

Manual for Excitech “Generation 1” Handeld

Courtesy of Josh Glenn of [CAMaster](#) and [CNC Experts](#)

Embedded Numerical Control System Control Card with USB Terminal

Manual

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Chapter I

I) Installation

Control Card(Controller) is totally separated from computer and controls engraving machine independently. It receives target file through USB interface on computer. User needs to install USB driver which offers user two files: “*.inf” and “*.sys”. files’ transmission and downloading are executed by software: ZHBUSBHOST.exe. This card communicates with engraving machine through 37 pins terminal. This system offers driving files and downloading files. At the same time, users connect the 37 pin terminal to communicational terminals on different engraving machines.

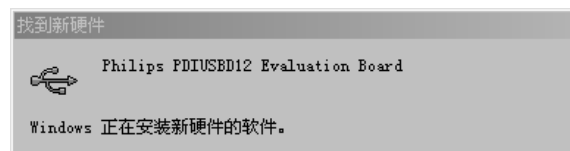
This system is easy to install and operate, it is more stable than ISA or PCI socket control card which needs computer. It reduces troubles (such as: computer system crashes down, there is no such mainboard with socket or it does not comply with the mainboard) and makes convenient for the users.

1. Software setup

It is convenient to set up the software. To copy all files on CD-ROM root directory to the directory on your computer. For an example, copy them to D:\DSP. Then to set up USB driving software. It is necessary to prepare a USB terminal for control card. Connect the control card to the computer. Computer searches USB driving software automatically. When it appears clues asking to choose driving file, you should choose D:\ DSP\USB\D12TEST.inf in Windows’98 or D:\DSP\USBCAM.inf in Windows’2000.If ZHBUSBHOST.exe file in DSP directory can be executed successfully; it means that the software has been downloaded correctly.

Detailed installation steps follow:

When the computer automatically finds USB driver, clue appears as below(In Window98)



There is no wanted driver in the second edition of Window98. Click “Confirm” and it displays as follow:



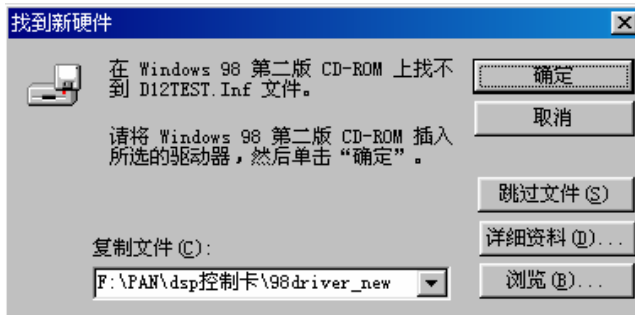
Input driver file directory in Dialogue window or click browser to search

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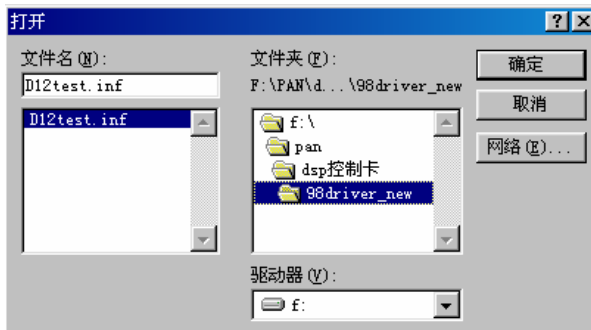
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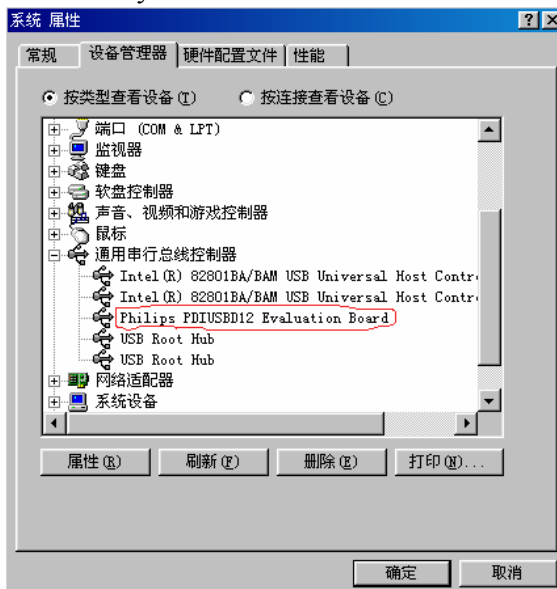
D12TEST.inf in Windows’98 driver files.



Click “Confirm” and it displays as below:



Re-click “Yes”. the system goes into setup state and updates system information. It adds a line to “Universal Host Control” which is in Device Management; it is illustrated as red line circle in following figure that indicates software has been set up successfully.



The installation steps are similar to Windows’2000/me/xp/NT(for an instance in Window’s 2000):

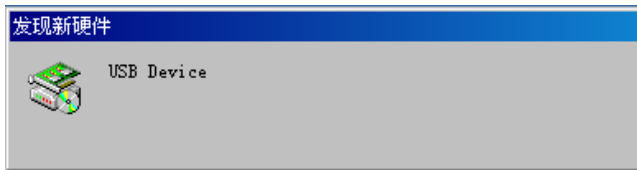
After connect the control card to the USB interface, the following windows

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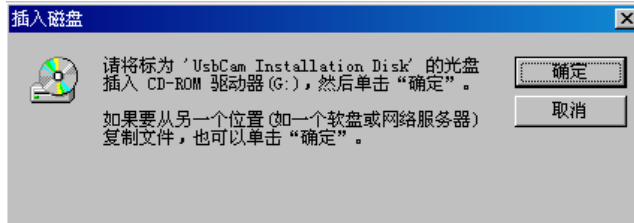
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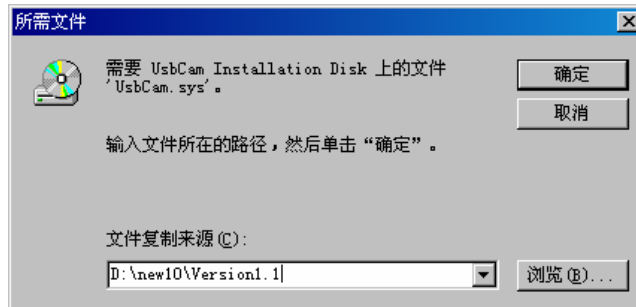
appears:



Then the following information appears:



Click “Confirm” according to clue, then it appears following window:



Input driver file directory in Dialogue Window or click browser to seek Win2000 drive file USBCAM.inf (which is in Win2000-xp-driver folder). Click “Confirm” then relick, the system begins setting up.

2. Hardware Setup

The control card adopts 50 pins terminal to communicate with engraving machine. The detailed definition of the 50 pins are as follows: (circuit diagram is in appendix)

Connection between Control Card and engraving machine

The user needs a 37 pins connecting line through which the control card communicates with carving machine. Generally speaking, carving machine only uses 12 pins within the 37 pins. So it prepares I/O terminal for user to expand other functions; such as, auto sword adjusting, hard limit position and master axis startup/stop function. The 37 pins connecting line are as follows:

pin	signal	Function specification
1	VCC 5V	+5v
2	X PULSE+	X axis pulse+
3	X DIR+	Direction of X axis+
4	YPULSE+	Y axis pulse+
5	Y DIR+	Direction of Y axis+
6	Z PULSE+	Z axis pulse+
7	Z DIR+	Direction of Z axis+

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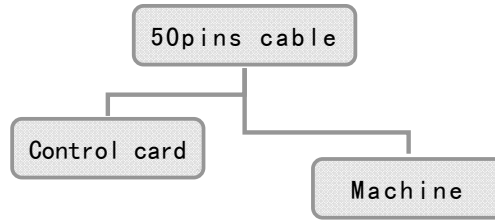
8	C PULSE+	C axis pulse+
9	C DIR+	Direction of C axis+
10	CADI 11+	Figure inputting terminal
11	CADI 10+	Figure inputting terminal
12	CADI 9+	Figure inputting terminal
13	CADI 8+	Figure inputting terminal
14	VCC 5V	+5v
15	CADI 7+	Figure inputting terminal; Cut adjusting device signal input+
16	CADI 6+	Figure inputting terminal
17	CADI 5	Figure inputting terminal
18	CADI 3	Figure inputting terminal
19	CADI 1	Figure inputting terminal; origin of Y axis sensor signal
20	AVDD I	IO positive shared terminal
21	AVDD O	IO positive shared terminal
22	CADO 1	Figure outputting terminal
23	CADO 3	Figure outputting terminal
24	CADO 5	Figure outputting terminal
25	CADO 7	Figure outputting terminal
26	GND	GND
27	X PULSE-	X axis pulse-
28	X DIR-	Direction of X axis-
29	Y PULSE-	Y axis pulse-
30	Y DIR-	Direction of Y axis-
31	Z PULSE-	Z axis pulse-
32	Z DIR-	Direction of Z axis-
33	C PULSE-	C axis pulse-
34	C DIR-	Direction of C axis-
35	CADI 11-	Figure inputting terminal
36	CADI 10-	Figure inputting terminal
37	CADI 9-	Figure inputting terminal
38	CADI 8-	Figure inputting terminal
39	GND	GND
40	CADI 7-	Figure inputting terminal; Cut adjusting device signal input-
41	CADI 6-	Figure inputting terminal
42	CADI 4	Figure inputting terminal
43	CADI 2	Figure inputting terminal; origin of Z axis sensor signal
44	CADI 0	Figure inputting terminal; origin of X axis sensor signal
45	CADGND	IO negative shared terminal
46	CADGND	IO negative shared terminal
47	CADO 0	Figure outputting terminal
48	CADO 2	Figure outputting terminal
49	CADO 4	Figure outputting terminal
50	CADO 6	Figure outputting terminal

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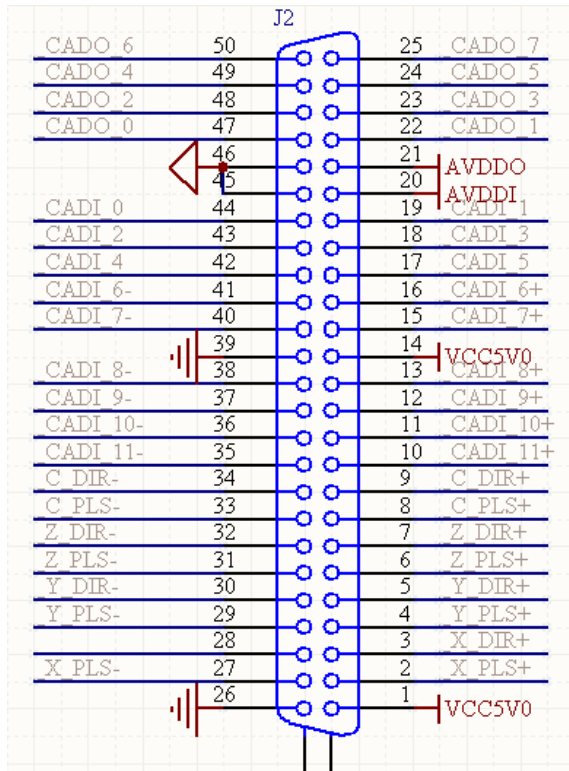
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After having got know the detailed definition of the 50 pins, we should get know how to connect the control card and machine;



From above structure, we can tell that the 50 pins cable works as a bridge between the control card and engraving machine. The relationships between control card and 50 pins cable is unchangable; while the relationship between 50 pins cable and machine is changeable, this is why engraving machine is always lower than control card. Common engraving machine just apply 12 pins among the 50 pins that is only 12 pins are useable. And this control card has I/O interface which makes it to expand other functions(such as: auto adjust cut). The 50 pins cable connection method is illustrated as below:



3. Test CNC engraving machine and control card

After having been connected with CNC engraving machine correctly, the control card should be opened(before doing this, pull out USB connecting line and disconnect it from computer) and the screen displays:



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Press IV①/OK button to confirm (Buttons’ detailed function specification are in Description of Buttons’ Function section). And then all axes move to origin of machine tool. If it doesn’t work well, press III④, the system clues to password, input password and then press III④ button to confirm. Entering function setting menu

{ press I① to go upward
press II① to go downward } and find SYSTEM SETUP, press III④ to confirm { press I① to go upward
press II① to go downward } to get Home Direction, press III④ to confirm { Press IV④ to skip
press IV④ to confirm } , then pressing III① makes to go to machine origin.

Then check their directions, if it moves to wrong direction, press III④ to enter function setting menu, press OK to confirm, find SYSTEM SETUP with up or down buttons, press OK to confirm, then find Motor Direction, set each axis direction (setting method is similar to clear direction setting). If they move to right direction, it indicated that the connection between control card and engraving machine is correct.

If it is necessary to adjust screw interspace for testing the machine, press III④, the system clues to Password, input 2003 and then press OK button to confirm. Entering function setting menu { press I① to go upward
press II① to go downward } and find Screw Interspace, press OK to confirm. User must be careful to set this parameter, otherwise it may do harm to the engraving machine.

When the control card connects with computer, USB connecting line supplies power to the control card; when it connects with engraving machine, and engraving machine system offers power to it. So it is necessary to disconnect one end in order to connect the other.

User may connect it to computer to examine.

Spindle startup/stop control signal terminal has not been named yet which needs to process according to user’s demands and control mode.

In order to guarantee normal operation, engraving machine’s highest speed and acceleration should set according to different engraving machine.

II) Description of buttons function

I①	I②	I③	I④
II①	II②	II③	II④
III①	III②	III③	III④
IV①	IV②	IV③	IV④

Figures above show position of buttons and their functions are illustrated as below:

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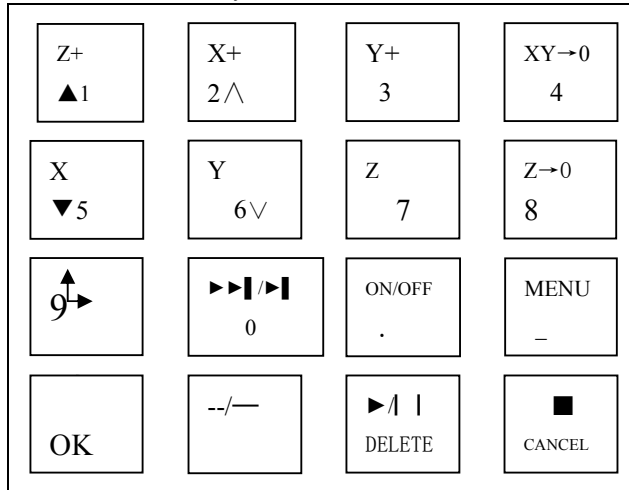


Chart of buttons function is below.

Name	Function
I①	Positive movement of Z axis, Menu upward , figure 1 inputting
I②	Positive movement of Y axis, accelerate cut speed, figure 2 inputting
I③	Positive movement of Z axis, figure 3 inputting
I④	Origin of X axis and Y axis setting, figure 4 inputting
II①	Negative movement of X axis; Menu downward, figure 5 inputting
II②	Negative movement of Y axis; slowdown cut speed; figure 6 inputting
II③	Negative movement of Z axis, figure 7 inputting
II④	Z axis origin setting ; figure 8 inputting
III①	Axes home to machine tool origin, figure 9 inputting
III②	Manual moving mode, high speed or low speed selection, figure 0 inputting
III③	Spindle startup/stop, decimal point inputting
III④	Menu setting entering, negative symbol inputting
IV①	All axes home: motions confirm/inputting/operating
IV②	Manual move, continue, step and distance modes selection
IV③	Cut process running/pause/inputted words delete
IV④	Cut process stop/selections, inputting and operating cancel

III) Description of operating

Users can program target files by programmable software, such as, TYPE3,ARTCAM ,MASTERCAM,UG,Pro/E,CAXAand get G code files whose extended file name must be “*.CNC”. And the file will be downloaded to control card through ZBHUSBHOST.exe file which offered by the system.

Before execute ZBHUSBHOST.exe file, connect computer and control card through USB line and disconnect engraving machine and control card (pulling out 50 pins plug). Execute ZHUSHOST.exe file (double click file symbol). The process of downloading G code file to control card is simple. Open ZBHUSBHOST.exe file and then target G code file, choose “Setting—change process mode” and “Common
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mode” at the left down corner on the screen changes into “HIGH”(Which means high speed mode). Then select “Setting---Process parameter configuration” to set process speed, travel speed and acceleration. It is unnecessary to adopt high manual section. Finally choose “Operation---download process data” till “download Finished” dialogue window appears which means that G code file has been download completely (Details are in software download section).

After having downloaded target file, quit ZBHUSBHOST.exe file and then pull out USB connecting line. Connect control card to engraving machine and start the engraving machine, then control card screen clues:



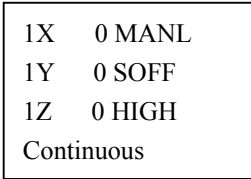
Goto Home?

Press OK to confirm and all axes go to machine tool origin and LCD screen displays:



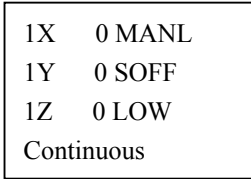
1X 0 MANL
1Y 0 SOFF
1Z 0 HIGH
Continuous

After clear process and having target material fixed well, then to definite origin position of target material. For example, we are going to set its center to work origin, the operating steps are as follow: 1) move X and Y axes to the center of target material, press I④ to home the two axes; 2)move Z axis to the center of target material and press II④ to home it. Cutting depth and cut safe high are determined by design software. LCD screen displays:



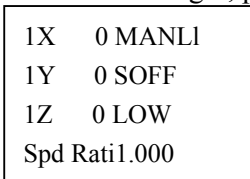
1X 0 MANL
1Y 0 SOFF
1Z 0 HIGH
Continuous

Press III② to switch high speed and low speed and the LCD displays:



1X 0 MANL
1Y 0 SOFF
1Z 0 LOW
Continuous

After having located work origin, pressing DELETE and LCD displays:



1X 0 MANL
1Y 0 SOFF
1Z 0 LOW
Spd Rati1.000

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Before displaying “Spd Rati1.000” at the left corner, the system will display target file name and lasts for 1 second. The speed can not be accelerated if it displays “Spd Rati1.000”. If it is necessary to accelerate the speed, you must set the speed before you download file. If it needs to change process speed, press I② and II② to accelerate and reduce.

Press DELETE to pause cutting and re-press DELETE to continue. When it is in Pause state, there is only Z axis can move. Z axis moving leads to change cutting depth, so it is easy to reset the cutting depth when the cutting depth is not suitable.

Press CANCEL to stop cutting motion and LCD screen displays:

```
1X  0 MANLI
1Y  0 SOFF
1Z  0 LOW
Save Stop PT?
```

To press I① (Figure1) saves stop point at 1 area(Stop points can be saved in 1,2,3 areas).

```
1X  0 MANLI
1Y  0 SOFF
1Z  0 LOW
Save Stop PT? 1
```

Pressing IV① confirms and LCD screen displays:

```
1X  0 MANL
1Y  0 SOFF
1Z  0 LOW
Goto Home?
```

Pressing IV① confirms and LCD screen displays:

```
1X  0 MANL
1Y  0 SOFF
1Z  0 LOW
Continuous
```

“X” on the screen means that the space between set Z axis working origin and machine tool origin.

Press IV③ +I① starts cutting from stop point1 and IV③ +I② starts cutting from broken point 2. .

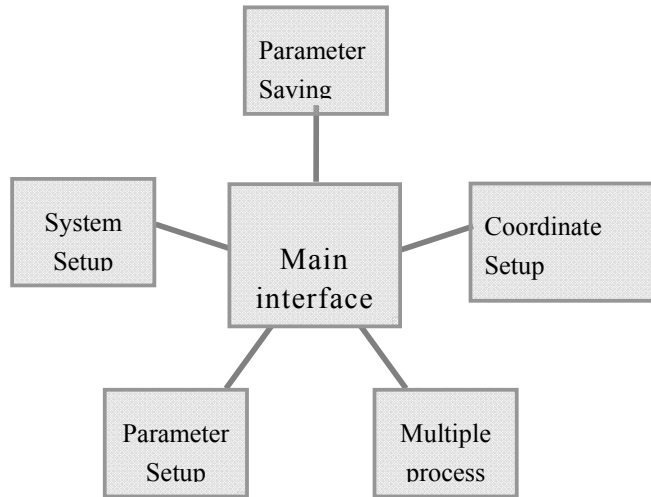
IV) Diagram of Menu List

The following is the menu

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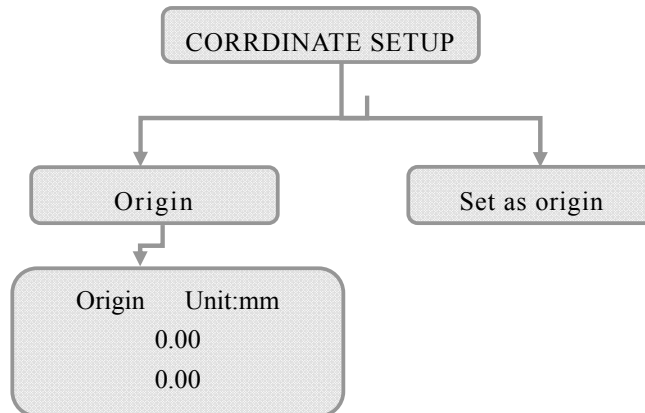
How to get into the main Menu, we are going to introduce as follows:

The control card displays: Goto Home? When it gets power supply, OK confirms and gets into Main interface, otherwise CANCEL denies. It displays:

```
1X 0.000 MANL
1Y 0.000 SOFF
1Z 0.000 LOW
Continuous
```

When it is above main interface, you can get into function menu setting, press III④ and the system clues to “Password”, input figure “2003” and the system displays “****”, right password leads to function setting menu and wrong password leads to go back main interface(Some versions need password, and others do not).

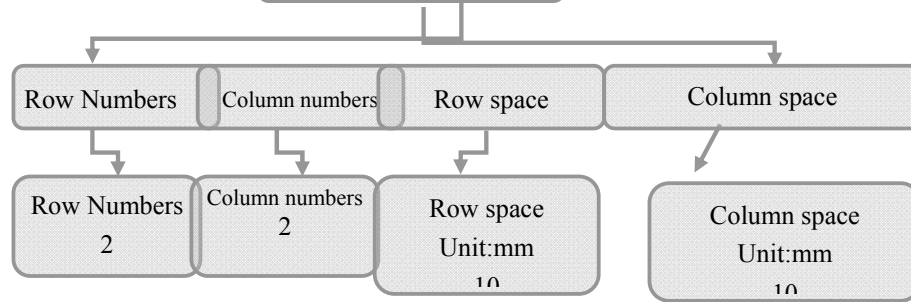
After getting know the method of getting into function setting menu, we are going to learn detailed submenu information.



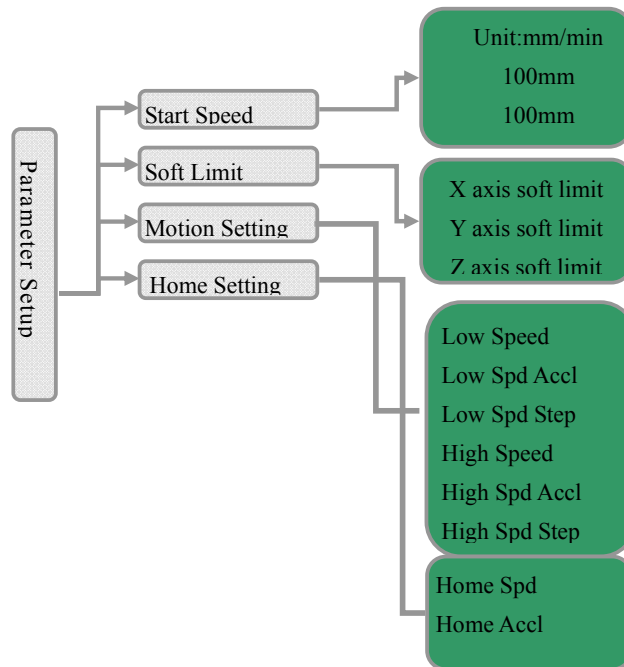
(coordinate system setting structure diagram as above)

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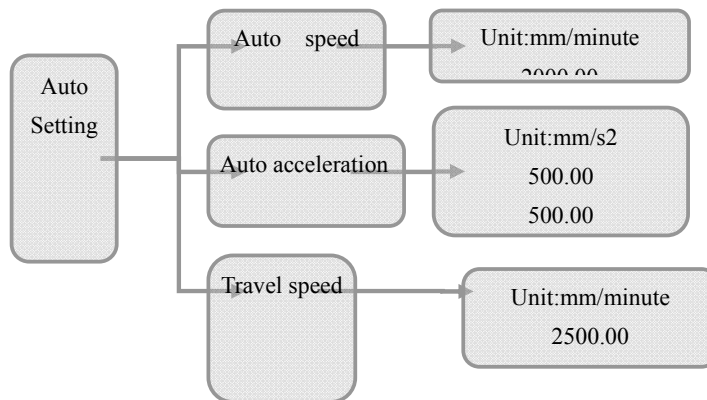
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(Multiple process structure diagram is as above)



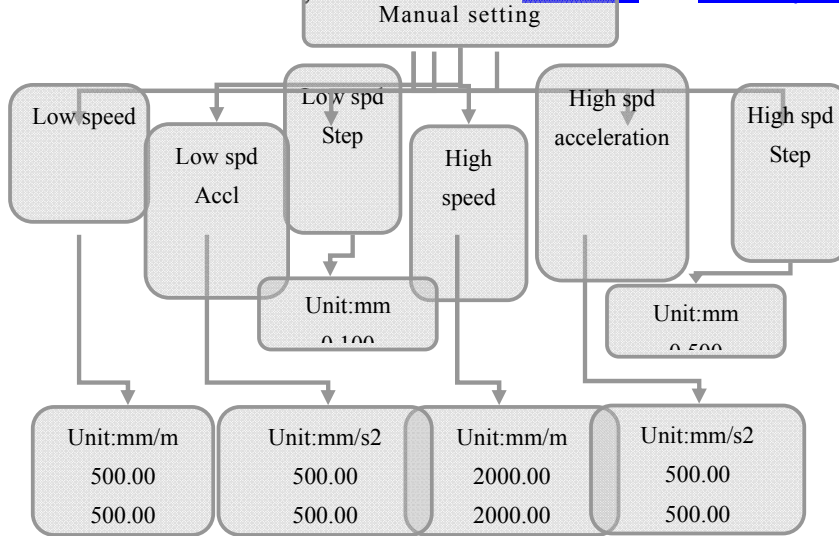
(it is parameter setting structure diagram as above)



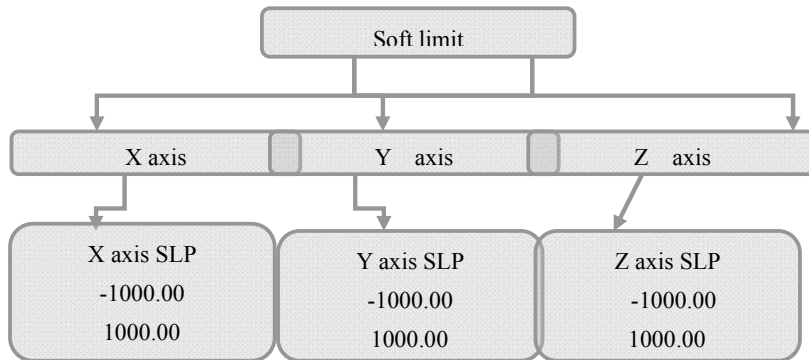
(this is auto process setting diagram)

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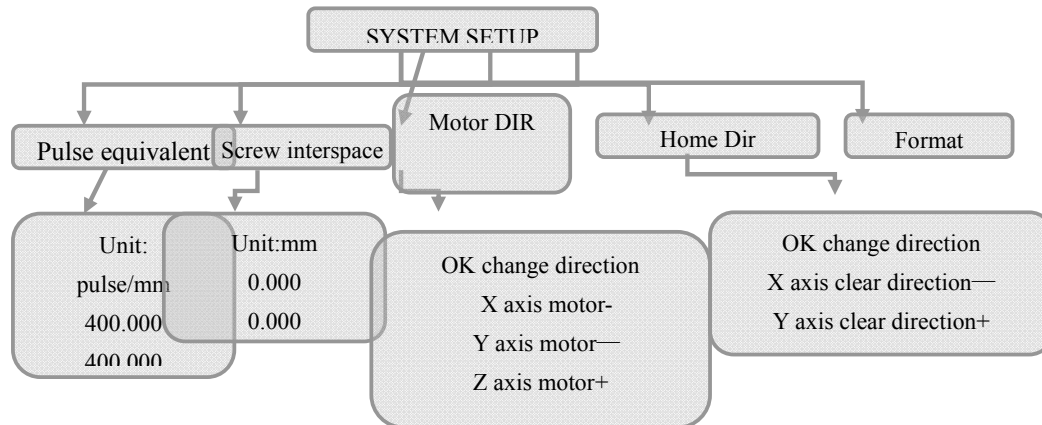


(this is manual setting diagram)



(this is software limit diagram)

The data above is system default; users can set their values according to different engraving machine.



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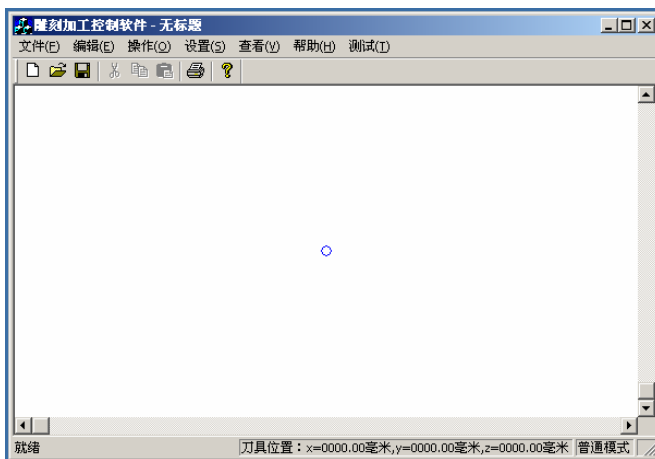
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(this is system maintenance diagram)

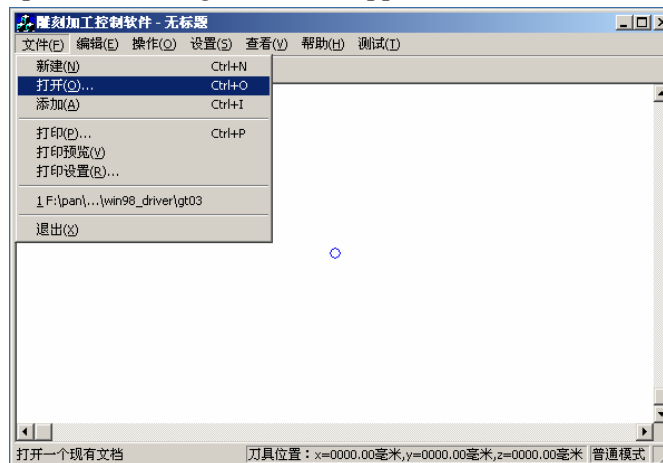
In system setup, pulse equivalent should be set according to motor, screw interspace’s value gets from scale, and “Motor direction” and “home direction” should be set by users according to different engraving machine.

V) Description of software downloading

It is through ZHBUSBHOST.exe file to download G code file to control card.. To open this file needs to connect control card through USB connecting line to offer power to control card. To execute ZHBUSBHOST.exe (double click left button of mouse) runs this software as below:

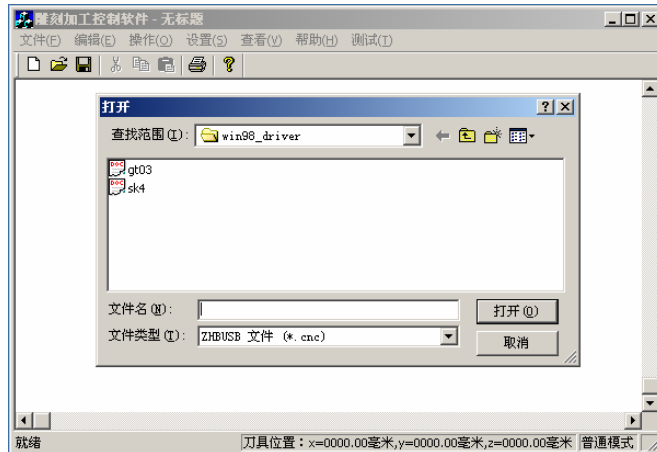


Click “File→Open” and dialogue window appears:

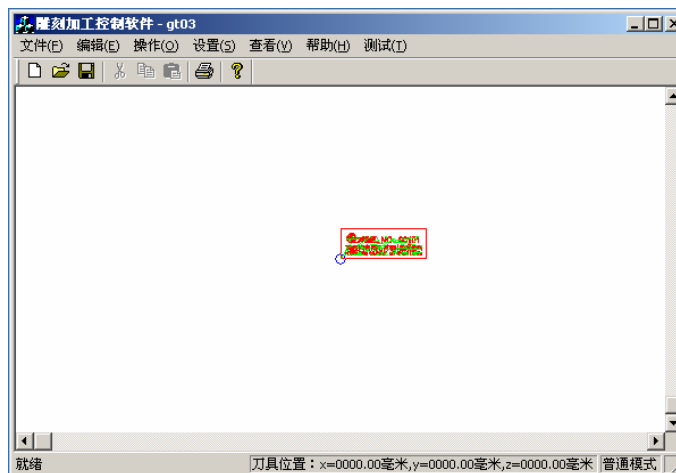


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Input target file's name in "File name", such as "gt03", the extended name of the G code file must be CNC. Click "Open" and diagram of target file appears:



The next operating is to click "Setting → Change process mode". Process modes include Common mode and High speed mode. The speed of Common mode will be very slow, especially when it does curvilinear motion. To advertisement engraving machine, it is always to adopt High speed to meets engraving decision demands.



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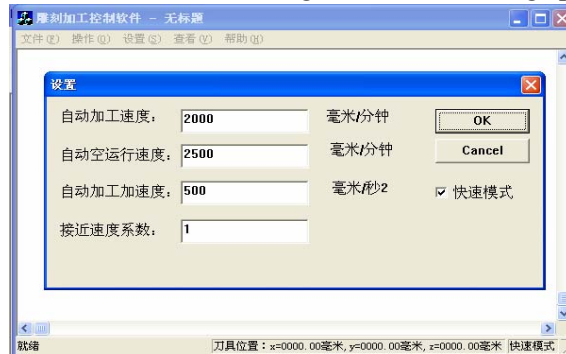
“Common mode” changes into “High speed mode” at left down corner on the screen after clicking “change process mode”.

Select “Setting→ Configuration process parameter” and dialogue widow appears. Input parameter into dialogue window.

Auto process speed:---it refers to running speed when engraving machine starts cutting

AutoTravel speed---it refers to travel speed when engraving machine rise cutters.

Auto process acceleration---its value is higher and the cutting speed is faster.



Manual high speed item does not need to set which has been set in control system. Click “OK” to close dialogue window after setting. Select “Operation→ Download process data” to download target file to control card. And downloading processing percentage will show. Following dialogue window appears finally which means target

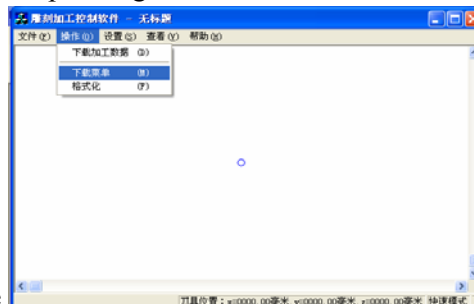


file has been downloaded completely.

Cautions:

Do not click “Operation→ Format” which leads to format programs in control system.

“Download menu” downloads operating interface to control card. Its name is



“Menu.txt” which is adjustable.

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“Update” is for updating main control system, it is unnecessary for user to execute this function.

Chapter II

I) Description of basic operations

1. How to give numbers to the keyboard

They are four lines of numbers in keyboard with 4 buttons for each line. Each button has two or above functions. In different states the definition for each button is quit different (Details are in Description of buttons). In order to make it easy to remember, follows are the numbering method: we describe buttons in the first line as I* and II* to buttons in the second line. The same to the third and fourth lines. Diagram of buttons is illustrated as below:

I①	I②	I③	I④
II①	II②	II③	II④
III①	III②	III③	III④
IV①	IV②	IV③	IV④

There are three ways to press buttons: it is usually to press wanted button and release at once; the second way is long-timed pressing which means to press the wanted button for 0.5 second and then release; the third way is to press combined buttons, such as pressing combined buttons II②+ IV③, its operating method steps are: firstly press and keep pressing II② then press IV③, finally release the two buttons at same time. There is no sequence to release buttons.

3.How to reply clues

Frequently there are clues when the system is running. For example, when the system starts up, it will clues: “Goto Home?” at the bottom of the screen. And it clues “Goto Home?” when it has finished process. If there are no special demands, pressing IV① confirms the clue and pressing IV④ denies.

4.How to input single number

In following descriptions of button functions, it always needs users to input figures (e.g. when we change Manual state to step mode or input parameters in Menu state). Its operating methods are as follows: you can press related button to input any number in process (I① to III② represents figure 1 to 0), pressing III③ inputs decimal point and pressing III④ inputs negative sign. Caution: At some cases, it only allows to input positive number and negative sign is not allowed to input. At other cases, it only allows to input positive integer, then decimal point and negative sign are not allowed to input. If there is wrong inputting, pressing IV③ delete former inputted symbol. After inputting all figures, pressing IV① finishes inputting process or pressing IV④ cancel inputting.

For an example: it needs to input “-3129.87”, the inputting sequences are: pressing

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III④, I③, I①, IV①, IV③, II④, II③.

5. How to input 3 axes parameters

It frequently needs to input 3 axes parameters when you set system parameter in Menu (such as Home speed and pulse equivalent). It needs to input 3 continuous figures, the first inputted figure refers to corresponding parameter of X axis, the second represents Y axis and the third represents Z axis. The system shows current value of parameter before user's inputting. Pressing IV① or IV④ keeps this value. If you input a new value according to single number inputting methods, the parameter changes into new value.

There is an example for inputting home speed. Current home speed is 1500mm/minute (X axis), 1400mm/m (Y axis) and 1300mm/m (Z axis). It needs to change home speed to 1500mm/m (X axis), 1200mm/m (Y axis) and 800.5mm/m (Z axis). Select “Home spd” in Menu and it displays as below on the screen:

Unit: mm/minute 1500.00

“1500.00” displaying on the screen is the current home speed of X axis, directly pressing IV① keeps its value. Then the screen displays as below:

Unit: mm/minute 1500.00 1400.00

“1400.00” displaying on the screen is current home speed of Y axis, input “1200” and the screen displays as below:

Unit: mm/minute 1500.00 1200.00 1300.00
--

“1200.00” on the screen is new home speed of Y axis and “1300.00” is current home speed of Z axis. Inputting “800.5” changes home speed of Z axis. Then it finishes new home speed setting.

6. How to operate Menu

After opening Menu, the screen displays below:

Parameter Saving Coordinate Setup Multiple process Parameter Setup

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On the screen each Menu item displays from the top to the bottom. The item with black background is the current chosen item. Pressing I① moves cursor to previous item and pressing II① moves cursor to next item. If the chosen item is the first item in the menu, pressing I① moves cursor to the last item, the same to last item, if it is the current chosen item Pressing II① moves cursor to the first item. Because of screen space limit, it can not display all items. When Pressing I① and II① choose menu item, the system rolls the screen automatically and it makes that the chosen item is on the screen.

After selecting wanted item, pressing IV① executes its function. If it has sub-menu, pressing IV① enters the sub-menu

When it displays Menu, pressing IV④ goes back previous item. For an example, user chooses “Coordinate Setup” and press IV① to go into its sub-menu, at this time, pressing IV④ goes back “Coordinate Setup”. Attention: long-timed pressing IV④ quits Menu displaying state and goes into Manual state (Detailed information is in “Description of system state” section).

7. Long-timed storage

It is frequently to meet this term in this manual. So-called long-timed storage means that every change of the value will be stored even the control card closes or power falls. If it is formatted, the value recovers default.

II) Description of system state

The system has several different states. It displays different content on the screen in different states and buttons have different function. So it is necessary to understand which state the system is in.

1. Manual process state

When the system starts up, it displays as follow after executing clear operating:

1X 0.000 MANL
1Y 0.000 SOFF
1Z 0.000 LOW
Continuous

It is fundamental system state, within which users can execute many basic operations, such as: manual control moving, multiple process, home, coordinate system changing, origin setting and stop point restart and so on.

2. Menu state

When it is in manual process state, pressing III④ and inputting passwords (the operating method is the same to single figure inputting method). If it is wrong password, it returns Manual process state; if it is correct password, the screen displays:

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Parameter saving
Coordinate Setup
Multiple Process
Parameter Setup
System Setup
Process Time
Version No.

In Menu state, it can execute many menu operations and all kinds of menu demands, such as: highest acceleration setting and manual speed.

3. Auto process state

When it is in Manual state, pressing IV③ runs into Auto process state, and the screen displays as below:

1X 0.000 MANL
1Y 0.000 SOFF
1Z 0.000 LOW
DBXP?

In this state, it can execute many menu operations, such as: pause, stop, save stop point and adjust speed ratio and so on.

III) Description of coordinate operating

No matter what state the system is in, user must confirm coordinate before start processing.

1. Machine tool coordinate

Machine tool coordinate is the primary one among all coordinates. Each machine tool just has one coordinate. Its origin is the switch position of machine tool origin, its X direction is the direction of X axis screw; its Y direction is the direction of Y axis screw; its Z direction is the direction of Z axis screw. It is absolute coordinate and others are relative coordinates to this coordinate.

At most cases in order to accurate machine tool coordinate before operating, it is necessary to execute home operating when the system starts up (press IV① when it clues “Goto Home?”). After homing, the system moves according to set direction and speed till it reaches at machine tool origin. Then the system stops and set origin to machine tool origin automatically.

(1) The type of origin switch

In order to accurate Home operating, it should always output a different signal to normal position when origin switch moves out its position.

(2) Install position of origin switch

The origin switch must be installed at a corner of the machine tool. Then it can move back by certain direction to machine tool origin no matter what position the machine tool is.

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(3) Home direction

To set home direction according to origin switch position promises home moves to right direction not to opposite direction. The direction relates with origin position and motor swear direction (details are in Description of Menu function).

(4) Home speed

In order to prove efficiency, home speed should be set as fast as possible (eg. 3000mm/m). Home speed for each axis is separated from each other' s because of different axis load or different motors. Attention: Because of adopting unique algorithm, home decision has nothing to with home speed. (Details are in Menu function section)

(5) Home acceleration

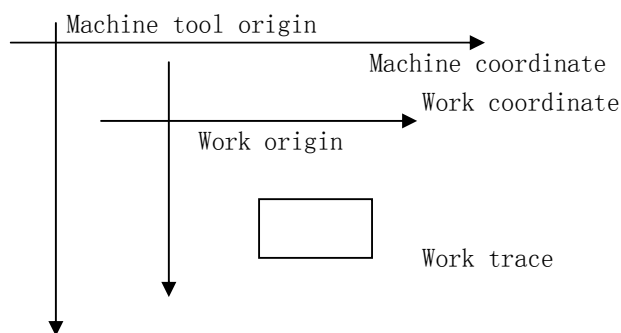
To set home acceleration should base on each axis home speed, motor and axis load. If home speed is faster then home acceleration becomes slower; if motor load gets bigger, home acceleration gets slower. (Details are in Menu function section)

Machine tool coordinate is unchangeable, so users can operate machine tool by times. Once it records the value of machine tool coordinate, it is easy to go back that point at any time.

2. Work coordinate

When we program G code processing, we adopt separated coordinate system in order to convenient to send materials and install card, this coordinate system is work coordinate and all coordinates are relative coordinate in G code file. It is always to install card and processed material, then to a proper point on the material to work coordinate origin and begin to operate.

The relationships between work coordinate and machine coordinate are illustrated as below:



Their directions are same which differs a slanting. In fact, the slanting is the workpiece origin value in machine tool coordinate. So it is easy to set work coordinate system by setting the value of work origin in machine tool. And their transformation formation is illustrated below:

$$X_a = X_o + X_r$$

$$Y_a = Y_o + Y_r$$

$$Z_a = Z_o + Z_r$$

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Xa, Ya and Za are values of machine coordinate; Xo, Yo and Zo are values of workpiece coordinate origin in machine coordinate; Xr, Yr and Zr are values of work coordinate.

There are always several target files which need to operate, so the system offers 9 work coordinate for users. Users can freely set that 9 work coordinate origins and it is convenient for users to switch current work coordinate.

If the machine tool offers power failure protection function, it will automatically save that 9 set work coordinate even the power falls suddenly. They are available to operate when the control card opens next time.

Because auto process, multiple process, stop point process are relative to current work coordinate, it is necessary to make sure that the current coordinate is correct before operating mentioned functions. Before operating auto process, multiple process, stop point process, it is always to move to align point and set the align point to current work coordinate origin (Detailed information is in “System operating method” section), then begins to run motion.

3. Coordinate system operating method

We number the 9 work coordinate system fro figure 1 to 9. in manual process state and auto process state, we can tell current work coordinate system by checking the first figures in the first line to the third line on the screen. Illustration is below:

1X 0.000 MANL
1Y 0.000SOFF
1Z 0.000 LOW
Continuous

The figure “1” on the left shows that current work coordinate is NO.1 work coordinate. If it is “A” on the left, it means that machine tool system is current coordinate system. In Manual process state, to press III④ + any figure form 1 to 9 changes current work coordinate systems among the 9 coordinates. For an example, it needs to change current coordinate into 7th work coordinate, the operating method is to press III④ + II③ and the screen displays:

7X 0.000 MANL
7Y 0.000 SOFF
7Z 0.000 LOW
Continuous

If you want to check value of machine tool coordinate, press III④ + III② switch between current work coordinate and machine tool coordinate. For an example: it is in 7th coordinate system, the screen

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displays while pressing III④ + III②:

```
AX 0.000 MANL
AY 0.000 SOFF
AZ 0.000 LOW
Continuous
```

Repressing III④ + III② switches to 7th work coordinate system and the screen displays as below:

```
7X 0.000 MANL
7Y 0.000SOFF
7Z 0.000 LOW
Continuous
```

Caution: It does not change current work coordinate but its display state when we switch display states between current coordinate system and machine tool coordinate system.

In manual process state, we can not only switch current work coordinate but also set origin position of current coordinate. Pressing I④ sets X, Y current position to X axis and Y axis values of current coordinate origin. Pressing II④ set Z position to Z axis value of current coordinate origin. Follow is an example: It is in 5th coordinate system, the current origin value is at (20.0, 30.0, 40.0) and current coordinate position is at (100.5, 120.2, 220.45). According to mentioned formation, current machine tool coordinate position is at (120.5, 150.2, 260.45). Then the screen display as below:

```
5X 100.500 MANL
5Y 120.200 SOFF
5Z 220.450 LOW
Continuous
```

Pressing I④ sets current machine tool coordinate X,Y position to X,Y value of 5th work coordinate origin. At this time the screen displays:

```
5X 0.000 MANL
5Y 0.000SOFF
5Z 220.450 LOW
Continuous
```

Pressing II④ sets current machine tool coordinate Z position to Z value of 5th work coordinate origin. At this time the screen displays:

```
5X 0.000 MANL
5Y 0.000 SOFF
5Z 0.000 LOW
Continuous
```

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Then current machine tool coordinate position (120.5, 150.2, 260.45) becomes 5th work coordinate origin.

It is the short way to set work coordinate origin, and another way is to input work coordinate origin directly with coordinate inputting method (Details are in “Description of PARAMETER SETUP”).

If it has power failure protection model, the system will save current work coordinate origin setting. All default value of work coordinate is (0, 0, 0) and default work coordinate is 1st work coordinate.

IV) Description of Manual process

Manual process means user directly controls machine tool’s moving direction and distance. This function is used to adjust machine tool’s position, set origin and test. This function is available only in manual moving state.

In order to get know manual process, it is necessary to understand manual moving mode, manual speed mode and manual mesh. Because manual process is controlled and produced by pressing button combines manual moving mode, manual speed mode and manual mesh.

1. Manual speed mode

Manual speed can be set freely, but it is complex to do that directly (Details are in Parameter setup section). It is impossible for user to set this frequently. Generally, users have two aims for manual moving: one is to adjust machine tool position that promotes efficiency; the other is to adjust cut location which promotes precision. So the system offers two manual speed modes: one is high speed mode and the other is low speed mode. Users can set the two modes separately or pressing III② switches state between the two modes in Manual moving state. Users can check the speed mode at the down right corner on the screen.

Attention: Manual moving speed is long-timed storing variable. The default value for low speed mode is 1meter/minute and 3meters/minute for high speed mode.

2. Manual step

In real Manual moving process, it requires to move to stable distance position. For an example: it needs to move a few mm or least distance, and it is hard for traditional manual moving control methods to do this. So here we adopts the definition-step which guarantees manual moving to stop at mesh point. For an example, the current mesh is 0.1mm, when a positive moving stops at 37.52mm, the system will continue to move to 37.6mm point automatically. Attention: this auto movement is relative to machine tool coordinate system.

Users can set mesh value freely whose range is from 0.05mm to 1mm.

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Because it is complex to set mesh space (Details are in Parameter setting section) and it just needs to set long space for high speed and short space for low speed, the system offers user to set two kinds of spaces: one is the long space in high speed whose value is bigger (eg. 0.5mm or 1mm), the other is short space in low speed whose value is smaller (eg. 0.05mm or 0.1mm). when pressing III② switches speed modes, it switches mesh spaces automatically.

3. Manual moving mode

In order to meet different requirements for manual moving, it offers three kinds of manual moving modes, there are Continuous moving mode, Step moving mode and Space moving mode. Users can switch moving modes by pressing IV② in manual state and check the moving mode at bottom of the screen.

(1) Continuous moving mode

In this mode, users press moving direction buttons (I①, I②, I③, II①, II② and II③) and machine tool will move as ordered direction till all buttons release. Its speed is determined by current speed mode. Attention: if the pressing time on buttons is too short (less than 0.5 second) and releases the button at once, the machine tool moves to and stops at nearest step point automatically. When this moving mode ends, the machine tool always stops at mesh point. This mode is suitable to adjust position of machine tool.

(2) Step moving mode

It always moves at low speed with two step per second. Its step space is determined by current speed mode. This mode is suitable to adjust cut position and machine tool position precisely.

(3) Distance moving mode

In this mode, users press moving direction buttons (I①, I②, I③, II①, II② and II③) and machine tool moves to ordered location. The machine tool moves according to current speed mode and set spaces. The moving is not influenced by step and stops precisely at ordered point not at step point.

IV)Description of Manual process operating

When the control card starts and the system is in low continuous moving mode, the screen displays:

1X 0.000 MANL
1Y 0.000 SOFF
1Z 0.000 LOW
Continuous

At this time users can switch speed modes between low speed mode and high speed mode by pressing IV② or switch speed modes among Continuous

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moving mode, Step moving mode and Distance moving mode by pressing III
②. For an example: Pressing III②, the screen changes into:

```
1X 0.000 MANL
1Y 0.000 SOFF
1Z 0.000HIGH
Continuous
```

It is in high speed manual mode at this time. Pressing III②, the screen changes into:

```
1X 0.000 MANL
1Y 0.000 SOFF
1Z 0.000HIGH
Step
```

The system is in Step mode, re-pressing III②, the screen displays as below:

```
1X 0.000 MANL
1Y 0.000 SOFF
1Z 0.000HIGH
Dist
```

It displays Space at the bottom, it needs users to input figures (its unit is mm). For an example, after inputting 1000.25, the screen changes into:

```
1X 0.000 Manual
1Y 0.000 Axis stop
1Z 0.000 High speed
Dist 1000.25
```

It means that it successes in inputting distance moving mode when screen displays with figures. Pressing any direction button, the machine tool moves for a distance of 1000.25mm in ordered direction. If it is necessary to change the distance value, it must to repeat mentioned operating method that is to press OK for three times and input a new value.

After having set manual moving mode and manual speed mode, users can run the manual moving by pressing direction buttons. Caution: If the machine does not move, it means that manual moving acceleration is too high and the system can not bore it. Users reset its acceleration in Menu and reduce the value.

In manual moving process, it displays current position coordinate on the screen. In Continuous moving mode and Step moving mode, user can tell whether it reaches the wanted position form displaying coordinate on the screen.

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V) Description of auto process

Auto process means that the system moves according to ordered trace in G code file. The following steps must be strictly followed: before running any auto process, users must download legal G code process data. Firstly the system must be in manual state, users should connect the control card to computer with G code file through USB connecting line. Secondly users download G code file to control card (Details are in Communication program operation section). Only in Manual state, G code file can be downloaded, otherwise something wrong will happen. The system can save 9 G code files and the target file must be less than 15MB(for 16MB storage system) or less than 31MB (for 32MB storage system). The downloaded file will last forever till it is reformatted. Caution: If users operate followed steps without downloading any G code file, it may cause unexpected movement.

The system is ready to start after having download target G code file. Generally, users adjust cuts to the starting point by all manual process means and set that point as current work coordinate origin. To carving machine, after setting origin, it is necessary to raise Z axis to a certain height in order to avoid to destroy target workpiece. Then the screen displays as follow:

```
1X 0.000 MANL
1Y 0.000SOFF
1Z 5.000 LOW
Step
```

At this time, to press IV③ execute auto process program. For example, user downloaded SAM01 file, the screen displays:

```
1X 0.000 MANL
1Y 0.000 SOFF
1Z 5.000 LOW
SMA01
```

At the bottom of the screen it displays the target file' s name. Caution: the machine tool will not start as soon as the IV③ pressed down, because the spindle needs some time to start up. The system begin starting after spindle runs smoothly, at most cases it needs 2 seconds. If it is not your wanted file, pressing IV④ quit auto process. When it begins to execute auto process, the screen displays:

```
1X 12.371 RUN
1Y 37.452 S-ON
1Z -1.000 LOW
Spd Rati1.000
```

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In auto process there is “RUN” displaying on the screen which means that it is operating auto process. Displaying “Spd Rati1.00” on the screen refers to speed ratio whose value is form 0.1 to 1.0. Machine tool real running speed is the product of set speed in G code file times speed ratio. In running state, users press I② to increase speed ratio (once pressing add 0.1 and 1.0 is its maximum value) or press II② to reduce speed ratio (once pressing reduces 0.1 and its minimum value is 0.1). When it finished all G code file process, the system raises cuts to machine tool coordinate origin of Z axis and then moves to current work coordinate origin.

When it is in process, pressing DELETE pauses auto process and pressing CANCEL stops auto process.

It displays as below when it is in pause state:

```
1X 12.371 RUN
1Y 37.452 S-ON
1Z -1.000 LOW
Spd Rati1.000
```

At this time, Pressing I③ and II③ adjust the location of Z axis; pressing I② and II② adjust speed ratio or pressing IV④ quits auto process and goes back Manual state.

When pressing IV④ quits auto process from running state or pause state, the system clues: “Save Stop P?”, illustration is as below:

```
1X 14.971 RUN
1Y 49.213 S-ON
1Z 0.000 LOW
Save Stop P?
```

If it is unnecessary to save, pressing IV④ neglects the clues. If it needs to save the stop point, pressing I①, I②, I③ then IV① saves it. Pressing I① saves the stop point in 1st stop point saving area, the same to I② and I③.

After saving stop point, it clues “Goto Home?” and the screen displays as below:

```
1X 14.971 RUN
1Y 49.213SOFF
1Z 0.000 LOW
Goto Home?
```

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If users want cut edge to go to the position of current work coordinate origin, to pressing IV① does it; pressing IV④ keeps cut edge at the current position. It goes back manual state, after homing, the screen displays as below:

```
1X 0.000 MANL
1Y 0.000 SOFF
1Z 0.000 LOW
Continuous
```

Then it finishes a total auto process program.

2. Stop point process

In order to restart operating while the cuts stop or stop operating during long time process, the system offers strong stop point saving and processing function.

The system offers 3 stop point saving areas, they are No.1 stop point saving area, No.2 stop point saving area and No.3 stop point saving area. Each area can save a stop point forever and the saved stop point can be recovered by times.

In above section, we have introduced stop point saving method. And we are going to introduce how to restart operating auto process from saved stop point.

There are two points for operating stop point process: firstly, the system must be in manual state, secondly the current work coordinate is coordinate with the work coordinate of the stop point and the operating data are the same with the data of the stop point. If it needs to operate stop point in No.1 stop point saving area, press IV③+I① starts running state and target file name displays at the bottom. The screen displays as below:

```
1X 0.000 MANL
1Y 0.000 SOFF
1Z 5.000 LOW
SAM01
```

The same to auto process, stop point process delays starting for 2 seconds till spindle runs stable. It starts at the position of stop point and following steps are the same with auto process.

3. Multiple process

The system supports multiple process which repeatedly executes one target G code file according to ordered row numbers, column numbers, row space and row space.

Before running multiple process, it is necessary to set target multiple parameter, such as row(s), column(s) and row space and column space

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(Detailed information is in parameter setting section.). Pressing Down ⑦ + Down② starts multiple process which the system is in manual state. The following operations are the same with auto process.

4. Cautions:

1)The current work coordinate should be properly set in all state. After setting origin, it is necessary to raise the cutter to safe height which prevents the cutter from destroying the surface of target work piece.

2)When it executes stop point process, the current work coordinate system should complies with the work coordinate system of stop point and their G code files should be the same. Stop point saving function saves the position of stop point not the left G code file, so it demands the G code file to offer data. It can download other G code file or execute other operation when it is not executing stop point process. If it needs to execute stop point process, it needs to download G code file which stop point is in.

VI) Description of Parameter Setup

All Parameter /setup are in Menu; the setting methods have been introduced in previous sections. Here we are going to introduce long-timed saving parameters. Pressing III④ after entering Menu, follows are the definitions of those parameters:

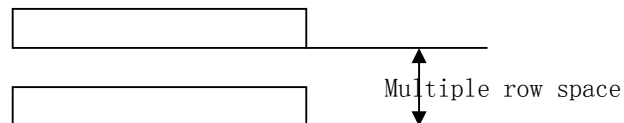
Origin: In “COORDINATE SETUP” menu, user can check current work coordinate origin or change its value.

Row Numbers: In “Multiple Process” part, row numbers refers to the number of rows which the system needs to repeat operating. That is how many times the system should move to the direction of Y axis. Its value should be any integer which is not less than 1.

Column Numbers: In “Multiple Process” part, column number refers to the number of columns which the system needs to repeat operating to the direction of X axis. Its value should be any integer which is not less than 1.

Row Space: which refers to the space between two rows to the direction of Y axis. Its unit is mm.

Caution: space here does not refer to their interval. Its definition is illustrated as below:



Column space: which refers to the space between two columns to the direction of X axis. Its unit is mm. And its definition is similar with array row space.

Speed ratio: which refers to speed proportion, its value is any real number from 0.1 to 1.0.

Home speed: which means the maximum moving speed of each axis when it

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executes home operation. Its unit is mm per minute. In order to promote home efficiency, the value should be enlarged as possible. Its moving speed is strict by motor and machine tool structure, it has nothing to do with home decision.

Low Speed : which refers to manual process running speed in manual low speed mode. Its unit is mm per minute. Its function specification is in Description of Manual process.

Low speed acceleration: it refers to manual acceleration in manual low speed mode. Its unit is mm/square second. It just needs to adjust once according to the character of motors and machine tool.

Low speed step: which refers to step space in manual low speed mode. Its unit is mm per square second. Its detailed information is in “Description of manual process” .

High speed: which refers to manual process running speed in high speed mode. Its unit is mm per minute. Detailed information is in Description of manual process.

High speed acceleration: which refers to manual acceleration in manual high speed mode. Its unit is mm per square minute. It needs to adjust once according to the character of electronic machinery and machine tool.

High speed step: which refers to mesh space in manual high speed mode. Its unit is mm. Detailed information is in Description of manual process.

Auto process mode: which refers to maximum speed of auto process. Its unit is mm per minute. Attention: the communication program in computer adopts this parameter too.

Auto acceleration: it refers the maximum acceleration in auto process. Its unit is mm per square second. The communication program in computer adopts this parameter too.

Travel speed: it indicates the maximum travel speed in auto process state. Its unit is mm per minute.

X axis soft limit: it needs to input maximum and minimum value of X axis. Its unit is mm. The inputted coordinate position is absolute coordinate position. It indicates that the software limits machine tool moving range. This function works as a hardware limit switch. It is suitable for simple machine tool without hardware position limit.

Y axis soft limit: it needs to input maximum and minimum value for Y axis.

Z axis soft limit: it needs to input maximum and minimum value for Z axis.

Pulse equivalent: which refers to pulse equivalent of each axis. Its unit is equivalent per mm and its value is any integer. Its calculation method is: pulse equivalent is equal to equivalent per circuit of motor/ screw space between axes.

Screw interspace: which refers to the space between screws. Its unit is mm.

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Motor direction: which adjusts the relationship between motor and the value of coordinate. For example: if value of X axis is adding, the motor revolves in clockwise. If it needs to change motor direction when the value of X axis is adding. Detailed operating steps are as follow: to execute “Motor direction” function according to mentioned method, and the screen displays as below:

X axis motor direction +

If it needs to change motor direction at this time, pressing **IV①** will achieve this and the “+” symbol in the last line change into “-” (Illustration is below). Pressing **IV④** omits it. It is the way to operate axis direction.

X axis motor direction -
Y axis motor direction +

Home direction: which refers to moving direction of machine tool while executing home operation. Its value is determined by motor moving direction and home switch fixed position. Its setting method is the same to mentioned motor direction setting method.

Formate: It may have bad trances after long time operating. It will be fine after being formatted. Generally speaking it is unnecessary for user to format it. If the communication program demands to do this, users do it as the clues ask.

Caution: formation leads to lose all current parameters and target G code file. It needs to reset the system and re-download G code file.

VII) Cut adjusting device operating method

Firstly put the cut adjusting device on a stable work platform, then move X, Y axes to the position above the cut adjusting device, check X,Y axes’ moving data and input the values to cut adjusting device absolute position; then press decimal point button and Menu button, automatically X, Y, Z coordinates will move the position above the cut adjusting device, then Z axis will slowly cut to cut adjusting device, it stops till cut adjusting device approaching switch indicator flashes; then check changed data of Z axis and input it to cut adjusting device absolute position. If it needs to change cut during operating process, it just needs to press Menu button then Z axis auto adjusts, press confirm button after that, X, Y axes move back their form positions, repress confirm button to continue process.

VIII) Multi files system

It can store 9 target files in the control card. When user needs to process one of

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them, press IV③ and related figure button.

IX) One button recover function

This card offers one button recover function when the card can't work normally because of users' faulty operating. Detailed operating step is: press (RECOVER) and don't let it go then insert USB power supply, then the system recovers.

X) Appendix

The brief diagram of control card is below:

