Friendess, Inc.

CypCut Laser Cutting Control System

User Manual

Version: V6.3.6

Welcome

Thank you for using CypCut laser cutting control system.

CypCut laser cutting control system (CypCut for short) is a set of system software designed for plane laser cutting, including laser cutting process, common layout function and laser processing control, most of its functions are applied in graphics processing, parameter settings, custom cutting process editing, layout, path layer planning, simulation and cutting process control.

CypCut software can realize process control only if used with Dog and Control Card.

CypCut will enter DEMO mode while running on a computer without Dog, so that you can get all other functions except process control for normal use. Therefore, CypCut can be installed in a separate notebook for the design before processing.

Please note that this User Manual is only for instructions of main program about CypCut software.

Please refer to other Manuals or contact us for the details of other tools installed with CypCut software, such as platform configuration tool.

The Document is drawn up based on Version 6.3.646.6 of CypCut. As product functions are being updated, there may be some differences between your product and the Manual. We will apologize for such inconvenience.

Please feel free to contact us with any questions or suggestions you may have.

The operation of the machine and the effect of laser cutting is directly related to the materials to be cut, the laser used, the gas used, air pressure and the parameters you have set. Please set the parameters seriously and cautiously based on the requirements of your cutting process.

The inappropriate parameter setting and operation may result in the reduction of cutting effect, damage to laser head or other machine parts or even personal injury. CypCut laser cutting control system has tried to provide a variety of protective measures, and laser equipment manufacturers/end users should comply with the operating rules in case of injury accidents.

The company will not assume any direct, indirect, incidental and/or resulting losses or responsibilities caused by improper use of the Manual or the product.

Contents

I. Quickstart

1.1 Features

⌗   Supports AI, DXF, PLT, Gerber, LXD and other graphic data formats, and accept the

international standard G code generated by Mater Cam, Type3, Wentai and other software.

- To conduct automatic optimization when opening / importing DXF and other external files, including: to remove repetitive lines, merger connected lines, remove tiny graphics as well as automatically distinguish inside and outside dies and conduct sorting. The above each function can be defined, as well as be carried out manually.

- To support common editing and typesetting functions, including: zooming in and zooming out, translation, mirror , rotation, alignment, copying, combination and so on.

- To use the easiest way to set the lead, slotted compensation, micro connection, bridge connection, lead inside or outside, lead seal without gap and so on.

- To distinguish the inner mold and yang cut, determine the direction of slotted compensation in accordance with the inner mold and yang cut, and check the led.

- To support curve splitting and connection, curve smoothness, text-to-curve, component integration and exploding.

- Time-saving automatic nesting feature that automatically co-edge and generate excess material.

- Easily fill plate through a variety of array patterns.

- With Flexible automatic sorting and manual sorting functions, to support the function to fix the processing order of internal graphs in group through group.

- With particular browsing capabilities of processing order, to check the processing order in a more interactive way than that of imitation.

- Flight cutting path set by a key, allowing processing more with less.

- To support two stage piercing and progressive piercing, grouping pre-piercing. To support the settings of separate laser power, frequency, laser form, type of gas, air pressure, peak current, time delay and following height for piercing process and cutting process.

- To edit frequency and power curve in real-time editing, and to set parameters of slow starting.

- With Powerful material library functions, to keep all processing parameters so that it can be provided again for the same material.

- With processing breakpoint memory, to trace the breakpoint forwards and backwards; to process some graphics.

- To be able to be positioned to any point in the process of stop or temporary stop; to start processing from any position.

- The same set of software supports round pipe cutting and plane cutting, and the way of programming is exactly the same; to support intersecting line cutting.

- To support given height cutting and following outside-plate.

- To support automatically seek edge and positioning precise[1].

- With powerful expansion capacity, as much as 30 PLC process edit and more than 50 programmable process.

- Programmable input and output outlet, programmable alarm input[2]

- To support the remote control of the system through wireless teachbox and Ethernet[3].

1.2 Obtaining and Installing the Software

You can contact the supplier or customer service staff to obtain the software installation program.
Before installing the software, please check whether your system meets the following minimum requirements.

- ⌗ The operating system should be above Windows 2000.
- ⌗ CPU with basic frequency above 1.0G
- ⌗ The memory should be 512Mb at least.
- ⌗ The VGA monitor should be more than 15 inches with a resolution of more than 1024*768. And it would be better to use 32-bit true color display.
- ⌗ There should be two USB interfaces at least.
- ⌗ If your operating system is vista-based (including Windows Vista, Windows 7, Windows 8, Windows 2008 Server), please run the system as an administrator as much as possible in order to avoid the possible errors,

After completing the inspection, you can start to install the software. You can just run the installer directly. If you want to install the program in Vista-based operating system, you should have administrator permission so that it can run.

In order to prevent the program files from being modified during the installation process and ensure the normal installation of all drives, please close 360 security guards and anti-virus software in the system. Note: 360 security guards cannot guarantee that there are no viruses in the computer. If the computer has been infected by the viruses, while 360 security guards are running, it may point out that CypCut is a virus, and then cause CypCut not to run normally.

1.3 Starting to use

1.3.1 Desktop Shortcut

After installation, an icon shown on the right will appear on the desktop. The CypCut laser cutting control system will run after double clicking this icon.

Please check whether the dongle has been inserted into the USB interface with normal operation before running CypCut. If the dongle detection fails, the system will enter DEMO mode, and you can use all other functions normally except the process control.

1.3.2 User Interface
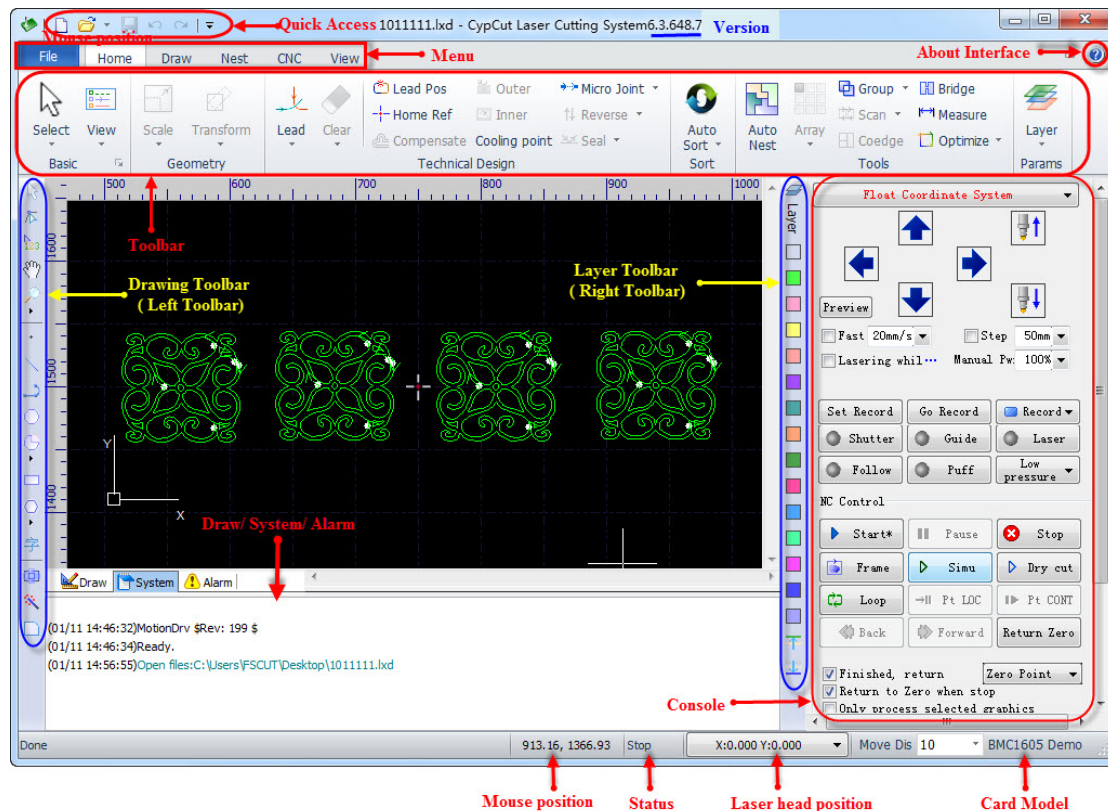
The figure with black background in the center of the interface is the **Drawing Board**; while the white frame with shadows represents the machine breadth, and it displays with grids. The staff gauges at the top and the left of the drawing area and the grids will change with the zooming of the views, and in this way they can provide references for drawing.

Above the interface from top to bottom one by one are **Title Bar**, **Menu Bar** and **Toolbar**. The toolbar is arranged with very obvious large icons in grouping and most of the common functions can be found here. The menu bar includes the menu "File" and five toolbar menus, namely "Home", "Draw", "Nest", "CNC" and "View", and toolbar display can be switched through selecting these five menus. There is a toolbar called "**Quick Access Bar**" at the left of the title bar, which can be used for fast creating, opening and saving a file; besides, undo and redo commands can also be finished quickly here.

At the left of the interface is "**Drawing Toolbar**", which is called directly "Left Toolbar" in the following instructions. It provides the basic drawing functions, and the first five buttons are used to switch the graphics mode, which includes selecting, node editing, order editing, dragging and zooming. The following other buttons respectively correspond to the corresponding graph and a new graph can be inserted in the drawing board by clicking these buttons. At the bottom there are three shortcut keys, which are Align Center, Explode selected graphic, and Rounded.

At the right of the drawing area is "**Process Toolbar**", which is called directly "Right Toolbar" in the following introduction. It includes a "Layer" button and seventeen color square buttons. "Layer" dialog box can be opened by clicking the "Layer" button, and then most of the parameters can be set.

Each of the seventeen color square buttons corresponds to a layer, and when a graph is selected, the selected graph can be moved to the specified layer by clicking these buttons, when no graphs are selected, it means to set the default layer for the next drawing by clicking these buttons. The first white square indicates a special layer. When "un-exported Layer" is displayed, the graph on this layer will be shown in white and it cannot be processed. The last two layers are layers of first processing and last processing.

There are three scrolling displayed ribbon text windows below the interface. The left one is "**Draw Window**". The related prompting messages of all the draw instructions or input message will be shown here. The middle one is "**System Window**", and other system messages will be displayed here except drawing. Each message has time mark and they will be shown in different colors according to the importance of the message, which includes prompting, warning and error and so on. The right one is "**Alarm Window**", in which all the alarm message will be displayed in red background and white text.

There is the **Status Bar** at the bottom of the interface, which can show different prompting messages according to different operations. There are some basic messages of drawn processing graphics at the left, and some commonly used messages at the right of the status bar, including the location of the mouse, processing status and the location of the laser head. The latter one is the fine-tuning distance parameter, which can move the graphs quickly by using direction keys. The final show is the type of control card.

The rectangular area at the right of the interface is called "Console", and most common operations related to control will be done here. From top to bottom one by one are choices of coordinate system, manual control, work control, processing options and processing count.

1.3.3 Toolbar

The toolbar of CypCut uses a style called Ribbon. It puts the common functions by column and area, and also applies many large-size buttons for easy operation. The photo below will help you to understand this new toolbar:
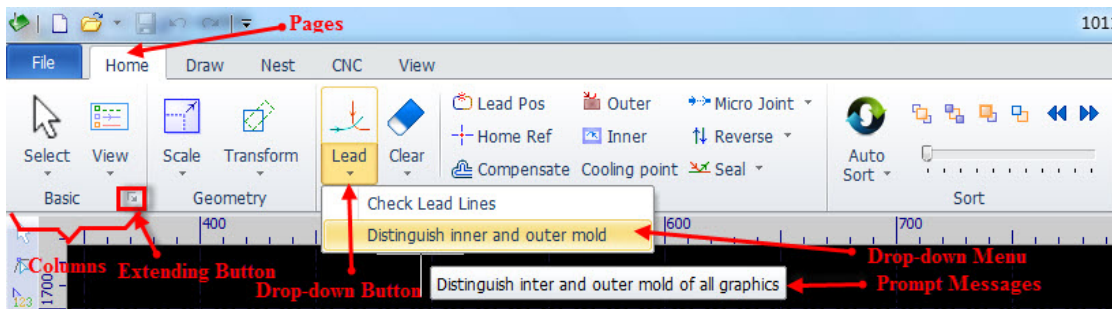
The whole toolbar is divided into five "pages", which can be selected by the five menus "Home", "Draw", "Nest", "CNC" and "View". When selecting each menu, the pages related to the selected contents will appear. Furthermore, the page "Being Processed" will appear during processing and it cannot be switched to other pages before stopping.

The toolbar of each page will be arranged again in multiple "Columns" according to the functions, such as "Base operation" and "Geometric transformation" and so on. The first buttons of the general columns are all in large size, and there is a small button" 🔲 " at the lower right corners of some

columns, which is called "Extending Button", and a related dialog box can be opened by clicking this button.

Note: there are small triangles below some large-size buttons, which are called "Drop-down Buttons", a related "Drop-down Menu" will appear after pressing the button, and the menu can offer richer operation options. When the mouse is moved to the top of the button, two obviously different rectangles will appear, the corresponding function of the button can be directly executed by pressing the upper part of the button, while a menu can be opened by pressing the lower part of the button.

If you have used Office 2007, Windows 7 or other procedures which use the Ribbon style before, you may have been very familiar with this arrangement. It does not matter even if you use it for the first time, and we are sure that you will like this style soon.

1.3.4 File Menu

There is a special menu called "File Menu" at the upper left corner of the toolbar, and it contains some menu items related to the files. The menu can be opened by clicking the button " [File] " as shown below:
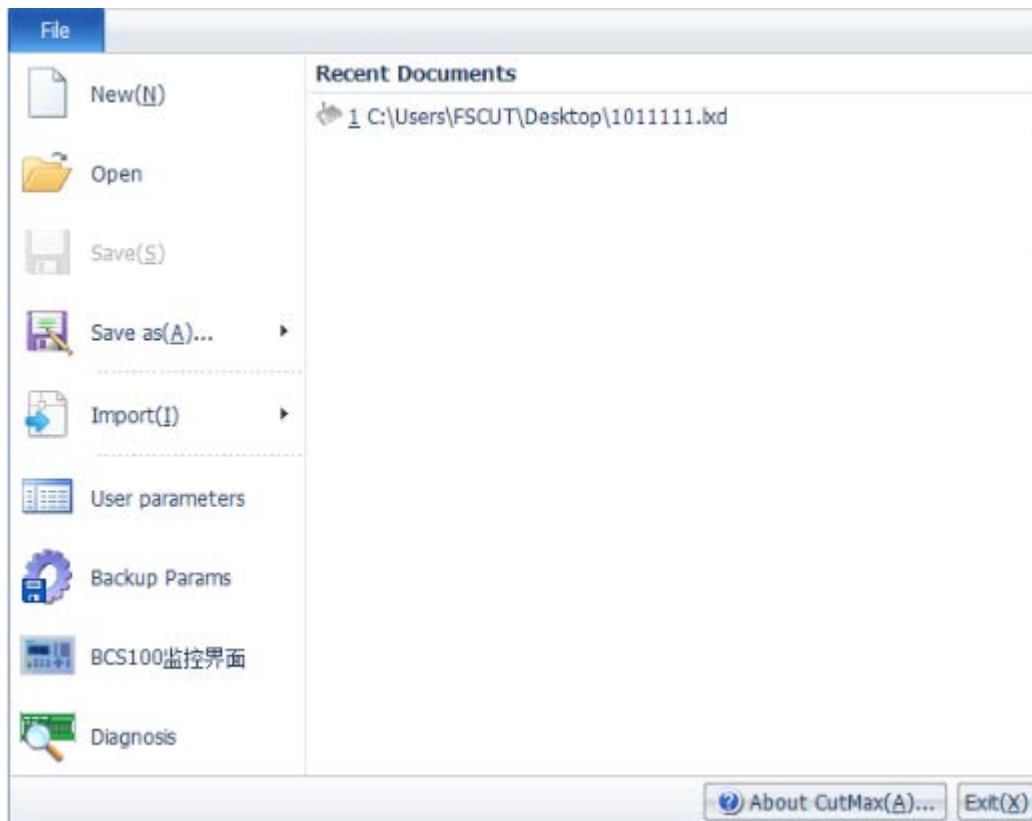
Please note that at the right of the menu the recently used files are listed. While the files saved by CypCut are marked with the icon" ", and in this way it is convenient for you to find the designed documents of last time.

The "Import" in the menu can be used to import another document to the drawing board on the basis that the existing graphics are not cleared. If you just would like to open an external file, please

directly use "Open".

The menu "User Parameters" is used to set some parameters related to the using habits; and the menu "Backup Params" is used by users to backup all parameters as a compressed file; and the menu "BCS100 monitor" is used to monitor and display the interface of BCS100 Height controller in the software; while the menu "Diagnosis" is used for program diagnosis and monitoring.

You can see the detailed version information of CypCut software by clicking "About" at the lower right corner.

1.4 Operation Process
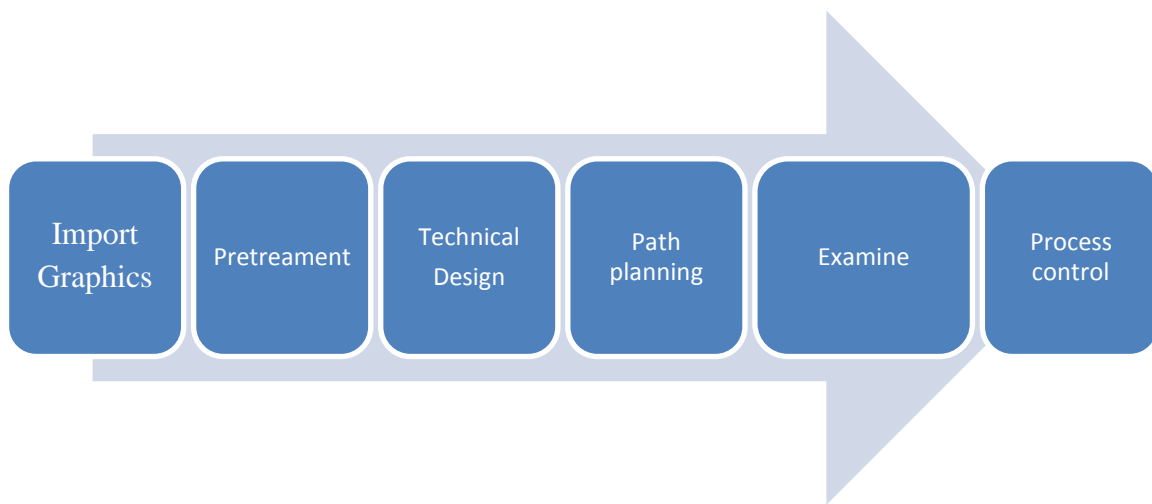
1.4.1 Import Graphics

After clicking the button of opening files " " in the quick launch bar at the upper left corner of the interface, the dialog box of opening files will be popped, and then you can choose the graphic you need to open. There is a quick preview window at the right of the opening file dialogue box, and it can help you to find quickly the file you need.
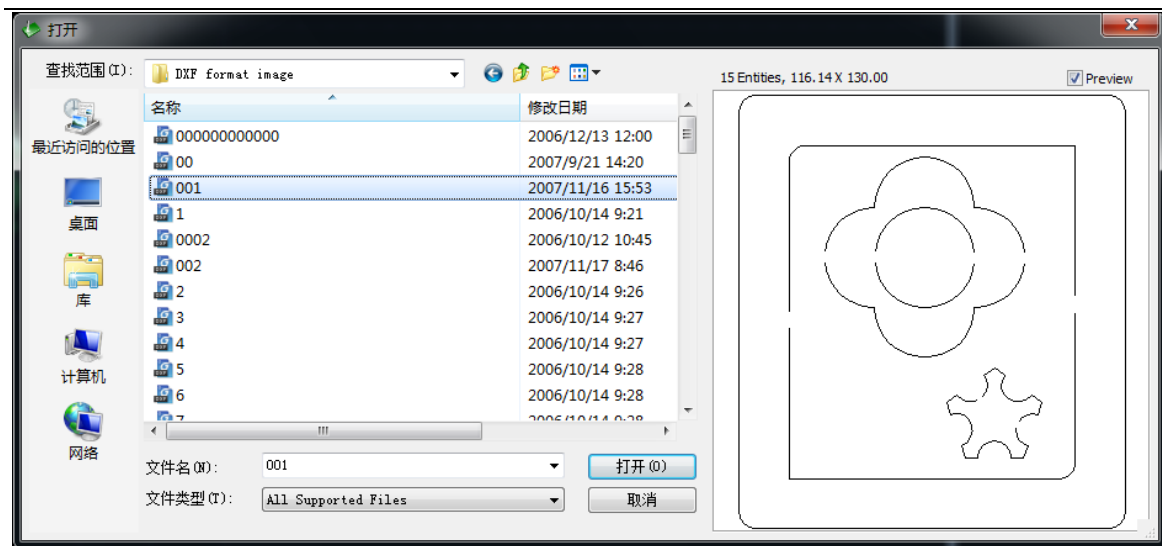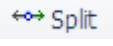
If you hope to draw a part on the spot through CypCut software, please click the create button " 🗋 "and then draw pictures with the buttons of the drawing toolbar at the left. See the details in related chapters.

1.4.2 Preprocessing

When importing the graphics, CypCut will automatically remove trivial and duplication, combine near as well as automatically smooth, sort and de-group. And usually you can start to set technical parameters without other handlings. If the automatic processing cannot meet your requirements, you can open the menu "File" and "User Parameters" for configuration.

Generally the graphics to be processed based on the requirements of software as closed curves. Therefore, if the files you opened include unclosed curves, the software will prompt you and the unclosed curves will be displayed in red. However, this function may be closed. Thus, if you would like to look over the unclosed curves in the drawing board, you can click the buttons " 🔲 " and " 📈 " under menu "View" in the toolbar to highlight them. You can also click the big button "Select" at the leftmost side of the toolbar, and then click "Select Unclosed Curve" to choose all of them.

In some cases, you have to split the graphics manually, please click the button" ↔ Split " under "Optimize" in the common used menu and then click the mouse in the position where you need to split. When you need to merge the graphics, please select them and then click the button " Combine near ".

1.4.3 Technical Design

In this step you may use most of the functions of "Technical Design" in the common used menu, and
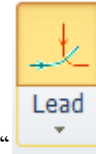
they include setting lead lines, setting compensation and so on. Big size button " " can be used

to set lead lines, and the button " " is used to set lead seal over, lead seal gap or lead seal

parameters. The button "" is used for cutting compensation; the button" " can insert micro joint of not cutting into the graphics; the button " " can reverse a single graph; and the button " " is for setting a cooling point
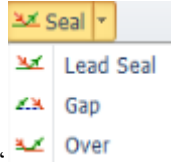
in the graph. Clicking the button" " and then clicking the position where you hope to set as the start of the graphics, you can change the start of the graphics; if you click outside the graphics, and then click on it again, you can draw a lead manually.

You can press Ctrl+A to select all the graphics as quick start tutorial, then click the button "Lead" and set the parameters of the lead lines, and then click OK. In this way the software can search suitable positions to add the lead automatically according to your settings. You can conduct the Lead Lines Check by clicking the small triangle below the button "Lead" and selecting "Check lead lines". When select "Distinguish inner and outer mold", lead can be automatically optimized according to inter and outer mold.
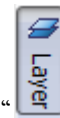
You can set detailed cutting technical parameters by clicking the button " " in the toolbar at the right. The dialog box "Layer Parameter Settings" contains almost all the parameters related to the cutting effect.

1.4.4 Lead Planning

In this step the graphics will be sorted as required. You can conduct automatic sorting by clicking the button " " under the "Home" or "Nest" menu, while you can select the ways of sorting and control whether it is allowed to change the direction of the graphics and automatically distinguish inner and outer mold during the automatic sorting by clicking the small triangle under the button,.

If the automatic sorting cannot meet the requirements, you can click the button" " in the toolbar at the left to enter the manual sorting mode, and click the graphics with mouse one by one, and in this way you can set the working order . You can specify the order between these two graphics through pressing the mouse and drawing a line from one graph to another.

You can fix the order of several sorted graphics by selecting them and then clicking " ⬚ " button under "Home" or "Nest" menu. The following automatic sorting and manual sorting will not influence the graphics inside the "Group", and the "Group" will always work as a whole.

You can conduct automatic sorting for the graphics within the group by selecting a "Group" and then clicking the right key with selecting "Group Sort".

1.4.5 Inspection before Processing

Before the actual cutting, you can check the working route. You can align graphics by clicking align button; you can view the processing order quickly by dragging the interactive pr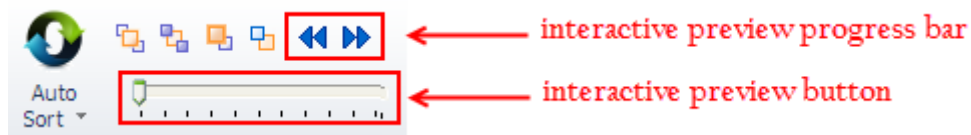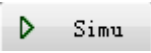eview progress bar under "Draw" menu as shown below, and you can view the processing order of the graphics one by one by clicking the interactive preview button,.

You can simulate process by clicking the button " ▷ Simu " on the console, and you can adjust the speed of the simulation processing through the function "simulation speed" on the page " CNC ".

1.4.6 Actual Processing
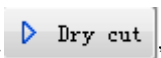
Please note that this step must be done on the actual machine with the support of dongle and the control card.
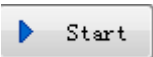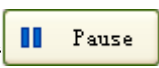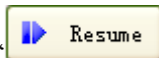
Before formal processing, you need to match the graphics on the screen with the machine. You can find the relative positional relationship between the upcoming processing graphics and the machine breadth on the screen by clicking the left button " Preview " above the "Console". This corresponding relationship is calculated in accordance with the dock point markers on the screen and the position matches of the machine laser head. Some common coordinate markers on the screen are shown in the photo below. When you click "Preview", the "Dock Point" will be moved to the "Laser Head Position" and visually parallel move occurs in the graphics on the whole.
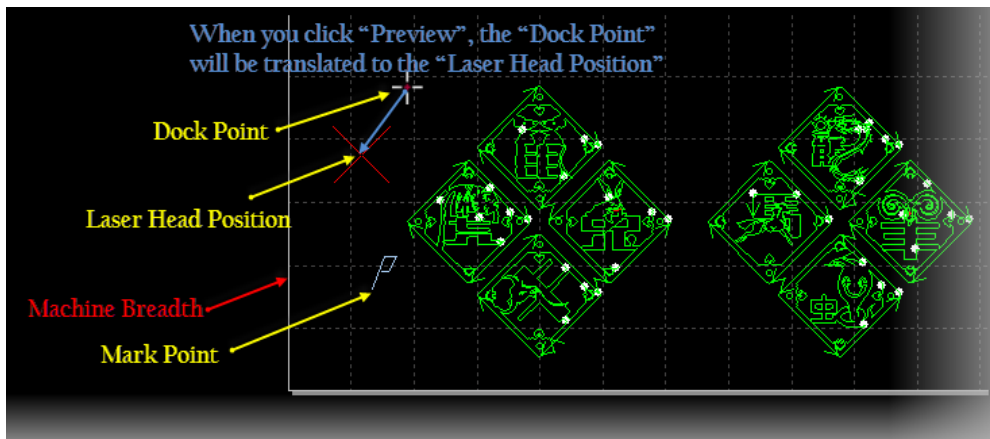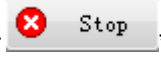
If the "Laser Head Position" shown by the red cross cursor does not match the actual laser head position of the machine, please check whether the position of the machine origin is correct, and it can be corrected through "Numerical Control"—"Go Origin". After previewing, if you find that the graphics are outside the machine breadth wholly or partially, it means that it may exceed the range of travel during processing.

You can change the relative relationship between the graphics and the dock points by clicking the button " $-\vert-$ Home Ref " under "Home" menu. For example, if the laser head is at the lower left corner of the upcoming processing work-piece, you can set the lower left corner as the dock point and so forth.

If there is no error on the screen after checking, you can click the button " Frame " on the "Console", and the software will control the machine to go around the outer frame of the upcoming processing graphics so that you can check whether the working positions are correct. You can also click the button " ▷ Dry cut ", and the machine will run completely without laser along the graphics which will be processed so that you can check more carefully whether there may be any impropriety in the processing.

Finally please click the button " ▶ Start " to start the formal processing, and you can click the button " ❚❚ Pause " to suspend the processing. During the suspension, you can control the laser head to go up and down manually, and switch the laser, gas and so on manually, besides, you can also trace back along the working route through the buttons " ◀ Back ▶ Forward ". You can continue to work by clicking the button " ▶ Resume ".

You can click the button " ✖ Stop " to stop the processing and the laser head can automatically return to the corresponding point according to your setting. As long as you do not change graphics or start new processing, when click the button " →❚❚ Pt LOC ", the system will

allow you to locate to the position you stopped last time; when click the button " ▐▶ Pt CONT ", the system will allow you to continue the processing from the position of last stopping.

II. Graphical Operation

CypCut provides the common drawing functions, which can be available easily from the drawing toolbar on the left. The use of these functions is similar to AutoCAD mostly, and it is very intuitive. Thus, this Manual will not introduce them in detail, if you have any questions, please feel free to contact the customer service staff or Friendess Electron for help. We will introduce some special graphical operations of CypCut as the software for laser cutting.

2.1 Graphical Display Effect

"View" in the first column under "Home" menu has multiple buttons which can help to control the display effect, as shown below:
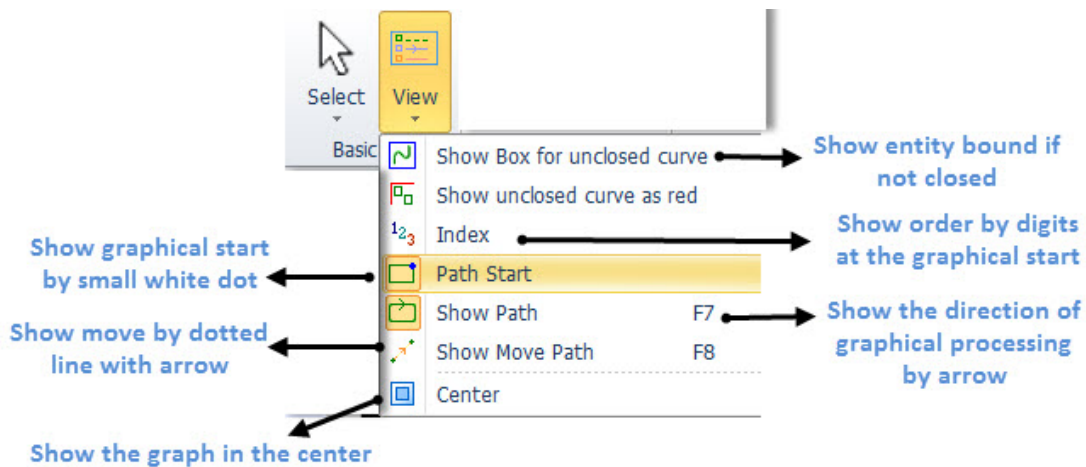
After you click the buttons in the figure above, the display will take effect immediately and then you can find the changes in the display effect in the drawing board. Please pay attention to the display changes of the buttons themselves, if the ground color is light yellow, it shows that the corresponding effect has started; otherwise, it indicates that the display effect does not start yet. For example, in the on- state " ", the arrow will show the graphical processing path in the drawing board; while in the off state " ", the arrow will disappear.

When a graph is selected, by clicking the button " ▣ Center ", the graph will be shown in the center of the screen. If no graphs are chosen, please just click the button directly, and the whole graphs will be displayed in the center.

By clicking the button " ⬚ " in the lower right corner of the column, a dialog box will be opened, and it can conduct more detailed control for the drawing board, including turning on and off the auto attach key-points, turning on and off the ruler and controlling the pick precision of mouse.

The views can be zoomed by scrolling the mouse wheel in the drawing board. By clicking F3, all the graphs will be shown in the center of the screen. By clicking F4, the machine breadth range will be displayed in the center. The above operations can be selected by clicking the right key of the mouse with selecting "Zoom" in the drawing board.

2.2 Selection of Graphics

CypCut offers a variety of graphical selection methods. The basic operation is "**Click Selection**", and the graphs will be selected just by clicking the mouse on the graph. Another more common operation is "**Box Selection**"; by this way, a translucent box can be formed by dragging the mouse in the screen to select the graphs. There are two kinds of box selection. When dragging the mouse from left to right, it shows a blue translucent rectangle with solid line and only the graphs covered completely in the rectangle box can be selected; when dragging the mouse from right to left, a cyan translucent rectangle with dotted line will appear and as long as any part of the graph is in the box, the graph will be selected.

The schematic diagram of these two options is shown below. The left one is the option from left to right and BC will be selected; while the right one is from right to left, and ABCD all will be selected. Flexible use of these two methods can help you to choose the graphs you need in a more convenient way.
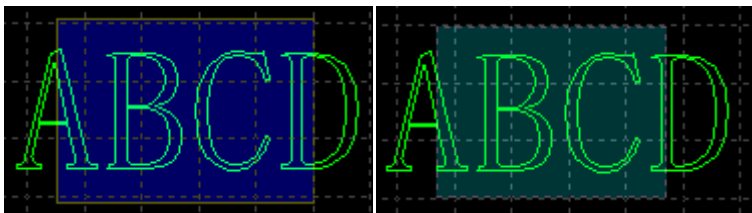
No matter it is "Click Selection" or "Box Selection", if you press "Shift" while you make a selection, you can add or cancel selected graphics without the need for clearing the original selection.

When you click the button "Select", a drop-down menu will appear, through which you can conduct senior selection operation, including the selection of unclosed graphics, similar graphics, all outer or inner mold, and all graphics smaller than specific size. Among them, "**Select similar curve**" allows you to select all the graphics which looks close to each other on the drawing board. For example, you may select all the circles with a diameter of 5mmm by selecting a circle with a diameter of 5mm and then clicking "Select similar curve".

2.3 Geometric Transformation

The column "Geometric Transformation" under "Home" menu provides abundant geometric

transformation functions. Select wanted transformation graphics before applying. Most of the commonly used geometric transformations can be completed only by clicking the drop-down triangle under "Transform", for examples: Mirror, Rotate, Align and Scale.

2.3.1 Size Modification

CypCut provides 7 fast size transformations, which can be completed by the drop-down menu below the button "Scale". Click the small triangle under "Scale" button, you can open a drop-down menu, providing selected graph operations of size transformation, as shown below.
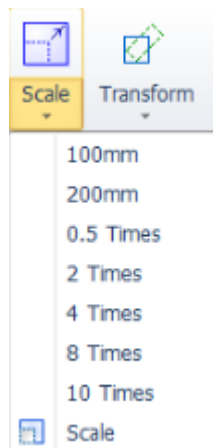
For examples: "100mm" means to zoom graphics in equal proportion with a width of 100mm, "2 Times" means to zoom graphics in equal proportion by 2 times.

If you want to input accurate size, please directly click the button "Scale", the following dialog box will appear, then you can input the new size and complete the size transformation by clicking "OK".
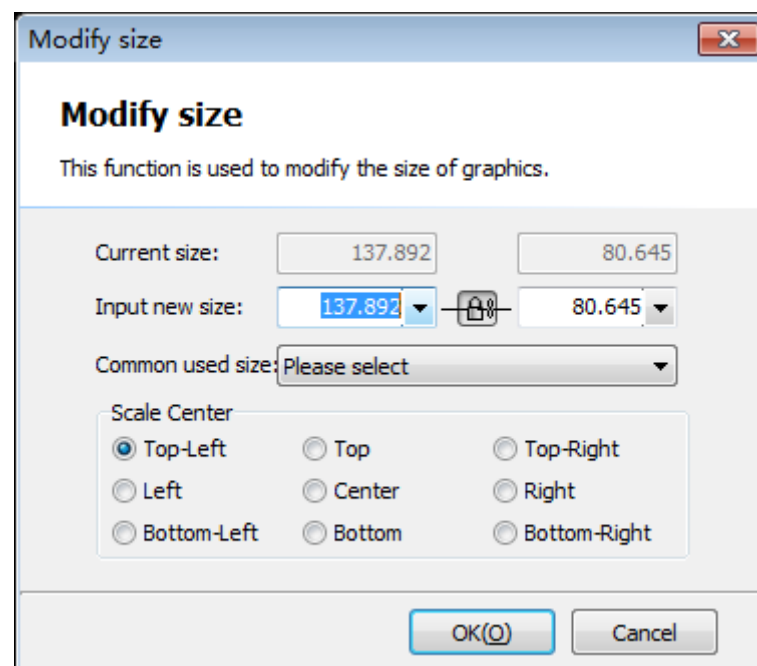
When the status of lock of the interface is ⊟ , the length and width are locked as the proportion of the original graphics. If you want to separately input length and width, you can cancel the cancel lock status by clicking the button ⊟ , and then the button will become ⊠.

"Zoom Center" can determine the location relations between the new graphics and original graphics after being zoomed. For example, when you select "Upper Left", it means that the new graphics and original graphics are aligned in accordance with the upper left corner after the transformation, and other parts are zoomed by taking the upper left as a basis.

Note: **The lead and slotted compensation set for graphics cannot be transformed at the same time, and the numerical value of lead and slotted compensation will not change after the size is changed.**

2.3.2 Interactive Geometric Transformation

CypCut provides 3 kinds of interactive geometric transformation, including interactive zooming, rotation and mirror, and you can achieve more detailed geometric transformation through them. Before doing these operations, you need to firstly select the operation graphics, click the corresponding menu or button, and then conduct operations in accordance with the tips at the bottom of the screen.

For example, if you want to rotate a rectangle by taking its lower left corner as a basis, you can conduct the operations as follows:

1) Firstly, you need to select the rectangle for operation;
2) You need to click the small triangle below the "Transform" and opening the drop-down menu, and select "Rotate", and then there will be a prompt "Please Specify Base Point" in the lower part of the screen;
3) You need to move the mouse to the lower left corner, and then the mouse will be automatically absorbed to the lower left corner. As shown below:
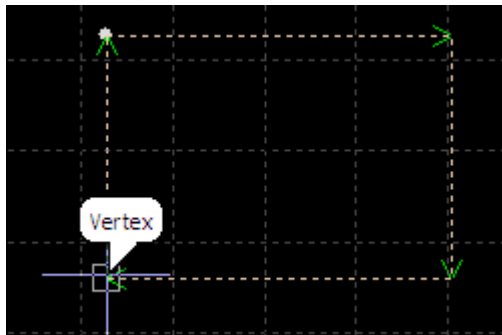
4) You need to click the mouse, and then there will be a prompt "Specify Start Point of Rotation or Input Rotation Angle" at the bottom of the screen;
5) You can complete the operations by directly inputting 45 and then clicking Enter.

If you do not know the angle of rotation in advance but want to rotate the rectangle to the position aligning with another graphic, then the first four steps is the same as above, please conduct the following operations from step 5:

6) Please move the mouse to the lower right corner of the rectangle, at this moment, click to form a horizontal line and take it as the start line of rotation.
7) The screen shall appear the prompt "Please Specify End Point of Rotation". Then the graphics

will rotate with the mouse when you move the mouse, and you can complete the operations by clicking the mouse at the expected end point of rotation. As shown below:
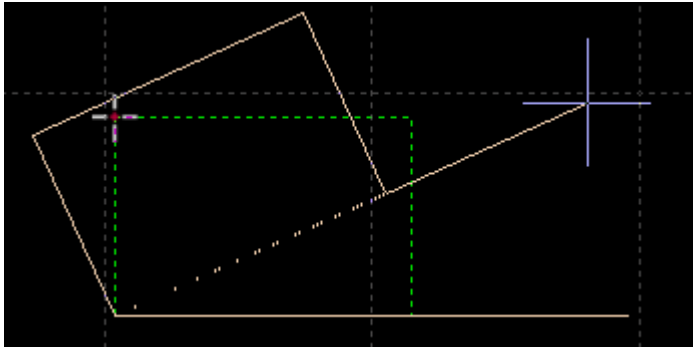
The operations of interactive zooming and mirror are similar with this, so there is no further explanation.

2.3.3 Quick Translation and Copy

CypCut software allows you to translate the graphics quickly by using the direction keys. After the graphics are selected, when you press any direction key, the graphics will be translated to a distance in the corresponding direction, and the distance parameters can be inputted in the window " Move Dis 100 " at the lower right corner of the main interface. This function can help you to shift away a graphic temporarily and quickly, then you can focus on the design of other graphics, and later you can move it back to the original place rapidly. Since the fine-tune distance parameters can be controlled precisely, you do not have to worry about the deviation of the graphical positions.

You can copy the selected graphics by pressing Ctrl and the direction key concurrently. For example, when you press "Ctrl + Rightward➔", the selected graphics will be copied at the position with a distance of 100mm on the right.

2.4 Input of Coordinates and Parameters

In some cases, you may hope to draw with precise coordinates. And CypCut allows you to input the coordinates directly and the input format of coordinates is as follows: ‹X coordinate›‹comma,›‹Y coordinate›. For example, if you would like to input the coordinates (100, 100), you can only input "100, 100". And the inputted coordinates and parameters will be shown in blue.

Most of the drawing operations allow both mouse operation and inputting coordinates directly. Below is an illustration for drawing a rounded rectangle with a length of 300mm and a width of 200mm and a fillet of 25mm.

1) You need to click the icon " ▭ " on the left toolbar, and then "Please Specify Start Point" will be prompted on the screen.

2) You need to input the coordinates "0, 0" and press Enter, and then "Please Specify Cross Point" will be shown on the screen.

3) You need to input the coordinates "300, 200" and press Enter, and then "Please Specify Corner Radius or [Fillet (F)]" will be shown on the screen.

4) You need to input 50 and press enter. All the operations are completed, as shown below.

```
Command: New RoundRectangle
please specify start point:
0, 0
Please specify cross point:
300, 200
Please specify corner radius or[Fillet (F)]:
50
Completed
```

2.5 Automatic Adsorption

Cypcut will provide the functions of automatic adsorption during drawing according to the needs, including automatic adsorption to the grids, adsorption to the critic points of the graphics, adsorption to the borders of the graphics and so on.

You can close the functions of automatic adsorption, and the operation steps are as follows: click the menu " File ", select "User Parameters", then select the tab "Drawing Board" in the opened dialog box, and finally cancel the option " ✓ Auto attach keypoints ". The precision of automatic adsorption can also be set in the above dialog box.

2.6 Text Input

CypCut supports text input and text conversion to curve. After clicking the button "字" on the drawing toolbar at the left, you can insert text in the position where you hope by clicking the mouse and the newly inserted text will be selected automatically.

After selecting the text at any moment, a new page "Text" will appear in the toolbar, and you can modify the content, the style and the size of the text and so on using it. As shown below:
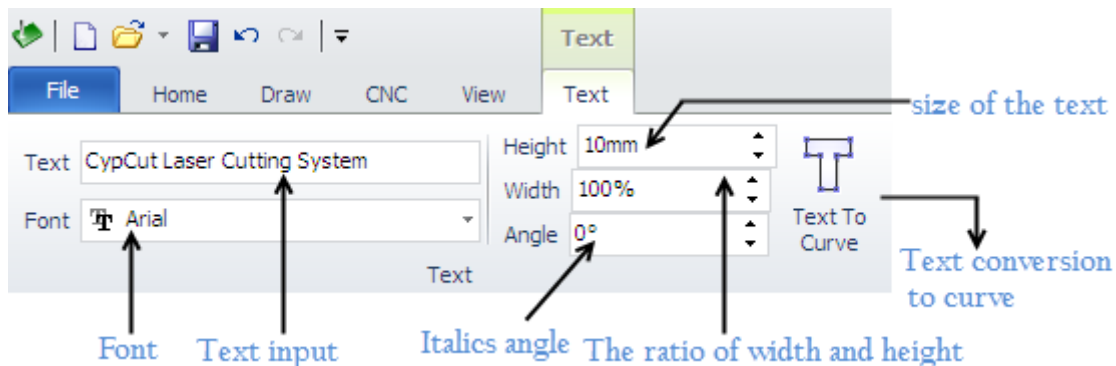
Please note that once the text is converted to the curves, the above option cannot be used any longer. If you would like to design a text with specific font and special effect, please convert it to curves after you design it well.
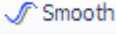
2.7 Graphical Optimization

When importing the external graphics, CypCut can optimize the graphics automatically. If you have to optimize them manually, you can use the right functions in the toolbar. As shown below:
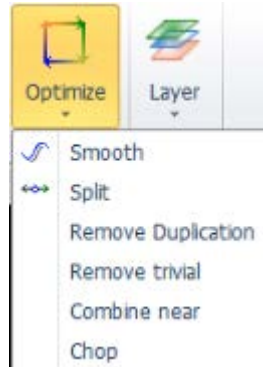
Please select the graphics to be processed, click the corresponding buttons, and then operate according to the prompts.

2.7.1 Smooth

Please select the polylines to be optimized, then click   Smooth   button, a prompt "Smooth the selected curve according to a given precision" will be shown on the dialog box. Please input the expected curve smoothing precision and then click ok.

The contrast between the original curve and the smoothed curve is as shown below. In order to facilitate the observed effect, the curve smoothing precision value entered here is greater. Please use the actual value according to required processing precision.

2.7.2 Split

Split is to divide the closed graphic into two graphics and the user can edit these two graphics

separately. Please click the button "   Split   ", and then click the mouse in the position where you need to split. The process of curve split can be carried out continuously as far as ESC cancels the command or it is switched to other commands.

2.7.3 Remove Tiny Objects

Sometimes the imported graphics may include the curves which are visually imperceptible, which causes the display size to become very small, or move to an abnormal position when processing. These graphics can be deleted through the function "Remove trivial". You may click the button "Remove trivial", set the size range of the graphics, and then confirm the operation. The graphics smaller than this size will be deleted and other curves will be retained.

2.7.4 Remove Duplicated Curves

This function can be used to delete the visually overlapping lines and only leave one. You can search and clear all the graphics by clicking "Remove Duplication"

2.7.5 Combine Near

The graphics drawn by using AutoCAD often include the graphs which connect visually while do not connect actually. Through connecting near, they can be combined. Please select the graphics to be merged, then click " Combine near " and input merging accuracy, lastly confirm the operation.
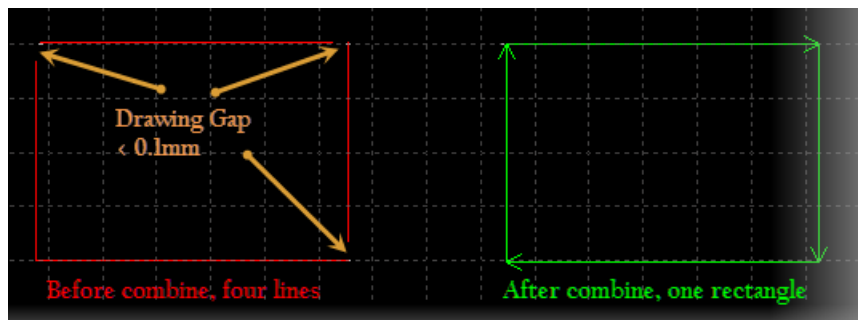
Note: The end points of the graphics in visual may be not the ones in geometric, and the excess backtrack lines may exist in the end points, and these graphics need to be split and deleted firstly through "Split", and then can be combined.

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III. Technical Design

This chapter will describe the related functions of technical parameters provided by Cypcut. Because most of the technical parameters have direct relations with the materials to be cut, the used lasers and air pressure, you need to set the parameters according to the actual technical requirements. All the parameters mentioned here including the ones in the graphics should only be used as examples rather than being considered as guidance parameters.

Warning! The inappropriate or incorrect parameters may result in poor cutting effect or

even damage to the machine, so please set the parameters carefully.

3.1 Lead lines

3.1.1 Distinguish inner and outer mold
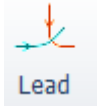
When opening the external files such as DXF and so on, CypCut can distinguish inner and outer mold automatically. If the graphics are modified during editing and they result in the changes in the relationship between inner and outer mold, you can click the button "Auto Sort" when the inner and outer mold need to be distinguished again, and then any way of sorting can distinguish them, which is required to select "Distinguish inner and outer mold when sorting", locating at the drop-down menu of "Auto Sort" button with default selection. Also, you can directly click drop-down triangle button of "Lead" and select "Distinguish inner and outer mold.

CypCut distinguishes inner and outer mold in accordance with the surrounded relations, and it always takes the outermost layer as outer mold, while the next one as inner mold, then outer mold and so forth. Besides, an unclosed graphics cannot form a layer. If you would like to start outer mold from one layer, you can choose all the graphics from this layer and inside it, group them, and then distinguish inner mold and outer mold through "Group Sort".

When adding the lead lines, the external layer is yang cut, so it will be led in from the outside; the internal layer is inner mold and will be lead in from the inside. When set inner and outer mold manually, please select the graphics to be set, and then click the buttons " 🔴 Outer 🔲 Inner " under "Home" menu.

3.1.2 Automatic Lead Lines
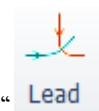
Please select the graphics to be set with lead lines, click the icon " Lead " under "Home" menu, then set the lead lines parameters in the popped window. As shown below:
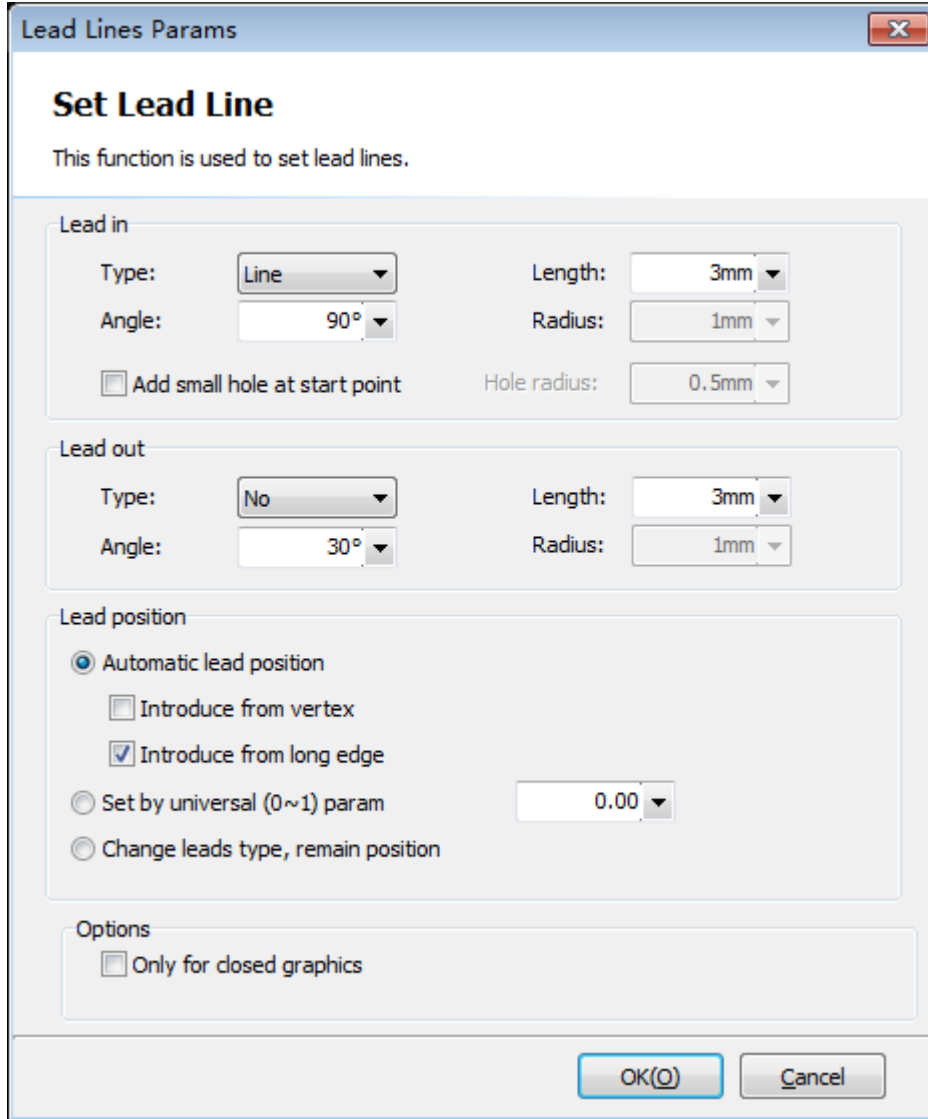
The supported lead types include Arc, Line and Line + Arc, while the supported parameters consist of lead type, lead angle, lead length and lead radius. You can also choose whether to add a small hole at the starting point of Lead lines.

When you select arc leading, the end of the circular arc needs to keep in tangent with the graphics to be cut (no matter how big the set angle is). As shown in the right figure. In fact, the angle set at this moment is an included angle between the connecting line of the start point and the end point of the lead line and the graphics to be cut. The lead out lines are similar to it.
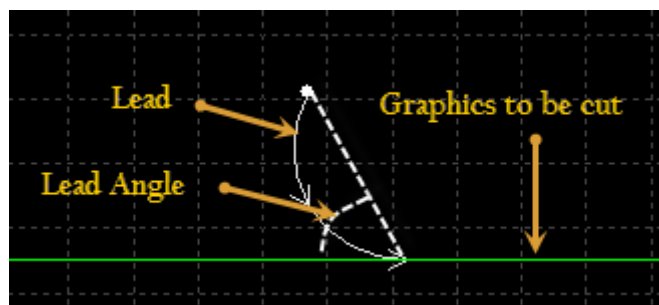
Please note that automatically select the appropriate lead position, it will search preset priority long side or priority vertex in order to determine lead position, thus the previous parameters of the

graphics such as lead position and type will be covered. If you have a fixed requirement for the lead position, you can choose to set unified position according to the total length of graphics or un-change the lead position, and only change the type option.

3.1.3 Manually Set lead lines

You can modify the leanin manually by clicking the button "⟨🖱 Lead Pos⟩" on the toolbar. If you click on the graphics, you can change the position of the lead lines; however, you cannot modify the angle and the length.
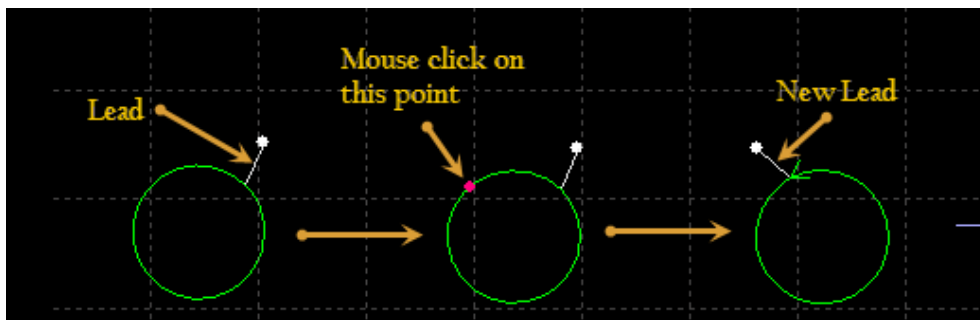
Firstly please click (point A, yellow point) outside the graphics, then click (point B, red point) on the graphics, in this way you can draw a lead line from point A to point B.
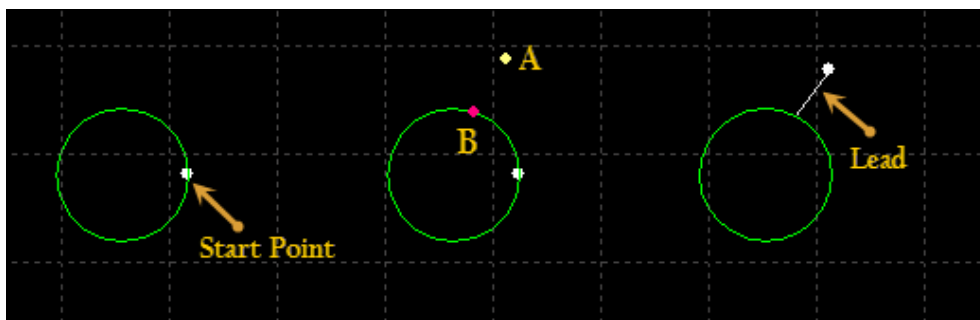
3.1.4 Check the Lead lines

You can click the small triangle below the button" Lead", and then select "Check Lead" so that you can check the lead lines which are set already. This function can shorten the lead lines with too much length, and thus prevent them from intersecting with other graphics. Click "Distinction inner and outer mold", you can determine the specific lead position according to set inner and outer mold.

3.1.5 Lead Seal, Gap and Over
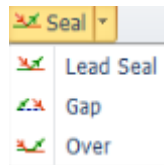
There are three buttons, as , in "Technical Design" under "Home" menu, which are used to set lead seal, gap and over. Please select the graphics you need to set, and then click the corresponding buttons. The size set of "Gap" or "Over" can only be valid when resetting gaps or over cut later, and the size which has been set before will remain unchanged.

3.2 Cutting Compensation

Please select the graphics to be compensated, and then click the button "" on the toolbar for cutting compensation.

The cutting width will be obtained in accordance with the actual cutting results. The compensated track will be shown in white on the drawing board and the system will run along the compensated track during processing. The compensated original drawing will not be processed and will be displayed on the drawing board only in order to facilitate operation.

The direction of cutting compensation can be selected manually. It can also be judged automatically according to outer mold or inner mold. Outer mold needs outward compensation, while inner mold needs inward compensation.

During the process of cutting compensation, you can select to translate the corner in the form of round angle or right angle. As shown below:
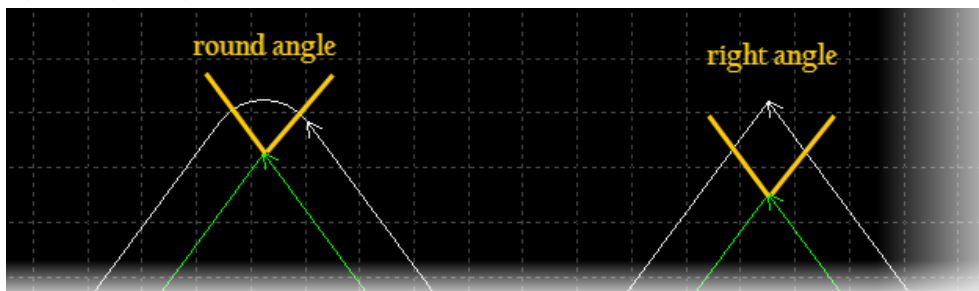
In the figure the green is the original, the white is the compensated track, and the light yellow is the vertical lines drawn from the corner. From the figure you can find that the cutting edges can coincide with the original after both sides of the vertical lines are compensated, while the corner needs transition. Usually round angle transition can ensure that the cutting edges can still coincide with the original and run more smoothly during transition.

To facilitate the selection, you can edit the common compensation value in the general configuration.

In order to clear compensation, please select the needed graphics, then click the button "Clear" and choose "Clear Compensation".

3.3 Micro Joint

"Micro Joint" can be used to insert a micro joint into the track which will not be cut. When cutting to here, the laser will be closed; however, whether closing the gas and the follower is determined by the related parameters of short-distance vacant move during cutting. Micro joint is shown as a gap on the drawing board. As shown below:

You can add a micro joint by clicking at the position of the graphics needed to add micro joints by clicking the button " Micro Joint " on the toolbar,. You can insert multiple micro joints by clicking continuously until you press ESC to cancel the command or switch it to other commands. You can not only click on the graphics but also click on the compensated track to insert micro joints.

Please directly enter the length parameter of the micro joint in the drawing window at the bottom of the software, and the new parameters will be valid for the following operations after setting.

Except adding the micro joints manually, CypCut also provides the function of inserting micro joints automatically. Users can click the " Auto MicroJoint " button by clicking the small triangle button in the right corner of "Micro Joint", set the parameters in the popped dialog box, and then confirm it. You can select "adding by quantity", for example, you can add ten micro joints to each graphic; or "adding by distance"; for example, you can insert a micro joint every 100mm.

The graphics may be divided into paragraphs through "Micro joint". If you want to modify some separation section alone, you can click the "explode MicroJoint" button under the "Micro Joint" drop-down menu. Unclosed graphics after "Micro Joint" operation will be regarded as a separate entity for modification.

In order to clear the micro joints, users need to select the needed graphics, then click the "Clear" button and choose "Clear Micro Joint".

3.4 Cooling point

Click the " Cooling point " button in the "Home" menu. When click on the corresponding position in the graphics, you can set a cooling point at that location. When cutting is implemented to the cooling point, laser will be off and blow will be delayed according to cooling point corresponding settings in the global parameter. Later, laser will be on and operate normal cutting. Cooling point displayed as a solid point in the drawing board, as shown below:

冷却点
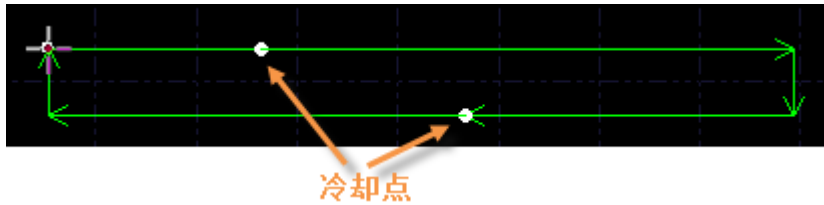
Cooling points can also be inserted multiple by continuous clicking as well as Micro Joint. Cooling points can still be added after operate the process of micro joint and compensation and so on.

Cooling point can be deleting by pressing Shift and then clicking the cooling points.

3.5 Group

"Group" in CypCut refers that multiple graphics and even multiple "Groups" are combined together to form a "Group", and the entire "group" will be regarded as a whole. Within the "Group", the order, the positional relationship between the graphics and the layers are all fixed and they will not be influenced during sorting, dragging and other operations.
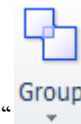
Please select the graphics which you need to form a group, and then click the button " " to combine the selected graphics to a group. If you need to cancel the group, please select the "Group"
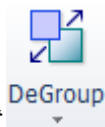
button, which has changed to " " button. If you would like to explode all the groups on the drawing board, please click the small triangle below "Group", and then select "Explode Graphics".

If there is a graphic which can contain all the other graphics in the group, it can be called the outer contour. The "Group" with outer contour will be regarded as a "Part".

Although CypCut software allows you to group any graphics and operate them as a whole, we still recommend the users to use the function of group "logically" and only group the graphics which meet the logical conditions of the "part" as much as possible. From now on we may use these two terms "group" and "part" indiscriminately.

Please note that CypCut software will always group the graphics with "Coedges" to ensure the integrity of these graphics. Furthermore, the result of bridging one "Group" with other graphics or "Groups" must be a "Group" and it can also ensure the integrity of the graphics.

3.5.1 Sorting of Group

The part will be regarded as a whole when being sorted, and it will be involved in sorting with the outer contour or the first graphic as the basis. The graphical order within the part will not change during sorting.

If you need to sort the graphics within the group without exploding the group, you can select the group, click the right key, and then choose "Sort in Group".

The operation of "Sort in Group" will not change the graphical order of the sub-group within the group. The order of "Sort in Group" only has the relations with the geometrical properties of the graphics, while no relation with the layer to which it belongs. During the sorting, it will distinguish inner and outer mold automatically according to the geometrical containing relations.

3.5.2 Processing of Group

The group (the part) will be considered as a whole during processing, and it will be finished by continuous work. No other graphics will be inserted during processing. Even if the group (the part) includes the graphics at multiple layers, it will be processed successively. Pre-piercing in group also follows this rule.

Please note that no matter what the graphical order within the part is, the outer contour of the part will always be processed finally. Please sort before processing.

3.6 Scanning

When the graphics to be cut are regular (such as rectangular, full circle, polygon) and possess a certain regular arrangement, you can connect the cutting line segment with same direction by scanning to conduct flight cutting, which will greatly improve the cutting speed and save cutting time.

It recommends that users sort graphics needed to be scanned before scanning. This operation can optimize the path of scanning and save move time.
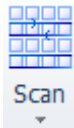
Click " " button under "Home" menu and then enter the fly cutting parameters setting interface.

The starting position is to set the starting position of fly cutting. The minimum length of scan line refers to the minimum segment length of actually cutting after fly cutting. If the segment length of actually cutting after fly cutting is less than a given "minimum length of scan line ", the fly cutting does not give any results, and prompt "It does not detect any curve to meet the fly cutting conditions." At this case, it recommends increase the parameter value of "minimum length of scan line ".
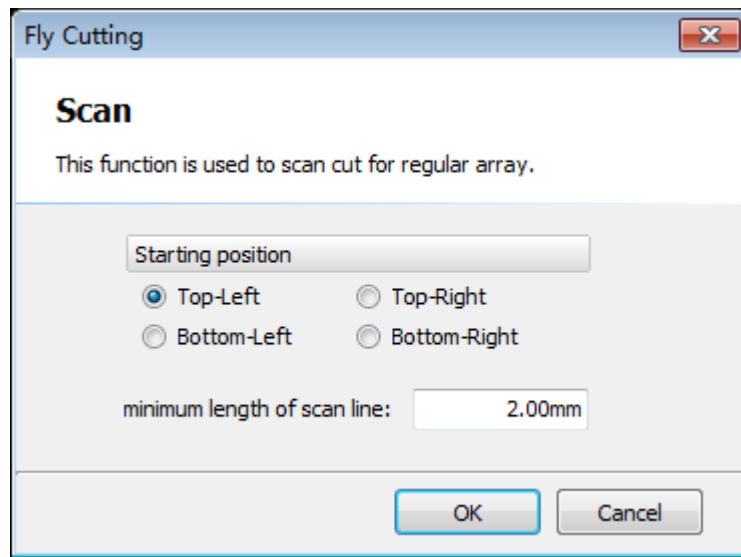
" Lines Scan " under "Scan" button under "" applies to rectangle and the straight line with

same direction, and " Circles Scan " applies to arcs and circles of natural fly cutting. If you choose

"Arc sort before scan", circle or arc will be sorted from top to bottom and then conduct fly cutting. The graphics after fly cutting will automatically become a group.

The example of fly cutting and its partial enlarged detail is shown as below:
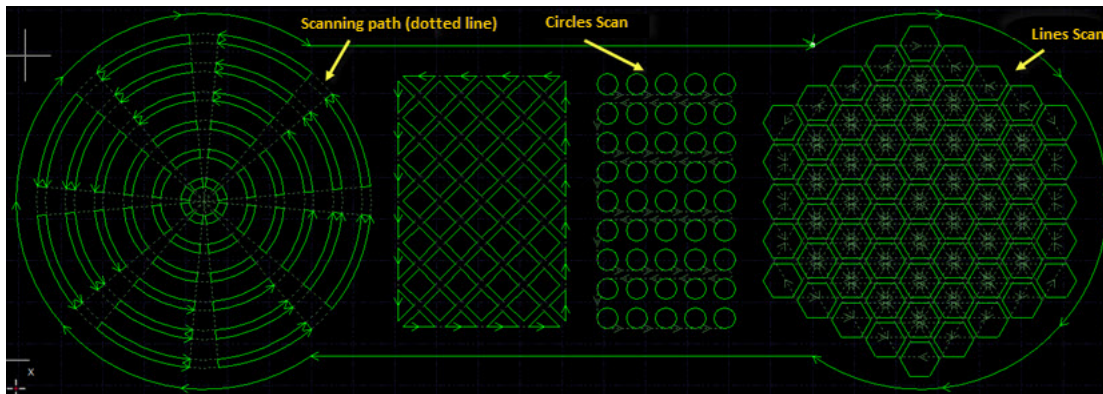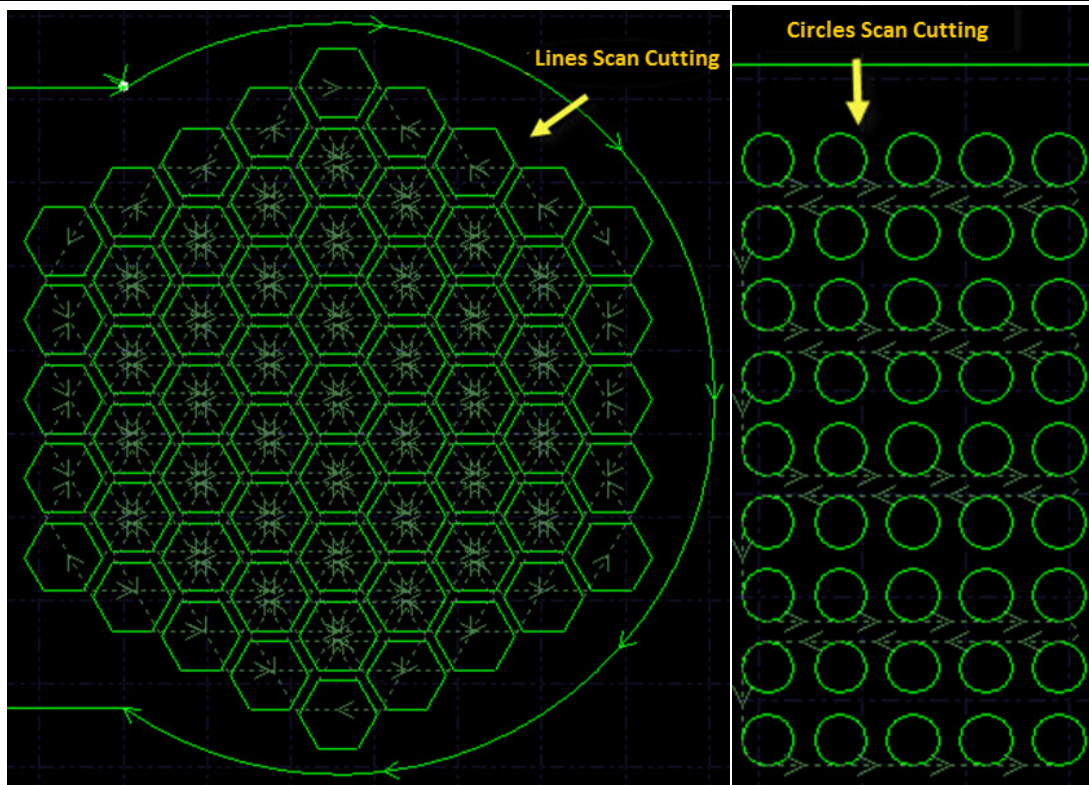
3.7 Coedge

It can save a lot of processing length and improve efficiency by merging the workpieces with same edges. In CypCut, when the boundary distance between two graphics is less than 0.1mm, the two graphics can use the same edge. The function of automatic adsorption provided by CypCut will drag these two graphics together for coedge.

After selecting two or more graphics which you need to coedge and then clicking the button " " on the toolbar, CypCut will try to coedge the selected graphics. If the selected graphics cannot meet the conditions of coedge, the window "Draw" at the lower left corner of the interface will display a prompted message.

At present CypCut only supports to coedge the four sides of the graphics, and it cannot coedge the straight lines of the recesses within the graphics.

The graphics involved in coedge will be combined to form a "Group" after coedge. If they meet the requirement of the "Part", the frames of them will be shown in bold like the right figure. If the graphics involved in coedge include other graphics such as small holes, please combine the graphics and all the interior graphics together to form a group firstly, then coedge them; otherwise, the relationship between the interior graphics and the coedged group will become meaningless, and it will be difficult to determine the processing order and the relations of the internal and external dies
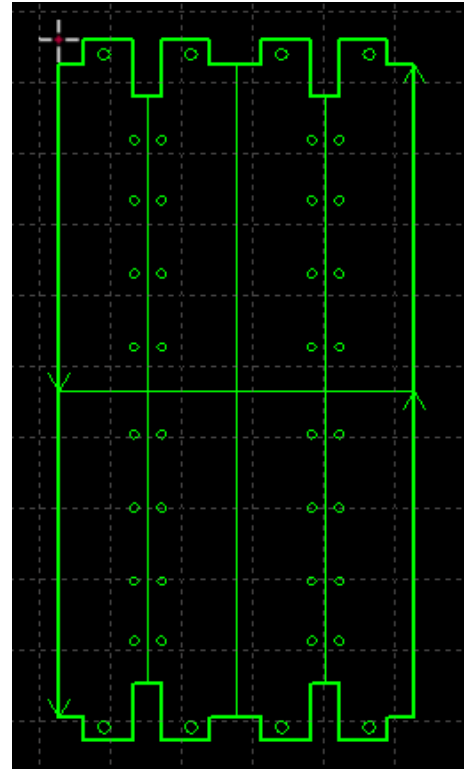
3.7.1 Coedge Automatic Adsorption

In CypCut, when you drag the graphics to the position where you may coedge them, CypCut will try to adsorb automatically and display the corresponding prompted message. You can drag together the two graphics which you need to coedge very easily, and the function of automatic adsorption will help you to locate them quickly when they become close to each other. Even when you select many graphics and drag them together, it can also locate them rapidly.

Once the two graphics are dragged together and they have the same edges, you can finish the coedges just by selecting them and clicking the button "Coedge". If you would like to disconnect and continue to edit the coedged "Part", or set their order, please select "Part", and then click "Degroup" under "Home" menu. You can combine them again through the button "Group" after editing.
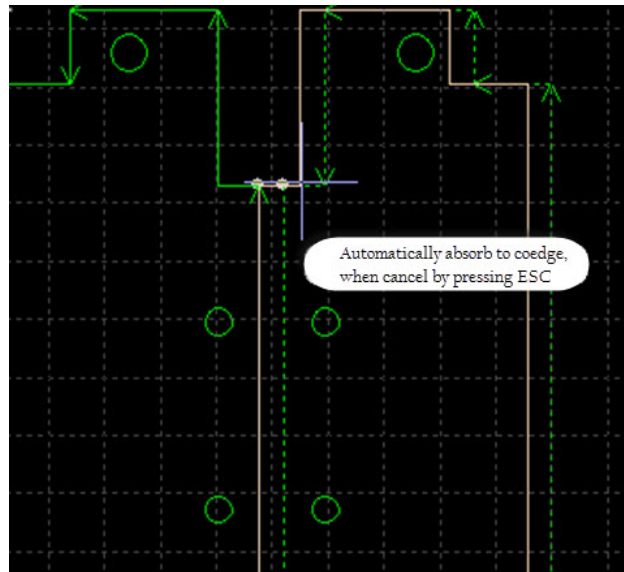
3.7.2 Compensated Coedge

If you hope to still retain the cutting compensation after coedge, firstly please compensate the graphics which you need to coedge, and then coedge them. In any case, "Coedge" will keep the processing track unchanged. If the coedged graphics contain compensation, the compensated track will be retained after "Coedge" and the original will disappear. As shown below.
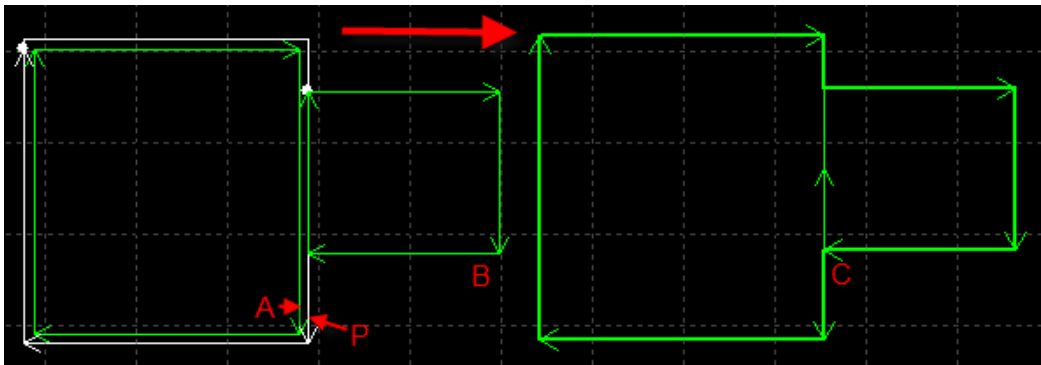
In fact, in the figure above, the original A cannot be coedged with the graphic B, and only the compensated track P can be coedged with it. Even if you move the graphic B to the position near to the original A, you still cannot coedge them because it is not the track to be processed.

3.8 Bridge

When a workpiece consists of many parts and you do not hope to scatter them after cutting, you can connect them through "Bridge". Besides, this function can also reduce the pierce count. Multiple use of the function "Bridge" can also achieve the effect of "One-stroke" for all the graphics.

To bridge two graphics, please click the button " Bridge ", and then draw a line on the screen. And all the graphics intersected with it will be bridged together two by two. As shown below:
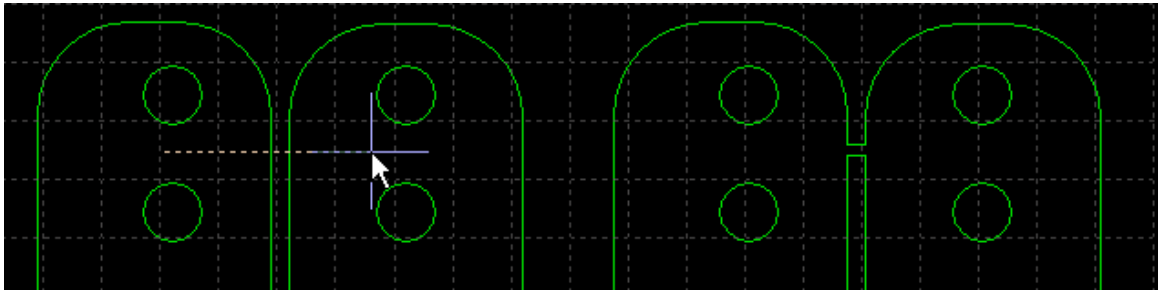
Bridge needs to specify two parameters. The first parameter specifies the maximum distance between two adjacent curves, and you can bridge them when the distance between two graphics is less than the specified parameter. The second parameter specifies the width of bridge.

Please note that the graphics will become a whole after bridging. Maybe any part will not be cut before completing the "One-stroke" cutting, so you need to pay more attention to the change of the heat affecting.

3.9 Nest

Nest function is used for reasonably arranging given parts on the plate with maximum utilization. CypCut not only supports nest through a key, but also provides a number of optimization parameters for you to make fine adjustments, such as: Gap, Plate Margin, Rotate Angle, Auto coedge and Create

remnant and so on. Click " " button in "Home" page or "Nest" page to achieve this function.

Please specify certain size plate before nesting. You can draw or import a graphic, select it,

choose " " button under "Nest" page, and then click "Set as plate"; Or select the graphics and click right key to select "Set as plate". You can also click "AutoNest" button to set the length, width and count of standard plate in Auto Nest interface. Similarly, the number and parts can also be set in the similar method. The graphics before nesting is shown as below:
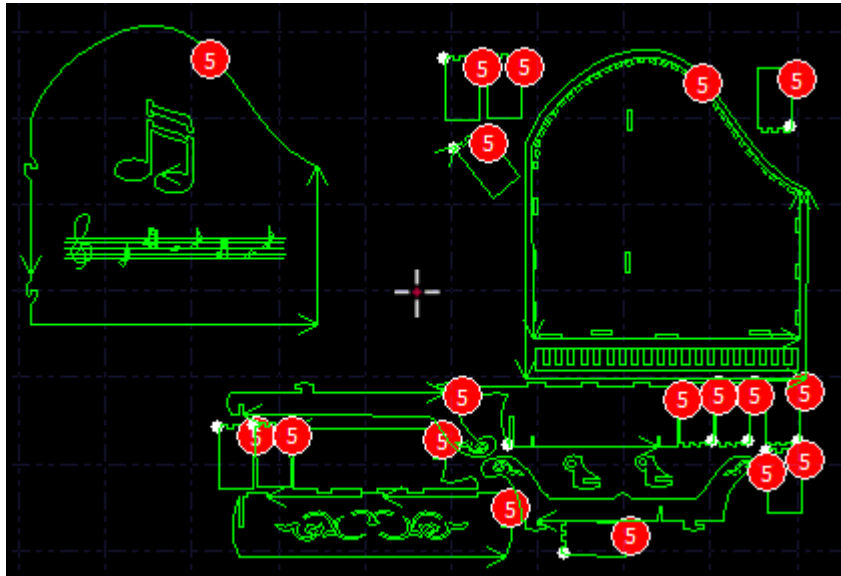
Auto Nest needs to set some parameters. "Gap" means setting a size not smaller than the distance between the parts and components; "Plate Margin" parameter specifies the plate border of parts nesting remained; "Rotation Angle" refers to the adjustment angle of rotating parts during nesting, and in the case of not allowing to have relative rotation between parts and plates, lease select "prohibit rotation"; "Nesting direction" means a direction where the parts is close to the plates.
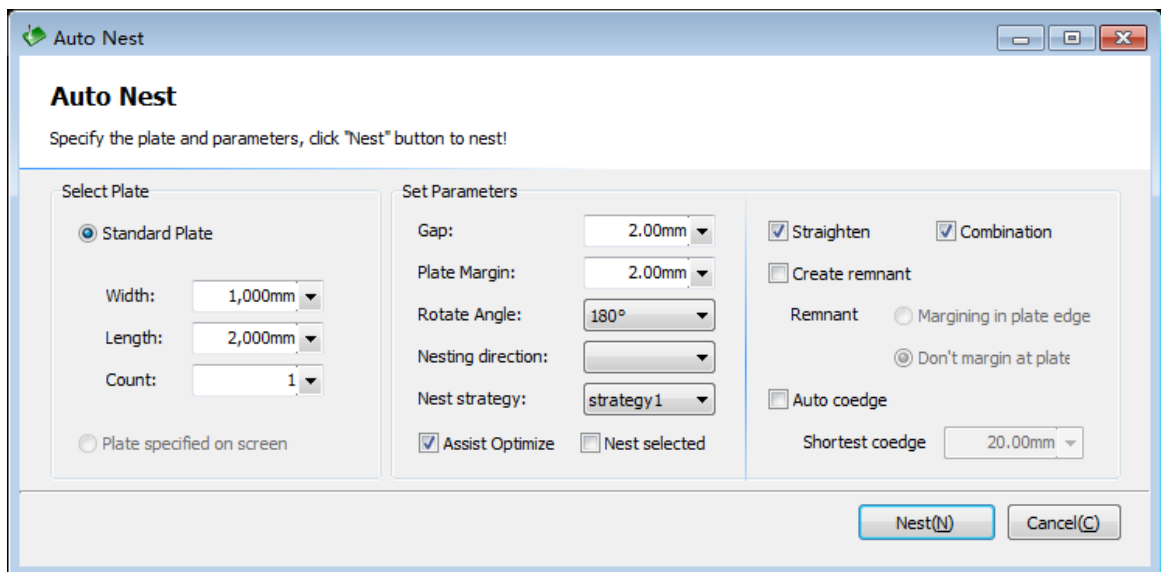
"Nesting strategy" means the strategy that is used to calculate the results of nesting by the program. Currently, auto nest offers five strategies:

Search pattern: Nesting depends on searching shape-matched parts of outline to be ranked space, and nesting results is relatively close between parts.

Stack pattern: The nesting strategies that parts occupied space height is in average growth; when the nesting result is that height of space occupied by parts is lower and more average, larger rectangle remnant can be generated.

Array pattern: Arrange parts into the plate by array pattern when parts have fewer types; It is recommended to use this strategy, especially when single part nesting.

Rectangular pattern: Arrange parts thorough rectangular pattern with the same kinds of parts form into a rectangular block; the nesting results of the local and overall layout are more neat, fit for parts similar to rectangular pattern.

Sequential pattern: Nest parts in plates from large to small.

Graphical after nesting will also have a certain optimization options: select "" ☐ Assist Optimize „ will automatically optimize graphics after nesting, but also will consume more time, you can choose according to the actual situation; "" ☑ Straighten „ straighten parts of crooked posture before nesting;

" ☑ Combination „ will automatically distinguish parts of complementary shape and then couple together for nesting, to improve the nesting speed and neat of parts arrangement; If you select " ☐ Auto coedge „, you need to set the shortest coedge, only when the coedge length of graph is greater than the value, co-edge will be performed automatically, Note: this function can't be simultaneously used with " ☐ Assist Optimize „. Graph after nesting is shown as below:
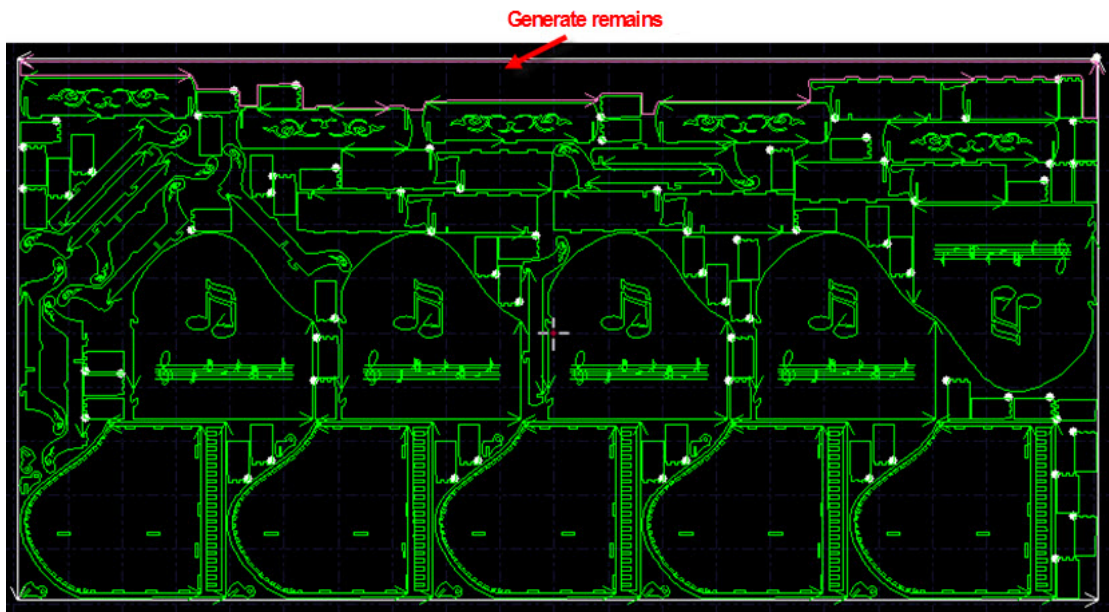
You can also deal with remnant after nesting. Select " ☐ Create remnant " will draw remnant shape drawn on the board, so you will cut down remnant easily.

3.10 Array

"Array" command can be used to quickly and accurately copy an object, CypCut provides three ways of array.

3.10.1 Rectangular Array
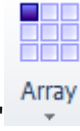
Click "" button or "Rect Array" under "Array" drop-down menu. Parameter interface appears as shown below.

Set the number of rows, columns, offset and direction and then can quickly copy the selected graphics, as shown below:
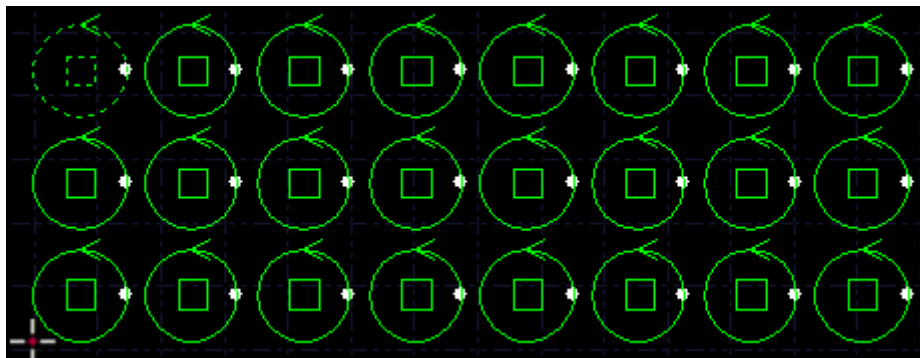
3.10.2 Manual Array

Click "Manual Array", set up the spacing of line and column, you can designate the area by dragging the mouse to select the graphics for quick array copy. As shown below:
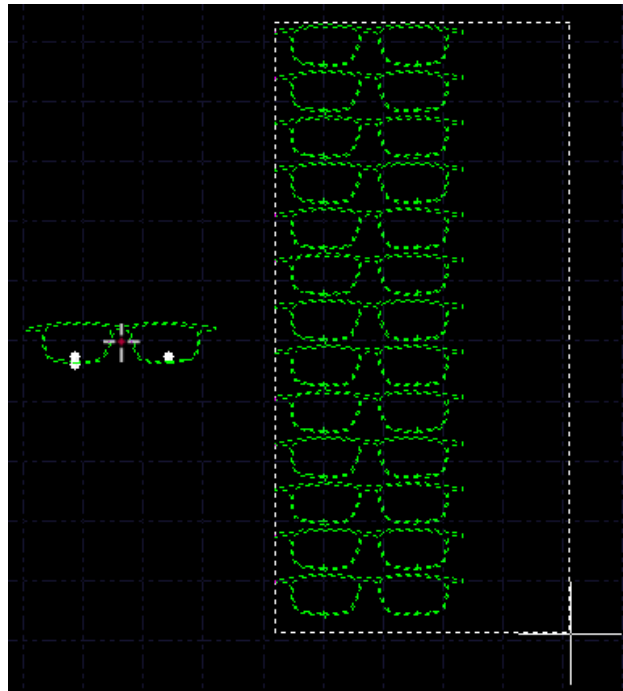
3.10.3 Full Fill Nest

Full fill Nest is mainly used for entire board cutting of single graphic, click "Full Fill", the software will quickly full fill nest according to given part, parameters and plate. See plate setting in "Nest" part. Full fill effect is as shown below:
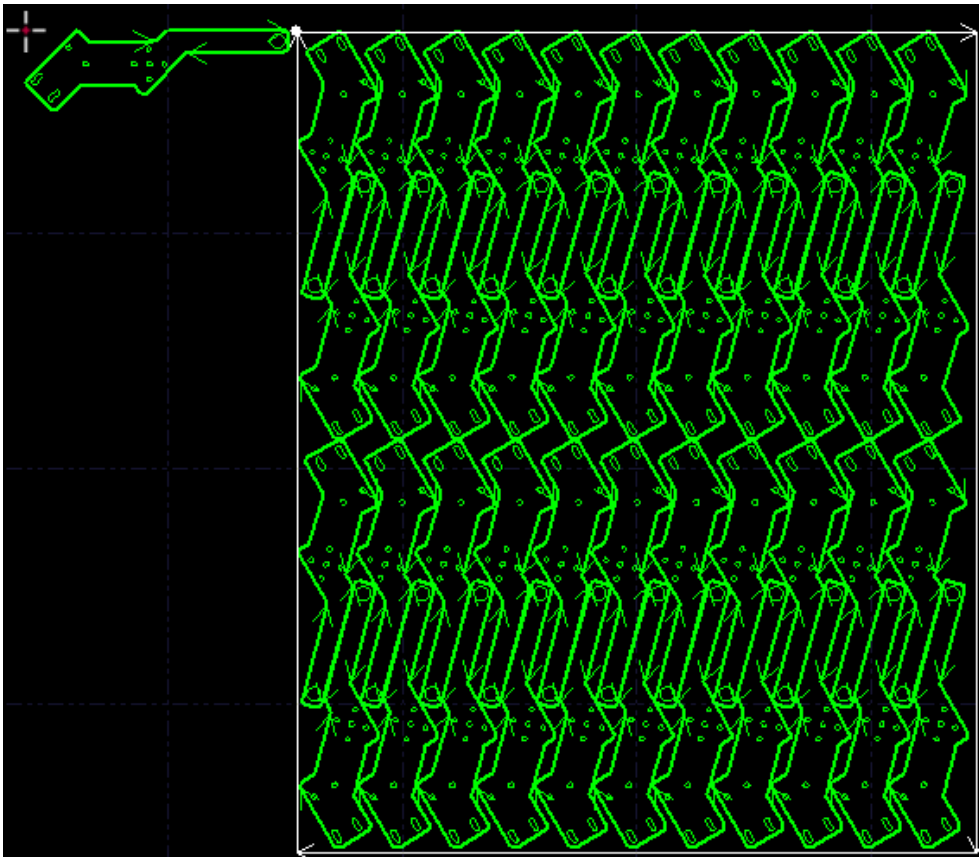
3.11 Layer Parameters

CypCut provides sixteen layers and every layer can set separately the technical parameters such as move speed, laser power, pressure, cut height and so on.

You can open the dialog box "Layer Parameter Settings" by clicking the button " " under "Home" menu. This dialog box includes almost all the technical parameters required for processing. The first page of the dialog box is "Global parameter" and they are used to control the parameters outside the layers, including motion parameters, default parameters of laser and gas, and follow parameters and so on. The other pages of the dialog box list all the currently used layers, and you can set the parameters of this layer separately by clicking every layer.
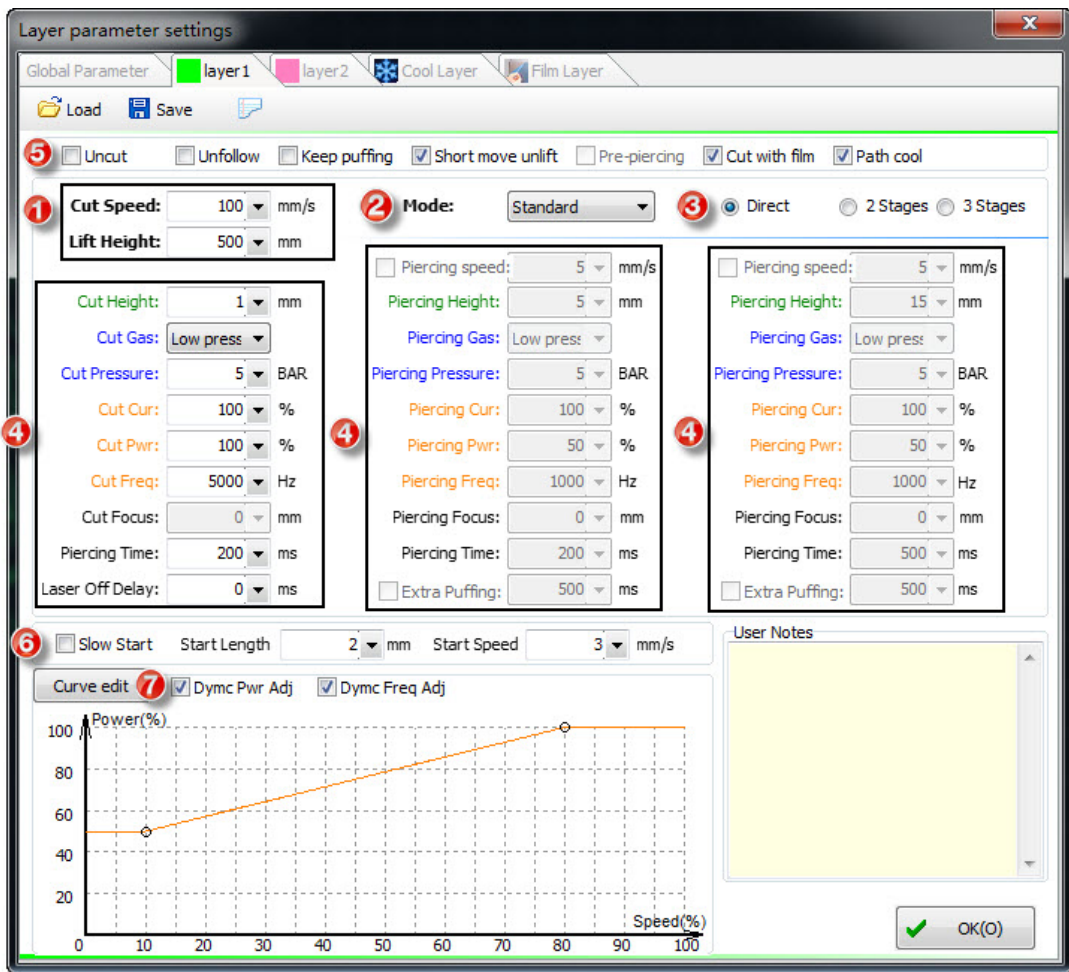
Note: Different options may be displayed in the dialog "Layer Parameter Setting" due to different lasers, different gas pipeline configurations and different followers. The above figure is only used for reference, and the actual contents displayed in your software shall be taken as the criterion.

3.11.1 Descriptions of Parameters

The brief descriptions of some parameters in the layers are as follows.

① Basic Parameters	
Cut Speed	Set the actual target speed of cutting. There are acceleration and deceleration at the first and last sections as well as the corners of cutting track, so the actual cutting speed is often less than the speed.
Lift Height	Set the lift height of laser head after cutting a segment of curve. Z-axis will lift to a certain height after suspending the cutting, and the height is lift height.
② Cutting mode	
Standard	Cutting according to set standard parameters.
Fixed Height Cut	Cutting with fixing laser head at a certain height.
Extra-plate follow	When you select the mode, the knife point can be docked off the board. During actual cutting, portion of the laser head outside the

	plate will stay in the "Reference height", and follow cutting after detecting in the board. Commonly is used for cutting metal plate.
	The setting pattern of "Reference height" is that save the parameters by the path of "CNC" _ "BCS100" _ "save reference height when follow outside plate", when the laser head move to the appropriate height.

③　Piercing mode	
Direct Cutting	Piercing and cutting use the same parameters, which are commonly used for thin board cutting.
Two stages piercing	Piercing and cutting use the same parameters, which are commonly used for thick board cutting,. You can choose whether needs progressive piercing.
Progressive piercing	Based on stage piercing, the piercing method of variable defocusing amount is used, i.e., slowly fall when piercing, and this method is commonly used for thick board cutting. During stage piercing, the piercing time can be set to be a small value, such as 100MS. At this time, actual piercing time = 100MS + the time required for slowly falling to the cutting height from the piercing height.
Three stages piercing	Based on stage piercing, conduct another stage piercing. You can choose whether needs progressive piercing. And this method is commonly used for thick board cutting

④　Cutting Parameters	
Cutting Height	Set the height from the laser head to the board during cutting.
Cutting Gas	Set the type of auxiliary gas used in cutting.
Cutting Pressure	Set the pressure of auxiliary gas during cutting, and use it with proportional valves or multiple valves.
Peak Current	Set the peak current of fiber laser, i.e., diode power. Peak power determines the maximum cutting power that machines can reach. As for a cutting machine with a power of 500W, if its diode current is set to be 80%, the diode power it can reach during cutting is 500W * 80% = 400W.
Cutting Power	Set the laser power used in cutting, i.e., the duty ratio of PWM modulation signal.
Cutting Frequency	Set the carrier frequency of PWM modulation signal during cutting, i.e., the laser number within one second. The larger the value is, the more continuous the laser.
Cut focus	The position of focus far from Sharp-tongued of cutting head nozzle.
Piercing time	Delay for piercing plate, so make cutting more fully.
Laser off delay	Delay for ensuring complete cutting before laser off.
The definition of piercing parameters, such as pressure and power and so on are similar to the cutting parameters, which can take effect only when the option of "2 stages" in ③ is selected.	
Piercing speed	Set the speed from piercing height slow down to the cutting height

	during progressive piercing.
Extra puffing	Set time for puffing with laser off after piercing, in order to make the plate cool.
⑤ Other parameters	
Uncut	The layer process is not processed.
Unfollow	Height controller is not carried to follow motion when this layer is during cutting.
Keep puffing	Keep puffing during cutting.
Short move unlift	After select this option, if the move distance between two graphics is less than the value of "Unlift move distance less than" set in global parameter, then Z axis is not elevation and directly moves to the beginning point of the next graphics to start processing, after the above graphic complete processing.
Pre-piercing	Before actual cutting, piercing in advance at the beginning point of graphics (or lead starting point). CypCut provides auto group pre-piercing. You can select this option in the global parameter. Note: This option is not available with "Cut with film".
Cut with film	You can use film parameter to perform one time cut with film along the cutting path, and then perform normal processing according to layer parameters. After selecting this parameter, "film layer" setting page will appear.
Path cool	After a single graphic normal processing, process one time with laser off and puff on along the original track, in order to accelerate parts rapid cooling and reduce the impact of thermal expansion and contraction effect on the accuracy of the work-piece. After selecting this parameter, "Cool layer" setting page will appear.
⑥ Slow start	
Start length	Set the length of slow start, to prevent cut thick plate without completing at the beginning.
Start speed	Set the speed of slow start

3.11.2 Dynamic power and frequency adjustment

After selecting "☑ Dymc Pwr Adj ☑ Dymc Freq Adj", the cutting power and frequency will vary with the changes in speed during the cutting process, and the specific changes are determined by the power and frequency curve. You can click " Curve edit "button to edit power and frequency curve.
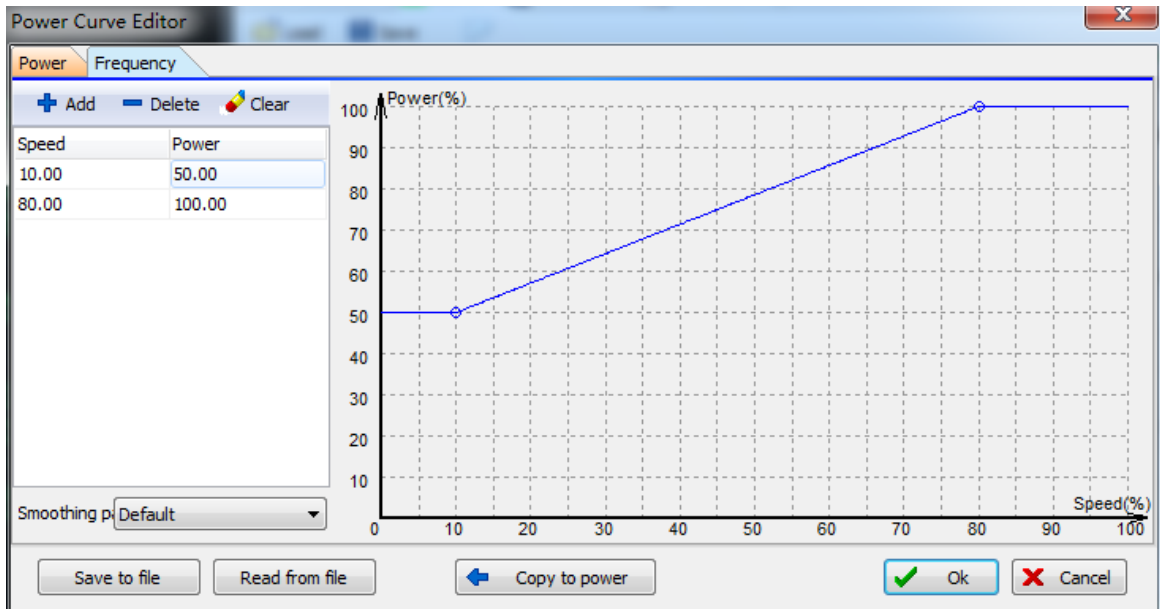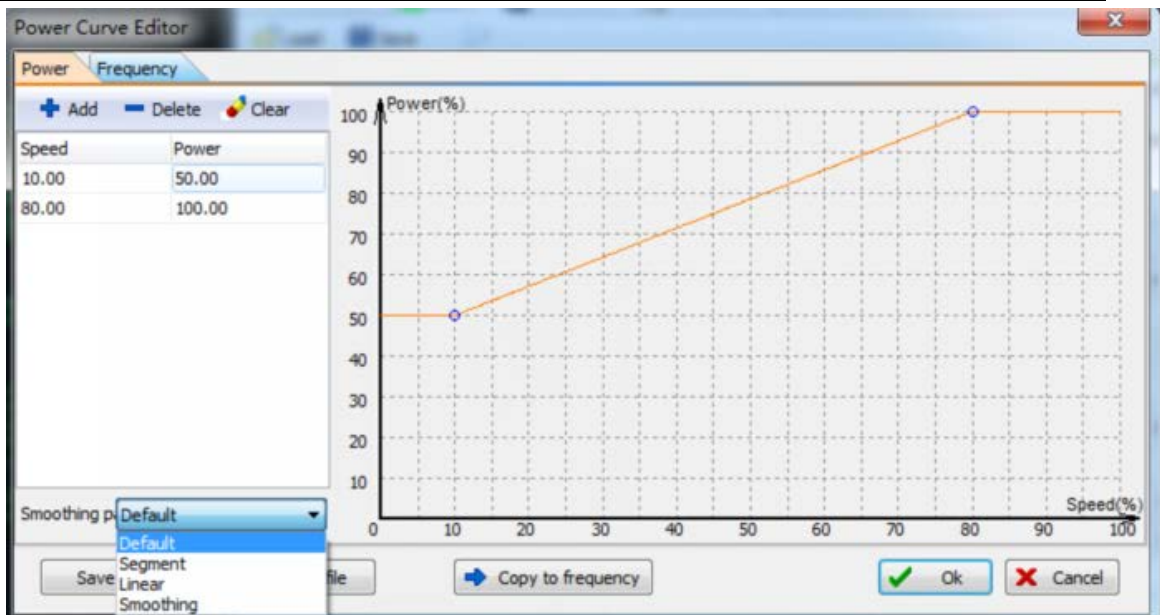
As shown above, the X-coordinate of power / frequency curve represents cutting speed, while the Y-coordinate represents cutting power / frequency, with a unit in percentage. You can add the appropriate speed corresponding to power point and select the curve smoothing pattern. You can also click " **Copy to frequency** " to copy the power curve as frequency curve. By this table, it can reflect the percentage of actual power/ frequency in cutting power/ frequency when the actual movement reaches the turning and the speed drops to a few percent of target speed. Note: Adjusting frequency in real-time makes sense only after selecting "Dymc Pwr Adj".

For example, if the laser power is 500W, after setting the cutting speed to be 100mm/s, peak current to be 90% and cutting power to be 80%, when the actual cutting speed drops down to 29mm/s, the power of laser is as follows:

Laser power X Peak current (percentage) X Cutting power (percentage) X Speed following power (percentage) X =500W X 90% X 80% X 79.00%= 284.4W

However, the power cannot be less than a pre-set minimum value, anyhow. Generally, it is set to be 10%, i.e., **500W * 10% = 50W**.

If " ☑ Dymc Pwr Adj   ☑ Dymc Freq Adj " is not selected, the power will remain unchanged in the cutting process. Referring the above example as a reference, the power in the cutting process is as follows: 500W X 90% X 80% = 360W

3.11.3 Piercing Ways

CypCut presets three piercing ways, namely direct cutting, two stages piercing and three stages piercing. Two stages piercing and the three stages piercing can be achieved only with the support of BCS100 height controller. The specific processes of these three piercing ways will be controlled by the preset PLC process. Direct cutting is commonly used in cutting plate; two stages piercing is also known as segment piercing, and achieves the purpose of cutting thicker plates by setting different parameters of piercing and direct cutting. You can choose whether to enable a progressive piercing during segment piercing, which can make piercing process more fully. Three stages piercing is performed before segment piercing. As the same, you can choose whether to enable a progressive piercing during piercing to strengthen piercing effect, usually used for cutting thicker plate.

3.11.4 Pre-piercing

After selecting " ☐ Pre-piercing ", it will pierce firstly at all the needed positions when processing this layer. The piercing way will be specified by " ⚪ Direct   ⚪ 2 Stages ⦿ 3 Stages " in the layer. You can operate "Direct Cutting" after completing pre-piercing.

Note: You can select " ☐ Pre-piercing " only after you select "2 stages" or "3 stages" piercing.

3.11.5 Material Library file
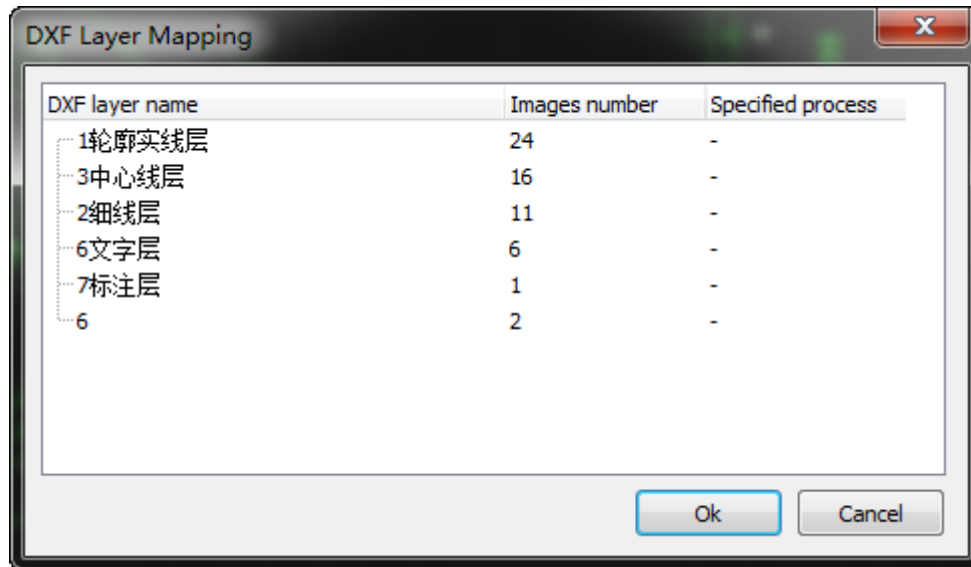
After editing all the parameters of the layers, you can save them to the material lib for the next use. You can save them to the material lib by clicking the button " 🖫 Save " and inputting the file name,. We recommend the user to set the file names by using the material properties as the name, such as 2mm carbon steel.

When you need to use the material library file next time, please click the button " 📂 Load ", and then select the file saved previously. CypCut will prompt you "Whether Covering the Current Parameters", and the software will import the parameters in material library file automatically when you click "Yes"; if you click "No", the software will cancel the reading operation.

3.11.6 Layer setting

You can choose lock or display a particular layer according to prompt by clicking drop-down triangle button of "Layer" under "Home" menu. If there are multiple layers when import DXF files, please click the "DXF Layer Mapping" to see the number of layers and the corresponding graphics. As shown below:

3.12 Sorting and Path Planning

You can find the column shown below in the page "Draw" of the toolbar. It includes all the functions listed in the above figure, furthermore, there are tools for graphical alignment at the top. As shown below:
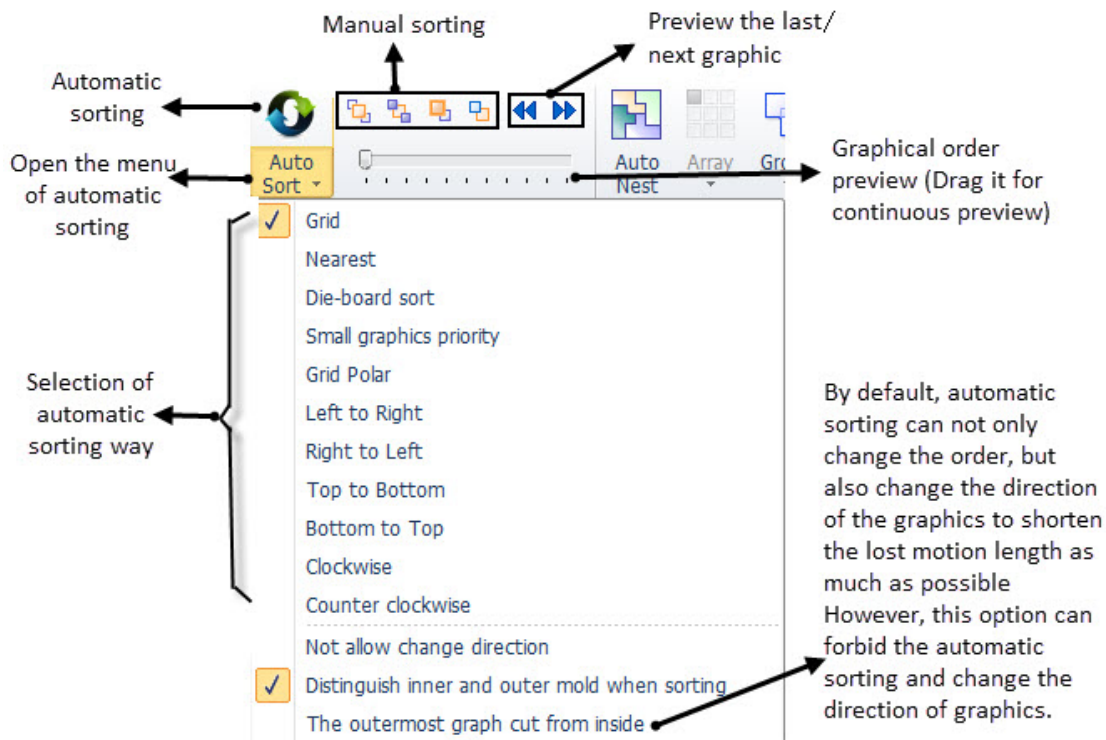
As for the rules of group sort, please see the chapter "Group". If there is no special requirement, we recommend you to select the way of "Grid Sorting".

3.12.1 Order Preview

You can preview the processing order by dragging the progress bar "Graphical Order Preview" or clicking the button " ". The figure below demonstrates a screen when previewing the parts.
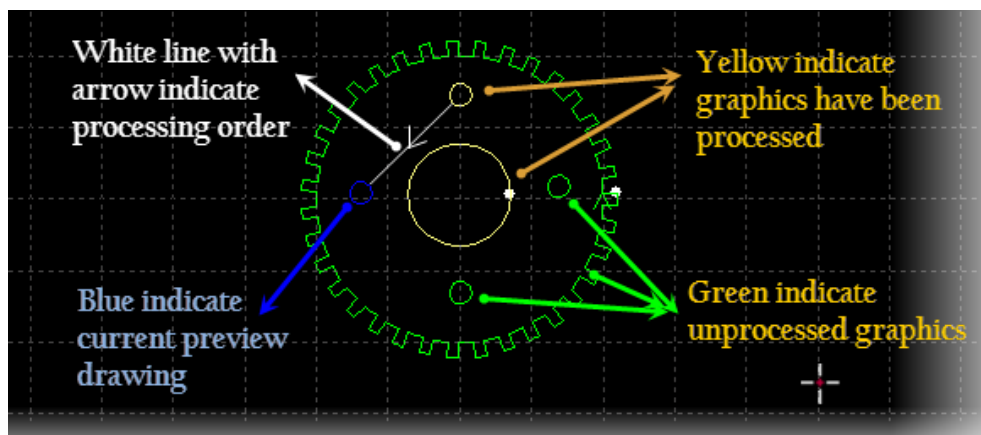
The order preview is fully interactive and it can be more easily controlled than simulation processing. You can also zoom in the position where you would like to observe carefully and preview forward and backward repeatedly. All the move paths will be shown by clicking the button " " und drop-down triangle button of "View" on the common toolbar, and they will help you to look over the

whole processing order.

3.12.2 Manual Sorting

If you would like to fine-tune the results of the automatic sort, you can use the manual sorting. Firstly please select the graphics to be adjusted, and then click the buttons in the icon " ". The functions of the four buttons from left to right are as follows:

Moving to the first		Moving the selected graphic to the first one for processing
Moving to the last		Moving the selected graphics to the last one for processing
Moving to the prior		Moving the processing order of the selected graphic forwards
Moving to the next		Moving the processing order of the selected graphics backwards

Note: no matter how you move the graphics, the order of the graphics can only change within the layers to which they belong. The overall order between the layers can be adjusted in the dialog box "Layer Parameter Settings". See the chapter "Layer Parameters".

Except the manual sort of fine-tuning, you can also perform the manual sort more intuitively through "Manual Sorting Mode". The system will enter the "Manual Sorting Mode" after you click the

button " " on the left toolbar of the main interface. The move path and the digital display of the

graphical order will be opened automatically on the screen. According to your expected order, the processing order of the graphics will be set after you click with the mouse one by one. If click an incorrect position by mistake, you just need to click again from the incorrect position or cancel the operation with the right key. If you just would like to adjust the order between two graphics, you can hold the mouse and draw a line from one graphic to another, and then you can set the order between these two graphics. As shown below.
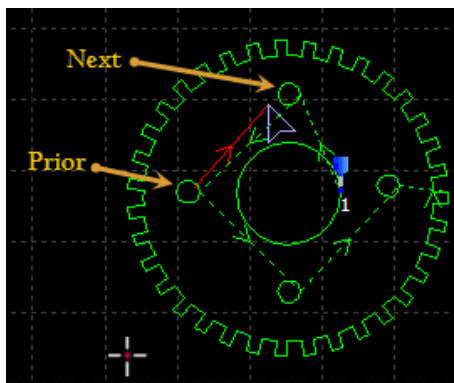
3.12.3 Partition Sorting

After completing sorting the order of one part, if you hope to fix it, you can select the graphics needed to fix the order and then click "Group". After that, the order between them will maintain unchanged; besides, the subsequent manual sorting and automatic sorting will not influence the interior of the group. Note: after grouping, all the graphics within the group will be finished by continuous work from the first to the last, meanwhile, the graphics which are not included in the

group will not be processed.

If you just would like to perform automatic sort for part of the graphics without influencing other parts, you can also complete it through grouping. Please select the graphics needed to be sorted automatically, click "Group", and then click "Group" with the right key, lastly select "Sort in Group".
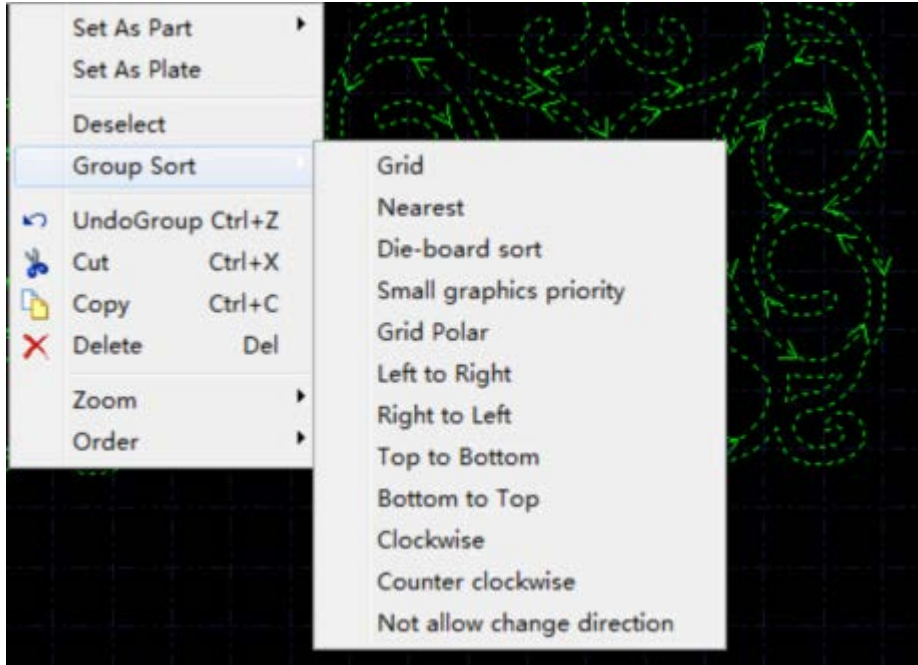
IV. Work Control

CypCut is a set of software combining design and work control together. As mentioned above, all the graphics and the parameters can be prepared without the machine tool, the files can be saved after finishing all the design, and then they can be copied to the machine tool for processing.

4.1 Coordinate System

The "Model Coordinate System" used in the graphical design has no relation with the machine, and its zero point is marked by "⊞" on the screen. However, the coordinate system used in the processing is related to the operating status of the machine. The correspondence of these two coordinate systems is shown as below.
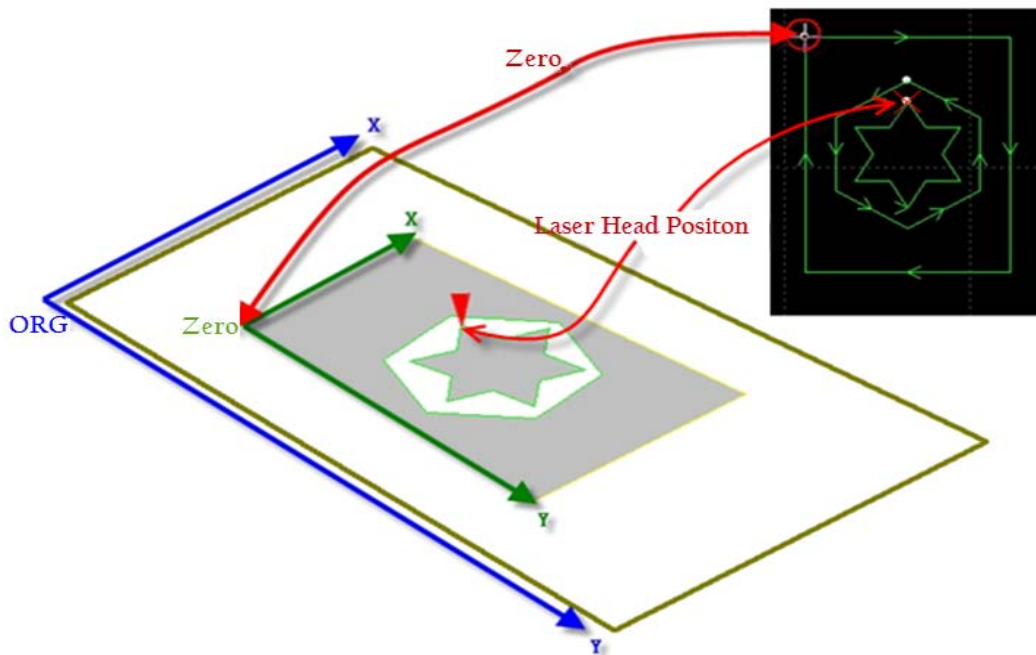
The positional relation between the graphics and the machine tool breadth will be displayed on the screen after you click the button "preview" on the console.

4.1.1 Mechanical Coordinate System

The mechanical coordinate system is uniquely determined by the machine structure and the machine parameters. At any time all the coordinate systems set through clicking "Go Origin" are consistent with each other. You can reset the mechanical coordinate system through clicking "Go Origin" in the "CNC" page after completing the initial installation or when the mechanical coordinate system deviates because of the abnormal reasons.

No matter which kind of mechanical structure is used, the definitions of CypCut for the coordinate systems are always consistent with each other. All the moves are the moves of the laser head relative to the workpiece. If the laser head is rightward, it is X positive direction; however, if the laser head is backward, it will be Y positive direction. That is to say, the lower left corner of the workpiece (steel plate) is the minimum coordinate, while the upper right corner is the maximum coordinate.

4.1.2 Program Coordinate System

Because the coordinate system of machine tool is fixed, you need to introduce the workpiece coordinate system for convenient use. The direction of each coordinate axis of all the program coordinate systems in CypCut is fully consistent with the machine coordinate system. Only the zero point of the coordinate system is different, and it is called **program zero point**. The program coordinate system is divided into the floating coordinate system and the workpiece coordinate system.
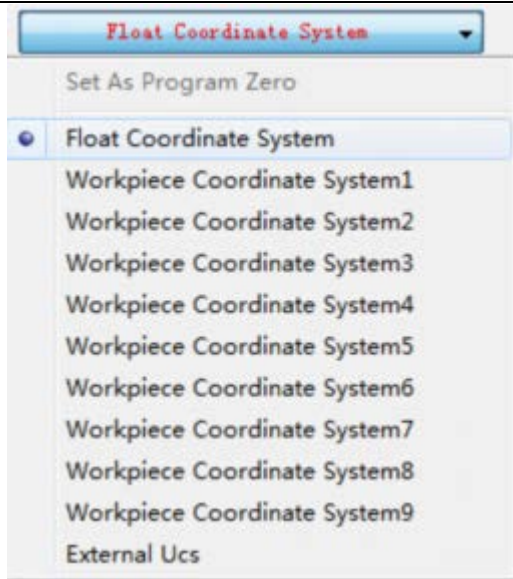
The button at the top of the console can be used to select the program coordinate system, and it can also be used to select "Floating Coordinate System", nine "Workpiece Coordinate Systems" and one "External Ucs".

Usually **the floating coordinate system** is used for informal processing, and it can be considered that "Where the laser head moves, it will start to work from there". The zero point of its coordinate system is automatically set as the current position of the laser head when the users click "Walk", "Dry Cut" or "Work".

When selecting the **workpiece coordinates** 1-9, its zero point will be set manually by the users through "Set the Current Point as the Zero Point". Once it is set, it will be saved forever until you reset it next time. Thus the workpiece coordinate system is suitable for bulk production, and its location is generally decided by the fixture. It can be maintained that every processing will be performed in the same position of the machine by using the workpiece coordinate systems 1-9.

Click status bar " "at the bottom. You can choose to "Show Machanical or Program Position. You can also set zero here of the two coordinates. If you select "coordinate positioning", laser head will be positioned to a specified coordinate position.
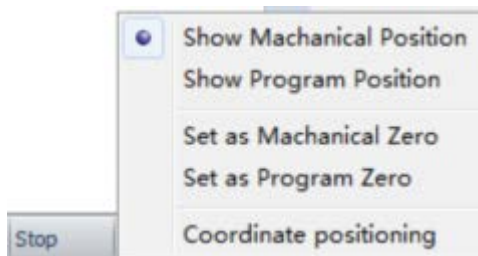
4.1.3 Searching Zero Point after Exception Occurs

Case one

If the processing is interrupted only due to the exception of external equipments such as the

laser and auxiliary gas, and they do not cause the coordinate system to deviate, you can click directly "Return Zero" to go to the zero point.

Case Two

If the mechanical coordinate deviates due to suddenly power failure or servo alarm, we recommend the users to perform "Go Origin", reset the mechanical coordinate system, and then click "Return Zero" to find the zero point.

4.2 Alarms

CypCut will monitor all the parts during the running of the machine. Once it monitors the alarms, it will display immediately the alarm in red title bar and take measures such as stopping the motion. Before the software alarms are removed, many operations will be forbidden, and users need to check the machine and operation again after the alarms are canceled. One example of the alarm is as shown below.
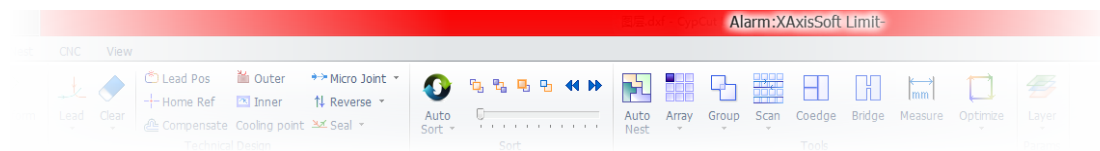
Except the title bar, the "Alarm Window" at the lower left corner of the interface can also display the alarm information. After the alarms are removed, the red display of the title bar will disappear, however, the information in the "Alarm Window" will be retained. You can look over all the history by double clicking "System Window", so that you can find out the events happened during the running of the software.

In addition to the alarms, if CypCut detects other operation exceptions, it will display the exceptions in different colors on the "Alarm Window" according to the exception levels, which include warning, reminding, message and so on. This information will not cause the machine to stop moving, however, it will still suggest you to pay attention to the information shown by the software in time so that you can take the necessary measures as soon as possible.

4.3 Manual Testing
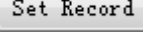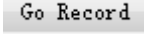
The functions of the manual control on the console are shown in the following figure:
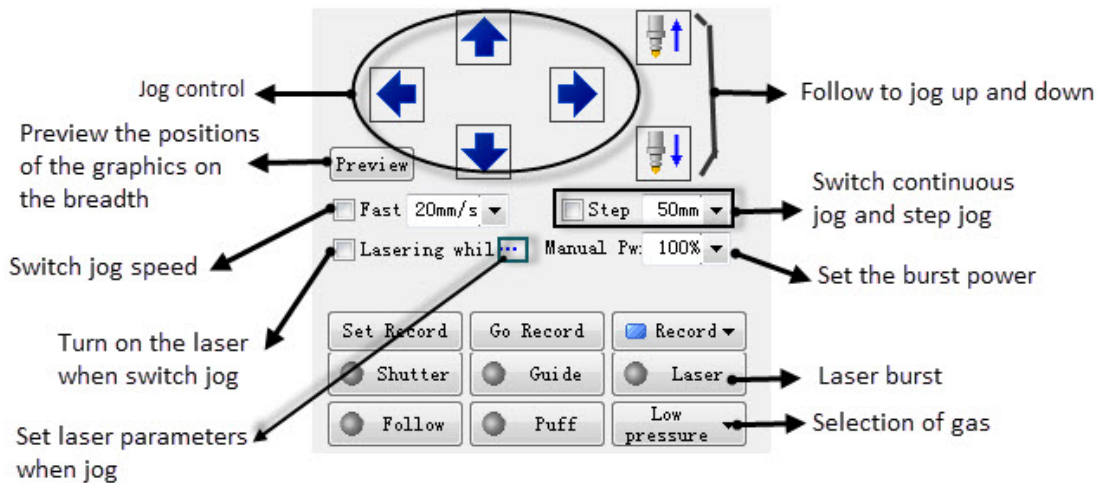
The button with the icon " ⬤ " will become " ⬤ " after the corresponding equipment is opened.

You can turn on the laser by pressing the button " ⬤ Laser ", and you can turn off the laser by releasing it. You can switch other buttons by pressing them and not conduct any actions by releasing them. Taking button " ⬤ Puff " as an example, blowing will start after you press the button, and it will stop after you press the button again. According to the differences of the lasers, the " ⬤ Shutter " may become " ⬤ " after pressing the button and this state is read from the laser.

Note: all the button actions need the support of the corresponding parts on the machine. If the machine is not equipped with these parts, or the platform parameter configuration is incorrect, some buttons may become invalid.

The current position of the machine tool can be recorded by clicking " Set Record ", and the machine can return to the previously recorded position by clicking " Go Record " if required later.

Six positions can be recorded in total and they will be selected through " Record ▾ ".

4.4 Soft Limit Protection

In order to protect the machine, CypCut is installed internally with the soft limit protection, which can be turned on and off through the option "" on the console. It is enabled by default.

After the soft limit protection is enabled, if the software detects that the motion may exceed the travel range, it will prompt "Motion is Out of the Range", and will not issue any motion commands to avoid the possible hits. At this moment please check the positions of the graphics and the machine to ensure that there is no mistake before operation.

Apart from this, the software will also monitor the machine coordinates in real time during the motions of the machine. Once they are beyond the soft limits, the software will alarm at once and then

stop all the motions.
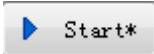
Note: the soft limit protection depends on the machine coordinate system. If the coordinate system is not correct, the protection will also be incorrect. Thus, after the operations such as abnormal close of the system and modification of the machine parameters, users need to build the correct machine coordinate system through the operation "Go Origin".

4.5 Frame

The laser head will dry cut a rectangle along the frame of the graphic to be processed by clicking the button " Frame " on the console, so that you can determine the approximate size and position for processing the boards. The speed of walk can be set in the "Layer Parameter Setting" – "Global Parameters" – "Walk Around Parameters".
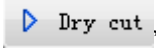
Note: If you operate "Edge Seek" before framing, the software will record the results. The laser head will move along the inclined rectangle during framing, that is to say, move along the actual frame which is corrected by the "Edge Seek". See the Chapter "Edge Seek" for the details.

4.6 Processing and Dry Cut

You can start processing by clicking the button " Start* " on the console. During the processing the monitoring screen will be displayed as below. It includes the information such as the coordinates, the speed, work time, follow height and so on.
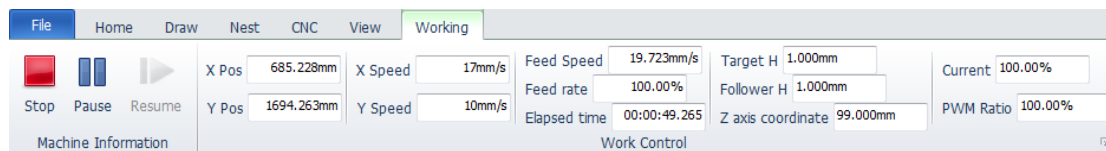
When displaying the screen above, it cannot be switched to other pages of the toolbar, in order to prevent from modifying the graphics during the processing. However, the menu "File" can still be used. If you need to modify the parameters during the processing, please pause firstly, and then click the button "Layer" on the right toolbar of the interface.

You can perform the operation of dry cut by clicking the button " Dry cut " on the console. The difference between dry cut and the actual processing lies in that dry cut can select whether to follow without the need for turning on laser or gas. However, all the running tracks, including the move, speed, process of acceleration and deceleration of "Prepiercing", are exactly same to the actual processing. You can also perform the same operations of pause, continue, forward and backward; besides, the breakpoint memory after stopping is identical to that of the actual processing; furthermore, you can modify the parameters after pausing, and then continue the operation of dry cut. Thus dry cut can be used for the comprehensive inspection and simulation of the whole processing without cutting.

If you would like to open "Follow" during the dry cut, please select " ☑ Enable follow in dry cut " in "Layer Parameter Settings" – "Global Parameters" – "Follower Param". In the default condition it will not open "Follow" during the dry cut.

By default, it will return to the zero point automatically after completing the processing. If you would like to return to other position after the processing, please select the needed position on the console. The supported positions include zero point, start point, end point, origin point and record point. Cancelling " ☑ Return to Zero when stop " is equal to returning to the "End Point", that is to say, the laser will not move after the processing. If you use the "Floating Coordinate System", we recommend you to return to the zero point after the processing. If you hope to return to record point after the processing, please select "Record&1" and confirm it.

Every time when the processing is finished, the process count on the console will add 1, and when it reaches the preset times, a dialog box will be popped to prompt so that you can control the production. You can open "Auto Pause" interface to control piece management and auto pause by clicking the button " Config ". If you need loop work, please click the button " Loop " to set corresponding parameters.
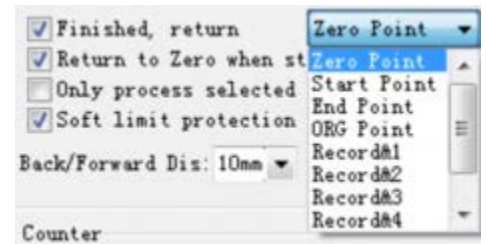
4.7 Stop, Pause and Resume

If you need to stop the processing, please click the button " ▮ " on the toolbar during processing or the button " ❌ Stop " on the console. After stopping, the machine will return to the zero point. If you do not hope to go back to the zero point, please cancel the selection of option " ☑ Return to Zero when stop " on the console.

If you pause the processing, please click the button " ▮▮ " on the toolbar during processing or the button " ▮▮ Pause " on the console. Then the processing will resume from where you pause.

If you need to continue to work, please click the button " ▶ " on the toolbar during processing or the button " ▮▶ Resume " on the console. If the parameters are modified during the pause, the button "Continue" will be marked with "*", which indicates that the system needs to rebuild the processing commands. According to the size of the files to be processed, you may need to wait a while if you click the button "Continue" at this moment.

During the pause, you click the button " ◀ Back " or the button " ▶ Forward " so that the machine can move backward or forward along the processing track. The distance and the speed of

every motion can be set through the button " Back/Forward Dis: 10mm ▼   50mm/s ▼ " on the console.

4.8 Breakpoint Memory

If the processing stops or suspends due to accidents, the software will keep breakpoint memory. As long as the graphics or the parameters are not modified, you can click " →‖ Pt LOC ", and then the software will automatically locate to the position where it stopped last time; If you click " ‖▶ Pt CONT ", the software will continue to start processing from the position where it stopped last time.

If you change the corresponding parameters after stopping, the "*" will appear behind "Start" on the console. When " ▶ Start* " appears, functions of " →‖ Pt LOC " and " ‖▶ Pt CONT " will no longer be used.

4.9 Processing from Any Location

CypCut support the function to start processing from any specified position. Users can right-click the location where you want to start, and then select "Processing from Here". As shown in the right figure.

For safety reasons, the software will pop-up a dialog box and requires reconfirmation after selecting "Processing from Here (F)". After confirmation, the laser head will move to the location you specify and then start processing from there, and the tracks in front of the specified location will not be processed.

If you want to first position it to the specified location but do not start processing, please select "Positioning Here", so that the system will move to the specified location and then go into the suspended state.

You can right-click the place for many times and select "Positioning Here", until the operation is confirmed. You can also conduct positioning in a more precise manner through " ➡ Forward " and " ⬅ Back ".

Set As Part	▶
Set As Plate	
Deselect	
✂ Cut	Ctrl+X
🗐 Copy	Ctrl+C
✖ Delete	Del
Zoom	▶
Order	▶
Positioning here (L)	
Processing from here (F)	
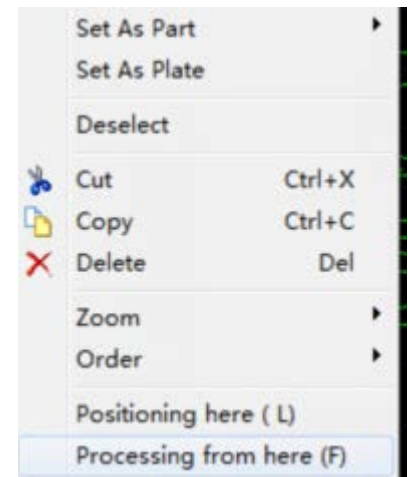
4.10 Global Parameters

Some movement control parameters are provided in the tab "Global Parameters" of dialog box "Layer Parameter Adjustment" for adjustment. The adjustment of these parameters will influence the smoothness of mechanical running as well as processing effect and efficiency.

Some parameters of tab "Global Parameters" are list in the table below.

| Motion Parameters	
Move Speed	Speed during move (not the speed during processing).
Move Acceleration	The maximum acceleration of each shaft during move. It needs to be used with move speed.
Frame Speed	Speed of framing.
Cut Acceleration	The maximum acceleration of each shaft during track processing. It needs to be used with cut speed.
Laser Parameters	
PWM Frequency	PWM frequency is used when laser on.
Default Current	Peak current is used when laser on.
Default Pressure	Air pressure used in manual mode
Gas Delay	Delay time used in step "**Gas Delay**" of PLC during piercing
Initial gas delay	Additional delay time on the basis of gas delay when puff after processing
Switch gas delay	During replacing the gas, Delay time that is used to discharge all existed gas and enter new gas .
Cooling point delay	Puff time during cooling.
Follower Parameters	
Maximum follow height	Each type of cutting head has a upper limit height to follow. When you need to follow the height above this maximum height due to demand, such as piercing, the height controller will follow through two steps, that is, firstly follow to the position near the plate surface, and then lift up. This parameter is used to set the height of the upper limit for following.
Using frog style Lift	After Z-coordinate lifts to the specified height, X-coordinate and Y-coordinate begin move, so as to shorten the time of move.
Enable follow in dry cut	The default Z-axis can't move in the default case of "dry cut". If users want to follow during "dry cut", the user can select this option.
Disable follow	Following and cutting is needed during normal processing. If you do not need to follow during the processing, you can select this option.
No alarm during piercing	Under the environment, such as cutting thick plates, large quantities of spark generated during piercing could cause alarm of height controller, thereby interrupting the process. If you select this option, you can ignore the alarm of capacitance class generated by height controller during piercing. Of course, ignoring the alarm will also bring some risks.
Unlift when move distance less than	If you select "Short Move unlift", when move length is less than this length, the height controller will not lift during moving and keep following.
Unit Selection	You can make a selection according to your use habits.
Advanced Parameters	

Enable NURMBS interpolation	After selecting this option, nurbs curve will be adaptively fitted, which can improve processing speed and the degree of graphics smoothing.
Group pre-piercing	After selecting this option, group pre-piercing can be automatically operated according to outermost frame without grouping, while still compatible with the manual group
1 mm circle precision	The speed and acceleration will be extra dropped down, when cut circle less than 5mm. This parameter is the control precision corresponding to circle of 1mm diameter.
Compensate precision	The precision of distance between compensation curve and original curve during gap compensation.

V. NC auxiliary function

5.1 Analog Processing

After all the sorting of patterns is completed, you can simulate the processing of entire document through simulation. This process can be carried out of the machine. Simulations can see not only the order among the graphics, but also the process within graphics.

Click " ▷ Simu " button to start simulation, and the toolbar will automatically jump to the "CNC" page. You can adjust the analog processing speed in the first column of "CNC" page, as shown below.
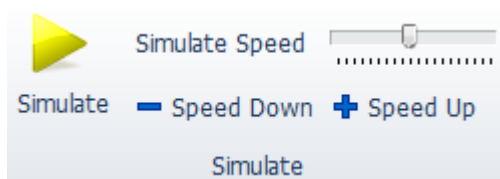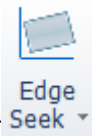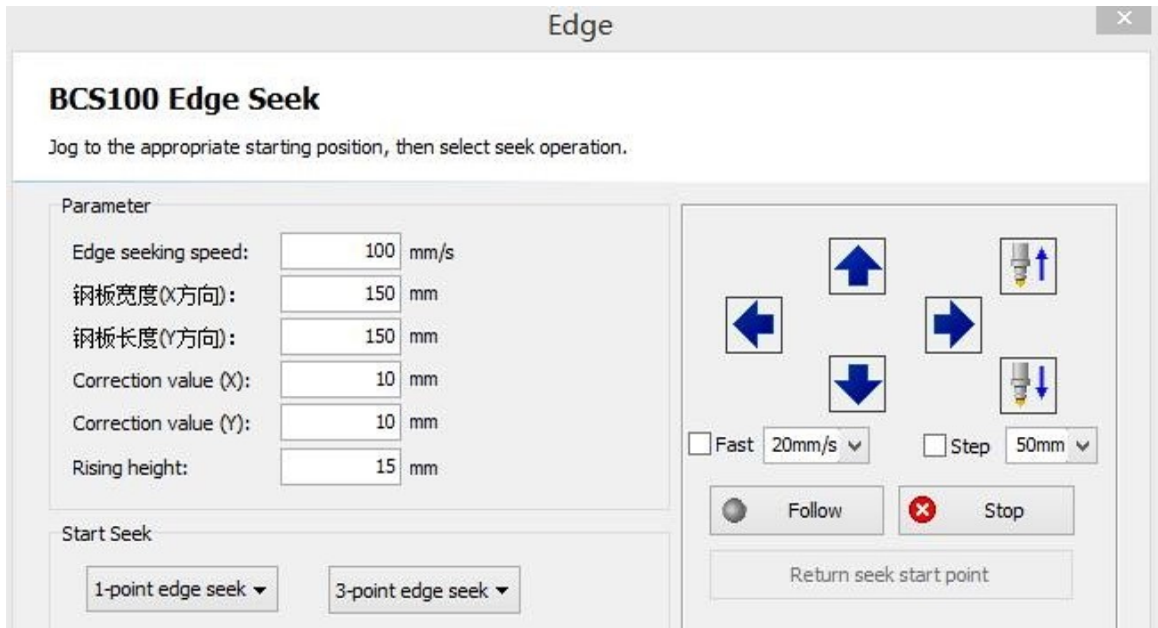

5.2 Edge seek

CypCut software supports "BCS100 edge seek", "Infared edge seek" and "Manually edge seeking". By clicking "Edge seek" drop-down triangle button, you can choose the most appropriate way to seek edge, in order to determine the placement of the plate. Seek results will be displayed in the top right of the drawing area, as shown below:

5.2.1 BCS100 edge seek

By clicking "Edge Seek ▾" button under the "CNC" page or clicking "BCS100 edge seek", you can enter the edge interface.

"BCS100 edge seek" needs to set some parameters. Edge seeking speed has effect on the precision of edge seeking, recommending setting value is 200mm / s. The plate width is length of plate in the machine X axis direction. The plate length is length of plate in the machine Y axis direction. Correction value is used for correcting seek result, with a positive number indicating the laser head is shifted inside the plate and negative number indicating the laser head is shifted outside the plate. Rising height is the height that the cutting head lifts during edge seeking.

After unlocking advanced parameters, you can set the following parameters.
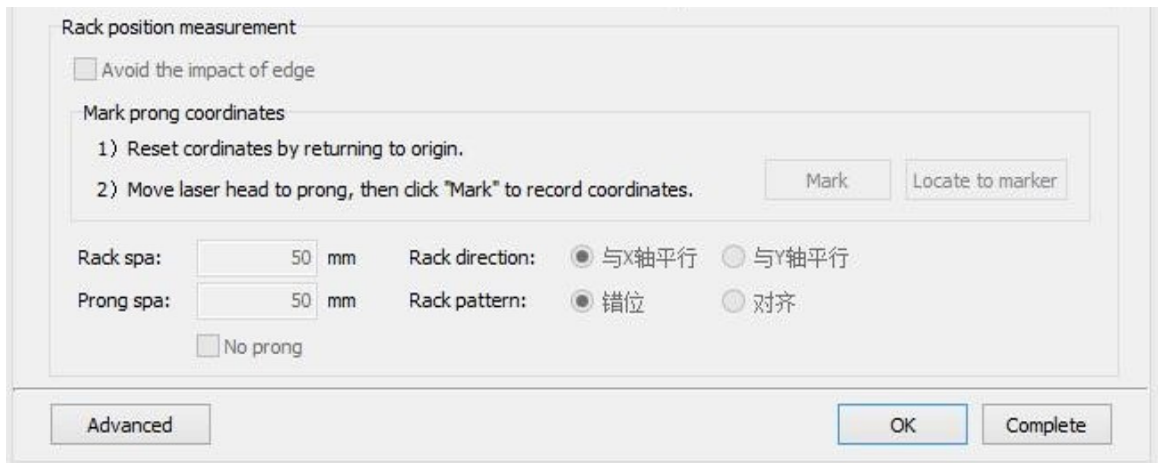
After selecting "Avoid the impact of edge", you can set "rack space", "prong space", "rack

direction" and "rack pattern" to avoid rack impact on edge seeking. When you enable this function, you must firstly mark prong coordinates. "Rack space" is the space between adjacent racks; "prong space" is the distance between adjacent prongs; "rack direction" is the relative relationship between the rack installing position and the machine; "rack pattern" is to select disloc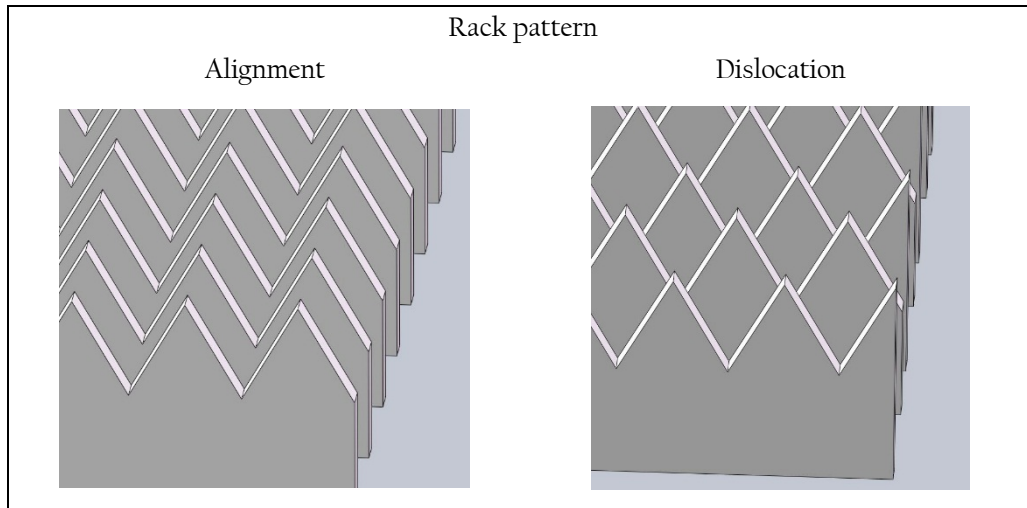ation installation or alignment installation; "No prong" is the setting when the rack is neither dislocation installation nor alignment installation.

Rack pattern
Alignment   Dislocation

You can jog the cutting head to the appropriate starting position through small console on the right. Please move the cutting head inside plate as the starting position of edge seeking, and then select the operation under edge seeking testing that you want to perform.

If select "Edge seek before start", the software will perform **"BCS100 edge seek"** during moving or before starting to process based on the stopping position of graphics.

Note: Please return origin to correct the machine coordinate system and confirm cutting head can properly follow before you operate edge seeking. The inclination angle of steel should not exceed 10 degrees.

Other settings and instructions of **"BCS100 edge seek"** refer to Appendix.

5.2.2 Infared Edge seeking

At present, the software uses "Infared Edge seeking" function required matching with Omron E3Z-L61 model switch.

Before the first edge seek, the offset value of the photoelectric switch and laser Center should be determined and set in advanced parameters. Before the actual edge seek, please make sure to move the cutting head to the nearby stopping point (among upper left, lower left, upper right, lower right) as the starting position of edge seek.
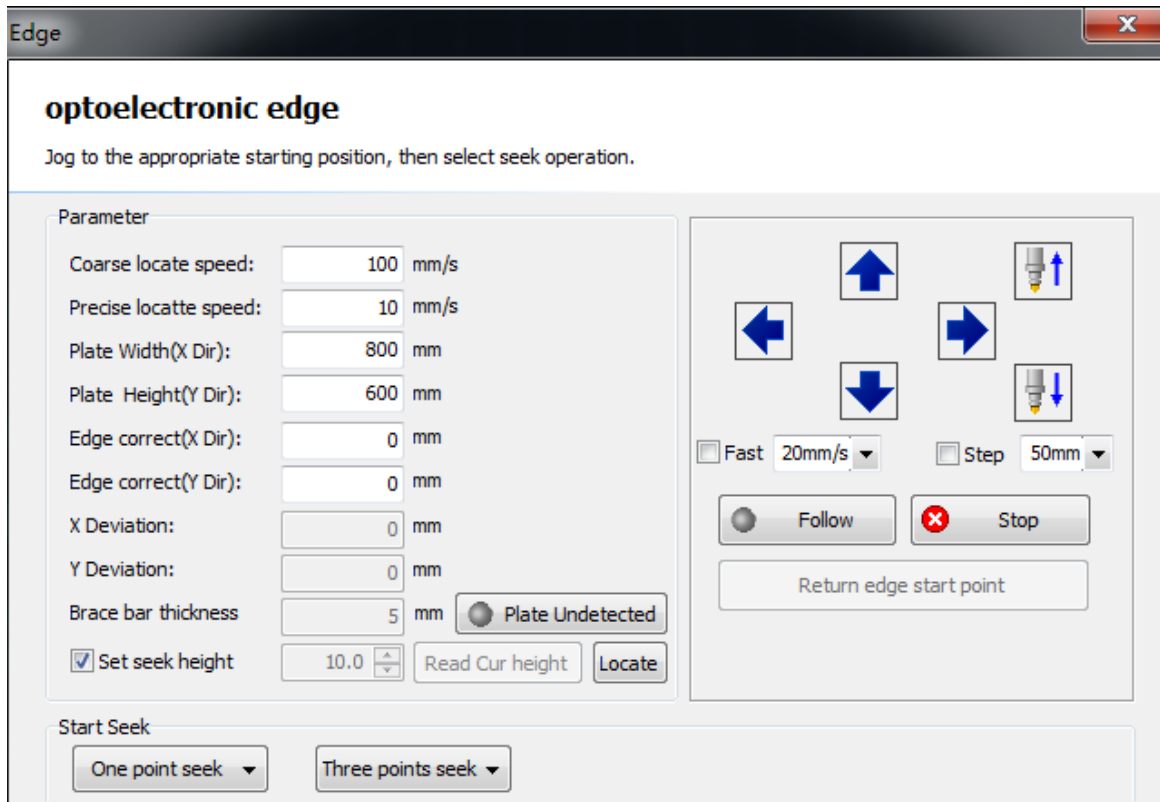
"Infared Edge seeking" needs to set some parameters. Coarse positioning speed is the speed of coarse positioning during edge seek, and recommended value is 100mm/s. Fine positioning speed is the speed of fine positioning during edge seek, which will affect the accuracy of edge seek, recommending setting value as 10mm / s without exceeding 30mm / s. The smaller the fine positioning speed is, the longer the time of edge seek is and the higher positioning accuracy is. Plate size and correction value is similar to "BCS100 edge seek".

The deviation between the photoelectric switch and the laser head can be corrected by setting advanced parameters and filtering rack interference.
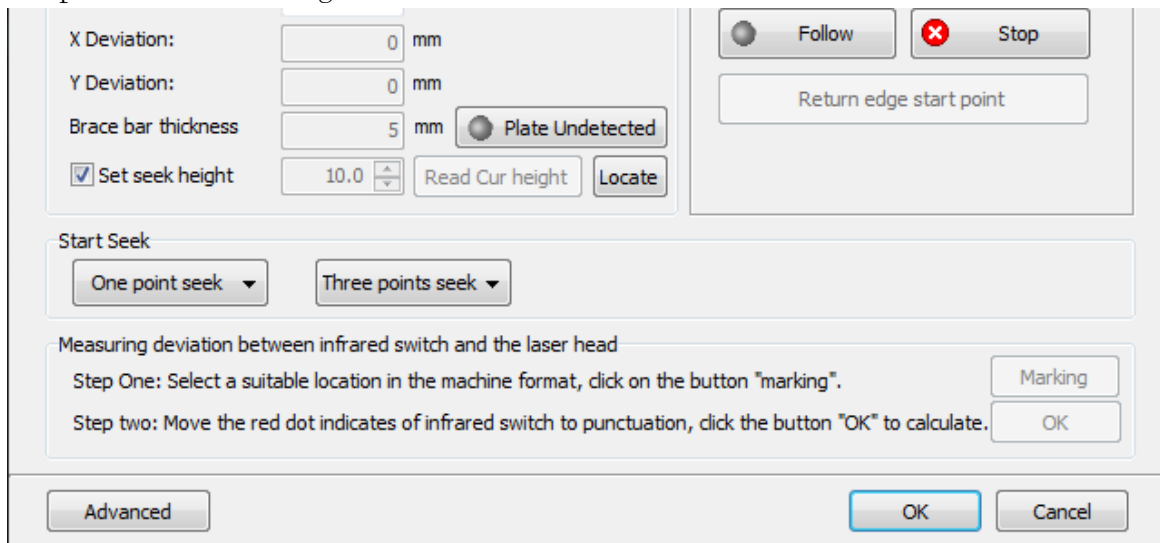
You can set the following parameters: "Offset value" is the deviation between photoelectric switch and the laser head position. After setting the "deviation between photoelectric switch and the

laser head", the software will automatically set this parameter without manually modifying. "Rack space" can filter out the interference of rack on Infared Edge seeking. It is recommended to set the value consistent with the actual rack space. "Set edge height" applies to the case of the photoelectric switch fixed in the cutting head. Users can adjust the position of the photoelectric switch thorough jogging height controller. You can read this height through "Set as the current height". When the edge seek is opened each time, height controller will move to this height. In addition, move to this height by "positioning". "Fixed height edge seek" applies to the case of the photoelectric switch without being installed in the cutting head.

Note: Plate tilt angle should not exceed 40 degrees.

Other settings and instructions of Infared Edge seeking refers to Appendix.

5.3 PLC process

Click the "[PLC]" button under the "CNC" page, you can customize the PLC process and execute them.

Note: Improper modification may lead to serious consequences! If necessary, please contact our technical staff..

5.4 Go origin

5.4.1 Return to origin

You can click the "Go Origin" under the "CNC" page or select "All axis" under its drop-down menu to make laser head return to mechanical origin and reset the machine coordinate system. The details refer to "coordinate" part. You can also select "X only" or "Y only" under drop-down menu to make a single axis separately return to origin.

5.4.2 Gantry synchronism

During using a dual-drive gantry machine, the beams of machine may become crooked occurring after a period of operation due to various reasons, such as the unparallel installation of two Y axes, friction and load, which will affect machining accuracy. Gantry synchronism function judge and automatically adjust the vertical position of the beam by recording and monitoring Z signal of Y1 and Y2 axes when go origin.
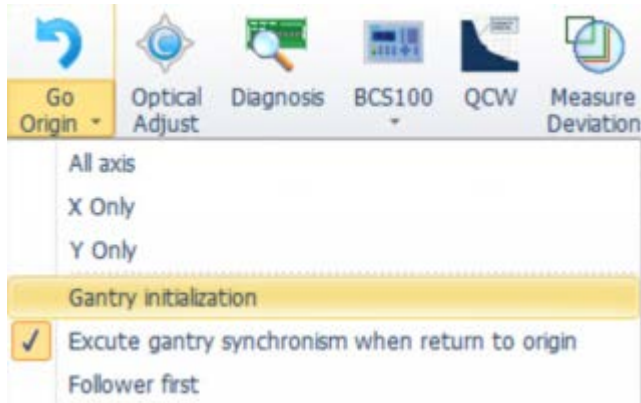
Click the drop-down triangle of "Go origin" on the "CNC" Page and select "Gantry initialization", as shown on the right:

Select "Execute gantry synchronism when return to origin" after completing Gantry initialization", and enter the password. Related compensation information will be displayed in system window of the software.

Note: Make sure re- execute "Gantry initialization" after adjusting machine.

Specific steps and precautions, please, refer to Appendix.

5.5 Optical adjustment

During the specific processing, if you need to locate the cutting head to a specific point, you can
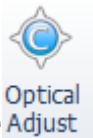
click " " button, and input a specific coordinate you want to locate, as shown at right.

You can also appropriately set the laser interferometer on the adjustment interface of optical path to test error between the movement position given by the software and the actual mechanical, thereby performing mechanical error compensation, also known as pitch compensation.

5.6 Diagnosis
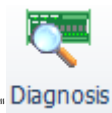
During processing, click the " " button, you can observe the state information of each cutting part, in order to determine whether there is a problem in the process.
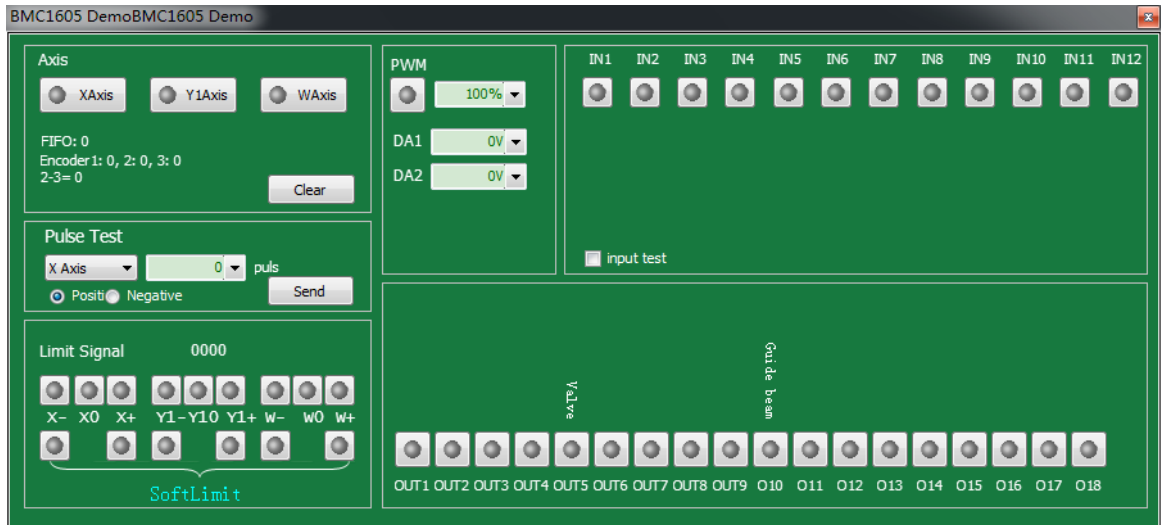
Motion axis shows each axis signal and the corresponding encoder feedback value; Pulse test is used to send fixed pulse to single axis, in order to test the accuracy of pulse equivalent; Limit signal is used for displaying whether the cutting head is h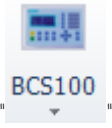it limit; PWM is used to show the situation of laser switch; The valid situation of 12 inputs and 18 outputs are also shown.

5.7 BCS100

This function must be used compatible with our height controller BCS100. By clicking " ", you can operate a series of actions in the software, such as Return to origin, Follow to, Absolute positioning and one key calibration, to control BCS100. And you can also operate via BCS100 monitoring interface without operating on the entity, which is more convenient and quick.

5.8 QCW

QCW is a mode of laser operation. CW and QCW is two modes d of laser. CW is continuous light, and QCW is pulse laser. By clicking " " button, you can set the appropriate optical parameters.

5.9 Deviation measurement

When click " Measure Deviation ", the cutting head will move along the graphics to be processed. After the cutting head finishes move, a blue dotted line will appear to show the trajectory of the servo motor feedback. You can adjust process parameters required for the actual cutting according to this trajectory.

VI. Appendix

6.1 Example of Coedge

Now we demonstrate edge-shared nesting by taking the actual sample of a customer as an example. Before setting edge-shared function, the manual drawing of the customer using CAD is as shown at right.

In the drawing, unclosed graphic is shown in red. All the graphics in the drawing are straight line requiring coedge, and the customer drew it manually with CAD before, so all the graphics have been drawn as straight lines.

It can be seen from the figure that the original drawing consists of 10 narrow parts below 6 large parts and narrow workpieces (9x2=18) at right, exactly occupying the space a steel plate.

We now first draw 3 parts in the original drawing, and generally the 3 parts are all from the DXF drawings of customer. As shown below:
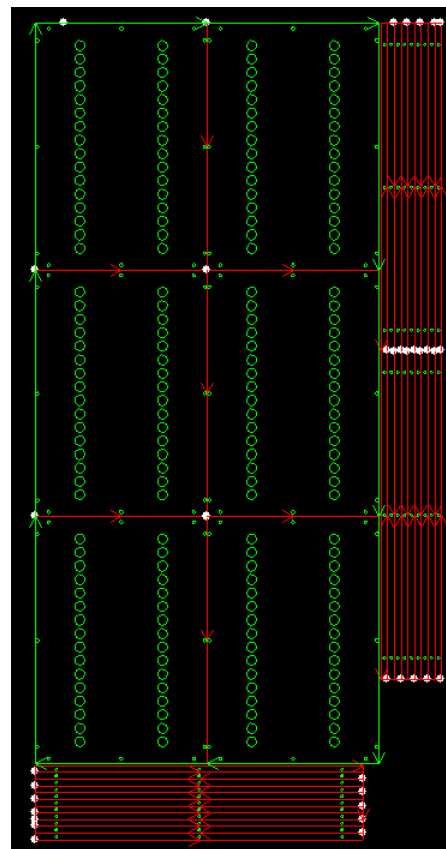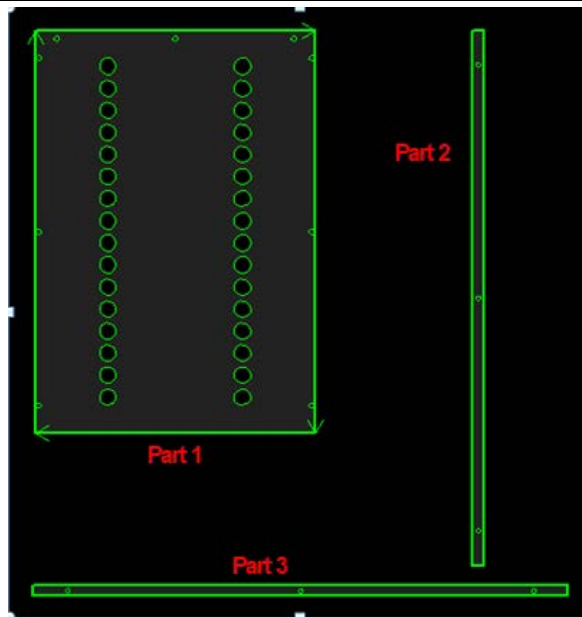
Step 1: First select all graphics of each part, respectively implement "Group". After grouping, the outer contours of parts will be shown in bold.
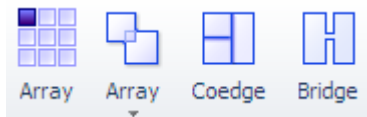
Select Part 1, and then make an array with 3 rows and 2 columns. As shown in the lower right figure.

Select the 6 arrayed parts, and complete coedge for the above 6 parts by clicking "Coedge".

After dragging Part 2 to the position close to the top right position of the above figure, the parts will be automatically adsorbed to the boundary of Part 1 and become top aligned.
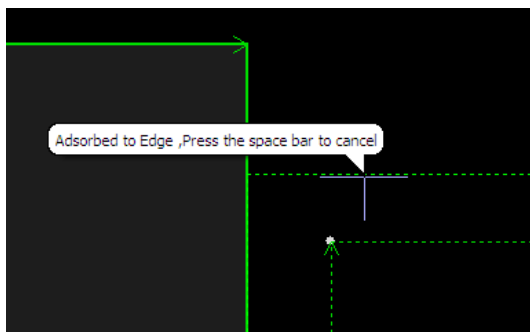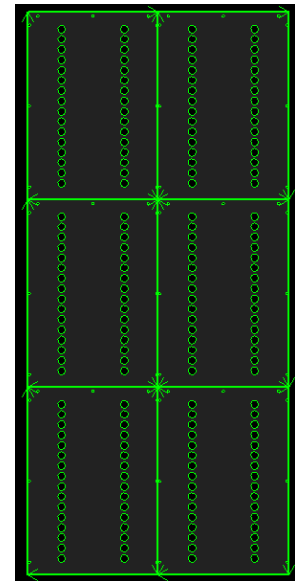
Select Part 2, make an array with 2 rows and 9 columns, and then obtain the figure shown at right.

As shown at right, you can select all 18 Part 2 by pulling out a pale blue box from the upper left corner of Part 2 to the lower right corner, while Part 1 will not be selected.
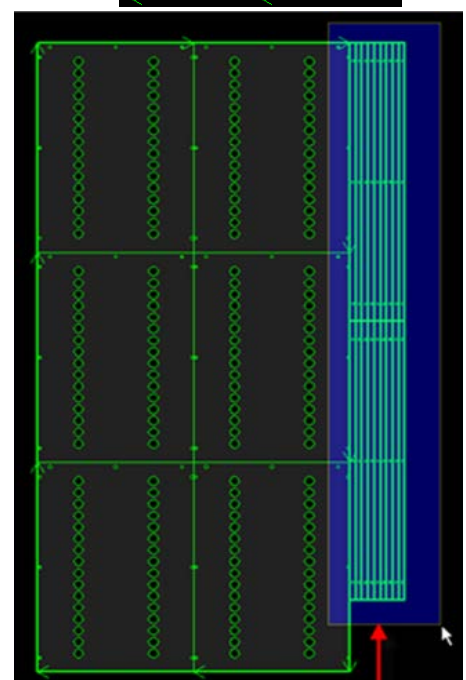
Processing from right to left
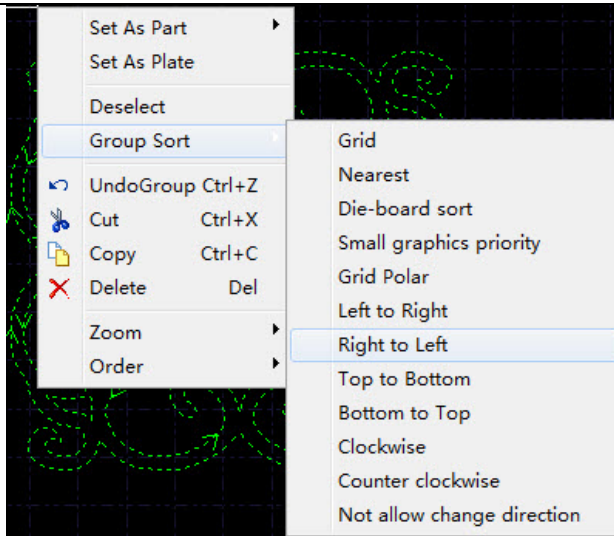
You can complete the coedge of 18 Part 2 by clicking "Coedge". Please note that the processing order of Part 2 must be from right to left, or steel plates will jitter or even deviate due to the lack of support.

Select coedge Part 2, click the right mouse button, and then select the right-to-left sorting from the pop-up menu. As shown below:

Attentive user may ask why the coedge needs to be conducted after dragging Part 2 to the boundary of Part 1. They think that it is difficult to conduct selection.

In fact, the order can be exchanged. Here we first conduct coedge for Part 3 and then drag it to the position below Part 1.

Select Part 3, make an array with 10 rows and 1 column, and then get the following figure.
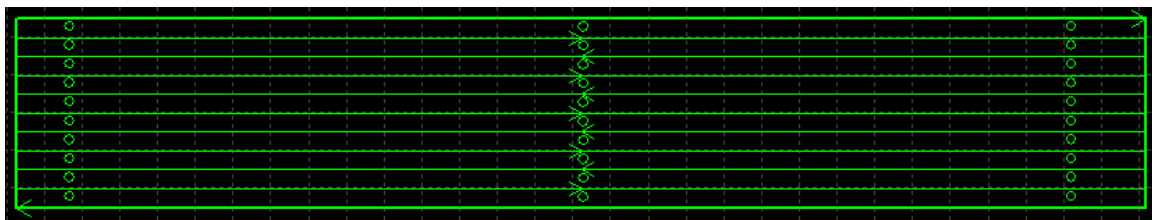
After selecting 10 Part 3 and clicking "Coedge", the coedge of Part 3 is completed and they become a whole. As shown below. Please note that the thickness of the lines is different. Each Part 3 has a bold outline border before coedge, the whole has a bold outline border after coedge, and the coedged line segments in it are all shown in thin lines.

When the mouse is suspending above Part 3, corresponding prompt will be displayed, showing that it is a combination.
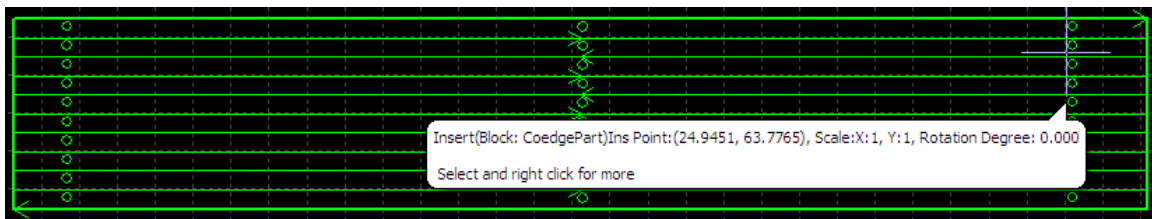
Similarly, we need to conduct a sorting for Part 3 from bottom to top, so as to prevent the steel plates from jittering and deviating due to the lack of support.

When selecting the overall Part 3 after coedge and dragging it to the lower left of Part 1, the parts will be automatically adsorbed to the boundary of Part 1 and become left aligned.
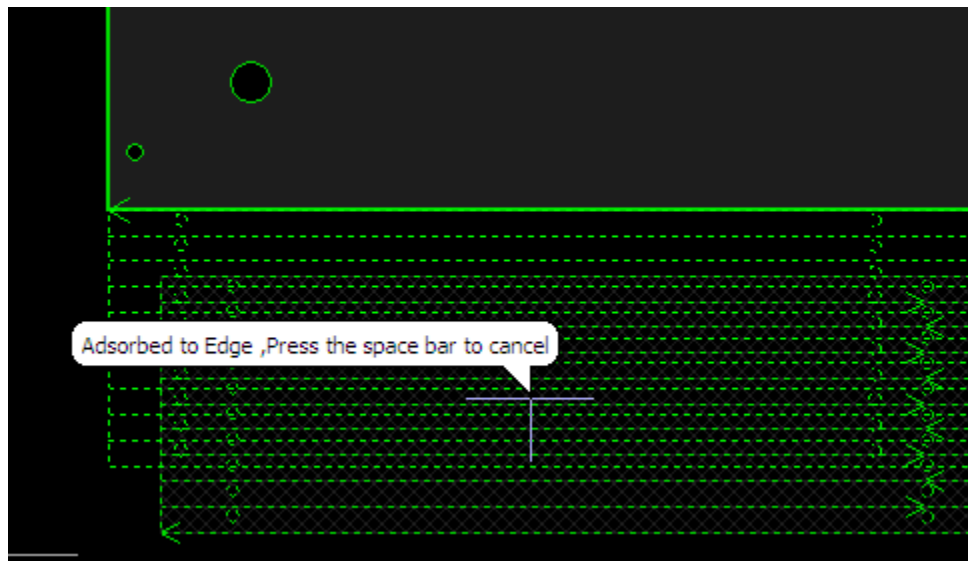
Next, select all the graphics to coedge all Part 1, Part 2 and Part 3.

If you do not want to coedge Part 2 and Part 3 with Part 1, this step can be omitted. Of course, Part 2 and Part 3 should be slightly dragged from the boundary of Part 1.

When dragging the graphic from the coedge boundary, you can press the space bar to avoid automatic adsorption, and then the automatic adsorption function will be temporarily disabled.

6.2 Gantry Synchronism Operating Instructions
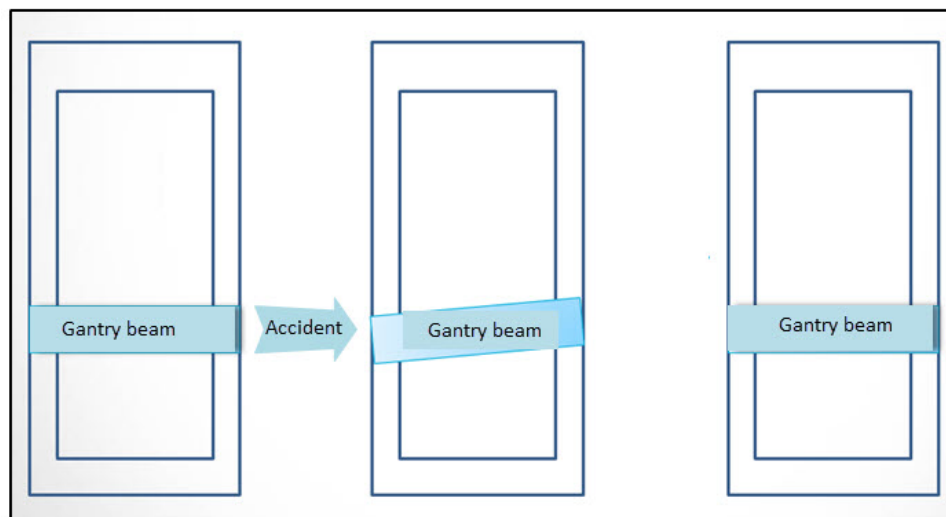
6.2.1 Platform Configuration

If you want to use the gantry synchronism function, firstly, you need to configure in the platform configuration tool .

1) Machine config tool->Machine->Select "Dual drive"

2) Machine config tool ->Return Org-> Select "Enable"

3) Machine config tool ->Alarms-> Input the value of "Max Dev tolerance of the gantry sync". When the beam is subject to severe collision or serious distortion, which makes the deviation exceed this value, we need to re-examine the machine. You can change this value according to the actual situation of the machine.

6.2.2 Gantry initialization and synchronization

To prevent the error of gantry **synchronism**, please confirm the following situations before initialization:

1. The beam of machine has been corrected.

2. The machine can correctly move and the direction is right.

3. The origin signal is configured correctly and efficiently, so that homing processing is normally executed.

4. Z signal welding interface of 15 core wire is correct (the 5th port corresponding to Z +, the 13th port corresponding to Z-).

5. Pulse number of encoder feedback is set correctly. You can observe encoder feedback to detect by manually sending pulse number in diagnostics window.

After entering the software, click "Gantry initialization" under "Go origin" drop-down menu on the "CNC" Page, as shown on the right:
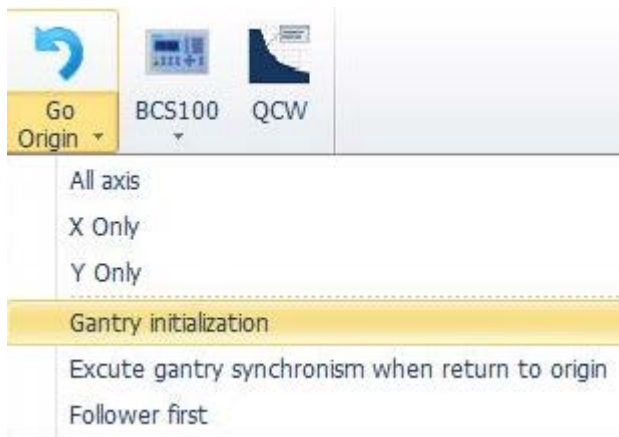
After entering your password, the machine will return to the origin, and then the gantry axis will move in the positive direction to find two Z signals. After the operation is completed, the system window under the software displays the position of Z signal and the offset value of the two axes of Z signal (Y2-Y1 offset):
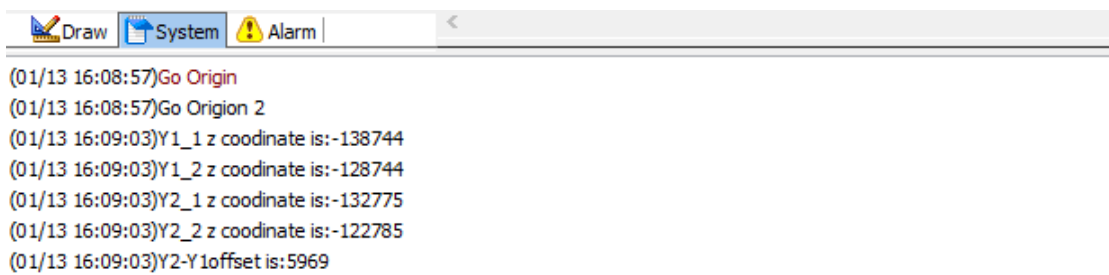
After completing gantry initialization, select "Excute gantry synchronism when return to origin" and then enter the password for confirmation.

When select and implement "Go origin" or "Y only", the software will detect Z signal value of Y1 and Y2-axis and calculate the deviation to compensate. Z signal and the compensation value (Y2 compensate) will be displayed in the system window of the software.

```
(01/13 16:09:52)Go Origin
(01/13 16:09:52)Go Origion 0
(01/13 16:09:55)Y1_1 z coodinate is:-10001
(01/13 16:09:55)Y1_2 z coodinate is:2
(01/13 16:09:55)Y2_1 z coodinate is:-4035
(01/13 16:09:55)Y2_2 z coodinate is:5965
(01/13 16:09:55)Y2 compensate -0.003mm
```

6.2.3 Precautions

1. Z signal must be enabled to use this function.

2. After adjusting machine, It must be re-initialized.

3. When the beam is greatly collided and vertical degree has greatly visible changes, gantry synchronism may not be accurately adjusted. At this moment, gantry axis mechanism needs to be adjusted and re-initialized.

6.3 BCS100 edge seek operating instructions

After version 6.3.644 of CypCut, the function of BCS100 edge seek is improved to enhance the accuracy of the edge seek through avoiding the impact of the rack on edge seek in advanced parameters. Edge seek after being improved is required for using with height controller Version 3.0.3072 and later versions. Height controller Version 2.0 do not supported BCS100 edge seek of the new version.

6.3.1 Platform Configuration

Open platform configuration tool, click "Edge Seek" to enter the parameter setting interface on the shortcut options of left side screen, and select "Enable BCS100 Seek".
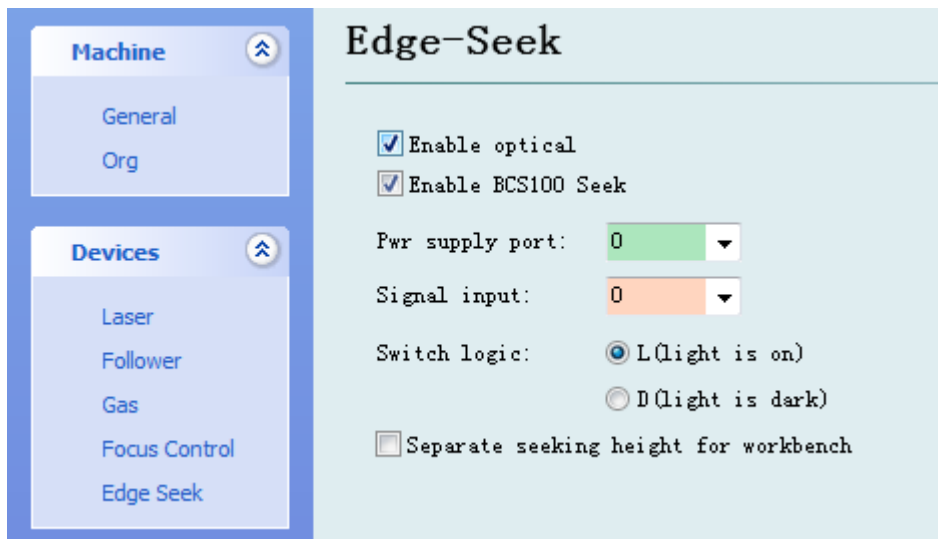
6.3.2 One point edge seek Instructions
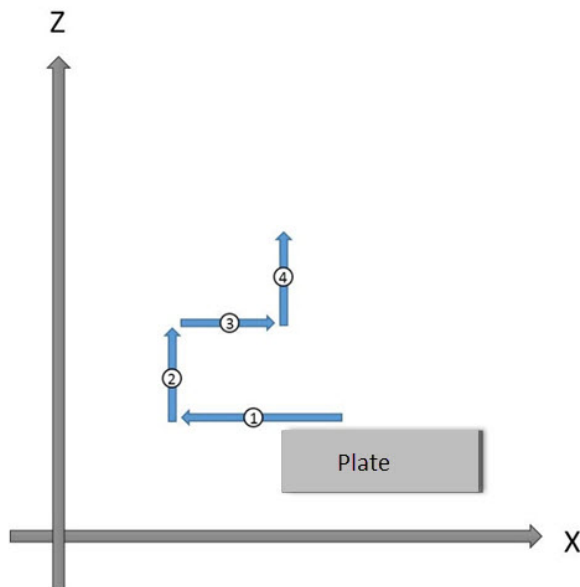
Take left direction for example without using "Frog style lift".
1) Cutting head follows to plate and start edge seek on the left.
2) Cutting head moves up an elevation height.
3) Cutting head moves to the right boundary point.
4) Cutting head moves up to stopping point.
5) Finish the processing of edge seek.

6.3.3 Three point edge seek Instructions
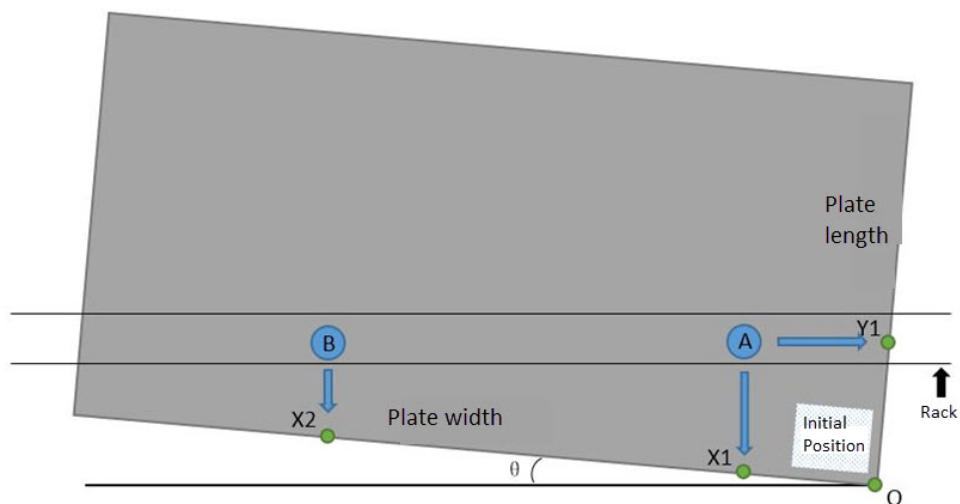
Take lower right edge seek for an example, and select "avoid the impact of the rack on the edge seek":
1) The cutting head moves inside the plate near the lower right region, to determine the initial

position of the edge seek;

2) Select "Down right" under "Three-point edge seek 'drop-down menu.

3) The software automatically determines the A and B points based on the initial position, the plate length, plate width and rack position

4) Move to point A;

5) Seek the first point X1 thorough Y negative direction;

6) Move to point B;

7) Seek the second point X2 thorough Y negative direction;

8) Move to point A;

9) Seek the third point Y1 thorough X positive direction;

10) After completing edge seek, calculate the rotation angle θ, determine vertex O on the lower right of plate and move to vertex O. The edge seek results will be displayed in yellow font on the upper right of software.

6.3.4 Precautions of BCS100 edge seek

1) Before edge seek, have to return to the starting point to correct machine coordinate system

2) Make sure that the actual number of pulses sent by diagnostic interface must be consistent with the number of encoder feedback. If inconsistent, please modify the servo parameters.

3) The setting value of plate length and width should be consistent with the actual value.

4) Inclination angle of plate should not exceed 10 degrees.

5) The direction of edge seek in BCS100 edge seek interface can be arbitrarily set. But in actual use of BCS100 edge seek function, you must set stopping point as upper left, lower left, upper right and lower right, to determine the direction of edge seek.

6) Before edge seek, please make sure the cutting head moves inside the plate as the starting position of edge seek.

7) Before edge seek, please make sure the cutting head can properly follow.

6.4 Infared edge seek operating instructions

The CypCut version after 6.3.642.6 improves the function of infared edge seek. Infared edge seek function should be used with OMRON photoelectric switch of E3Z-L61 model.

6.4.1 Photoelectric Switch Introduction
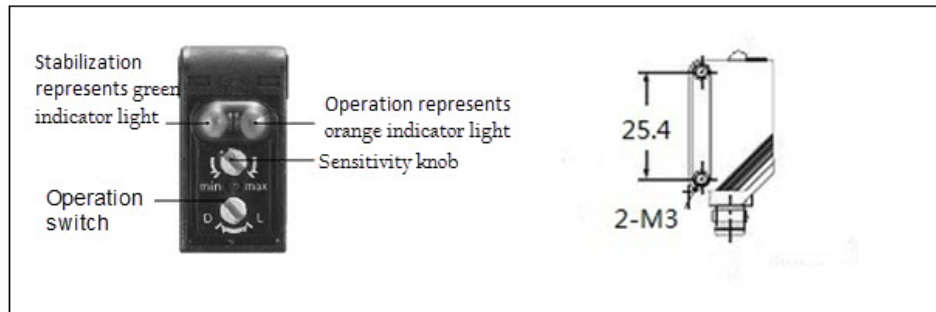
The effective operating range of this photoelectric switch is 90 ± 30mm; Mounting thread is M3; The switch can be switched between two operation modes. L represents the orange indicator light is on when photoelectric switch outputs signal. D represents the orange indicator light is dark when photoelectric switch outputs signal. Turning the sensitivity knob can change the sensitivity of the photoelectric switch.

6.4.2 Wiring and Configuration
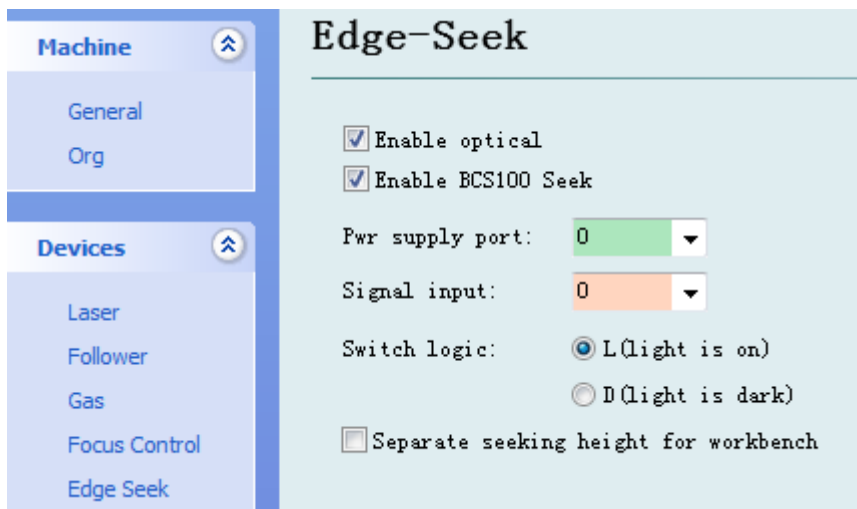
Open platform configuration tool, click "Edge Seek" under shortcut options on the left screen to enter the parameter setting interface, and select "Enable optical".

Brown wire of photoelectric switch (power supply 24V+) is connected to any thyristor output on IO external board (corresponding to Pwr supply port on platform configuration), Blue line (power supply 24V-) is connected to COM port on IO external board, while black wire is connected to any input on IO external board (corresponding to Signal input on platform configuration).

Switch logic on platform configuration must be consistent with the switch model corresponding to photoelectric switch action. It is
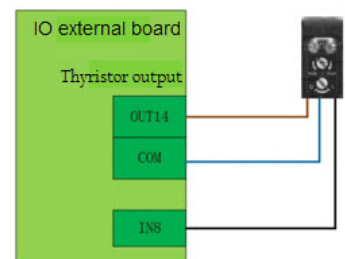
recommended use L model (Effective when light is on).

If workbench has high and low height, please select "Separate seeking height for workbench".

6.4.3 One point edge seek Instructions
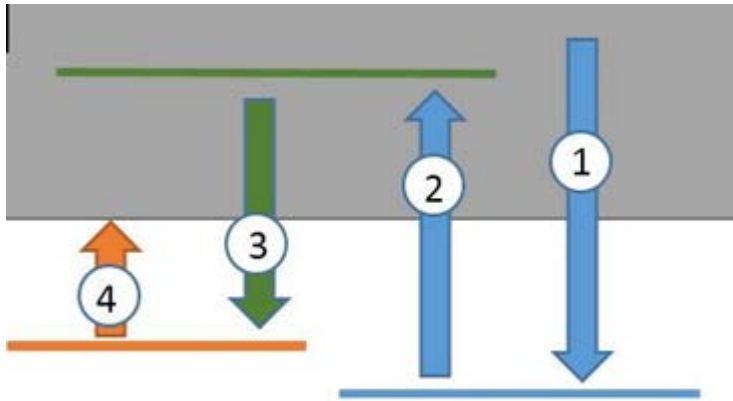
Take down side edge seek for an example:
① Coarse positioning outside the plate.
② Coarse positioning inside the plate.
③ Fine positioning outside the plate.
④ Move to plate margin.

6.4.4 Three point edge seek Instructions
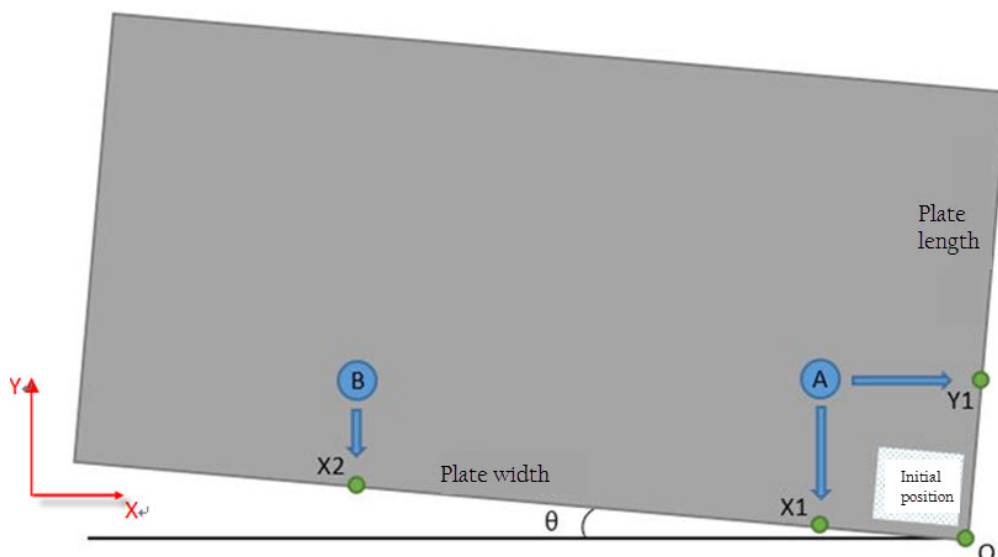
1) The offset value between photoelectric switch and laser cutting head must be measured, when three-point edge seek is firstly used;

2) The cutting head (ie, red light produced by lasers, rather than the photoelectric switch) moves inside the plate near the lower right region, to determine the initial position of the edge seek;

3) Select "Down right" under "Three-point edge seek 'drop-down menu.

4) Point A and B are determined by the initial position, the plate length and plate width. Where,

A $_{\text{point coordinate}}$ is (X_{initial}-0.2*plate length，Y_{initial}+0.2*plate length)

B $_{\text{point coordinate}}$ is (X_{initial}-0.6* plate width，Y_{initial}+0.2* plate width)

5) Move to point A;

6) Seek the first point X1 thorough Y negative direction;

7) Move to point B;

8) Seek the second point X2 thorough Y negative direction;

9) Move to point A;

10) Seek the third point Y1 thorough X positive direction;

11) After completing edge seek, calculate the rotation angle θ, determine vertex O on the lower right of plate and move to vertex O. The edge seek results will be displayed in yellow font on the upper right of software.

6.4.5 Precautions of Infared edge seek

1) Make sure that the actual number of pulses sent by diagnostic interface must be consistent with the number of encoder feedback. If inconsistent, please modify the corresponding servo parameters.

2) When adjust the photoelectric switch sensitivity, please make sure that the green indicator light is normally on during mowing inside and outside the plate as far as possible.

3) The setting value of plate length and width should be consistent with the actual value.

4) Inclination angle of plate should not exceed 10 degrees.

5) The direction of edge seek in Infared edge seek interface can be arbitrarily set. But in actual use of Infared edge seek function, you must set stopping point as upper left, lower left, upper right and lower right, to determine the direction of edge seek.

6) Before initial edge seek, please firstly measure the offset value between photoelectric switch and laser center.

7) Before actual edge seek, please make sure the cutting head (ie, red light of laser instead of red light of photoelectric switch) move inside the plate as starting position of edge seek.

6.5 Adjustment of Motion Parameters

6.5.1 Introduction of motion control parameters

CypCut software mainly open four types of motion control parameters for users to adjust, such as speed, acceleration, low-pass filter frequency, circle and corner precision. Other sports-related parameters have been optimized internally without needing user to set. The meaning of these parameters is shown as below:

Parameter Name	Introductions
Move speed	The maximum speed when move, which can directly fill the maximum

	move speed calculated by Servo Tools software.
Move acceleration	The maximum **acceleration** when move, which can directly fill the maximum move **acceleration** calculated by Servo Tools software.
Cut acceleration	The maximum **acceleration** when processing, which directly determines the **acceleration** and deceleration time of turning movement during cutting. Adjust by observing the torque curve of servo.
Filter frequency	Suppress filter frequency of machine vibration. The smaller the value, the more obvious the effect of suppressing vibration is, however, which will make the **acceleration** and deceleration time longer.
Circle precision	The upper limit of circle precision. The lower the value, the more obvious the circle speed.
Corner precision	Fit with corner precision by NURBS curve. The lower the value, the closer corner is to sharp, however, the more obvious deceleration is.

6.5.2 Adjust cut acceleration

Set the speed value of high-speed jog as high as possible, such as 500mm / s. When complete a jog, moving distance is required to be long enough, in order to make sure that speed can be accelerated to the set value.

Observe the torque curve of Jog movement by the servo debugging software. For example, when the maximum torque is less than 80%, appropriately increase processing acceleration; when the maximum torque is more than 80%, appropriately reduce the processing acceleration.

Adjust acceleration until the maximum torque is nearly 80%. Generally, cut acceleration withstood by screw should not be more than 0.5G. Generally, rack and pinion should not be more than 2G.

6.5.3 Adjust move acceleration

The maximum acceleration calculated by ServoTool software can be directly filled. Or you can appropriately increase move acceleration on the basis of cut acceleration, such as setting as 1.5 to 2 times of cut acceleration. When move is required, the maximum torque reached by servo should not exceed 150%, and the mechanical structure with withstanding this acceleration does not appear obvious deformation and vibration. Generally, Move acceleration withstood by screw does not exceed 0.5G. Generally, rack and pinion should not be more than 2G.

6.5.4 Adjust low-pass filter frequency

When you set up the low pass filter frequency parameter, you can cut a sample map. It is proposed mark the plate after turning laser power down. Observe the accuracy of marking path. Cutting sample image includes various sized small round, six polygon, twelve polygon, star, and rectangular, etc. As shown below:
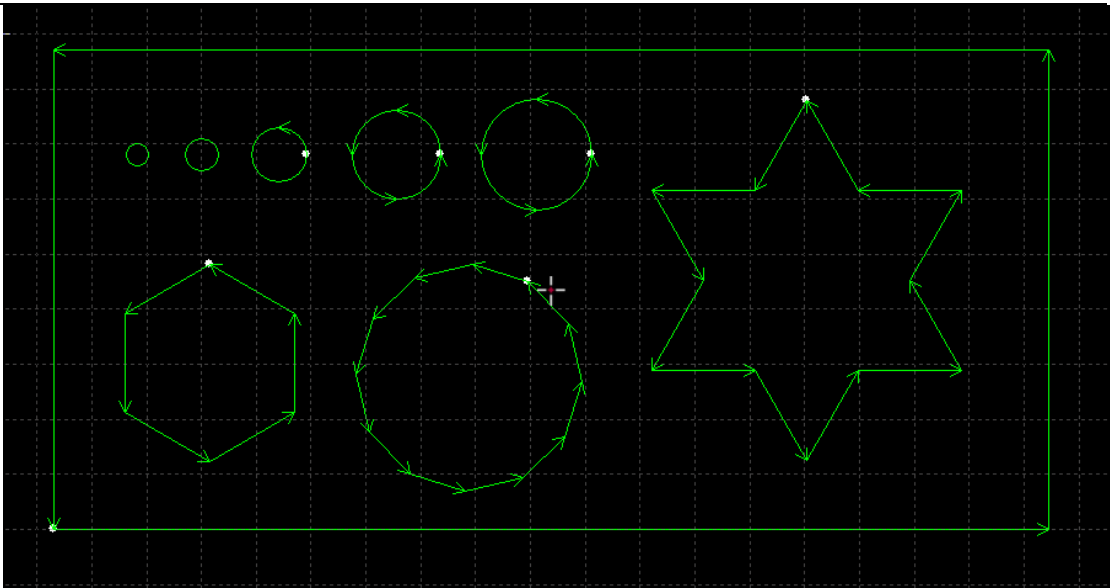
Adjust low pass filter frequency as high as possible without affecting the accuracy. It requires both of before corner and after corner do not generate waves when cutting a rectangle, polygon and starbursts. It can be set according to the following experienced table. Or adjust the low-pass filter frequency within the upper and lower two ranges after determining cut acceleration. The parameters of cut acceleration and low-pass filter frequency must be matched. Please do not adjust one parameter value very large and another parameter value very small.

Level	1	2	3	4	5	6	7	8	9	10
Cut acceleration (G)	0.1	0.2	0.3	0.4	0.5	0.6	0.8	1	1.5	2
Filter frequency (HZ)	3	3.5	4	5	5.5	6	6	6	7	8

6.5.5 Set circle and corner precision

It's not recommended users modify these two parameters of circle and corner precision under normal circumstances. Under special circumstances, you can fine-tune these two parameters in the vicinity of the default parameters range.

If you are not satisfied with the circle precision, you can tune the parameter of circle precision down, with limiting the speed of cutting circle. The smaller the value is, the more obvious the speed will be limited. If you are not satisfied with the corner precision, you can tune the parameter of corner precision down. And then turning will slow down, The smaller the value is, the more obvious the corner will slow down. The higher the value is, the closer the corner will be to a fillet.

6.6 Shortcut Key

The following table lists some of the commonly-used shortcut keys. Some of them are used in specific conditions and they have been introduced in related chapters, so there is no need to list them here.

Shortcut key	Effect	Service conditions
Ctrl + A	Select all the graphics	None
Ctrl + C	Copy graphics to clipboard	Select graphics to be operated
Ctrl + Shift + C	Specify "Base Point" and copy command	Select graphics to be operated
Ctrl + O	Open the file	None
Ctrl + P	Show/hide the graphic direction and move track	None
Ctrl + V	Paste graphic in the clipboard to the drawing board	There are copied graphics in the clipboard
Ctrl + W	Adapt to window	None
Ctrl + X	Cut the graphics to Windows clipboard	Select graphics to be operated
Ctrl + Y	Redo the cancelled orders	There are cancelled commands
Ctrl + Z	Cancel the orders just finished	There are finished commands
F3	Check all of the graphics	None
F4	Check the whole machine range	None
F5	Check the graphics in the zone of selection	Select graphics to be operated
F6	Open the dialogue box "Layer Parameter Settings"	None
F7	Show/hide the processing path	None
F8	Show/hide the motion path	None
DEL　(Delete)	Delete the selected graphics	Select graphics to be operated
SPACE (Space)	Repeat the last command	Last command can be repeated