Friendess, Inc.

CypTube 3D Pipe Cutting Control System

User Manual

Version: V6.4.0

Welcome

Thank you for using CypTube laser cutting control system.

CypTube laser cutting control system (CypTube 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.

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

CypTube 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, CypTube 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 CypTube software.

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

The Document is drawn up based on Version 6.4.516.1 of CypTube. 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. CypTube 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 IGES graphic data format.
- Supports the cutting of any tube of the extruded body.
- With particular onekey calibration levelness and automatic seek the center of rotation.
- To use the easiest way to set the lead and slotted compensation.
- To distinguish the overcast cut and yang cut, determine the direction of slotted compensation in accordance with the overcast cut and yang cut, and check the led.
- With Flexible automatic sorting and manual sorting functions, to support the function to fix the processing order through group.
- With particular browsing capabilities of processing order, to check the processing order in a more interactive way than that of imitation.
- To support poly punching and incremental punching, pre-punching. To support the settings of separate laser power, frequency, laser form, type of gas, air pressure and following height for punching process and cutting process.
- To support the speed capacity control and set separate lead velocity.
- 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.
- To support Covercut, auto seek edge, cutter starting and cutter lifting.
- With powerful expansion capacity, as much as 15 PLC process edit and more than 30 programmable process.
- Programmable input and output outlet, programmable alarm input.
- To support the remote control of the system through wireless teachbox and Ethernet.

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.

1.3 Starting to use

1.User Interface
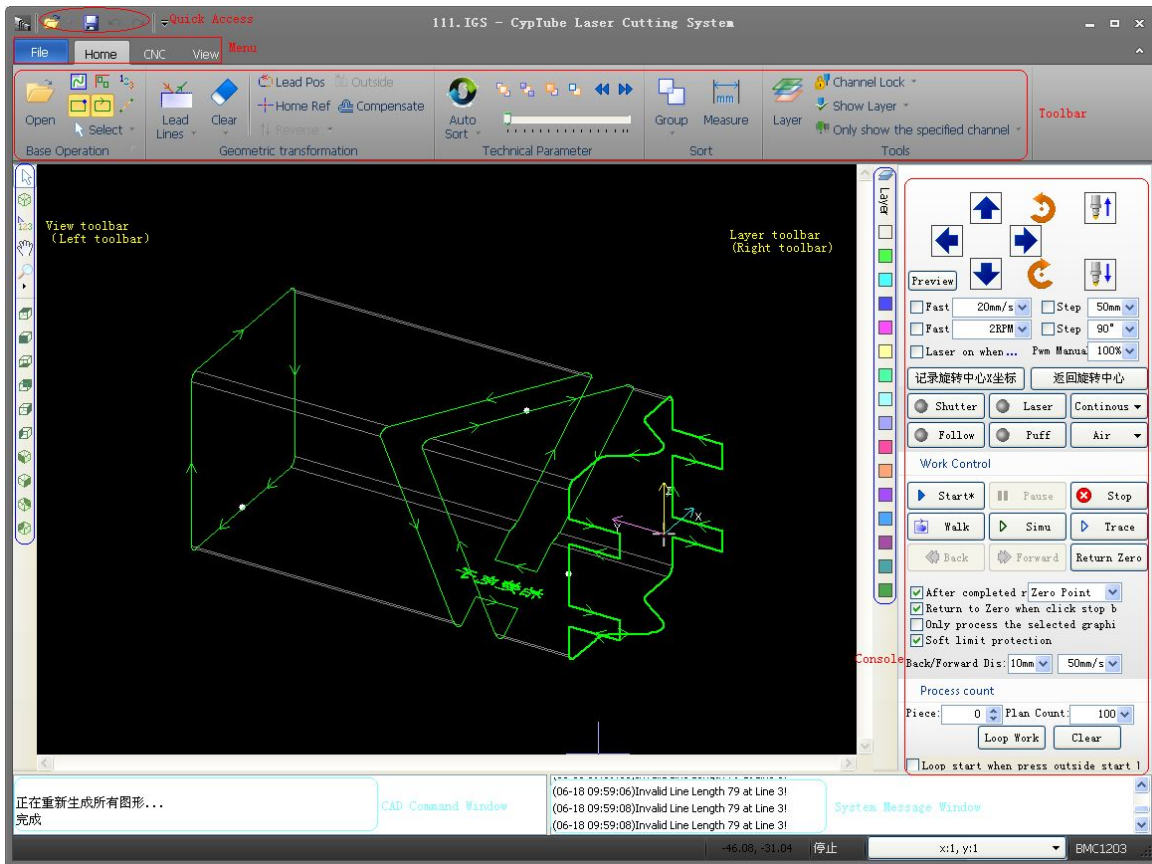
The figure with black background in the center of the interface is the Drawing Board.

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 four toolbar menus, namely "Start", "Drawing", "Numerical control" and "View", and toolbar display can be switched through selecting these four 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 "View Toolbar", which is called directly "Left Toolbar" in the following instructions. It provides the basic view functions, which includes ten viewpoint control method such as top view,front view,bottom view and so on.

At the right of the drawing area is "Layer Toolbar", which is called directly "Right Toolbar" in the following introduction. It includes a "Layer" button and sixteen 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 sixteen 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 "Layer 0" is displayed, the graph on this layer will be shown in white and it cannot be processed.

There are two scrolling displayed text windows below the interface. The left one is "CAD Command Window",the related prompting messages of all the drawing instructions will be shown here. The right one is "System Message Window", each message has time mark and they will be shown in different colors according to the importance of the message, which includes prompting, warning, alarming and error and so on.

There is the Status Bar at the bottom of the interface, which can show different prompting messages according to different operations. There are 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 last one is the fine-tuning distance parameter, which can move the graphs quickly by using direction keys. See the descriptions in related chapters.

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.

2.Toolbar

The toolbar of CypTube 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 four "pages", which can be selected by the four menus "Start", "Drawing", "Numerical control" and "View". When selecting text and other special objects, 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 "View". 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.

The first column of the toolbar "Base Operation" has multiple buttons which can help to control the display effect, as shown below:
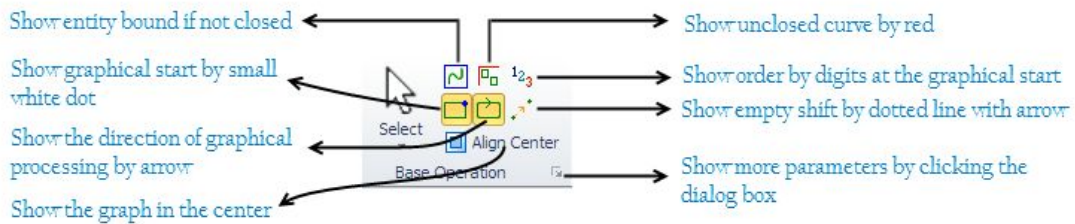
After you click the buttons in the figure above, the display will take effect immediately and then you can find the changes in the display effect in the drawing board. Please pay attention to the display changes of the buttons themselves, if the ground color is light yellow, it shows that the corresponding 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 direction of the graphical processing in the drawing board; while in the off state " ⬜ ", the arrow will disappear.

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 style Ribbon 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.

1.4 Operation Process
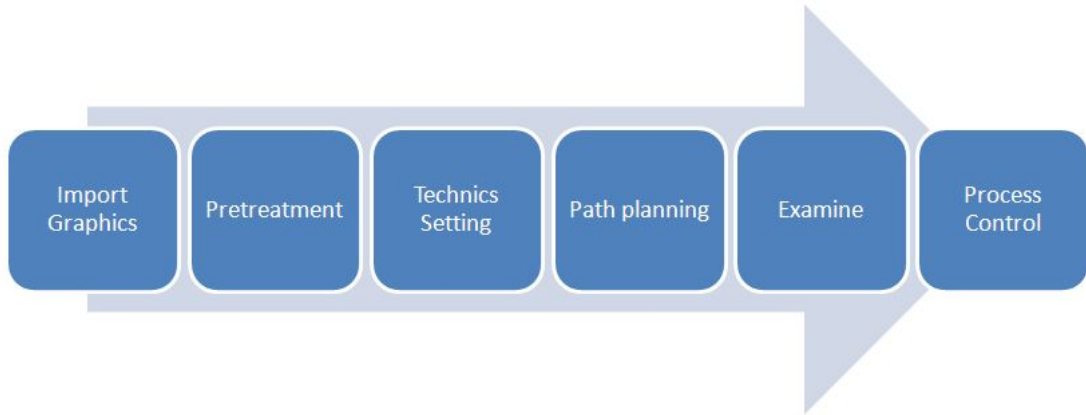
1. Import Graphics

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.
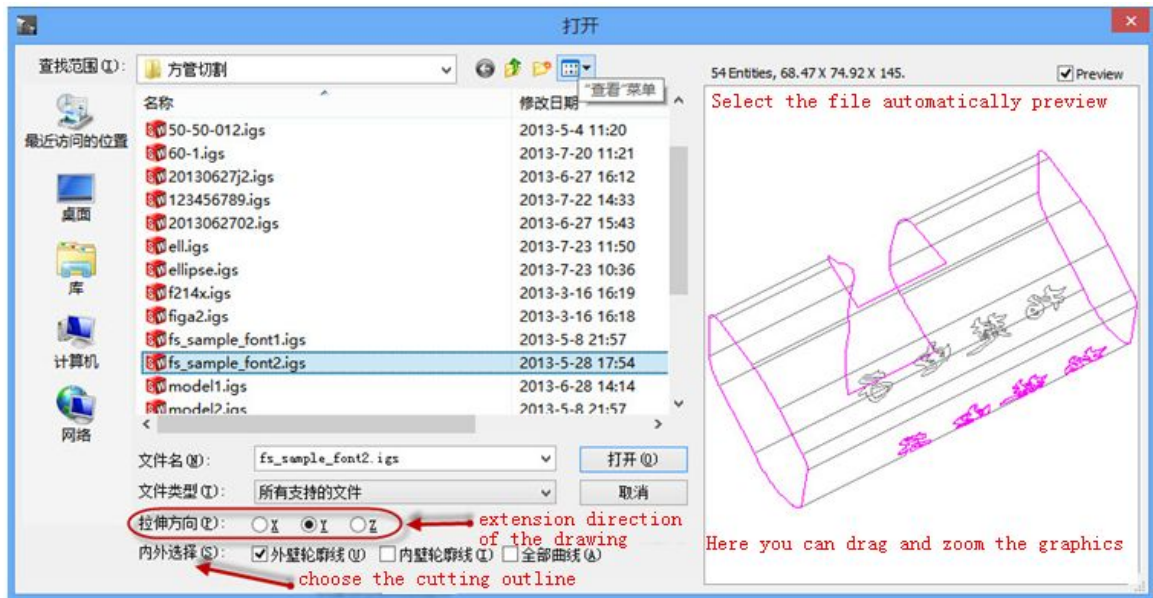
Note:Please make sure the extension direction of the drawing you opened is same as the original extension direction of the drawing. And it's better to create fillet surface when drawing the tube.The cutting outline can be identified automatically,and the gray lines are auxiliary lines which don't need to be processed.

2. Technical Parameter

In this step you may use most of the functions of "Technical Parameter" in the toolbar, and they include setting lead lines, setting compensation and so on. Big size button " Leading " can be used to set lead. The button " Compensate "is used for cutting compensation and the button " Reverse " can reverse a single graph. Clicking the button" Lead Pos " 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 leadin manually.

You can press Ctrl+A to select all the graphics using quick start tutorial, then click the button "Lead Lines" 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. You can conduct the Lead Lines Check by clicking the small triangle below the button "Lead Lines" and selecting "Examine Lead".

You can set detailed cutting technical parameters by clicking the button "Layer" in the toolbar at the right. The dialog box "Layer Parameter Settings" contains almost all the parameters related to the cutting effect, and it can be called up rapidly by pressing "F6" for fast setting.

3. Lead Planning

In this step the graphics will be sorted as required. You can conduct automatic sorting by clicking the button " ", while you can select the ways of sorting and control whether it is allowed to change the direction of the graphics during the automatic sorting by clicking the small triangle under the button,.
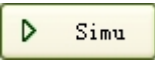
If the automatic sorting cannot meet the requirements, you can click the button" 123 " in the toolbar at the left to enter the manual sorting mode, and click the graphics with mouse one by one, and in this way you can set the working order . You can specify the order between these two graphics through pressing the mouse and drawing a line from one graph to another.

4. Inspection before Processing

Before the actual cutting, you can check the working route. You can view the processing order quickly by dragging the interactive preview progress bar as shown below, and you can view the processing order of the graphics one by one by clicking the interactive preview button,.
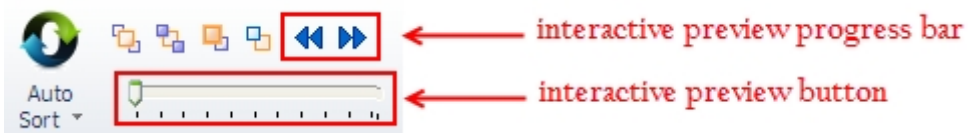
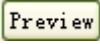You can simulate process by clicking the button " ▷ Simu " on the console, and you can adjust the speed of the simulation processing through the function "simulation speed" on the page " CNC ".

5. 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.Make the laser head upon the tube which is clamped on machine tool,and then click the button" Edge Seek ",the Cyptube can calibrate levelness and seek the center of rotation automatically.

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 translated to the "Laser Head Position" and visually parallel move occurs in the graphics on the whole.
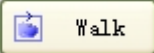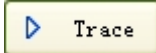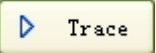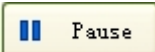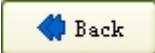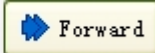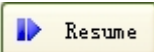
If the "Laser Head Position" shown by the red cross cursor does not match the actual laser head position of the machine, please check whether the position of the machine origin is correct, and it can be corrected through "Numerical Control"—"Go Origin". After previewing, if you find that the graphics are outside the machine breadth wholly or partially, it means that it may exceed the range of travel during processing.
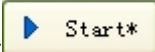
You can change the relative relationship between the graphics and the dock points by clicking

the button " Home Ref " on the toolbar.

If there is no error on the screen after checking, you can click the button" Walk " on the "Console", and the system 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 " Trace ", 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 " Trace " 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 "" to stop the processing and the laser head may return to the zero point according to your setting. As long as you do not make any modification, that is to say, there is no marker "*" on the button" Start* ", the system will allow you to continue the processing from the position of last stopping when you click the button "Start" again,.

II. Technical Parameters

This chapter will describe the related functions of technical parameters provided by CypTube. 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.

2.1 Lead lines

1. Distinguish Overcast Cut and Yang Cut

When opening the external files such as IGES and so on, CypTube can distinguish overcast cut and yang cut automatically. If the graphics are modified during editing and they result in the changes in the relationship between overcast cut and yang cut, you can click the button "sort" when the overcast cut and yang cut need to be distinguished again, and then any way of sorting can distinguish them.

When adding the lead lines, the external layer is yang cut, so it will be led in from the outside; the internal layer is overcast cut and will be lead in from the inside. When setting overcast cut and yang cut manually, please select the graphics to be set, and then click the buttons " Outside " on the toolbar.

2. Automatic Lead Lines

Please select the graphics to be set with lead lines, click the icon " Leading " on the toolbar, then set the lead lines parameters in the popped window. As shown below:

Please note that the automatic lead lines will search the graphics to determine the most appropriate lead position, thus the previous parameters of the graphics such as lead position and type will be covered.

3. Check the Lead

You can click the small triangle below the button" Lead Lines", and then select "Check Lead" so that you can check the lead lines which are set already. This function can shorten the leadlines with

too much length, and thus prevent them from intersecting with other graphics.

2.2Cutting 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 yang cut or overcast cut. Yang cut needs outward compensation, while overcast cut 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:
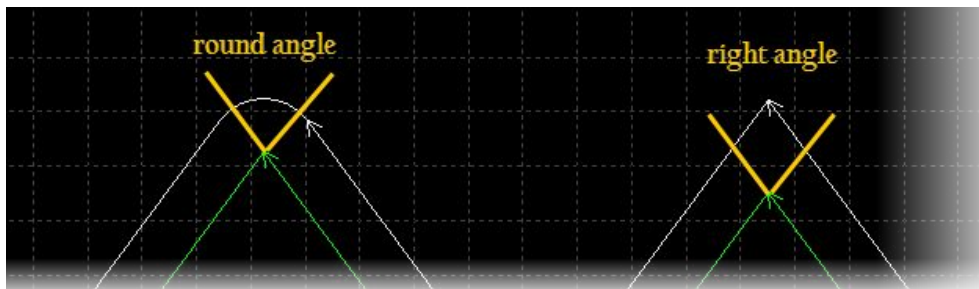
In the figure the green is the original, the white is the compensated track, and the light yellow is the vertical lines drawn from the corner. From the figure you can find that the cutting edges can coincide with the original after both sides of the vertical lines are compensated, while the corner needs transition. Usually round angle transition can ensure that the cutting edges can still coincide with the original and run more smoothly during transition.

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

2.3Layer Parameters

CypTube provides fifteen 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 Setting" by clicking the button "Layer " on the toolbar. This dialog box includes almost all the technical parameters required for processing. The first page of the dialog box is "Global parameters" and they are used to control the parameters outside the layers such as vacant move speed, burst power and so on; besides, you can also choose the speed and acceleration units. 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. You can change the order among the

layers by pressing the button "Layer*" with the mouse and dragging it, and the layer arrayed in the front will be processed firstly.
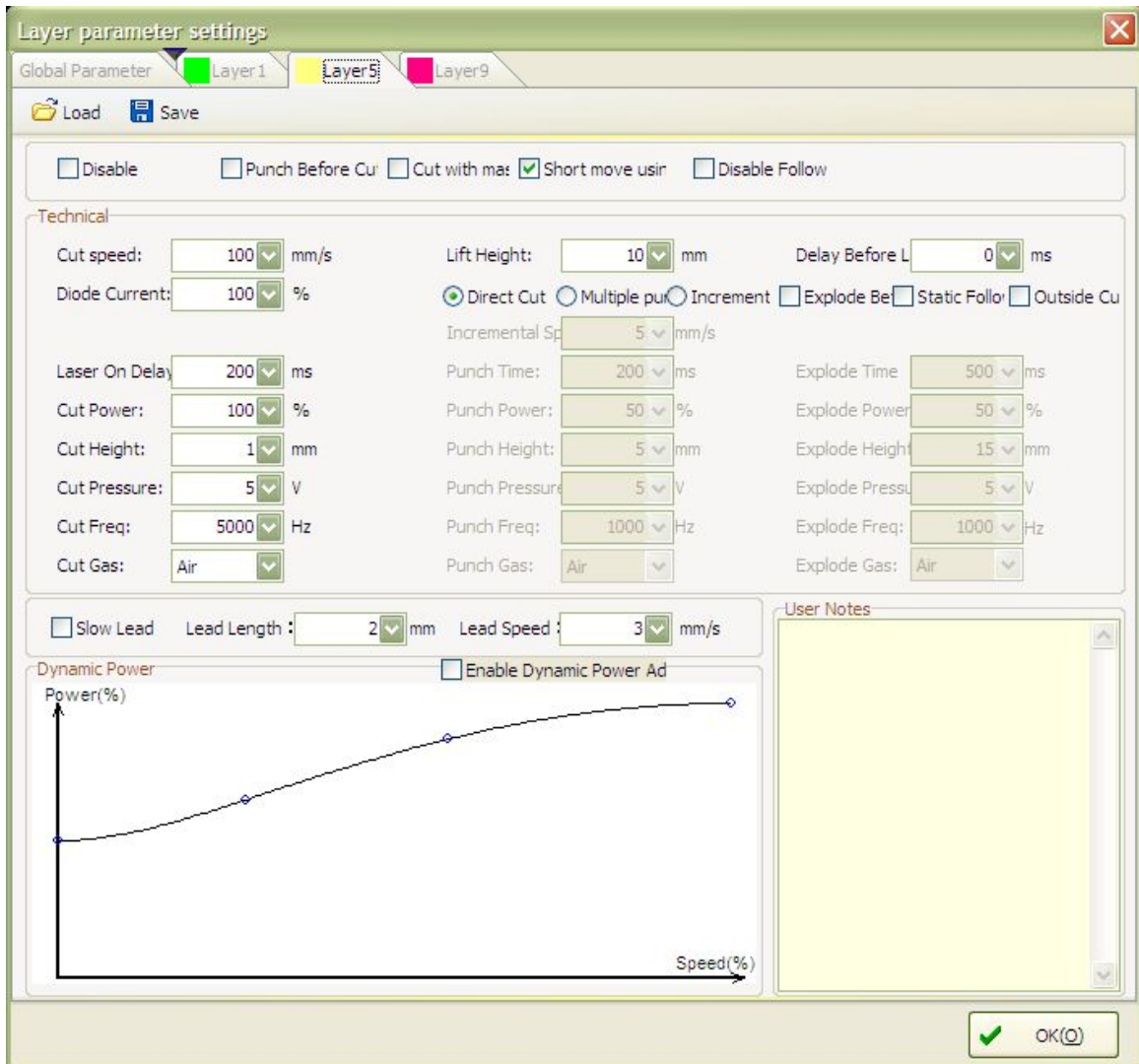
Note: Different options may be displayed in the dialog "Layer Parameter Setting" due to different lasers, different gas pipeline configurations and different followers. The following figure is only used for reference, and the actual contents displayed in your software shall be taken as the criterion.

1. Descriptions of Parameters

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

Technical Parameters	
Cutting 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.
Punching Time	Time required for punching the cut board. Set the time according to the thickness and material of actual board (Set the parameter to a small value or 0 during incremental punching).

|	
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.
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 Type	
Direct Cutting	Punching and cutting use the same parameters, which are commonly used for thin board cutting.
Multiple Punching	Punching and cutting use the same parameters, which are commonly used for thick board cutting.
Incremental Punching	Based on multiple punching, the punching method of variable defocusing amount is used, i.e., slowly fall when punching, and this method is commonly used for thick board cutting. During multiple punching, the punching time can be set to be a small value, such as 100MS. At this time, actual punching time = 100MS + the time required for slowly falling to the cutting height from the punching height.
Cutting Parameters	
Cutting Power	Set the laser power used in cutting, i.e., the duty ratio of PWM modulation signal.
Cutting Height	Set the height from the laser head to the board during cutting.
Cutting Pressure	Set the pressure of auxiliary gas during cutting, and use it with proportional valves or multiple valves.
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.
Cutting Gas	Set the type of auxiliary gas used in cutting.
Punching Parameters	
Incremental Speed	Set the speed for slowing falling down to the cutting height from punching height when using incremental speed.
Punching Power	Set the laser power used in punching, i.e., duty ratio of PWM modulation signals.
Punching Height	Set the height from laser head to board during punching.
Punching Gas	Set the pressure of auxiliary gas during punching, and use it with proportional valves or multiple valves.
Punching Frequency	Set the carrier frequency of PWM modulation signal during punching. Generally, low frequency is used during punching, and pulse punching is used to avoid burst.
Punching Gas	Set the type of auxiliary used during punching.
Other parameters	

Disable Follow	Not use follower for following movement during cutting.
Enable Dynamic Power Adjusting	After starting the function, the system will conduct real-time adjustment for the laser power (duty ratio of PWM) according to the actual cutting speed, so as to provide a great help for improving the cutting quality of optimized corner.
Lead In and Lead Out	
Lead In Speed	Set the processing speed of leadin. The processing speed will become effective after being selected, and cutting speed will be used when not being selected.
Lead Out Speed	Set the processing speed of leadout. The processing speed will become effective when being selected, and cutting speed will be used when not being selected.

2. Adjustment of Speed Following Power

After selecting "☑ Enable Dynamic Power Adjusting ", the cutting power will vary with the changes in speed in the cutting process, and the specific changes are determined by the power curve. The power curve can be dragged and edited by using mouse.

The X-coordinate of power curve represents cutting speed, while the Y-coordinate represents cutting power, with a unit of percentage. The table reflects the percentage of actual power in cutting power when the actual movement reaches the turning and the speed drops to a few percent of target speed.
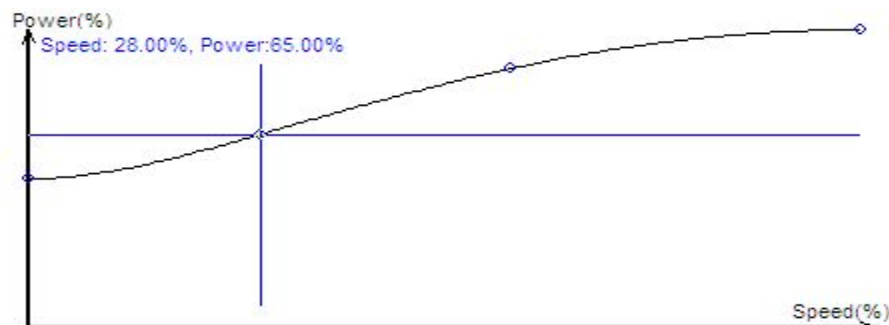
As shown below, if the laser power is 500W, after setting the cutting speed to be 100mm/s, peak current to be 90% and cutting power to be 80%, when the actual cutting speed drops down to 40mm/s, namely the red marker point, the power of laser is as follows:

500W X 90% X 80% X 62.43% = 223.75W

Laser power X Peak current (percentage) X Cutting power (percentage) X Speed following power (percentage) = 500W X 90% X 80% X 62.43% = 223.75W

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

If " ☐ Enable Dynamic Power Adjusting " 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. Material Lib

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 lib next time, please click the button " 📂 Load ", and then select the file saved previously. CypTube will prompt you "Whether Covering the Current Parameters", and the system will import the parameters in material lib automatically when you click "Yes"; if you click "No", the system will cancel the reading operation.

III. Work Control

CypTube 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.

3.1 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 "Return Origin" are consistent with each other. You can reset the mechanical coordinate system through "Return Origin" 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 CypTube 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.

If the rotation axis is parallel to the Y axis, the counterclockwise rotation seen from Y- to Y+ is forward direction.

3.2. 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 "Return Origin", reset the mechanical coordinate system, and then click "Return Zero" to find the zero point.

3.3 Alarms

CypTube 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 system alarms are removed, many operations will be forbidden, and users need to check the machine and operate again after the alarms are canceled. One example of the alarm is as shown below.
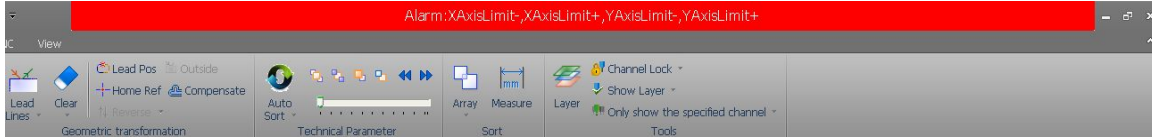

Except the title bar, the "System Message Window" at the lower right corner of the interface can also display the alarm information. After the alarms are removed, the red display of the title bar will disappear, however, the information in the "System Message Window" will be retained. You can look over all the history by double clicking "System Message Window", so that you can find out the events happened during the running of the machine.

In addition to the alarms, if CypTube detects other operation exceptions, it will display the exceptions in different colors on the "System Message 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 system in time so that you can take the necessary measures as soon as possible.

3.4 Manual Testing

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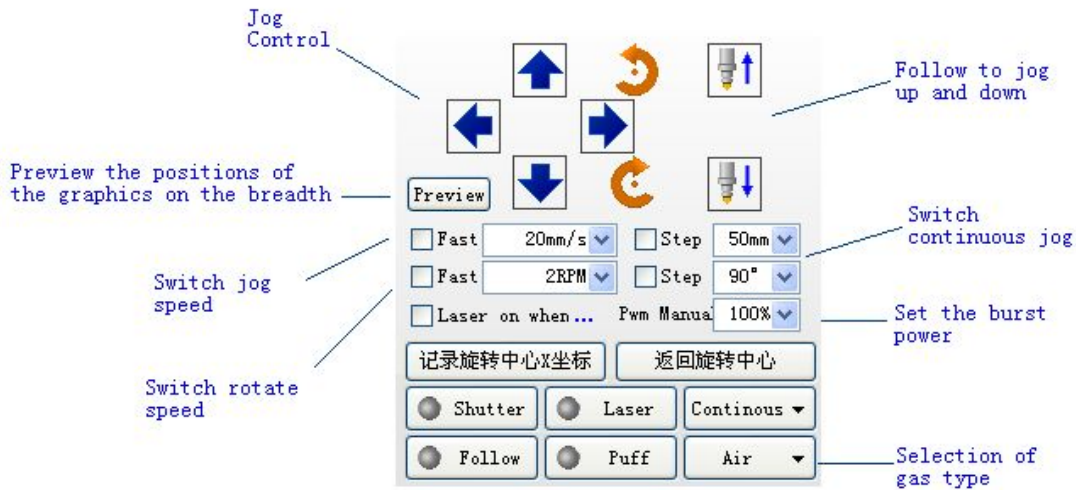
The button with the icon "⬤" will become "🟢" after the corresponding equipment is opened.

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 "Bowing" 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.

3.5 Soft Limit Protection

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

After the soft limit protection is enabled, if the system 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 system will also monitor the machine coordinates in real time during the motions of the machine. Once they are beyond the soft limits, the system will alarm at once and then stop all the motions.
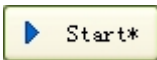
Note: the soft limit protection depends on the machine coordinate system. If the coordinate system is not correct, the protection will also be incorrect. Thus, after the operations such as abnormal close of the system and modification of the machine parameters, users need to build the correct machine coordinate system through the operation "Go Origin".
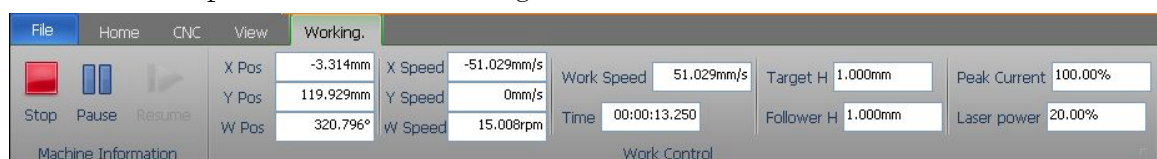
3.6 Walk

The laser head will dry cut a rectangle along the frame of the graphic to be processed by clicking the button " 📇 Walk " 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: Please make sure you have recorded the the center of rotation before walking.

3.7 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.

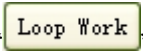| File	Home	CNC	View	Working.								
⬛ Stop	⏸ Pause	▶ Resume		X Pos	-3.314mm	X Speed	-51.029mm/s	Work Speed	51.029mm/s	Target H	1.000mm	Peak Current	100.00%
				Y Pos	119.929mm	Y Speed	0mm/s	Time	00:00:13.250	Follower H	1.000mm	Laser power	20.00%
				W Pos	320.796°	W Speed	15.008rpm						
Machine Information								Work Control				

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 "▷ Trace" 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 lost motion, speed, process of acceleration and deceleration of "Prepunching", 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 while tracing" in "Layer Parameter Setting" – "Global Parameters" – "Advanced". In the default condition it will not open "Follow" during the dry cut.
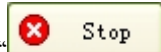
By default, it will return to the zero point automatically after completing the processing. If you would like to return to other position after the processing, please select the needed position on the console. The supported positions include zero point, start point, end point, origin point and specified point. Cancelling "☑ After completed return to" 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 the specified point after the processing, please jog to the position where you hope to return, and then select "Select the Specified Point..." 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 clear the counts by clicking the button "Clear". If you need loop work, please click the button "Loop Work".
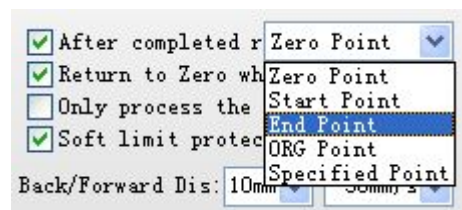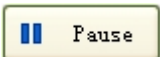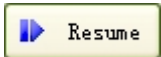
3.8 Stop, Pause and Resume

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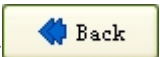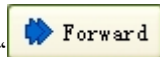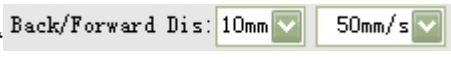the machine will return to the zero point. If you do not hope to go back to the zero point, please cancel the selection of option "☑ Return to Zero when stop"

on the console.

If you pause the processing, please click the button " ▮▮ " on the toolbar or the button

" [▮▮ Pause] " on the console. After pausing, you can modify the parameters by clicking the button "Layer" on the right toolbar; besides, you can operate partial functions of the manual control on the console, including laser burst, switching the gas and switching the follow. However, you cannot make the machine move.

If you need to continue to work, please click the button " ▶ " on the toolbar 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.

3.9 Breakpoint Memory

If the processing stops or suspends due to accidents, the system will keep breakpoint memory. As long as the graphics or the parameters are not modified, the system will ask you whether to continue to work from the position whether it stopped last time when clicking "Start" next time. As shown below:
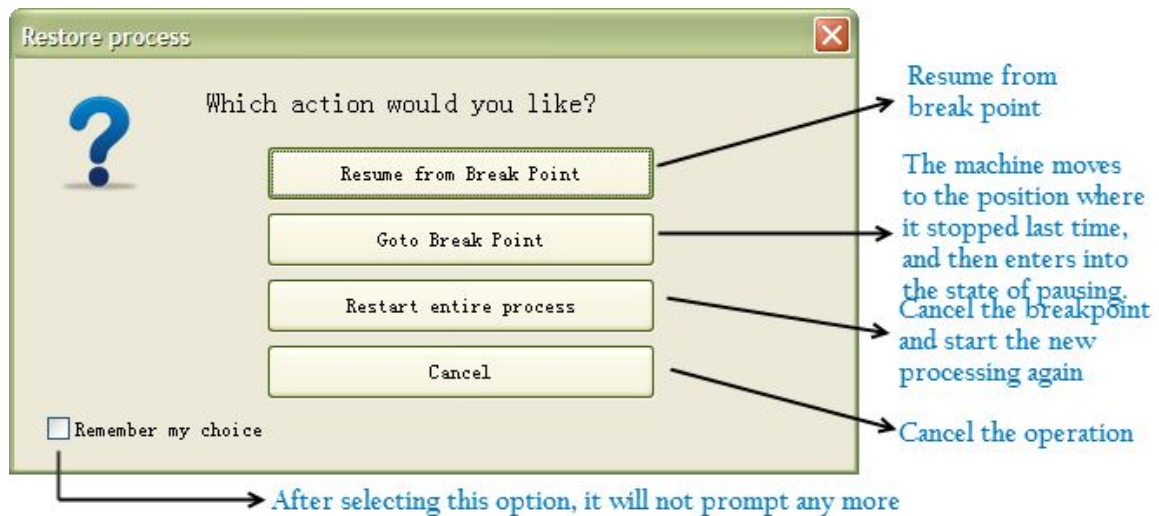
Only when the start button is in the state " [▶ Start] ", the dialog box above will appear. If

the starting button becomes the state " ▶ Start* " with "*", the machine will start to work directly from the starting point by clicking the button.

3.10 Processing from Any Location

CypTube 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 system will pop-up a dialog box and requires reconfirmation after selecting "Processing from Here". After confirmation, the system 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.

Zoom ▶

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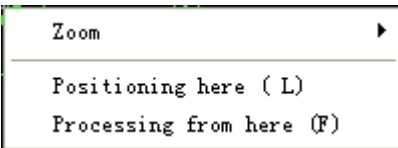
If you want to first position it to the specified location but do not start processing, please select "Positioning Here", so that the system will move to the specified location and then go into the suspended state.

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 ".

3.11 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	
Lost Motion Speed XY	Speed during lost motion (not the speed during processing).
Lost Motion Speed W	Speed of rotation axis during lost motion
Working Speed	Speed of walking.
Max Rotation Speed	Up to the max rotation speed of your servo motor and the reduction ratio,for example,the max rotation speed of motor is 3000r/min and the reduction ratio is 1:30,so the Max Rotation Speed is 3000/30=100.
Processing Acceleration	The maximum acceleration of each shaft during track processing. It needs to be used with processing speed.
Turning Acceleration	The maximum allowable acceleration at the path turning during track processing. It is used to limit the turning speed at the corner of greater than 90 degrees. The turning speed of smaller than 90 degrees

	will be reduced to zero.
Speed of 10mm Reference Circle	It is used to limit the speeds of the figures with small arcs and curvature.
Default Parameters	
PWM Frequency	PWM frequency used by laser in manual mode
Default Peak Current	Peak current used by laser in manual mode
Default Pressure	Air pressure used in manual mode
Delay for Gas On	Delay time used in step "Delay for Gas On" of PLC during punching
Max Follow Height	If the cutting height exceeded Max Follow Height,the BCS100 wont follow directly.
Advanced Parameters	
Fitting Frequency of Curve	Fitting precision when converting Spline / Bezier to straight line for processing
Maximum Lost Motion Length for Short Move without Lifting	If "Short Move Using A Separate Laser Parameters" is checked, when lost motion length is less than this length, the laser needs to be shut down without lifting. The specific process is determined by Laser off process for short move.
Using Leapfrog Lift	After Z-coordinate lifts to the mid height, X-coordinate and Y-coordinate begin lost motion, so as to shorten the time of lost motion.
Unit Selection	You can make a selection according to your use habits, and the units will be switched in the interface.

IV. Appendix

4.1 Tube Debugging

Please make sure that the tube is parallel to Y axis,as shown below:
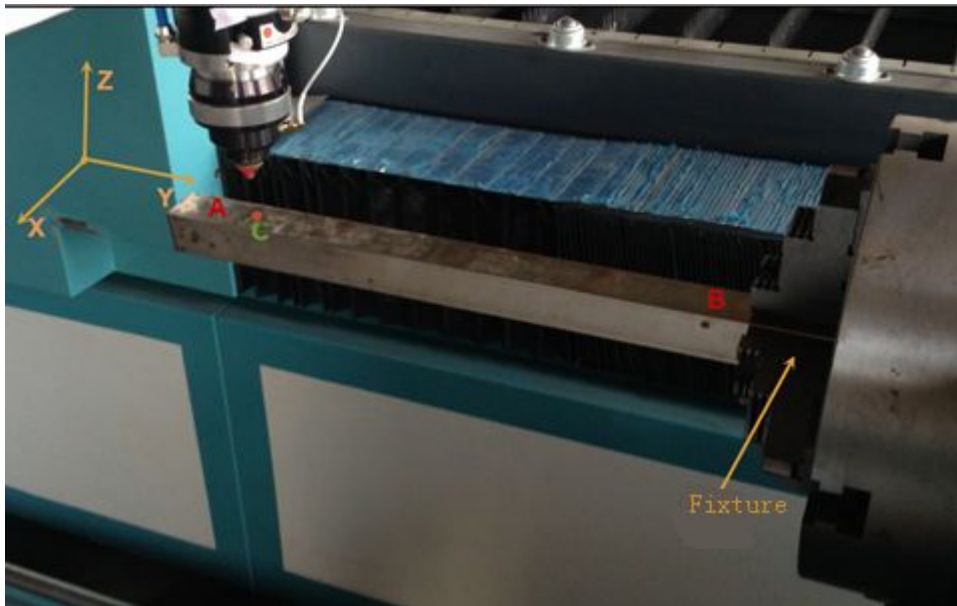
1.The levelness adjustment

Debugging steps:

(1)Make the laser head upon the tube by "Jog Control", such as the C point in the figure above.And then click the button "Edge Seek" to make the tube oriented horizontally.

(2)Click the "File/Diagnosis"to open the BCL3764 Diagnosis ,as shown below.And then take the laser head to the A point in the figure above,click "Follow",record the coordinate value of the Z axis.Move the laser head slowly from A to B, observe the changes of the coordinate value of the Z axis.

(3)Rotate the W axis 180 degrees, and then repeat step 2.

(4)Debug the tube according to the following phenomena:

■   The fixture is not horizontal

  If the coordinates value of the Z axis both changed from big to small ,heighten the side close to A of the fixture,and vice versa.
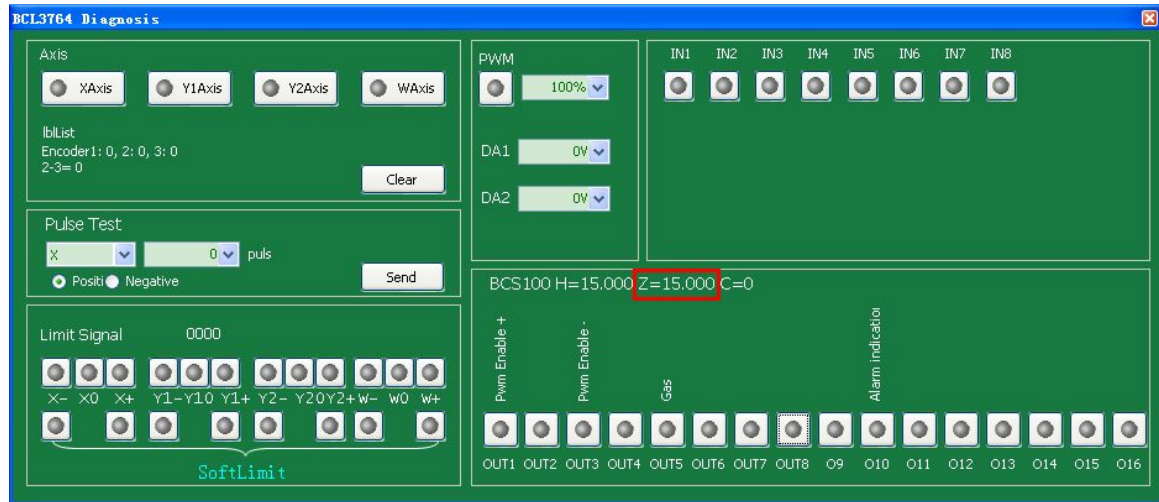
■   The tube is not horizontal

If the coordinate value of the Z axis in step 2 changed from big to small,and the value in step 3

changed from small to big,heighten the side close to A of the tube,and vice versa.

(5)Rotate the W axis 90 degrees, and then repeat the 5 steps above.

2.The center of rotation adjustment

Debugging steps:

(1)Make the laser head to the edge of the tube,and then move the laser head slowly from A to B, observe whether the red light always been close to the edge of the tube .If not,please adjust the placement of the tube.

(2) repeat step 1 until the red light always close to the edge of the tube.

(3)Rotate the W axis 90 degrees, and then repeat step(1)and(2).

4.2 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 + O	Open the file	None
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

CypTube 3D Pipe Cutting Control System

Shortcut key	Effect	Service conditions
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