Content

Chapter 1 Introduction of KEDM(KCUT)

1.1 Brief introduction

KEDM CNC wire cut EDM control system (or named KCUT) was developed based on Windows 7. When use the software, user doesn't need to know detailed programming editing, just needs to draw drawing in CAD software or load relative DXF or DWG file into KEDM, then postprocess the drawing in KEDM to create cutting program. User can set or select relative cutting parameters from database and adjust to get satisfied result. During cutting process, KEDM can also adjust feed speed by itself according to different requirement of cutting speed. This kind graph display of machining status is easy to use.

Cutting feed speed, finished percent of task, cutting efficiency, working time, remaining time, and monitoring of working status are all shown in the main interface of KEDM. Meanwhile, various malfunction (such as power breakdown, hang of computer etc.) would be record and handled to protect and reduce loss of malfunction.

1.2 System composition

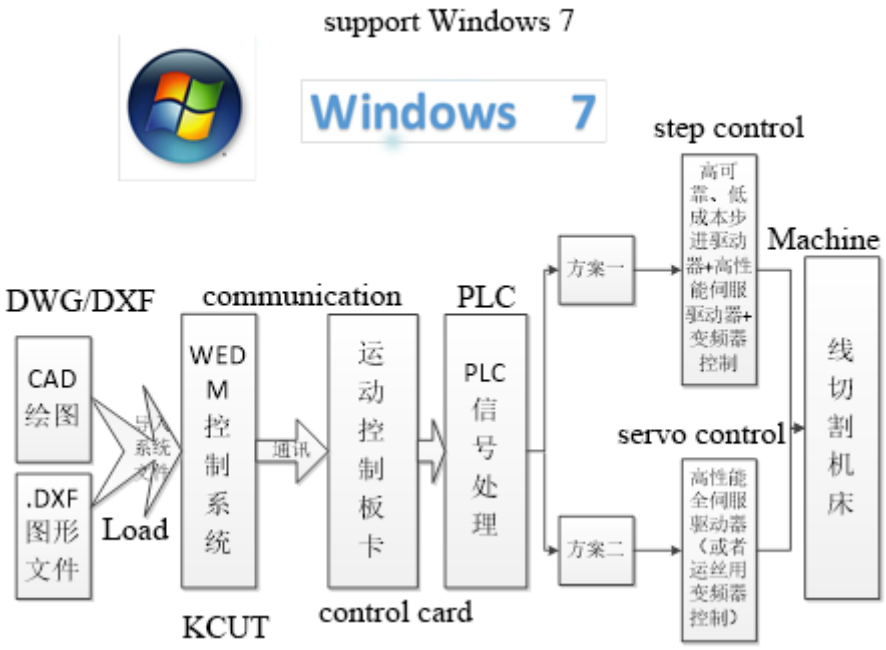


image 1-1 WEDM composition of KEDM

image 1-1 shows complete control solution of KEDM, we offer multiple solutions for different customers' needs. Solution 1: three sets stepping drivers and three sets servo

drivers, this solution can satisfy general requirement of the market with relatively low cost; solution 2: all 6 sets servo drivers for X, Y, U, V, Z and wire drum, it's designed for developing trend with better performance and stability.

1.3 Main functions of KEDM

1) It supports graph-based automatic programming, operator does not need to know programming codes, in practical operation, operator needs to load DXF file created by other software then postprocess in KEDM to create cutting track according to instructions in software.

2) Multiple machining modes, flexible for different purposes, for example, single segment cutting, continuous cutting, forward cutting and backward cutting.

3)XYUVZ can realize 5-axis simultaneous control, drive type could be stepping drive or servo drive, all 5 axes can be monitored in real-time in main interface of cutting.

4) KEDM shows present machining position, coordinate, finished percent of task and left time to go in real-time. Operator can judge actual cutting status according information in GUI, which could be zoomed according to operator.

5) Standard taper control system to realize cutting of equal-degrees taper, variable-degrees taper and abnormity (up-down different profile taper). Multiple axes simultaneous control makes complicated taper cutting much easier and efficient.

6) Standard with multiple cuts capacity to get better surface finish and cut accuracy.

7) With capacity of corner clearing to improve performance of corner cutting.

8) Support compensation of screw pitch, capable of segmental compensation of pitch error of the machine.

9) With automatic alarm function, when machining is done or malfunction appears (such as short circuit), dialogue of alarm pops out and KEDM records information of alarm automatically.

10) Remote control for motion of machine, wire feed, pump, HF power etc., which makes operation more efficient.

11) Remote has tool setting function (wire straightness setting) to simplify straightness of wire to workpiece, easy to switch parameters for tool setting.

12) Power off recovery function, repositioning start point, pause point, end point, moving track selection function.

13) Cutting program setting includes jump holes setting, mirror, rotation, lead-in line setting and so on.

14) Short circuit detection & feed-back, short circuit alarm. When short circuit happens, wire would move back and feed forward again to get suitable gap between

wire and workpiece.

15) Manual function includes move axis, centering, touch edge etc.

16) Setting includes factory default setting, user setting. Factory default setting is not allowed to change unless permission and guidance from manufacturer.

17) IO monitoring could keep monitoring data of input and output and to enable operator know control system better.

18) Debugging system record information of alarms.

19) File management could do setting of graphs in system, it also can read files from hard driver or USB memory, file should be DXF.

20) length measure function to check distance between two points, to make sure graph is correct.

21) Simulation function simulates actual procedure of cutting, to check if programming is correct.

1.4 Main features of KEDM system

1) KEDM adopts graph drive technology, generate cutting track automatically with simple setting, reduce time of programming, increase manufacturing efficiency, reduce possibility of mistakes by operator, and save producing cost.

2) Operation is easy, and easy to learn.

3) multiple axes simultaneous control to simplify programming of complicated taper cutting task.

4) Fully support complete servo control, to satisfy trend of market of high accuracy cutting.

5) Internet communication available, swift, and stable. 4G module is available to connect internet, sim card is required

6) Real-time monitoring, ERP system.

7) PLC control, no more PCBs are used, simplified wiring system, less malfunction. And PLC is very power and has good scalability

8) Real-time IO monitoring

9) Standard network cable connection, fast, stable, and efficient

1.5 System running environment

OS: Windows 7 or latter OS from Microsoft
Basic hardware requirement: 2 Internet connection socket, 4G memory, 32G hard drive

Chapter 2 Main Interface

After installation of system, enter main interface as

image 2-1 shows

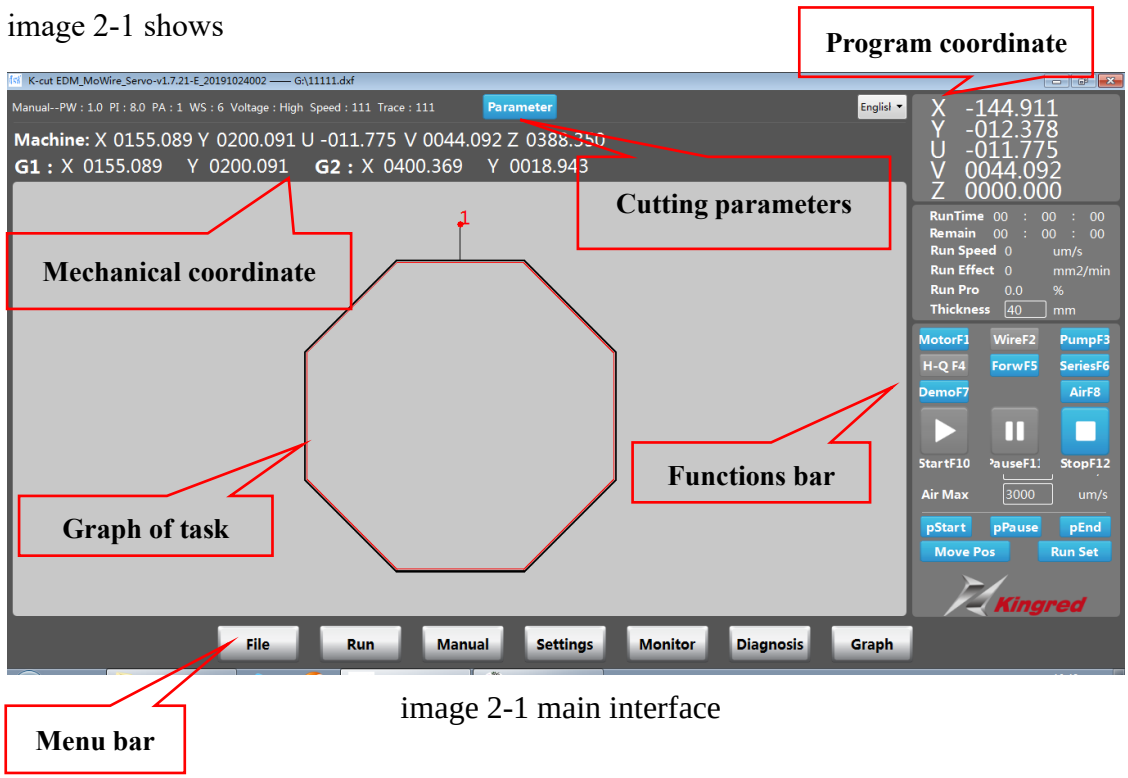


image 2-1 main interface

2.1 Program coordinate of task

Display graph of task in coordinate of XYUV and height of Z axis.

2.2 Menu bar

File management**:** files management, add or delete graph.

Manual function: move axis, auto center, touch edge centering, hypotenuse and etc.

Setting: Factory settings, user settings and so on.

Monitor (I/O monitoring)**:** shows status of present task.

Diagnosis: shows alarm messages

Graph information**:** show information of present task in graph.

2.3 Function bar

2.3.1 Introduction of functions

Runtime: cut time of present task.

Remain: remaining time of cutting present task.

Run speed: feeding speed of present task um/s.

Run Effect: cutting efficiency of present task mm^2/min.

Run Pro: finished percent of present task.

Thickness: Thickness of present job.

2.3.2 Indication of button color: take “Wire F2” for instance

Wire F2: left click to turn it on, or press F2, when button at green color 

, it means the button is activated; and not activated when it’s blue color 

; Gray color 

means it’s not operated; when wire feeding is in working, color is greyish-green 

.

Motor F1: on and off the motors, usually it is always on.

Pump F3: on and off flushing pump

H-Q F4: High frequency power on and off.

Forw/Bacw F5: forward/backward, default is forward, left click to change to backward, and color changed to Green 

.

Forward: actual cutting direction is same as track in the graph of task;

Backward: actual cutting direction is opposite to track in the graph of task.

Series F6: continuous machining, default is continuous machining without stop. Left click to change to single segment machining, color in green 

;

Continuous: stop until complete track is finished.

Single segment: cutting track is usually divided to many different segments, for example an arc or a line, single segment means machine stops after finish one segment and waiting for operator to do next operation.

Demo F7: simulation, left click to enter simulation page, no actual cutting and movement of all axes.

Air F8: it is dry rum, machine moves according to track of cutting program, but no HF power discharging. HF power is off.

Start F10 
: cutting start, left click, or press “F10” of keyboard.

Pause F11  : pause present task, left click, or press “F11”.

Stop F12  : stop present task, to avoid wrong operation by operator, it requires confirmation. left click, or press F12

Tra: trace, it indicates tracing distance between wire and workpiece, decrease the value, wire feeds tightly to workpiece, usually for short workpiece; increase the value, wire feeds less tightly, keeps bigger distance to workpiece, usually for high workpiece. + and – of keyboard can change it, or by mouse.

Run Max: Max speed of actual cutting.

Air Max: Max speed of dry rum, no actual cutting, but machine is moving.

pStart: reselect start point, could be any point of track of graph, mechanical coordinate keeps same, program coordinate changes.

pPause: select any point of track of graph to pause, when cut to this point, machining pauses, Max 20 pause points.

pEnd: select any point of track of graph, cutting completely stops when cut to this point.

2.3.3 Move position

Select position to move: click “Move position” to enter its interface, there are serval options, such as “temporarily move”, “move to start position”, “move to end position” etc.

Temporarily move

In the processing mode, under the pause state, you can choose to manually shift the axis temporarily. Enter the temporary shift axis interface, you can temporarily shift the axis. Before temporarily shifting the axis, the temporary coordinate system is (0,0). When exiting the temporary shift coordinate system, the coordinate system must be (0,0). If forced to exit, the graphics coordinates will not change, but the machine coordinates will change.

There are two modes for returning to the temporary origin, dry run back to the origin,

servo dry run, no discharging, and dry run speed is adjustable. Cutting back to the origin, high-frequency discharging is on, the cutting parameters are processed by the manual axis interface parameters, and the tracking and discharge parameters can be changed during the cutting back to the origin.

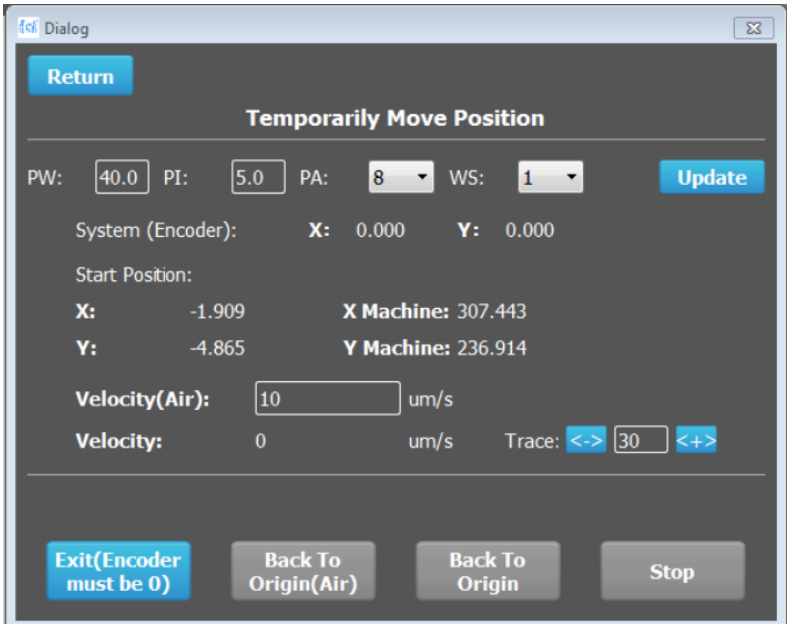


Image 2-4 temporarily move axis

Move to start position of the graph, to end position, to segment number N, etc.
For example, move to start point of segment number N: click the button to move to the starting point of the segment N, then confirm to enter the target segment index, enter the segment number you want to move, after confirmation, enter the moving track interface. After confirmation, start to move the axes.

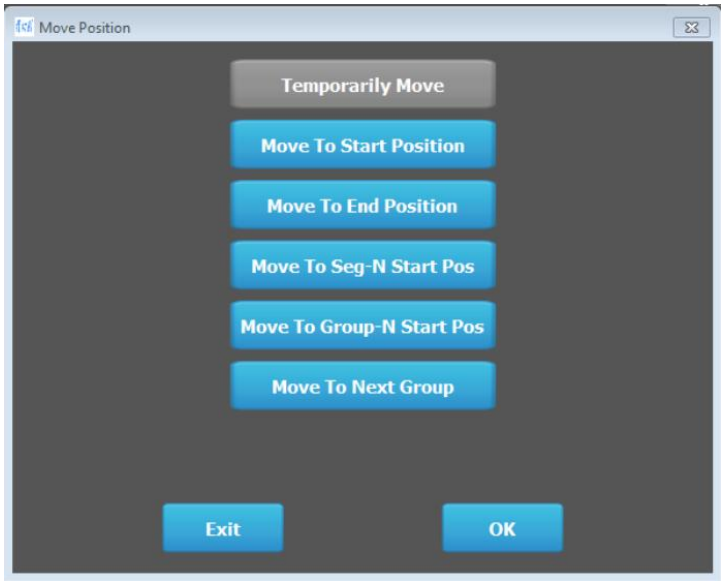


Image 2-5 Move posiiton

2.3.4 Machining setting (work setting)

Work setting: left click to enter the setting interface, there are jump line setting (wire resetting), rotate/mirror, set lead-in line(add wire) and etc. please check image 2-6.

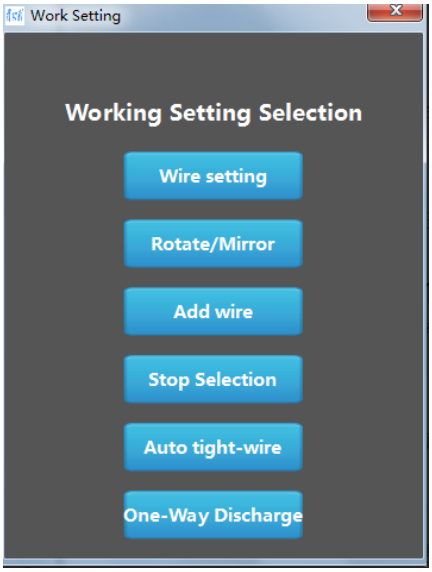


image 2-6 machining setting (work setting)

Graphs jumper setting (wire setting): three options, they are always air-run, jump mode, and working mode.

Jumper mode means there are more than one single graph to cut, i.e. multiple graphics cutting, how to move from one to another is the choice operator needs to decide.

Always air-run: dry drum all the paths of all graphs.

Jump mode: dry run the path between graphs.

Working mode: cut the path between graphs

Tick always air-run: execute dry run all the paths

Tick jump mode: execute jumper mode with dry run of path between graphs

Tick working mode: execute cutting the path between graphs.

If tick nothing, for multiple graphs machining, pause at start point of jumper, and default jumper line as dry run, and waiting for operator to do next steps.

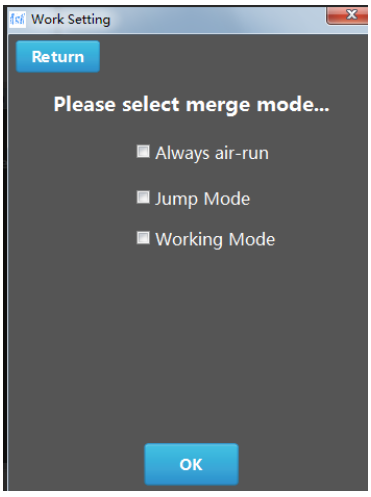


image 2-7 setting of jumper line

Rotate/mirror:

Mirror L-R: tick it and click OK, mirror image of processing track in left-right opposite direction.

Mirror U-D: tick it and click OK, mirror image of processing track in up-down opposite direction.

Rotate degrees: input degrees to rotate, click OK to rotate the graph.

Note: this function can only be used for straight cutting, can't be used for cone(taper) cutting.

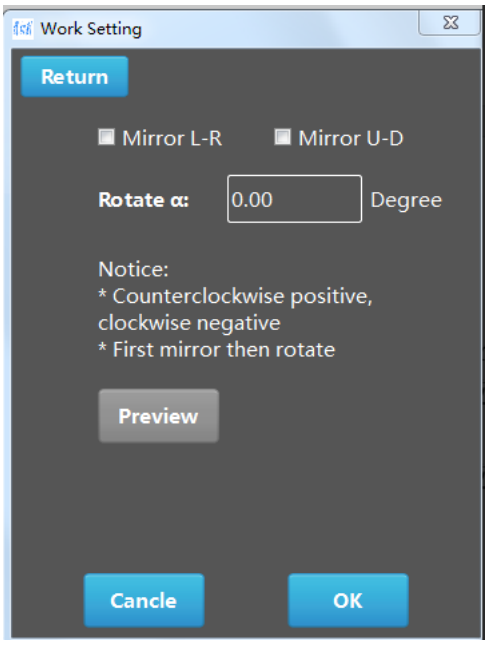


image 2-8 rotate/mirror setting

Add wire(set lead-in line):

X-length: the length of lead-in in X axis, unit in mm.

Y-length: the length of lead-in in Y-axis, unit in mm.

Undo: You can undo the added lead-in line.

Add: add the current lead-in length, and then click the OK button

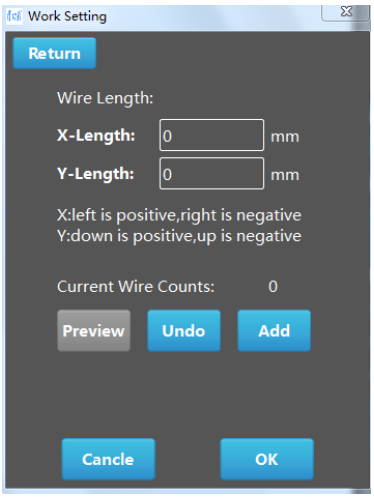


Image 2-9 add wire (add lead-in line)

Stop selection(select the timing to stop wire feed-wire drum stops):
After entering the setting page, there are numbers of selections: multi-group cut, single graph end; current task is over; stop at pause-point; trajectory selection, L Commutate(stop at left direction change position), R Commutate(stop at right direction change position)

Operator just need to tick stop type and stop position, if don't need to use the function, just leave all not ticked.

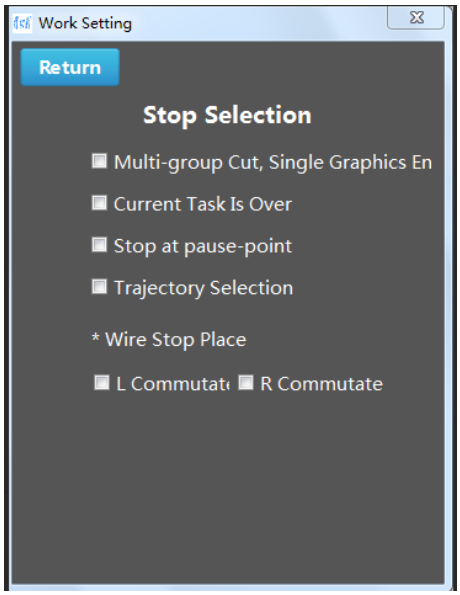


image 2-10 stop selection(select where to stop wire feed)

Auto tight-wire(automatic wire tension control):
For the model with automatic wire tension control, operator select different tightening strength actual to practical cutting.

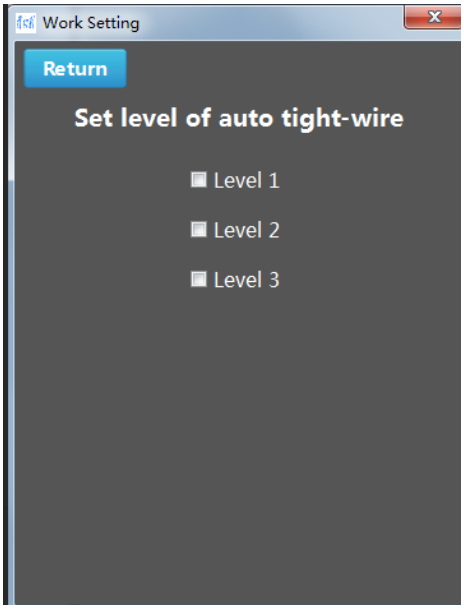


image 2-11 automatic wire tension(set level of auto tight-wire)

One-way discharge:

There are two options, positive and negative direction, that's the direction of wire drum feed.

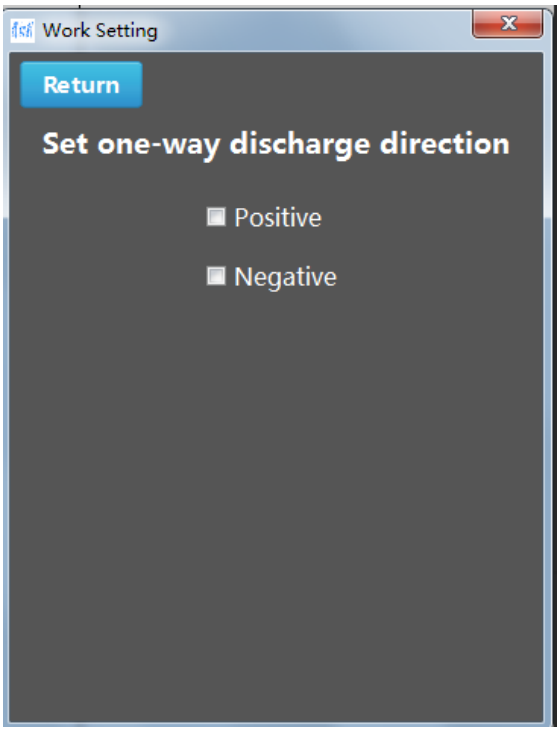


Image 2-12 one-way discharge

2.4 Machining parameters (electrical discharge parameters)

Click “parameters” at the top of main screen to enter parameters setting interface, if the parameters are in practical working, they are in yellow color. If not in practical working, they are in wight color.

Modify parameters:

Select the row of parameters, take 2nd row of 2nd cut for instance. First click 2nd row of parameters, input the value of specified parameter, such as PW, click update and then click OK to complete modification.

Batch modify processing parameters:

Select the row of parameters, take 2nd row of 2nd cut for instance. First click 2nd row of parameters, input all the values of specified parameters to modify, then click All Update and OK.

Manual--PW:40.0 PI:5.0 PA:8 WS:1 Voltage:High Velocity:111 Trace:111

Cut-1--PW:40.0 PI:5.0 PA:8 WS:1 Voltage:High Velocity:100 Trace:30

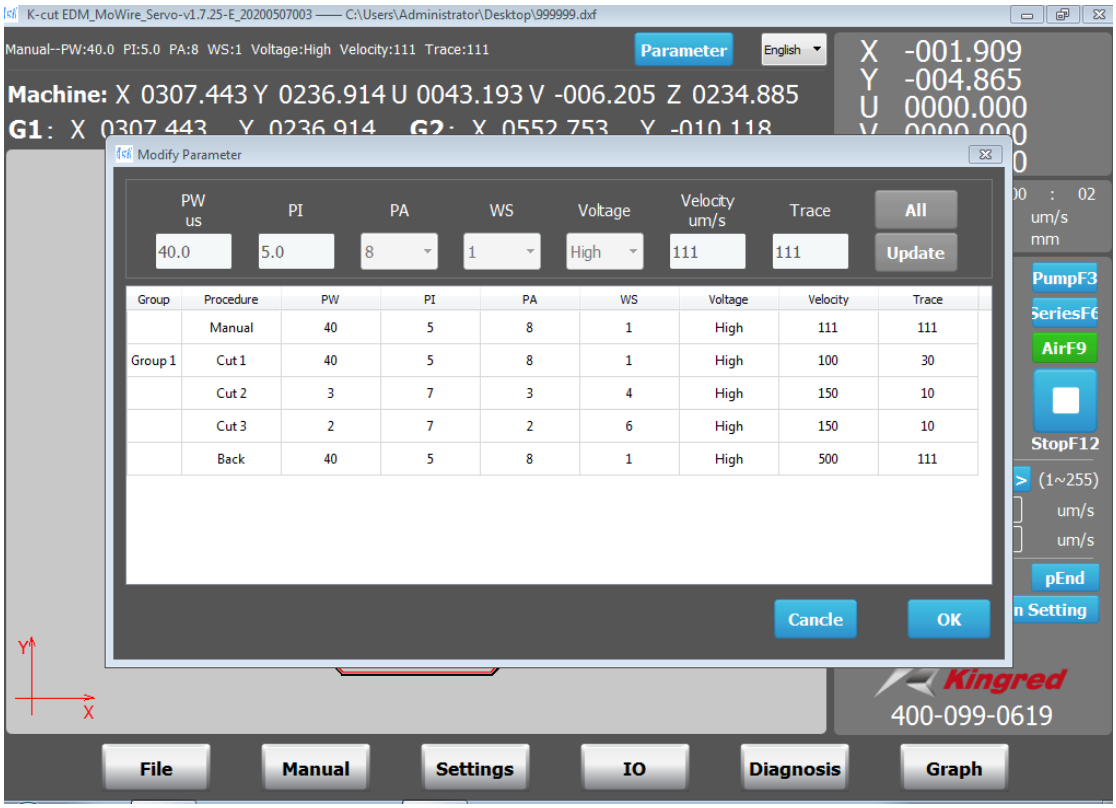


Image 2-13 machining parameters

Note: the cut the path back to start point default as parameters of first cut. Tool setting parameters of remote are same as manual cutting parameters.

2.5 Coordinate setting

Mechanical coordinate: show mechanical movement of X, Y, U, V, Z in coordinate.
X and Y mechanical coordinate can't be set 0/cleared.
When there is no actual cutting, right click UVZ mechanical coordinate, a dialog box pops up, operator can clear the UV axis coordinates, or operator can set the current Z axis coordinates as the fixed height.
The G1 and G2 coordinate systems are for the coordinate system established after manual find center or other similar setting. In the unprocessed cutting program, double-click to enter the G1 and G2 coordinate system. As shown below, take G1 as an example.
Click "X center", to find center of X axis of G1 coordinate system. Click "X reset", to clear X axis of G1 coordinate system.
Move of "Absolute coordinate", move axis to position that reference to (0,0) of G1 coordinate.
Move of "Relative coordinate", move axis to position that reference to present position.
Input X-translation distance, click "start" to move X axis
Input Y-translation distance, click "start" to move Y axis
GoOrigin: go to home of G1 coordinate

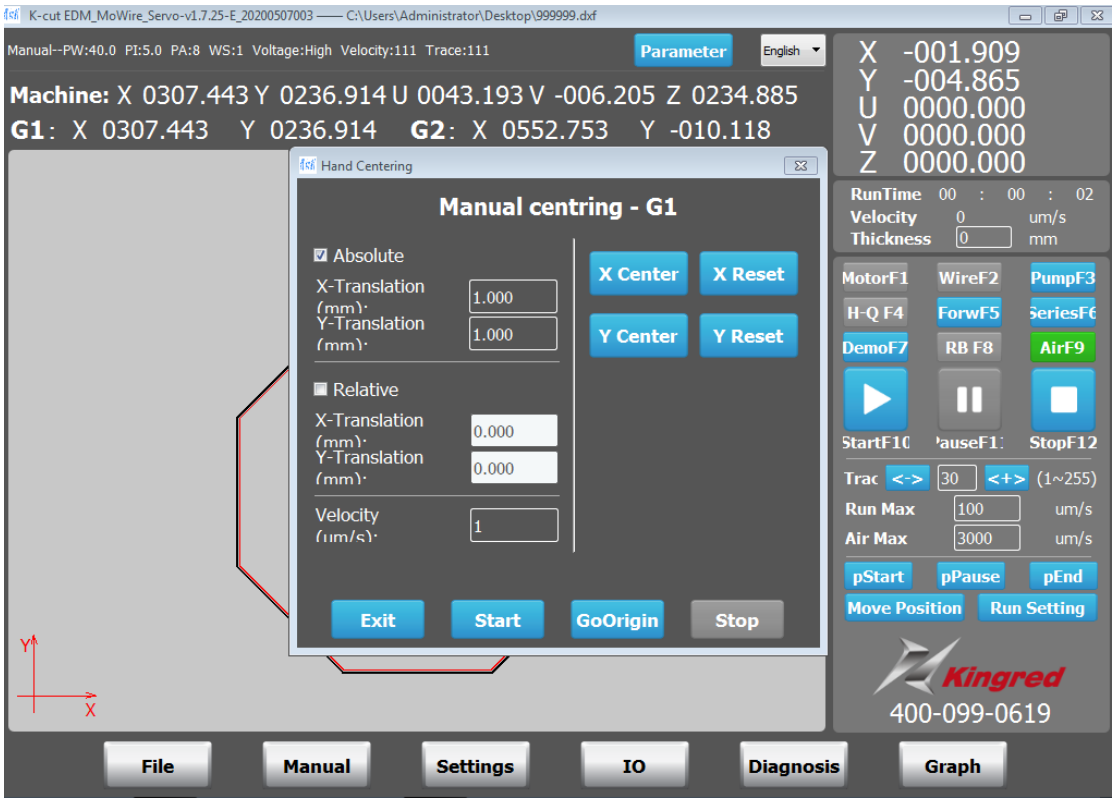


Image 2-14 manual centering

Chapter 3 Manual control

Manual control includes move axis, auto center, touch edge, centering, hypotenuse

3.1manual move axis

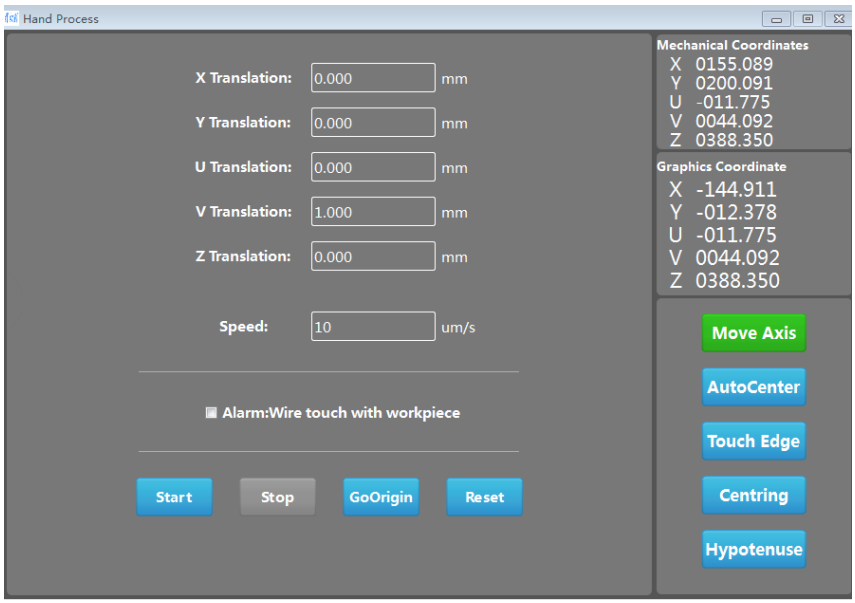


image 3-1 manual move axis

input the distance that XYUVZ axis need to move, and input feed speed, and click start.

3.2 Auto center

The system can do automatic find center in X directly separately, Y direction separately, X and Y axis both together.

Tick the X axis, that is, the X axis is independently centered.

Tick the Y axis, that is, the Y axis is independently centered.

Tick both the X and Y axis, that is, the X and Y axis are centered at the same time.

First speed: the fast feed speed of first-time finding center

Second speed: the slow feed speed of second-time finding center,

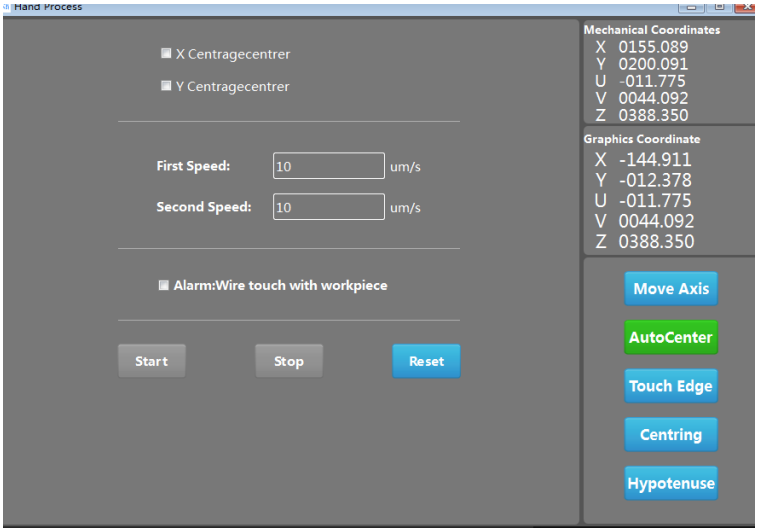


image 3-2 Auto Center

3.3 Touch edge

Can do touch edge in directions of 0 degrees, 45 degrees, 90 degrees, 135 degrees, 180 degrees, 225 degrees, 270 degrees, 315 degrees.

Once touch speed: first time touch edge with fast speed

Twice touch speed: second time touch edge with slow speed.

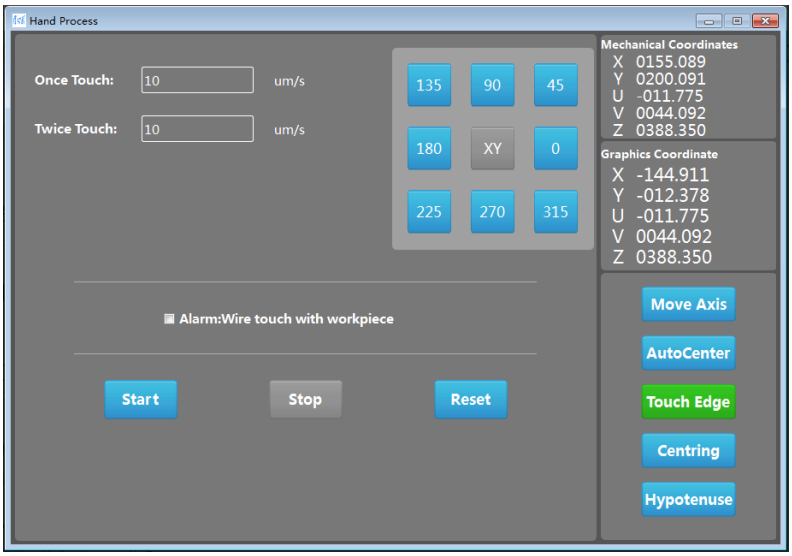


image 3-3 touch edge

3.4 Centering (find center of circle)

Ratio (Offset coefficient): 0.01-1. L= offset ratio * r + r

Diameter: input diameter of the circle, must be accurate.

Back distance: the return distance after finding point 1, 2, 3 is done

Speed-1: fast feed of first finding

Speed-2: after fast speed of firs finding, slow goes back and find again with slow speed.

Circle direction: the directions sequence to find center.

Go Center: after find center is done, click it to move to center of circle.

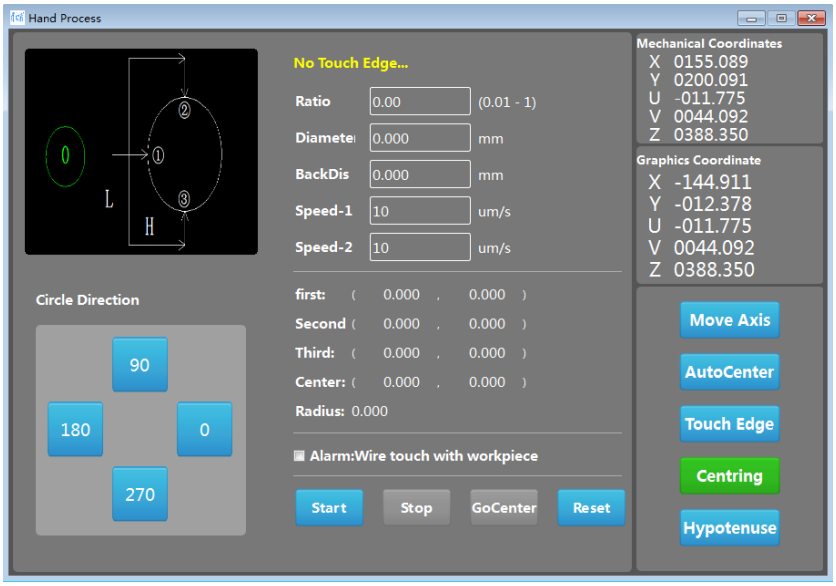


Image 3-4 centering

3.5 Hypotenuse

Width: △X distance, set the distance as bigger as possible, the accuracy will be better.

Back distance: return distance after confirm first point, set value should be bigger than △Y.

1 speed: find edge first time with fast speed.

2 speed: find edge second time with slow speed after first finding done.

Bevel edge direction: select direction to start to measure bevel edge.

Rotate: after measure the bevel edge, it shows degrees of it, and system can rotate the graph with clicking rotate button.

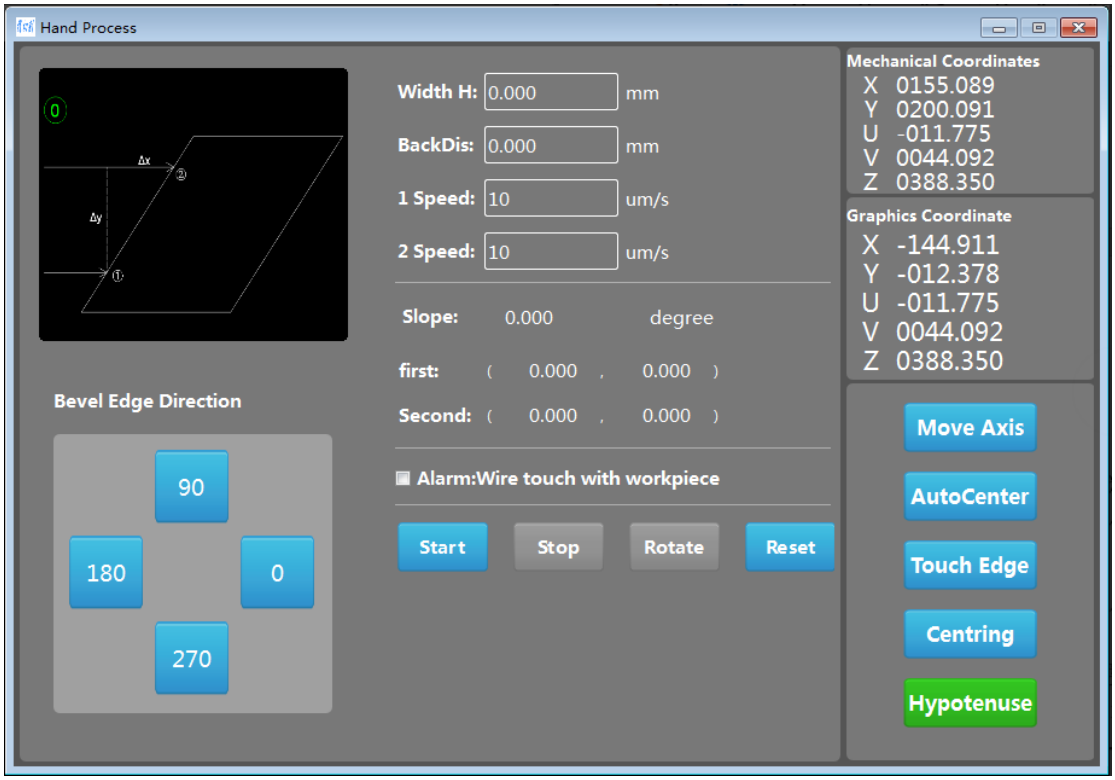


image 3-5 hypotenuse

Chapter 4 System setting

4.1 Screw pitch compensation

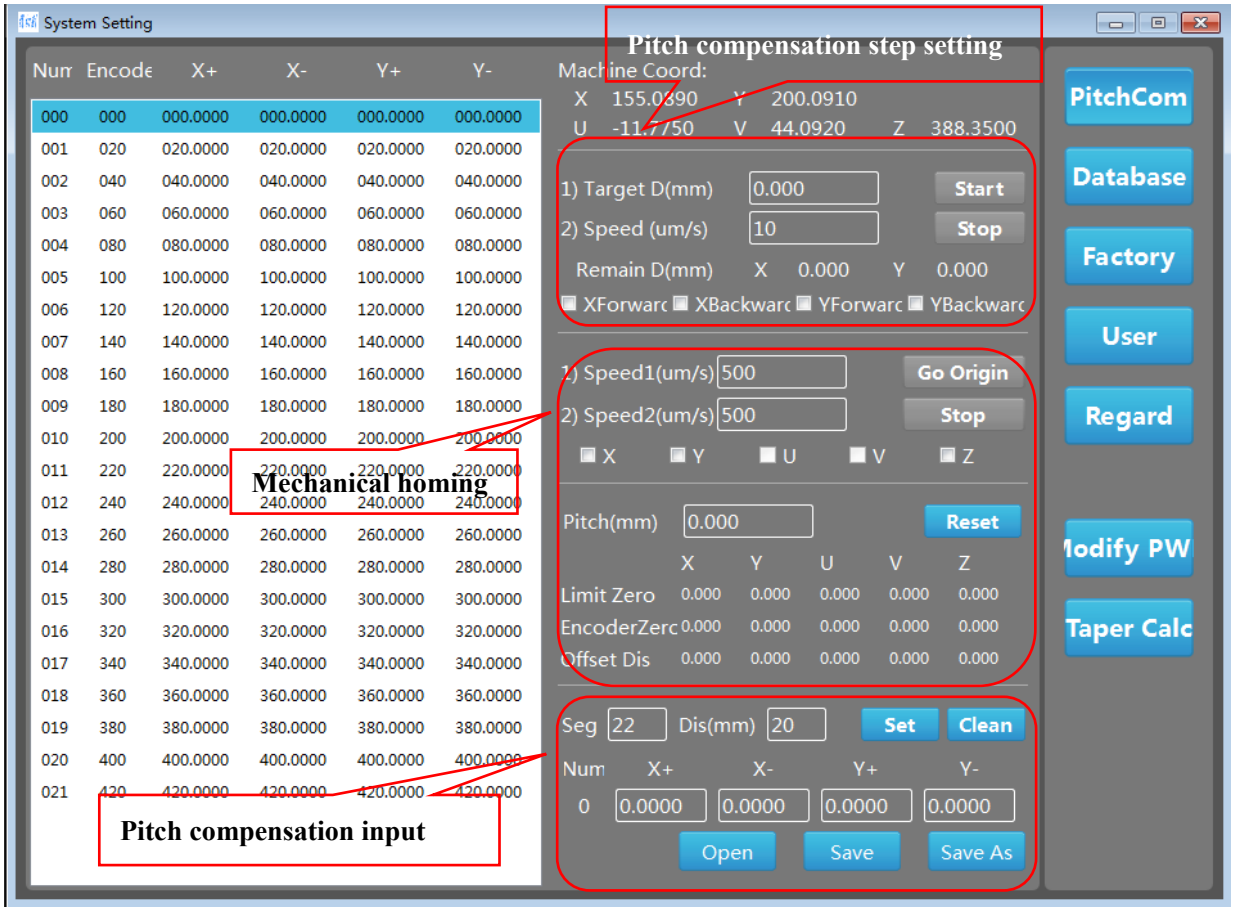


image 4-1 pitch compensation

4.1.1 Pitch compensation step setting

Target D(target steps): steps required to go for pitch compensation
Speed (feed rate): speed of moving axis
Start: start to feed steps
Stop: stop feeding steps
Remain D: remained steps to go
X forward: X positive direction feed
X backward: X negative direction feed
Y forward: Y positive direction feed
Y backward: Y negative direction feed

4.1.2 Mechanical homing

Speed 1: fast speed feed to mechanical origin.
Speed 2: go back to origin more accurately with slow speed, recommend speed is less

than 100 um/s.
Pitch: pitch of ball screw
Go origin: execute mechanical homing
Reset: set zero of limit coordinate, encoder zero coordinate, offset distance
X: X axis homing
Y: Y axis homing
U: U axis homing
V: V axis homing
Z: Z axis homing
Attention: UVZ mechanical origin shall be set as usable according to factory setting

4.1.3 Pitch compensation input

Seg: number of segments of pitch compensation
Dis: pitch compensation distance.
Set: Set pitch compensation data
Clean: Clear the pitch compensation data
Save: save present pitch compensation data
Open: open previously saved pitch compensation data
Save as: save and backup current pitch compensation data to somewhere else

4.2 Database

The machining parameters database is divided into factory parameters and user parameters. The factory parameters are the processing parameters set before leaving the factory, which can be loaded by the operator.

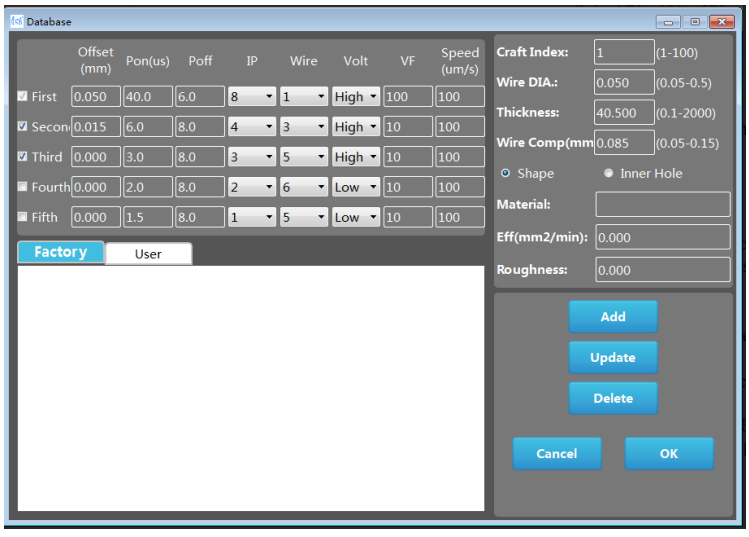


Image 4-2 database

4.3 Factory parameters

Parameters can only be used for factory or professionals

4.4 User parameters

Parameters can be set by operators, please seek guidance from the manufacturer.

4.5 About

Shows information of manufacturer

4.6 Password motidification

User parameter initial password is 111111, operators can modify parameters by themselves

Note: Remember the modified parameters to avoid unnecessary trouble

4.7 Cone(taper) calculator

For taper cutting, as the measurement of some distance data is not accurate, so the actual cutting is not accurate too. KEDM provides a solution to solve this problem, shown in image 4-7-1.

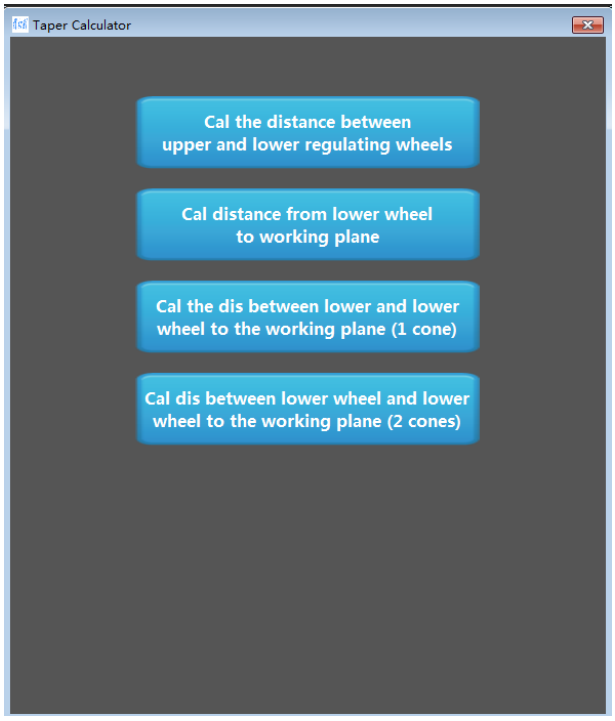


image 4-7-1 taper calculator

First measure the data of distance that needed for taper cutting, for example “the distance between upper and lower wheel (wire guide) and input these measured data in the dialog in image 4-7-2. Then use these data to make cone cutting program for first job of taper cutting. Then measure the actual dimension of first cut job. Or use “calculate the distance from lower wheel to working plane” or other options.

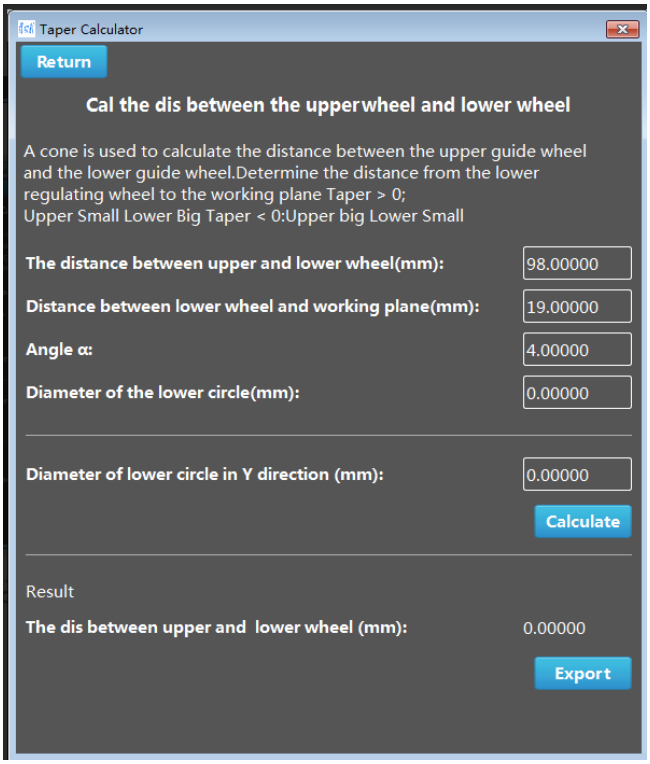


image 4-7-2 calculate the distance between upper and lower wire guide

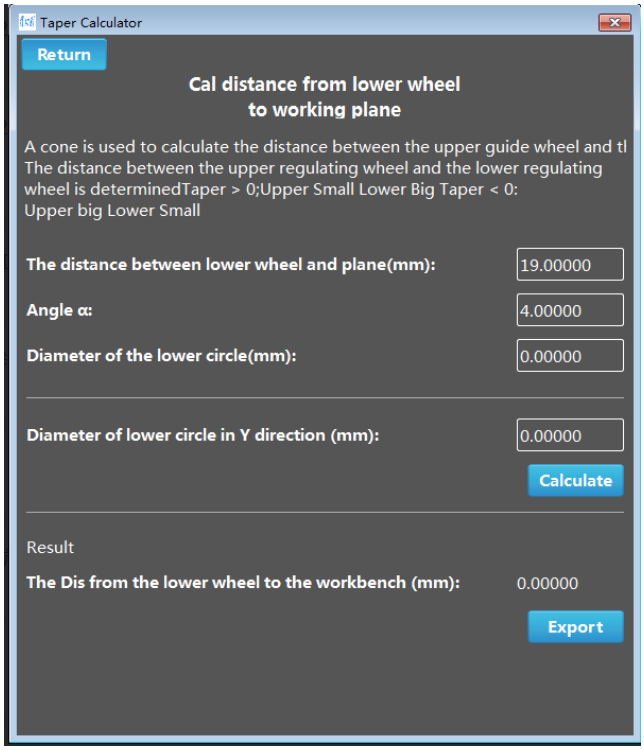


image 4-7-3 calculate the distance from lower wheel to working plane

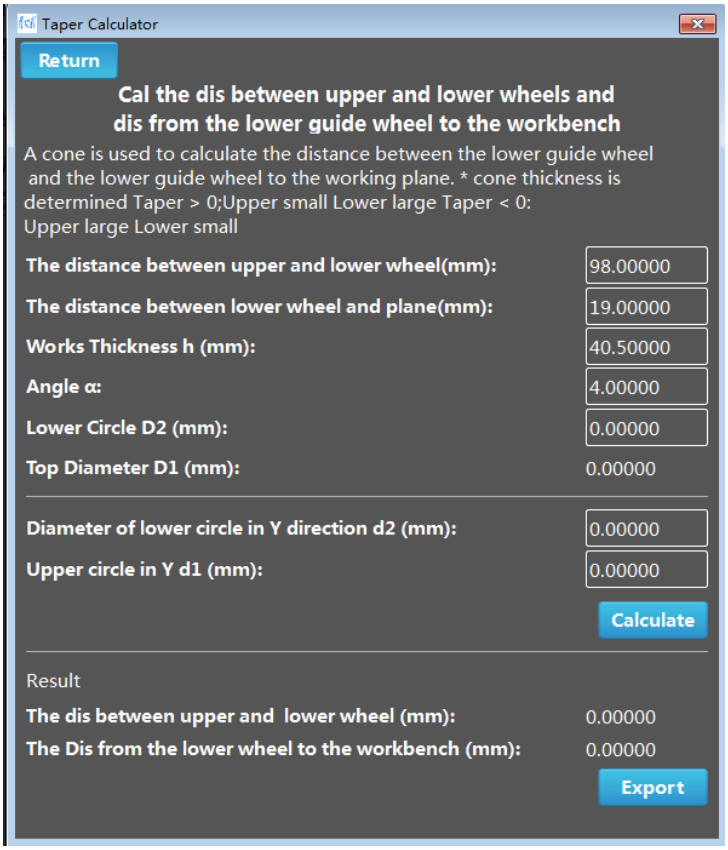


Image 4-7-4

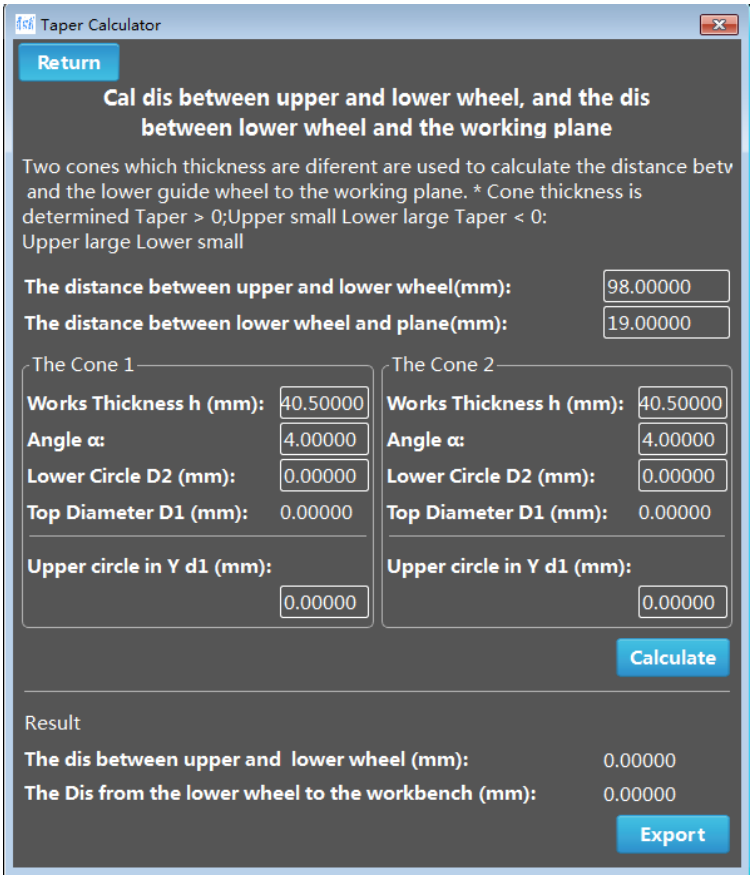
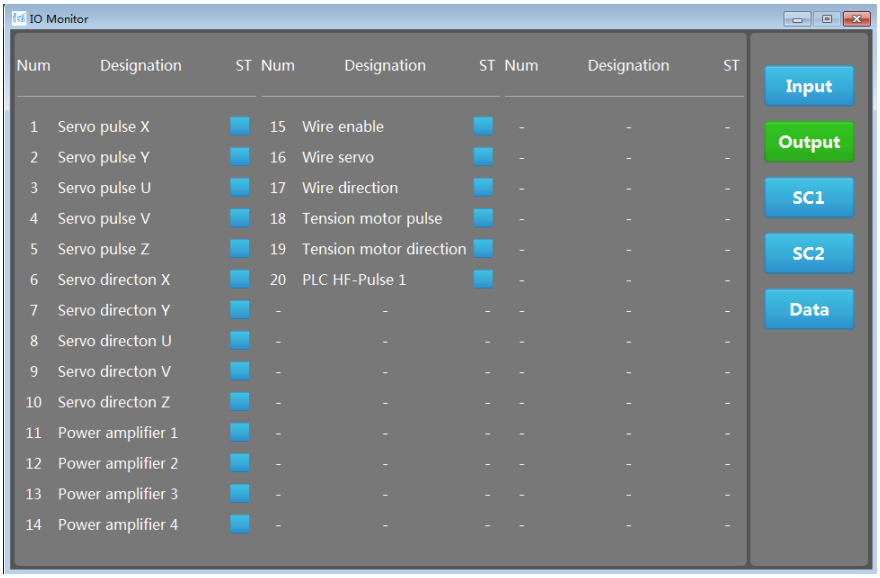


Image 4-7-5

After cut first job of angle cutting with measured data, then measure the dimension of cut part, and then input in the dialog and then click Calculate, then system shows result. Use new calculated data to make new cutting program of taper, the result would be more accurate.

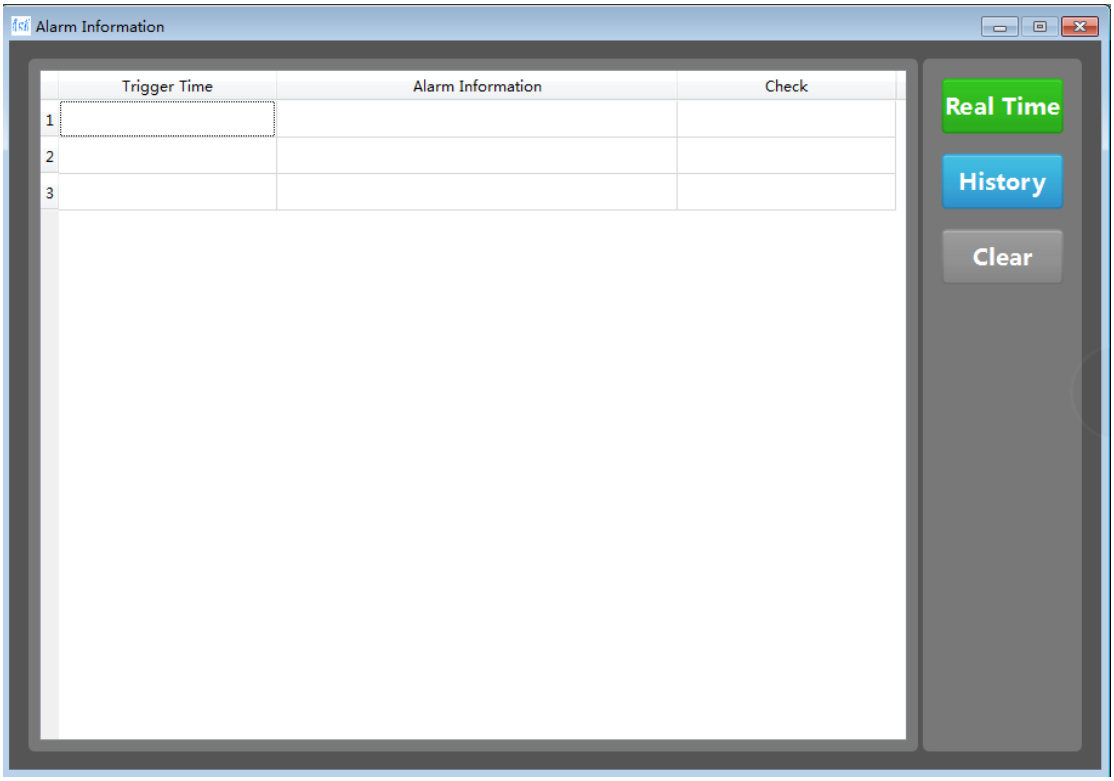
Chapter 5 I/O interface



It is monitoring working status of each device.

Chapter 6 Debugging interface

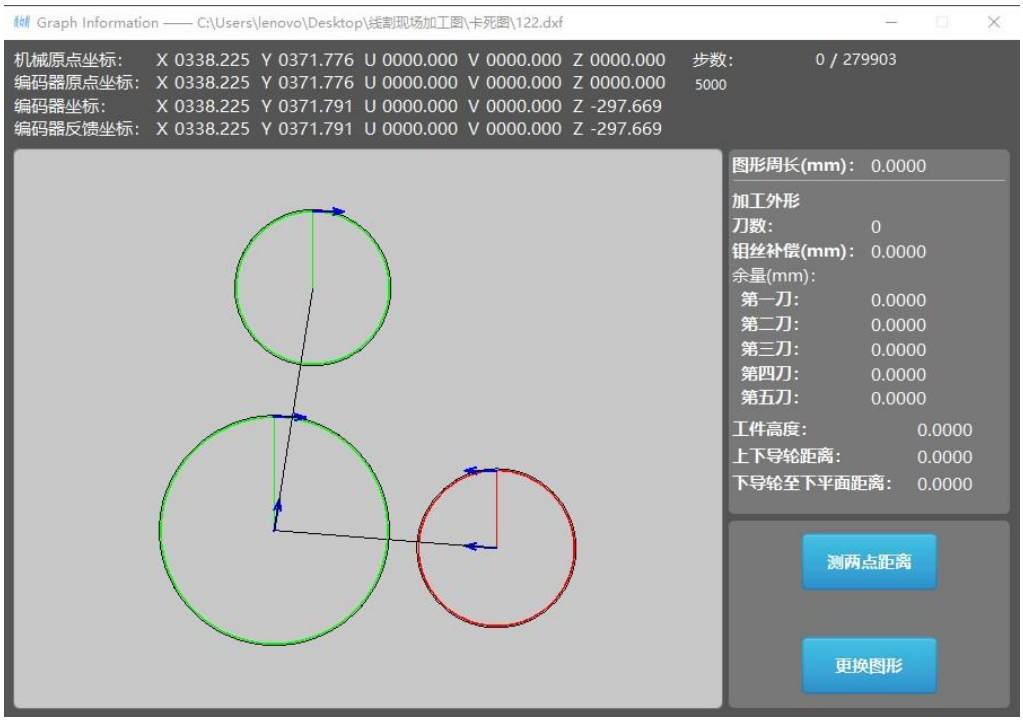
Record alarm information, there are real-time alarm and historical alarm information



Chapter 7 Graph information

The graphl information interface displays the parameters of the current cutting path. Machine origin coordinates, encoder origin coordinates, encoder coordinates, encoder feedback coordinates.

Graphic information, molybdenum wire compensation, cut allowance, etc.



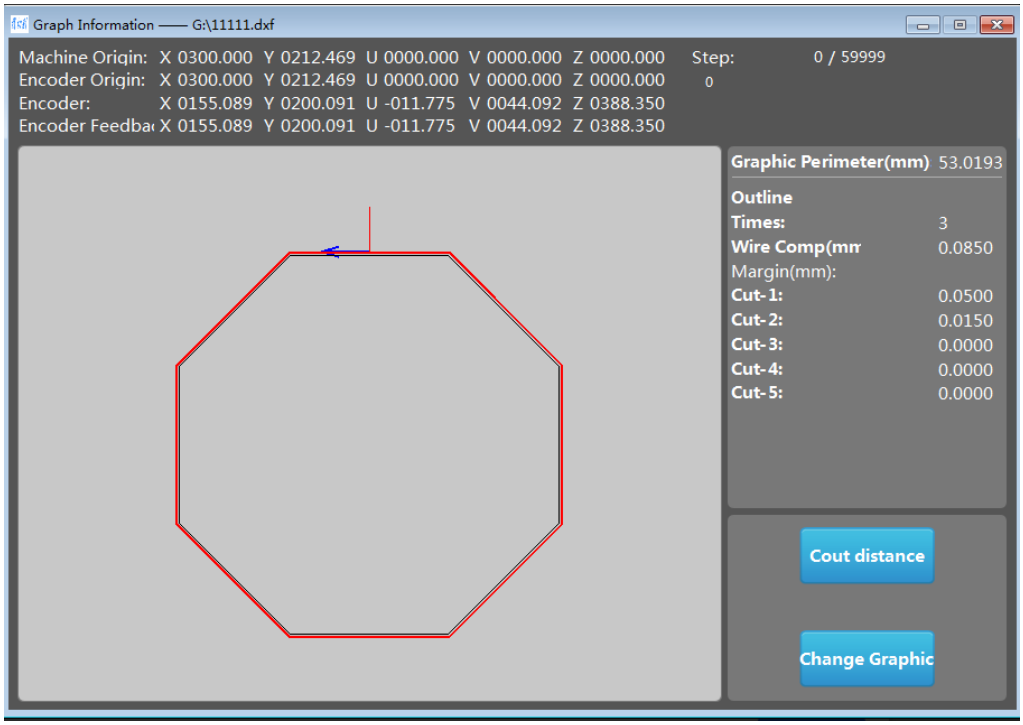


image 7-1 graph information