



Read this manual before operation

- The content include of electric connections and operating steps
- Read the manual to operate the systems

# RDCutist V2.0

Laser cutting system software manual

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# CERTIFICATION DECLARATION



## CE

The product has been certified by the CE (Communate European) safety certification. It has passed the corresponding conformity assessment procedure and the manufacturer's declaration of conformity, in accordance with the relevant EU directive.



## ROHS

This product has been certified by EU legislation (Restriction of Hazardous Substances) Safety certification; comply with relevant EU environmental regulations.



## FCC

This product has been certified by the Federal Communications Commission for safety, Comply with us electronic safety regulations.

# SAFETY INFORMATION

When using this system, please make sure the operation is correct and the usage is safe. Some signs or text will be used to remind you to pay attention to the dangerous matters and some important information.



## **Dangerous:**

Indicates a serious danger. In the process of use, if the operation is improper or the way of use is wrong, it may cause serious injury or even death to the user. Please do not operate it easily until you have made sure that the operation method is correct and the way of use is correct.



## **Warning:**

Danger. In the process of use, if the operation is improper or the use is wrong, which may lead to the injury of the personnel, please do not operate the personnel and related personnel easily, until ensure the correct operation method and use method is correct before use.



## **Cautious:**

Represents the potential risk of the product. In the process of use, if the use method is wrong or improper operation, it may cause damage to the product or some parts. Please do not use it until you have made sure that the operation method is correct and the usage is correct.



## **Important:**

Represents important information to be paid attention to during the use of the product. Please do not ignore this information, this information will provide effective operational help.



This sign indicates laser radiation, which is usually posted on products with laser output. Please be careful with laser and pay attention to safety when using this kind of equipment.

# Devanning

The product itself with plastic or metal shell can protect the external electrical components from damage. The products are packed in foam bags and anti-static bags. If there is any external damage to the package, check the equipment and notify the carrier and carrier in writing of the damage.

## Important:



After receiving the product, please check whether the outer package is intact; check whether the product is complete after unpacking and whether all parts are intact. If any damage is found, please contact ruida immediately.

Remove all cargo from package and keep packing material and wiring parts. Please take care of the safety of the goods when unpacking them. After taking out the goods, please check whether the parts are complete and intact. If any missing parts or damaged parts are found, please contact ruida technology immediately. Do not install or debug the equipment if any obvious damage is found.

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# Section 1 Introduction

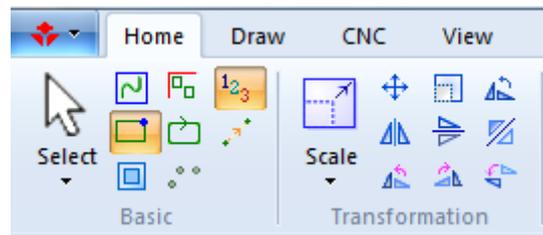
## CONTENTS:

- Software main interface
- Function introduction of each module
- Toolbar Description
- Parameter Description
- Processing interface description



## 1.1.2 Toolbar section

The toolbar has four parts: start, draw, NC, and view.



1.1.2

**Start toolbar:** There are mainly viewing display, geometric transformation, process setting, sorting, and graphics processing tools.

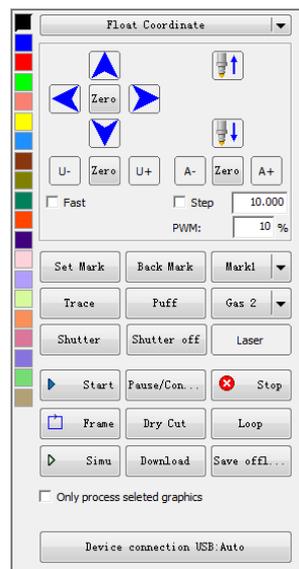
**Drawing toolbar:** It mainly used for simple graphics drawing and alignment operations.

**CNC toolbar :** Machine-related configuration, process-related parameter settings, and machining-related functions can be implemented.

**View toolbar:** There are mainly interface mode selection (parallel movement, sorting, editing), clipboard, partial module display, hiding, and display, hiding and locking of each layer.

## 1.1.3 Processing Control Section

Processing control is mainly related to processing operations. There are coordinate system selection, manual, automatic, cycle machining, machining selected graphic settings, zero return, border and layer color settings.



1.1.3 Processing control interface

## 1.1.4 Operation Record Section

Record various functional operations and the implementation of this operation.. The path where the file is opened is displayed.

```
Command: Measure
Please specify a starting point: (391.406,453.985)
Please specify the end point: (423.565,476.293)
Length: 39.139, X Direction: 32.159, Y Direction: 22.308
```

```
(04-17 17:59:25)Ready.
(04-17 18:04:38)Open file: C:\Users\Administrator\Desktop\rlc\001.rlc
```

1.1.4 Operation record interface

## 1.1.5 Status Bar Section

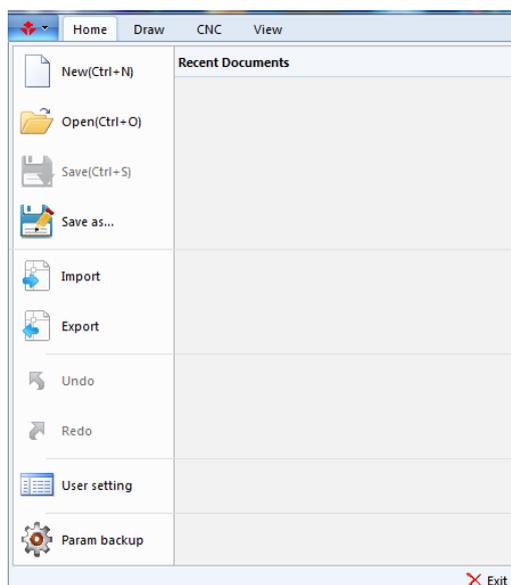
The status bar displays the selected element properties, cursor position, processing timing.



## 1.2 Function introduction of each module

### 1.2.1 Main Menu

The main menu contains file related operations (new, open, save, import, export), edit related operations (undo, restore) interface settings



### 1.2.1-1 Main Menu interface

**New:** Create a new view page. If the original view page has no saved graphic data, it will ask if it is saved.

**Open:** Open the project file saved by the software in the format rlc.

**Save:** Save the graphic data. If the opened file has been modified, it will be saved directly to the original file. If it is newly created graphic data, the graphic saving interface will pop up.

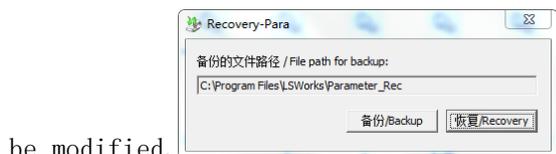
**Save as:** Save graphic.

**Import:** Pop-up import graphical data interface, you can import file data in ai, plt, dxf format

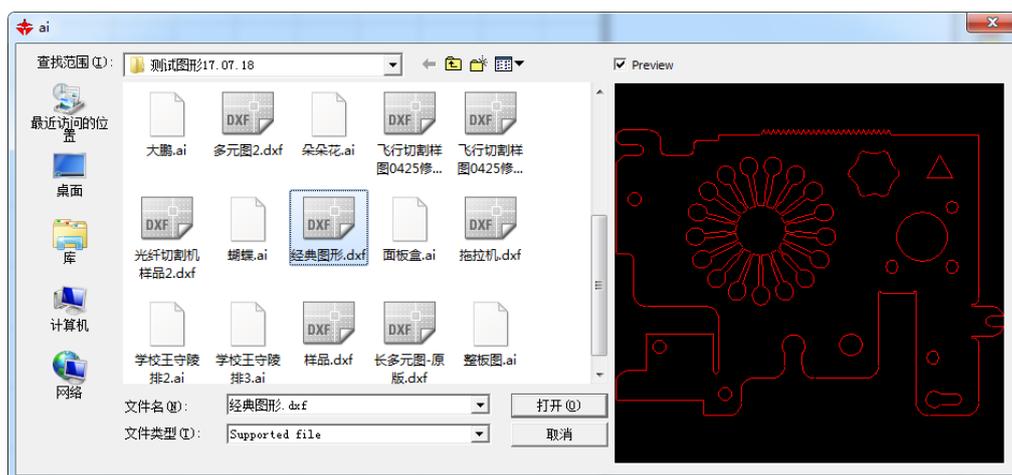
**Export:** Export files data in ai, plt format.

**Parameter backup:** The software parameters can be back up to the specified folder, and restore the software parameters through the Recovery-Para. (The program is in the

installation contents  ). User can back up the parameters after tested. If the software parameter file is destroyed, the parameters can be restored. The backup parameter is a folder, the manufacturer can name the folder with the date, and the file name in the folder cannot



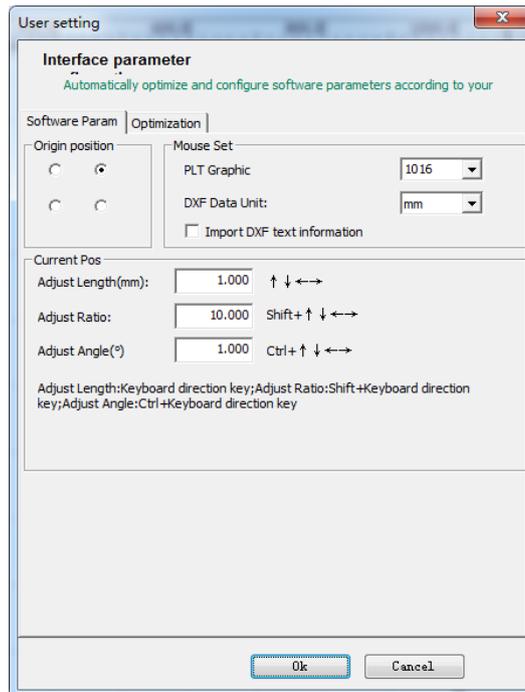
be modified.



### 1.2.1-2 Import and export data interface

**Revocation, recovery:** You can undo and restore the most recent graphics processing. The shortcut keys are Ctrl+Z and Ctrl+Y.

**Interface setting:** It is the interface display related parameter settings and parameter settings related to the import file (automatic optimization parameters).



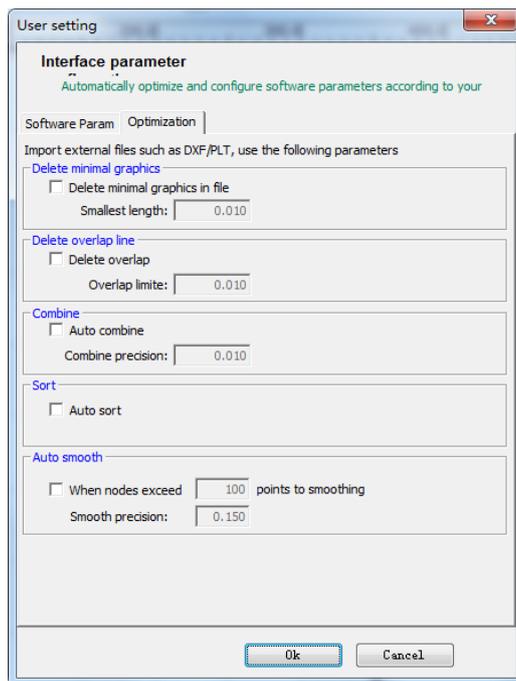
1.2.1-3 Software parameter interface for user parameters

## 1.2.2 Software Parameter Description

**Origin position:** Set the zero position of the graphic display area, which needs to correspond to the actual origin position of the machine (reset position). Otherwise, the processed graphic will not correspond to the graphic coordinates of the drawing area. This is the benchmark for creating a graphical coordinate system.

**File import settings:** To set the precision of the PLT graph, the ratio of the length unit to the logical unit conversion. DXF data units can be millimeters, centimeters, inches, and custom. Import Dxf text information Select this item to import Dxf text.

**Keyboard settings:** When the keyboard up, down, left and right keys are set, the distance of the single step movement and the angle of rotation are selected.



1.2.2 User parameter optimization parameter interface

### 1.2.3 Description of optimization parameters

The parameters of this page can be set to the processing of the graphics when importing graphics and the parameter settings of each operation.

**Remove very small graphics:** Remove the outline of the outer frame that is smaller than the set length.

**Remove duplicate lines:** Remove line segments where graphics and graphics overlap.

**Merging connected lines:** When the start/end distance of multiple non-closed entities is less than the set length, the joins are merged into one graph.

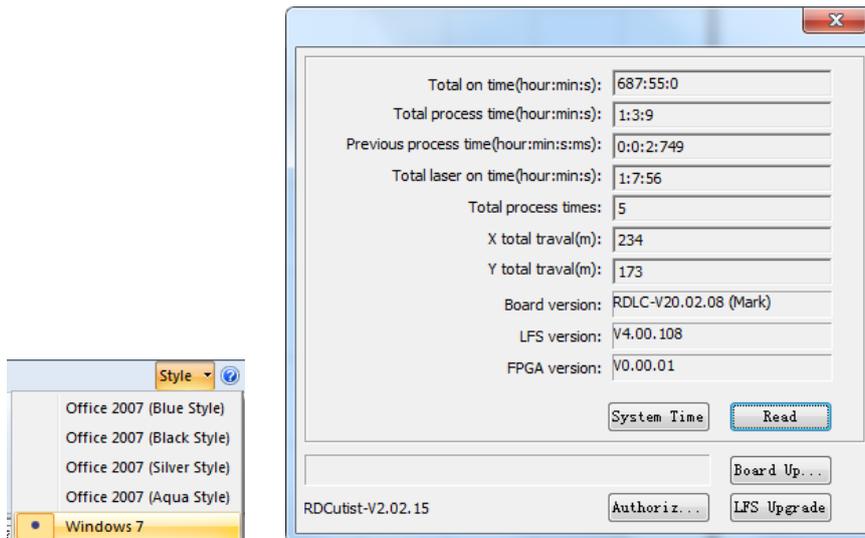
**Automatic sorting:** The imported graphics are automatically sorted according to the parameters set by the software sorting interface.

**Auto smoothly:** When the number of primitive nodes exceeds the setting number, smooth processing is performed automatically.

## 1.3 Toolbar Description

The toolbar of the software is a Ribbon-style toolbar with four toolbar pages: Start, Draw, NC, and View. Two buttons in the upper right corner of the software  , It can set software style and view system version information. Win7 system must set Style to Windows 7, otherwise the entire

Ribbon toolbar will be put away.



1.3

**System information:** You can view the various accumulated time and schedule of the connected control system, view the system version number, and upgrade and authorize the board.

**Read:** It can read the accumulated time, travel, number of times, and mainboard, firmware version number, etc.

**Mainboard upgrade:** Upgrade the system board using the .upd type file provided by the company

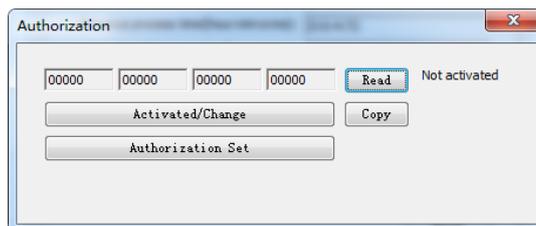
**Firmware upgrade:** Use the .bin type file provided by the company to upgrade the height system.

**Authorization management:** With the dongle for the staged authorization operated.

**System time:** Before there is no installment authorization, user can set the system time.

### 1.3.1 Authorization management

Authorization is mainly for the staging operation with the dongle. The machine manufacturer can perform operations such as activation, encryption, and authorization. If the terminal customer purchases the machine in installments, it needs to obtain the corresponding authorization code from the manufacturer to unlock the operation.



1.3.1-1

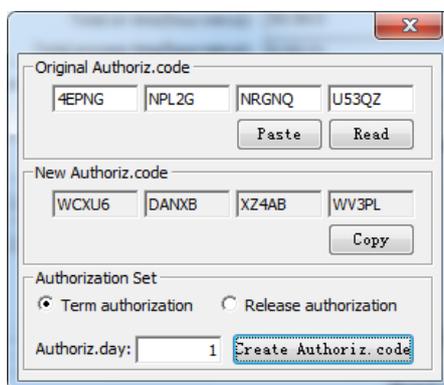
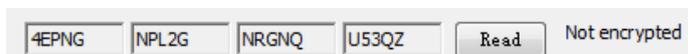
**Authorization page:** This page can be used by both customers and manufacturers. It can read the

authorization status of the control system (inactive, unencrypted, activated encryption) when the control system is connected. If encryption is activated, the encoding of the system can be read.



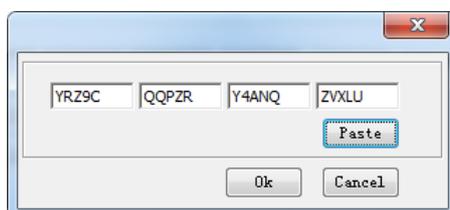
1.3.1-2

Activate/change authorization: Activation is for an inactive system that is activated by the manufacturer using a dongle. Changing the authorization is to authorize the system to encrypt the time, thus achieving the purpose of staging. The manufacturer activates first, after the activation is successful, the reader will get the code assigned to the system.



1.3.1-3

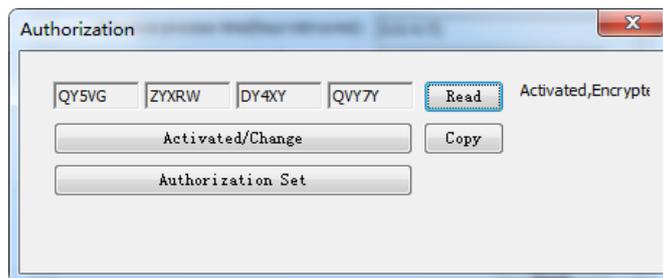
Authorization settings: An authorization code can be generated on the pop-up interface to authorize the encryption time of the system. Enter the system code which is the original authorization code, and then set the authorization period. Click “Generate New Authorization Code” to generate a new authorization code. The operation is based on the original authorization code provided by the manufacturer according to the system. Generate a new installment authorization code in case.



1.3.1-4

Change authorization: For systems that are not encrypted and only activated, the manufacturer can generate an initial authorization code (operation in the authorization settings), which is the number of authorized days in the first period, and then change the system authorization when connecting the system. For the system that has been encrypted, the original authorization code is provided by the customer to the manufacturer, and then the manufacturer generates the authorization code for the next authorization

day. The new authorization code is sent to the customer. The customer uses the change authorization and enters a new authorization code to unlock the system.



1.3.1-5 Activated and encrypted system

## 1.3.2 Starting the toolbar

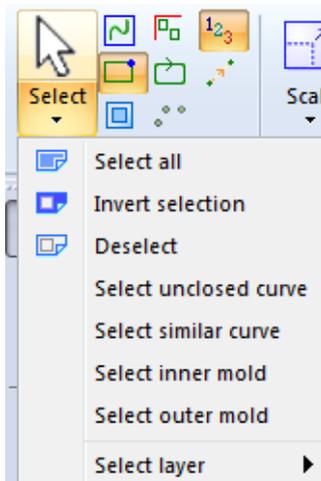


1.3.2-1 Starting the toolbar interface

The start toolbar is divided into views, geometry transformations, process settings, sorting, tools, and parameter settings.

**View:**

You can select various graphics, or you can display auxiliary information when displaying graphics on the interface (unclosed image highlighting, graphic frame display, starting point, direction, number, empty path, node display, or centered display). Check the graph).



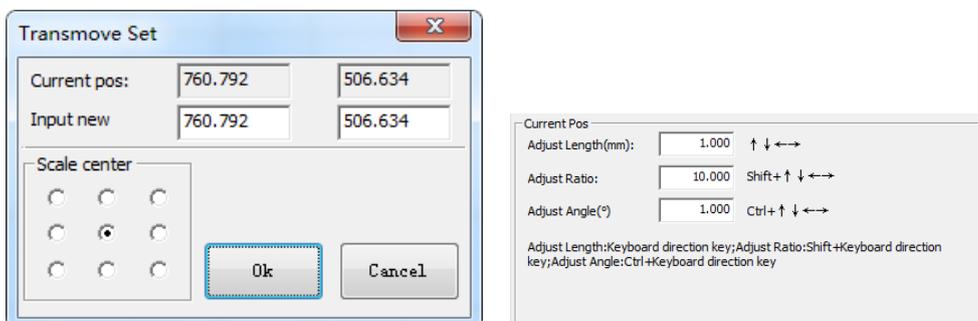
1.3.2-2

**Geometric transformation:**

It can quickly perform panning, graphic size transformation, mirroring, rotation, etc., and can also perform interactive rotation, scaling, and arbitrary angle mirroring operations.

parallel movement: click , pop-up parallel movement interface, The interface displays the

position coordinates of the selected reference point of the drawing, and then inputs the position of the new reference point. If yes, the selected graphic is translated to the set new position based on the reference point. You can also select the graphic, use the keyboard's arrow keys to move(hold Shift + arrow keys to quickly move), the parallel movement distance is set in the keyboard parameters of the user parameters.

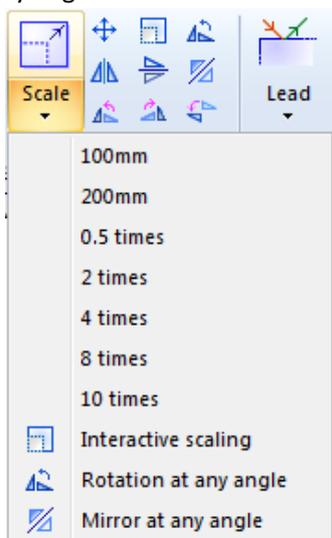


1.3.2-3 Parallel movement setting interface

Rotate at any angle: You can click the rotation icon at any angle to enter the rotation state of any angle. Then, according to the interactive window prompt in the lower left corner, select the base point, input the angle, and presses Enter to rotate the graphic. If the angle is directly input without selecting the base point, the rotation is performed based on the center of the graph.

Interactive zoom: The operation is the same as the rotation at any angle, except that the input is the magnification of the graphics zoom.

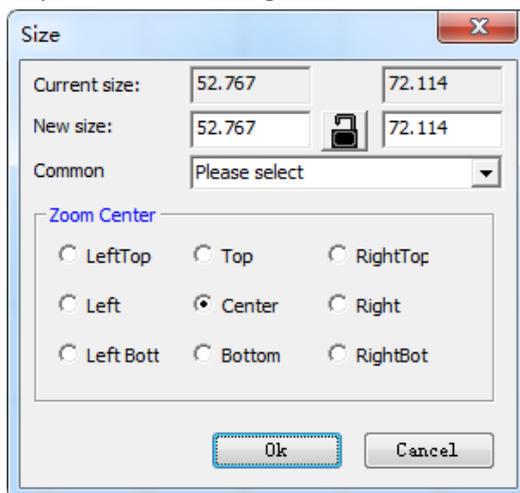
Mirror at any angle: Click any angle mirror icon to enter the mirror state at any angle. According to the interactive window prompt in the lower left corner, the mouse rotates the mirrored two endpoints of the mirror to complete the mirror at any angle.



1.3.2-4 Geometric transformation page

Size change: In addition to quickly selecting the zoom factor in the pop-up menu, you can also click the size icon, pop-up size setting interface, you can select the common size, you can also enter a new size,

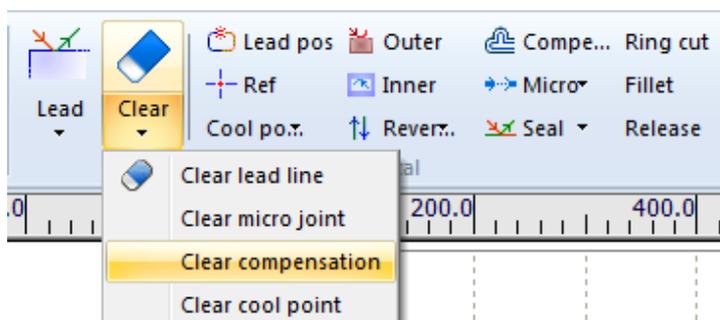
the zoom center is the reference point when the image is zoomed.



1.3.2-5 Size setting interface

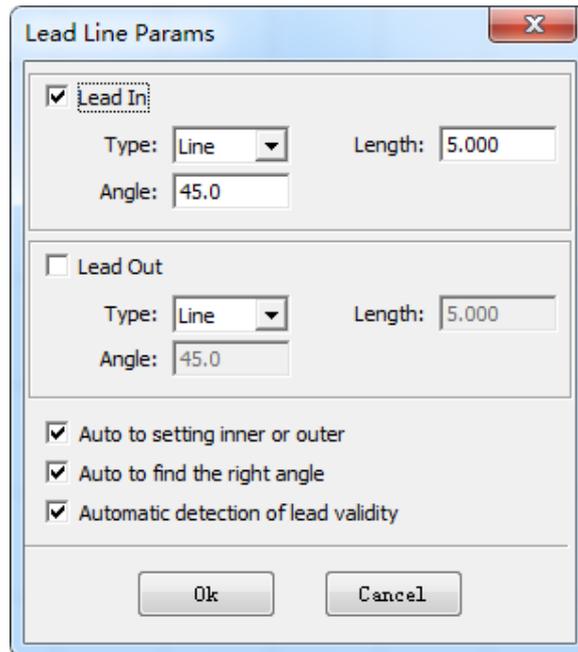
■ **Process setting:**

Process settings can be used for lead, compensation, starting point modification, positioning settings, cooling point settings, internal and external cutting settings, micro-connection, direction setting, sealing settings, etc.



1.3.2-6 Process Settings Page

■ **lead: Add, modify, and inspect the leads.**



1.3.2-7 Add lead interface

**Add wire instructions:**

You can choose to add the lead-in or lead-out line, as well as the length and angle of the lead, or you can set the internal and external cutting properties of the graphic and detect the validity of the lead automatically, etc.

Automatically finding the right angle calculates the angle of the added lead automatically (from tangential or vertical) by graphical features.

Check the lead-in and pull-out to set the lead safe distance and modify the qualified leads (check the interference between the leads and the graphics itself and other graphics)

Modify the lead-in lead: To enter the modified state, use the left mouse button to drag the leader of the lead to the desired position. (Status operation press ESC to exit)



1.3.2-8

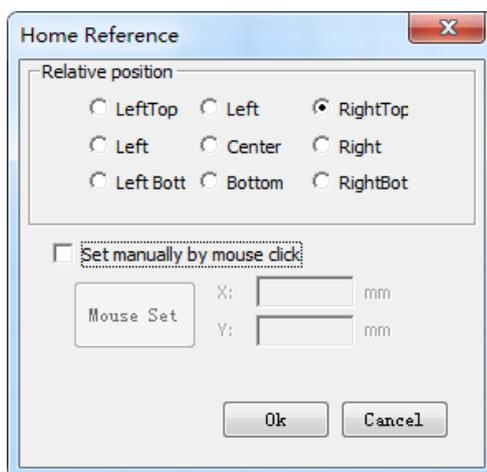
**Modify the starting point:**

Click  **Lead pos**, Enter the modified starting point state, the mouse clicks in the drawing interface, if the first click is outside the graph, the second click is on the graph, then the lead is added at the first click position and the second click position, and the starting point is modified to the second click. If you click on the graph for the first time, you can directly modify the starting point to that position (unclosed graphics

cannot modify the starting point). (Status operation press ESC to exit)

**Position setting:**

Set the graphic reference point (the point marked by the green square) as the various moving reference of the graphic (the floating coordinate system and the workpiece coordinate system are used during processing). You can directly specify the 9 relative positions of the selected graph as the reference point, or you can use the mouse to specify the absolute position as the reference point. The reference point is mainly used in the floating coordinate system, so it is better to set the reference point to be close to the origin position, otherwise there may be problems beyond the format in the floating coordinate system.

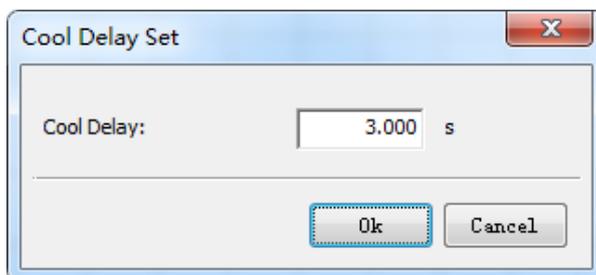


1.3.2-9 Graphic reference point setting interface

**Cooling point setting:**

Click **Cool po...**, Go to the Add Cooling Point state and use the mouse to add a cooling point by clicking the left button on the element. When processing, the default process is to turn off the laser here - the cooling point delay - to turn on the laser. Also click the expand button of the

button. , you can see the cooling point delay setting and click the button to enter the setting interface.



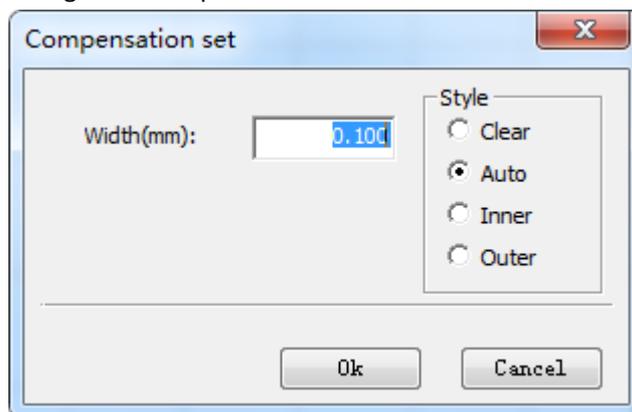
1.3.2-10 Cooling point delay setting interface

**Internal and external cutting settings:**

Set the inner and outer cut properties of the selected graph, and the related leads and compensations will also change accordingly.

■ **compensate:**

Click the compensation icon, the compensation dialog box will pop up, the compensation parameters will be set, and the compensation will be implemented. The compensation is corrected for the case where the pattern obtained by cutting the laser spot size is inconsistent with the size of the original pattern.



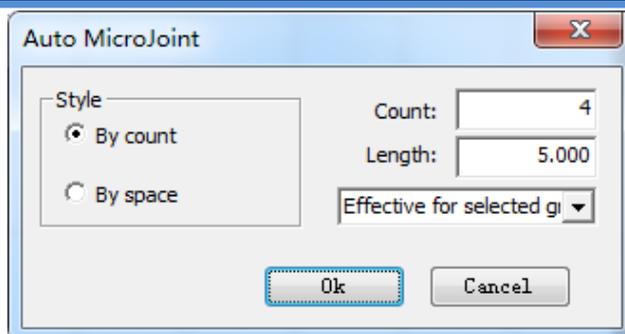
1.3.2-11 Compensation setting interface

■ **Micro connection:**

Micro connected with manual micro connection and automatic micro connection. Adding micro-connections is to prevent the cut graphics from falling (turning off the light at the set micro-connection).

Manual micro-connection is implemented with the left mouse button, click the micro-connect button , Enter the manual add micro-connection state, according to the interactive window prompt in the lower left corner, the mouse clicks on the picture element, then add the micro-connection at the click position, the size of the micro-connection is the size set in the automatic micro-connection. (Status operation press ESC to exit)

Automatic micro-connections can be selected to add micro-connections automatically by number and by distance. According to the quantity, a specified number of micro-connections are added to the selected figure; according to the interval distance, a micro-connection is added every such long interval according to the set interval size.



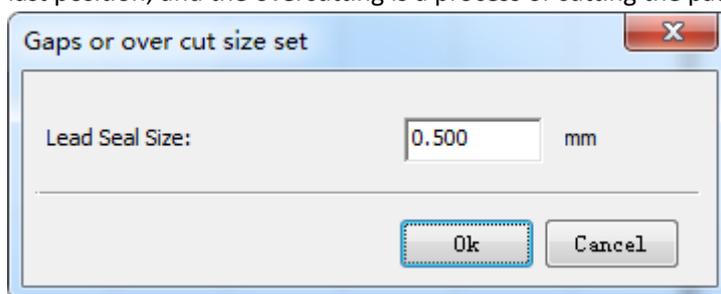
1.3.2-12 Automatic micro connection settings

■ **Direction setting:**

You can reverse the selected graphic, or you can set the direction of the graphic to be clockwise or counterclockwise.

■ **Sealing treatment:**

It includes sealing, notch, and overcutting. The sealing is a sealing closure process for a pattern that has been subjected to a notch or overcut operation; the gap is a process of cutting off a segment of the closed pattern at the last position; and the overcutting is a process of cutting the pattern over a distance.



1.3.2-13 Notch, overcut size setting interface

■ **Ring cutting:**

In order to prevent the position of the sharp corners from being too severe, resulting in burning angles, all the curves are added at the sharp corners to cut and cut to achieve the purpose of reducing the speed.

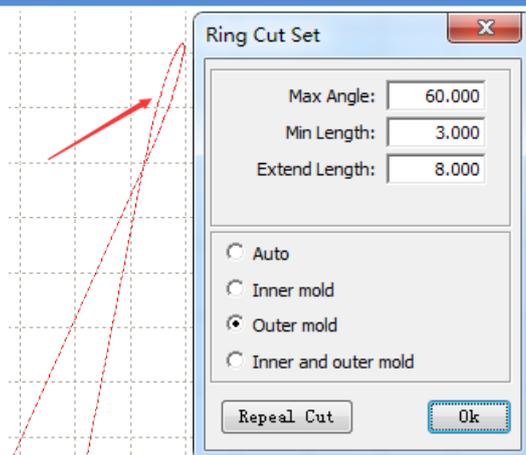
Maximum angle: Only less than this angle will add the loop cut effect.

Shortest side length: The length of the two sides that make up the angle cannot be less than this value.

External lead length: The length of the circumcission extends.

Automatic, external, internal, internal and external: The circumcission is the angle that acts on the convex or concave angle.

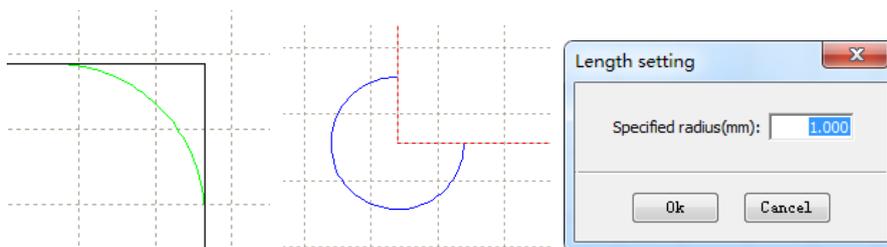
Cancel ring cutting: The ring with the circumscribed curve is cut off.



1.3.2-14 Loop cutting effect and parameters

**Round:** After setting the fillet radius, enter the rounded state and click the corner of the graph with the left mouse button to round the corner.

**Release angle:** After setting the fillet radius, enter the release angle state and click the left corner of the graph to change the angle to release the fillet. It is mainly used for materials with thickness. After the cutting is completed, it should be folded at the angle. In order not to withstand the thickness, all the release angle is added.

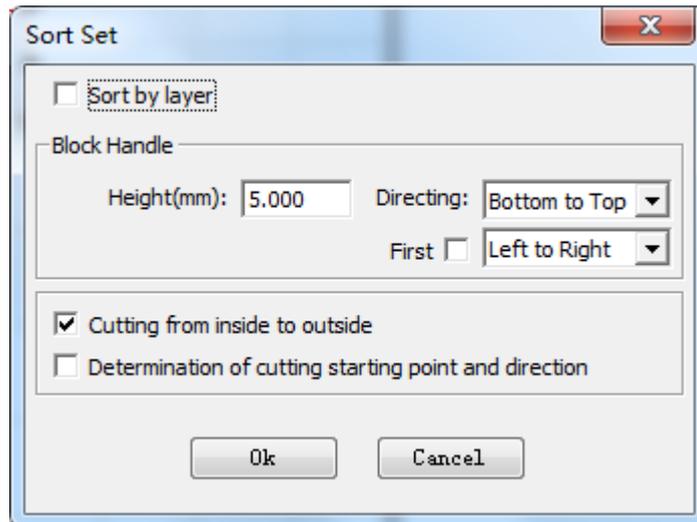


1.3.2-15 Round, release angle effect, and radius settings

■ **Sort:**

Sorting can optimize the path of all graphics, or manually select a single graphic for sequential adjustment operations.

**Path optimization:** Path-optimized parameters can be set. Sorting can be done according to the layer, setting the height and direction of the block, and automatically sorting the starting point and direction of the cutting according to the inner and outer films sorted from inside to outside.



1.3.2-16 Path optimization setting interface

Path optimization settings instructions:

In layer order: It is sorted by the order of the added layers in the overall sorting, and the inside of the layer is sorted by the following selection. .

Block processing: All graphics can be divided into areas by height, sorted according to the set direction and the position of the reference point in each area.

Cutting from inside to outside: The ordering of parts follows the cutting order from inside to outside

Automatically determine the cutting start and direction: When starting the sorting, the starting position and direction of the graphic are modified as needed. If the item is not selected, the starting position and direction of the graphic are not changed.

Single graphic position adjustment: For a single graphic selected, you can move to the last, move to the front, move forward, and move backward.

Single step preview: Select a graphic, click to preview the previous graphic, and preview the next graphic button to see the selected graphic showing the processing order.



1.3.2-17 Single graphic position adjustment

■ tool:

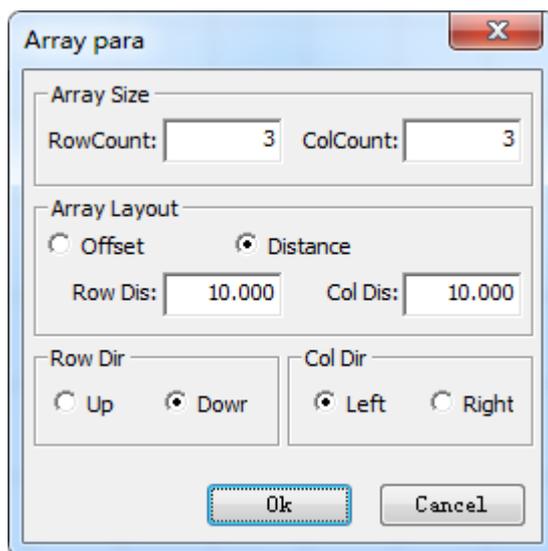
The tools are mainly auxiliary processing functions for processing graphics, with the aim of improving processing efficiency and fulfilling some special functional requirements. The tool has array, group, scan, co-edge, bridge, measurement, curve segmentation, automatic bridging, delete repeat lines, delete small graphics, merge connected lines.



1.3.2-18 Accessibility toolbar

**Array:**

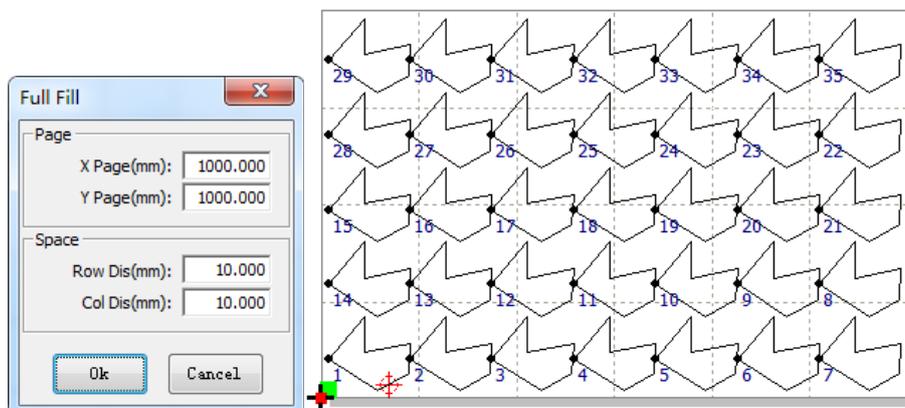
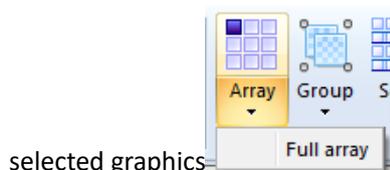
The selected graphics are arrayed according to the number of rows, columns, offsets (which can be offsets or pitches), and row and column directions.



1.3.2-19 Array setting

**Covered:**

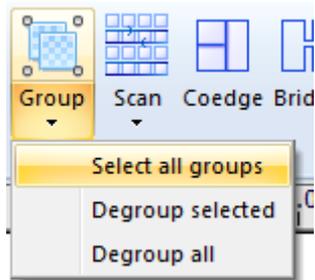
Fill the format of the array's sub-items according to the set size, automatically fill the format with the



1.3.2-20 Covered parameters and effects

■ **Group:**

The graphics that need to be combined can be combined into one group for processing, and the individual parts generally composed of multiple graphics are combined into one group. For groups, the group can be broken up or all groups can be broken up. Select multiple graphics, and then click the group button, so the selected graphics will form a group. The selected graphic can be a single graphic or a group. So groups can also contain groups.



1.3.2-21 Group handle

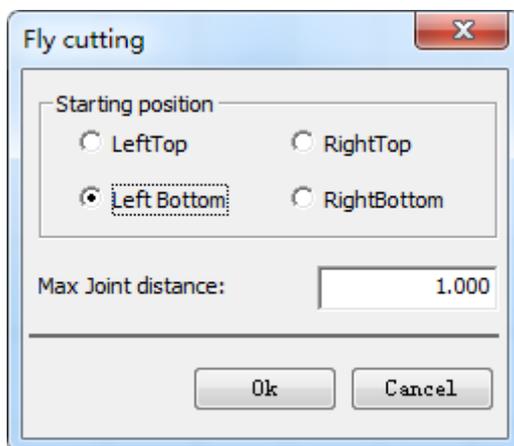
■ **Co-edge:**

Combining workpieces with the same boundary and sharing one boundary can save a lot of processing length and improve efficiency. It can be co-edge when the boundary distance between the two

figures is less than 0.1 mm. Select multiple graphics and click the co-edge button on the toolbar , The software will co-edge the selected graphics.

■ **scanning:**

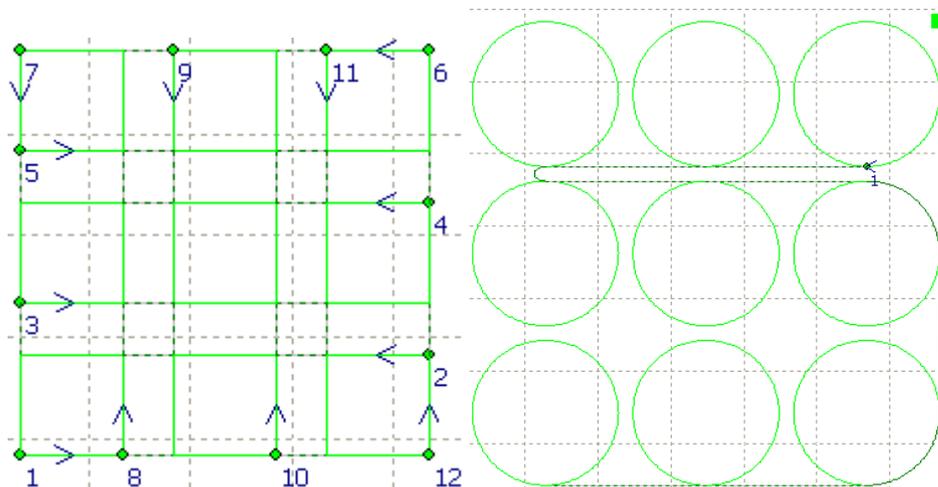
Straight line group scanning, according to the set interval, the line segments on the same line form a scan line. When these scan lines are processed, only the laser switch operation is performed, so that the line segment processing on the same line does not decelerate. Scanning can reduce the processing time (scanning line internal ordering follows the direction of the initial scan, without being affected by path optimization).



1.3.2-22 Straight fly scan setup

Starting position: It refers to the position where the cutting starts, for example, the upper left is cut from the upper left position of the overall figure, and the subsequent figures are sorted according to the most recent principle (looking for the image closest to the current graphic end point).

Minimum scan length: If the length of the line segment of the graphics memory is less than this length, the graph does not perform a line scan operation.



1.3.2-23 Scan processing result

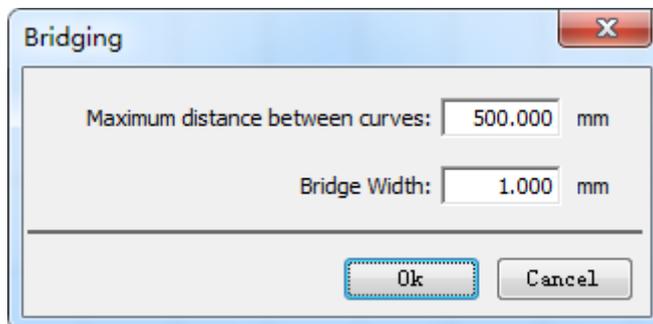
**bridging:**

When a workpiece consists of multiple parts, but you don't want to scatter after cutting, you can connect them by "bridging." At the same time, this feature also reduces the number of punches. Multiple use of the "Bridge" function, you can also achieve the effect of "one stroke" on all graphics.

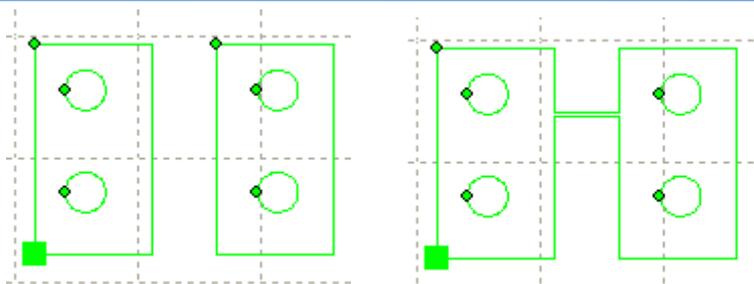


Click **Bridge**, Enter the bridge state, click on a position by the mouse, then pass through the graph to be bridged and click on another location to form a bridge, and all the graphics that the bridge passes will be automatically bridged. (Hold down the Ctrl key to create a horizontal or vertical bridge)

The bridge has two configurable parameters, one is the maximum distance allowed to bridge the graph, ie the maximum distance between adjacent curves; and the bridge width.



1.3.2-23 Bridge parameter settings



1.3.2-24 Changes before and after bridging

**Measure:**

The distance between two points is measured and the distance between the two figures. Click the



measurement button on the toolbar **Measure**, Entering measurement status, Mouse click on the interface to get two points ( Hold down the Ctrl key to get the horizontal or vertical distance ), Then calculate the distance between the two points and display it in the interactive window in the lower left corner.

```
Command: Measure
Please specify a starting point: (306.960, 698.233)
Please specify the end point: (312.247, 706.273)
Length: 9.623, X Direction: 5.287, Y Direction: 8.040
```

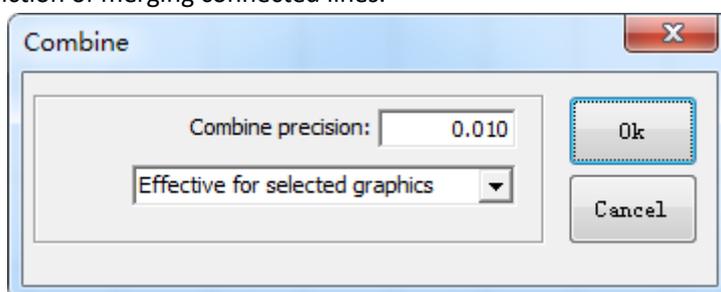
1.3.2-25 Measuring length display

**Curve segmentation:**

Split a single curve into multiple curves as required. Click the curve split button  to enter the split curve state, then press the prompt in the lower left corner interactive window, left click on the graph to be split, and split the single graph into multiple Split a single curve into multiple curves as required. Click the curve split button to enter the split curve state, then press the prompt in the lower left corner interactive window, left click on the graph to be split, and split the single graph into multiple.

**Merging connected lines:**

Combine multiple curves that meet the requirements into one. When using this function, if the graph is selected, it is merged for the selected graph, and if no graph is selected, it is merged for all graphs. The graphics that have been split are merged. If they have not been moved, the merged multiple lines can be merged using the function of merging connected lines.



1.3.2-26 Merge connected line settings

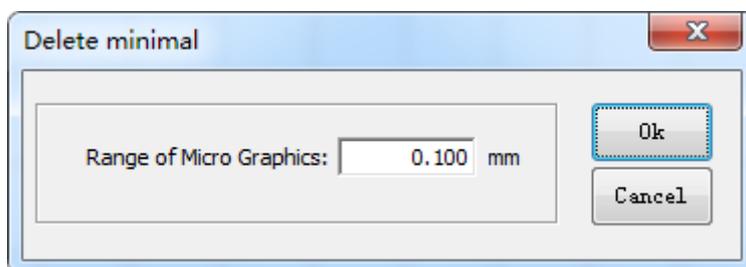
**Remove duplicate lines:**

This feature is for single graphic, removing duplicate segments in a single graphic. After this

processing, a single graphic may become multiple graphics.

**Remove very small graphics:**

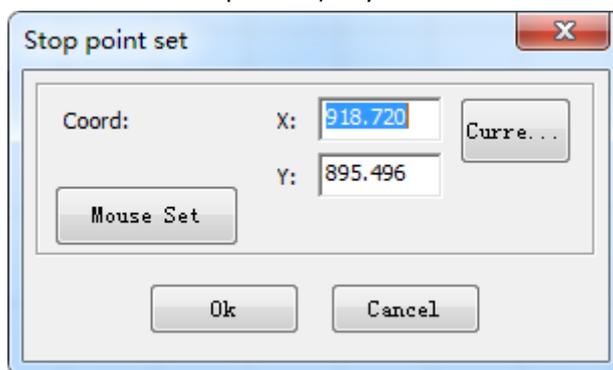
Delete these eligible graphics based on the conditions of the set minimum graphics.



1.3.2.-27 Very small graphical condition setting

**Stop setting:**

Click , The Stop Point Settings dialog box pops up, you can directly enter the stop position (you can get the coordinates of the current laser head position) or you can select the stop position by mouse.



1.3.2-28 Stop setting interface

### 1.3.3 Drawing toolbar

You can draw some simple graphics, and you can align, move, and size the selected graphics.

**Graphic drawing:**

You can draw polylines, rectangles (squares), and ellipses (normal circles).



1.3.3-1 drawing

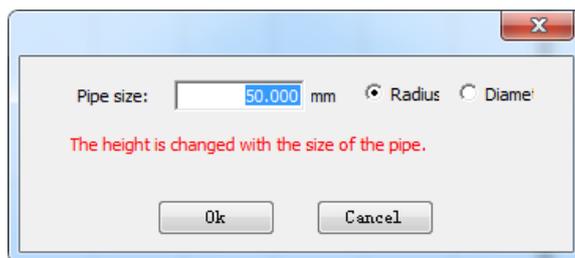
**Round tube cutting drawing:**

In the machine parameters, the cutting platform is set to be a circular tube cutting, then the pipe diameter, the circular pipe surface cutting drawing, and the intersecting line drawing can be set here.



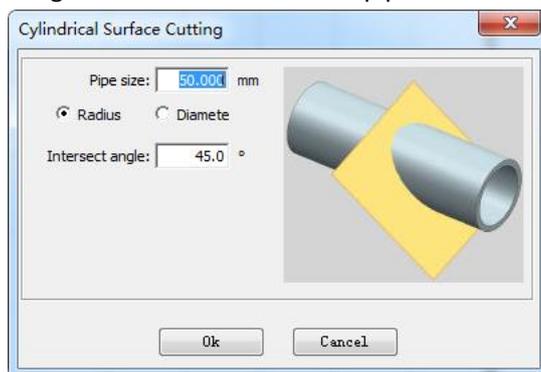
### 1.3.3-2 Tube cutting related operations

Pipe diameter setting: Set the diameter of the pipe to be cut, and the width of the pipe varies according to the pipe diameter (the pipe is unfolded).



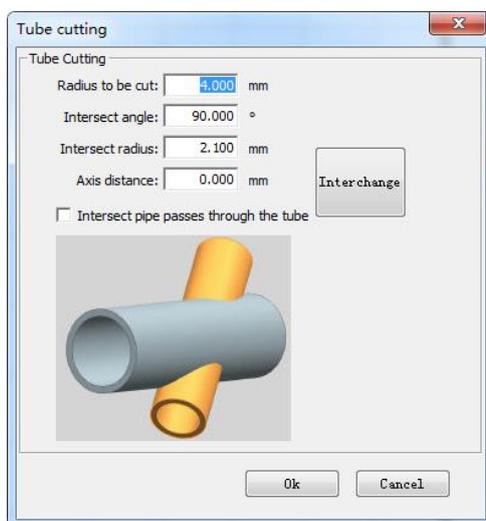
### 1.3.3-3 Pipe diameter setting

Circular tube surface drawing: Set the diameter of the pipe to be cut and the angle of the section



### 1.3.3-4 Circular tube cutting drawing setting interface

Intersecting line cutting: Set the pipe diameter to be cut, the intersecting angle, the relevant pipe diameter, and the axial distance.



### 1.3.3-5 Intersecting line cutting drawing setting interface

■ **Alignment processing:**

You can align the selected graphics (press shift + left mouse button to select multiple graphics), alignment processing has upper alignment, lower alignment, left alignment, right alignment, vertical middle alignment, horizontal middle alignment, and center alignment.



1.3.3-6 Alignment processing

■ **parallel movement and transformation:**

The selected graphic can be parallel movement to the 4 corners of the web as well as the center position for easy edge-to-edge processing. It is also possible to arrange the selected graphics in equal width, contour and equal size, and horizontally and vertically.



1.3.3-7 parallel movement and transformation

## 1.3.4 CNC Toolbar

Perform machining operations, processing related parameter settings, and auxiliary functions such as machine detection and laser setting.

■ **Processing operation:**

Here you can start and stop normal cutting, air travel machining and simulation (analog speed adjustable)



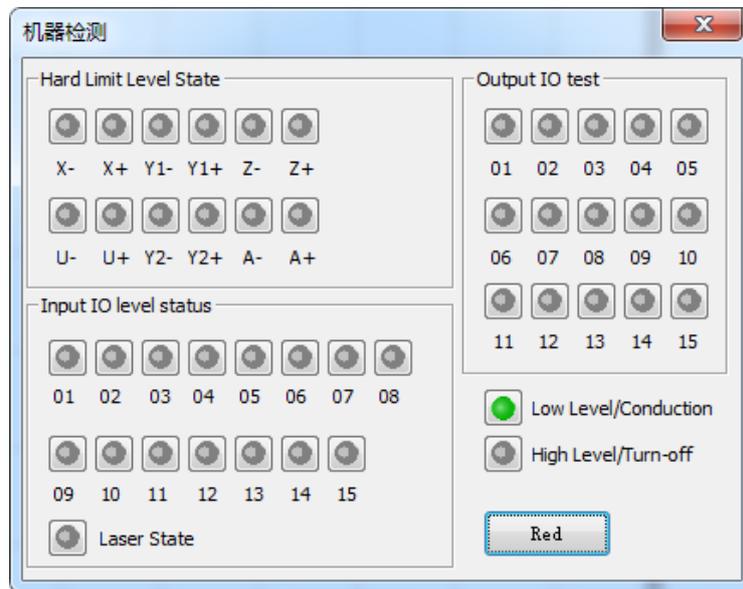
1.3.4-1

**Scan preview:** After setting the mode to "Laser Scan" in the layer parameters, User can view the processed data here. And after resetting the corresponding layer parameters, user can "preview", and click the "Apply", the parameters set here can directly apply to the corresponding layer.





Click **Machine Check**, Perform machine inspection. Detectable system IO input and output, limit is normal

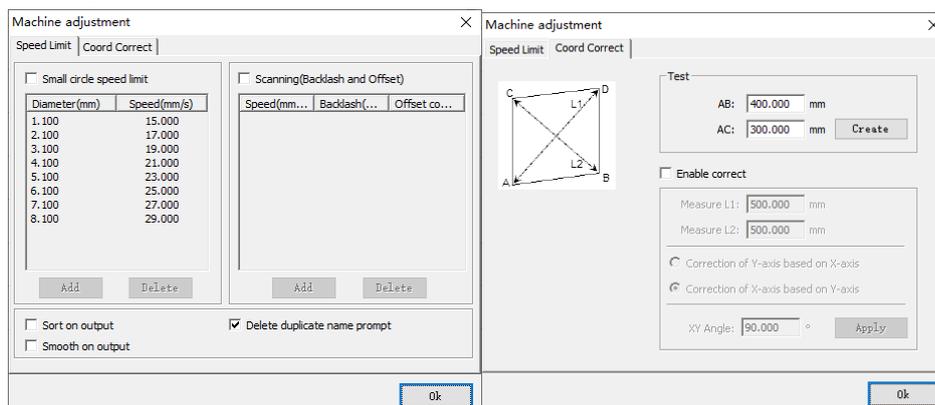


1.3.4-4 Machine detection interface

Hard limit Voltage status, input IO Voltage status: These statuses are automatically read when the dialog box is popped up. After entering the interface, you need to manually read the button to read. Shown here is the Voltage state, green is low Voltage, gray is high Voltage.

Output IO test: Click the corresponding output IO button to check whether the LED light corresponding to the control system changes. The interface displays green to turn on to OGND, and gray to turn off (float).

**Machine adjustment:**



It is mainly used to compensate the software for the dissatisfaction of the existing machine. it is for small circle speed limit, verticality correction, etc.

small circle speed limit: After enable, fill in the diameter and speed. When processing,

the speed limit will be processed according to the range of the small figure.

**Scanning (backlash):** Used in engraving, used for backlash compensation and position offset processing.

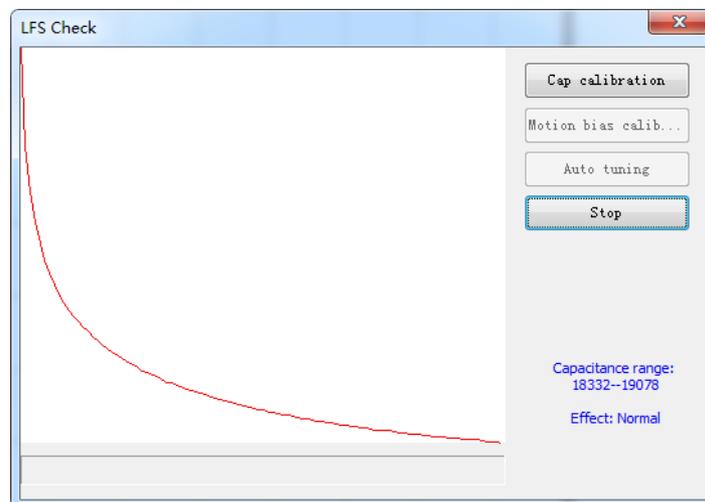
**Sort on output:** Automatically sort when processing, downloading and saving offline files

**Smooth on output:** Automatically smooth when processing, downloading, and saving offline files.

**Verticality calibration:** It mainly compensates for machines with insufficient X and Y axis perpendicularity. First generate a rectangle of the setting size, and then cut the rectangle, then measure the length of the diagonal. After enable, fill the corresponding diagonal length into the corresponding position, and select the reference axis, click "calculate", and then calculate the compensation data automatically.

**Following system:**

Here you can calibrate the height controller. The speed mode of controller can perform servo calibration, auto-tuning and capacitance calibration. The position mode height controller can only perform capacitance calibration.



1.3.4-5

**Capacitor calibration:** Move the head to the position close to the plate (the plate must be stable), click the capacitor calibration, then start calibration, when the calibration ended, the calibration result will be returned, the calibration effect will be automatically determined, and in the normal ,it is available. Click OK to save the calibration. As a result, if you don't want the calibration result, click Cancel.

**Servo calibration:** Use the speed mode, to move the head to the middle of the Z-axis position and

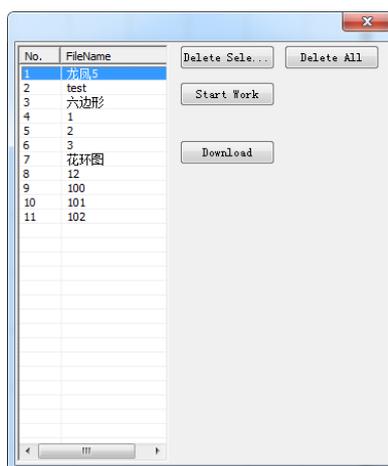
click the servo calibration button to calibrate.

Automatic tuning: Use the speed mode, to move the head to the position close to the plate (the plate must be stable), and click the automatic setting to adjust.

Stop: The above 3 kinds of operations can use the stop button to exit in halfway.

**Document management:**

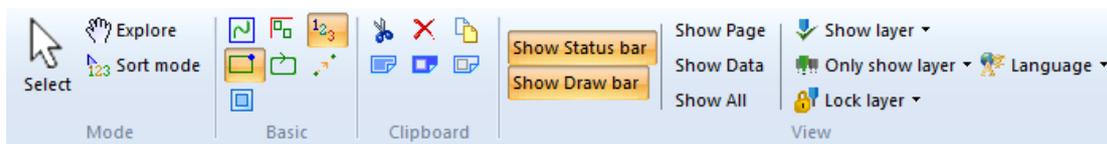
It must be connected to the system to be used. Here you can view all downloaded files of the system, or delete these files, you can download the saved offline files to the system. At the same time, the selected file processing can be started.



1.3.4-5

### 1.3.5 View toolbar

This toolbar is mainly related to some interface display functions, such as: the parallel movement mode and sort mode switching of the drawing interface, the selection of special graphics (intimal, adventitia, similar, etc.), the display and hiding of the drawing bar and status bar, and the figure. Layer display and locking, etc.



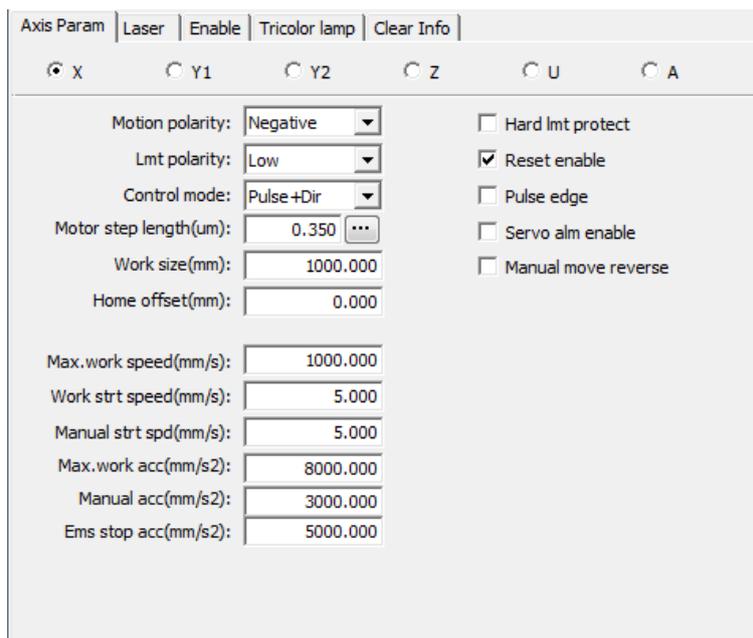
1.3.5 View toolbar

## 1.4 Parameter Description

### 1.4.1 Vendor parameters



Click , it can open the vendor parameter setting interface, where you can set the axis related parameters, laser control related parameters, enable and three color lamp related settings.



1.4.1-1

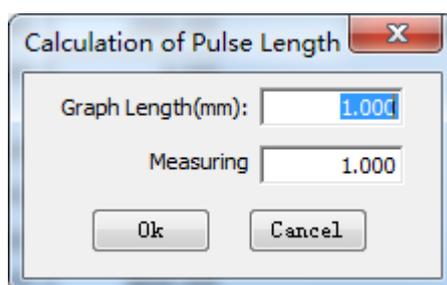
Axis related parameters

Axis parameters	
<b>Directional polarity</b>	Modifying the direction polarity allows the motor to move in the opposite direction. The target of the modification is to make the axis move to the origin when resetting. If the axis moves away from the origin when resetting, the polarity setting of the axis is wrong and should be modified.
<b>Limit polarity</b>	Used to set the high and low voltage mode of the limit signal. If the motion axis reaches the limit position, input a low voltage signal to the main board, and then the limit polarity should be set to negative.
<b>control method</b>	The types of controller output pulses include positive and negative pulses and pulse + direction. This option is set correctly based on the requirements of the actual connected driver.
<b>Step</b>	It is the pulse equivalent of the motor, when sending a pulse to the motor, corresponds to the absolute distance movement by the motion axis. Before the value is set correctly, the machine can cut

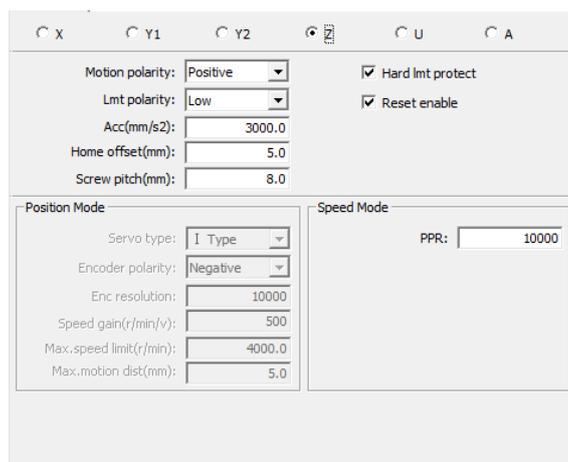
	a large rectangle (if it is the larger figure, which can make the error smaller), and automatically calculate the motor step by the length of the figure and the length of the measurement.
<b>Work size</b>	The farthest distance that the motion axis can move. It depends on the actual conditions of the machine.
<b>Origin offset distance</b>	If the axis is enabled with hardware limit protection, the value should normally be set to 2~5mm. If it is set to 0, the motion axis will run to the minimum coordinate 0, it may make the limit valid, which will trigger false. The hardware limit protection function makes the machine stop urgently. If the hardware limit protection is not enabled, set the value to 0~5mm.
<b>Hard limit protection</b>	Used to enable the hardware limit protection function of the axis.
<b>Reset enable</b>	If the machine is configured with this axis, the axis "Reset Enable" option should be turned on. If the axis is not configured, the "Reset Enable" option for that axis should be disabled. The meaning of this parameter is to control the "power-on reset" option in the user parameters and the "axis reset" function in the function keys to prevent the user from erroneously resetting a motion axis that does not exist.
<b>Pulse rising valid</b>	The pulse signal used to set the motor driver is valid for the rising edge or the falling. When this option is not enabled, the controller falling valid. When this option is enabled, the controller rising valid.
<b>Servo alarm enable</b>	Enables whether to detect the servo alarm signal of the axis. When enabled, the system will prompt the servo alarm when the servo alarm is generated, otherwise the system will not detect the alarm signal.
<b>Key reverse</b>	Used to control the direction of motion when moves the motion axis manually. If the direction polarity parameter set correctly, press direction key on the operation panel, the axis moves in the opposite direction, then enable button reversed.
<b>Dual drive enable</b>	This option has two Y-axis output channels Y1 and Y2 for use on machines with bilateral gantry structures. This parameter has only the Y1 axis parameter, and the other axes are not. After setting, Y1 and Y2 use the parameter of Y1.
<b>acceleration</b>	
<b>Maximum speed</b>	The maximum speed of movement that the shaft can withstand. This parameter is related to the driving ability and motion of the motor. The inertia of the shaft and the gear ratio are related. Typical values are 200~500mm/s.
<b>Start speed</b>	The speed at which the motion axis starts directly from the standstill state. If the value is too large, it will cause the motor to lose step, jitter, and even whistle. If the setting is too small, the running speed of the entire graphic will be reduced. If the

	inertia of the moving shaft is large (the shaft is heavy), a small start speed can be set. If the inertia of the moving shaft is small (the shaft is light), the start speed can be appropriately increased. Typical values are 5~30mm/s.
<b>Key start speed</b>	Pressing the key on the keyboard to move the starting speed of the axis movement, it cannot be higher than the starting speed of the axis.
<b>Maximum acceleration</b>	The maximum acceleration value of the motion axis during acceleration and deceleration, the acceleration setting is too large, which will also cause the motor to lose step, jitter and even whistle. If the setting is too small, the acceleration will be slow and the running speed of the whole graphic will be reduced. For a shaft with a large inertia, such as the Y axis corresponding to the beam, a typical setting range is 800-3000mm/s <sup>2</sup> , corresponding to the axis with less inertia, such as the X-axis corresponding to the trolley, a typical setting range is 8000~ 20000mm/s <sup>2</sup> .
<b>Emergency stop acceleration</b>	If the axis is enabled for hard limit protection, when the axis moves to the limit position, the axis will be emergency deceleration and stop operation with an emergency stop acceleration. This value can take 2~3 times of the maximum acceleration of the axis.
<b>Key acceleration</b>	: The acceleration value when the button moves the axis movement cannot be higher than the maximum acceleration of the axis.

Motor equivalent measurement method: In the manual movement, use the stepping motion to move 100mm in a single direction and measure the actual moving distance, click , Enter the calculation interface, fill in the values set at the beginning and the measured values, and click OK to calculate the equivalent. You can also cut a larger rectangle and measure the size of the cut pattern, compared to the size set by the software.



1.4.1-2 Step calculation

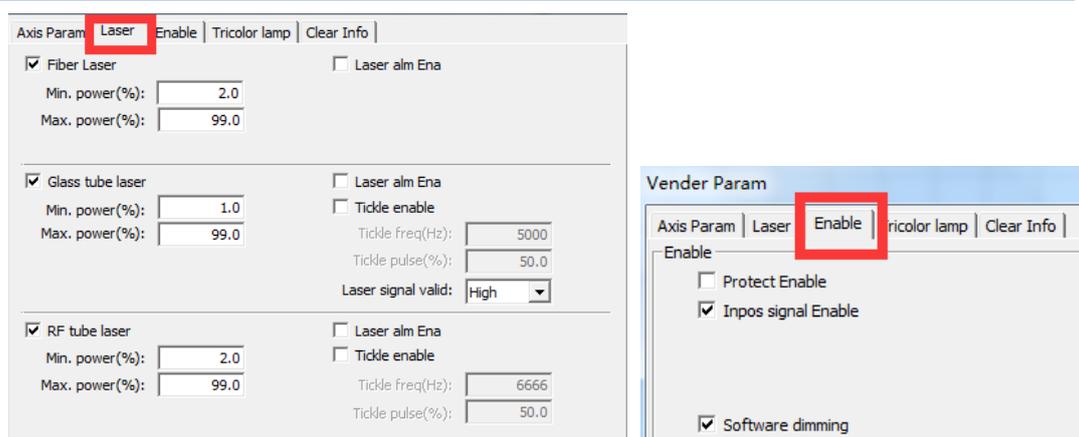


1.4.1-3

Z axis vendor parameters

Z axis parameters	
<b>Directional polarity</b>	Same with other axis
<b>Limit polarity</b>	Set the hardware limit polarity. If the hardware limit is low voltage when the hardware limit is triggered, set the hard limit polarity to negative polarity. If the hardware limit is high voltage when the hardware limit is triggered, the hard limit polarity is set to positive polarity.
<b>Acceleration</b>	Used to set the acceleration when moving.
<b>Origin offset distance</b>	Same with other axis
<b>Screw pitch</b>	The pitch of the screw, this parameter needs to be set according to the actual situation of the machine.
<b>Hard limit protection</b>	If the hardware limit is enabled, when the hardware limit is triggered, limit protection will be generated; if the hardware limit is disabled, when the hardware limit is triggered, no protection.
<b>Enable reset</b>	Same with other axis
<b>Servo alarm enable</b>	Same with other axis
Speed mode parameter	
<b>Servo type</b>	<p>According to the principle of different servo driver control signals and the voltage logic, the servo drivers are divided into different types, and each type of servo driver needs to select the corresponding type.</p> <p>I : Panasonic A5 Series</p>

	II : Sanyo R, Yaskawa series
<b>Encoder polarity</b>	Used to set the polarity of the encoder.
<b>Encoder pulse number</b>	Set the number of pulses fed back by the encoder per revolution of the motor, which needs to be consistent with the drive parameter settings.
<b>Speed gain</b>	Each 1V analog voltage corresponds to the actual motor speed and needs to be consistent with the driver parameter setting.
<b>Upper speed limit</b>	Set the maximum speed allowed by the motor. When the actual speed exceeds the upper limit of the speed, a servo alarm will be generated.
<b>Maximum route</b>	Refers to the maximum distance the cutting head moves downward (referenced to coordinate value 0). When the soft limit is enabled and the distance moved downward exceeds the maximum route, it will protect.
<b>Position mode parameter</b>	
<b>circle pulse number</b>	The number of pulses per revolution of the motor.



1.4.1-4

Laser parameters

Laser parameters	
<b>Machine enable</b>	The laser machine can enable fiber laser, glass tube and radio frequency tube. The three lasers can be enabled at the same time, and then the lasers selected according to the layer parameters and processes.
<b>Minimum power</b>	The system limits the minimum power that the laser can output.
<b>Maximum power</b>	The system limits the maximum power that the laser can output.
<b>Laser frequency</b>	Laser PWM output signal frequency.
<b>Laser on signal voltage</b>	For non-fiber lasers, the voltage of the laser switching signal can be set, which is set according to the voltage of the switching signal required by the

	laser.
<b>Laser alarm enable</b>	Check this option, when the laser to generate an alarm, the system has an alarm prompt and related processing.
<b>Enable pre-ignition</b>	For non-fiber lasers, the pre-ignition mode can be used.
<b>Pre-ignition frequency</b>	When it is a radio frequency laser and requires a pre-ignition pulse, it can be configured by Pre-ignition frequency and pre-ignition pulse width the characteristics of the ignition pulse.
<b>Pre-ignition pulse width</b>	When it is a radio frequency laser and requires a pre-ignition pulse, it can be configured by pre-combustion frequency and pre-ignition pulse width the characteristics of the ignition pulse.
<b>Enable parameters</b>	
<b>Machine protection enable</b>	When the signal is externally input, it can be connected to external devices such as water tanks and sliding doors. When this option is enabled, the system will detect whether these devices generate this type of alarm.
<b>In-position signal enable</b>	When choose this option ,the height controller use of the in-position signal to detect whether the follow-up or rise is in place; otherwise, the delay is used
软件调光	Mark point visual processing, the software can adjust the light source size through the serial port.



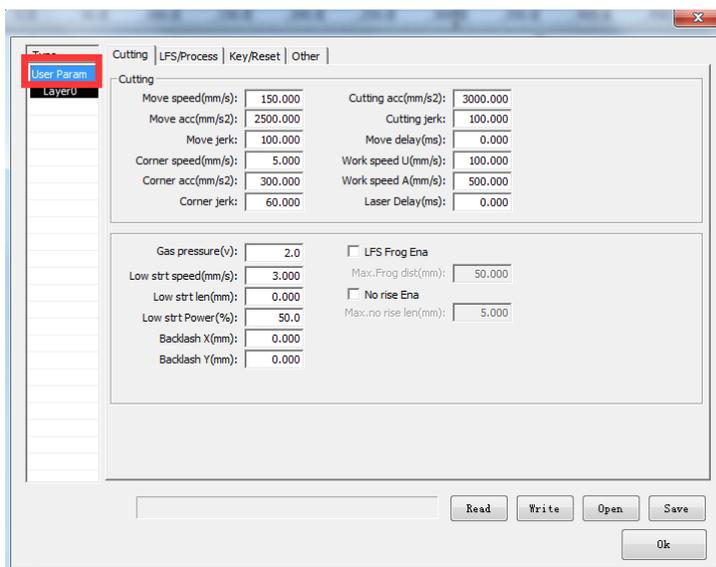
1.4.1-5 Tricolor light settings

The output of the tri-color lamp and buzzer can be enabled here. And can set the performance of three-color lights and buzzer during idle, running, pause and fault.

## 1.4.2 User parameters



Click **Layer para**, User parameters can be selected for viewing and modification.



User parameters settings

Cutting parameters	
<b>Idle speed</b>	This parameter determines the maximum speed of all the lines that do not emit light during the movement of the machine.
<b>Idle acceleration</b>	The highest acceleration without a straight line. The setting of the idle speed and the idle motion is large, which can shorten the working time of the entire graphic, but if the setting is too large, which may cause the track to be shaken, and the setting needs to be comprehensively considered.
<b>Idle acceleration ratio</b>	This parameter reflects how quickly the acceleration on the ray segment changes.
<b>Turning speed</b>	The speed at which sharp corners are cut during cutting, and also the lowest speed during the entire cutting process.
<b>Turning acceleration</b>	The acceleration value at the sharp corner when cutting. If the cornering speed and the cornering acceleration are set too large, the cornering will be shaken. If the setting is too small, the cutting speed will be affected. The cornering acceleration is the minimum acceleration value in the entire pattern cut.
<b>Turning factor</b>	This parameter reflects the degree of turning when cutting arcs of various curvatures.
<b>Cutting acceleration</b>	The highest acceleration value of the ray segment during the entire cutting process.
<b>Cutting acceleration rate</b>	This parameter reflects how fast the acceleration on the laser on ray segment changes.
<b>Move delay</b>	If the parameter is 0, no delay will be made after the idling; otherwise the speed will be decelerated and delayed after the idling.
<b>backlash X\Y</b>	Backlash of the X\Y axis; set this value according to

	whether the machine has a backlash or not, accurate to 1um, if the value is not zero, the control system will compensate for the backlash.
<b>Low starting speed</b>	Set the low-speed for starting length to be non-zero, and then use this speed to cut within the length of the start of processing.
<b>Low-speed starting length</b>	If the setting is not zero, the cutting speed and power will be used for cutting within the length of the processing start.
<b>Low-speed starting power</b>	Processing power within low-speed starting length.
<b>Enable leapfrog</b>	When cutting, after processing one element, it will go to the next element, and when the follower starts to lift, it will start to move when it is in idle. Otherwise, you need to wait for the head to rise in place before you start the idle movement.
<b>Leapfrog maximum distance</b>	Leapfrog maximum distance, If the length of the idling exceeds this value, the Leapfrog will not be used.
<b>Short distance does not lift</b>	Less than the length of the lift without lifting up, the laser head does not rise.
<b>The length of un-rising</b>	The maximum length of idle when the laser head do not rising
<b>Following processing parameters</b>	
<b>Raising speed</b>	Refers to the speed of lifting during the cutting process.
<b>Following speed</b>	Refers to the maximum speed following the cutting process.
<b>Rising height</b>	The height of the idle jump in the cutting process.
<b>Standby height</b>	The height of the cutting head when the entire graphic is cut.
<b>Follow-up delay</b>	When the delay mode is used, the time that the moving head rises is considered to have been in place beyond this time.
<b>Follow-down delay</b>	When using the delay mode, the time to follow the head drop is considered to be in place beyond this time.
<b>Following completed delay</b>	When the delay mode is used, the lifting time of the moving head after the processing is completed. it is considered to be in place after this time.
<b>Soft limit enable</b>	If the software limit is enabled, when the limit is triggered, limit protection will be generated; if the limit is disabled, when the limit is triggered, no protection will be generated. When the upward movement exceeds the origin coordinate value (the origin coordinate is 0), the software limit is triggered; when the downward motion exceeds the maximum stroke, the soft limit is also triggered.
<b>Filter coefficient</b>	Increasing this parameter can improve the response speed of the follow-up, but it is easy to cause the shock during the follow-up.
<b>Alarm filtering</b>	This parameter should not be set too large. The excessive alarm filter coefficient will make the cutting head fail to lift the protection in time after the collision alarm occurs. On the contrary, the too small alarm filter coefficient is likely to cause false alarm caused by cutting

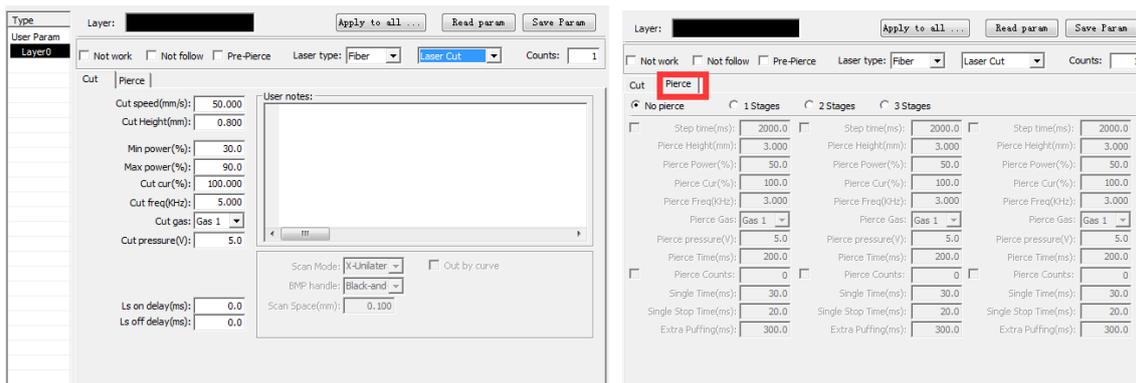
	slag.
<b>Jitter filtering</b>	This parameter is used to suppress the jitter of the thin plate during cutting. The larger the parameter, the more obvious the suppression effect, but it will reduce the response speed of the follow-up.
<b>Maximum following error</b>	When the cutting head is in the following state, the maximum following error is allowed. When the following error exceeds the set maximum following error, an alarm of "following error too large" is generated.
<b>Nozzle height</b>	Refers to the position of the set nozzle, the height of the cutting head nozzle from the metal plate during cutting.
<b>Gas delay</b>	During the cutting process, the laser head starts to follow the delay for such a long time, and then starts to blow. The delay is shorter than following the in-position time, and the pre-blowing is realized.
<b>Gas exchange delay</b>	Different gases are used for perforation and cutting. When the punching is cut, the time is delayed, and the gas in the trachea is drained to prevent mixing.
<b>Button reset parameter</b>	
<b>Fast button</b>	Manual movement of the axis, select the speed at manual high speed
<b>Slow button</b>	Manual movement of the axis not selecting the speed at manual high speed
<b>Reset speed</b>	Movement speed when the axis is reset
<b>Power-on reset enable</b>	When the system is started, whether the corresponding axis is reset.
<b>other</b>	
<b>Return position</b>	The position where the laser head is stopped after processing is completed. There can be four kinds of mechanical origin, positioning point, no return, and back stop.
<b>Frame mode</b>	The movement mode when the panel starts the frame movement. It can be related to the laser off frame, the laser on frame and the four corners.
<b>White edge distance</b>	The distance of the frame motion track relative to the actual graphic frame.
<b>Engraving</b>	
<b>X, Y axis starting speed</b>	The take-off speed of the scan, when using the motor for dragging, it does not need to accelerate from 0, it can do directly from a certain speed to shorten the overall processing time, but the speed cannot be too high, and due to the load of the X and Y, the X axis initial speed is generally slightly higher than the Y axis.
<b>X, Y axis acceleration</b>	To match the scanning speed (layer speed in the layer parameters), if the setting is too small, the scanning requires a longer acceleration distance, which affects the scanning efficiency. The actual setting can be different according to the machine structure and load. Due to the

	different loads on the X and Y axes, the acceleration on the X axis is generally much higher than the Y axis.
<b>Scan line feed speed</b>	This parameter is used to control the maximum speed of the vertical movement of the previous line to the next line in the scan mode. If the line-to-line spacing is larger during scanning, or when the block graphics are scanned, the distance between each block is larger, and when it is necessary to accurately position each line or each block, user can set the scan line feed with a lower value. The minimum value of this parameter cannot be less than the take-off speed of the corresponding motion axis, and the maximum cannot be higher than the maximum speed of the corresponding motion axis.. If the user sets illegally, the controller will automatically control this parameter within the above range.
<b>Scan mode</b>	Two modes: General mode and special mode, when selecting general mode, no processing will be done when scanning. When selecting special mode, the laser spot will be processed. If the special mode is enabled, the laser power should be increased. The lower the spot percentage, the more the laser power is attenuated. If user want to achieve the same scanning depth, the larger the laser power can be set. The purpose of selecting the special mode is to make the laser at a high power for a short time, and obtain a flatter bottom effect during deep scanning. But it should be noted that if the spot adjustment is not suitable, the purpose may not be achieved, and the high power short-time light output will have a certain impact on the laser lifetime. So the general mode is selected by default.
<b>Spot size</b>	When the general mode is selected as the scanning mode, this parameter is invalid, and when the special mode is selected, this parameter takes effect. The controller controls this parameter between 50% and 99%.
<b>Scan factor</b>	This corresponds to the acceleration in S-shaped acceleration and deceleration. Indicates the urgency of acceleration and deceleration.

### 1.4.3 Layer parameters



Click , it can set the layer parameters. Different layers are distinguished according to the different colors of the primitives, and one color represents a layer. When the process parameters open, the layers appearing in the primitives are displayed according to the color of the primitive. Different layers can be set with different parameters so that layers can be used to distinguish the processing process.



### Layer parameter settings

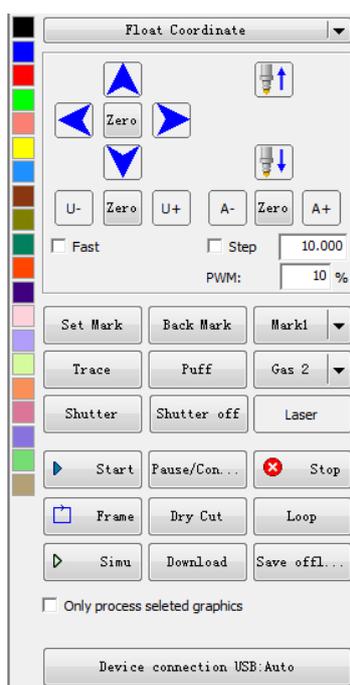
Special parameters	
<b>Apply to all layers</b>	Apply the parameters of the currently selected layer to all layers.
<b>not processed</b>	The graphics corresponding to the layer are not processed
<b>Not following</b>	When the graphics of the layer are processed, the laser does not follow
<b>Layer processing times</b>	The number of times for repeated process of the layer, maximum is 30 times
Process parameters	
<b>Cutting speed</b>	Set the target speed for actual processing. Since there are acceleration and deceleration processes in the first and last corners and corners, the actual cutting speed is smaller than this speed.
<b>Cutting height</b>	When cutting, the following height of the auto focus controller.
<b>Minimum power</b>	Set the power corresponding to the minimum speed during the cutting process
<b>Maximum power</b>	Setting the cutting speed during the cutting process is the corresponding power.
<b>Peak current</b>	Set the peak current of the fiber laser, which is the peak power. The peak power determines the maximum cutting power that the machine can achieve. For a 500W cutting machine, if the peak current is set to 90%, the peak power that can be achieved when cutting is $500W * 90\% = 450W$ .
<b>Cutting frequency</b>	Set the carrier frequency of the PWM modulation signal during cutting, that is, the number of times of light emission in 1 second. The larger the value, the more continuous the light is.
<b>Cutting gas</b>	Set the type of auxiliary gas used for cutting
<b>Laser on delay</b>	When cutting, delay the laser time. There is a lag in machine motion, delaying the laser to synchronize with the motion.
<b>Laser off delay</b>	When cutting, delay the time to turn off the laser. There is a lag in machine motion, and delaying the laser off. It can be synchronized with the motion.
<b>Focus position</b>	<b>reserved</b>
<b>Residence time</b>	<b>reserved</b>

Remarks	Additional information can be set for the layer.
<b>Punching parameters (it can be divided into non-punching, first-level, second-level and third-level)</b>	
<b>Progressive punching time</b>	If choose this option, the progressive punching is enabled. Here you can set the time for progressive punching.
<b>Punching height</b>	The starting height of the progressive punching. If the progressive punching is not selected, it indicates the height of the perforation at that level
<b>Punching power</b>	Set the punching laser power, it is the duty cycle of the PWM modulation signal
<b>Punching frequency</b>	Set the carrier frequency of the PWM modulation signal when punching. Generally, the lower frequency is used for the punching, and the pulse punching is used to avoid the explosion.
<b>Peak current</b>	Set the peak current when the fiber laser is punching, that is, the peak power.
<b>Punching gas</b>	Set the type of auxiliary gas for punching
<b>Punching voltage</b>	In the case of a proportional valve, the voltage can be directly controlled.
<b>Punching time</b>	In the case of non-pulse punching, the time for punching.
<b>Punching times</b>	Set the number of pulse punching here.
<b>No laser blowing delay</b>	After punching, turn off the laser and blow time. Cool the overheated sheet after punching, and then cut to reduce the thermal impact of the starting point. This parameter is used for both segmented and progressive punching.
<b>Single punching time</b>	When pulse punching is enabled, the opening time in the single switching laser process.
<b>Single Residence time</b>	When pulse punching is enabled, the laser-off time in a single switching process.
<b>Focus position</b>	reserved
<b>Residence time</b>	reserved
<b>engraving</b>	
<b>Scan mode</b>	The method of generating scan lines by vector graphics and bitmaps can be horizontal unidirectional, bidirectional scanning, vertical unidirectional and bidirectional scanning. The method of generating scan lines by vector graphics and bitmaps can be horizontal unidirectional and bidirectional scanning and vertical unidirectional and bidirectional scanning.
<b>Bitmap processing</b>	The processing method of bitmap supports three types: black-and-white, scatter, and dot. DPI is only effective when processing dot plots. The larger the DPI, the finer the graph, and the longer the processing time, the greater the memory consumption.
<b>Scanning interval</b>	Sampling interval when generating scan data.
<b>Primitives are</b>	When the primitives of the same layer are scanned and calculated,

output separately	they are output as a single primitive or calculated and output together with the layer data. Choose this option indicates single image output. Bitmap and vector diagram are calculated separately.
Cutting after scanning	After scanning, cut the figure frame.
Interval	After scanning, the distance between the cutting frame and the actual scan image which is prevented the cutting frame is too close to the scan image.

## 1.5 Processing interface description

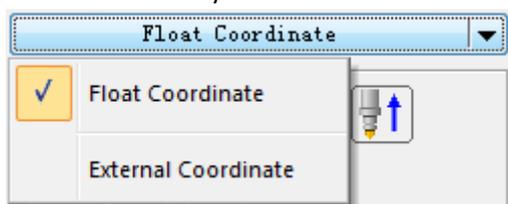
The machining interface is located on the right side of the software. This is a split window, mainly some control controls related to machining. Including: coordinate system settings, manual machining, status display and control, automatic machining, return to positioning points, cycle processing and system connection and other related controls.



1.5-1 Processing control interface

### Coordinate setting:

It is used to set the positioning method used for automatic machining. It can be set to the floating coordinate system and the absolute coordinate system in the software.

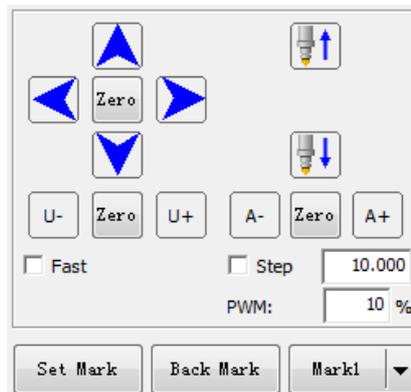


1.5-2 Coordinate selection

Floating coordinate system : In this coordinate, the positioning method is the current position processing. That is, according to the current position of the laser head and the positioning point of the processing graphic (the small green square next to the graphic), the graphic is moved to the current position for processing. In this coordinate system, to set the positioning point of the graphic, if the positioning point setting (which can be set in the user parameter) is inappropriate, it is possible to make the graphic exceed the processing width after moving. For example: The laser head is currently located in the lower left corner of the breadth, and the graphic positioning point is set in the upper right corner of the graphic. When the processing starts, the graphic moves beyond the format.

Absolute coordinate system: In this coordinate system, the position of the pattern during processing is constant, and the laser head moves to the position of the pattern to start processing. In generally, we choose to use the absolute coordinate system

Manual processing:



1.5-3 Manual processing

Manual processing is mainly used for single-axis movement. The axis can be controlled to move in four directions: up and down, left and right, and the single axis motion can be continuous motion or step motion. Continuous motion is to hold down one of the up, down, left and right buttons, then keep moving in that direction; jog motion is to select jog and set the step distance, then click the button to move a step distance to the corresponding direction.

The manual motion is divided into slow speed and fast, respectively. The axis keys set in the user parameters are slow and fast respectively. For quick, the “manual high speed” option is selected, and the motion is moved at a set higher speed.

Laser power: Set the laser power for the laser testing.

Marking point: You can mark 6 marker locations and select stops. Depending on the selected marker or stop, you can use the return marker/dock to move the cursor to the specified position. (The Red Cross circle icon  in the drawing area is the stop position, and the green flag icon  is the marker position)

■ **Status display and control:**



1.5-4 Control

Clicking on the laser button can also be used for the laser test (the power of the laser can be set here, and the other parameters are set in the user parameter setting).

laser switch settings: Click the laser button to turn off the laser after a period of time (the opening time is set in the global parameters). it can determine if the laser used for cutting is suitable.

Gas select: You can choose the type of gas to use when firing. Click the Blow button to test whether the gas control is normal or not.

The shutter is open and the shutter is closed: it is used on the fiber laser, which is equivalent to the enable signal.

■ **Automatic processing:**

Mainly for the processing related to graphics cutting. Include: cutting process, bordering, idling, looping, simulating, downloading, and saving standalone files.



1.5-5 Automatic processing

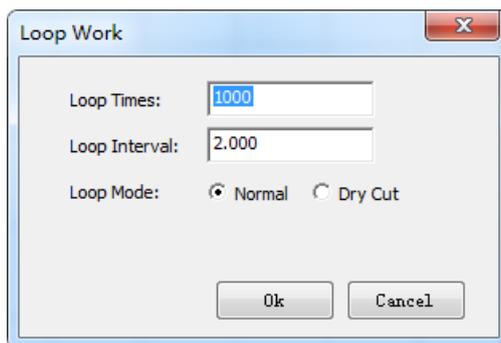
Cutting process: There are start, pause, continue, stop. And continue to pause after the start of processing and then continue to start processing, first move the laser head to the breakpoint position recorded at the time of pause, then resume the follow-up, gas, laser state, and then perform the unfinished cutting process.

Process selected graphics: When you click Start to process, only the selected drawing is processed.

Frame: The laser head go along the circumscribed rectangular frame of the processed figure.

**Cyclic processing:**

Set the number of cycles, cycle interval and machining mode. Click OK to start. Processing mode is divided into ordinary cutting and idle.



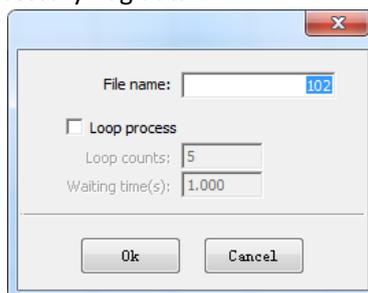
1.5-6 Cycle processing setting

**simulation:**

Without the machine movement, you can see the basic motion process of the cursor simulation processing in the drawing interface.

**Download:**

The graphics to be processed are downloaded to the control system as files, and the processing of the file can be started directly from the HMI. The downloaded data includes user parameters, layer parameters, processing data, and necessary flag data.



1.5-7

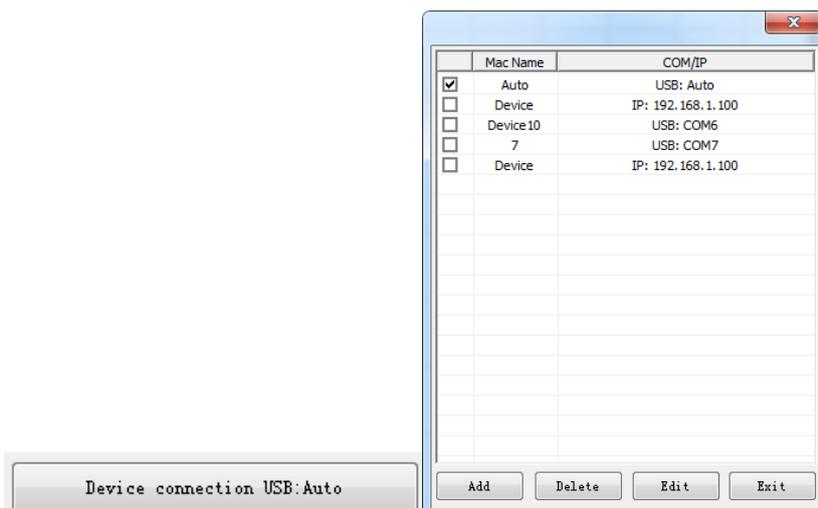
Downloaded file name: Set the name of the file to download. The file name cannot exceed 8 characters in length (no more than 4 Chinese characters).

Cyclic processing: Check here to download the files for cyclic processing.

**Save standalone files:**

The processing file can be saved to a computer or USB flash drive. The file is saved in .rd type. You can copy it and download the file to the software-connected system using "Download standalone Files" in the file management function of the software.

**Device connection:**



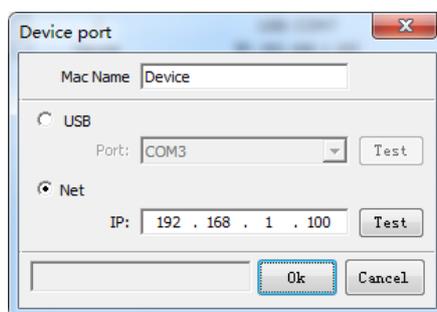
1.5-8

Click the "Device Connection" button to enter the setup connection configuration interface. Add, delete, and modify connections in the interface. You can also tick the way to connect and use the machine name to distinguish different machines. You can connect multiple machines through different ports on one computer and configure the corresponding connection method here.

Add: You can add a connection method, here you can set the machine name, connection method, connection port, and then add this new setting method to the optional list.

Delete: Delete the existing connection method in the selected list.

Modify: Modify the selected connection method.



1.5-9

Add and modify in this interface, the connection method is USB, network, USB needs to set the port number of the connection, the network needs to set the IP address, the software IP address needs to be consistent with the system, the computer's IP address needs to be set and system On the same network segment.

# Section 2 Quick operation for software

## CONTENTS:

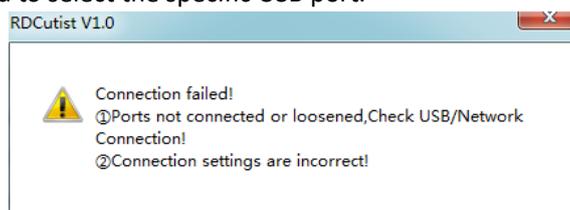
- System communication
- Creating processing data
- Manual operation
- Automatic operation



## 2.1 System communication

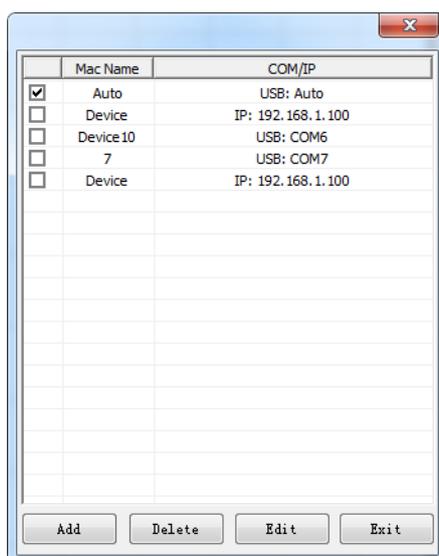
If you are the first time to using this software, with a few simple operations, the system can be put into normal operation, even if the novice can quickly have a preliminary understanding of the whole system. Quick operation is basically divided into system communication, creation of machining data (including partial graphics processing), manual movement, and automatic processing.

Run the software, If the system has been set up last time, this time will be automatically connected, otherwise there will be a prompt for connection failure. There are two major reasons for the connection failure. One is the physical connection problem (the computer and the system are not wired, or the wiring is loose, or the physical interface is faulty), and the second is the connection port setting error (the physical connection is the USB connection of the network cable result setting) or the IP address is incorrect. The physical connection is the USB connection or the USB port setting is incorrect.) If the computer is connected to only one machine and the USB port is used, you can use the automatic option directly, otherwise you need to select the specific USB port.



2.1-1 Connection failure interface

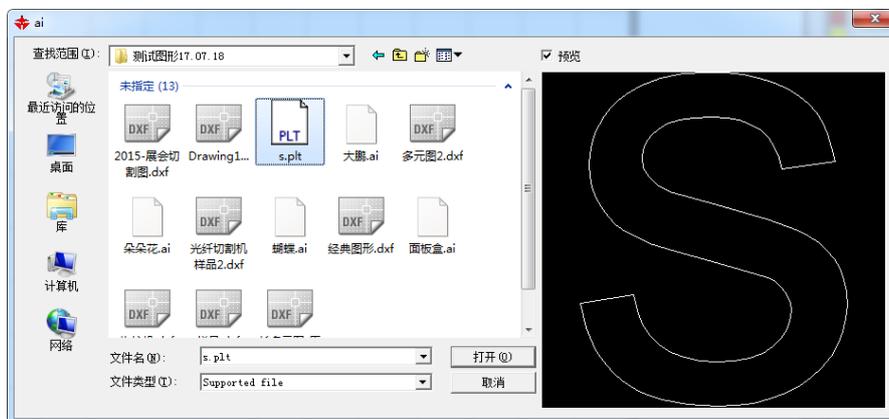
When multiple machines are connected to one computer, you can name different machines through the connection settings and operate different machines by checking different connection options. One computer can only connect to one machine at a time.



2.1-2 Connection setting interface

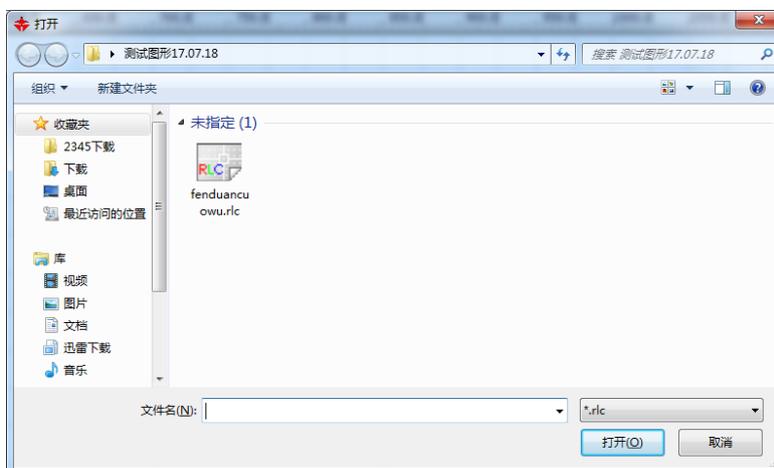
## 2.2 Creating processing data

Create processing data, which can be used to import graphic files from the outside, or to open previously saved project files, or to draw simple graphics directly.



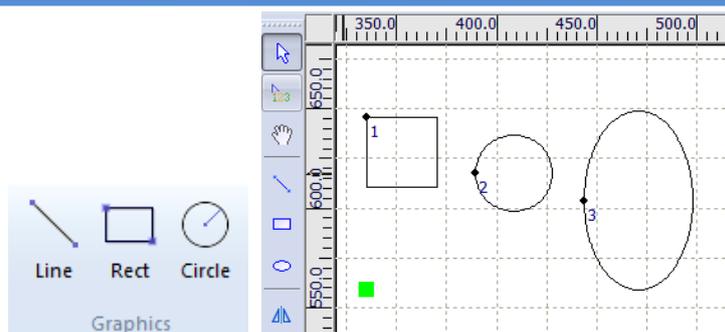
2.2-1 Import graphical interface

Select Import ai in the main menu, the import graphical interface will pop up, and the software can import files in three formats: AI, PLT and DXF. When Import the PLT file, there will be a prompt to show whether it is smooth. If you select Yes, a curve smoothing interface will pop up, the imported PLT graphic data can be smoothed here.



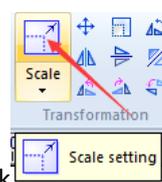
2.2-2 Rlc file open interface

The rlc project file saved by the previous software, using the opening of the main menu, can directly open the project file for processing here.

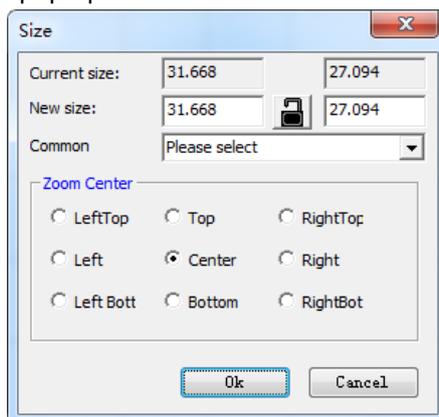


2.2-3 Simple drawing

You can select a simple drawn drawing on the drawing page (or select it in the toolbar on the left), and the software can draw polylines, rectangles, and ellipses. When you draw a rectangle or an ellipse, hold down the Ctrl key to draw a square and a perfect circle.



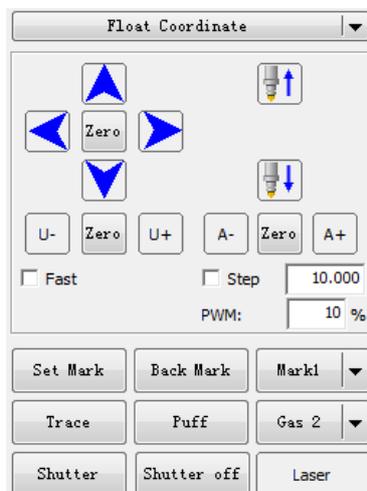
After creating the graphic data, you can select the graphic data, then click  , The size of the graphic can be modified in the pop-up interface.



2.2-4 Size modification interface

The size of the selected graphic will be displayed here, or the modified graphic size can be entered (selecting the lock to enter the width and height, and the other value is proportionally changed), and the zoom center refers to the reference point of the graphic zoom.

## 2.3 Manual operation

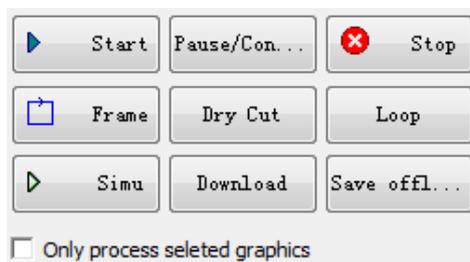


### 2.3 Coordinate system selection and manual operation

The coordinate system selection has a floating coordinate system and an absolute coordinate system. To set the coordinate system, the graphic data changes when the data is automatically processed and loaded. Manually operating this block allows for single-axis operation for fast and slow jog and continuous motion. You can also test followers, blows, shutters, lasers.

You can use a single-axis manual motion to move the laser head to the position you want. Using a floating coordinate system, you can move the machining data to that position. You can also use a single-axis motion to move the laser head to some position that needs to be recorded, then select "point X", then "mark coordinates", you can record the position to the corresponding mark point, and use the "return mark" next time. You can quickly return to the marked location.

## 2.4 Automatic operation



### 2.4 Automatic processing operations

Start, pause/continue, stop: It is a software control for automatic machining. In the case of processing graphics and setting layer parameters, these three buttons can be used directly for processing control.

Frame: The software control system performs the frame function (this function is simply to

determine the position of the graphic cut, which is inconsistent with the HMI controlled frame)

Idle: The control system performs movement along the processing path without control of height adjustment, gas and laser.

Cyclic processing: The number of processing times and the processing interval can be set to repeat the processing movement at the same position (Idle or cut).

Simulation: The software simulates motion trajectories.

Download: The cutting graphics that can be downloaded to the control system, and then the graphics can be started in the control system (you can set the parameters and download the cyclic processing graphics).

Save standalone files: The graphic file for processing can be saved. The file format is .rd. The file can be copied from the computer and used on other machines.

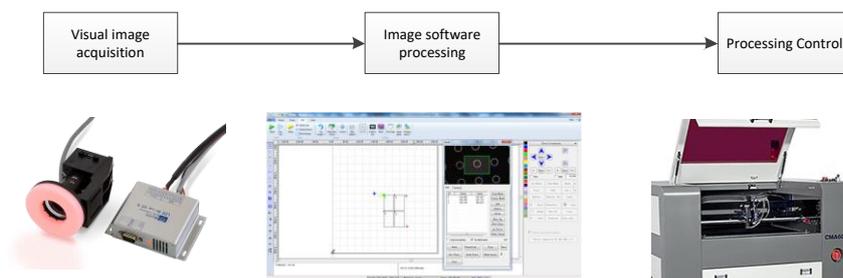
# Section 3 Mark point function

## CONTENTS:

- Function description
- Function instructions

### 3.1 Mark point function description

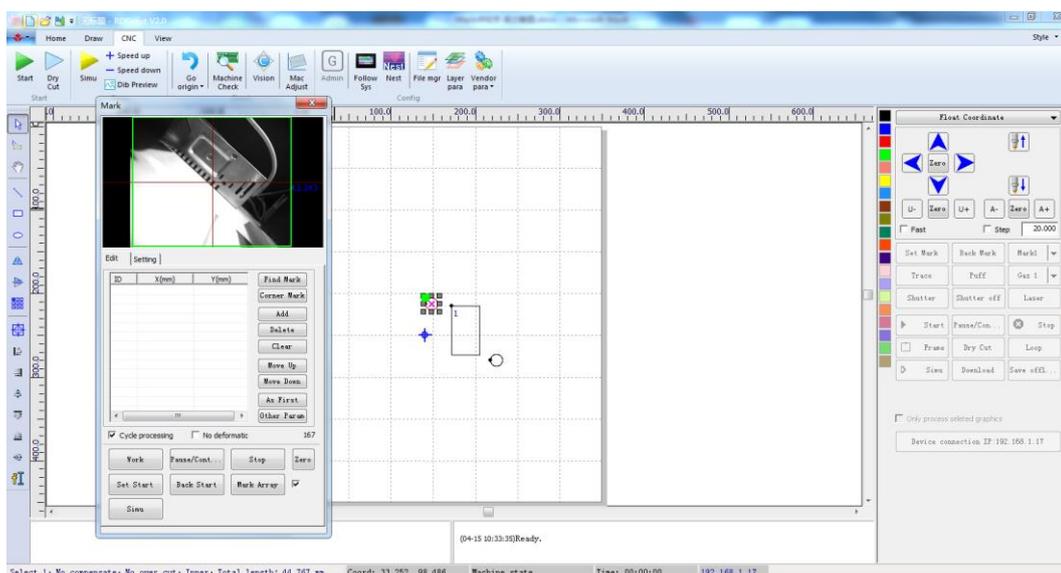
The visual cutting control system is a software function based on intelligent target recognition. The hardware consists of a motion control card, a CCD industrial camera, and an industrial control computer. Based on the basic cutting function, the image processing algorithm is combined with target image feature extraction, target recognition and pre-drawn cutting contour to complete the cutting work.

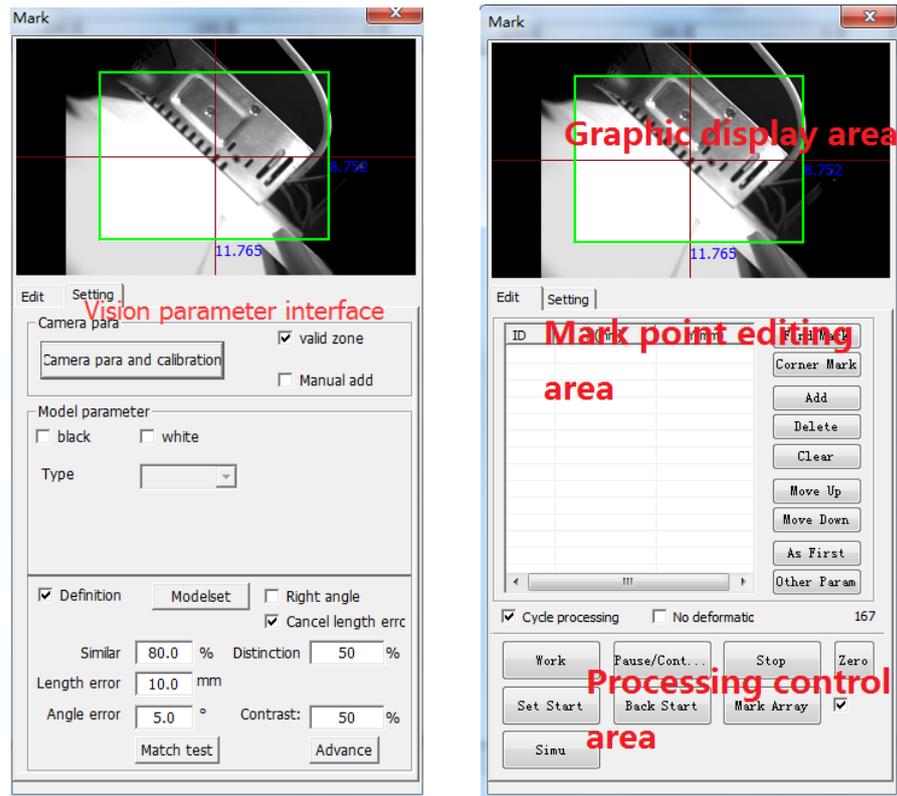


### 3.2 Mark point function instructions

#### 3.2.1 Visual function software interface

After the machine is normally reset, open the RDCutist V2.0 software and connect to the control card, select the [CNC] page in the menu bar, click the [Visual] button, and the Mark software window will pop up and display in a floating window.

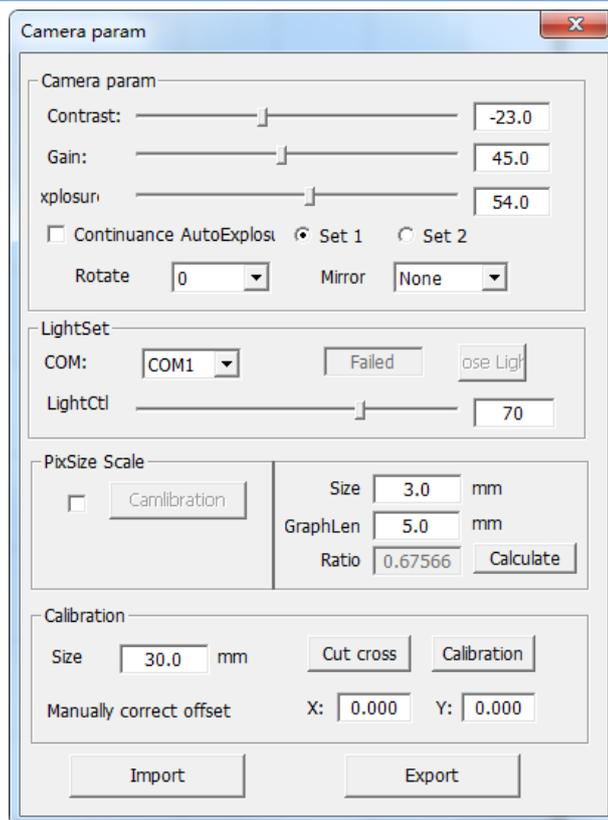




### 3.2.2 Camera setup instructions

■ **Camera parameters:**

Click [Camera parameters and calibration] will pop up the following window, you can set the camera parameters.



The adjustment of the camera image quality mainly from the aperture and focal length, but after the camera is installed, it cannot be adjusted casually. After the camera adjustment is completed, User can do the setting from the ambient light source and camera parameters to improve the software imaging effect.

**Contrast:** Mainly adjust the image quality by adjusting the difference between the background color and the material color.

**Gain:** It is the magnification of the image brightness

**Exposure:** The longer of exposure time, the higher of image brightness

**Continuous auto exposure:** The software will automatically adjust the above exposure value. When the exposure value is automatically adjusted to stable, cancel this option.

**Parameter 1, Parameter 2:** When the external environment has a greater impact on the imaging quality, two sets of parameters can be used for identification.

**Rotation angle:** Image display area imaging angle rotation.

**Mirror:** To set the mirror image from the image display area.

■ **Pixel accuracy calibration:**

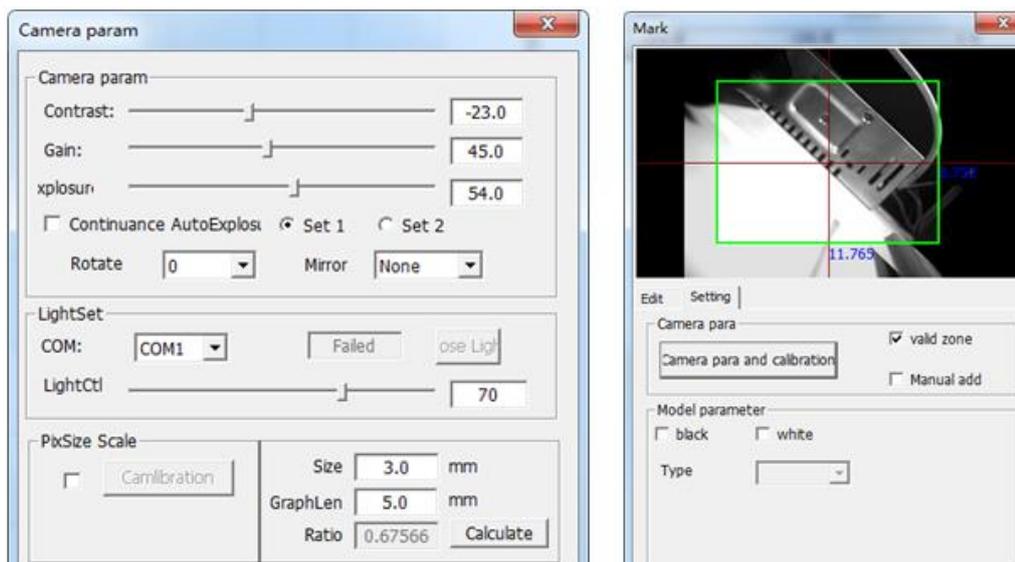
Pixel accuracy calibration is to correct the camera pixel imaging data, which can improve the accuracy of camera recognition, and supports two methods of proportional calibration and film calibration. When [Calibration] is checked, the [Calibration] button is valid and the right scale calibration parameter is invalid

and indicating film calibration. When option [Calibration] is not checked, the [Calibration] button is invalid and the right proportional correction parameter is valid, indicating proportional correction.

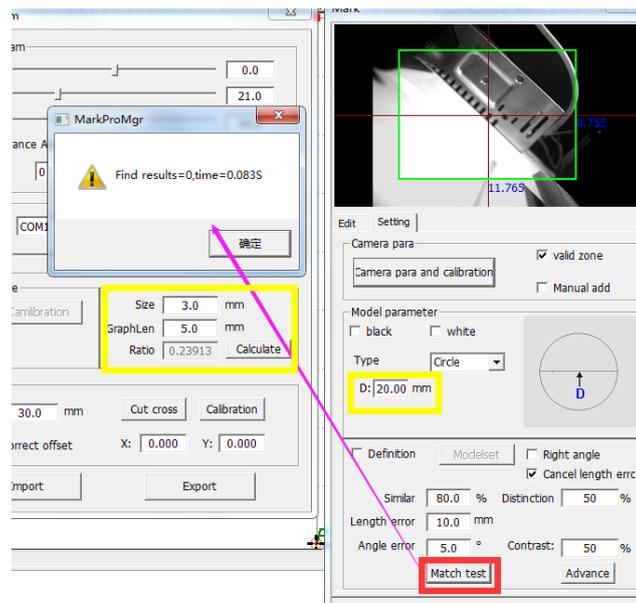
**The steps of proportional correction are as follows:**

- 1) Prepare a reference for comparison. Prepare a reference object of suitable size, such as cutting or printing a small circle of 5mm.
- 2) Put the reference object close to the table. Adjust the camera position, lens and camera parameters until the reference object can be clearly displayed in the software graphics display area.
- 3) The green border in the graphic display area is selected to identify the effective area, and drag the green border on the software to make the border of the effective area just fit the reference object.
- 4) Fill in the actual size of the figure and the recognition length calculated by the software in the pixel accuracy calibration. Click [Proportional calculation] to complete the calibration.

The [Scale] will be automatically updated.

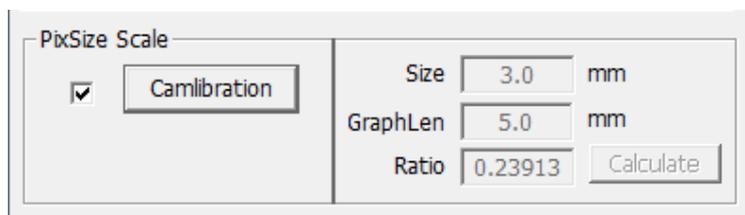


- 5) After adjusting the ratio correctly, click the 'match test'. If the number of results found is 0, the reason should be: D may be incorrect or the "ratio" may be incorrect, or the black template and white template may be incorrectly selected.

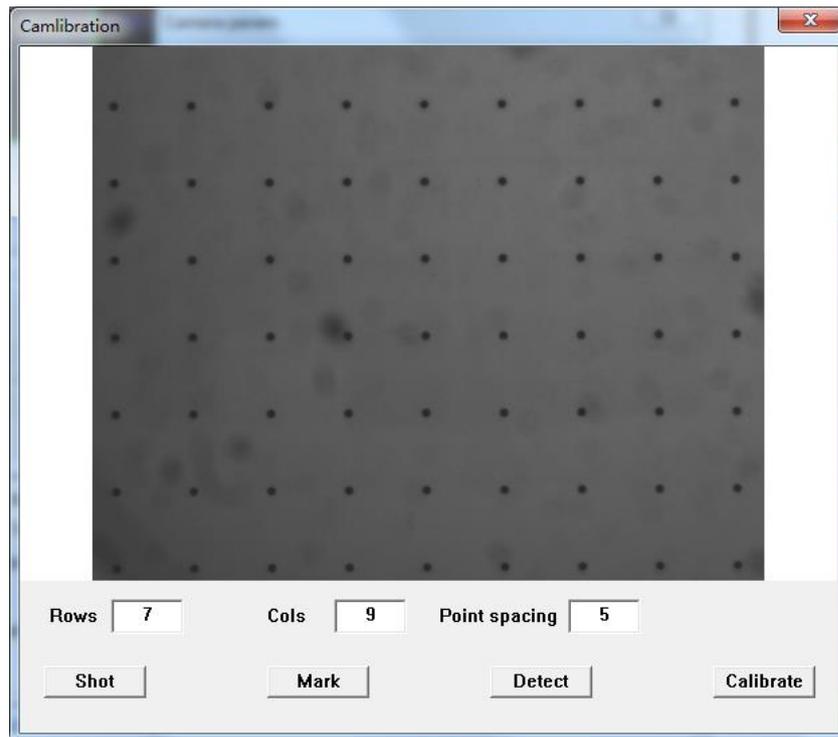


**The operation steps of film calibration are as follows:**

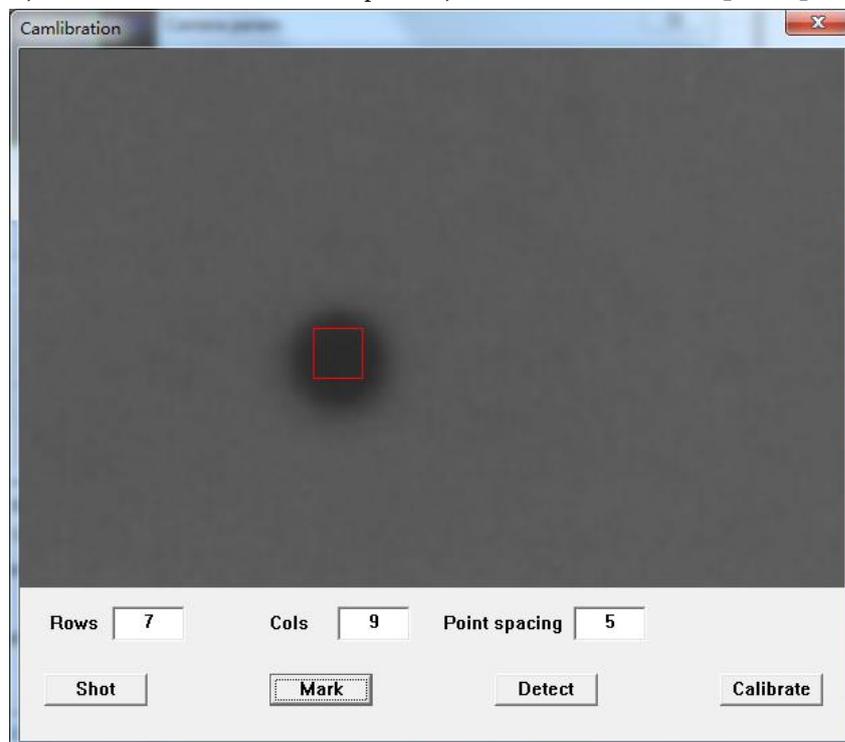
- 1) Put the matching film in the field of view of the camera, adjust the camera and camera parameters, so that the black dots on the film can be clearly recognized in the image display area.
- 2) Check the calibration option. The [Calibration] button on the left will be valid, and the [Proportional calculation] parameter on the right will become invalid.



- 3) Click the [Calibration], and will pop up the calibration process :



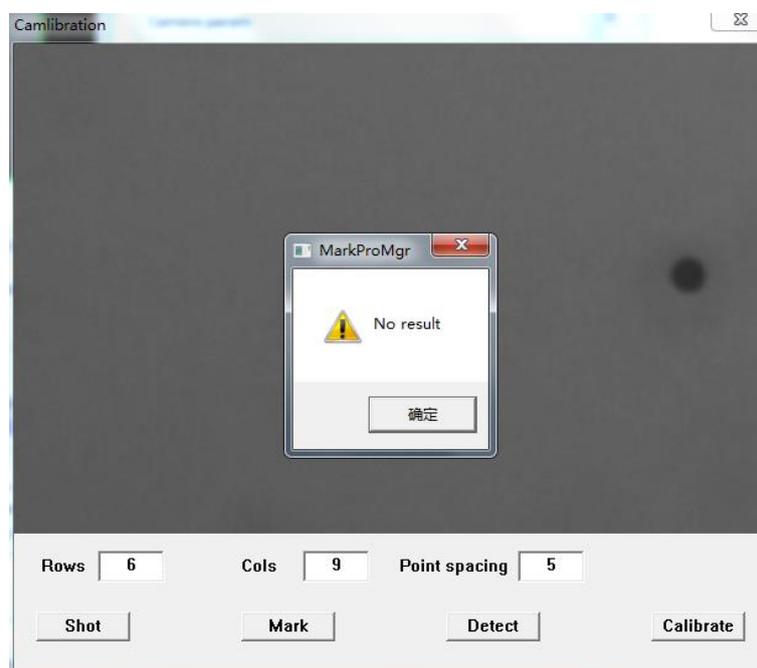
- 4) Fill in the number of rows and columns according to the array points in the picture, and the point spacing is the actual spacing of the film array points.
- 5) Click **【Shot】**
- 6) Mark feature points. Enlarge the picture to clearly select a feature point, select the feature point, and then click [Mark]

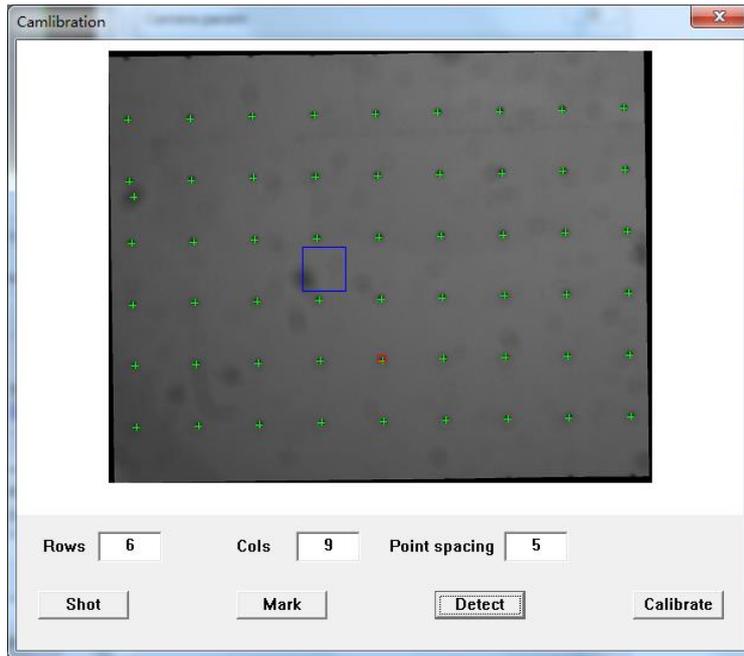


- 7) Identify feature points. Click the [Detect], the software will automatically identify the

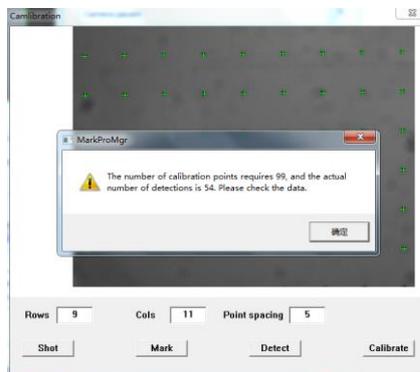
feature points in the picture. If there are misidentified feature points in the picture, you can select and delete them with the mouse. If there are missing feature points in the picture, you can enlarge the picture to find the feature point, and then double-click the center of the feature point with the mouse to add it manually.

- 8) When there is no result pop-up or there are fewer matching points after detect, check whether the black template or white template in the "Template Parameters" is selected correctly.

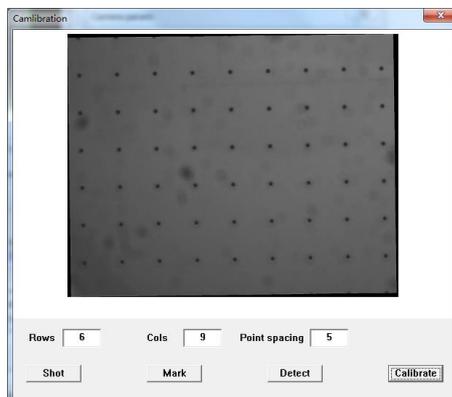




- 9) Click the [Calibrate] to complete the calibration. According to the setting number of rows and columns, if the feature points are extracted correctly, the system will automatically complete the calibration, the green cross in the picture will automatically disappear, and the camera calibration is completed, user can close the [Camera Calibration].



This figure shows the correction failure.



This figure shows that the correction is successful.

### ■ Camera Distance Calibration:

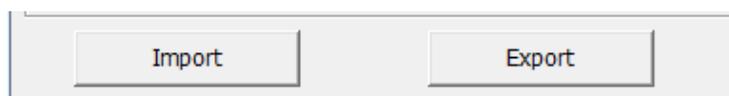
The calibration is used to test the relative installation position of the cutting head and the camera. After finished this calibration, the system can perform visual processing.

#### The operation steps of Camera Distance Calibration are as follows:

- 1) Cut the cross. Set the size of the cutting cross and move the cutting head to an idle position to ensure that there is enough space for the camera's field of vision to see the cut cross. After click [Cut Cross], the system will automatically cut a cross shape, and then move the camera to be visible position of the cross. The power of cutting cross can be set in [Other parameters] under [Edit] page.
- 2) Camera Distance Calibration. Move the cutting head to the center of the camera's field of view to coincide with the center of the cross. Click [Camera Calibration], and the system will calculate the offset from the center of the camera's field of view to the center of the laser head.
- 3) Verify. Repeat the above steps to observe whether the center position of the camera's field of view and the center position of the cutting cross coincide after the cutting cross is completed.

### ■ Calibration file management:

Save pixel accuracy calibration parameters, support import and calibration files.



### ■ Effective area:

Select an effective recognition area within the camera's field of view. If not, the effective area is the entire picture.

### ■ Deformation processing:

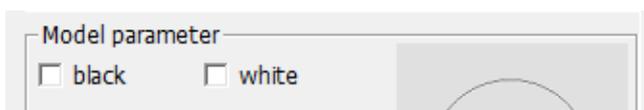
When the position of the Mark point deviates from the actual position of the drawing, deform the processing file.

### ■ Manually add points:

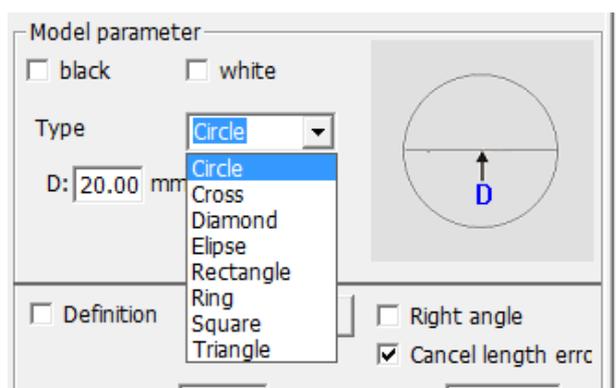
When there is no matching target during processing, add points manually from image display area.

**Template parameters:**

**Black template / white template:** After the camera takes a picture and generates a picture, during the process of the software identifying the feature template, the Mark point template displays the color.



**Customized Template:** The software supports customized templates, Mark point templates and right angle templates. Mark point templates support many common types of Mark points. After selecting the Mark point template, you need to set the mark point related characteristic parameters. For example, if you select [Circle], you need to set the diameter D of the circle.



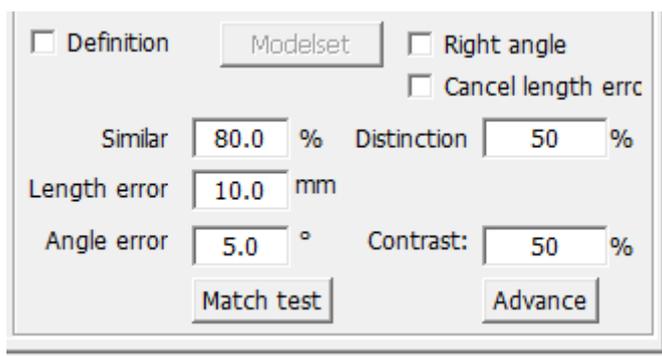
**Similarity:** The similarity between the mark point in the visual imaging picture and the setting mark point. This value will directly affect the matching recognition result.

**Distance deviation:** The system recognizes the maximum distance of relative position deviation between mark points.

**Angle deviation:** Reasonable angular deviation when matching

**Cancel deviation error:** When multiple points match the Mark point, the system will prompt an error when it recognizes that the actual distance between the Mark point and the preset position deviation is greater than the distance deviation. If the choose the option of cancel deviation alarm, no error will be prompted.

**Discrimination / contrast:** Effective when the right-angle module template is selected

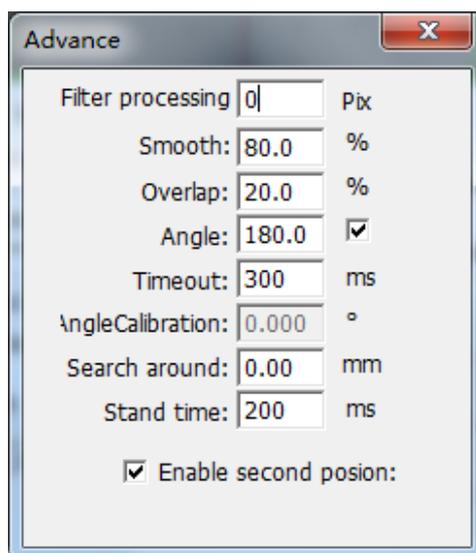


■ **Match testing:**

The current template matches the target image of the camera's current field of view, and the test results are returned in the results interface. You can debug the relevant parameters of Mark points in the image from the test results.

■ **Advanced:**

Enter the change advance option. User can set the template matching parameters:



**Smoothly factor:** The higher the smooth coefficient, the less the scattered points of the extracted features.

**Similarity:** The score which is the template with the actual graphics matching result. The setting of similarity directly affects the quality of matching.

**Overlap:** The percentage overlaps of the bounding rectangles of the two target images. This parameter controls whether the target is recognized or not when there has an overlap.

**Matching angle:** It is the angle range of template rotation search. For example: the value is set to 180 degrees, and the angle range searched during template matching is: -180 ~ 180 degrees. The matching

angle is set according to actual needs. The larger the angle, the longer the matching time required. If the user does not need to set this parameter, it can remove the directly.

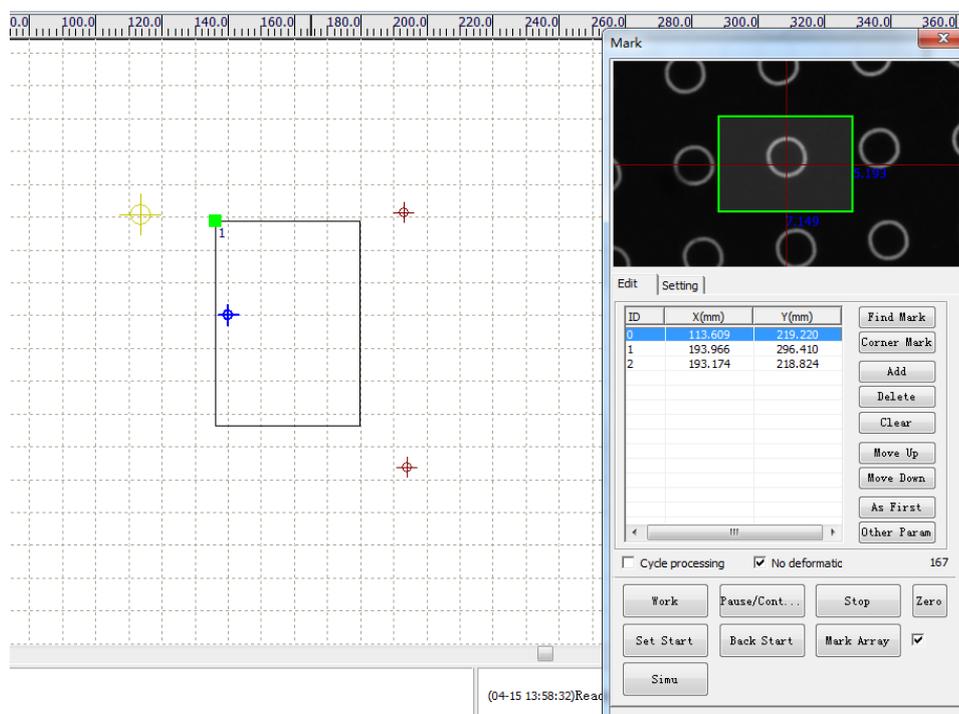
**Match timeout:** This parameter controls the matching time. In order to avoid waiting for a long time or insufficient time to cause the target image matching to fail during the search process, you need to adjust this parameter. This parameter is mainly affected by the complexity of template features.

**Extended search:** When the Mark point is processed and recognized, the target feature may not be within the camera's field of view. Setting this parameter can expand the search range.

**Stable schedule:** It is the time to wait for the photo after moving to the target position. It is recommended to be at least 200ms.

**Enable secondary positioning:** After finding the target, automatically moves to the target, takes a picture again, and repositions the target position coordinates. When the pixel precision correction uses film for calibration, you can uncheck Enable secondary positioning; when the pixel precision correction uses proportional correction, it is recommended to check Enable secondary positioning.

### 3.2.3 Mark point editing instructions



When user using the Mark point visual function, it should be to edit the Mark first, including adding Mark points, and editing the Mark position and order. The right side of the software provides a number of

shortcut function buttons for users to use. In the software graphics editing area, user can see the



graphic mark. The largest mark is the first point of Mark points.

**Choose Mark point:** After selecting a primitive in the graphics editing area of the software, similar graphics are automatically being set as Mark point coordinates.

**Four corner mark points:** In the graphics editing area, the four corners of the circumscribed rectangular box of the selected primitive are used as the coordinate position of the Mark point.

**Add:** Add the center of the selected element position in the software graphics editing area as the Mark point coordinate to the Mark point coordinate queue.

**Delete:** Select an item in the Mark point coordinate editing queue and delete it.

**Clear:** Clear all contents in the Mark point queue.

**Up:** Select an item in the Mark point coordinate editing queue to move up, and change the order of searching for Mark points.

**Down:** Select an item in the Mark point coordinate editing queue to move down, and change the order of searching for Mark points.

**Set as first point:** set as the first point after selecting an item in the Mark point coordinate editing queue.

**Cross-cutting speed:** Camera calibration crosses- cutting speed.

**Cross-cutting energy:** Camera calibration Cross-cutting power

**Cross-cut frequency:** Camera calibration cross-cutting frequency

**Delete the original image after adding Mark points:** This item is configured in [Other parameters], whether to delete the original graphics data in the editing area when selecting primitives to add Mark points in the graphics editing area.

## 3.2.4 Mark point processing control

Mark point visual processing control is similar to ordinary processing control. It is operated by the processing control button in the Mark visual pop-up window. The system also supports starting Mark point visual processing from the panel. The user can directly understand the current system from the entry bar in the lower left corner of the main interface Processing status, distinguish whether it is currently <normal mode> or <visual mode>.

**Start:** Start visual processing.

**Pause / Continue:** Pause / continue visual processing.

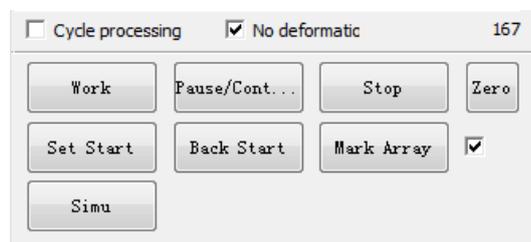
**Stop:** Stop visual processing.

**Set starting point:** Set the starting point of Mark point processing, and display it with a mark in the graphics editing area.

**Return to starting point:** Click the button to move to the starting point quickly

**Moving speed:** During the visual processing, look for the moving speed of the Mark point.

**Return position:** After processing, the laser head returns to the position. There are Mark start point, mechanical origin, stop point, and non-return option.



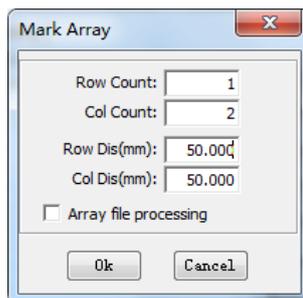
Mark point vision processing supports array processing and cyclic processing. The array processing function can facilitate users to place multiple processed parts on the machine table at one time, and the system will process one by one according to the entire row of processing parameters. The cyclic processing function can support the cyclic loading function.

**Clear:** Clear the count of the graphics processed.

**No deformation processing:** Checking indicates that the Mark point is only used to fix the position and does not stretch the processed graphics.

**Simulation:** Simulate motion to find Mark point function without downloading and processing actual graphics.

**Nesting processing:** After selecting nesting processing, it shows <Mark point array processing> configuration information. Fill in the corresponding parameters according to the row number, column number, row spacing, and column spacing of the table material.



**Cycle processing:** After choose this option, the system will automatically perform cyclic processing according to the feeding parameters.

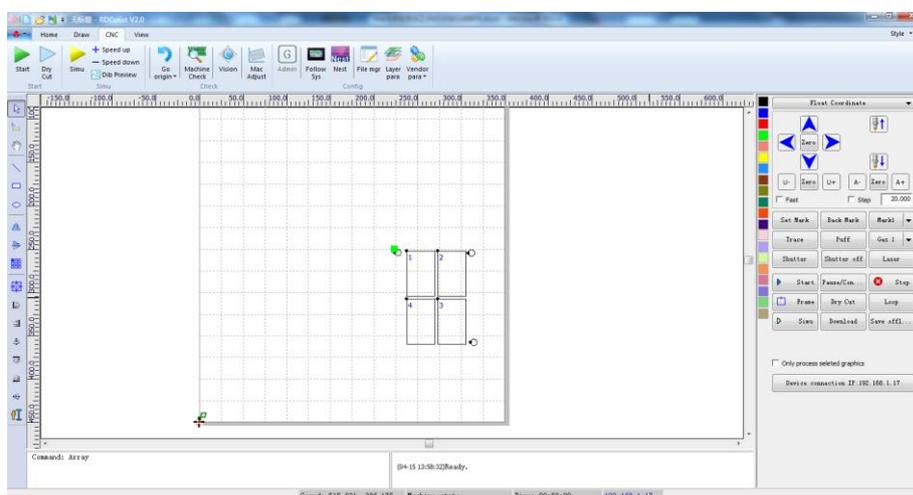
**Feeding times:** Times of cycle processing.

**Feeding length:** Each feeding length during the cycle processing,

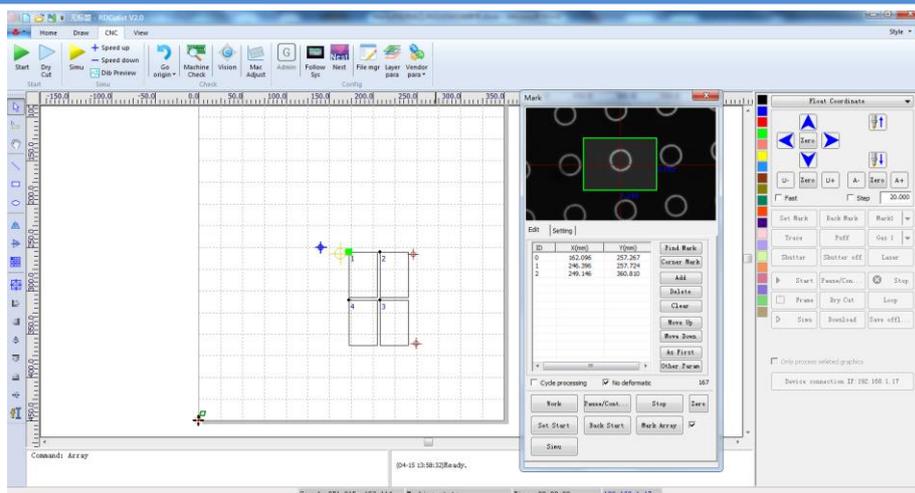
**Feeding direction:** The system automatically compensates the position deviation of the first point after feeding according to the feeding direction.

### 3.2.5 Mark point fast processing

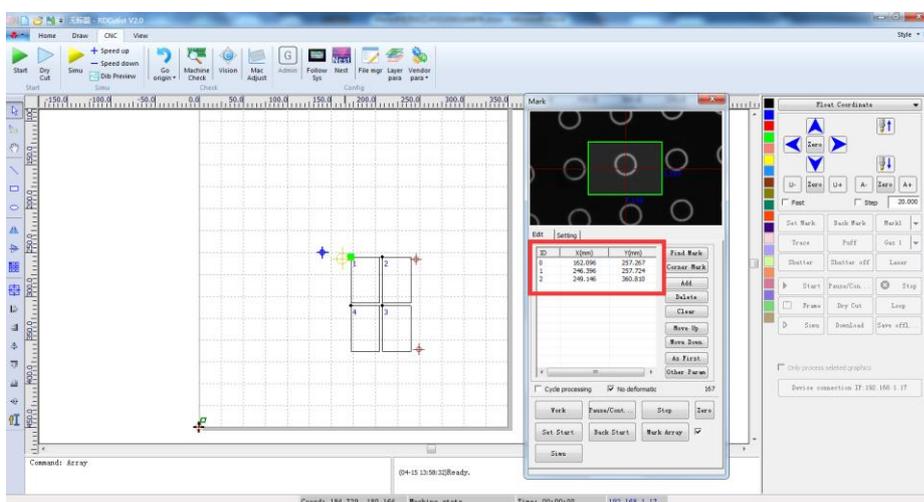
- 1) When the system is powered on, system reset
- 2) Import processing files and set all process parameters, such as cutting parameters, sorting, etc.



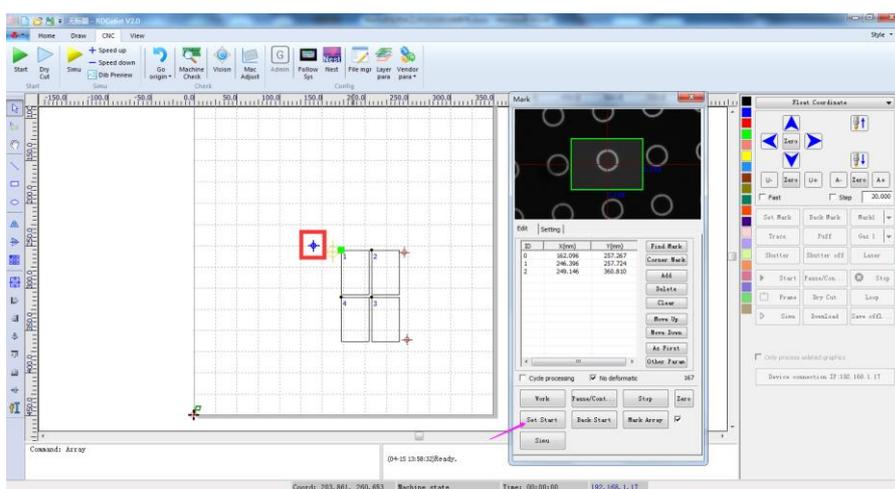
- 3) Open the Mark point visual window and adjust the camera parameter settings to ensure that the matching test can correctly identify each Mark point.



4) Choose and edit the coordinates of Mark points in the graphics editing area.



5) Set the starting point. Move the laser head so that the camera's field of vision can recognize the Mark starting point, and then click [Set Starting Point].



6) Set the visual processing parameters. Such as array processing, cycle processing, return position, etc.

7) Start visual processing.

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