential pair signals, using twisted pair will improve its anti-interference ability
	D-	C axis direction- differential signal	
Spindle1	FWD1	Spindle forward 1	Support 0-10V analog
	OA1	Analog output 1	
	GND	Ground signal	
Spindle2	FWD2	Spindle forward 2	Support 0-10V analog
	OA2	Analog output 2	
	GND	Ground signal	
OUTPUT SIGNAL	Y01	Spindle forward / reverse signal	If the inverter is in parallel with the common end and FWD, then Y01 no need wiring
	Y02	Spindle speed shift 1	Low Level effective
	Y03	Spindle speed shift 2	Low Level effective
	Y04	Spindle speed shift 3	Low Level effective
	Y05	Definable signal	Low Level effective
	Y06	Definable signal	Low Level effective
	Y07	Definable signal	Low Level effective
	Y08	Definable signal	Low Level effective
	24V	DC 24V output	Can be used for DC24V indicator power supply
INPUT SIGNAL	X01	X HOME signal （mechanical origin）	Low Level effective, Support mechanical, proximity, photoelectric and other types of HOME sensors
	X02	Y HOME signal （mechanical origin）	Low Level effective, Support mechanical, proximity, photoelectric and other types of HOME sensors
	X03	Z HOME signal	Low Level effective, Support mechanical,

	（mechanical origin）	proximity, photoelectric and other types of HOME sensors
X04	C HOME signal （mechanical origin）	Low Level effective, Support mechanical, proximity, photoelectric and other types of HOME sensors, X04 is tool setting signal on three axis controllers
X05	Tool setting signal	Low Level effective, support normal tool touching plate and tool setting instrument
X06	Drive alarm signal	Low Level effective
X07	Hard limit signal	Low Level effective
X08	Emergency stop signal	Low Level effective
X09	Definable signal	Low Level effective
X10	Definable signal	Low Level effective
X11	Definable signal	Low Level effective
X12	Definable signal	Low Level effective
X13	Definable signal	Low Level effective
X14	Definable signal	Low Level effective
X15	Definable signal	Low Level effective
X16	Definable signal	Low Level effective
COM	common port	Provide ground signal for the active sensors
24V	Sensor power output	Provide 24V working voltage for active sensors

3.1.2　Servo wiring board

3.1.2.1　Servo board

Earthnet port

HDMI socket

Ethernet

HI40632R24-H20-VIR0

RichAuto®

B5X Series

CNC & Motion Control

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PWM
- PWM+
- PWM-
- NC
- GND

PWM control

X16
X15
X14
X13
X12
X11
X10
X09
X08
X07
X06
X05
X04
X03
X02
X01
24V
GND

INPUT

Input signal wiring terminal

X axis output — AXIS1
Y axis output — AXIS2
Z axis output — AXIS3
A axis output — AXIS4
Spindle interface — SPINDLE
Handwheel port — MPG

24V
GND
Y01
Y02
Y03
Y04
Y05
Y06
Y07
Y08
Y09
Y10
Y11
Y12
Y13
Y14
Y15
Y16

OUTPUT

Output signal wiring terminal

24V
GND

24V DC Input

3.1.2.2   I/O ports of servo board

Terminal	Position	Name	Pin definition	Pin functions and remarks
DC24V		24V+	Input power supply+	To provide 24V operating voltage after power on, recommend to use DC 24V (current≥3A) power supply
		24V-	Input power supply-	
X_AXIS Y_AXIS Z_AXIS A_AXIS B_AXIS Servo Ports	1	A+	Servo encoder A+	Encoder A+ phase pulse output
	2	A-	Servo encoder A-	Encoder A + phase pulse output
	3	B+	Servo encoder B+	Encoder B + phase pulse output
	4	B-	Servo encoder B+	Encoder B - phase pulse output
	5	C+	Servo encoder C+	Used to detect encoder Zero
	6	24V	24V	24V
	7	C-	Servo encoder C-	Used to detect encoder Zero
	8	ALM	Servo Alarm input	Servo Alarm input
	9	SRV_ON	Servo enable	Send a signal to the drive, let the drive supply power to the motor (excitation)
	10	SRV_CLR	Servo alarm clear	Clear the alarm signal of the servo drive
	11	PULS+	Pulse differential +	P+ and P- are pulse differential pair signals, using twisted pair will improve the ability of anti-interference
	12	PULS-	Pulse differential -	
	13	SLGN+	Pulse direction +	D+ and D- are direction differential pair signals, using twisted pair will improve the ability of anti-interference
	14	SLGN+	Pulse direction -	
	15	GND	24V circuit Ground	24V circuit Ground
Hand	1	HX1	Hand wheel speed	Select X1 ratio

			ratio X1	
	2	HX10	Hand wheel speed ratio X10	Select X10 ratio
	3	HX100	Hand wheel speed ratio X100	Select X10 ratio
	4	GND	5V circuit Ground	5V circuit Ground
	5	5V	5V	Supply power to the handwheel encoder（+5V）
	6	ESTOP	Handwheel emergency stop switch	
	7	HSX	Handwheel axis selection X	Select X axis
	8	HSY	Handwheel axis selection Y	Select Y axis
	9	HSZ	Handwheel axis selection Z	Select Z axis
	10	HS4	Hand wheel axis selection 4	Select the 4th axis
	11	HA+	Handwheel encoder A+	Encoder A phase signal
	12	HA-	Handwheel encoder A-	
	13	HB+	Handwheel encoder B+	Encoder B phase signal
	14	HB-	Handwheel encoder B-	
	15	HS5	Handwheel axis selection 5	24V circuit Ground
Interfac SPINDLE	1		System reserved	
	2	IN ALM2	Inverter alarm input	Inverter alarm input signal 2

			2	
	3	SP CCW	Spindle Inversion	Spindle CCW（Spindle 2 CW）
	4	SP CW	Spindle Forward	Spindle CW（Spindle 1 CW）
	5		System reserved	
	6	OA1	Spindle analog output 1	Spindle analog output 1
	7	OA2	Spindle analog output 2	Spindle analog output 2
	8	IN ALM1	Inverter alarm input 1	Inverter alarm input 1
	9	GND	Ground	
OUTPUT TERMINAL		Y01	Definable signal	Low level effective
		Y02	Definable signal	Low level effective
		Y03	Definable signal	Low level effective
		Y04	Definable signal	Low level effective
		Y05	Definable signal	Low level effective
		Y06	Definable signal	Low level effective
		Y07	Definable signal	Low level effective
		Y08	Definable signal	Low level effective
		Y09	Definable signal	Low level effective
		Y10	Definable signal	Low level effective
		……	Definable signal	Low level effective
		Y16	Definable signal	Low level effective
		24V	DC 24V output port	Can be used for DC24V indicator power supply
		COM	Common port	Can be used as a Ground signal
INPUT TERMINAL		X01	X axis HOME signal	Support mechanical and photoelectric types switches
		X02	Y axis HOME signal	Support mechanical and photoelectric types switches

	X03	Z axis HOME signal	Support mechanical and photoelectric types switches
	X04	A axis HOME signal	Support mechanical and photoelectric types switches
	X05	B axis HOME signal	Support mechanical and photoelectric types switches
	X06	Definable signal	Low level effective
	X07	Definable signal	Low level effective
	X08	Definable signal	Low level effective
	X09	Definable signal	Low level effective
	X10	Definable signal	Low level effective
	....	Definable signal	Low level effective
	X16	Definable signal	Low level effective
	24V	DC 24V output port	Can be used for DC24V indicator power supply
	COM	Common port	Can be used as a Ground signal

3.1.3 Hardware wiring

Installation Requirements：Switching mode power supply（24V, 3A）, it's better to add a power supply filter to avoid the electric field interference. If origin detecting switch is different power supply type, the special detecting switch power supply is needed. (Recommend 24V origin detecting switching type power supply).

RichAuto-B5X control system is controlled by connecting the interface board to the CNC machine. Generally, the interface board terminals can be divided into 2 kinds-input terminals and output terminals：

Input terminals include:

INPUT (Input signals terminal); DC24V（Main power supply terminal）

Output terminals include：

X_AXIS（**X** axis pulse signal output terminal & Encoder output terminal）

Y_AXIS（**Y** axis pulse signal output terminal）

Z_AXIS（**Z** axis pulse signal output terminal）

C_AXIS（**C** axis pulse signal output terminal）

OUTPUT（Output signal terminal）

OA（Analog signal output terminal）

PWM （PWM digital signal output terminal）

Input terminals

DC24V Main power supply wiring:

24V switching power supply
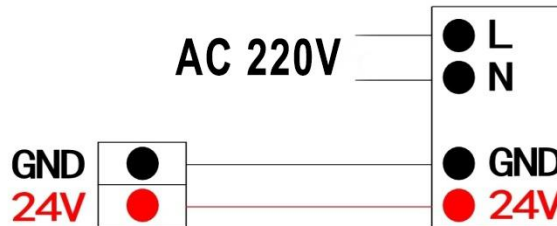
INPUT wiring

1. **HOME signal ports：**

a) Mechanical HOME switch wiring

Mechanical Home switch wiring
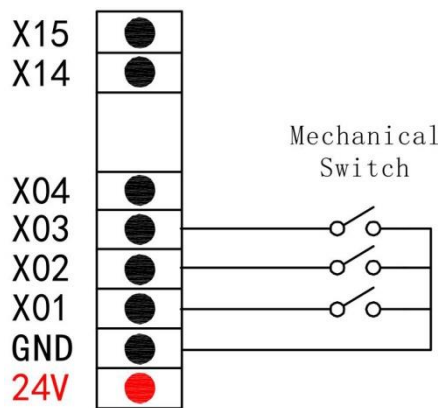
b) NPN normally open proximity HOME switch
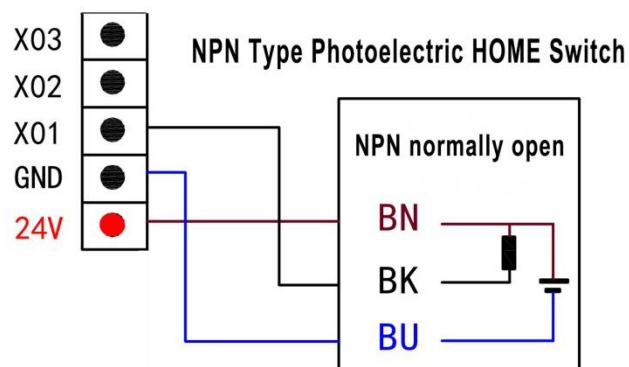
2. **Tool-setting input port：** For your attention, X4 port is tool setting port for all of the 3 axis controllers, but X4 will be

mechanical origin signal for the 4 axis controllers, thus X5 will be tool setting signal for 4 axis controllers.
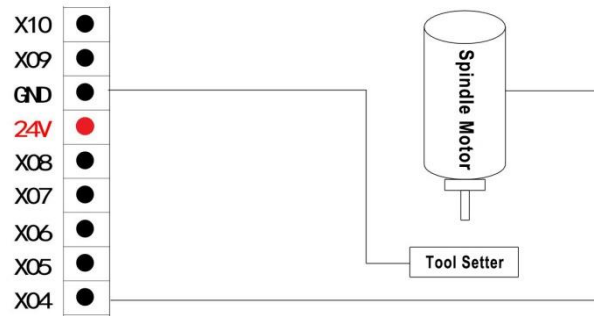
3. **Definable ports wiring：**

Take X6-X8 (they are respectively configured into drive alarm, hard limit, emergency stop signal) for instance

INPUT SIGNAL
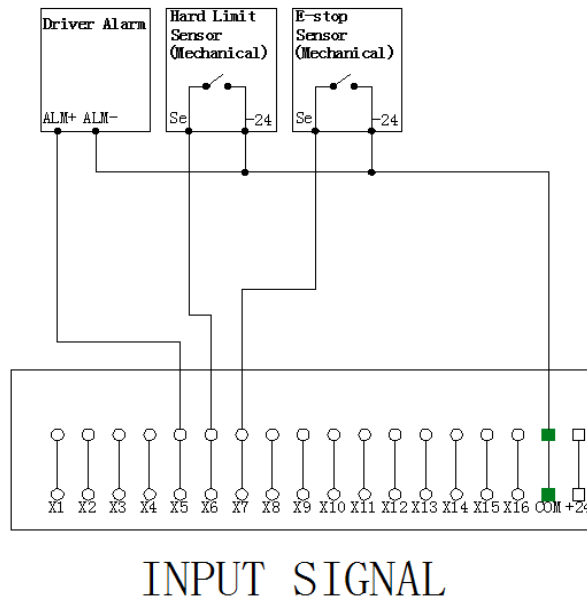
4. **Handwheel Interface wiring**

Handwheel interface
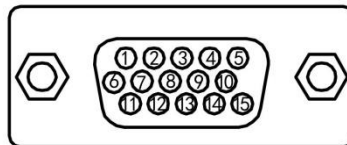
Handwheel interface pin definition

1	HX1	handwheel speed ratio X1
2	HX10	handwheel speed ratio X10
3	HX100	handwheel speed ratio X100
4	GND	return circuit ground
5	5V	5V
6	ESTOP	handwheel E-stop switch
7	HSX	handwheel axis selection X
8	HSY	handwheel axis selection Y
9	HSZ	handwheel axis selection Z
10	HS4	handwheel axis selection 4
11	HA+	handwheel encoder A+
12	HA-	handwheel encoder A-
13	HB+	handwheel encoder B+
14	HB-	handwheel encoder B-
15	HS5	handwheel axis selection 5

5. SPINDLE terminal wiring

a) Stepper board

Inverter Analog Wiring For Stepper Board
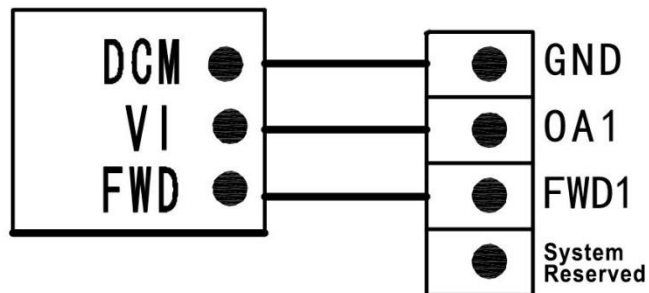
b) Servo board

Main shaft interface

20
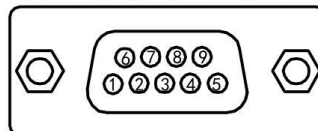
Spindle interface
pin definition

1		N/A
2	INALM2	Interver alarm input 2
3	SP CCW	SP CCW(SP2 CW)
4	SP CW	SP CW(SP1 CW)
5		N/A
6	OA1	Spindle anolog output 1
7	OA2	Spindle anolog output 2
8	INALM2	Interver alarm input 1
9	GND	Return circuit ground

6.   Motion axis output terminals wiring

X_AXIS：X axis pulse signal wiring (Y、Z、C axis pulse signal wiring methods are the same to X axis)

Stepper drive:

Stepper Driver Wiring Diagram

PUL+●	———	● XP+
PUL–●	———	● XP–
DIR+●	———	● XD+
DIR–●	———	● XD–
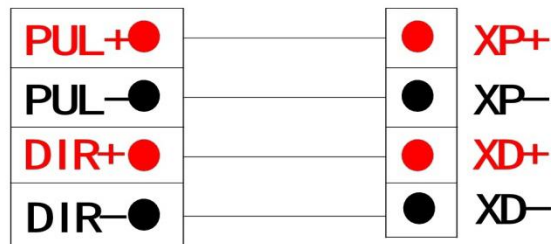
Servo drive:

1） Servo axis pin definition
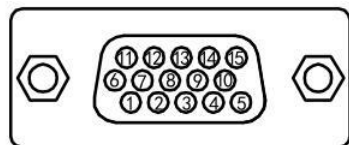
X axis servo interface

Servo axis interface pin definition

1	A+	servo encoder A+
2	A-	servo encoder A-
3	B+	servo encoder B+
4	B-	servo encoder B-
5	C+	servo encoder C+
6	24V	24V+
7	C-	servo encoder C-
8	ALM	servo alarm input
9	SRV_ON	servo enable
10	SRV_CLR	servo alarm clear
11	PULS+	pulse difference+
12	PULS-	pulse difference-
13	SIGN+	pulse direction+
14	SIGN-	pulse direction-
15	GND	24V return ground

2） Brake wiring:

Yaskawa servo Σ-V series driver

参数		连接器针端子		含义	生效时间	类别
		＋端子	－端子			
Pn50F	n. □0□□	－	－	不使用 /BK 信号［出厂设定］。	再次接通电源后	设定
	n. □1□□	CN1-25	CN1-26	从 CN1-25/CN1-26 输出 /BK 信号。		
	n. □2□□	CN1-27	CN1-28	从 CN1-27/CN1-28 输出 /BK 信号。		
	n. □3□□	CN1-29	CN1-30	从 CN1-29/CN1-30 输出 /BK 信号。		

First, ensure that the brake output is enabled, and then set Pn50F to 0300, and select brake signal output terminal CN-29 and CN-30.

Wiring is as follow：
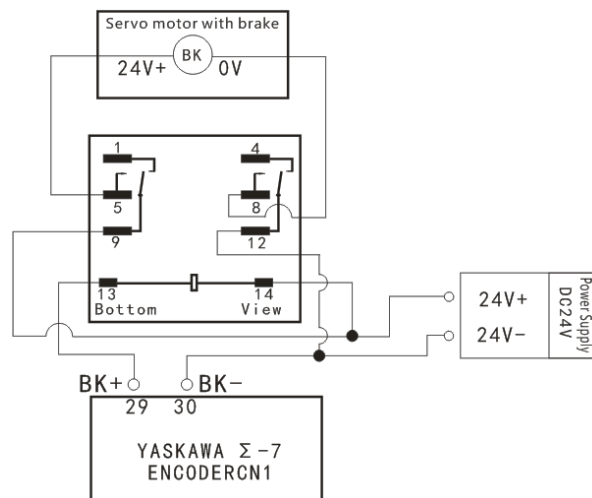
OUTPUT: Spindle output

1 line 2 states：Spindle start—ON；Spindle stop—OFF

Spindle ON/OFF:
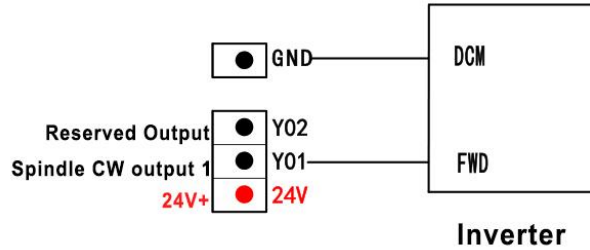
Spindle State (control status):

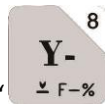**Setting method: Enter into "spindle state", the screen displays:**

Spindle Count

Press" "key，input digit 1 to modify the spindle line number to 1 line, and then press" "key,

the screen will show:
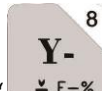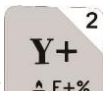
Press" "、" "keys could move the cursor up and down, press " "key to modify the

indicator color, as like as the figure showing above.

3 lines 8 states: Spindle start---S1—the first shift spindle speed，S2—the second shift spindle speed，Sn—the N

shift spindle speed; The screen shows "Fn" when the spindle OFF—"N" is the shift number while spindle stop.

3 lines，8 states wiring:
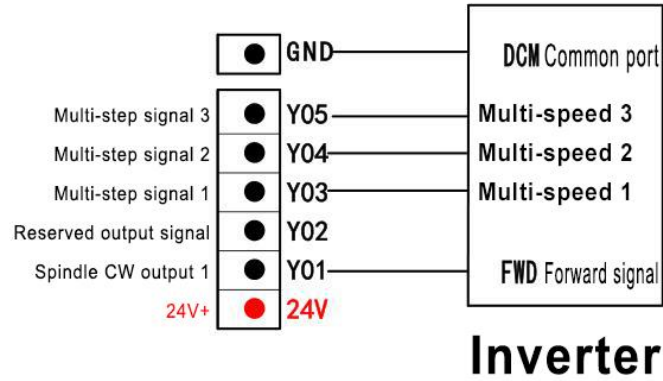
Spindle state：

　　Setting method: Enter into "spindle state", the screen displays:
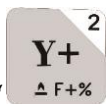
Press" "key and input digit number 3 to change the spindle lines number to 3 lines, and then

press" "key, the screen shows:
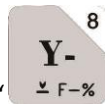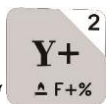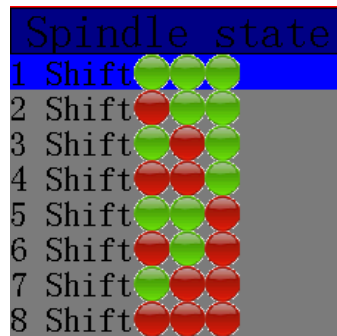
Press" "、" "keys could move the cursor up and down, press " "key to modify the indicator

color, as like as the figure showing above.

　　PS：In case there are some inverters internal in parallel with FWD and DCM, or the machine factory's wiring habit

　　is to parallel connect inverter to FWD and DCM, then no need to connect Y1 port anymore. ONLY connect the

　　DCM to COM port on the OUTPUT SIGNAL of the wiring board, and also no need to set spindle state again.

ANALOG- Analog output signal wiring:

Inverter
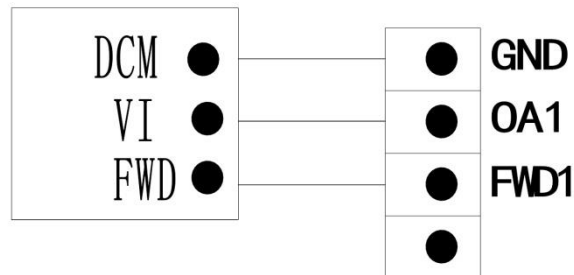
The spindle max. speed should be set if using analog output. The value can be set at"**MENU**"- "**Menu function user interface**"-- "**machine setup**"--"**spindle setup**"-- "**Spindle Max. Spd(speed)**"；Meanwhile, modify the G code setting at "**MENU**"-- "**Menu function user interface**"-- "**auto pro setup**"--"**G code setup**"-- "**G read S code**"，and then change the setting into "Read S". The users can configure the spindle output to Single / multiple analog or multi shifts(multi step speed)by themselves under **"System setup"-- "Function confi" -- "SpdOutpt(spindle output)"**.

3.2 Debugging of machine and control system

1. Power on the system, do not return machine HOME position immediately, press "Cancel" key to enter into the main interface first, and then access the "Menu function user interface"-"machine setup"-"Pulse equiv (equivalent)"to input correct values. After that, press direction keys of each axis to move manually and check the motion direction of them, if any axis motor direction is opposite to the defined direction, user can change the stepper motor phase sequence（exchange A+ & A- or B+ & B-）or servo driver parameters(refer to the servo driver user's manual) in order to make the all axis motion direction correctly.

2. Set "HOME sequence" according to the defined mechanical origin position. Enter "Menu function user interface"-"machine setup"-"Home setup" - "Home sequence".

3. Check whether the Home sensors are working normally. Enter "Menu function user interface"-"machine setup"-"Voltage setup"-"Input voltage setup", and then manually trigger each HOME sensor, if the corresponding indicator light up (change from green to red) means the Home sensor is working properly.

It can be determined the machine has been connected properly if all above steps pass the debugging.

4 User interface introduction
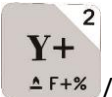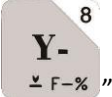
RichAuto-B5X motion control systems have assigned 5 user interfaces， including：**"Menu control user**

interface","Menu function user interface", "Remote control user interface", "Input Output control user interface" and "View toolpath user interface".
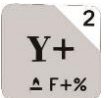
4.1 Manual Control User Interface

After the system is powered on, the system prompts "Home Type At Start" at the boot screen to remind you to execute return mechanical origin position operation：

```
HomeTypeAtStart
All axis home
Z home only
none axis home
```
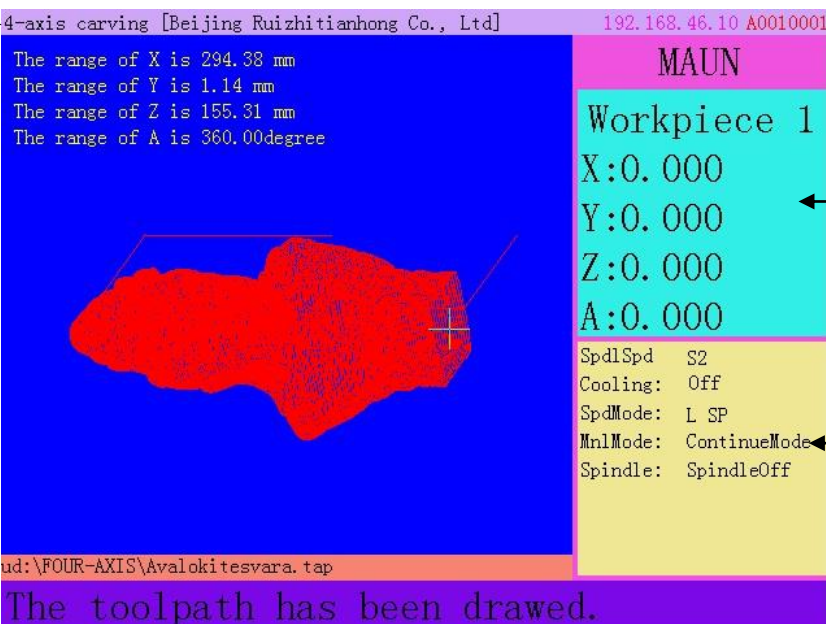
Press" Y+ / Y- "keys to move the cursor and choose one Home type, and then press" 归零 REF 确认 OK "key to confirm.

Press " 菜单 MENU ", the screen prompt "Switch user interface" dialog box：

```
Switch user interface
Manual control user interface
Menu function user interface
Remote control user interface
Input output control user inter
View toolpath user interface
```

Press" Y+ , Y- "to choose one user interface as you need, and then press" 归零 REF 确认 OK "to confirm and access.

Manual control user interface

Title bar →
The range of X is 294.38 mm
The range of Y is 1.14 mm
The range of Z is 155.31 mm
The range of A is 360.00degree

4-axis carving [Beijing Ruizhitianhong Co., Ltd]   192.168.46.10 A0010001

MAUN

Workpiece 1
X:0.000
Y:0.000   ← Coordinate system
Z:0.000
A:0.000

SpdlSpd   S2
Cooling: Off
SpdMode: L SP
MnlMode: ContinueMode   ← Machine status
Spindle: SpindleOff

Simulation area →

File name → ud:\FOUR-AXIS\Avalokitesvara.tap
Message area → The toolpath has been drawed.

1. **Title bar**: Display system software type（4-axis carving）and company information.

2. **Simulation area:** Display processing file simulation graph, tool path and file size etc.

3. **File name:** Display file name（including file name extension）, record location.

4. **Message area:** Display file loading and complete information.

5. **Coordinate system area:** Display the current coordinate system, including machine coordinate system and work coordinate system; there are 1-9 work coordinates system, total 9 work coordinates.

6. **Machine status area:** Display spindle state, speed mode, motion mode, spindle state, cooling unit state etc.

Under the manual control interface, press" 停止 STOP 取消 CANCEL "key, screen shows **"The display function list"**， it is convenient

for customers to use different ways to view the simulation image of processing file. Function list as shown below:

```
The display function list
Display the whole tool path
Zoom in the tool path
Zoom out the tool path
Left to view the tool path
Rigth to view the tool path
Up to view the tool path
Down to view the tool path
Display the limit of the machin
```

4.2 Manual Function User Interface

```
3-axis carving [Beijing Ruizhitianhong Co., Ltd]          A0125003
MACHINE SETUP          Pulse Equiv
AUTO PRO SETUP         Table Size
SYSTEM SETUP           Spindle Setup
OPERATE FILE           Home Setup
VERSION VIEW           Toolset Setup
                       Voltage Setup
                       Max Spd Limit
                       Inputs List
                       Outputs List
                       Input Confi
                       DistTime Limit
```
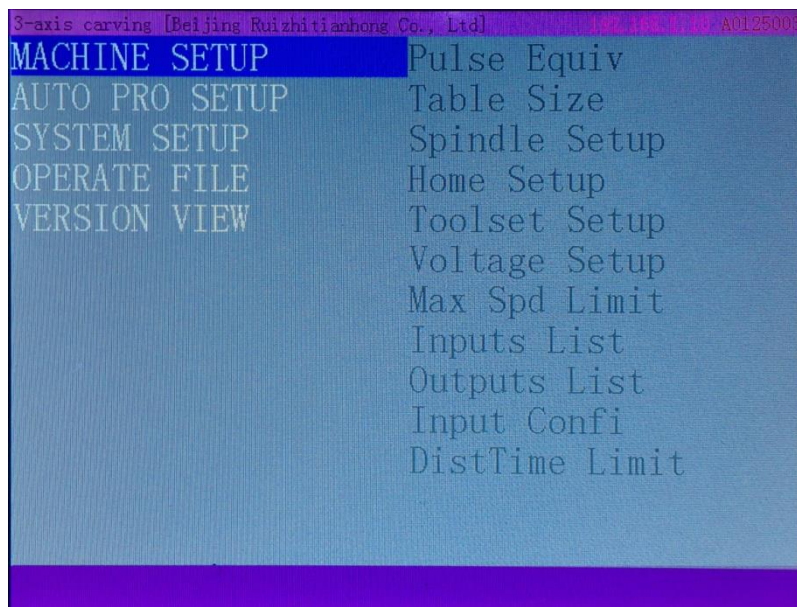
Menu details：The system menu is divided into **5** primary menus according to its function type: MACHINE SETUP、AUTO

PRO SETUP、 SYSTEM SETUP、 OPERATE FILE、 VERSION VIEW**.**

4.2.1 Machine setup

"Machine setup" is used to set the machine hardware related parameters which is always be set by the machine manufacturers according to their machine hardware related parameters. All of the parameters once have been set, user had better not to modify them unless machine hardware or electrical parameters changes. Users should consult the machine factory and modify the parameters of "machine setup" under the guidance of the technical engineer.

Machine setup menu structure

MACHINE SETUP

- Pulse Equiv
- Table size
- Spindle Setup
- Home Setup
- Toolset Setup
- Voltage Setup
- Max Spd Limit
- Inputs List
- Outputs List
- Input Confi
- DistTime Limit
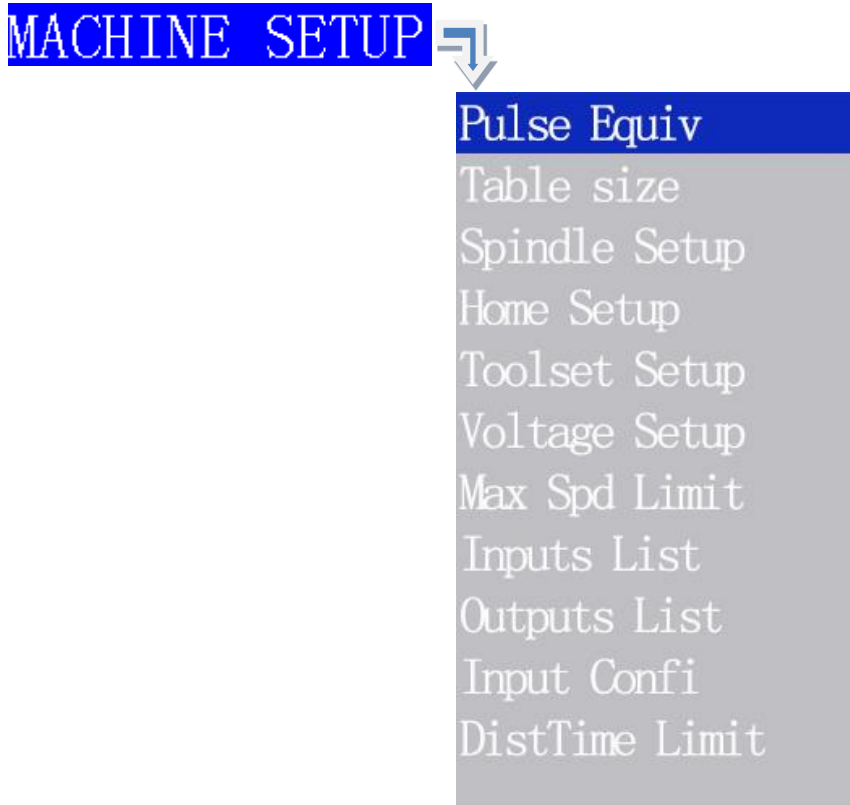
1. Pulse equivalent

Linear axis: The number of pulses required to send from the controller in every 1 mm movement of the machine. Unit is Pul/mm;

Rotary axis：The number of pulses required to send from the controller in every 1°rotation of the machine. Unit is pulse/degree;

1) **Stepper motor drive**

Linear axis:

Formula=(Number of pulse per revolution of the motor)/(moving distance per revolution of the motor)。

"Pulses per revolution" formula:（360°/ stepper angle）* driver subdivision

Distance per revolution formula:

Screw drive machine tool = Screw pitch * mechanical transmission ratio(reduction ratio)

Rack（straight）drive machine tool= rack module * gear teeth number*π*mechanical transmission ratio (reduction ratio)

Rack（helical）drive = rack module*gear teeth number*π*mechanical transmission ratio(reduction ratio)/cos（helical angle）

Pulley & belt drive = π*pulley diameter*mechanical transmission ratio(reduction ratio)

Therefore stepper motor system formula is as below：

✓ Screw drive:

$$pulse = \frac{\frac{360°}{Stepper\ angle}*Driver\ subdivision}{Screw\ pitch*transmission\ ratio}$$

Pulse/rev	SW5	SW6	SW7	SW8	MSTEP	SW5	SW6	SW7	SW8
400	ON	ON	ON	ON	2	ON	ON	ON	ON
800	OFF	ON	ON	ON	4	ON	OFF	ON	ON
1600	ON	OFF	ON	ON	8	ON	ON	OFF	ON
3200	OFF	OFF	ON	ON	16	ON	OFF	OFF	ON
6400	ON	ON	OFF	ON	32	ON	ON	ON	OFF
12800	OFF	ON	OFF	ON	64	ON	OFF	ON	OFF
25600	ON	OFF	OFF	ON	128	ON	ON	OFF	OFF
51200	OFF	OFF	OFF	ON	256	ON	OFF	OFF	OFF
1000	ON	ON	ON	OFF	5	OFF	ON	ON	ON
2000	OFF	ON	ON	OFF	10	OFF	OFF	ON	ON
4000	ON	OFF	ON	OFF	25	OFF	ON	OFF	ON
5000	OFF	OFF	ON	OFF	50	OFF	OFF	OFF	ON
8000	ON	ON	OFF	OFF	125	OFF	ON	ON	OFF
10000	OFF	ON	OFF	OFF	250	OFF	OFF	ON	OFF
20000	ON	OFF	OFF	OFF	DISABLE	OFF	ON	OFF	OFF
40000	OFF	OFF	OFF	OFF	DISABLE	OFF	OFF	OFF	OFF

E.g.1:Driver nameplate 1   E.g.2:Driver nameplate2   Motor nameplate/ stepper angle=1.8°

Explain: Stepper angle is the data of motor, means the angle of motor rotating for a single step. Driver subdivision is set in the driver.

In E.g.1, Pulse/rev is Pulses per revolution of stepper motor, so that the user only needs to select a relative value according to the actual dial code. For example: If user choose 3200 Pulse/rev, indicates (360 °/stepper angle)* Driver subdivision=3200.

In E.g.2, the MSTEP means subdivision number. So, if the stepper angle is 1.8°, selected subdivision is 16, then (360 °/stepper angle)* subdivision=(360°/1.8)*16=3200.

The user should use correct computational method according to the actual marks of stepper motor driver nameplate.

Screw pitch：Represents the distance that the nut moves in one revolution of the ball screw   rotation.
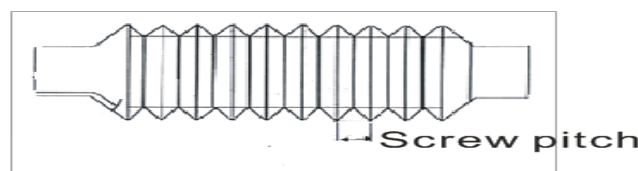
Transmission ratio: The ratio of the angular velocity or the rotational speed of the front wheel to the end most driven wheel.

✓ Rack drive:

Straight teech:

$$pulse = \frac{\frac{360°}{Stepper\ angle} \times Driver\ subdivision}{rack\ module \times gear\ teeth\ number \times \pi \times transmission\ ratio}$$

Helical teech:

$$pulse = \frac{\frac{360°}{Stepper\ angle} \times Driver\ subdivision \times cos（helical\ angle）}{rack\ module \times gear\ teeth\ number \times \pi \times transmission\ ratio}$$

Explain:

Rack module and gear teeth number are both the parameters of the rack.

Rack module*gear teeth number*Pi is the pitch circle circumference of the rack.

✓ Pulley & belt drive:
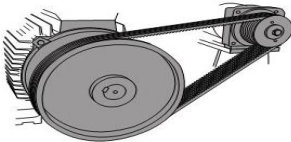
$$pulse = \frac{\frac{360°}{Stepper\ angle} \times Driver\ subdivision}{\pi d \times transmission\ ratio}$$

Explain:

"D" represents the belt pulley diameter.
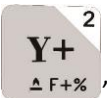
Rotary axis:

Formula = pulses per revolution / angles per revolution（360°）

$$pulse = \frac{\frac{360°}{Stepper\ angle} \times Driver\ subdivision}{360° \times transmission\ ratio}$$

Setting method：Enter into "Pulse Equiv"menu, cursor in the position of X axis pulse equivalent option, press" Y+ "," Y- "key to move the cursor to the options to be modified, press" DELETE "key, value is in

modifiable state, input values by pushing digit keys, press" "key to save the changes. Modify **X、Y、Z、A pulse**

equivalents one by one, and then press" "key to save all changes, go back to "**Pulse Equiv**" menu.

No mechanical and electrical parameters situation：If the user is unable to get any mechanical and electrical

parameters, it can be calculated by the following method,

Suppose the handle pulse equivalent is 'A', press " " switching to "Distance" mode, set a distance value 'B',

then you can measure the actual moving distance 'C', to get the actual pulse equivalent = A × B ÷ C.

For example: Suppose handle pulse equivalent A = 400, distance B = 100, actual distance C = 80, then the actual

pulse equivalent = 400 × 100 ÷ 80 = 500

Repeat calculation for several times until you get the correct pulse equivalent value.

2) **Servo motor drive**

The handheld controller defaults the factory   pulse equivalent value of **X、Y、Z、A** are all **400**, it can be regarded

as a constant quantity or change a new value. Set the electrical gear ratio on the servo driver, reducible of a fraction.

Electronic gear ratio numerator: represents encoder resolution which can be achieved in the servo driver manual.

Electronic gear ratio denominator:
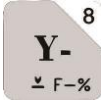
Linear axis:

► Screw drive：pulse equivalent * screw pitch*mechanical transmission ratio

► Straight rack：pulse equivalent*rack module*gear teeth number*π*mechanical transmission ratio

► Helical rack：pulse equivalent* rack module*gear teeth number*π*mechanical transmission ratio/cos（helical angle）

► Pulley&belt drive：pulse equivalent *π*pulley diameter*mechanical transmission ratio

Rotation axis：Pulse equivalent *360 * transmission ratio (reduction ratio)

2. Table size (Unit: mm)

RichAuto systems make the table size as soft limit values, in order to avoid machine over travel, machine size

must be less than or equal to the actual machine travel range values.

Setting method：Enter "**Table size**" menu，press" "," " to move cursor to option to be modified.

Press " "key，the value is in modifiable state，press digit keys to input new values and then

press" " key to save the change, modify **X、Y、Z、A** axis table sizes one by one, after that,

press" "key to save the changes, and return back to "**Table Size**" menu.

3. Spindle Setup：

Spindle delay：Including start delay and stop delay (Unit: ms);

Spindle state: To be used for setting system parameters, user can set multi-step speed or just spindle ON/OFF to control the spindle. The system defaults "3-line 8-state", if the"1-line 2-state (On/Off)" is needed, change the number of lines into 1; Detailed information please refer to spindle output wiring diagram.
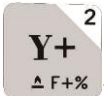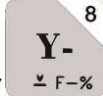
Spindle Max Spd：User should set this menu when selected 10V analog quantity to control the spindle speed, this value is the maximum speed of the spindle. Unit: r/minute. No need modify this menu if choosing "multi-step" mode.

4. Home setup:

Home speed：Axis moving peed when the machine executes returning HOME, system default speed X, Y: 3000 mm/min, Z,A: 1800 mm/min.

Setting method：Enter "**Home speed**" menu，screen prompts:

```
Unit MMPerMin
XSpeedOfHome      3000.000
YSpeedOfHome      3000.000
ZSpeedOfHome      1800.000
ASpeedOfHome      1800.000
```

Press" ", " " to move cursor to option to be modified. Press " "key，the value is in
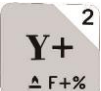
modifiable state，press digit keys to input new values and then press" " key to save the change, modify the

remaining options one by one, after that press" "key to save all the changes.

Home sequence: Set the HOME order of each axis when the machine goes HOME position.

Including:
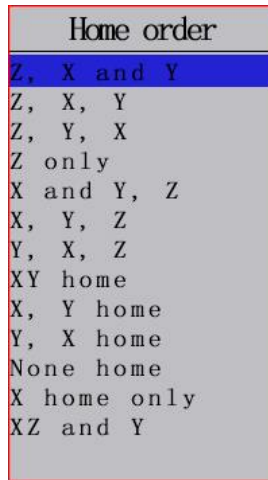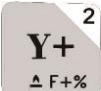
Setting：Enter "**Home speed**"，press" "、" "key to move cursor and choose a HOME order as you

need and then press " " to complete the change.

Home direction: Refers to each axis motion direction when executing HOME operation. This setting depends on the position of zero point switch (HOME sensor) of each axis which are installed on the machine. If home switch is installed in the positive direction, then home direction should be set as "positive", and vice versa.

Setting：Enter "**Home direction**"，screen shows：
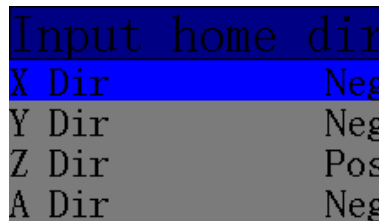
Press down" "，" "keys to move to the which option to be modified, press" "key to

modify and press" "key to save the change, go back to the "**Home Direction**" menu.

5. **Toolset Setup**

C.A.D. Thickness **: (Unit: mm)**
This should input actual tool setter thickness value. It will lead to Z axis over cut if input value is bigger than actual thickness; if smaller, Z axis tool bit can't reach material surface. This parameter can only take effect when user uses auto tool setting function. Invalid when manual set workpiece origin (press XY→0, ZC→0)

6. **Voltage setup**
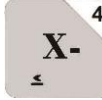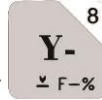
Voltage setup is used to set voltage level（High or Low）of input and output signals. The system defaults green

light（or light off）stand for normally open state while the red light(or light on) indicates normally closed state. Contains

2 rows of lights which are as shown below:
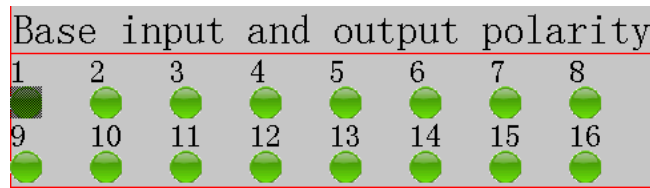
The top row of lights are input levels：To be used for setting the voltage level of input ports. Input level from No. 1 to 4 are **X, Y, Z** axis mechanical origin and tool setter input signal respectively. **Note: No. 5 is tool setter input signal on B58.**

The bottom row of lights are output levels: To be used for setting the voltage level of output ports. Output levels from No. 1 to 4 are spindle ON/OFF, Spindle speed 1, Spindle speed 2, and Spindle speed 3 output ports respectively.

Setting method: Press" X+ " or" X- "key can move left and right in the row, press" Y+ "or" Y- " key can jump up and down. Move the cursor to the light to be modified, press" DELETE "key for changing its state and return to previous menu.

7. **Max Spd Limit (Max. Speed Limit, Unit: mm/min)**

The maximum moving speed of the three axis of the machine tool, it only takes effect in auto processing mode, doesn't limit the motion speed in manual mode.

Setting method: Enter "**Max Spd Limit**" menu, the screen shows,

The"*"refers the speed is infinitely-great and limitless. Press" Y+ "or" Y- " key to move the cursor to the option to be modified, press down" DELETE "key, the value changes into modifiable state, press digit keys to input new value and then press " OK " key to save the change, modify the

remaining options one by one, after that press"〔归零 REF 确认 OK〕"key to save all the changes.

8. **Input List**

It is used for reviewing input ports signal function from X1-X16.

输入端口功能	Input config
X1:1号轴回零	X1:Home of 1 axis
X2:2号轴回零	X2:Home of 2 axis
X3:3号轴回零	X3:Home of 3 axis
X4:对刀	X4:Home of 4 axis
X5:伺服报警	X5:Toolset
X6:1号轴硬限位	X6:ServAlm
X7:急停	X7:Emerg
X8:脚踏开关	X8:Limit of 1 axis
X9:主轴坏	X9:SpdlErr
X10:没有使用	X10:FootSwt
X11:没有使用	X11:None used
X12:没有使用	X12:None used
X13:没有使用	X13:None used
X14:没有使用	X14:None used
X15:没有使用	X15:None used
X16:没有使用	X16:None used
	X17:None used

3 axis　　　　　**4 axis**

Note：The "None used" ports are definable; For B51/55/57,X4 is toolset signal.

9. **Output List**

It is used for reviewing output ports signal function from Y1 to Y16.

```
Output config
Y1:Spindle CW state,Spindle CCW state
Y2:None used
Y3:None used
Y4:Inverter alarm
Y5:RunLamp
Y6:AlarmLamp
Y7:PowerLamp
Y8:None used
Y9:None used
Y10:None used
Y11:None used
Y12:None used
Y13:None used
Y14:None used
Y15:None used
Y16:None used
Y17:None used
```
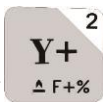
Note：The "None used" ports are definable.

10. **Input Confi (configuration)**

To enable or disable input signals, use can choose to disable the ports if some input ports on the wiring board haven't connected to any signal, in order to avoid wiring error or other incorrect operation leading to system alarm.

Setting method：Enter "**Input Confi**" menu, the screen displays,

```
InputDisableMask
X1:Enable
X2:Enable
X3:Enable
X4:Enable
X5:Enable
X6:Enable
X7:Enable
X8:Enable
X9:Enable
X10:Enable
X11:Enable
X12:Enable
X13:Enable
X14:Enable
X15:Enable
X16:Enable
```
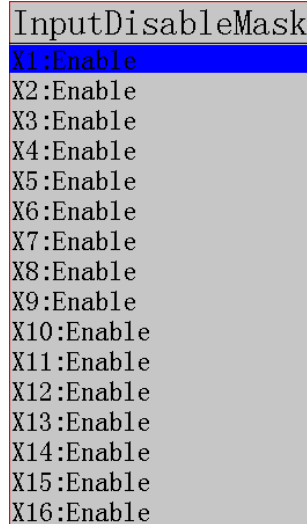
Press" **Y+** "or" **Y-** " to the option to be modified, press down" **RUN/PAUSE DELETE** "key to Enable or Disable the

corresponding input signal, change the others one by one, after that press" **REF OK** "key to save the changes.

11. DistTime Limit(Distance time limit, Unit: s)

The system will automatically change to "Continuous" motion mode if there is no action within a certain period of

time which is called "Distance Time Limit". In case the user has set pretty long distance limit time and also forget to

exchange it into "Continuous" mode after use the "Distance", and pressed " **Z-** "key leading to the danger of

spindle hits the machine body. To guarantee the operation safety, we added this menu into the system. The system

defaults "Distance time limit" value is **30** seconds.

Setting method: Enter "DistTime Limit" menu. The screen prompts,

```
ance timeout, unit second, no timeouDis
DistTimeOut                              30
Outputs List
Input Confi
DistTime Limit
```
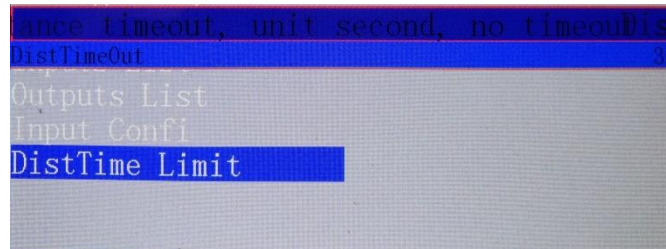
Press" **RUN/PAUSE DELETE** "key and input a new value, after modification press" **REF OK** "to save the change.

4.2.2 Auto Pro Setup

The "Auto Pro Setup" menu is used for setting parameters of the processing file and G code file read attributes.

Auto Process Setup menu structure chart

AUTO PRO SETUP

Work Speed
Accel
Start Speed
Safe Height
ManualSpd&Grid Set
Wrk Origin Offset
Auto Scale
Fall Scale
Stop Status
G Code Setup
Pro Attribute
Work Array
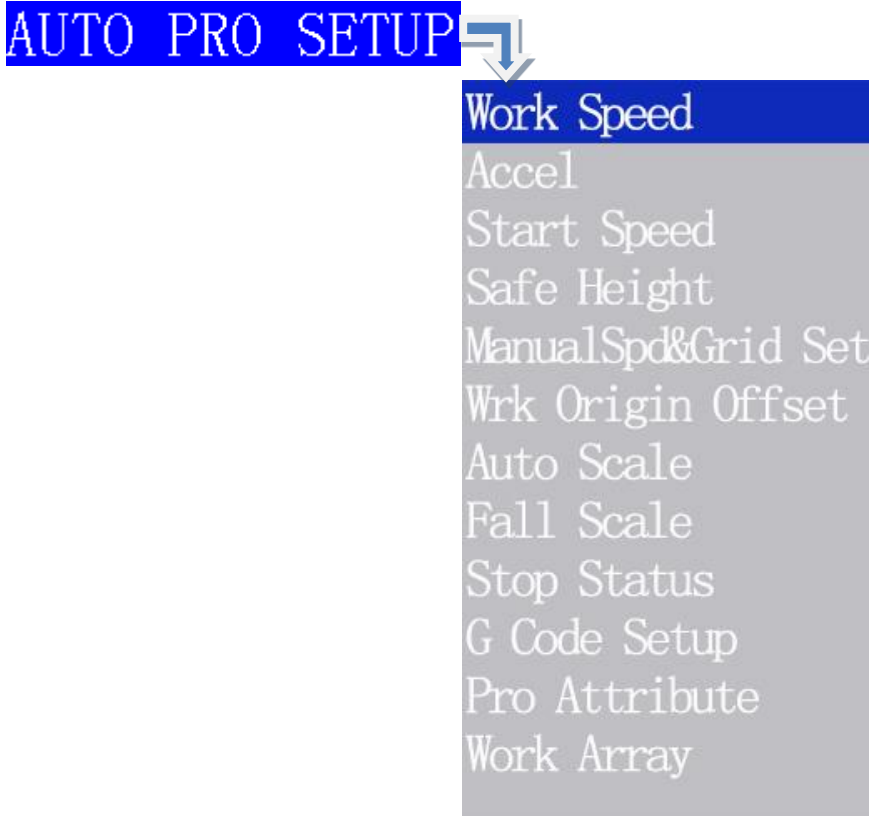
1. **Work Speed (Unit: mm/min)**

Include "work speed" and "fast speed".

Setting method：Enter "**Work speed**" menu, the screen prompt:

Unit MMPerSec
WorkSpeed: 3000.000
FastSpeed: 3000.000
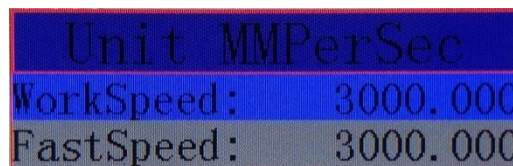
Press" 运行/暂停 RUN/PAUSE 删除 DELETE "key, input new work speed value and then press" 归零 REF 确认 OK "to save the change, after that
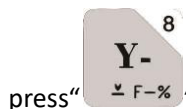
press" Y- ⨄ F-% " key to move the cursor to the "fast speed"(rapid traverse) option, press" 运行/暂停 RUN/PAUSE 删除 DELETE "key and input

new value，after that press" 归零 REF 确认 OK "key to save the change.

2. **Safe Height(Unit: mm)**

To be used for setting Z axis cutter lifting height value, the system defaults value is 40.000mm.

Setting mode: Enter "**Safe Height**" menu, the screen prompts:

Unit mm
Safe height   250.000

Press" DELETE "key to modify to value and then press" OK "key to save the change.

3. **Manual Speed (Unit: mm/min)**

The "Manual Speed" refers to the motion speed of each axis when user moves the machine manually, it contains "High manual speed" and "Low manual speed".

Setting mode：Enter "**Low manual speed**" menu, the screen shows(**High manual speed setting method is the same**):
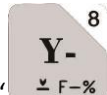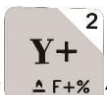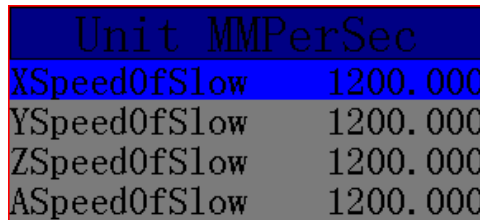
Unit MMPerSec
XSpeedOfSlow   1200.000
YSpeedOfSlow   1200.000
ZSpeedOfSlow   1200.000
ASpeedOfSlow   1200.000

Press" Y+ "or" Y- "key to move up or down to the option to be modified and press" DELETE "key, the value is in modifiable state, input new value and then press" OK "key to save the change, modify **X, Y, Z and A** axis low manual speed respectively, after that press" OK "key to save and then return to "**Low manual speed**" menu.

4. **Grid Setup(Unit: mm; Rotary axis unit: angle)**

The grid value is the distance of each axis movement in manual mode when the user has chosen low step mode or high step mode.

Setting mode: Enter "**Grid Setup**" menu, the screen displays:
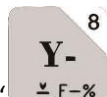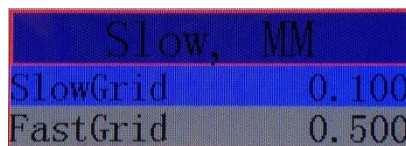
Slow, MM
SlowGrid   0.100
FastGrid   0.500

Press" Y+ "or" Y- "key to move up or down to the option to be modified and press" DELETE " key, the value is in modifiable state, input new value and then press" OK " key to save the change, modify **X, Y, Z and**

A axis manual grid distance (rotary axis is by angle) respectively, after that press" ![REF OK key] "key to save all changes, return to "**Grid Setup**" menu.

5. **Work Origin Offset***(Refer the details on page 83)*

```
WorkpieceOffset
XOffset          0.000
YOffset          0.000
ZOffset          0.000
AOffset          0.000
```

6. **Auto Scale**

In auto processing mode, Actual processing speed=work speed*auto scale，it doesn't affect "fast speed". User not only can change the setting under "Auto scale" menu, but also can modify this setting in the prompt dialog box before auto processing.

Setting：Enter "**Auto Scale**"，screen shows,

```
SpeedRatio
SpeedScale       1.000
```

Press" ![RUN/PAUSE DELETE key] "key, input new value, after modification press" ![REF OK key] "key to save the change.

7. **Fall Scale**

Including fall scale and fall height. Fall scale value system default is 0.2; **Fall speed=fast speed*fall scale;**

Max. Fall speed= Z axis negative speed limit*fall scale;

The value of fall scale can be modified under this menu and in the prompt dialog box before auto processing.

Fall height, system defaults value is 5mm. The fall scale will take effect when tool bit is 5mm over the work surface. Unit is **mm**.

Setting： Enter **"Fall Scale"**，screen prompts:

```
FallDownScale
FallDownScale       0.200
FallDownHieght      5.000
```

8. **Stop Status**

Stop position of the machine while auto machining is finished. User can choose a location in the system "Action after

work" list or set a designated location by input coordinate system value of each axis.

```
Work stop state
Act after work    Pickup Z
XCoordnt              0.000
YCoordnt              0.000
ZCoordnt              0.000
ACoordnt              0.000
```
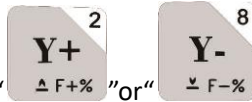
Set designated location，press" **Y+** ▲F+% "or" **Y-** ▼F-% "key to move the cursor to the option to be modified, and

then press " **运行/暂停 RUN/PAUSE 删除 DELETE** " and input required coordinate values, after that press" **归零 REF 确认 OK** "key to complete the

changes.

Set special location, press" **运行/暂停 RUN/PAUSE 删除 DELETE** "key, it will access to the stop position list as below:

```
Act after work
Pickup Z
BackToWorkOrg
BackHome
BackPosition
NoneMove
```

Press" **Y+** ▲F+% "or" **Y-** ▼F-% "key to move to required option and then press" **归零 REF 确认 OK** "key to save the change,

return to previous menu.

9. G Code Setup

Set the reading configuration of special codes in G code file. To make changes according to the actual need.

```
AttrOfGCode
G read F code     Ignore F
G abs center         False
G read T code    Ignore ATC
G spindle        Always on
Filter JD:            None
G read S code     Ignore S
Read G54        Ignore G54
Read G49        Ignore G49
Read G40        Ignore G40
CodeHead             Skip
Input T0               -1
```
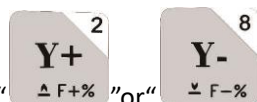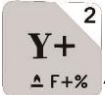
Setting mode：Press" **Y+** ▲F+% "or" **Y-** ▼F-% "key to move to G code attribute option that needs to be modified,

press" [运行/暂停 RUN/PAUSE 删除 DELETE] "key and then select the required attribute, and then press" [归零 REF 确认 OK] "key again to save the change, return to the previous menu.

10. **Pro Attribute**

Set special processing attribute, to make changes according to the actual needs.

```
Work attribute
AutoOn            None auto
Adjust Z          Adjust z
Adjust WP             None
IgnoreZ            Read Z
CircleLimit        55.556
StepWork           Contns
Spindle at ATC       Auto
FileParm           Ignore
```

Setting mode：Press" [Y+ 2 ▲ F+%] "or" [Y- 8 ▼ F-%] " key to move to processing attribute option that needs to be modified, press " [运行/暂停 RUN/PAUSE 删除 DELETE] " key and then select the required attribute, and then press " [归零 REF 确认 OK] " key again to save the change, return to the previous menu.

11. **Work Array**

Array work parameters including column count、Row count、Column space、Row space、Interval（Time unit：ms） and Array deepen

Column space：File spacing of X direction

Row space：File spacing of Y direction

Total Processing times= column count* Row count

Interval：System default 0，means not wait.

Array deepen：User can input a value of the deepness if user wants to gradually deepen the machining in each array. Unit: mm.

During array work, the operator has to replace a new work material when completed each array work. In that way, the operator needs a limitless interval value. Set the interval into a negative value. After the first array completed, the screen prompts "Waiting for the next array processing……" Press any key to start the next array processing at this time, if none key is pressed down, the system will keep waiting.

Press " [高级功能 ADVANCED] " key to start "Array work" function.
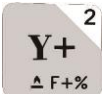
AdvancedWork
Array work
Resume work
Tool changing
Part work
Calc bound
Mill plane
Calc work time
Find break no
Auto resize
Scale work

Setting mode：Enter "**Array Work**" menu, the screen shows:

SetWorkParam
WorkSpeed: 3000.000
FastSpeed: 3000.000
SpeedScale   1.000
FallDownScale   0.200
HW guide   False
ArrayColCount   1
ArrayRowCount   1
ArrayColSpace   0.000
ArrayRowSpace   0.000
Array interval   0

Press" Y+ "or" Y- " key to move to the option that needs to be modified, and then press " RUN/PAUSE DELETE "

key and input new value, after that，press" REF OK "to save the change, modify the remaining options and

press" REF OK "to save all the changes, return to "**Array Work**" menu.

4.2.3 System Setup

System Setup menu structure chart
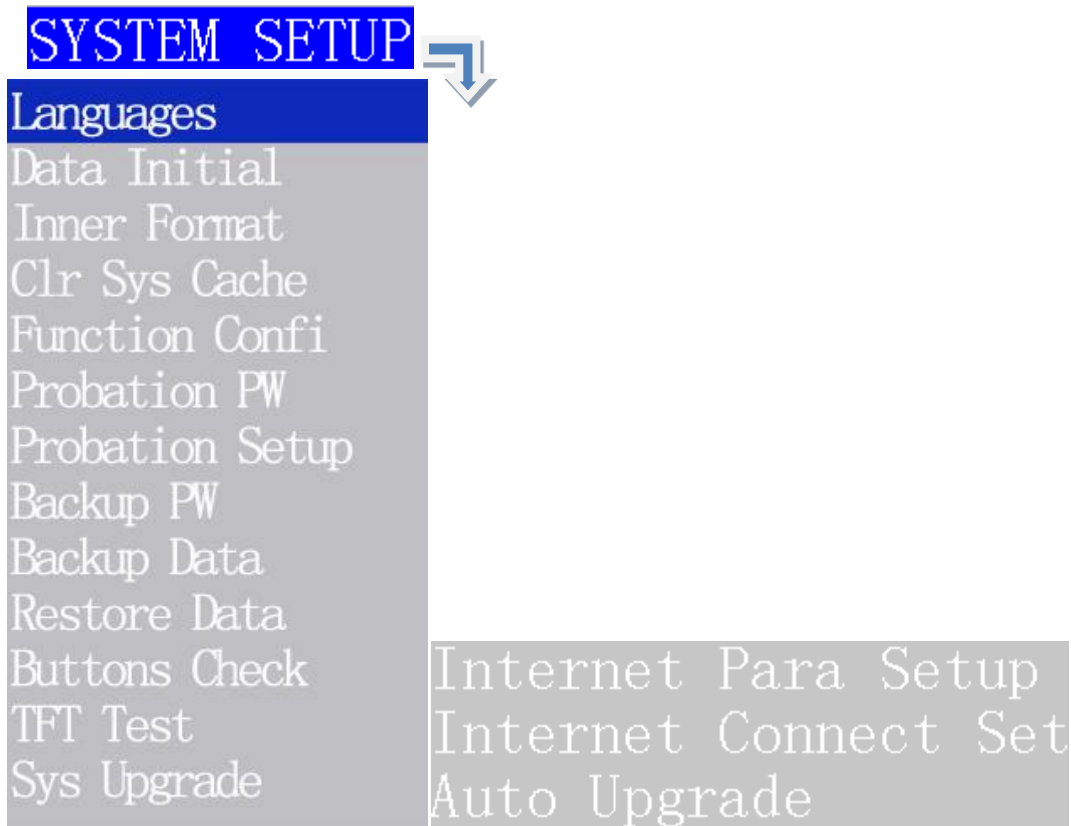
1. **Languages**

Change system language display, users can choose Chinese or English.

2. **Data Initial**

After data initial system parameters will restore to factory setting.

3. **Inner Format**

Clear the internal files. It won't damage the system parameters.

4. **Clr Sys Cache(Clear system cache)**
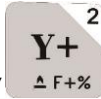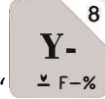
Users need to do this after functional upgrading. After this operation, user should restart the system.

5. **Function Confi（Function Configuration）**

Set whether the system retains a function or not, change it according to the actual application in accordance with the

practical application. After the operation user should restart the system.

Setting method：Press" Y+ "or" Y- "to move to the option to be modified and press" RUN/PAUSE DELETE "key

to choose new function as you want, after that, press" REF OK "key to complete the change, return to the previous menu.

6. **Probation PW (Probation Password）**

The controller has a initial 20-digit password, user should offer the 20-digit initial password and required probation time(Calculate according to processing time, unit: Hour), then we will offer new 20 digits password with limit time to the user.

Setting method: Press" REF OK "key and enter "Probation PW", the screen shows:

Please input new time password:
0226481547706127 0461   ⟶ Initial password

Input new password directly and then press" REF OK "key.
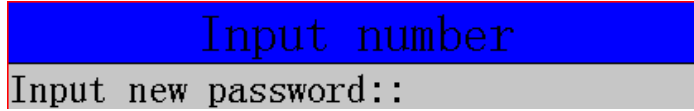
7. **Probation Setup**

Users could set 3 class of probation password by themselves in the menu.

8. Backup PW(Backup password)

To prevent the system parameter be backup in disorder condition, or the correct parameters be covered by disoperation.

Setting method: Press" 归零 REF 确认 OK "key to enter into "**Backup PW**", the screen displays:

Input number

Input new password::

Input a new password directly and then press" 归零 REF 确认 OK "key to save.
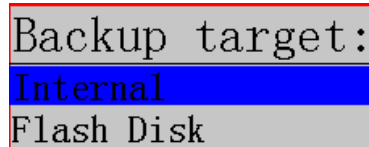
If the password should be canceled, just don't input any digit when it prompts "Input new password" and press" 归零 REF 确认 OK "key to save.
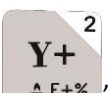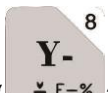
9. Backup Data

"Backup Data" means to backup the system parameters to U flash disk or internal space of the controller. "Inner Format" operation doesn't affect it. Its file format is: **data.bak**.

Setting：Press " 归零 REF 确认 OK " to enter "**Backup Data**"，screen shows:

Backup target:
Internal
Flash Disk
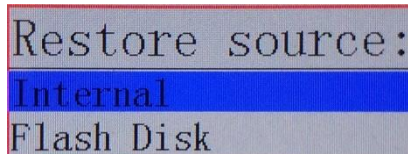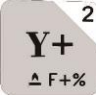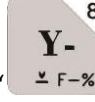
Press" Y+ ▲F+% "or" Y- ▼F-% " to move cursor and select the backup target, and then press " 归零 REF 确认 OK "key to confirm.

10. Restore Data

Restore the "data.bak" file from U disk or inner to the control system.

Setting：Press " 归零 REF 确认 OK "to enter into "Restore Data" menu, the screen shows,

Restore source:
Internal
Flash Disk

Press " [Y+ 2 ▲F+%] "or" [Y- 8 ▼F-%] "key to move cursor and select the restore source, and then press " [归零 REF 确认 OK] "key to confirm, the data restored successfully.

11. Buttons Check

Users can check buttons are valid or not under this menu. Enter "Buttons Check", press each button, the corresponding button will be highlighted on the screen. It will not be highlighted if the been pressed button is not available. To exit the "Buttons Check" by pressing" [归零 REF 确认 OK] "+" [停止 STOP 取消 CANCEL] "。

12. TFT Test

Enter "TFT Test"; press each button, if the screen shows pure colors means the screen is normal. If the screen missing color, then it should be returned back for repairing.

Red   green   blue   black   white
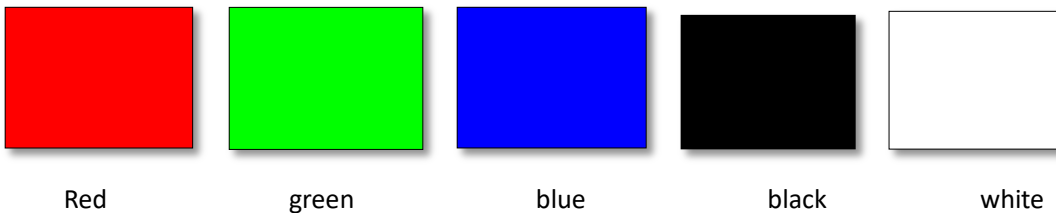
Press" [停止 STOP 取消 CANCEL] "key to exit "TFT Test".

13. Internet Para Setup

NetworkConfig
LocalIPAddress:192.168.1.10
LocalIPMask: 255.255.255.0
GateWayAddress: 0.0.0.0
DNS Address: 0.0.0.0

14. Internet Connect Setup

网络连接控制
允许：
允许：
允许：
允许：
拒绝：
拒绝：
拒绝：
拒绝：

15. Sytem Upgrade

If added new functions, we will offer upgrade file which extension name is ******.PKG format (File name is rz-xxxx or q13-xxxx). User could update the system through U disk, for more details please see **PS1**. System updating doesn't remove the controller original parameters.

Upgrade package format sample:

Sample: 𝐵51普通三轴雕刻[5寸彩屏][USB1](q9-194).pkg

4.2.4 Operate File

Operate File Menu Structure Chart

OPERATE FILE

Copy File
Del File
View File
Proc Info
Proc Time
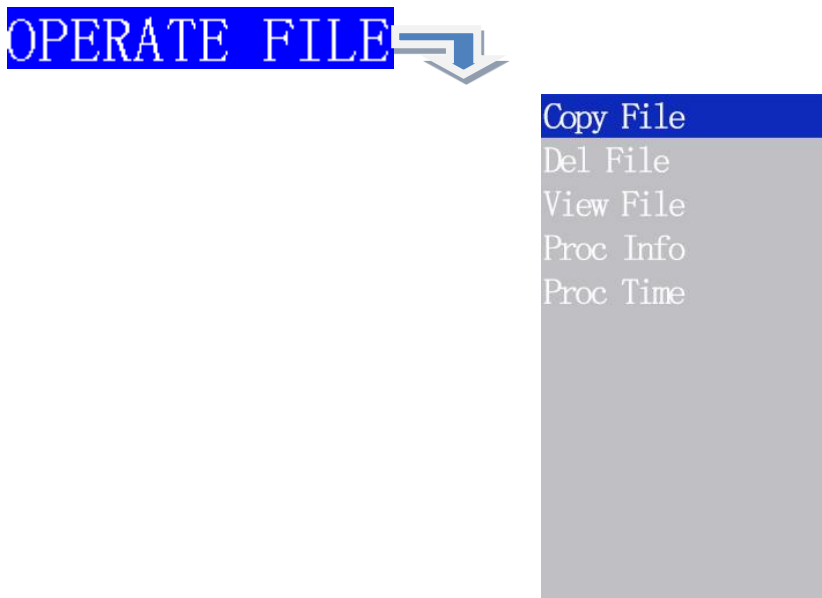
1. Copy File：

Copy files from U disk to inner space.

2. Del File（Delete File）：

Delete system internal files.

3. View File：

View the files and G codes of U disk or inner.

4. Proc Info（Processing Information）：
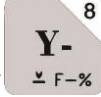
System powers on, it will statistical the times of successful processing by file name, if system powers off, the data will disappear.

5. Proc Time（Check Processing Time）：

Calculate processing time according to work speed, after reading G codes, the screen will display the processing time, different work speed corresponding to different processing time.

Operating mode：Press " [REF 归零 确认 OK] " to enter "Proc Time", the screen shows:

Select work file
UDisk File
Internal File
Recent File
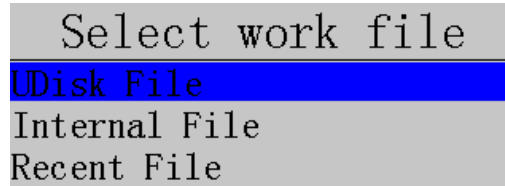
Press" [Y+ 2 ▲ F+%] "or" [Y- 8 ▼ F-%] "key and select from the options, after that, the screen shows：

Select work file
1HEAD1.tap
2.tap
21.tap
22.tap
Avalokitesvara.tap
GLM1.tap
0 1 0.tap
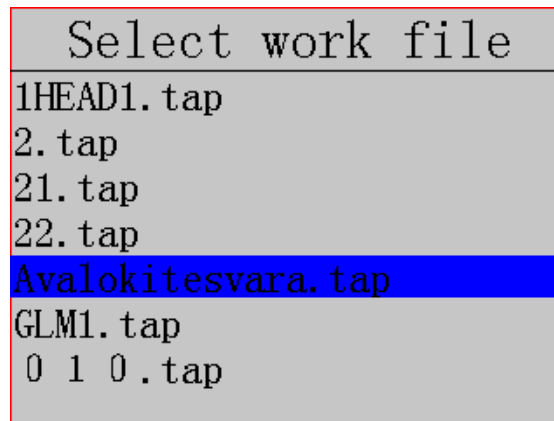
Press" [归零 REF 确认 OK] "key to enter and select the processing file required to be calculated, and then

press" [归零 REF 确认 OK] "key, the screen shows:

Calc work time
During calculating work time...
67.97%
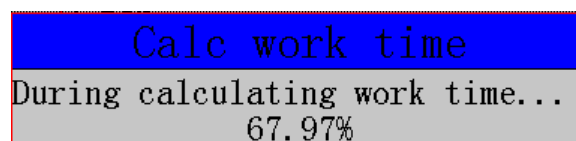
Screen will show processing time：

Information
The work time of
the file is 0 h
ours 28 minutes
42 seconds.
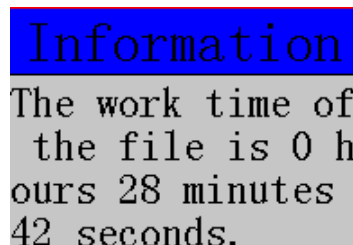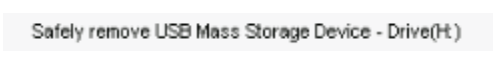
NOTE: Please pull out the U disk correctly after copying files from the computer, to avoid the risk for the controller can't

recognize the U disk.

1)   Win7 (32 bit) system: After copying files, please press" [icon] ", and then the display will show

2) "", choose the device to be shut down. When the display shows

"" means the U disk has been removed out from computer

successfully.

3) Win XP system: After copying files, press"", and then the computer screen will show

"", choose the device to be shut down. When it shows

"" refers to the U disk has been removed out from computer successfully.

4.2.5 Version View

Users can view information about the system hardware and software, including：

✧ Update Version： eg：P1.409/rz-xxxx/q10-82

✧ Product ID eg：A0020112

✧ Soft Version eg：A1.1936

✧ Emergency Version eg：A1.1920

✧ Soft type：3/4-axis carving

✧ Hardware type：4-axis carving Support 5-inch color screen

4.3 Remote control user interface (reserved)

4.4 Input output control user interface
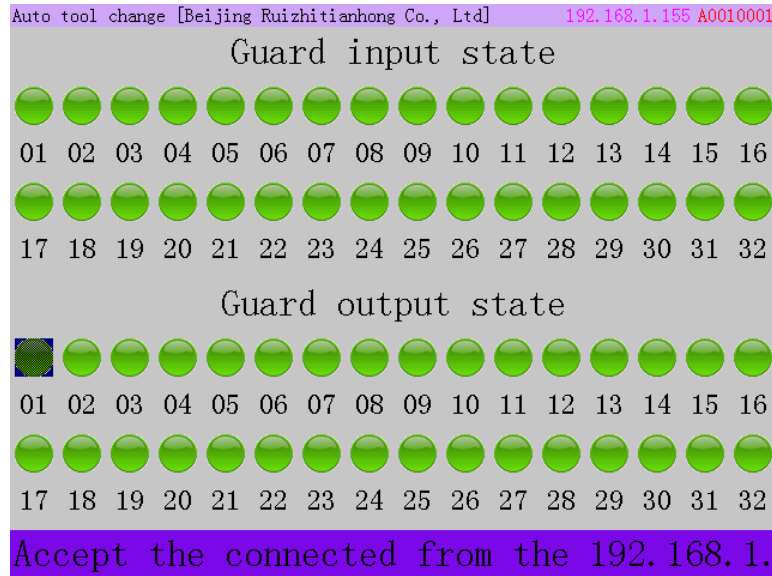
1) **Guard input state：**

The stepper wiring board has 16 status indicators which are corresponding to the X01~X16 port of the wiring board INPUT SIGNAL terminal.

Indicator 01 is X01-X axis HOME signal (Mechanical origin);

Indicator 02 is X02-Y axis HOME signal;

Indicator 03 stands for X03-Z axis HOME signal;

Indicator 04 stands for X04-Auto tool sensor signal; Or A axis HOME sensor on 4 axis system（B58）

Indicator 05 is X05 input signal to be defined, or tool sensor signal on 4 axis system (B58)

The remains input indicators are definable signals.

Input terminal debugging: Normally the lights display in green which means the signal has not been triggered; The lights turn to red when the input signals are triggered. However, if corresponding indicator light stays in green while the input signal is triggered. User should check the problem of corresponding signal sensor, circuit and the wiring board.

2) **Guard output state：**

There are 8 output ports on the stepper wiring board, while 16 output ports on the servo wiring board. Each output port is corresponding to the indicator light No. 01(Y01) to 16(Y16).

Indicator 01 stands for Y01-Spindle ON/OFF;

Indicator 02 stands for Y02-multi-step spindle speed 1;

Indicator 03 stands for Y03-multi-step spindle speed 2;

Indicator 04 stands for Y04-multi-step spindle speed 3;

The remains indicator lights are to be defined.

Press" 运行/暂停 RUN/PAUSE 删除 DELETE "key can change the indicator status (color). Thus, user can manually control the corresponding output port signal status. Press" 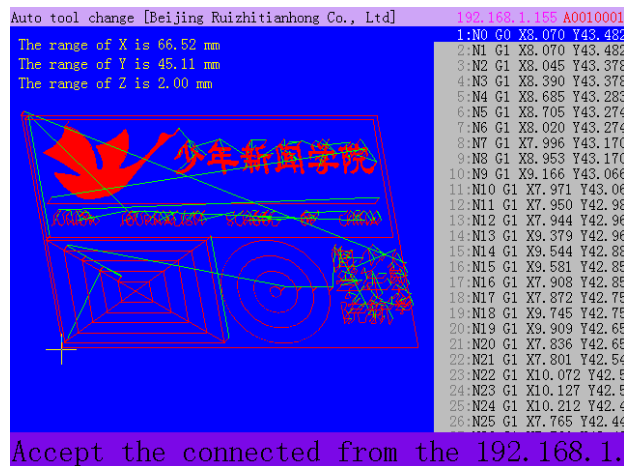X+ 6 ≥ "、" X- 4 ≤ "keys to move to left or right; then press" 运行/暂停 RUN/PAUSE 删除 DELETE "key to modify corresponding light status. **E.g.:** The cursor stays at 01 indicator, press" 运行/暂停 RUN/PAUSE 删除 DELETE ", it turns red from green，spindle starts.
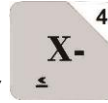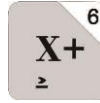
4.5 Tool path user interface

1. In this interface, user can preview simulation drawing, X/Y/Z/A axis machining range and the G code of the processing file.
2. In the g code viewing, press number buttons"2"or"8" to move up or down line by line.
3. Press number buttons"3"or"9"to move page by page.
4. Press number buttons"4"or"6" to switch from G code head to the end.
5. Press combination buttons "MODE"+ number buttons"2"or"8"to view top and bottom of the work path.
6. Press combination buttons，"MODE"+ number buttons"4"or"6" to view left and right side of the work path.
7. Press combination buttons，"MODE"+ number buttons"3"or"9"zoom in or out.

5 Machine Operation

5.1 Return HOME (ZRN)

It will display "**all axis home**", "**Z home only**", "**none axis home**" after starting up the DSP handle. Determine according to your actual needs. Machine return home can revise the coordinate of the dsp system.

In some cases, such as after normal power off, reboot and continue last operation, no need to go machine ZERO again, just choose "**none axis home**" to skip HOME operation. That is because system automatically saves the machine coordinate information before it exits normally.

HomeTypeAtStart
All axis home
Z home only
none axis home

5.2 Load processing file

Before processing, generally we should import files. RichAuto system has 2 ways to import files: U disk file loading and inner file loading.

1) Directly import the processing file into U disk, and then run with the U disk inserting in the controller. Press " 文件 FILE "key, screen shows:

SelectWorkFile
UDisk File
Internal File
Recent File

Select the file you need and press" 归零 REF 确认 OK "key.

2) Copy the files to handle internal storage area from U disk, and then run the inner file without U disk inserting. After checking the processing file code and drawing path, the screen will show the simulation image of the loaded processing file.

5.3 Manual Operation

Manual Operation refers to move the machine tool by pressing the direction key on the keypad. User can change the running speed and set the grid (step distance) in manual mode. System will enter Manual Operation state after returned HOME, and the screen displays:
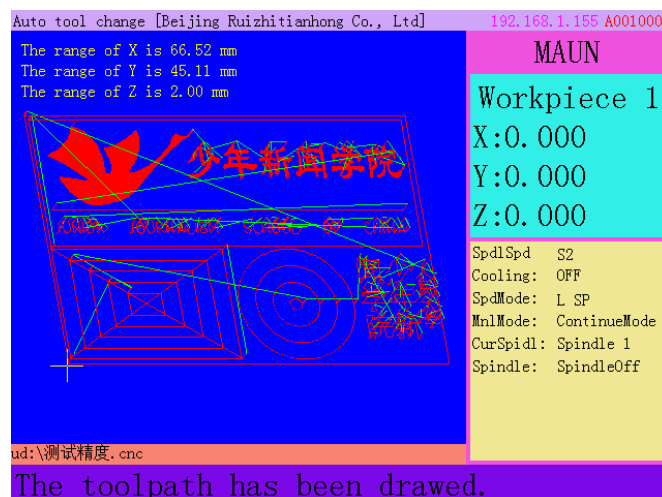
5.3.1 Manual speed switching and adjustment

1. Speed mode switching
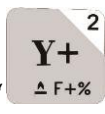
There are 2 speed mode-Fast/Slow speed switching. Press "   " to switch the mode.
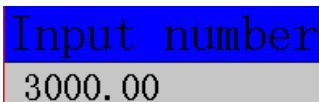
E.g.: Suppose the current speed mode is "H SP", press down"   ", the screen will change to "L SP" mode.

The speed mode status show on screen determines the actual manual moving speed.

2. Speed adjusting

Press"**MENU**"--"**Menu function user interface**"--"**Auto Pro Setup**"-- find "**Manual Speed & Grid speed**"--"**Low Manual Speed**" and "**High Manual Speed**", the screen displays as below：

Unit MMPerSec		Unit MMPerSec	
XSpeedOfSlow	1200.000	XSpeedOfFast	3000.000
YSpeedOfSlow	1200.000	YSpeedOfFast	3000.000
ZSpeedOfSlow	1200.000	ZSpeedOfFast	3000.000
ASpeedOfSlow	1200.000	ASpeedOfFast	3000.000

The cursor stays at "X SLOW", press "   "、"   "key and move to the option to be modified and then

press"   "key, the screen prompts:

Input number

3000.00

Enter required value, after that press"   "key to confirm; Press"   "key exit. If there is an

error in the inputted value, press"   "to delete from the last digit, then enter correct value.
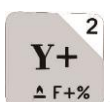
High speed mode setting method is the same to low speed mode.

5.3.2 Manual movement modes

To meet the requirements of manual movement in different situations, the system provides 3 manual movement

modes: Continue, step, distance. User could press "   " under manual mode to switch manual movement mode

and view the current movement mode at the "Machine status display area" of the screen.

1. Continue motion mode (Continuous motion mode)

This model has no specific data control, user could press motion direction keys（   、   、   、
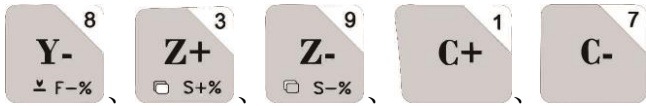
Y-、**Z+**、**Z-**、**C+**、**C-**），the machine continues to move until the direction keys are loosened. The motion speed is determined by current manual speed mode.
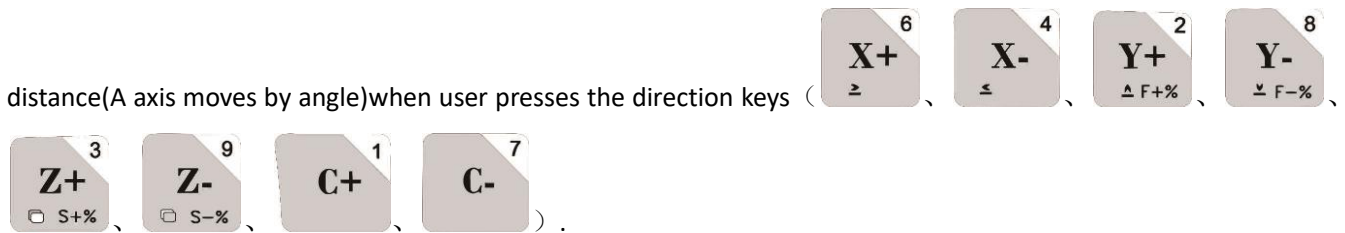
2. Step motion Mode

In step mode, machine moves 1 grid every half second. The grid distance is determined by the current speed mode. H SP moves 0.5mm/step, L SP move 0.1mm/step.

Step mode is suitable for fine adjusting the tool bit or position of the mechanical coordinate.
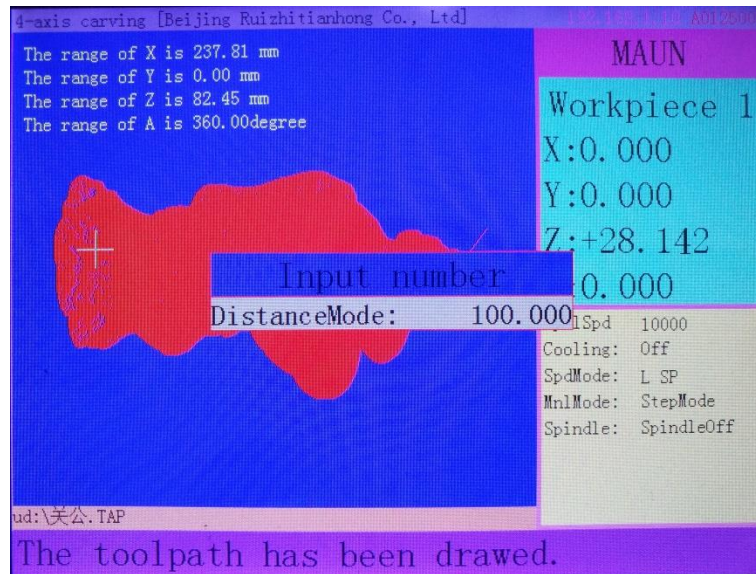
3. Distance motion mode (Fixed distance motion mode)

In Distance mode, the movement depends on the distance value you've set. The machine will move fixed distance(A axis moves by angle)when user presses the direction keys（**X+**、**X-**、**Y+**、**Y-**、**Z+**、**Z-**、**C+**、**C-**）.

Modification method: Press"**MODE**"key and switch to Distance motion mode, the screen shows as below:

Enter in the required distance value and press"**OK**"key to confirm.

Note: The distance mode is not affected by the step mode grid setting, it means that the machine moves accurately at the set distance (A axis moves by angel), it won't move to the grid point. If the distance value (A axis is angle value) needs to be change, just press"MODE"key three times to enter into the distance mode again, then input new value(A axis is angle).

54

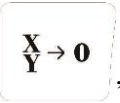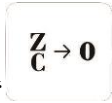## 5.4 Auto processing operation

Auto processing refers to the system processes the file in U disk or inner storage space according to the instructions. It also called "file processing". Before auto processing, user should set the machine tool parameters and all of the system parameters correctly.
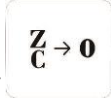
Auto processing steps refer to the following content.

5.4.1 Set work origin

The origin point of X, Y and Z axis in processing file is work origin. Before processing, we should associate that position with the actual location, operate as below:

Manually move X, Y and Z to the position where will start to process the file on material. Afterwards, press

" [X Y → 0] " to set X and Y work origin position. Do the same way to Z and A axis, press " [Z C → 0] "key so that the system saves the Z and C work origin position.

If use automatic tool setter, no need to press " [Z C → 0] "key. Only press " [对刀 TOOLSET] "key the system will remember the work origin of the Z axis.

5.4.2 Load processing file

After determined the work origin, press " [文件 FILE] "key, the screen shows:

```
SelectWorkFile
UDisk File
Internal File
Recent File
```
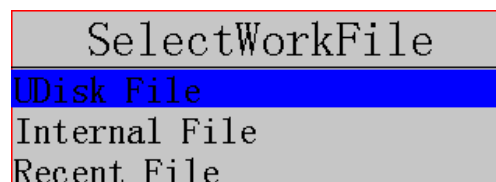
Select required file and then press " [归零 REF 确认 OK] "key.

5.4.3 Set Auto processing parameters

1) After loading the processing file, press " [运行/暂停 RUN/PAUSE 删除 DELETE] "key, prompts a list of auto processing parameters settings：

```
SetWorkParam
WorkSpeed:        18000.000
FastSpeed:         3000.000
SpeedScale         1.000
FallDownScale      0.200
```

2)
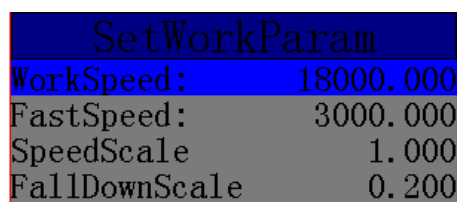
3) User can modify the work parameters, including work speed, fast speed, Speed scale, fall down scale and HW (handwheel guide).

4) Modification method: Press" $\boxed{Y+}$ "、" $\boxed{Y-}$ " Key to move the cursor to different items, press

" $\boxed{\text{DELETE}}$ "key and input new value, and then press" $\boxed{\text{OK}}$ "key to confirm the changes. After all options

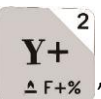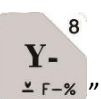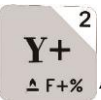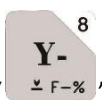have been modified, press" $\boxed{\text{OK}}$ "key, and wait for the spindle start：

Waiting for spindle on
Spindle will be on
4

5) The system starts to process after the spindle start rotating. During machining, the machining status can be viewed

at the machine status area， which contains work speed, work time, file line No., G codes etc. Press" $\boxed{\text{MENU}}$ "key
to switch the information in machine status display area.

5.5 Operations during processing

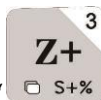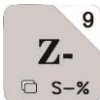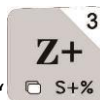### 5.5.1 Speed ratio & spindle state adjusting

1) Speed ratio adjustment

During processing, press " $\boxed{Y+}$ "、" $\boxed{Y-}$ " adjust the speed ratio. The speed ratio increase/decrease 0.1

each press on " $\boxed{Y+}$ "/" $\boxed{Y-}$ "key.

Speed scale (speed ratio): max. is 1.0; min. is 0.1, speed values are also change accordingly except for the time.

Current processing speed = work speed * speed scale

2) Spindle state Adjustment

If user has set multi step speed function， the multi-step speed can be adjusted during processing.

Press" $\boxed{Z+}$ "、" $\boxed{Z-}$ "key to adjust spindle speed from S1 to S8. Each press on" $\boxed{Z+}$ "key, the spindle speed

increases 1 stage until it reaches S8; Each press on " $\boxed{Z-}$ "key, the spindle speed descends 1 level until it reaches S1.

### 5.5.2 Pause & position adjustment

Pressing "[运行/暂停 RUN/PAUSE 删除 DELETE]"key to pause processing. The top right corner of the screen will change from "MAUN" to

"PAUS" and machine suspends processing except for the rotating of spindle. Shown below:
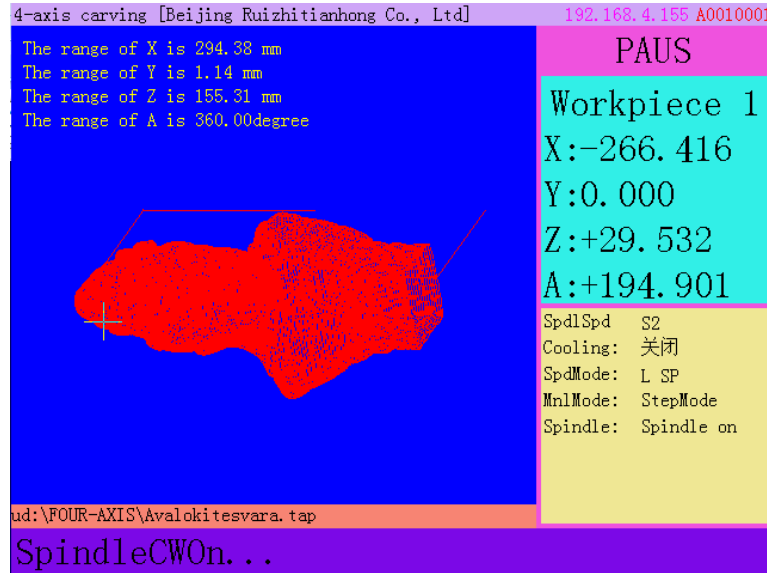
At this moment, the user is allowed to adjust the position of X, Y Z and A axis. The system default manual motion

mode is **STEP**. So that user can fine adjust each axis distance（A axis moves by angle）. Machine moves one low or high

speed grid distance every step.

When the adjustment is finished, press "[运行/暂停 RUN/PAUSE 删除 DELETE]"again, screen shows:
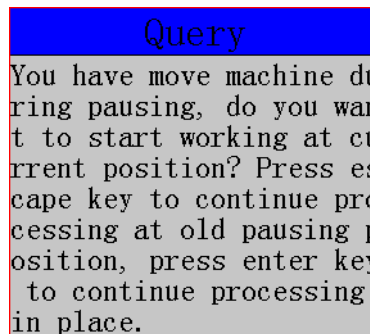
The system asks the operator to confirm whether to save the modified position or not. Press

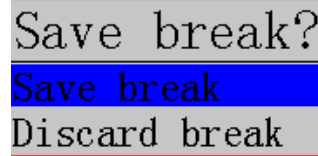"[归零 REF 确认 OK]"/"[运行/暂停 RUN/PAUSE 删除 DELETE]"key the system will start processing at modified position; Press"[停止 STOP 取消 CANCEL]"key the

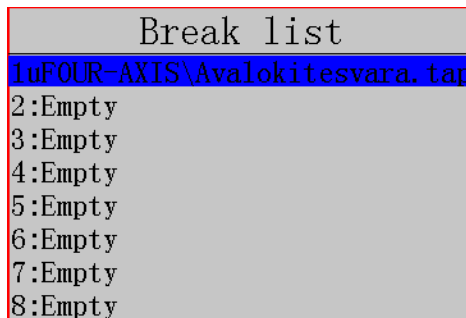system will start processing at suspend position (before modifying).
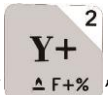
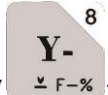## 5.5.3 Breakpoint processing &power failure recovery

1. Breakpoint processing

If user wants to stop machining during processing, press" "key, the screen shows as below:
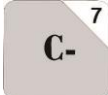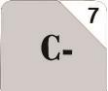
If the stop position has to be saved, user should press " "key, the screen displays break list (From breakpoint 1 to 8).

Press" "、" " move the cursor and select, and then press " " key to save, system automatically move to work origin. If the user wants to continue processing from the breakpoint, could press the combination keys " + corresponding number" keys. First, keep pressing the main function key " "and then press corresponding number key, afterwards, release them at the same time, the system will resume processing from the relative breakpoint.

E.g.: To restore from breakpoint 7, press" "+" "keys，press and hold the" "key and press" "key，then release them together，the system will be processing form breakpoint 7. If the user wants to process from the other g code line where is ahead the breakpoint, shall press" "and enter new line no. and then press" "key, the system will start to process at the new line. The system must have an action of returning HOME (mechanical origin) during the period of saving breakpoint and before machining.

2. Power off protection

When there is a sudden power failure during processing, system will save current coordinate and parameters and continue the processing when the power is electrify again. After power on, system **must return HOME at once**. Then the screen will prompt:

HomeTypeAtStart
All axis home
Z home only
none axis home

Last power off during working, because of inertia the machine position may be error, do you want to restore coordinate? Recommended go HOME to restore.

Press" 归零 REF 确认 OK "key to continue the unfinished processing, the screen will show stop line, shown as below:

Start Line No. Of Power Failure Recover
254:Z9.142 A-286.742
255:Z9.558 A-295.277
256:Z9.868 A-303.729
257:Z10.232 A-310.022
258:Z10.591 A-316.259
259:Z10.813 A-322.443
260:Z11.008 A-326.546
261:Z11.121 A-332.667
262:Z11.433 A-338.601
263:Z18.4 A-338.618
264:Z18.998 A-338.766
265:Z19.842 A-339.287
266:Z20.574 A-340.182
267:Z21.11 A-341.001
268:Z21.797 A-342.639
269:Z22.022 A-343.457
270:Z22.344 A-345.071
271:Z23.118 A-351.455
272:Z23.726 A-354.61
273:Z23.952 A-356.176
274:Z24.049 A-357.732
275:Z24.02 A-359.283

The line number can be chosen，press" 运行/暂停 RUN/PAUSE 删除 DELETE ", the screen pops up:

Input number
The line no of the code::160

Enter the line number to be backwards from current position and then press " 归零 REF 确认 OK ", the operate method is the same to what has mentioned in breakpoint processing. G code cursor will jump to the new line location:

掉电保护恢复的起始行号
160:Z4.765 A-103.546
161:Z4.592 A-98.742
162:Z4.481 A-93.911
163:Z4.537 A-79.362
164:Z4.642 A-69.678
165:Z4.822 A-62.435
166:Z5.087 A-55.23
167:Z5.423 A-48.079
168:Z5.729 A-40.995
169:Z6.096 A-33.973
170:Z6.39 A-29.33
171:Z6.84 A-24.723
172:Z7.398 A-20.167
173:Z7.726 A-15.678
174:Z7.915 A-13.289
175:Z18.66 A-13.967

Press" **REF/OK** "key the system will start processing from the new line.

5.6 Advanced Work

The development of Advanced work is to meet the special requirements in the operation, it mainly includes:

Array work, Resume work (breakpoint processing), **Mirror Work**, **Tool changing** (manual change tool bit), **Part work**, **Calculate bound**, **Auto Center, Mill plane**, **Calculate work time**, **Find break No.**, **Auto Resize**, **Scale work** and **Step work**.
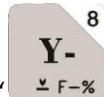
Pressing the shortcut key " **ADVANCED** "to access advanced Work list, the screen as shown below:

```
AdvancedWork
Array work
Resume work
Tool changing
Part work
Calc bound
Mill plane
Calc work time
Find break no
Auto resize
Scale work
```

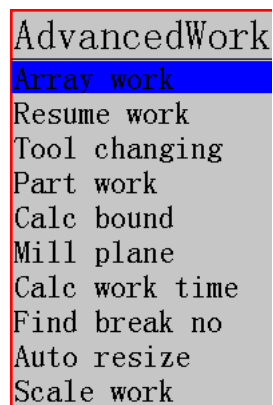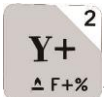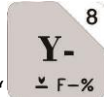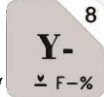**1. Array work**

Operating steps as below:

1) Press" **Y+** "、" **Y-** " to move cursor to the Array work option, press " **REF/OK** " to enter, and then press " **Y+** "," **Y-** " again to select different file lists;

2) Press" **REF/OK** " to enter file list, then press" **Y+** "、" **Y-** " to move the cursor and choose target file;
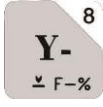
3) Set processing parameters, revise the relative parameters of Array Work here, or go to "MENU"--"AUTO PRO SETUP", choose "Work Array" and modify the array parameters. The rest steps are similar to the normal processing. After that, system starts the array work processing according to the user's settings.

4) During array work, press " **MENU** " view real-time row number, column number and other processing information.

Note: If user wants to manual control in array work, just change the setting of "Interval (unit:ms)"into a negative number.

2．Resume work (breakpoint processing)

Operation procedure is as follows：

Press" Y+ "、" Y- " to move cursor on **resume work**, press" 归零 REF 确认 OK " to enter the breakpoint list,


```
Break list
1uFOUR-AXIS\Avalokitesvara.tap
2:Empty
3:Empty
4:Empty
5:Empty
6:Empty
7:Empty
8:Empty
```

Press" 归零 REF 确认 OK " the system recover from the corresponding break point. However, if user don't want to

recover from the fixed break point in the list, should press" 运行/暂停 RUN/PAUSE 删除 DELETE "， the system prompts：

```
Input number
The line no of the code::160
```

Input new line No. and then press" 归零 REF 确认 OK "key, the G code cursor will jump to the new line:

```
Start source no of break working
160:Z4.765 A-103.546
161:Z4.592 A-98.742
162:Z4.481 A-93.911
163:Z4.537 A-79.362
164:Z4.642 A-69.678
165:Z4.822 A-62.435
166:Z5.087 A-55.23
167:Z5.423 A-48.079
168:Z5.729 A-40.995
169:Z6.096 A-33.973
170:Z6.39 A-29.33
171:Z6.84 A-24.723
172:Z7.398 A-20.167
173:Z7.726 A-15.678
174:Z7.915 A-13.289
175:Z18.66 A-13.267
176:Z19.126 A-13.139
177:Z20.056 A-12.187
178:Z20.667 A-11.236
179:Z21.249 A-9.565
180:Z21.656 A-7.925
181:Z22.126 A-4.675
```

Press" 归零 REF 确认 OK "key the system will start to process from the new line.

3．(Manual)Tool changing

It means manually loading or loosen the tool bit at a certain position of the machine tool. Press

" "key to enter into the setting:

After new tool bit is replaced press" " the machine will go back to workpiece origin.

4. **Part work**

Park work means user can select a start line and stop line from G code file, and realize machining a part of G codes

from the processing file. The operate steps are as follows：

1) Press" "key to enter the setting:

2) Press" "key，prompts：

3) Enter a new line number, press " "to confirm, the cursor in the G codes will jump to the new

line:

```
                    Input start line number
        48:Z5.417 A-136.037
        49:Z6.08 A-140.781
        50:Z6.691 A-145.438
        51:Z7.417 A-150.016
        52:Z7.9 A-152.275
        53:Z8.425 A-154.496
        54:Z8.858 A-156.686
        55:Z9.525 A-161.003
        56:Z10.099 A-165.251
        57:Z10.742 A-169.438
        58:Z11.321 A-173.56
        59:Z11.765 A-177.622
        60:Z12.098 A-181.637
        61:Z12.206 A-183.631
        62:Z12.434 A-195.522
        63:Z12.651 A-199.468
        64:Z12.557 A-201.434
        65:Z11.9 A-207.335
        66:Z11.103 A-213.325
        67:Z10.241 A-219.43
        68:Z9.699 A-223.572
        69:Z8.829 A-229.894
```

4) Press " 归零 REF 确认 OK " again to go to the end line input operation, prompts:

```
                     Input end line number
        48:Z5.417 A-136.037
        49:Z6.08 A-140.781
        50:Z6.691 A-145.438
        51:Z7.417 A-150.016
        52:Z7.9 A-152.275
        53:Z8.425 A-154.496
        54:Z8.858 A-156.686
        55:Z9.525 A-161.003
        56:Z10.099 A-165.251
        57:Z10.742 A-169.438
        58:Z11.321 A-173.56
        59:Z11.765 A-177.622
        60:Z12.098 A-181.637
        61:Z12.206 A-183.631
        62:Z12.434 A-195.522
        63:Z12.651 A-199.468
        64:Z12.557 A-201.434
        65:Z11.9 A-207.335
        66:Z11.103 A-213.325
        67:Z10.241 A-219.43
        68:Z9.699 A-223.572
        69:Z8.829 A-229.894
```

5) Press " 归零 REF 确认 OK " the cursor will automatically moves to the end line, user can modify by pressing

" 运行/暂停 RUN/PAUSE 删除 DELETE " key, input new end line number:

Input end line number

```
52275:Z41.45 A-55.681
52276:Z42.586 A-53.917
52277:Z43.999 A-51.613
52278:Z44.894 A-49.915
52279:Z45.45 A-48.236
52280:Z45.671 A-47.123
52281:Z45.677 A-46.014
52282:Z45.564 A-44.909
52283:Z45.297 A-43.804
52284:Z44.872 A-42.698
52285:Z44.388 A-41.587
52286:Z42.335 A-37.63
52287:Z39.993 A-32.383
52288:Z38.024 A-26.375
52289:Z36.473 A-20.198
52290:Z35.287 A-13.883
52291:Z34.444 A-6.168
52292:Z34.085 A0.0
52293:Z157.648 F3000
52294:M9
52295:M30
```

Press" "key to confirm, start processing.
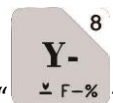
6) Setting up processing parameters, and the following steps are similar to normal processing.

5. Calculate bound

Calculate bound means user can check the size of processing file, thereby to avoid unnecessary waste of materials and machining errors. The steps are as below：

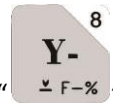1) Press" "、" " to move the cursor to "calculate bound", press" "to access in：


```
SelectBoundFile
UDisk File
Internal File
Recent File
```
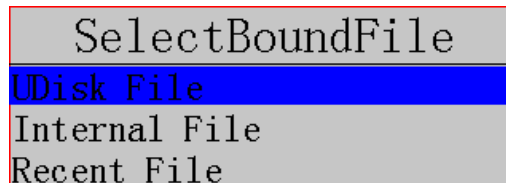
Press" "、" "again to move and select from different file lists;

2) Press" "to enter a file list, and press" "、" "to move to the target file:


```
SelectBoundFile
123.nc
16.nc
huG2-R.nc
test.nc
rabbit.nc
```
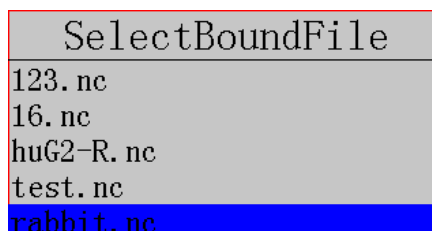
3) Press" "key, the system will calculate the file dimension after file reviewing:
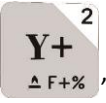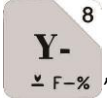
6. Mill plane

Including 2 types: Scanning type milling and Encircle type milling.

The specific procedures are as follows:
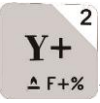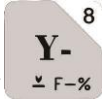
1、Scan milling

1) Press" Y+ "、" Y- "to move the cursor and choose a milling type.

2) Press" OK "to enter into the milling plane parameters setting, including Scan type, scan width, scan

height, tool diameter, tool depth, Z step(Z feed amount), T Ratio(Tool feed ratio).

3) Press" Y+ " 、 " Y- " to move the cursor and select the item to be modified,

press" DELETE "choose milling type(Horizontal milling/ lengthways milling) and modify specific values,

after that press" OK "to save the changes.

65

2、Encircle milling

1) Press" **Y+** ", " **Y-** " to move cursor to choose the mill type；

2) Press" **归零 REF 确认 OK** "to enter the milling plane settings， containing scan type, scan width, scan height, tool

diameter, scan depth, Z step(Z axis feed amount), T Ratio(Tool feed ratio of Z axis) .

```
Scan mill set
ScanType  AClockwise
Width       100.000
Height      100.000
Diameter     10.000
Depth         0.000
Z Step        0.100
TRatio        0.800
```
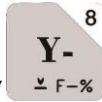
3) Press" **Y+** ", " **Y-** "to move and modify the settings, and press" **运行/暂停 RUN/PAUSE 删除 DELETE** "to select a scanning

type（Anticlockwise/ clockwise） and modify the specific values, and then press" **归零 REF 确认 OK** "to save the

changes.

7. Calculate work time

Calculate the total machining time according to the work speed.

1) Press" **Y+** ", " **Y-** "to move the cursor to "calculate work time"option, press " **归零 REF 确认 OK** "key to

enter into:

```
Select work file
UDisk File
Internal File
Recent File
```

2) Press" **Y+** ", " **Y-** "to select the file source,press" **归零 REF 确认 OK** "to enter into the file list：

```
Select work file
123.nc
16.nc
huG2-R.nc
test.nc
rabbit.nc
```

3) Press" Y+ △F+% "、" Y- ±F-% "to move and select file, press" 归零 REF 确认 OK "to confirm, after system calculating:
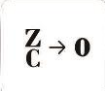
Calc work time
During processing...
54.38%

The screen will show the file total work time（different work speed correspond to different processing time）:

Information
The work time of the file is 0 hours 2 minutes 28 seconds.

8. Find break No.

During processing, if accidentally tool broken but user hasn't saved the break point, stop working and replace the tool. After that, user can manually move X, Y axes to the nearest point where the cutter was broken (recommend to move a little further), press combination keys " 运行/暂停 RUN/PAUSE 删除 DELETE "+" Z C →0 "to start advanced work fuction, and then press" Y+ △F+% "、" Y- ±F-% " move cursor to "Find break no.", then press " 归零 REF 确认 OK " to enter in. After guide and reading code, the system prompts:

Query
Press enter key to cnotinue working from searching position, press other key only show the line number!

Press" 归零 REF 确认 OK " to start processing, press" 停止 STOP 取消 CANCEL " key, the screen just show the current position line number.

Note: When using the "fine break no." function, the current work coordinate must be consistent with the work coordinate of the breakpoint.

9. Auto resize：

1) Press " Y+ △F+% " or " Y- ±F-% " to move cursor to "**Auto resize**"，and then press " 归零 REF 确认 OK "to enter.

2) Press " Y+ 2 △ F+% " or " Y- 8 ▼ F-% " move to the option witch needs to modified, then press " 运行/暂停 RUN/PAUSE 删除 DELETE " to

input new value, press " 归零 REF 确认 OK " save the modification.

InputTargetSize

X start	0.000
Y start	0.000
X size	10.000
Y size	10.000
X- Space	10.000
X+ Space	10.000
Y- Space	10.000
Y+ Space	10.000

3) After modified all the options, press" 归零 REF 确认 OK " to start processing.

Circle size: 200mm * 200mm

10mm（Y Positive gap）

10mm（Y Negative gap）

Work origin →

10mm （X Negative gap）   10mm （X Positive gap）
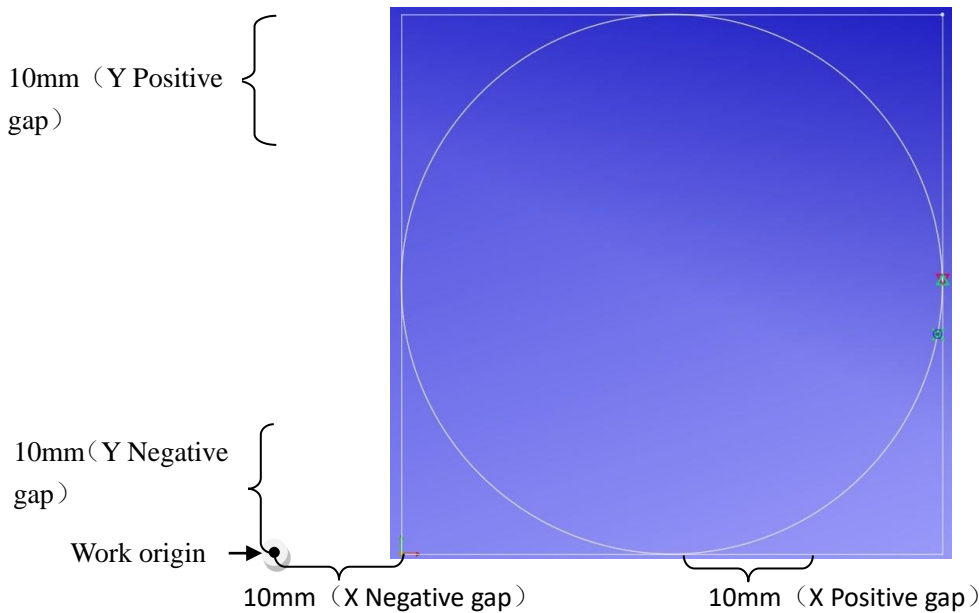
X、Y axis origin：Offset value of the new workpiece origin which is relative to the original workpiece origin.

X、Y axis size: New processing file size.

X negative gaps: See the bottom mark, in X direction, processing origin is moved back for 10mm.

X positive gaps: See the bottom mark, in X direction, processing origin is moved ahead for 10mm.

Y negative gaps: See the bottom mark, in X direction, processing origin is moved back for 10mm.

Y positive gaps: See the bottom mark, in X direction, processing origin is moved ahead for 10mm.

10. **Scale Work**

If user needs different sizes processing file, could select "scale work" , input the zoom scale and then start

processing. Press " 归零 REF 确认 OK "to enter:

Operate steps：

1) Press " Y+ 2 ▲ F+% " or " Y- 8 ± F-% " to move cursor to "scale work", then press " 归零 REF 确认 OK "to enter：

Scale work param
X scale   1.000
Y scale   1.000
Z scale   1.000
A scale   1.000
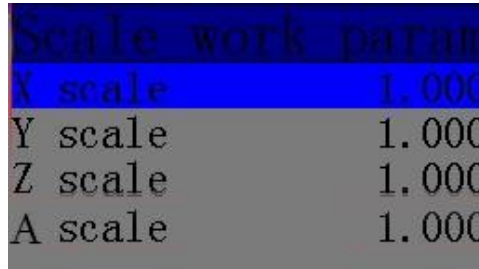
2) Press " Y+ 2 ▲ F+% " or " Y- 8 ± F-% " to highlight "X scale", press" 运行/暂停 RUN/PAUSE 删除 DELETE "to input a new value, then press" 归零 REF 确认 OK " to save the change.

When finished the modifications press " 归零 REF 确认 OK " to start processing.

6 B55 multi heads with cylinders motion control system introduction

6.1 B55 combination keys

B55 combination keys are compatible with B51 and have 2 more combination function keys than

No.	Combination Keys	Function
1	刀具切换 TOOL SWITCH " "	Switch spindle manually
2	菜单 MENU " " + 对刀 TOOLSET " "	Calculate the tool bit offset

6.2 Multi tool count

Input the number of tools in this option.

6.3 Multi heads offset setting

6.3.1 X and Y axis direction offset

Input value directly by measuring

B55 offset setting is a bit different from A55. Here we take 2 cutters as an example to explain and surely 4 cutters setting method is the same as 2 cutters.

In A55, no need to set the offset value of tool 1 , because it takes the position of tool 1 as reference, set tool offset from tool 2.

B55 changes the XY offset setting method. The X and Y axis offset of the spindle 1 must be set as 0 and can't be modified. Z axis of the spindle can be set according to the length and height of the tool. For the Z axis offset value, the system saves the values of each Z axis mechanical coordinate.
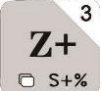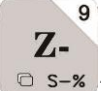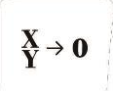
Take X axis offset as example. Load all spindles with center pointed knife, and then double press" 菜单 MENU "key to enter into *Input Output port control interface*, as shown below,
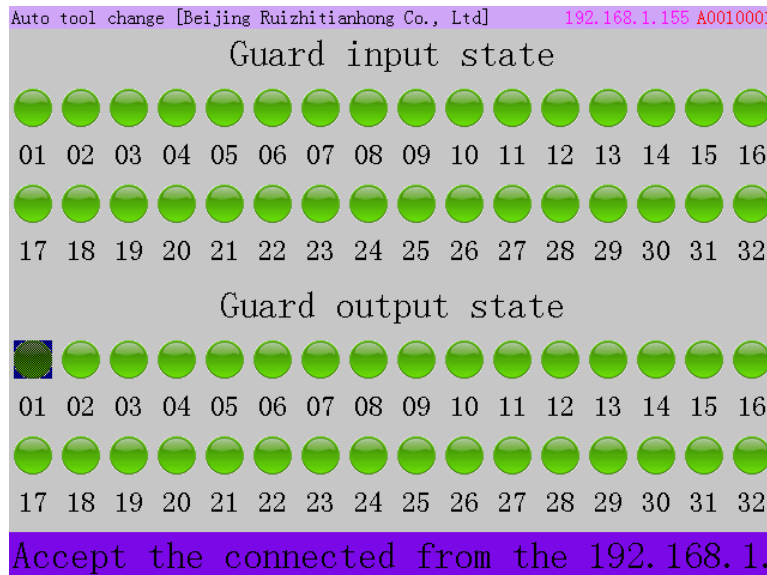
Move the cursor to the green circle 05 "05" , and then press" 运行/暂停 RUN/PAUSE 删除 DELETE "key to enable Y5, the green circle changes to red "05" , the control relay of spindle No.1 cylinder enabled, the spindle No. 1 moves down towards the machine table. After that, press" Z+ S+% "+" Z- S-% "keys to move and make Z axis tool nose just touch the part surface and mark a point on it, press" X/Y→0 "key to clear the X and Y coordinates.

Switching to spindle 2, before that, please manually lift up move spindle 1 and also move the cursor to Y6,
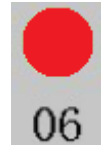
and then press button to enable Y6，it changes in red . Move the tool nose to the previous position where tool 1 has marked a dot. If the X axis display 200.000, means the distance between tool 1 and tool 2 is 200mm, and the X axis offset input value should be set as -200.000

6.3.2 Z axis direction offset

Stressed: First, lift the Z axis up to the highest position (the Z- axis HOME position) before manual tool replacement. And then replace the tool through the cylinder action, and keep it in place. Note that the mechanical coordinate may change after the manual tool change, this is normal. If it moves to the mechanical coordinate which was located at previous position at this time, you will find the tip of the new tool bit can completely coincides with previous one.

1) Machine without tool sensor

First, change the tool setting type as "**Manual**" under **SYSTEM SETUP-Function Config-Toolset type**；Second,

double press" " button, and enable Y5 signal to change to tool 1 under the I/O port control interface. Press

" "+" "to move Z axis tool nose touch the workpiece surface for measuring Z axis offset value of tool 1, and the mechanical coordinate value of tool 1 at this moment is its Z offset value. Input the measured value to option

of spindle 2 Z axis offset by pressing shortcut keys " "+" ".

Measuring method of spindle 2 or the others spindles are the same to spindle 1 which is switched by I/O port and then measured manually.

2) Machine installed tool sensor

The system default tool setting type is AUTO, user could find the setting under the menu system setup –function conf- **Toolset type. In this setting，it allows user to select different toolset type separately on different tools. But the A55 couldn't, user have to reset Z axis offset of all the tools if one of the tools to be replaced or changed. For B55, just need to switch to the required tool No. when user wants to reset its Z offset value. And then move the tool bit to**

a measuring surface (Note: All tools must use the same measuring surface), press " 运行/暂停 RUN/PAUSE 删除 DELETE "+" 轴启/轴停 SPINDLE "to set

the point as the current tool Z offset. Generally speaking, the X and Y offset value of every spindle is the same, so we

recommend the first method which is input value manually; But Z axis offset of each spindle cannot keep the same all

the time because of the tool usually changes or replaces during actual operations, recommend to the second way.

6.4 Cylinder Delay Time

Cylinder delay: Unit:ms(under Machine Setup)

The time that waiting for the complete of cylinder raise the spindle up or drop it down.

6.5 Programming Example

T1（Tool 1 switching signal）	T2（Tool 2 switching signal）
M03(Spindle 1 FWD ON)	M03(Spindle 2 FWD ON)
G00 X20　Y20　Z0	G00 X2　Y2　Z0
G01 X20　Y20　Z-2	G01 X2　Y2　Z-2
G01 X120 Y20　Z-2	G01 X12 Y2　Z-2
G01 X120 Y120 Z-2	G01 X12 Y12 Z-2
G01 X20　Y120 Z-2	G01 X2　Y12 Z-2
G01 X20　Y20　Z-2	G01 X2　Y2　Z-2
GOO Z20	GOO Z20
G00 X20　Y20	G00 X2　Y2
M05（Spindle 1 OFF）	M05（Spindle 2 OFF）

Programming principle of tool 3 and 4 are the same; the last line of the program can write M30- Go back to the start

point and end the main program instruction.

7 B57 Automatic Tool Change Motion Control System

7.1 Tool Change work mode

The tool change system uses standard G code instruction to convert T instruction to tool change instruction, so that the system executes tool change action while it reads T instruction.

When running machining file with T instruction, user should set the "Read ATC" under "Auto Pro Setup"-- "G code setup"— "G code read T" menu in advance.

7.2 B57 ATC System construction

Handheld Controller

HDMI Data Cable
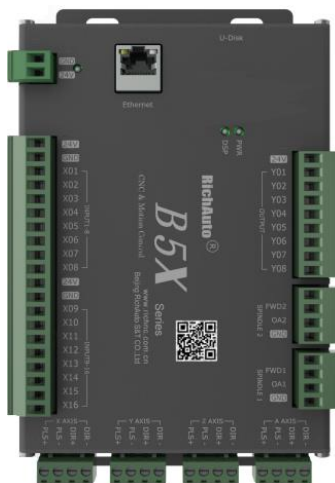
16 I/8 O wiring board

16 I/16 O wiring board

7.3 IO port definition:

Input No.	Input ports Definition	Output No.	Output ports Definition
X 1	X Home Signal	Y 1	Spindle Forward
X 2	Y Home Signal	Y 2	Definable
X 3	Z Home Signal	Y 3	Definable
X 4	Auto Tool Setting	Y 4	Definable
X 5	Inverter alarm Signal	Y 5	Definable
X 6	X axis servo driver alarm	Y 6	Dust hood open/close output signal（logic low）
X 7	Y axis servo driver alarm	Y 7	definable
X 8	Z axis servo driver alarm	Y 8	release/accept tool holder signal output signal（logic low）
X 9	Pump pressure sensor signal（logic low）	Y9	definable
X 10	Manually release/accept tool holder signal（logic low）	Y10	definable
X 11	Cylinder in place signal（logic low）	Y11	definable
X 12	Waiting spindle off signal（logic low）	Y12	definable
X 13	Tool released signal（logic low）	Y13	definable
X 14	Tool accepted signal（logic low）	Y14	definable
X 15	Dusthood open signal（logic low）	Y15	definable
X 16	Spindle with or without tool signal（logic low）	Y16	definable
COM		COM	
24V		24V	

7.4 Tool Change Function Keys

刀具切换 TOOL SWITCH " "	Manual tool switch
菜单 MENU " " + " 对刀 TOOLSET "	Calculate tool Z direction offset

7.5 ATC MENU

1) Tool Count

To be used to input the total number of spindle tools.

2) ATC position

Set tool change position of each tool.

3) C.A.D Position

To set the tool sensor location; Two calibration methods can be selected-In place/In Position.

4) Pickup Height (Custom variables)

Variable 1(Custom 1): During tool changing, the retract amount along X/Y direction from the tool clip after the spindle captured a tool.

Variable 2(Custom 2): During tool changing, set the spindle goes up amount along Z direction when switching from one tool to the other.

User only need to change variable 1 and 2, the other variables in the system setting are no need to change.

***All above 4 options can be found in "Machine Setup" menu.*

7.6 Manual tool loading operation

1) In the system manual control user interface, press" 菜单 MENU "button and choose "Input output control user interface" to enter in；

2) Move cursor to highlight Y6, press "RUN/PUASE/DELETE" button, the Y6 changes its light from green to red, the solenoid valve opens the dust hood.

3) Move the cursor and highlight Y8, and press "Run" button, Y8 green light changes to red, spindle solenoid valve turns on and releases the spindle pull claw which is going to grab a tool，manually put a taper tool holder with bit into the spindle chamber，afterwards change Y8 from red to green， to close the spindle solenoid valve， the pull claw capture the pull stud of tool holder， tool loading completed.

7.7 Set automatic tool change position

Entering into "ATC Setup" menu, input total number of tools in "Tool Count", then go back and select "ATC Position", the

system will display as below,
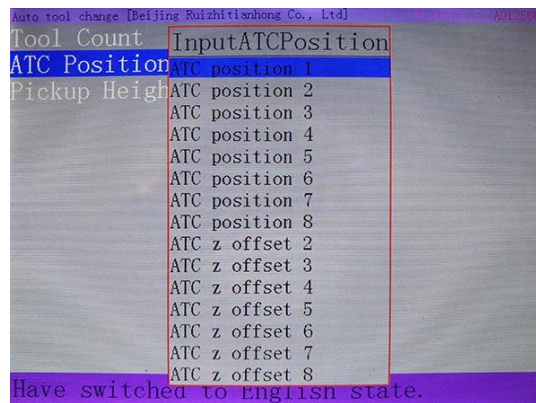
"ATC position 1" is highlighted, press " 归零 REF 确认 OK ", system prompts a dialog box, press " 归零 REF 确认 OK "to move to ATC position manually or press " 停止 STOP 取消 CANCEL "to set the ATC position by input its coordinate value;

7.7.1 Set ATC position by moving machine manually

1) To load a tool into the spindle manually, and make sure there is no tool holders in the tool clips.
2) Input the total amount of tools;
3) Go to "Tool change position", and then select "ATC position 1", press "OK"-a dialog box prompts, read it and press "OK" which means to set tool change position by moving the spindle to corresponding position manually;
4) Moving the spindle over and nearest the position of the tool clip 1, after that, slowly lower Z axis to a proper position in Y- direction of the tool clip 1, move the tool holder along Y axis/X axis into the tool clip 1, until it seats into the tool clip properly, press "OK" to save current coordinate value of ATC position 1.

5) Retreat the tool holder and remove it from the tool clip along Y or X axis, move up Z axis ，then go to tool clip 2..3…8, set the rest tool change positions one by one in the same way until completed all the tool change positions' setting.

7.7.2 Set ATC Position By Inputting Coordinates Values

1) Entering in "Tool count", input tools total amount;
2) Go to "Tool change position" , select "ATC position 1",system pop up a dialog box, read it and press "CANCEL" , afterwards input the tool change position(coordinate value of each axis).
3) Input X Y and Z axis coordinate value of ATC position 1, then press "OK" to save;
4) Set the rest ATC positions one by one in the same way until all of the ATC positions have been set.

   Recommendation: When the tool change position is set for the first time, it is recommended the method of *7.7.1* and record the X, Y, Z three-axis coordinate values of each tool, so that you can input those values straightly the next time.

7.8 Manual Tool Switching

On the keypad of B57 controller, there is a shortcut function key" 刀具切换 TOOL SWITCH "as a command button for tool switching. After pressing it, the system will prompt tool switch list as shown below,
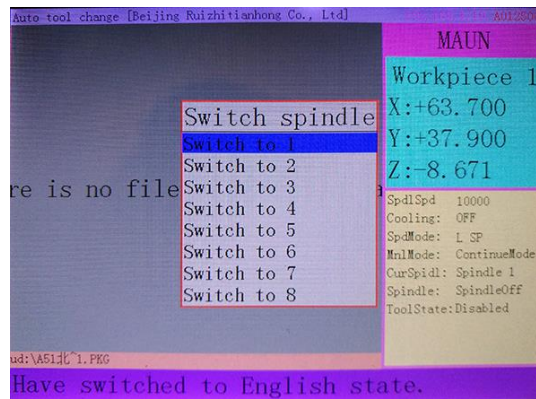
Move the cursor to desired position and press "OK", the system will automatic release the current tool and accept the new tool which is selected.

Tool switch process：

Pressing" **刀具切换 TOOL SWITCH** " button，enter into the tool switch list interface, as soon as you selected the system will perform the following actions:

Detecting input port X16 status and determines whether the current spindle has tool. If X16 signal status is ↓ indicates it doesn't have a tool in the spindle, so that the system can execute tool switch action immediately; If X16 status is ↑ refers to there is a tool in the spindle, the system will determine whether the tool is the target tool which is going to be switched to, if it is, the system displays the tool has been in place; if it isn't, the system will automatically release current tool and then accept the desired tool.

7.8.1 Tool loading procedure:

Detecting the status of input port X16, if it is ↓ means there is no tool in the spindle currently. Invert Y6 to ↑ for turning on the electromagnetic gas valve of the dust hood opens, get the time delayed until system receives the X15 signal status is ↑（turned on）, then go to the next step. *(If X15 status was ↓, the system would display: dust cover is not in place. Then system would quit the tool changing action automatically.)*

Move X and Y axis to the tool change position, invert Y14 tool release/accept output signal to ↑ (turns on) to open the pull claw inside the spindle, lowers Z axis over the ATC position and start to accept the tool; turns of Y14 ↓ to close the pull claw inside of the spindle, and capture the tool holder, locks pull stud tightly. Detecting input signal status of X14, if it is ↑means tool gripping succeeded, moves spindle to the tool retraction place to pull out the tool from the tool clip, move up Z axis to safe height. *(If X14 status was ↓, means failed to accept the tool, the system would get the spindle pull claw open, and would move up Z axis to the safe height, display: There is an error during accepting tool. Then the system would quit tool change action.)*

Inverting Y6 status to ↓, turns of the dust hood, moves X,Y and Z axis to to the initial position, tool changing complete.

7.8.2 Tool unloading procedure

Another case during tool switching: When the spindle is equipped with a tool, first, system determines whether the current tool is the desired one, if it is, the system will display: Tool has been loaded and quit tool switching action; if it isn't, the system should unload the current tool and then loading the target tool, thus, the system will execute the actions as shown below:

a). Turn on X15 input signal(↑) to open the dust hood, after time extending detecting, received X15 ↑(On) signal, continue performing the next action.*(If system received signal of X15 was ↓, it would display: The dust hood is not in*

place. Then the system would quit the action)

b). Move X and Y axis to the tool retract amount position, lower Z axis and pull the tool holder into the tool clip; Turns on output signal Y14 ↑(release/accept tool signal),to open the spindle pull claw, lift up Z axis to the safe height. Detecting whether the X13 input signal status is↑(On), if it is, means the tool unloading succeed, so that system executes the procedure of **'A'** then.

7.9 Set tool bit Z direction offset

System uses combination keys "[菜单 MENU]"+"[对刀 TOOLSET]" to calculate tool Z direction offset value.

After ATC position settings, user should set Z offset of each tool bit. The "[菜单 MENU]"+"[对刀 TOOLSET]" is used to calculate Z offset to each bit. For the tool switching and tool setting needs user's manual operation.

1) Switching to tool 1, press "[菜单 MENU]"+"[对刀 TOOLSET]" to start auto tool calibration, tool 1 moves over the center of tool touch off plate, and slowly lowers Z axis until the tool bit connects with the tool sensor, afterwards lifts up Z axis.

2) Press "[刀具切换 TOOL SWITCH]" switch to tool 2, press "[菜单 MENU]"+"[对刀 TOOLSET]"for calculating Z offset of tool 2.

3) Switch and calculate one by one until complete all of the Z offset settings.

4) After that, if any tool in the tool clip replaced, only need to set Z offset of corresponding tool bit independently. If there is no bit replaced, no need to set Z offset again.
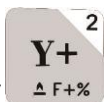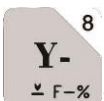
***Remarks**：*

The different between"[菜单 MENU]"+"[对刀 TOOLSET]"combination keys and the single key"[对刀 TOOLSET]" as shown below:

"[对刀 TOOLSET]"is the implementation of Z axis workpiece zero calculation, used to set Z aixs workpiece origin.

However, "[菜单 MENU]"+"[对刀 TOOLSET]" is to calculate Z offset and used to compare the lengths of different tool bits.

7.10   Machine automatic tool setting

1) First, go to" Machine Setup"- "Tool Setup"-"C.A.D position", press "[运行/暂停 RUN/PAUSE 删除 DELETE]" and then press "[Y+ 2 ▲ F+%]" or "[Y- 8 ▼ F-%]" to select a tool setting type as you need (In Place or In Position), and then press "[归零 REF 确认 OK]" to save

the change.

2) Press " 归零 REF 确认 OK "to enter into "C.A.D Pickup", input a value of the tool lift up distance after automatic tool setting (system default value is 60mm).

3) Press " 归零 REF 确认 OK "to go into "C.A.D Thickness", and then input the actual thickness of the automatic tool setting device. It is better to reboot the system after modification of the automatic tool setting instrument parameters. Afterwards, you can go on automatic tool setting operation.
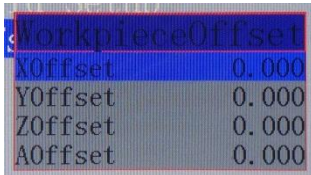
8 B58 Four Axis Motion Control System

B58 common used combination keys are the same to B51, and the forth axis manual movement control buttons are " C+ 1 "and" C- 7 ". Work origin setting button is " Z/C→0 ", after pressing it, the system will ask you to select Z or C axis go to work origin.

Most of Z axis work origin of 4 axis tool paths are in the center of the part(material), but the bit cannot plunge into material when setting Z work origin，thus the system offers "WorkOrg Offset" setting. After user set Z axis work origin offset value, the system will add the offset value automatically when setting Z work origin.

For instance, Z work origin offset is -20mm, the Z axis coordinate value will display 20 after set Z work origin.[0-(-20)=20].

The rotation axis can be represented by alphabet A, B, or C. The system reads the alphabets to realize rotational movement.

The rotation angle is calculated in absolute coordinates,

E.g.1:

X10 Y10 Z10 A 10

X20 Y20 Z20 A 20

The rotation axis rotates 10 degrees in positive direction when the second line is executed;

E.g.2:

X10 Y10 Z10 A 10
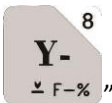
X20 Y20 Z20 A 10
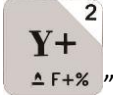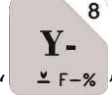
The rotary axis doesn't move when the second line is executed.

9 P.S.1: System update

During using, the dsp system can be updated when the company-RichAuto offers new update of the software,

Copy the upgrade package into U flash disk, then insert the U disk on dsp handle. The upgrade firmware format is " **.PKG", and display as "rz-xxxx" or "qxx-xx" on the screen. Here, '*' and 'x' refer to a number. Operation as follow,

Way 1:

1) Press " [菜单 MENU] " and select "Menu Function User Interface", press " [归零 REF 确认 OK] " to enter in, press " [Y+ 2 ▲ F+%] " or

" [Y- 8 ▼ F-%] " to move up or down, find "System Setup" and press " [归零 REF 确认 OK] " to access.

2) Press " [Y+ 2 ▲ F+%] " or " [Y- 8 ▼ F-%] "to select "System Upgrade" and press" [归零 REF 确认 OK] ", the screen displays as below,
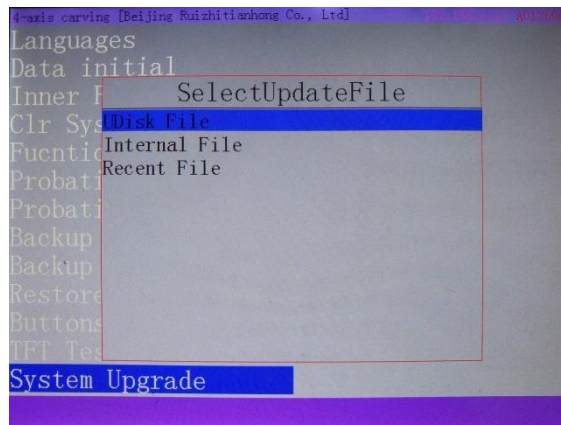
3) Press " [归零 REF 确认 OK] " to enter into "U disk File", select corresponding upgrade file and press " [归零 REF 确认 OK] "button,

then the system will automatically complete the upgrade.

4) Afterwards, reboot the controller. User can also choose "Clear System Cache" after restarting the controller.

Way 2:

1) Insert the U disk with update software package on the controller.

2) Press combination keys" [菜单 MENU] " + " [归零 REF 确认 OK] " the screen shows:
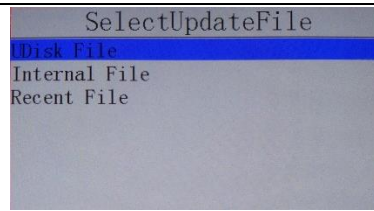
3) Do the same as step 3 and 4 mentioned in the "Way 1".

10 P.S.2. Common troubleshooting

10.1 Solution for handle screen prompts problems

1. After powered on the "Screen flicker or automatically restart"

Situation analysis and solution：

1) Switching mode power supply is insufficient. Check power supply if there are problems, and change high-quality power supply to solve the problems.

2) The local power grid unstable. Check local grid voltage stability or use the regulator filter device.

3) The power chip of the handle is ageing. This phenomenon also appears when the handle is powered through the USB cable to the computer. Please return back the handle to our company.

4) Temporary solution. Using standard 5V mobile phone charger, supply power through the USB cable to handle. Duplicate power supply for temporary emergency use.

2. Failed to set work piece origin during normal operation process

Situation analysis and solution:

1) The system is under the absolute coordinate system due to misuse. User can switch back to the 1st working coordinate system by pressing the combination keys "Menu" + "1", then the problem will be solved.

2) Key issues. Go to Menu-menu function user interface-system setup-buttons check, to test whether the button is normal or not.

3. No text display while screen lights up

Situation analysis and solution:

1) Needs emergency recover operation: First, power off; then, keep pushing "OK" button do not release it; Afterwards, supply power, and waiting for 3-5 seconds, release "OK" button. The system will enter into "Emergency State"; choose "Update System", "Inner Format" and "Initial Data" operations. At last, restart as usual.

2) Send back for detection and repairing if the system can't recover by emergency state.

10.2 Common problems during operation

1. After the machining, the cutting size doesn't match the actual size in processing file

Situation analysis and solution:

1) Pulse equivalent is wrong.

2) User has selected the wrong tool bit which is not the same as it set in process file.

3) Check if there is any problem with the path processing file.

2. The screen displays "exceed limit" during processing

Situation analysis and solution:

1) The machine hasn't returned ZERO, lead the system is unable to confirm the actual position. Solution is to go machine ZERO.

2) The reserved processing range is small than the actual file size after user set work piece origin. Confirm the actual file size and then set a correct working origin.

3) Set wrong working origin in the process of creating processing file path. Check the file path, and then generate the correct one.

3. Spindle feed amount too much or "Breaking Edge" phenomenon occurs during processing

Situation analysis and solution:

1) The working speed written in the processing file is beyond the machine itself Z axis speed withstands. Z axis motor loses step and doesn't move up to the right position when the spindle lift up, and then it will base on the wrong position and move down in the same depth and plunge in the material too much. Enter into "Machine Setup"-"Max. Speed Limit", change Z axis max. motion speed to the safe speed at which the Z axis can run.

2) Coupling connection loose or transmission mechanism slip. Re-adjust the connecting parts.

3) The signal line connected between the wiring board and the driver is disturbed. Re-adjust the line.

4) Processing documents error.

5) The wiring between motor and driver of Z axis is damaged due to long time using, or the connection line is too thin, the connection plug is loose result in current loss. Replace new wires.

4. Repeating the same processing file, Z axis cutting depths are not as same as each other every time after returning back HOME

Situation analysis and solution:

1) Machining table is uneven or processing object not firmly fixed, re-milling the machine table to adjust the flatness.

2) Z-axis origin detection switch repeat positioning accuracy error, causing Z axis homing error each time. Replace a high-quality detection switch.

3) Too much interference in the Z-axis homing process to form a false Z origin. Re-adjust the wiring.

5. The machine cannot stop after returning ZERO, and lead to spindle crashs the machine body

Situation analysis and solution:

Enter into "Input Output control User Interface", detect whether the signal can be turned on or turned off normally.

1) The origin detection switch is broken. Replace a new one.

2) The distance of the origin detection switch detection sheet beyond the detection range(This problem is common occurs in optoelectronic and proximity switches) of the switch, adjust the position of the test piece.

3) The origin detection switch to the interface board wiring aging or loosening. Check the connections again.

4) The interface board is broken. Return back o us to repair.

5) 50-pin data cable is broken. Replace it with a new data cable.

6. The machine uniform moves to the reverse direction when backing to the machine ZERO（HOME）

Situation analysis and solution:

1) The origin detection switch types do not match with the definition of the corresponding voltage level. Modify the voltage level in the controller. (Normally open type corresponds to a level defined the direction of the arrow down, normally closed type corresponds to the level defined arrow up).

2) The origin detection switch is broken. Replace a new one.

3) The origin detection switch connects interface board not well. Refresh the cable to confirm the wiring is correct.

4) Too much interference, resulting in the illusion of the detection switch has been triggered. Recalibrated the whole circuit.

5) The interface board is broken. Depot Repair.

6) 50-pin data cable is broken. Replace the data cable.

7. Abnormally running when processing or the actual file is different from theoretical file

Situation analysis and solution:

1) The system program disorder.

2) Too much external interference lead the controller cannot work normally. Re-adjust overall circuit. (The wires of weak current and strong current should be separately binding, the inverter and other components should be separated connected each GND of themselves).

3) There is something wrong while converting the file format and the program appears illegal characters or system unrecognized codes. Recommended to use third party simulation software to review the program paths.

8. After starting up automatic tool setting, the tool bit can't stop when it touched the tool setting device

Situation analysis and solution:

1) There is an open circuit of the cutter signal cable which is connected to X5 port

2) The "COM" signal port of the "INPUT" terminal on the wiring board is not well connected with spindle housing or poor connection.

3) Go to "MACHINE SETUP"-"Input Confi" to confirm if X5 is enabled.

9. **It is normal to the move from one position to another, but when return back from that position to the original position is abnormal**

Mechanical assembly problem, guide ball screw is not well installed.

10.3 Electrical components and wiring problems

1. **One axis or several axes can only move in one direction after power on**

Situation analysis and solution：

1) There is something wrong with the connecting between the interface board and motor driver common anode end, check the connection.

2) Interface board is broken. Replace the interface board.

3) The motor driver is broken. Replace the driver.

4) Measure the direction voltage of the axis with a multimeter. Check whether the direction is correct or not.

2. **The motor of one axis does not move after power on**

Situation analysis and solution:

1) The driver pulse cable and direction cable connect oppositely, exchange them;

2) Motor driver damaged if the motor can move when pushing it by hand;

3) The interface chip on the wiring board is broken, no pulse signal output.

3. **The screen displays "Spindle on" but actually the spindle off; displays "Spindle off" actually the spindle on**

Situation analysis and solution:

1) Circuit malfunction, FWD and COM is short circuit. Eliminate line failure.

2) The output level definition reversed. Go to the "voltage setup" and modify the output level definition.

4. **The handle screen doesn't light up or show nothing after power on**

Situation analysis and solution:

1) The power supply voltage is too large, or power supply positive and negative short chipset is burned out, return back for repairing.

2) Power supply damaged, replace it.

3) Check if HDMI cable is damaged. Replace HDMI cable.