

AutoCut WEDM Program-Control System Instruction



MOTION TUNER

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Chapter 1 The Introduction of AutoCut

WEDM Program-Control System

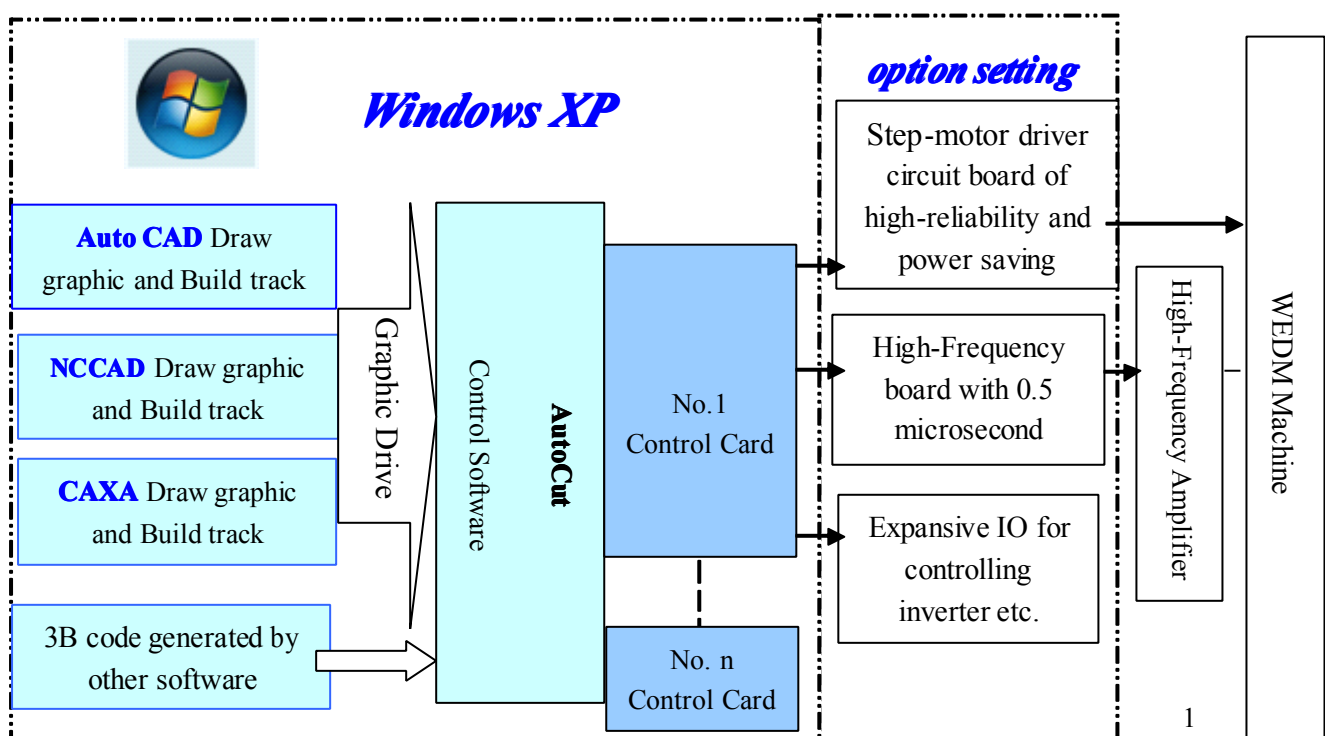
1.1 Introduction

The AutoCut WEDM Program-Control System (abbr. as AutoCut system as below), which is based on Windows XP operation system, consists of system software (CAD and CAM) that runs under the Windows OS, 4 axes motion control card that's designed to fit in a single PCI slot of a PC (based on PCI bus), step-motor driver circuit board of high-reliability and power-saving (without fans), High-Frequency board with 0.5 microsecond.

User use CAD to design the processing graphics according to the blueprint, and set the WEDM technics for the CAD graphics, generate 2D or 3D processing data, and then process the spare parts production. During the processing, the system can control intelligently the speed of motor and the parameters of pulse power etc. The processing method which is based on the graphic drive, is the dynamic integration of CAD and CAM in the WEDM field.

The system has the operation functions which has auto-control of cutting speed, real-time show during the cutting, preview of processing etc. At the same time, it can provide complete protection of all kinds of emergency (out of power, system halted etc.) to avoid reject the workpiece.

1.2 The Structure of AutoCut System



As above figure show, AutoCut system is one complete solution for WEDM. AutoCut system consist of AutoCut system software, motion control card that's based on PCI bus, step-motor circuit board of high-reliability and power-saving (optional), High-Frequency board with 0.5 microsecond and sampling board. AutoCut system software includes AutoCAD WEDM module, NCCAD (includes WEDM module), AutoCut plug-in of CAXA and Control software.

1.3 Main functions of AutoCut system

- 1、Support Graphic drive and auto-program, user doesn't need to contact the code, only need to set the processing technics for the graphic; meanwhile, support 3B and G code generated by other WEDM software;
- 2、The software can be directly embedded into all versions of AutoCAD、CAXA etc;
- 3、All kinds of processing ways can be combined together flexibility (Processing ways include Continuous, Single segment, Forward, Converse, Reverse etc.)
- 4、The direction of XYUV 4 axes can be adjustable, the drive motor can be set at 5-phase 10-bears, 3-phase 6-beats etc;
- 5、Real-time monitor the processing status of X Y U V 4 axis on WEDM machine;
- 6、Preview of processing, Real-time show processing; Taper processing can be showed by 3D, The processing graphic can be amplified or shortened, and it can be viewed from main view, left view, top view etc.;
- 7、Can be used for the multiple-process, it bring the maintainable function of technics library, and make the multiple-process easy and reliable;
- 8、Adopt 4 axes linkage control technic to process taper workpiece, Process the top and bottom shaped taper conveniently, make the complicated processing easy and exactly;
- 9、Can drive 4 axes motion control card, working stability and credibility;
- 10、Support multi-cards parallel work, one computer may control multi-machine at the same time;
- 11、Support auto-alarm, system will alarm when the processing finished or emergency, the time of alarm can be set arbitrarily;
- 12、Support time-delay for clear angle, delay time when processing the angle of the track, to make perfect for the deviation caused by electrode wire;
- 13、Support the gear clearance compensation, it can compensate the gear clearance error of the screw of machine and upgrade its precision;
- 14、Support pitch compensation: can sub-compensate the pitch error of machine;
- 15、Support two kinds processing mode: normal HS mode, communication output mode of MS;
- 16、Save the processing status automatically when power off, continue to work when power on and turn back when short-circuit etc. emergency;
- 17、Cut off the power automatically when the processing is finished over.

1.4 Main Characteristics of AutoCut System

- 1、 Use graphic drive technology, reduce the human labor, upgrade the efficiency of working, reduce the mistakes;**
- 2、 Software can be run on all versions of Windows XP etc., simple to use, easy to learn;**
- 3、 Directly embedded into all versions of AutoCAD、 CAXA , fulfill integration of CAD/CAM, expand the range of WEDM processing;**
- 4、 Adopt 4 axes linkage control technic to process taper workpiece; Process track with 3D designed; Compensate the radius of guide wheel, the diameter of electrode wire, the gap of single-side discharge and the error of large cone ellipse to eliminate the theory error of cone processing;**
- 5、 Adopt multi-cards parallel technology, one computer can control multi-machine at the same time;**
- 6、 Can be used for the multiple-process, it bring the maintainable function of technics library, Can intelligent control the speed and the parameter of processing, and make the multiple-process easy and reliable;**
- 7、 The software optimized the processing of super-thick workpiece (upper 1 meter), make the track stable and reliable.**

1.5 Running condition of AutoCut System

Computer software condition:

Win98/WinMe/Win2000/ Win2003/ WinXP Operation System .

Computer hardware condition:

Lowest scheme:

Computer of upgrade PENTIUM300, 1GB hard disk, 64MB memory , 4MB /16 bit true color graphics card.

Recommended scheme:

Computer of upgrade PENTIUM 1.7G, 20GB hard disk, 512MB memory, 4MB /32 bit true color graphics card.

Chapter 2 AutoCut system hardware and software installation

2.1 Hardware Installation

1、 Motion control card Installation

- 1) **Be sure the power of computer is off. Be strictly prohibited to insert the AutoCut motion control card when the power of computer is on.**
- 2) **When take out the AutoCut motion control card, must lightly hold and put. Be strictly prohibited to strike it seriously. Avoid direct human touch IC devices to prevent static electricity damage.**
- 3) **Open the cover of computer, select one free PCI slot, then insert the control card into this free PCI slot (Figure 2.1), During this operation, user's both hands should use the average force, preventing to damage computer's PCI slots on the motherboard.**
- 4) **Ensure that the PCI plug of the control card is reliable contacted with your computer's PCI slot on the motherboard, then use the screw to fix the control card on the computer's box.**
- 5) **Confirmed correct, cover the box cover.**
- 6) **Connect the motion control card with the control cable (DB25 or DB15 extended cable).**
- 7) **After installation, connect to the computer power supply, turn on the computer and let it running.**

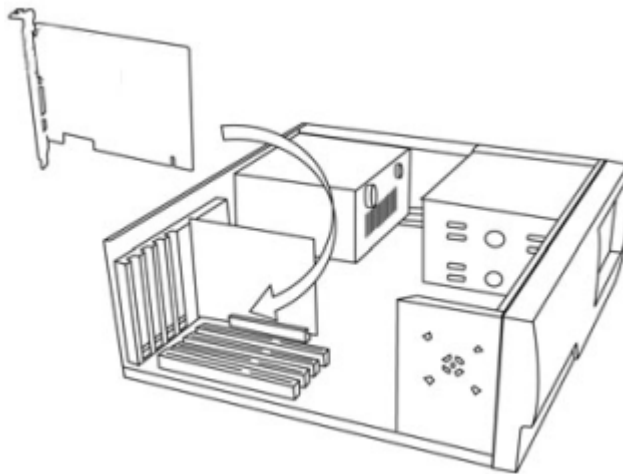


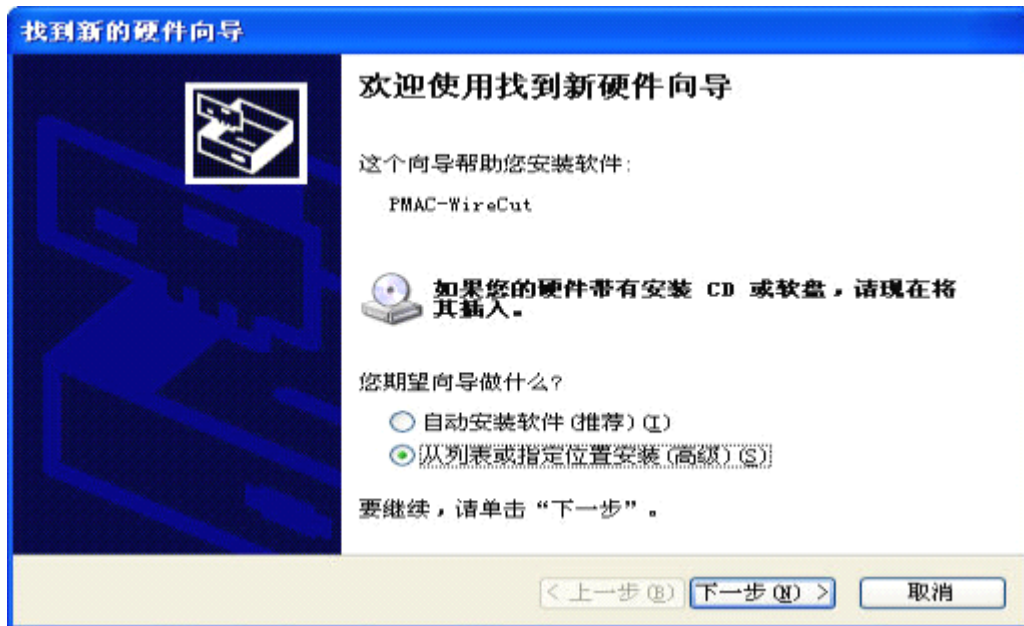
Figure 2.1

2、 Hardware driver Installation

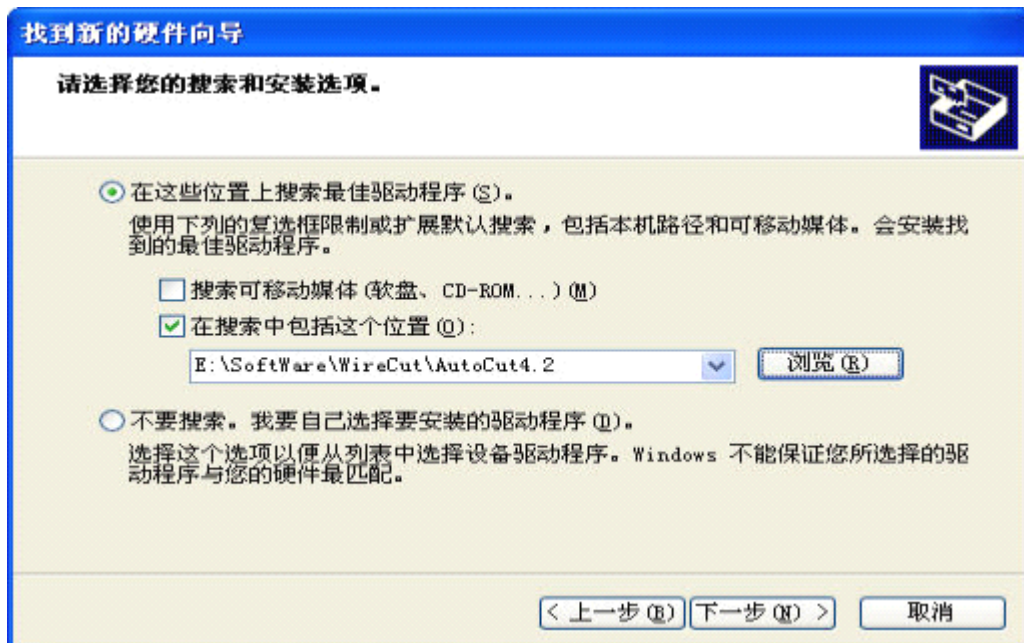
AutoCut motion control card is a plug and play (pnp) device, can be run in all versions of Windows Operating System.

We provide the driver of control card which is in the 'driver' folder of installation CD. There are some methods in the Windows XP operating system how to manually install the driver of control card.

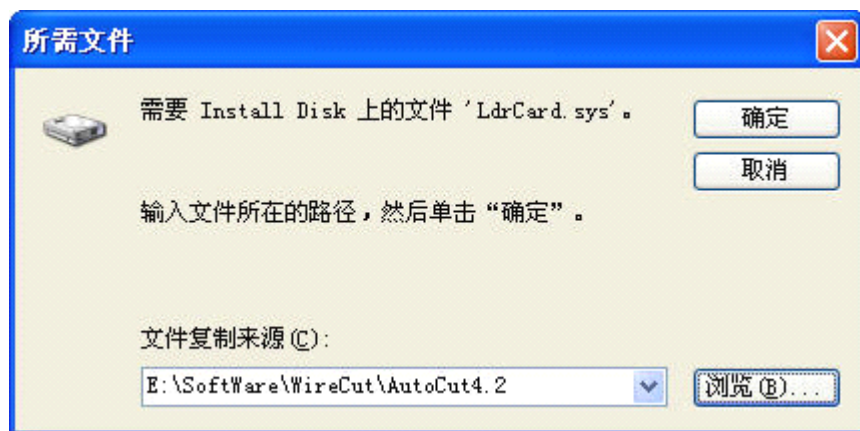
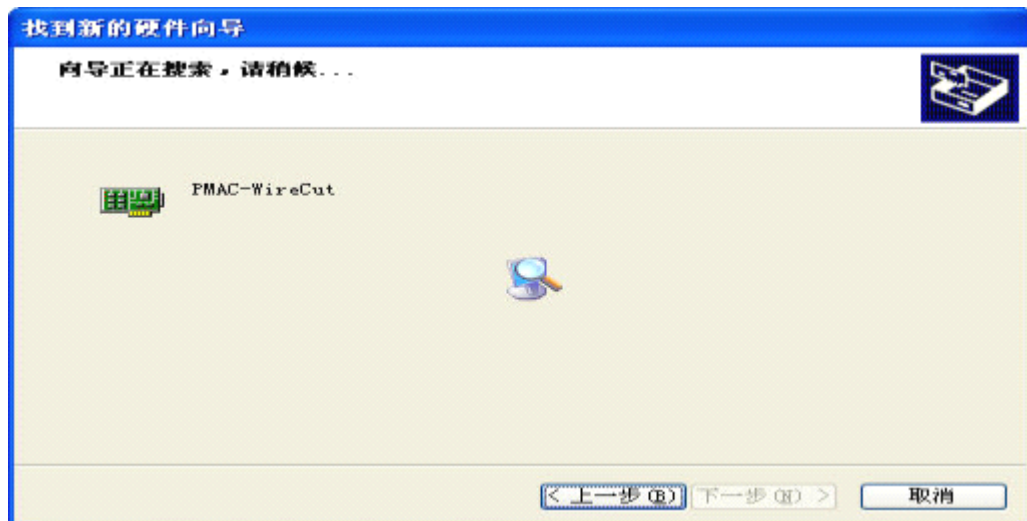
Control card is installed, start the computer, then the system will find the installation of new device and show the "Find New Hardware Wizard", as follow:



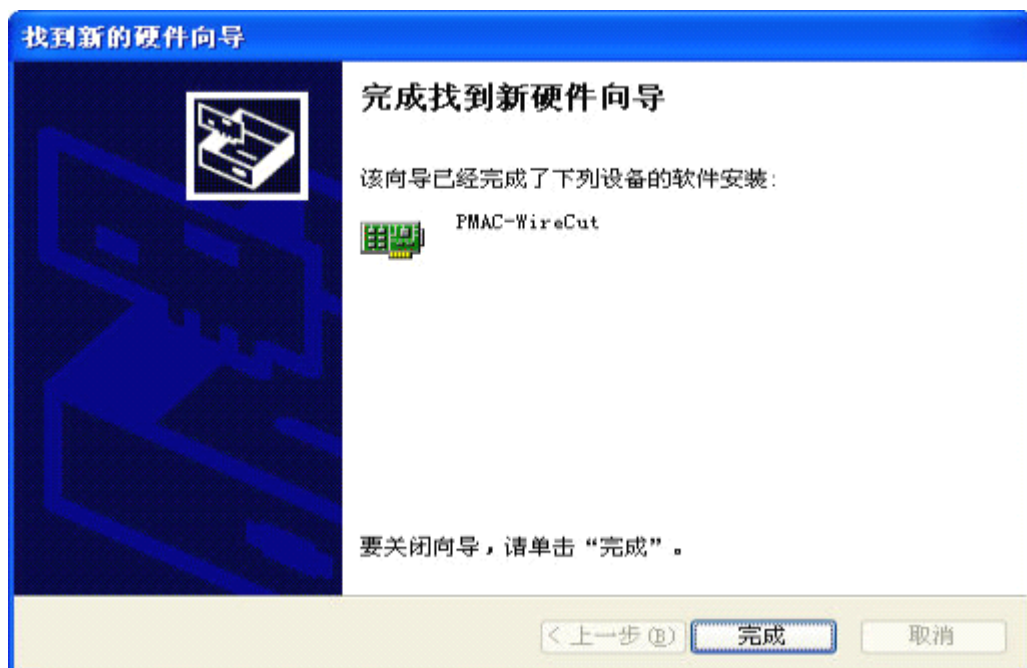
Click the "next" button, the system pop-up dialog box as follow:



Select the "In the search, including the location", click the "Browse" button, select the driver's folder, then click the "next" button, the system pup-up dialog box as follows:



Click the “Browse” button, select the driver’s folder, click the “OK” button.



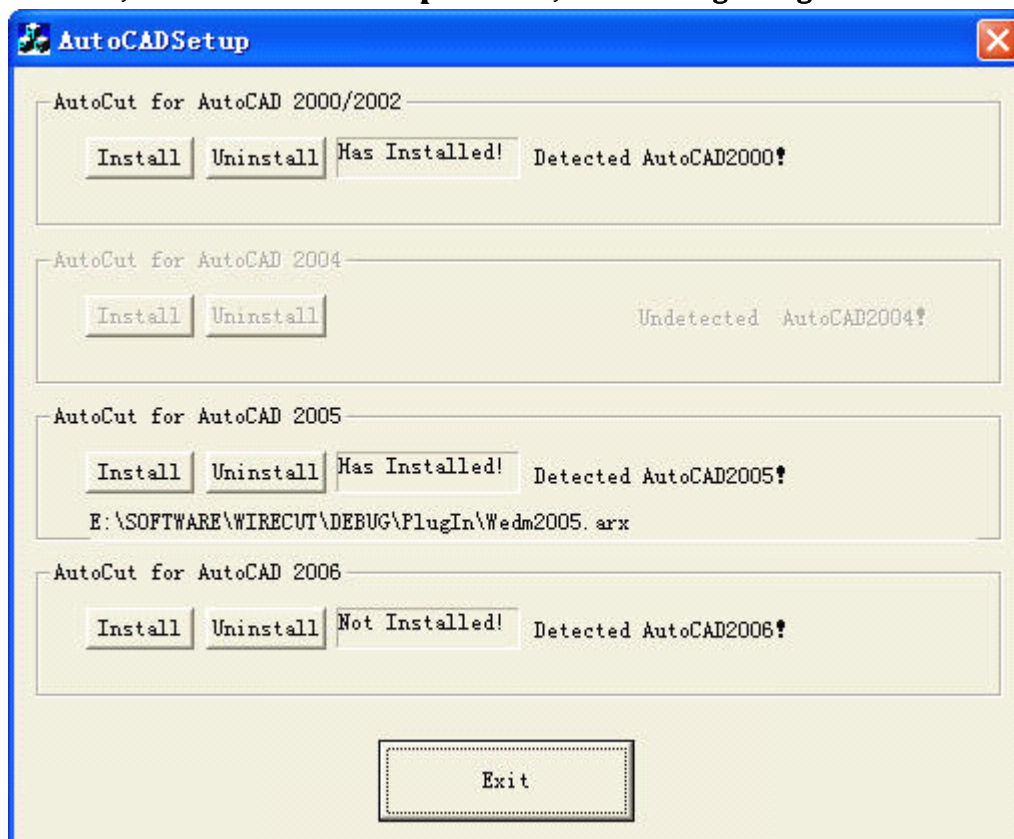
Click the “Completion” button, the driver of the motion control card is successfully

installed under the Windows XP operation system.

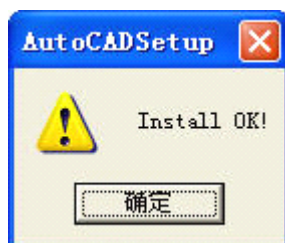
2. 2 Software installation

1、 Green installation method

Copy the “AutoCut” directory which is in AutoCut CD-ROM to the computer, NCCAD.exe is the executable file for NCCAD software, WireCut.exe is the executable file for AutoCut controlling software. For these users who need to use WEDM module for AutoCAD, will run AutoCADSetup.EXE file, the following dialog will be shown:



Click the “Install” button in different versions of AutoCAD, will install the WEDM module on the computer which has been installed AutoCAD software. " Install OK " interface will be shown after finishing installation.



2.3 Uninstall Software

1、 Uninstall method

For users who hadn't installed WEDM module of AutoCAD software, delete the AutoCut directory in the computer, can completely uninstall. If users have installed the WEDM module of AutoCAD, first run AutoCADSetup.EXE, in the above Figure, click the "Uninstall" button to complete the unloading of the WEDM module, then delete the AutoCut directory to complete the uninstall.

Chapter 3 The usage of NCCAD

NCCAD Drawing software working interface include Menu bar, Toolbar, Drawing Window, Catch bar, Status bar, Drawing area and command window etc. (Figure3.1). Click Menu-bar to open the menu, Click the button on Toolbar to start the corresponding function. User can find the function of these button in Menu-bar, but the button on Toolbar is a shortcut. When user moves the mouse at the button of Toolbar, the word of description will be displayed beside the button, and more detailed description will display in Status bar.

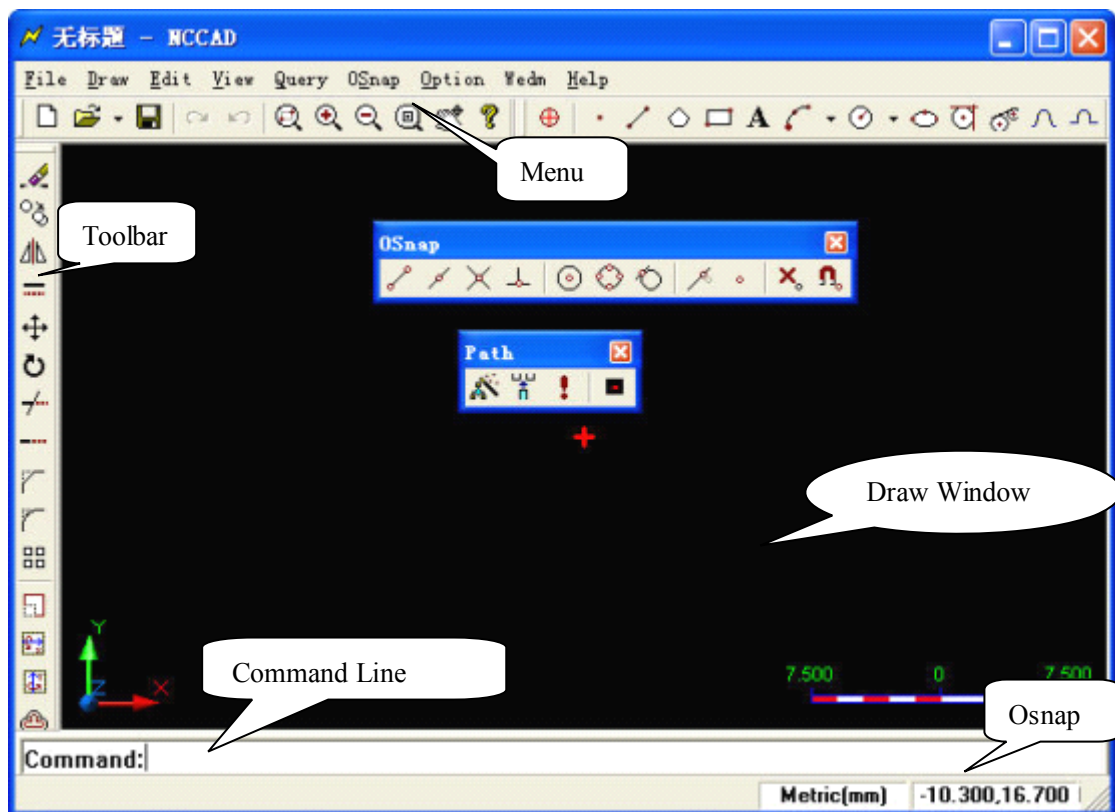


Figure 3.1 NCCAD main interface

Detailed Guide of the software is in the reference manual of the NCCAD drawing software.

Chapter4 The usage of AutoCut For AutoCAD

We provide the installation program of AutoCAD WEDM plug which is in the 'Autocut' folder of installation CD. Double click the "AutoCADSetup.exe" file, then display the next dialog (Figure 4.1):

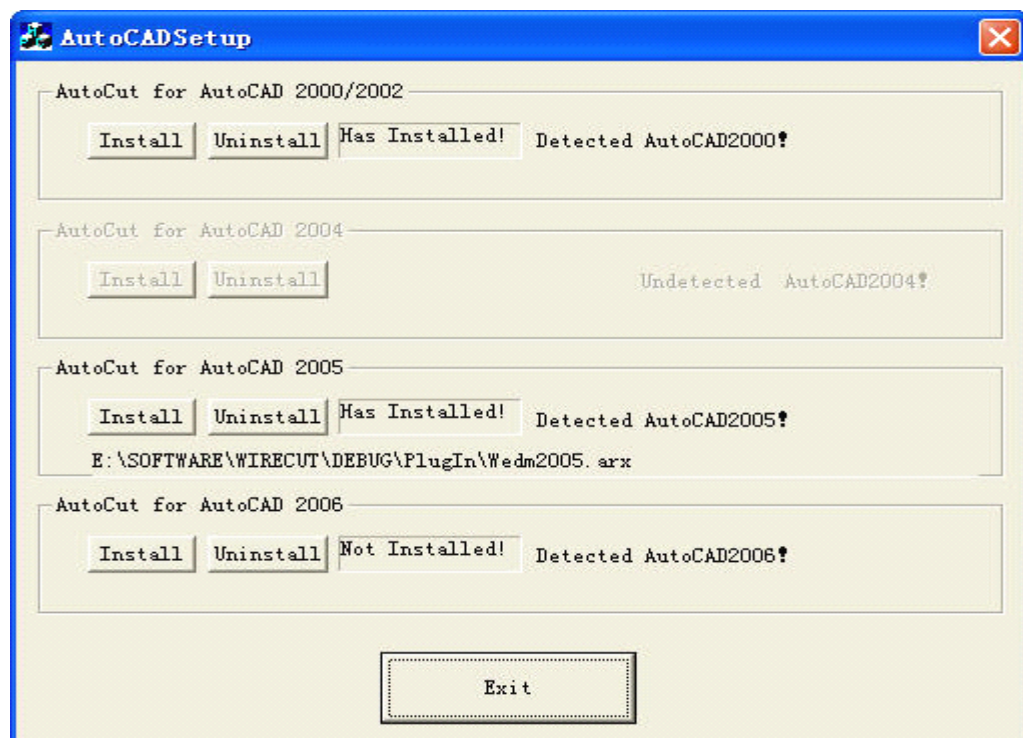


Figure 4.1

Install AutoCut for AutoCAD 2005. After installation, open the software of AutoCAD 2005, user can see AutoCut plug Menu-bar and Toolbar on the main interface of AutoCAD2005.

Main interface (Figure 4.2):

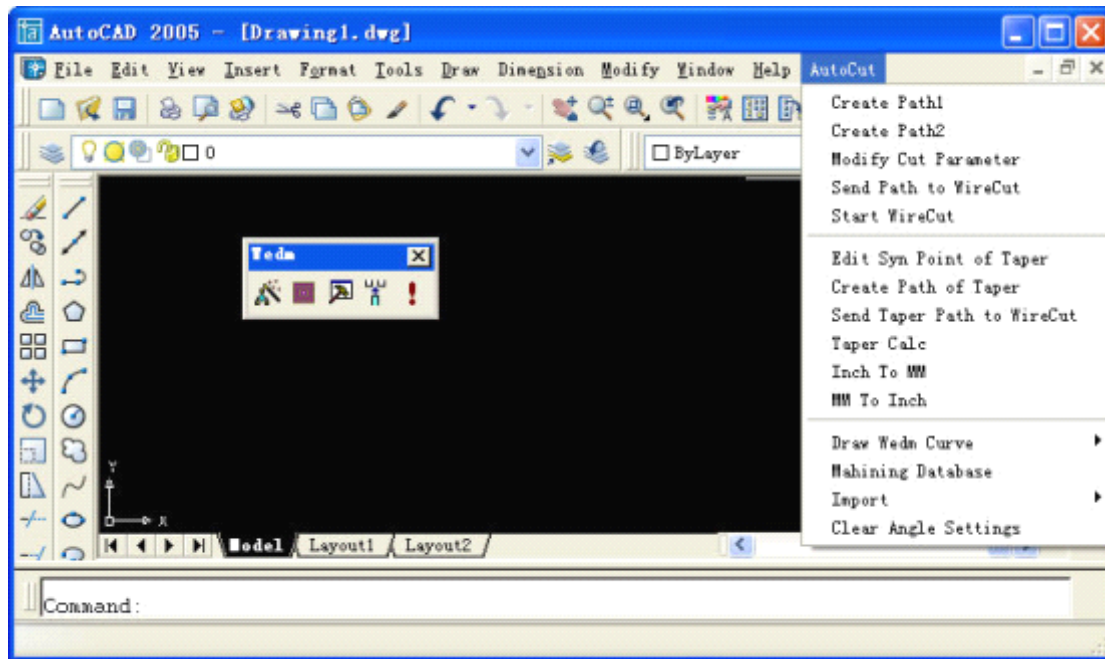


Figure 4.2: Main interface of AutoCAD2005 with AutoCut WEDM module

4.1 Draw Wedm Curve

The “Draw Wedm Curve” function of AutoCut For AutoCAD, include drawing Archimedes, Cycloid, Hyperbola, Involute and Parabola, Gear etc.

4.1.1 Archimedes

Execute the command of “Draw Archimedes” on the “Draw Wedm Curve ” menu under the “AutoCut” menu, will display the dialog of drawing the Archimedes spiral, after inputting parameters of the Archimedes spiral ,click the “OK” button to complete the drawing of the Archimedes spiral; The parameter equation of the Archimedes spiral

is
$$\begin{cases} x = r't \cos t \\ y = r't \sin t \end{cases}$$
, and parameters include the range of parameter t , the value of parameter r and the rotation angle and base-point coordinate of the Archimedes spiral in the space of drawing .

4.1.2 Parabola

Execute the command of “Draw Parabola” on the “Draw Wedm Curve” menu under the “AutoCut” menu, will display the dialog of drawing the Parabola, after inputting parameters of the parabola, click the “OK” button to complete the drawing of parabola; the parameter equation of parabola is $y=k*x^2$, and parameters include the range of x coordinate and the value of coefficient k , in addition, user can set the rotation and parallel-move of the parabola in the space of drawing.

4.1.3 Involute

Execute the command of “Draw Involute” on the “Draw Wedm Curve” menu under the “AutoCut” menu, will display the dialog of drawing involute, after inputting parameters of the involute, click the “OK” button to complete the drawing of the

involute; the parameter equation of involute is
$$\begin{cases} x = r(\cos t + t \sin t) \\ y = r(\sin t - t \cos t) \end{cases}$$
, and parameters include: base circle radius, unfold angle, and rotation angle of the involute in drawing space, station of base circle center.

4.1.4 Hyperbola

Execute the command of “Draw Hyperbola” on the “Draw Wedm Curve” menu under the “AutoCut” menu, will display the dialog of drawing hyperbola, after inputting parameters, click the “OK” button to complete the drawing of the hyperbola; the

parameter equation of hyperbola is
$$\begin{cases} x = a / \cos(t) \\ y = b * \tan(t) \end{cases}$$
, and parameters include: a, b, the range of parameter t is t1-t2 (t1<t<t2), in addition, users can set the rotation angle of the hyperbola in drawing space and the station of base point.

4.1.5 Cycloid

Execute the command of “Draw Cycloid” on the “Draw Wedm Curve” menu under the “AutoCut” menu, will display the dialog of drawing cycloid, after inputting parameters of the cycloid, click the “OK” button to complete the drawing of the cycloid;

the parameter equation of cycloid is
$$\begin{cases} x = r(t - \sin t) \\ y = r(1 - \cos t) \end{cases}$$
, and parameters include: coefficient r, swing angle t, and the rotation angle of cycloid in drawing space and the station of base point.

4.1.6 Gear

Execute the command of “Draw Gear” on the “Draw Wedm Curve” menu under the “AutoCut” menu, will display the dialog of drawing Gear Wheel (Figure 4.3), after inputting parameters and browsing the Gear, click “OK” to complete the Gear-Wheel drawing.

Figure 4.3:Gear

4.1.7 Shape Text

Execute the command of “Shape Text” on the “Draw Special Curve” menu under the “AutoCut” menu, will display the dialog of drawing vector word (Figure 4.4):

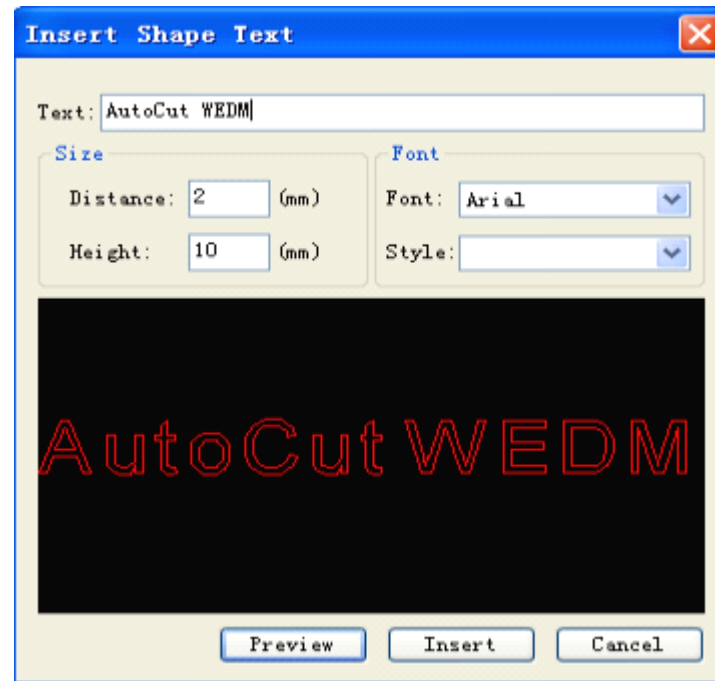



Figure 4.4: Vector Word

Write letter in the “Text” Editor, click the “Preview” button, will display the figure in the black window at the dialog, click the “Insert” button, complete insert the vector word into the main interface.

4.2 Track Designing

There are three designing track methods in AutoCAD WEDM module: create process track, create multiple process track and create path of taper.

4.2.1 create process track

Click “Create process track” menu under “AutoCut” menu, or click  icon button, will display the dialog (Figure 4.5), these are parameters of create path of high speed wire.

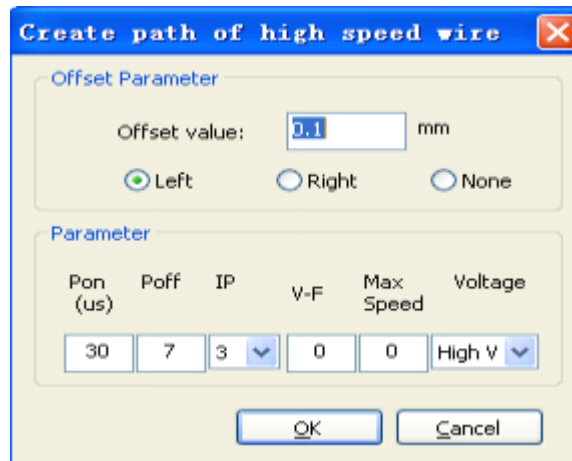


Figure 4.5 HS process track: setting process parameter

After selecting the offset direction, setting the offset value and parameter, click the “OK” button. “Please input start point:” will display in the Command Line, User can input start point coordinate through handing input relative or absolute coordinate, or use mouse to click mouse left-key for selecting one point at the screen as start point, after ensure the threading, “Please input cut point” will display in the Command Line, attention, the cut point must be at the drawing graphic, otherwise, it is invalid, user can input the cut point coordinate through handing input or use mouse to select one point as cut point at the drawing graphic. After ensure the cut point, “Please select cut direction <Enter = finish>”(Figure 4.6):

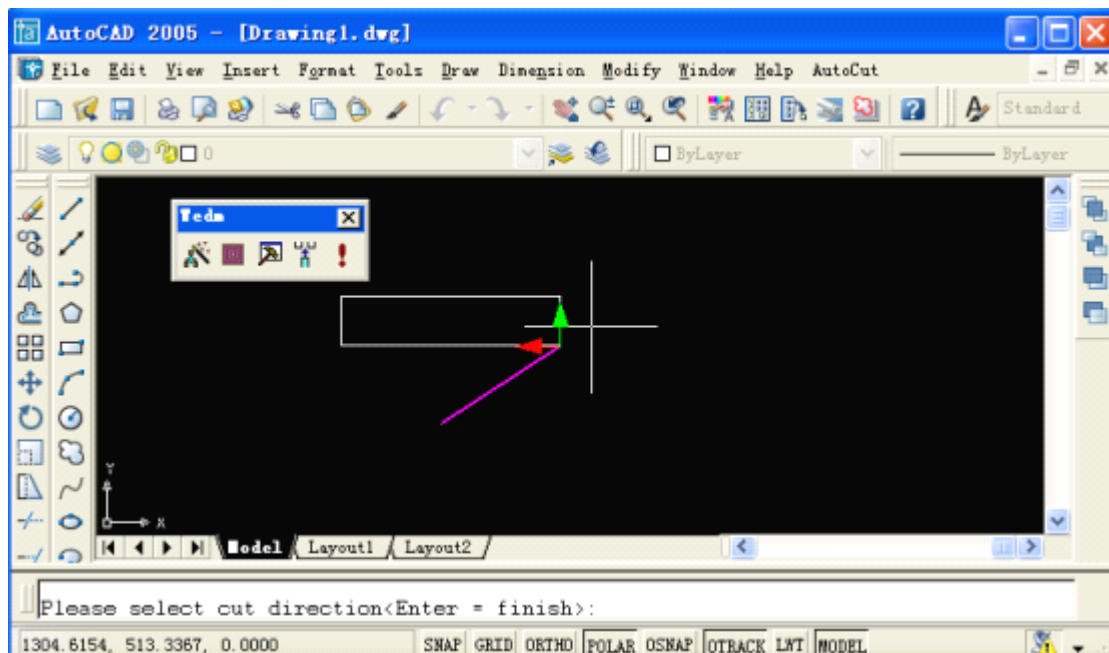


Figure 4.6: Create process track

User can see the red and the green arrow alternate conversion at the process track when moving mouse, click mouse left key at the green arrow to ensure cut direction, or click <Enter> key to finish the selection of the direction of the processing track, track’s direction will be the direction of the green arrow.

Attention, for closed graphic, through the above process, user can finish the track

of creating. But for unclosed graphic, it is different, after the above process, “please input end point <Enter = start point>”, Figure 4.7:

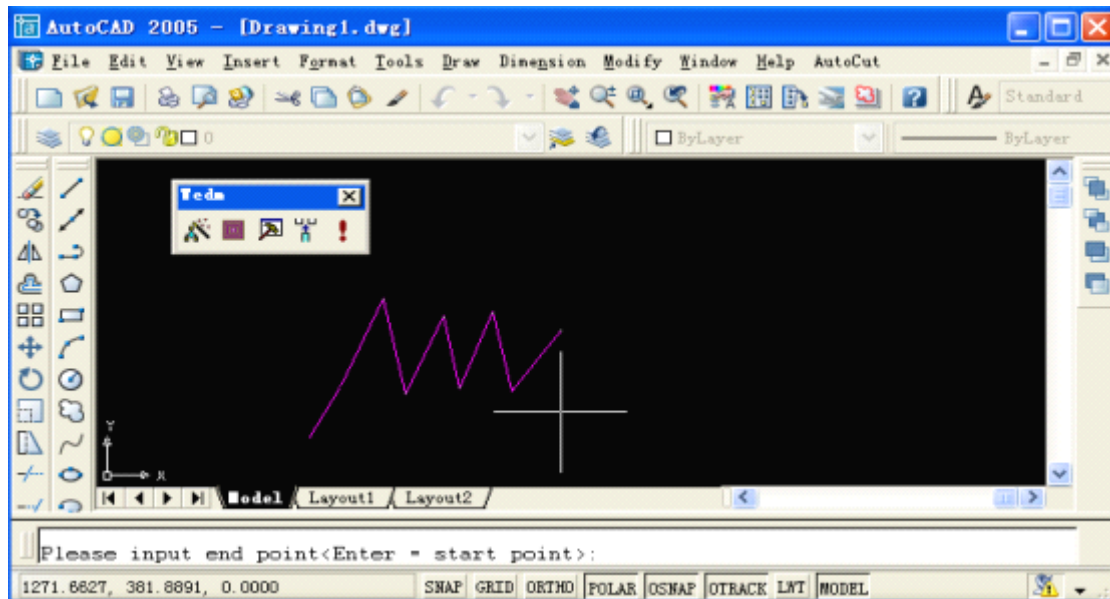


Figure 4.7 unclosed graphic: Create process track

Handing input or mouse select one point as exit point coordination, or click the <Enter> key to complete selecting exit point (default as exit point and threading point is the same point), so far, unclosed graphic ‘s process track is created.

4.2.2 Create multiple process track

Click “Create multiple process track” menu under “AutoCut” menu, or click icon button, will display the dialog of “Edit process path ”(Figure 4.8):

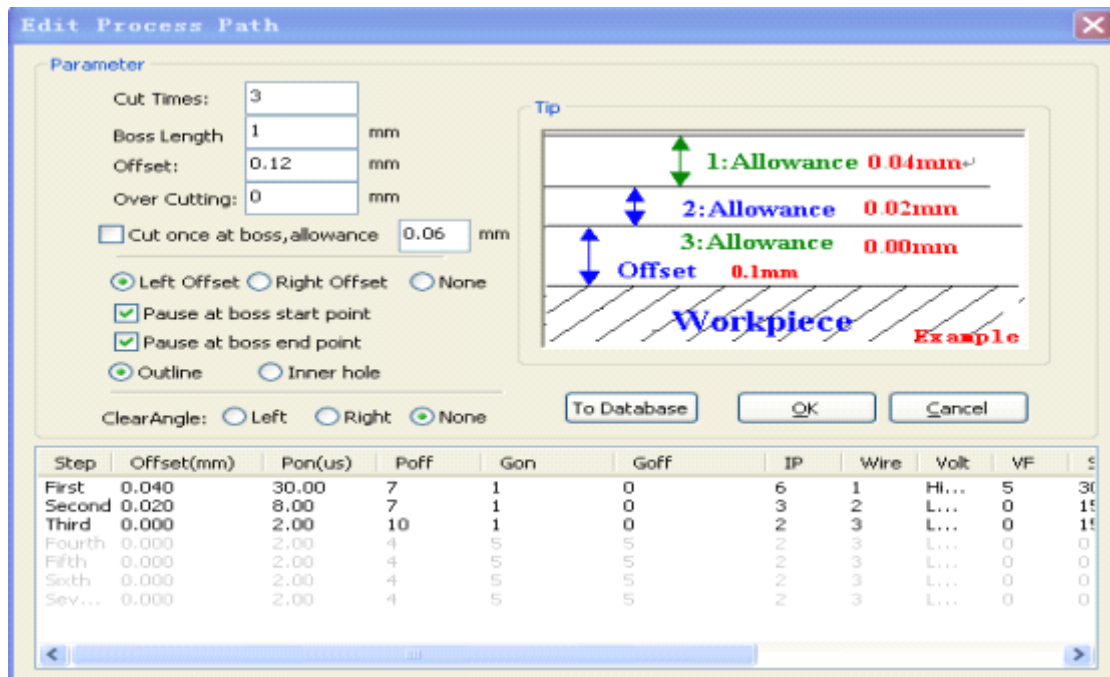


Figure 4.8: Edit the process path

Pause at boss start point

Cut times: multiple cutting times;

Boss length: punch's width, default: 1 mm;

Offset: The compensation for molybdenum, the offset value is 0.1 mm by default.

Over cutting: After process finished, some times the workpiece is un-detached, so user can set the over-cutting measure to make the workpiece detachment completely after processing.

Cut once at boss: Cut once at boss, and the offset value is the setting value;

Left offset: the reference is molybdenum along the workpiece contour 's process direction, molybdenum position located at the left of the workpiece contour.

Right offset: the reference is molybdenum along the workpiece contour 's process direction, molybdenum position located at the right of the workpiece contour.

None: the reference is molybdenum along the workpiece contour 's process direction, molybdenum position located at the position of the workpiece contour.

Pause at boss start point: if user need pause before processing boss, it must be selected, after manual treatment, will continue to process, otherwise user needn't use it.

Pause at boss end point: if user need pause after processing boss, it must be selected, after manual treatment, will continue to process, otherwise user needn't use it.

Outline: Process outline figure;

Inner hole: Process inner figure;

Clear angle: include left, right and none;

Click "To Database" button, open the expert database, Figure 4.9:

The screenshot shows a software window titled "Database" with a blue header bar. It contains a table of parameters, a list of materials, and several control buttons.

Parameter	Times	allowance (mm)	Pon (us)	Poff	GPon	GPoff	IP	Wire	Volt	V-F	Max Speed
<input checked="" type="checkbox"/> First		0.04	30	7	1	0	6	1	Low	5	300
<input checked="" type="checkbox"/> Second		0.02	8	7	1	0	3	2	High	0	150
<input checked="" type="checkbox"/> Third		0	2	10	1	0	2	3	High	0	150
<input type="checkbox"/> Fourth		0	2	4	5	5	2	3	High	0	0
<input type="checkbox"/> Fifth		0	2	4	5	5	2	3	High	0	0
<input type="checkbox"/> Sixth		0	2	4	5	5	2	3	High	0	0
<input type="checkbox"/> Seventh		0	2	4	5	5	2	3	High	0	0

On the right side of the window, there are radio buttons for "Factory Database" (selected) and "User Database". Below these are input fields for "Technics No.:" (0), "Wire Diameter(mm):" (0), "WorkpieceHeight(mm):" (0), and "Offset(mm):" (0.12). There are also radio buttons for "Outline" (selected) and "Inner hole". A "Material:" input field is at the bottom right.

At the bottom, there are two tabs: "Factory database" (selected) and "User database". The "Factory database" tab shows a list of materials:

- Number1-materials:123456-Wire D0.180mm-Thickness45.000mm-Silk Offset0.120mm-Work times3--Shape
- Number3-materials:123456-Wire D0.180mm-Thickness45.000mm-Silk Offset0.120mm-Work times1--Shape

On the right side of the list, there are buttons for "Add", "Update", "Delete", "OK", and "Cancel".

Figure 4.9: The Expert Database

In the expert database, user can set process parameters of the multiple-cutting, and can save these parameters to the expert database, click the “OK” button, current parameters will be sent to “Edit process path” interface, Figure 4.10:

Step	Offset(mm)	Pon(us)	Poff	Gon	Goff	IP	Wire	Volt	VF	S
First	0.040	30.00	7	1	0	6	1	Hi...	5	30
Second	0.020	8.00	7	1	0	3	2	L...	0	15
Third	0.000	2.00	10	1	0	2	3	L...	0	15
Fourth	0.000	2.00	4	5	5	2	3	L...	0	0
Fifth	0.000	2.00	4	5	5	2	3	L...	0	0
Sixth	0.000	2.00	4	5	5	2	3	L...	0	0
Sev...	0.000	2.00	4	5	5	2	3	L...	0	0

Figure 4.10: Edit process path

In the dialog of “Edit process path”, click the “OK” to finish the setting of the multiple-cutting;

After finishing the setting of the process parameters, “Please input start point” will display in the Command Line in AutoCAD software, User can input start point coordinate through handing input relative or absolute coordinate or use mouse to click left key for selecting one point at the screen as start point, after ensure the point, “Please input cut point” will display in the Command Line, attention, the cut point must be at the drawing graphic, otherwise, it is invalid, user can input the cut point coordinate through handing input or use mouse to select one point as cut point at the drawing graphic. After ensure the cut point, “Please select cut direction <Enter= finish>” (just as create process track). User can see the red and the green arrow alternate conversion at process track when moving mouse, click mouse left key at the green arrow to ensure the cut direction, or click <Enter> key to finish the selection of the direction of the processing track, track’s direction will be the direction of the green arrow.

For closed and unclosed figure, after setting the process parameters, other parts like “Create process track ” function.

4. 2. 3 Create Path of Taper

There are two created methods of taper process track: top and bottom shaped taper, appointed taper angle.

1) Before create top and bottom shaped taper process track, user need use “create process track” function to create two process tracks about top and bottom surface

(Figure 4.11).

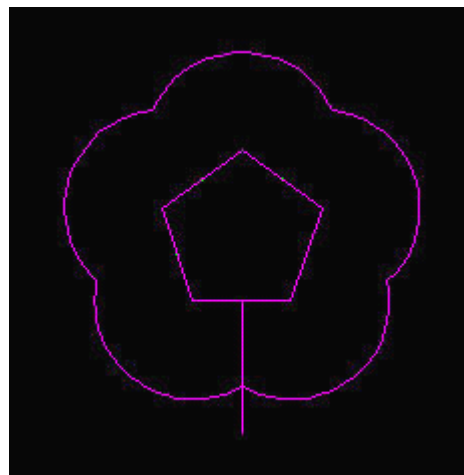


Figure 4.11: top and bottom surface

Click “Create Path of Taper” menu under “AutoCut” menu, will display the dialog “Taper cutting parameter”(Figure 4.12):

Step	Offset(mm)	Pon(us)	Poff	Gon	Goff	IP	Wire	Volt	Remark
First	0.000	50.25	8	1	0	0	0	L...	
Second	0.000	50.25	8	1	0	0	0	L...	
Third	0.000	50.25	8	1	0	0	0	L...	
Fourth	0.000	50.25	8	1	0	0	0	L...	
Fifth	0.000	50.25	8	1	0	0	0	L...	
Sixth	0.000	50.25	8	1	0	0	0	L...	
Sev...	0.000	50.25	8	1	0	0	0	L...	

Figure 4.12: Taper Cutting Parameter

Cut Times: multiple cutting times;

Boss Length: punch's width, default: 1 mm;

Offset: The compensation for molybdenum, the offset value is 0.1 mm by default.

Left offset: the reference is molybdenum along the workpiece contour 's process direction, molybdenum position located at the left of the workpiece contour.

Right offset: the reference is molybdenum along the workpiece contour 's process direction, molybdenum position located at the right of the workpiece contour.

None: the reference is molybdenum along the workpiece contour 's process direction,

molybdenum position located at the position of the workpiece contour.

Pause at boss start point: if user need pause before processing step, it must be selected, after manual treatment, will continue to process, otherwise user needn't use it.

Pause at boss end point: if user need pause after processing step, it must be selected, after manual treatment, will continue to process, otherwise user needn't use it.

Taper settings:

Guide Wheel: the wheel type, include big sawyer and small carriage.

Distance of up and down guide wheel (H1): the distance from top to bottom guide wheel's circle center, unit: millimeter (mm);

Distance of program plane to down wheel (H2): the distance from the bottom guide wheel's circle center to the worktable (workpiece bottom interface), unit: millimeter (mm);

The height of workpiece (h): the distance from workpiece's top to workpiece's bottom interface (the distance of the top to bottom program interface); unit: millimeter (mm);

The radius of guide wheel (R1): machine top guide wheel radius, unit: millimeter (mm);

Top and bottom shaped: Need select two processing track about top and bottom interface.

Appointed taper angle: after appointed taper angle, only need to select one process track, system will auto create corresponding taper graphic;

Variable cone: syn point control the taper angle;

Attention: the setting of multiple-cutting process parameters like "Create multiple process track".

1) Top and bottom shaped create process track:

After finishing the setting, click the "OK" button, "Please Select Top Interface " will display in the command line of AutoCAD software, after selecting one created process track, "Please Select Bottom Interface " will display, then select another created process track (Figure 4.13), "Please Input a New Threading Coordinate", User can input threading coordinate through handing input relative or absolute coordinate or use mouse to click mouse left key for selecting one point at the screen as a new threading coordinate , after ensure the threading, created figure as follows (Figure 4.14):

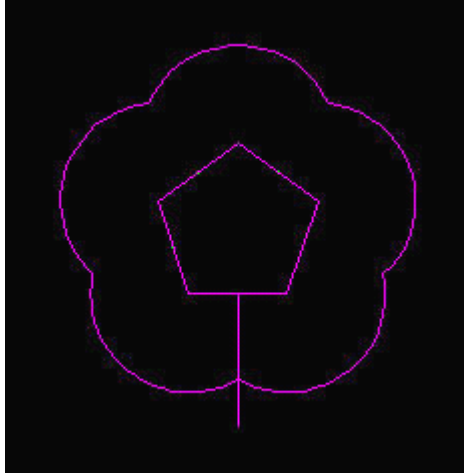


Figure 4.13 Process track

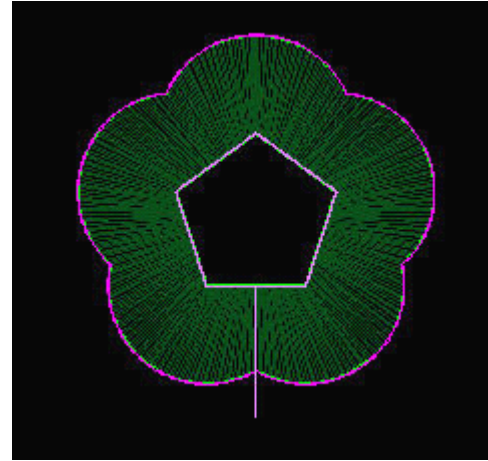


Figure 4.14 Taper process track

User “3D dynamic watcher” under the “view” menu, will display the 3D effect drawing as follows (Figure 4.15):

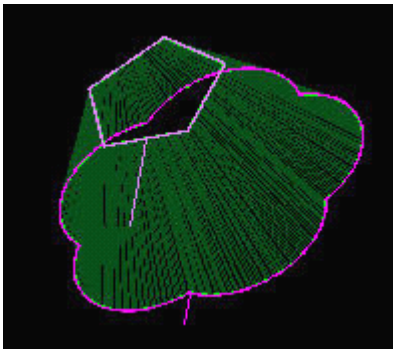


Figure 4.15: 3D Effect Drawing

2) Appointed taper angle create taper process track:

After finishing the setting, click the “OK” button, “Please Select Bottom Interface ” will display in the Command Line of AutoCAD software, after selecting one created process track (Figure 4.16), “Please Input a New Threading Coordinate”, User can input threading coordinate through handing input relative or absolute coordinate or use mouse to click mouse left-key for selecting one point at the screen as a new threading coordinate, after ensure the threading, created figure as follows (Figure 4.17):

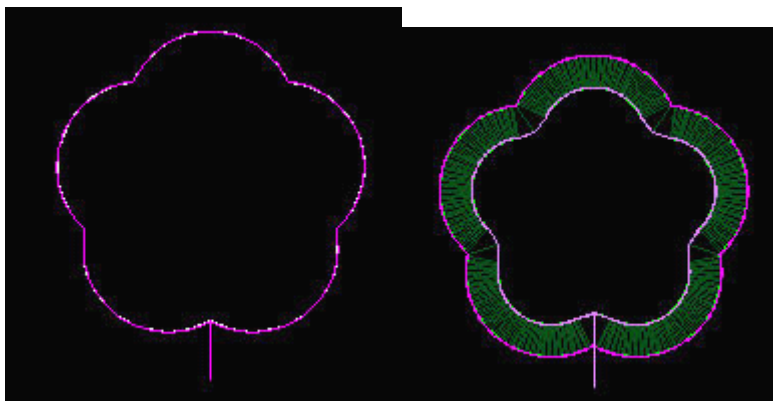


Figure4.16 Process track Figure4.17 Taper process track

Use “3D dynamic watcher” under the “view” menu, will display the 3D effect drawing as follows (Figure4.18):

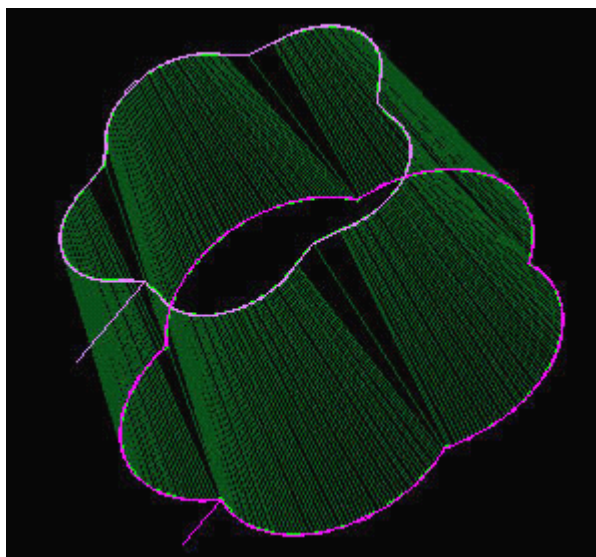


Figure4.18 3D effect drawing

4.3 Track process

There are three methods of processing track in AutoCAD WEDM module, one is send process task to AutoCut control software directly through AutoCAD software, another is send taper work task to AutoCut control software, the other is run AutoCut control software directly and through loading file to finish process workpiece in the control software.

4.3.1 Send Process Task

Click “Send Process Task” menu under “AutoCut” menu, or click  icon button, will display the follow dialog “Select Card”(Figure 4.19).

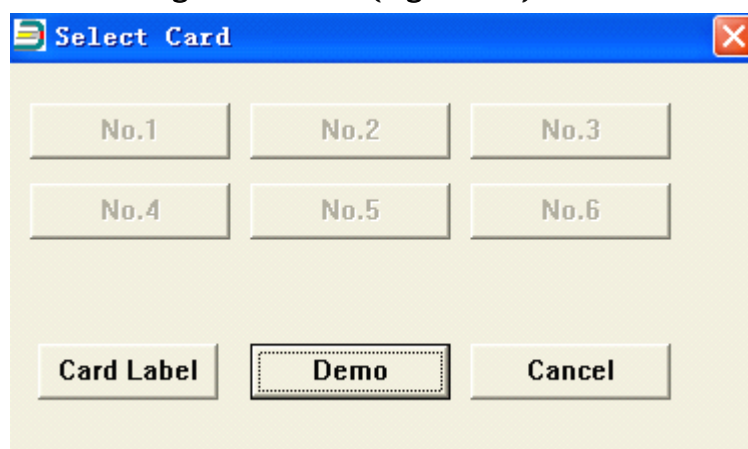


Figure 4.19: Select Card

Click the “No 1 Card” button (if there isn’t one control card, user can select “Demo card” for demo effect) , and then “Please Select Object” will display in the command

line of AutoCAD software, use mouse left key to select the follow pink track(Figure 4.20),

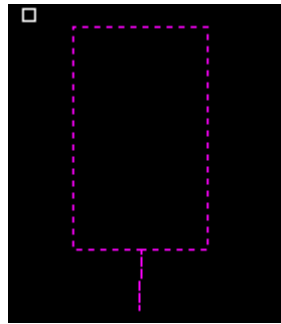


Figure4.20: Process Track

Click mouse right key, will enter into the control interface as follows (Figure 4.21):

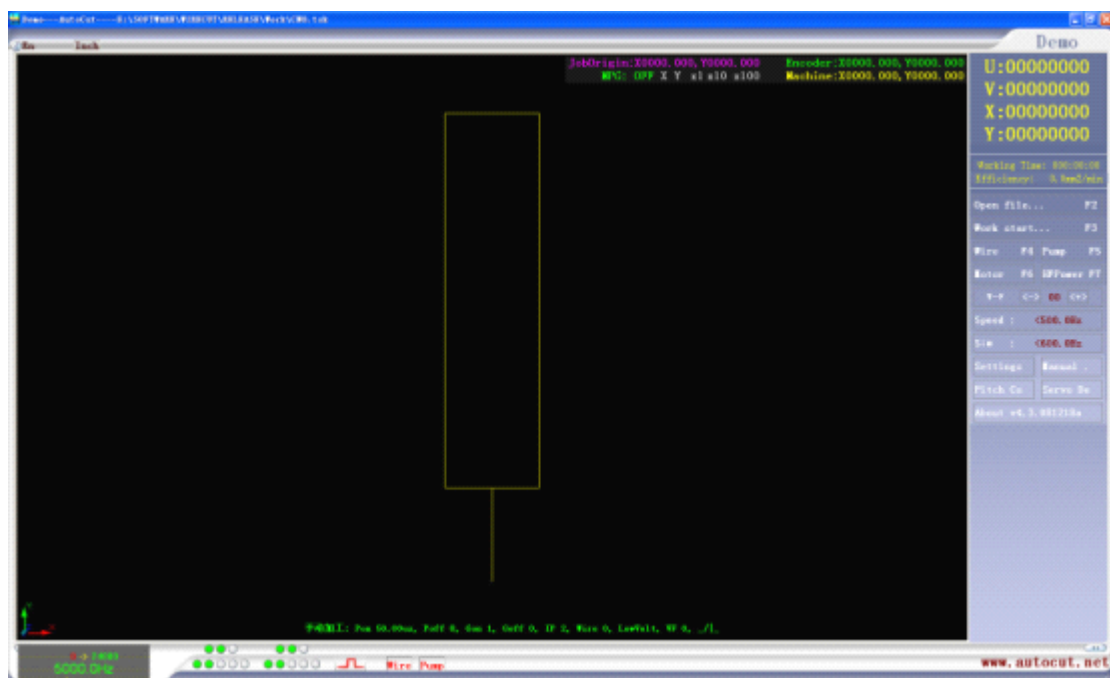


Figure 4.21: Main interface of Control Software

4.3.2 Send Taper Process Task

Click “Send Taper ProcessTask” menu under “AutoCut” menu, will display the dialog “Select Card”. After selecting one card, select one created taper process track, click mouse right key, and then send the taper process task to the control software as follows (Figure 4.22):

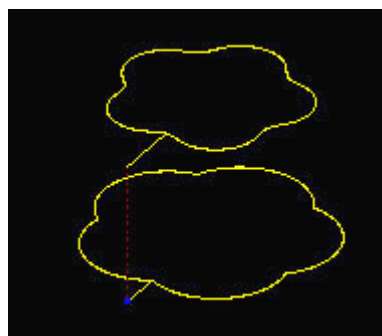




Figure 4.22: Taper Process task

4.3.3 Run Process program

Click “Run Process Program” menu under “AutoCut” menu, or click  icon button, will display the dialog “Select Card” (Figure 4.19).

Click “No 1 Card” button (if there isn’t one control card, can select “Demo card” for demo effect), will enter into the control interface directly.

4.4 Track Amendment

Click “Track Amendment” menu under “AutoCut” menu, or click  icon button, “Please Select the Process Track which want to be modified:” will display in the command line of AutoCAD software, when a process track is selected, will display under the interface (Figure 4.23).

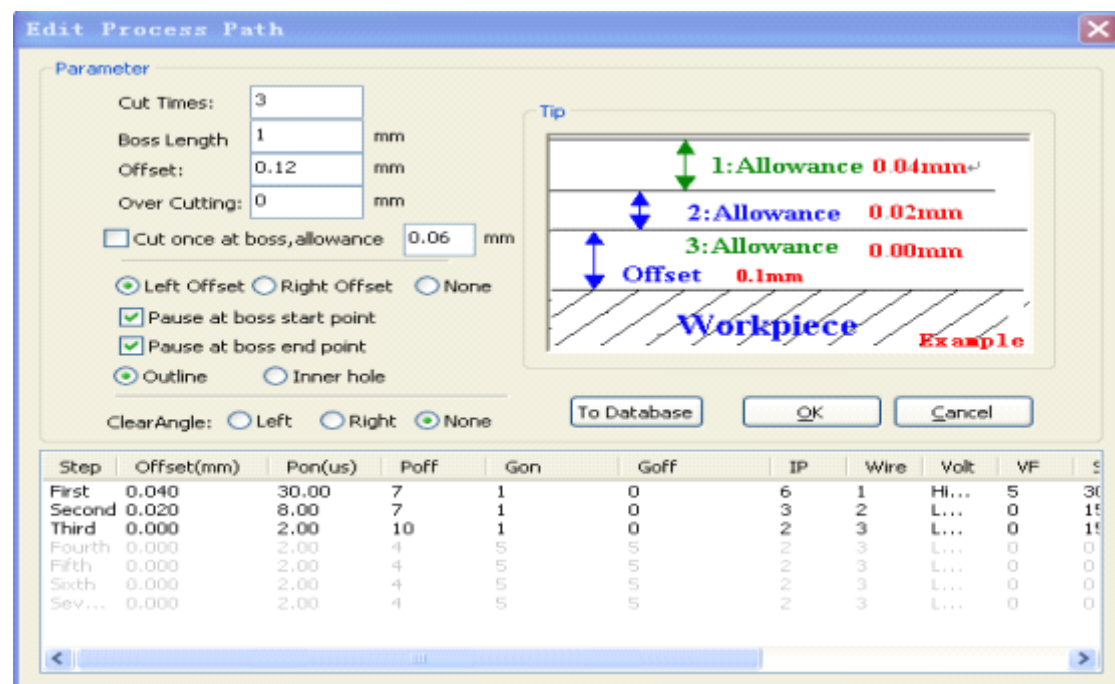


Figure 4.23: Edit Process Path

Parameters of the dialog is the process parameter of the selected process track, user can modify parameters through this function, modify method is as same as the setting process of “Create multiple process track”, after modification, click the “OK” button to complete the resetting process of the process track parameters.

4.5 Technics Library

Click “Maintain Process Library” menu under “AutoCut” menu, will display the interface of the “Expert Database” (Figure4.24).

Times	allowance (mm)	Pon (us)	Poff	GPon	GPoff	IP	Wire	Volt	V-F	Max Speed
<input checked="" type="checkbox"/> First	0.04	30	7	1	0	6	1	Low	5	300
<input checked="" type="checkbox"/> Second	0.02	8	7	1	0	3	2	High	0	150
<input checked="" type="checkbox"/> Third	0	2	10	1	0	2	3	High	0	150
<input type="checkbox"/> Fourth	0	2	4	5	5	2	3	High	0	0
<input type="checkbox"/> Fifth	0	2	4	5	5	2	3	High	0	0
<input type="checkbox"/> Sixth	0	2	4	5	5	2	3	High	0	0
<input type="checkbox"/> Seventh	0	2	4	5	5	2	3	High	0	0

☒ Factory Database ☐ User Database
 Technics No.: 0 (1-3000)
 Wire Diameter(mm): 0 (0.05-0.5)
 WorkpieceHeight(mm): 0 (0.1-2000)
 Offset(mm): 0.12 (0.05-0.15)
☒ Outline ☐ Inner hole
 Material:

Factory database User database
 Number1-materials:123456-Wire D0.180mm-Thickness45.000mm-Silk Offset0.120mm-Work times3--Shape
 Number3-materials:123456-Wire D0.180mm-Thickness45.000mm-Silk Offset0.120mm-Work times1--Shape

Add
 Update
 Delete
 OK
 Cancel

Figure4.24: Expert Database

- 1) **Remain (mm):** the distance of the twice cutting, unit: millimeter (mm).
- 2) **Pulse width (microsecond):** 0.5~250 microsecond;
- 3) **Pulse interval (pulse width number):** 1~30;
- 4) **Grouping pulse width (pulse number) :** 1~30;
- 5) **Grouping interval (times):** 1~30;
- 6) **Channel:** 1~ 6;
- 7) **Silk speed:** 0~3;
- 8) **Voltage:** High or low voltage;
- 9) **VF:** Can adjust the stability of the track, the track is better when the value is smaller; zero means not set;
- 10) **Max Speed:** the most speed when processing; zero means not set;
- 11) **Technics Number:** Process log's number in the technics library (virtual value: 1-3000);
- 12) **Molybdenum wire diameter (0.05-0.5):** the molybdenum wire diameter suitable for the current process log;
- 13) **Workpiece thickness (0.1-2000):** the Workpiece thickness suitable for the current process log; unit: mm;
- 14) **Molybdenum wire compensate (0.05-0.15):** the molybdenum wire compensate suitable for the current process log; unit: mm;
- 15) **Shape, Inner:** Shape, inner selection;
- 16) **Materials:** Descript the process material suitable for the current process log.

Add to the technics library: add process parameters to the technics library for using them at next processing.

Update the technics library: select the process log which has been written in the technics library list, and the process parameters of the selected process log will be display, modify corresponded parameters, then click this button, update the technics library.

Delete from technics library: select one process log which has been written in the technics library list, click this button, will delete the selected process log from the technics library list.

Technics library list: display the process parameter list in the database.

4.6 About AutoCut

Chapter 5 The usage of AutoCut control software

AutoCut wire cutting control software, friendly interface, convenient operation, general worker can use it from?? ten minutes to two hours .User needn't touch complicated process code , just need draw the process graphic in CAD software, then generate the corresponding process track, can process the part. Main interface as follows (Figure 5.1):

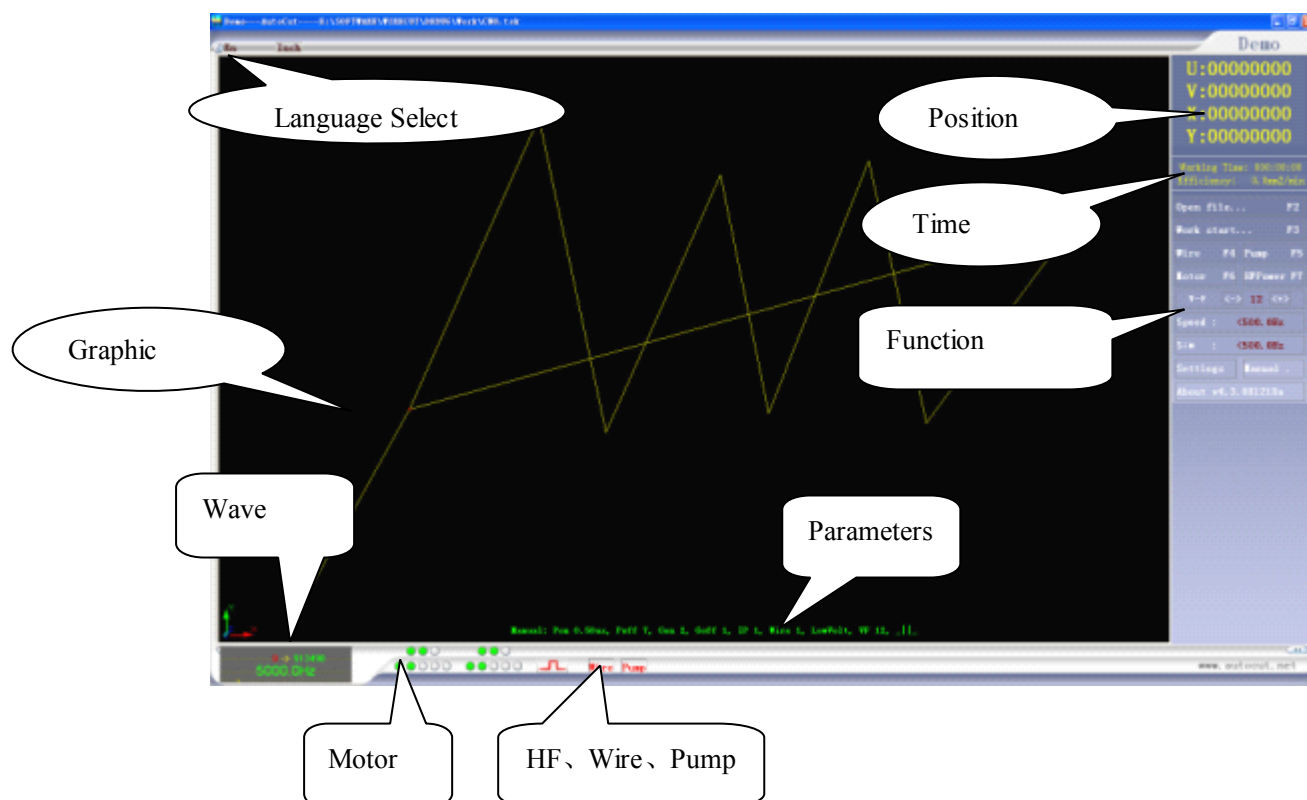


Figure 5.1:Main Interface

5.1 Interface

5.1.1 Language Selection

Click mouse left key at “Language selection area”, will display the interface of

✓ 中文简体

English

Русский

Chinese, English and Russian switch

switch through clicking mouse left key to select.

, user can finish the language

5.1.2 position show

When incising or empty walking, the position of X、Y、U、V four axes truly process

will be displayed in position show area.

5.1.3 time show

When processing, “Used time” means that the time is that has been used during the workpiece process, “remain time” means that the time is need to finish workpiece process.

5.1.4 Graphic Show Area

When incising or empty walking, Graphic Show Area will real-time display the current process position.

5.1.5 Process Wave

Process Wave will display the speed and the stability of process real-time.

5.1.6 Process Parameter

Real-time display the current process parameters : pulse width 、 pulse distance 、 grouping pulse width、 grouping distance 、 silk speed etc.

5.1.7 Step Motion Show

Real-time display the step motion is locked or not.

5.1.8 High Frequency、 Move-Threading、 Water Pump Show

Real-time display the high frequency、 move-threading、 water pump are open or not.

5.1.9 Function

Function area include open file, start process, motion, high frequency, gap, incising limit speed, empty-walking limit speed, settings, manual, about etc.

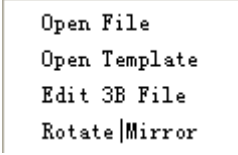
5.2 Load process task

5.2.1 CAD Graphics Drive

Use “Send Process Task” command in AutoCAD or NCCAD software, send the process track to the control software, user who needn’t touch the code, can process the workpiece.

5.2.2 Load File

Click the “Open File” button in control software or use shortcut key “F2” or click mouse right key on the “Open File” button ,will display the pull-down menu



Open File
Open Template
Edit 3B File
Rotate | Mirror

, select “Open File ”, will display the follow dialog (Figure5.2), select any file type in “file type”, then select the file that will be processed, open it and start processing, (ISO-G Code 、 AutoCut Task are the process file generated by NCCAD, 3B Code is generated by CAXA etc other drawing software);

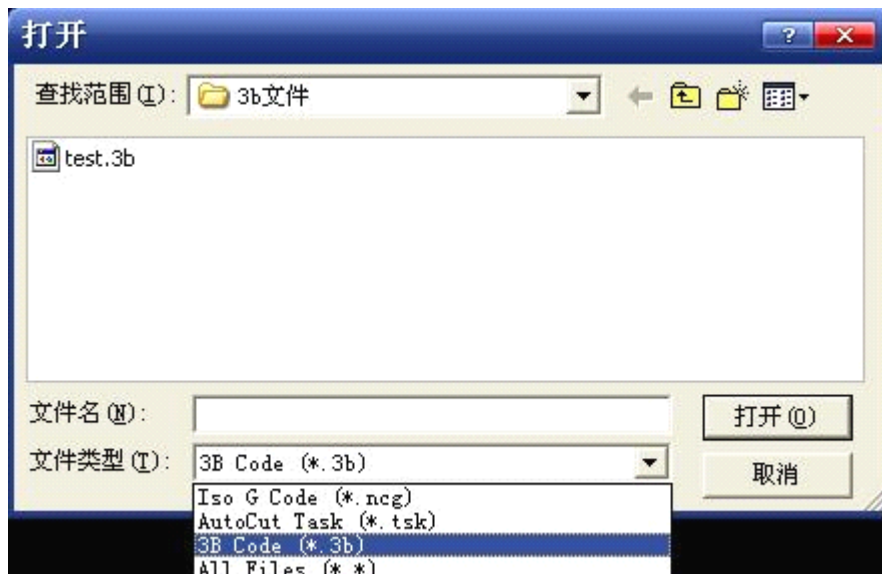
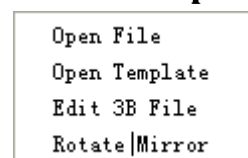


Figure 5.2: Open File

5.2.3 Load Template

Click “Open File” button in control software, will display the pull-down menu



, select “Open Template”, will display the follow dialog (Figure 5.3):

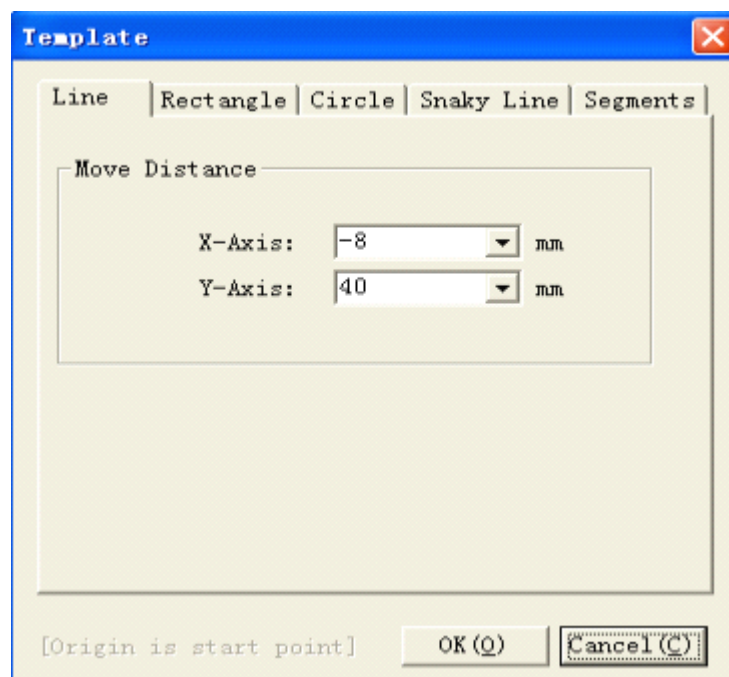


Figure 5.3: Template-Line

Line (Figure 5.3)

X axis distance: the X axis distance which need process, unit: millimeter (mm);

Y axis distance: the Y axis distance which need process, unit: millimeter (mm);

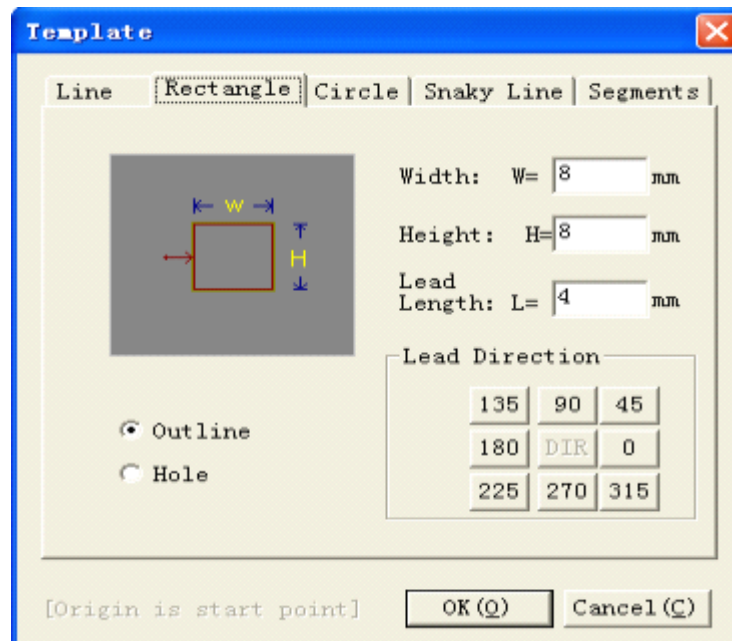


Figure 5.4: Template-Rectangle

Rectangle (Figure 5.4)

Rectangle width: the rectangle width which need process, unit: millimeter (mm);

Rectangle height: the rectangle height which need process, unit: millimeter (mm);

Lead Length: the length of the lead in of the rectangle which need process, unit: millimeter (mm);

Outside outline: means that is outside outline need process, leadin lie to the outside of rectangle which need process;

Inner hole: means that is inner hole need process, leadin lie to the inside of rectangle which need process;

Leadin direction: the direction of the leadin, has eight types:

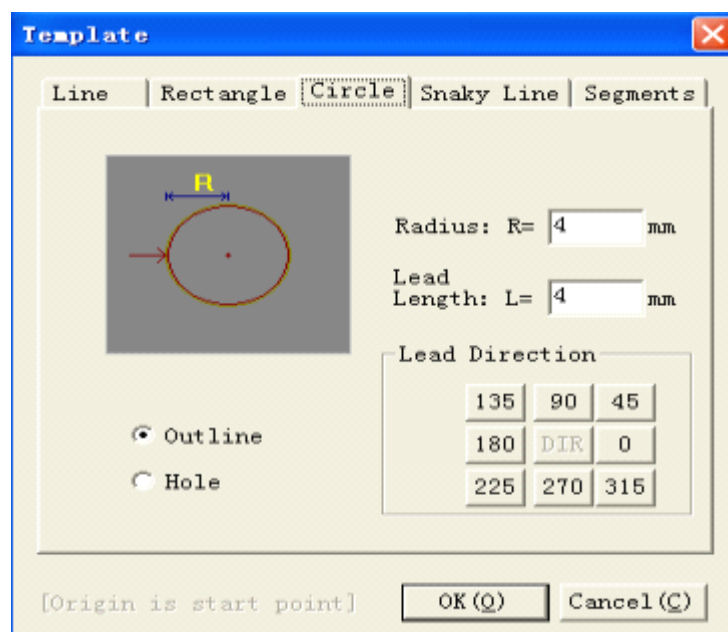


Figure 5.5: Template-Circle

Circle (Figure 5.5)

Circle radius: the radius of the circle which need process, unit: millimeter (mm);

Leadin: the length of the leadin of the circle which need process, unit :millimeter (mm);

Outside outline: means that is outside outline need process, leadin lie to the outside of circle which need process;

Inner hole: means that is inner hole need process, leadin lie to the inside of circle which need process;

Leadin direction: the direction of the leadin, has eight types:

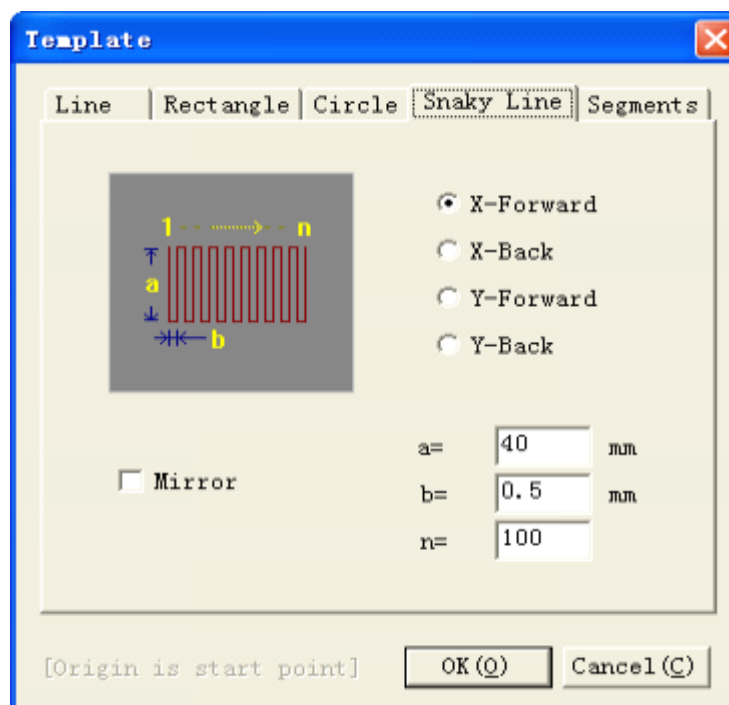


Figure 5.6: Template-Snaky Line

Snaky Line (Figure 5.6)

Step Direction: X forward, X backward, Y forward, Y backward four direction;

Height a: the height of the snaky line, unit: millimeter (mm);

Single width b: the single track width of the snaky line, unit: millimeter (mm);

Curve times n: the curve times of the snaky line;

Left-Right Mirror: mirror the current snaky line from left (right) to right (or left);

5.3 Settings

Settings interface as follows (Figure 5.7): include motion settings, process settings, high-frequency settings, encode settings, startup picture settings and system about etc:

- 1) **Motor (Figure 5.7)**

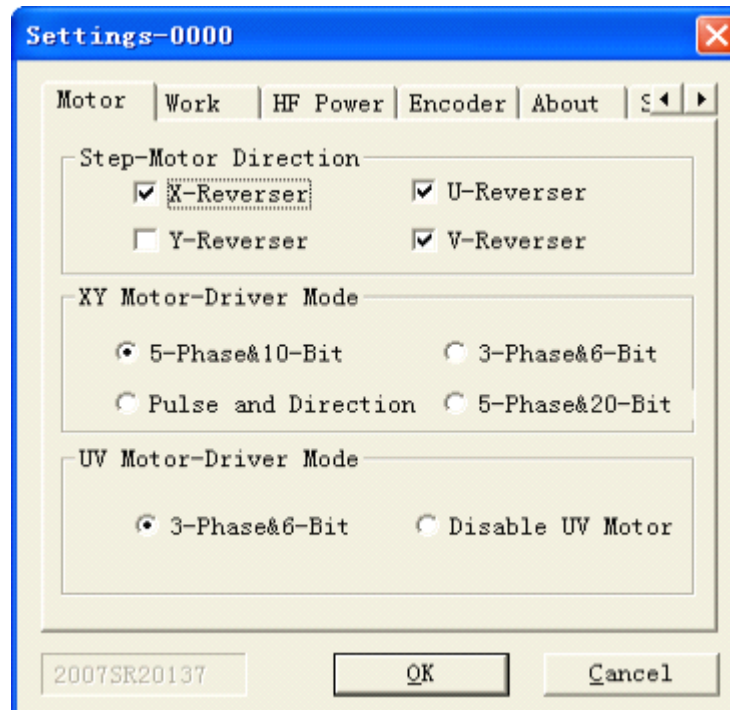


Figure 5.7: Setting-Motor

Stepper Motor Direction:

X-Reverser: after select it, will reverse the walk direction of X axis stepper motor;

Y-Reverser: after select it, will reverse the walk direction of Y axis stepper motor;

U-Reverser: after select it, will reverse the walk direction of U axis stepper motor;

V-Reverser: after select it, will reverse the walk direction of V axis stepper motor;

XY Axes Drive Types:

5-phase 10-beats: After selected, 5-phase stepper motor work with 5-phase 10-beats mode;

3-phase 6-beats: After selected, 3-phase stepper motor work with 3-phase 6-beats mode;

Drive Distribute Pulse Sequence: After selected, Control card export pulse and direction signal, this selection is used for the servo motor as usually;

UV Axes Drive Types:

3-phase 6-beats: After selected, 3-phase stepper motor work with 3-phase 6-beats mode;

Close UV axes stepper motor: After selected, will not use UV axis stepper motor;

2) Processing (Figure 5.8):

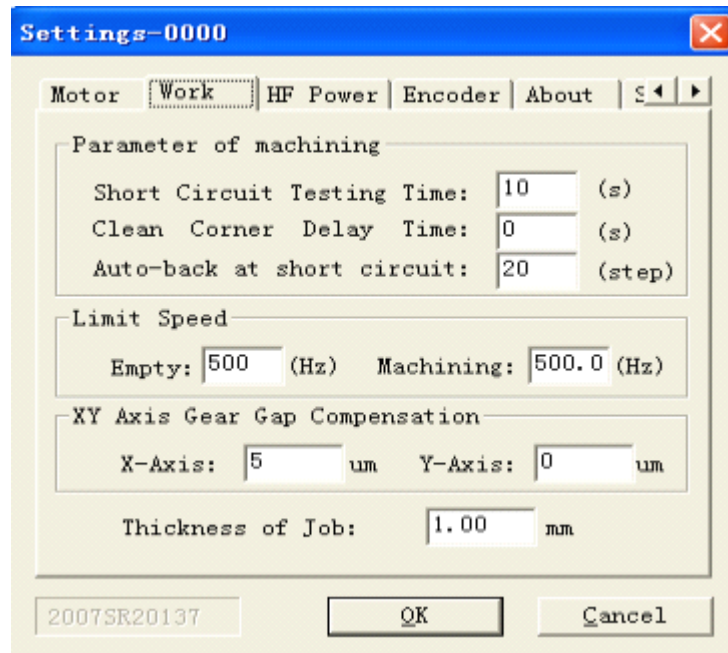


Figure 5.8: Setting-Processing

Processing Parameters:

Short-circuit check-wait time: the time of checking short-circuit when Processing, unit: second;

Clearing corner delay time: the time is the pause time at the corner when process to the corner;

Short-circuit auto-back: Short circuit when processing, the step of the system auto-back, unit: step;

Limit Speed:

Empty walking limit speed: the most run speed when empty walking, unit: step per second (Hz);

Incising limit speed: the most run speed of the motor when Incising, unit: step per second (Hz);

Tooth Compensation:

X axis compensation value: the tooth compensation of X axis compensation value, unit : micrometer (um);

Y axis compensation value: the tooth compensation of Y axis compensation value, unit : micrometer (um);

Process thickness (used to calculate efficiency): input the real workpiece thickness, unit: millimeter (mm);

3) **High-Frequency (Figure 5.9):**

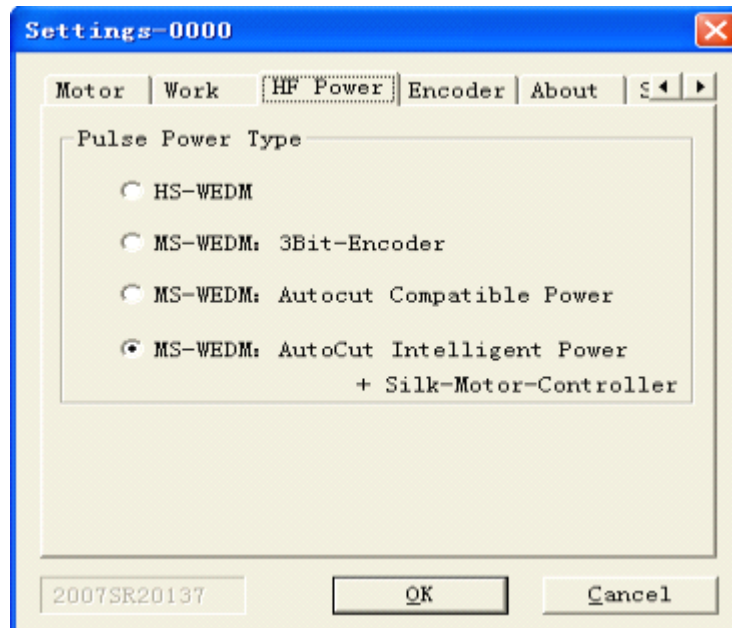


Figure 5.9: Setting-High-Frequency

High-Frequency Types:

HS-WEDM: common HS-WEDM High-Frequency;

MS-WEDM: 3Bit-Encoder;

MS-WEDM: AutoCut Compatible Power;

MS-WEDM: AutoCut Intelligent Power + Silk-Motor-Controller;

4) Encoder (Figure 5.10):

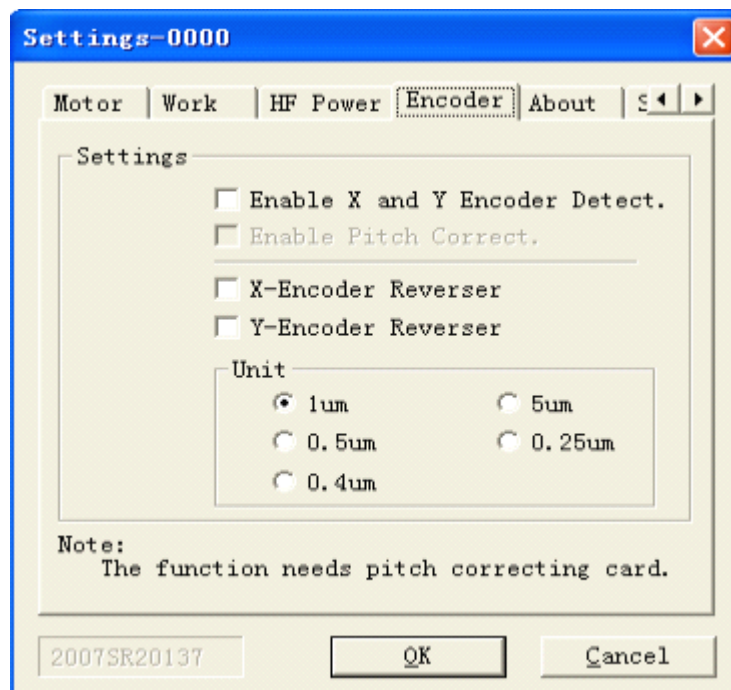


Figure 5.10: Setting-Encoder

Settings:

Enable X and Y Encoder detect: Can link circle encoder or linear encoder;

Enable X and Y pitch correct: After selected, Can modify the pitch error of

the lead screw, this function need input the table of pitch error;

X Encoder reverser: After selected it, will reverse the detected direction of X feedback signal;

Y Encoder reversing: After selected it, will reverse the detected direction of Y feedback signal;

Discrimination: can support the circle or linear encoder which discrimination is 1um、 5 um 、 0.5 um、 0.25 um、 0.4 um、 4 um;

Attention: this function can use when the circle or linear encoder has been installed on the machine, and they must be link to AutoCut pitch correct card.

5) About (Figure 5.11)

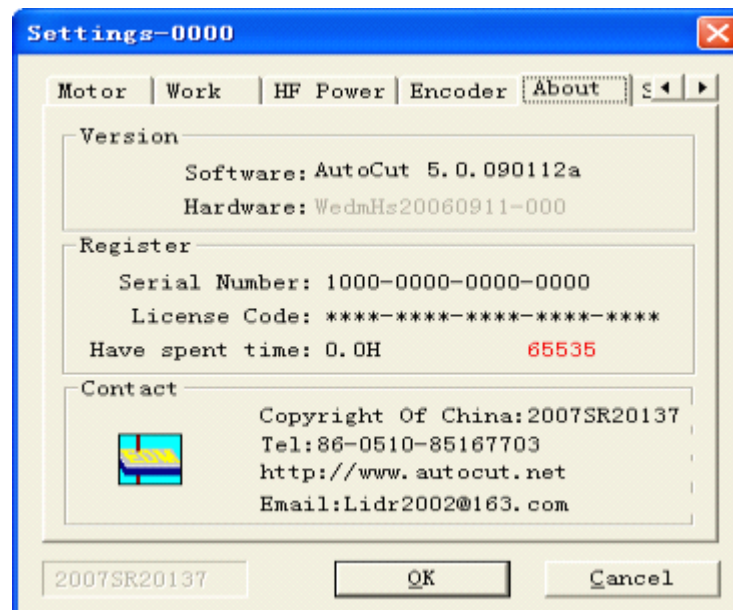


Figure 5.11: Setting-About

About meet with 5.16.

6) Startup picture (Figure 5.12): Control software can display the franchiser picture as startup picture when running the software, Display types include: not display, auto close after display the set time, continue display until manual close it.

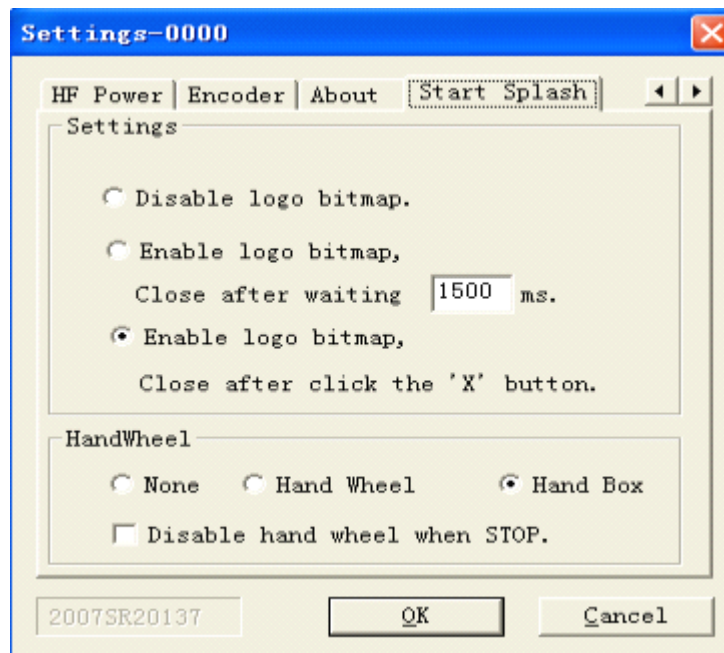


Figure 5.11: Setting-Startup Picture
Hand Wheel: include none, Hand Wheel and Hand Box;

5.4 Start Processing

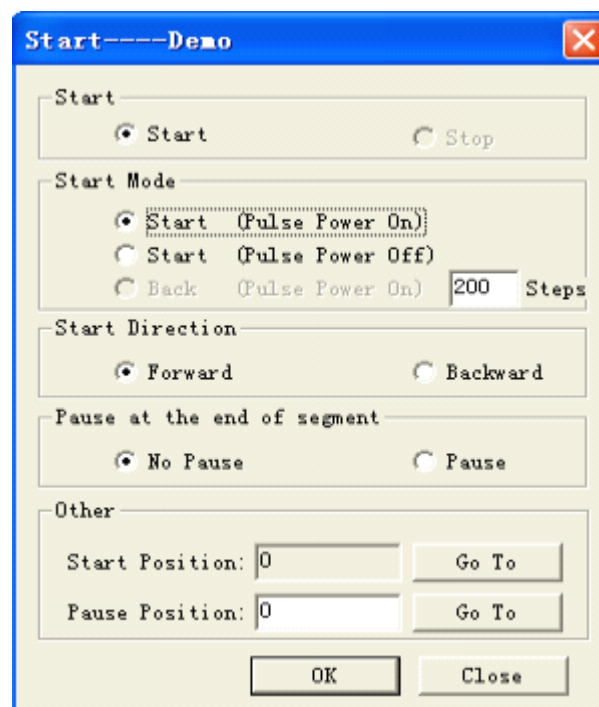


Figure 5.12: Start Processing

1) Start:

Start: Start processing;

Stop: Stop the current Processing;

Attention: user can't exit program when processing, must pause or

stop the current process at first, then can exit the program;

2) Start Mode:

Start (Pulse Power On): Open High-Frequency pulse power, Incising;

Start (Pulse Power Off): Not open High-Frequency pulse power, machine empty move;

Back (Pulse Power On): Open high-frequency pulse power, back move specify steps (the specify steps can be set in the settings interface);

3) Start Direction:

Forward: Incising direction is same as the direction of processing track;

Backward: Incising direction is converse as the direction of processing track;

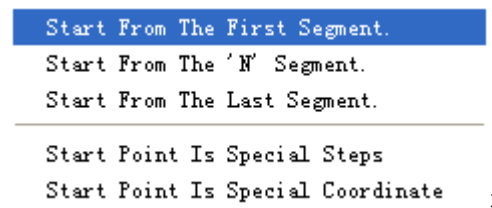
4) Pause at the end of segment:

No Pause: Stop after finishing the whole processing;

Pause: Pause after finishing one line or circle, wait user to deal with;

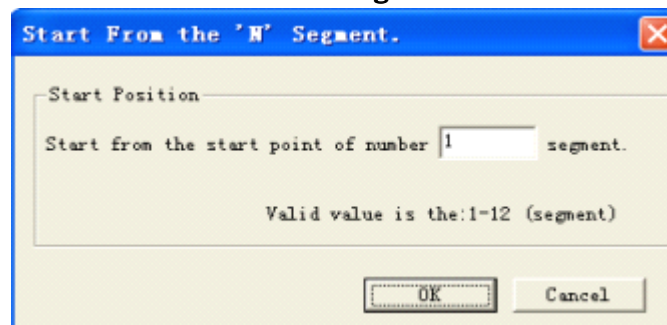
5) Other:

Start Position: click “Go to” button, display the pop-up menu



Select “Start From the First segment”: set the start point of the first segment as the start point;

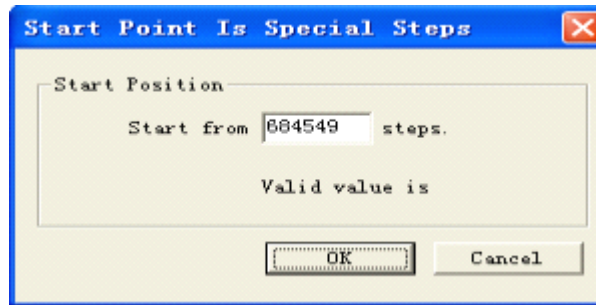
Select “Start From the ‘N’ segment” :



Input one value (in virtual value) to set the the start point of the ‘N’ segment as start point;

Select “Start Point From the Last Segment”: set the start point of the last segment as the start point;

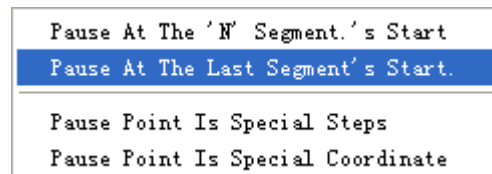
Select “Start Point is Special Steps”:



Input a special step

(in virtual value) to set the specify steps as start point;

Pause Position: click “Location” button, display the pop-up menu



, usage is same as the function of

“Relocation Start Point”;

After finishing the above selection, click the “OK” button to start processing, the originally “Start Process ” button will display “Pause Process”, user can click the button when need pause the processing, the above dialog (Figure 5.12) will be displayed for user to deal with corresponding things.

5.5 Motor



This command is used to lock or unlock the motor, when the motor is locked, the main interface will display with the green light as follows (Figure 5.13), otherwise will display the gray light.



Figure 5.13: Motor

5.6 High-Frequency



This command is used to open or close the high-frequency Pulse power, when it is opened, the main interface will display with the red pulse as follows (Figure 5.14), otherwise will display the gray pulse.

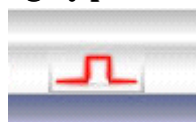


Figure 5.14: High-Frequency

5.7 Wire



This command is used to open or close the wire, when the wire is opened, the main interface will display with the red text as follows (Figure 5.15), otherwise will display the gray text.



Figure 5.15: Wire

5.8 Pump



This command is used to open or close the pump, when the pump is opened, the main interface will display with the red text as follows (Figure 5.16), else will not display the gray text.



Figure 5.16: Pump

5.9 Gapping

This command is used to modify the stability of processing. When processing thickness workpiece, the processing will not stability, add the value, will make the processing stability, click mouse left key on the display distance of the number, will display the dialog (Figure 5.17)

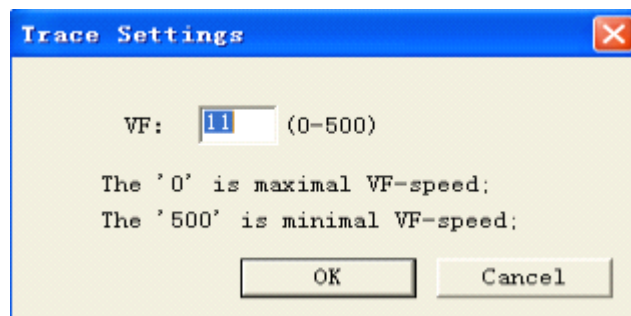




Figure 5.17: Trace Setting

Can modify the track value quickly, the range of the modification is between 0 and 500; click mouse left key  or  to micro-modify.

5.10 Incising Limit Speed

This function is used to set the max speed of incising (Figure 5.18), unit: step per second (Hz);

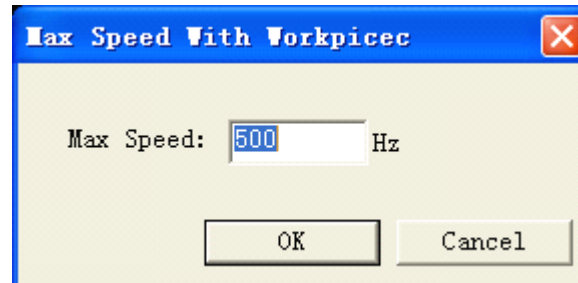


Figure 5.18: Incising Limit Speed

5.11 Empty Walking Limit Speed

This function is used to set the max speed of empty walking (Figure 5.19), unit: step per second (Hz);

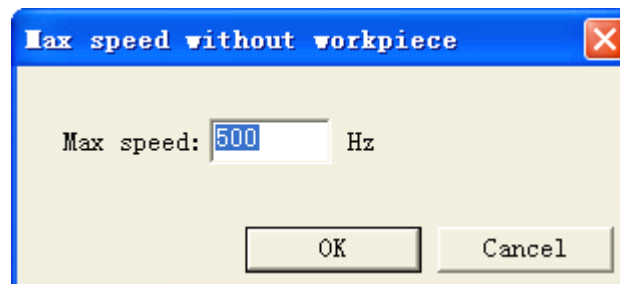


Figure 5.19: Empty Walking Limit Speed

5.12 Manual Function

1) Move Axes (Figure 5.20)

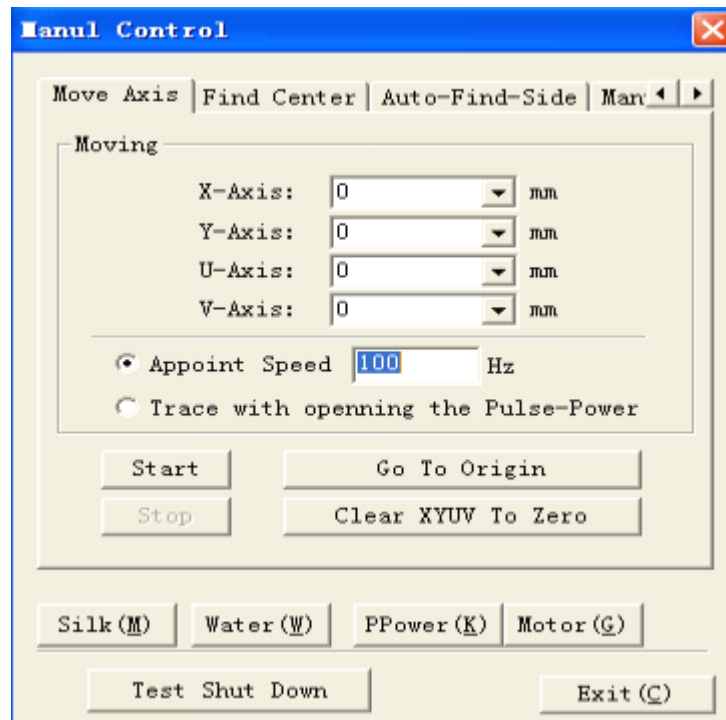


Figure 5.20: MoveAxes

Moving

X axis: the distance of X direction moving, unit: millimeter (mm);

Y axis: the distance of Y direction moving, unit: millimeter (mm);

U axis: the distance of U direction moving, unit: millimeter (mm);

V axis: the distance of V direction moving, unit: millimeter (mm);

(Attention: Input the plus will move to positive, otherwise input negative will move to negative)

Appoint Speed: move the special steps of any axis with fixed speed, unit: steps per second;

Trace with opening the Pulse-Power: Move the specify steps of any axis with incising;

Start: After setting the parameter, click the button to begin moving;

Stop: click the button to finish the motion during the moving;

Go To Origin: back to the origin with the shortest path;

Clear XYUV To Zero: clear the coordinate of X ,Y ,U, V axes in the main interface ;

Usage method:

1) **Empty Walking Move:** Input the moving distance in the corresponding moving direction, and set walking speed (default as 100 Hz), click the “Start ” button, move the special distance by special direction, user can click the “Stop ” to finish the motion during the moving;

2) **Moving with Incising:** click the “Track Step ”, system will auto open the high-frequency, incising the special distance by special direction, user can click the “Stop” button to finish the moving during the incising;

- 3) **Go To Origin:** when machine stop, user can click the “Back Origin” button, system will go back to the coordinate origin by the shortest path.
 - 4) **Clear XYUV To Zero:** click the button, user can clear the coordinate of X、Y、U、V four axes in the main interface ;
- 2) **Find Center (Figure 5.21)**

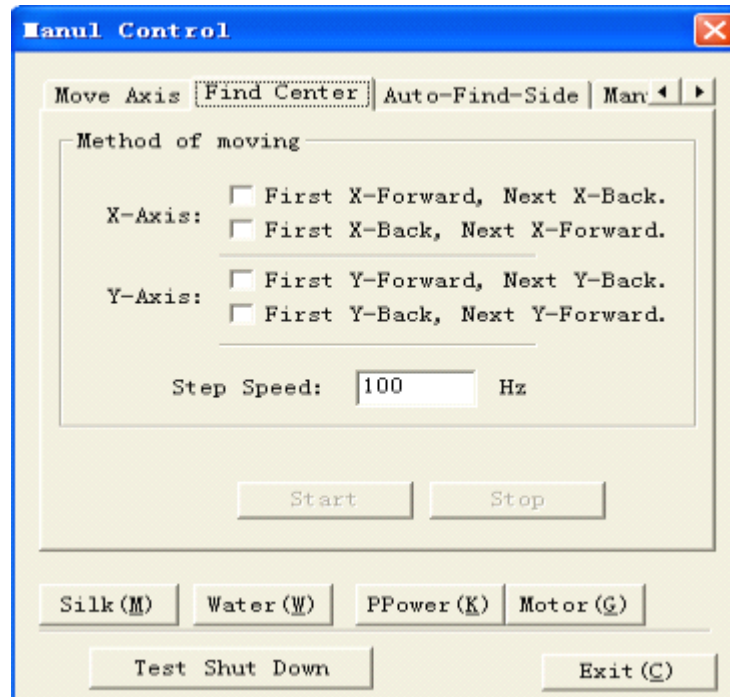


Figure 5.21: Find Center

Method of moving:

X-Axis: include “First X-Forward, Next X-Back” and “First X-Back, Next X-Forward”;

Y-Axis: include “First Y-Forward, Next Y-Back” and “First Y-Back, Next Y-Forward”;;

Step Speed: move by special speed, unit: step per second (Hz);

Start: After setting parameters, click the button to start finding center;

Stop: click the button to finish finding center during the process of the find center;

Usage method: Select step order in “X-Axis” or “Y-Axis”, and set step speed (default 100Hz), click “Start” to start find center, user can click “Stop ”button to finish finding center during the process of the find center, otherwise machine will stop until find the center.

- 3) **Auto-Find-Side (Figure 5.22)**

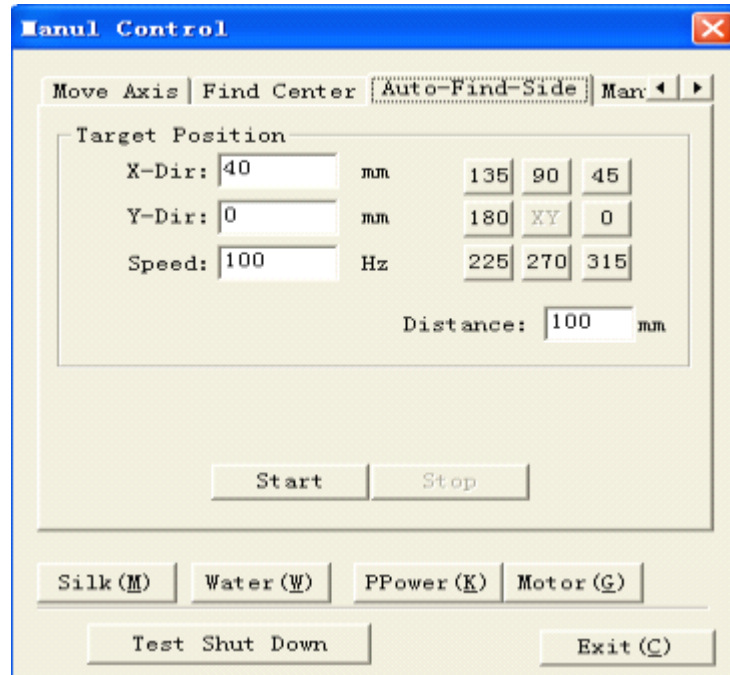


Figure 5.22: Find Side

Target Position:

X-Dir: the most distance to find side at X direction, unit: millimeter (mm);

Y-Dir: the most distance to find side at Y direction, unit : millimeter (mm);

Speed: find side by special speed, unit: step per second (Hz);

Distance: the most find-side distance, machine will stop when go to the distance;

Find-side parameters (X-Dir, Y-Dir and Speed) can be directly inputted or auto-calc through specified distance and direction;

Start: After setting parameters, click the button to start finding side;

Stop: click the button to finish finding side during the find-side;

Usage method: Input the most distance of find-side in the special direction (if machine can't find side when move the distance, will stop), set step speed, click "Start " to start finding side, user can click "stop " to finish finding side during the find-side, otherwise machine will stop until find the side;

4) Manual-Find-Side (Figure 5.23)

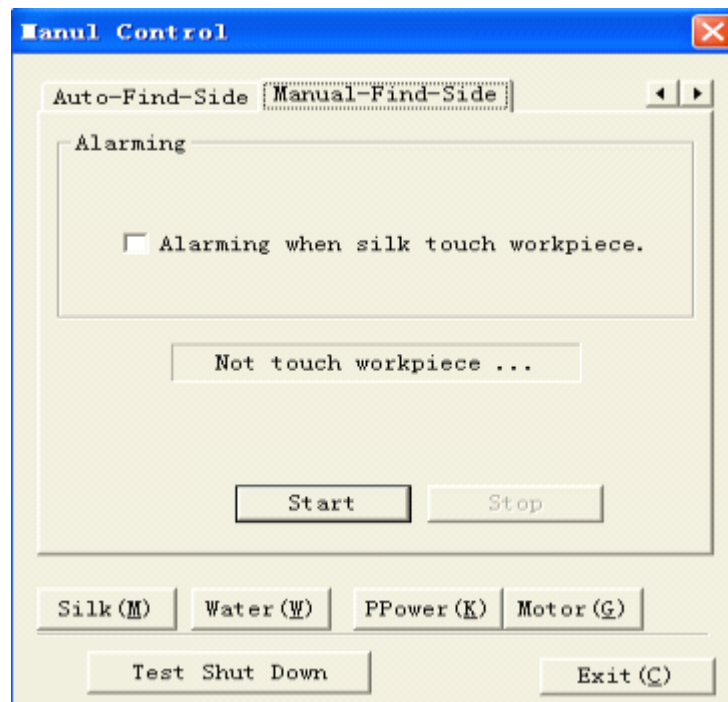


Figure 5.23: Manual Find-Side Alarm

Alarming: when user select **Manual-Find-Side**, select “**Alarming when silk touch workpiece**”, system will alarm when molybdenum silk touch the workpiece, otherwise system will not alarm;

In addition, user can open or close silk, high frequency, motor etc in the manual function, can test the function of shutdown;

5.13 Pitch Correct

Click  button, will display the dialog as follows (Figure 5.24):

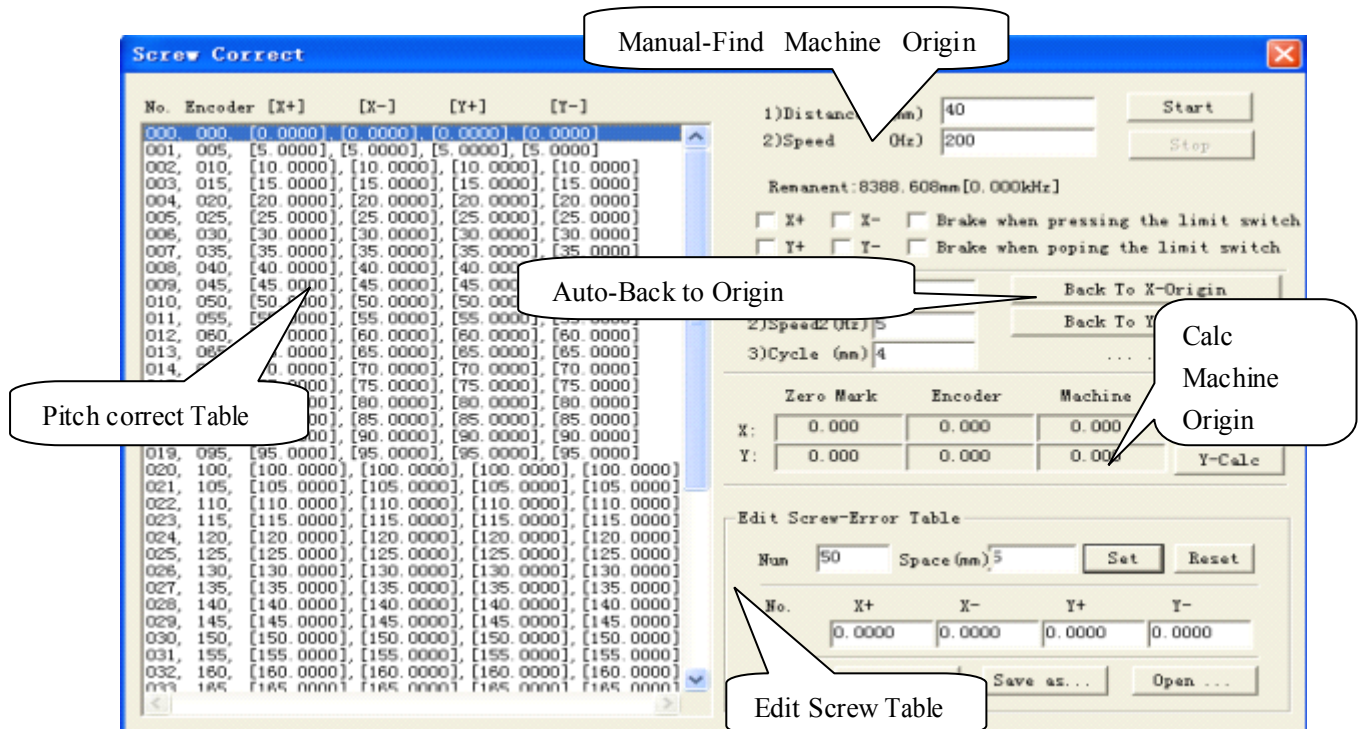


Figure 5.24: Pitch Correct

- 1) **Pitch correct table:** when enable the function of the pitch correct, correct the pitch error of the machine based on this table;

Serial Number (n): No. n point

Encoder: the Encoder coordinate of No. n, Encoder coordinate = $n * \text{distance}$;

[X+]: the read number of the laser interferometer when X-axis positive through the No. n coordinate.

[X-]: the read number of the laser interferometer when X-axis negative through the No. n coordinate.

[Y+]: the read number of the laser interferometer when Y-axis positive through the No. n coordinate.

[Y-]: the read number of the laser interferometer when Y-axis negative through the No. n coordinate.

- 2) **Manual find the limit switch of machine origin:** Control X axis or Y axis to move, user can set the auto stop when find the travel switch of the machine origin, this function is used to manual find the travel switch of the machine origin;

Distance (mm): the most distance of X-axis or Y-axis moving, machine will stop when move the distance;

Speed (Hz): the most step speed of moving, unit: Hz

X+, X-: select the step direction of X-axis;

Y+, Y-: select the step direction of Y-axis;

Brake when pressing the limit switch: After selecting it, machine will auto stop when check the limit switch is pressed;

Brake when popping the limit switch: After select it, machine will auto stop when check the limit switch is popped;

3) **Auto Return Machine Origin:**

Speed 1(Hz): the moving speed is used to find the travel switch of the machine origin;

Speed 2(Hz): After finding the travel switch, the moving speed is used to find encoder zero;

Cycle (mm): the pitch of the lead screw;

4) **Calculate Machine Origin:**

Clear: clear the coordination of encoder, machine and encoder zero;

X-Calc: calculate the X axis origin coordinate based on the coordinate of X axis encoder and encoder zero;

Y-Calc: calculate the Y axis origin coordinate based on the coordinate of Y axis encoder and encoder zero;

5) **Edit Screw-Error Table:**

Set: Generate the origin date of the pitch correct table based on the Serial Number and the distance;

Reset: Reset the content of the pitch correct table;

Save: Save the current modified date to the pitch correct table;

Save as: to back up the current pitch correct table;

Open: open a being pitch correct table;

Modify Pitch correct table: select one item need be modified in the pitch correct table, can edit the data of “X positive”, “X negative”, “Y positive”, “Y negative”, click the “Save” button to finish the modification.

5.14 Servo Debug

Click **Servo De** button, will display the dialog as follows (Figure 5.25):

The screenshot shows a 'Servo Debugging' window. It has a 'Machine Coordinate' section with a 'Speed' field set to 300 (um/s). Below this are two groups of controls: '绝对' (Absolute) and '相对' (Relative). The '绝对' group has 'Absolute X' and 'Absolute Y' fields, both set to 0, with 'X - Follow' and 'Y - Follow' buttons. The '相对' group has 'Relative X' and 'Relative Y' fields, both set to 5, with 'X - Move' and 'Y - Move' buttons. At the bottom of the 'Machine Coordinate' section is a table with columns 'Total (mm)', 'Dist (mm)', 'Number', and 'Delay (sec)', containing values 0, 50, 10, and 5 respectively. To the right of this table are 'X - Go' and 'Y - Go' buttons. At the very bottom of the window are 'XEncoder - Synchronization', 'YEncoder - Synchronization', and 'Stop' buttons.

Figure 5.25: Servo Debug

X-follow: Input the X-axis absolutely coordinate of the object distance, click the button, will move to the object distance;

Y-follow: Input the Y-axis absolutely coordinate of the object distance, click the button, will move to the object distance;

X-moving: Input the distance of the X axis relatively current coordinate of the object distance, click the button, will move to the object distance;

Y-moving: Input the distance of the Y axis relatively current coordinate of the object distance, click the button, will move to the object distance;

5.15 High-Frequency Settings

Click mouse left key on “Process parameter display area”, will display

HF Power Settings , click the “High-Frequency settings”, will display the dialog as follows (Figure 5.26),

No.	Pon(us)	Poff	Gon	Goff	C...	Wire	V...	VF	L...
Manual	0.500	3	2	1	1	1	L...	0	0
First	30.000	7	1	0	6	1	H...	5	300
Second	8.000	7	1	0	3	2	L...	0	150
Third	2.000	10	1	0	2	3	L...	0	150
First(T)	30.000	7	1	0	6	1	H...	5	300
Second(T)	8.000	7	1	0	3	2	L...	0	150
Third(T)	2.000	10	1	0	2	3	L...	0	150
Back	30.000	7	1	0	6	1	H...	5	300

Figure 5.26: Technics Parameters

In this interface, user can modify any parameters, operate method: select one parameter item need be modified in the upper list, modify it in parameter 1, then click the “Update” button to update the modified parameters to the technics parameters, click the “OK” to finish the setting;

5.16 About

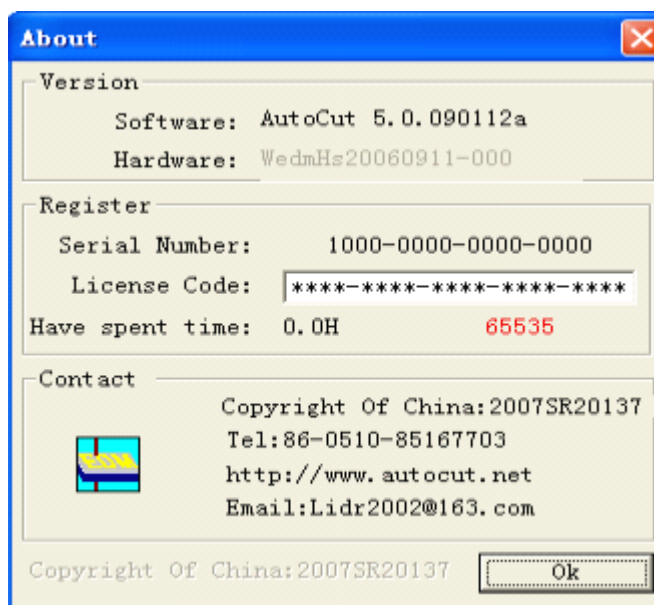


Figure 5.27: About

Version:

Software Version: control software version number, example: AutoCut 1.0;

Hardware Version: motion control card version number, example: WedmHs20070702—001;

Register:

Production Serial Number: motion control card unique serial number;

Production Register Code: Production's register code;

Attention: Tryout client, need get production register code from franchiser, otherwise can use the production in the special time, the production will be locked when the time coming and cann't be used until get the corresponding register code, Tryout client can see the obvious red symbol "TRY" under the graphic area in the control software main interface.

Register method: User send the production serial number (example: 1000-0000-0000-0000) to franchiser, get a bunch of register code (example: abcd-abcd-abcd-abcd-abcd), user may copy or manual input the register code to the

editing frame  in the about interface (Figure 5.27), click the "OK" button to finish the register.

Attention: Register code include "0~9", symbol '-', letter a~f (not match case) three types.

